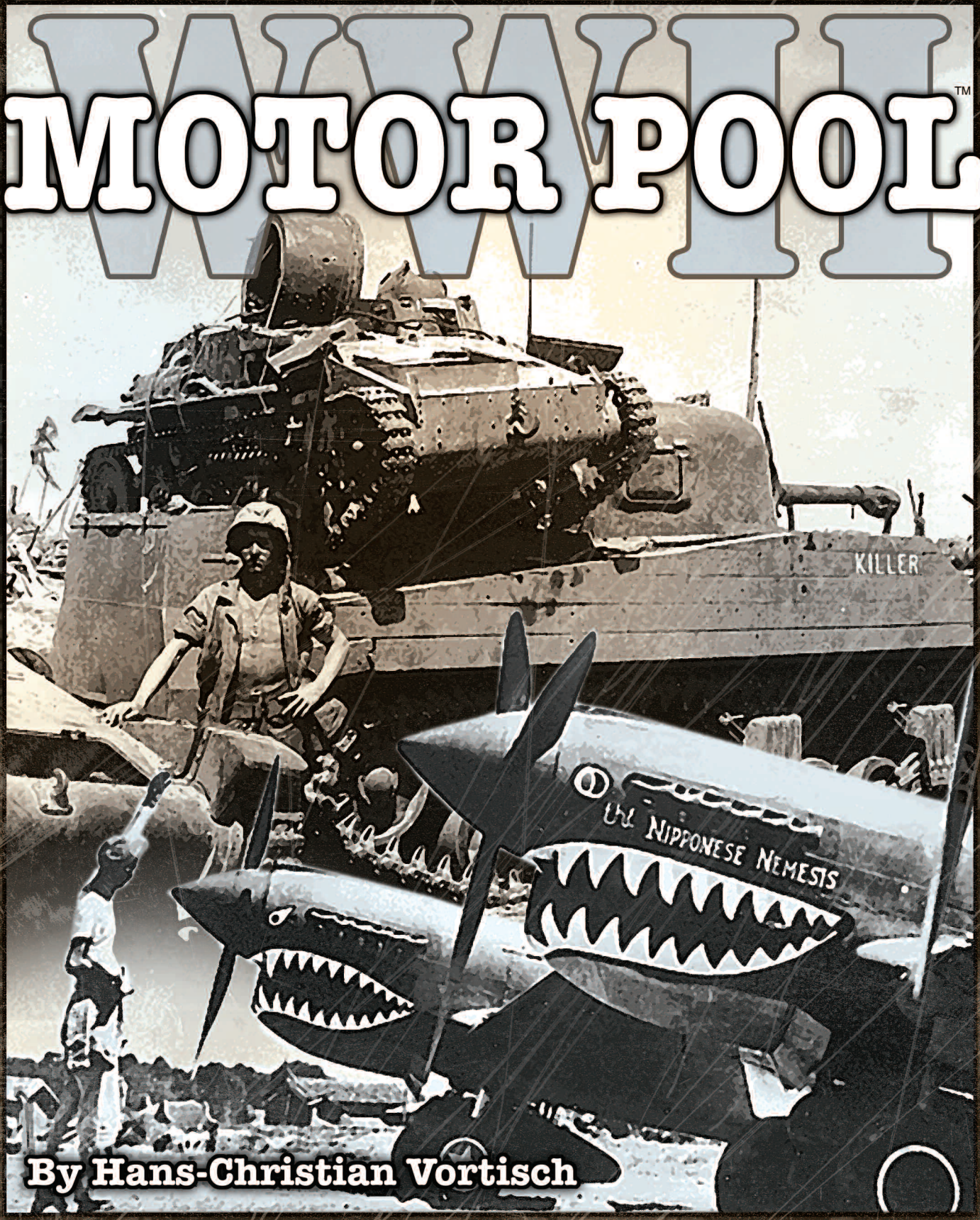
GURPS®

WWII

MOTOR POOL™



By Hans-Christian Vortisch

STEVE JACKSON GAMES

PROVE YOUR METTLE . . .

World War II raged from the deserts of North Africa to the jungles of the South Pacific, from the mountaintops of the Alps to the beaches of Normandy, across (and *under*) the high seas, and through the skies above it all. Soldiers in all of these places relied upon the machines of war: bombers, fighters, tanks, jeeps, ships, submarines, landing craft, and much more.

GURPS WWII: Motor Pool has a huge variety of historically accurate vehicles from mankind's greatest conflict. Many of the vehicles were common; others were rare or even unique. From the stodgy General Lee tank to the earliest helicopters and the wildly impractical Maus, ***Motor Pool*** has tons of new gear for every ***GURPS WWII*** player.

Motor Pool also gathers in one place all the refinements to the vehicle design system that have evolved since the original corebook came out, as well as a new system to describe any WWII-era conveyance in a few simple steps. These additions include scores of new weapons to be fitted on your war machines – some historical and some products of the imagination.

On top of all that, ***Motor Pool*** has advice on how to integrate vehicles into a roleplaying campaign, with details on how vehicle crews really lived and fought, from the difficulties of supply to getting their machine moving at all. Whether you're campaigning by land, by sea, or by air, ***Motor Pool*** dramatically expands your options!

. . . AGAINST HEAVY METAL!

GURPS WWII or the ***GURPS Basic Set,*** *Third Edition Revised*, are required to use this supplement in a ***GURPS*** campaign. Other ***GURPS WWII*** supplements, as well as ***GURPS Compendium I, Compendium II, High-Tech,*** and ***Vehicles,*** can provide further detail and campaign options. The historical and character information can be used with *any* game system.

THE MECHANICS

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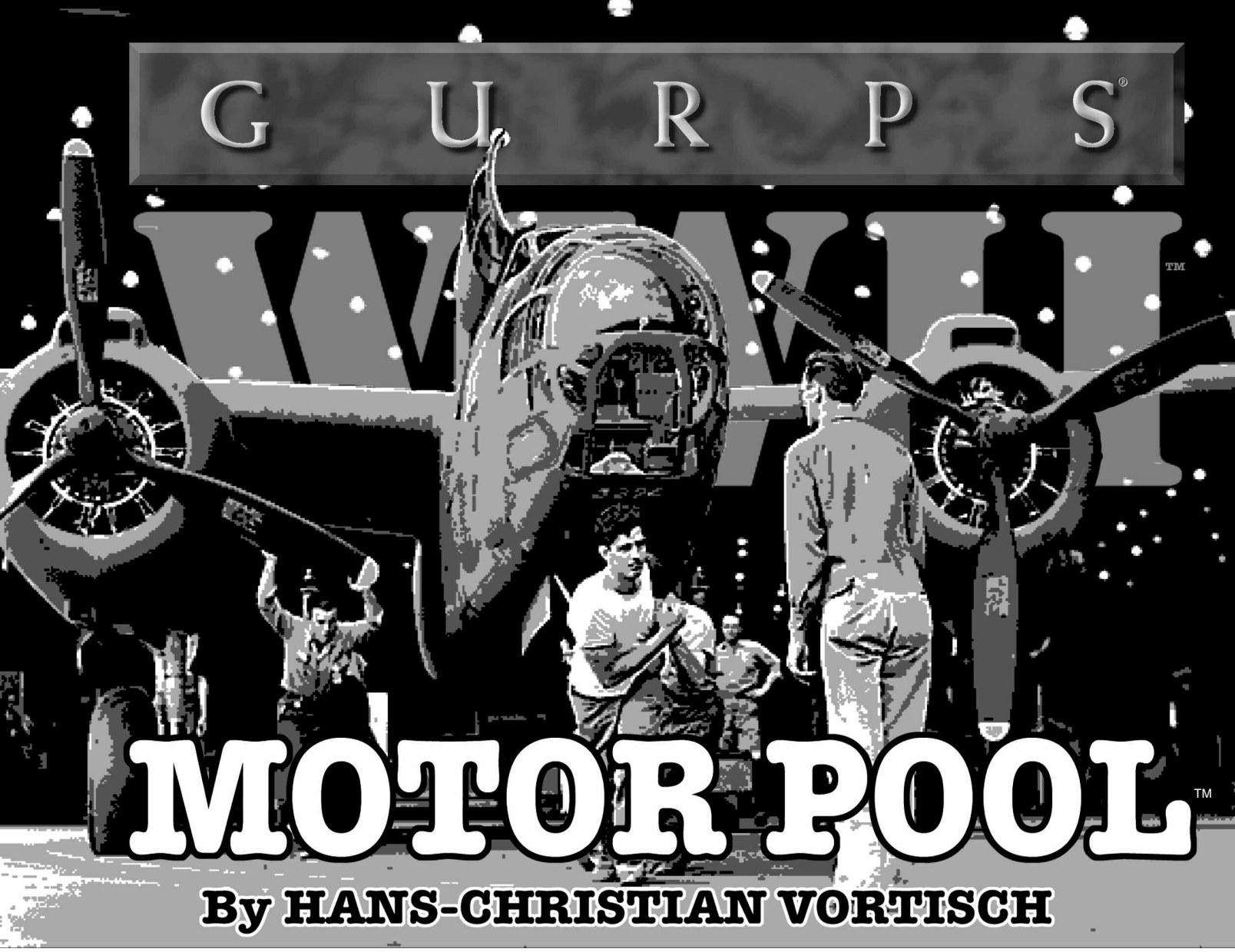

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About GURPS

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Pyramid (**www.sjgames.com/pyramid/**). Our online magazine includes new ***GURPS*** rules and articles. It also covers ***Dungeons and Dragons, Traveller, World of Darkness, Call of Cthulhu,*** and many more top games – and other Steve Jackson Games releases like ***In Nomine, Illuminati, Car Wars, Toon, Ogre Miniatures,*** and more. *Pyramid* subscribers also have access to playtest files online!

New supplements and adventures. ***GURPS*** continues to grow, and we'll be happy to let you know what's new. For a current catalog, send us a legal-sized or 9"×12" SASE – please use two stamps! – or visit **www.warehouse23.com**.

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GURPSnet. This e-mail list hosts much of the online discussion of ***GURPS.*** To join, point your web browser to **www.sjgames.com/mailman/listinfo/gurpsnet-l/**.

The ***GURPS WWII: Motor Pool*** web page is **ww.sjgames.com/gurps/books/ww2/motorpool**.

Page References

Rules and statistics in this book are specifically for the ***GURPS Basic Set,*** *Third Edition.* Any page reference that begins with a B refers to the ***GURPS Basic Set*** – e.g., p. B102 means p. 102 of the ***GURPS Basic Set,*** *Third Edition.* Page references that begin with CI indicate ***GURPS Compendium I.*** Other references are HT to ***High-Tech***, VE to ***Vehicles***, W to ***WWII***, W:AKM to ***WWII: All the King's Men***, W:D to ***WWII: Dogfaces***, W:FH to ***WWII: Frozen Hell***, W:HS to ***WWII: Hand of Steel***, W:IC to ***WWII: Iron Cross***, and W:RH to ***WWII: Return to Honor***. The abbreviation for *this* book is W:MP. For a full list, see p. CI181 or **www.sjgames.com/gurps/abbrevs.html**.

INTRODUCTION

Some historians like to call WWII the first war fought about and with oil. That perspective ignores a great deal of nationalism, empire-building, and racism that really motivated the conflict. Still, the point stands that in the Second World War, for the first time, machines may have played just as important of a role as the flesh-and-blood soldiers who had previously all but monopolized center stage.

When we began developing the ***GURPS WWII*** line, it became obvious that these machines would need proper support in the game mechanics. The fragile humans who operate them remain the focus of drama and emotional tension, but placing them in a setting with these complex tools as mere backdrops would become artificial and limiting. Often, it is enough for the GM to say, "You're trapped in the bowels of a battleship," but when the players try to cut their way out – or hijack the turbines' output to start up their kilowatt-greedy death ray – the GM needs some guide as to how thick or heavy or powerful or reliable various things are.

Of course, ***GURPS*** already possessed a guide to such things, David Pulver's ***Vehicles*** sourcebook, which is alternately praised for its utility or criticized for its complexity (which isn't really all that much worse than a lot of popular roleplaying systems). With an eye toward avoiding those criticisms, I decided to simplify the ***Vehicles*** system, grouping options together realistically, ignoring all content outside the WWII technology level, and stripping out a few things that simply weren't used. The resulting Modular Vehicle Design System still raised more than a few eyebrows – and remains the most criticized feature of the ***WWII*** corebook – but be that as it may, when a GM needs an idea how much weight a destroyer really could float, he can spend five minutes with the system and come up with a ballpark-accurate answer.

From the beginning, a German ***GURPS*** fan (who has since become a steady ***GURPS*** author) named Hans-Christian Vortisch made himself invaluable in developing the MVDS, the actual vehicle designs derived from it, and the small-arms profiles found in this line. His drive for precision collided with my passion for simplifying, and the result was something better than either of us could have produced on our own. (Certainly, not perfect – the MVDS squeaks and groans in certain places – but so would any 23,000 words attempting to mathematically model a world's worth of what once was cutting-edge technology . . .)

Despite its utility in working up the numbers for any vehicle that catches the GM's eye, what the MVDS cannot capture is the often fascinating stories about how a plane or tank or ship came to be developed, how its crews came to regard it, and how it fared in the actual fighting. These often give a vehicle more character than some of the PCs at its controls. With this in mind – and to serve those readers who still recoil at the though of approaching even a scaled-down ***Vehicles*** system – we decided to do a book full of the vehicles that simply couldn't fit elsewhere.

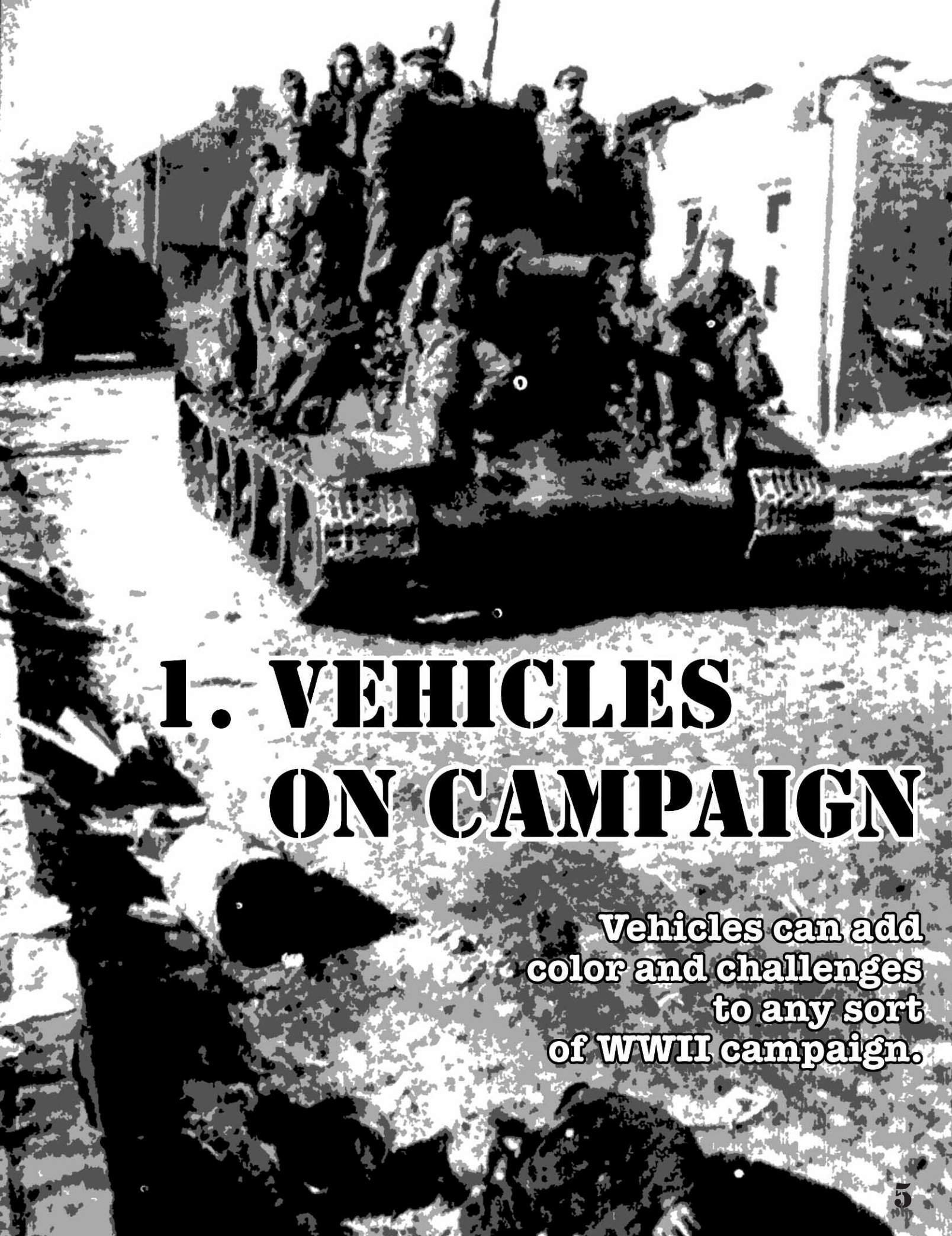
There was no question as to who should write it.

– Gene Seabolt

About the Author

Hans-Christian Vortisch is a writer and translator based in Berlin, Germany. His interest in armed vehicles goes back some 20 years, shortly before he first made contact with vehicle design in ***Car Wars***. He is obsessed with detail and trivia, a quirk that has served him well on most game projects that he has worked on so far.

In his day-to-day operations, he rides a battered bicycle – *sans* machine gun.



1. VEHICLES ON CAMPAIGN

Vehicles can add color and challenges to any sort of WWII campaign.

VEHICLES AND CREWS

Vehicle crews would often literally live in their vehicles. While this is obvious for large ships and submarines, it was also true of tank crews, long-range reconnaissance troops in light overland vehicles, and even the crews of certain aircraft, such as the Bristol Bombay (p. 84), which were operating in out-of-range forward positions. Consequently, the crews often developed a close relationship to their steeds, giving them names (see pp. W:D32, W:RH19) and covering them in graffiti. Often, a vehicle's erratic performance made this more of a love/hate relationship . . .

The crews generally crammed equipment anywhere that they could (p. 54). This soon converted units of tanks, trucks, and torpedo boats into gypsy trains littered with canvas packs, wicker baskets, wooden cases, and steel chests holding personal belongings, food and drink, spares, ammo, and, not uncommonly, war booty of one kind or other.

Combat crews frequently loaded more ammunition than the "specs" for their vehicle, especially if they were ordered to operate forward of their supply vehicles. For example, Soviet tanks in their rush to the west typically carried closer to two basic loads of ammunition for their armaments – one in the tank, and one crammed in crew spaces and strapped to the tank's exterior. Similarly, many bomber crews stowed spare ammunition to replenish the regulation loadouts of their defensive guns in flight.

While most sea vehicles and some aircraft were large enough for long-occupancy fixtures such as bunks and galleys, most ground vehicles were far too cramped for this – nevertheless, many a tanker slept uncomfortably crouched in his seat in the turret. More usually, a tank crew slept in a shallow trough dug out under the belly of their vehicle, for protection against artillery or aerial attack.

Olive Drab and Schlachtschiffgrau

Camouflage was an important concern, and the camouflage patterns used on WWII vehicles were countless. Camouflage's usage very much depended on the tactical circumstances. For example, in their early campaigns when the Luftwaffe was the master of the air, the Germans did not use camouflage much. As they lost air superiority during the course of the war, they began to display considerable ingenuity in camouflaging their vehicles.

At the other extreme, U.S. vehicles often had colorful markings, including scantily clad women on bombers and shark's teeth on fighters and tanks, especially late in the war, when just about all need for concealment had dissipated.

In most cases, however, vehicles were just colored for business, in dull shades of gray, sand, olive, and/or green. White also was common during the winter. The primary reason for this was to reduce the odds of spotting the vehicle, which considerably increased its chances of survival whether airborne, on the sea, or on the ground (also see p. W140).

Eating on the Move

Depending on size and configuration, many vehicles had facilities for the preparation of simple meals. Some large aircraft (especially those that evolved from early airliners), a few trains, and most ships and submarines had one or more galleys. These varied in sophistication from simply a wood- or coal-fired stove to banks of diesel or electrically heated burners, some with adjacent baking units and refrigerators (usually called "reefers"). The number of people served could vary from a few crew members to a vast complement requiring all the capabilities of a full mess hall.

In most cases, a lack of refrigeration limited the menu. Only larger ships had the capacity for reefers of decent size, and thus fresh meat. Canned meats or fish, of some kind or another, usually made up the main course. Bread was often available freshly baked, though not on submarines. Fresh produce (including milk, eggs, fruit, and potatoes to replace the despised dried potato powder) was seldom at hand. U.S. Navy ships, famously, not only had large reefers but the capacity to make ice cream on board.

Submariners were supplied with foods of relatively high quality, but the conditions onboard didn't allow for anything like *haute cuisine*. For example, typical (and repetitive) meals on British subs included herrings in tomato sauce ("HITS"), canned steak and kidney pudding ("babies' heads"), and a mixture of bacon, canned tomatoes, and scrambled dried egg ("train smash"). Units further down the ladder, including infantry, often had to endure simpler meals such as cabbage stew.

Smaller vehicles such as tanks or Long Range Desert Group trucks usually carried the equivalent of the British tommy cooker (or camp stove, see p. W88) to brew some tea or heat some soup in the field. Alternately, enterprising chefs could place their canned rations atop the intake manifold of their engine, then drive for a certain amount of time. Even a raw chicken could be cooked – and cooked rather well – in this fashion, given good skill rolls on both Cooking and Mechanic (to estimate the heat correctly). On badly failed rolls, canned rations burst messily or a similar disaster unfolds . . .

Like the infantry, vehicle formations had mess units that kept them fed except during active operations (during which the mess units often could not keep up with the fighting forces). The sort of fare provided by mess units might include a few loaves of bread, sausages, apples, and a bottle of wine or some beer for a German tank crew; rice boiled together with barley and red beans, dried fish, soy sauce, canned tangerines, and tea for Japanese sailors; or ham-and-cheese sandwiches, oranges, chocolate-chip cookies, and a thermos with coffee for a U.S. bomber crew (see p. W:D36).

A Camouflage roll can be used to further improve camouflage appropriately, such as by adding vegetation or using favorable positions. This may give a -1 to -5 penalty to Vision rolls (see p. W153). Camouflage netting was very common, and would give a -2 if it matched the surrounding terrain.

The LRDG used one of the more unusual camouflage patterns, painting their trucks (see p. W:HS27) a rather unwarlike pink. In the African deserts, this was more effective concealment than an actual sand color during dawn raids.

Aircraft usually had a light "sky-colored" underside to make them more difficult to spot from the ground, and a drab or camouflage-patterned upper side to protect them from the eyes of pilots flying above them. Night fighters were often painted black overall.

Ships were often painted in striking zigzag patterns of white, various grays, and black. This worked remarkably well to hide them in the distance at sea. This couldn't hide the telltale plumes of engine smoke, however . . .

On the other hand, it was very important that the vehicle's *own* side was able to identify the craft, to prevent "friendly fire." These unfortunate incidents were especially common in aerial combat, with both planes shooting at the wrong targets and taking fire from the wrong AA gunners.

Ground troops that feared fire from their own aircraft took to displaying large flags on their vehicle's top; this was especially common with German and Japanese crews. Air crews were wary of flak fire, especially when returning home; Allied carrier fighters had their wing leading edges and fins painted bright yellow from 1941, to reduce losses to overeager friendly AA gunners. The night before D-Day, many Allied aircraft were painted with "invasion stripes," white stripes on the wings, to make identification easier.

Such markings became doubly important on captured vehicles. Panthers in use with the Allies were liberally covered with the U.S. star, and B-17s flown by the Germans received huge Balkenkreuz markings – often to no avail . . .

Pedaling Panzergrenadiere

Despite the high mechanization of the war, most men had to use their own feet to take them into battle. (While millions of horses were used during the war, most of them were draft animals.) The next best thing to a ride in a truck or on a horse was riding a bicycle. In use with military forces since the 1880s, the bicycle tripled the speed at which infantry units could move on the march, and allowed even higher speeds in a dash. It also allowed the individual to carry more equipment, the military bicycles of the day often having provision for carrying MGs or rocket launchers in addition to the soldier's basic stuff. For example, German bikes had brackets to vertically carry two Panzerfaust launchers (see p. W98) over the front wheel.

Bicycles were used by all combatants, although the highly motorized Americans used theirs mainly on bases. The Italians fielded the famous Bersaglieri bicycle units (see p. W:GL16), the Finns used them extensively whenever they couldn't ski, and the Japanese mounted entire armies on the *Jitensha* (bicycle). The Germans, whose infantry and cavalry had used their *Truppenfahrrad* (troop bicycle) from the beginning, eventually also mounted two out of six battalions in most Panzergrenadier divisions on bikes in the desperate last year of the war, to save fuel. Even favored formations such as the SS divisions "Leibstandarte" and "Das Reich" had bike units.

A typical military bike weighs 55 lbs., costs $50, and can carry up to 300 lbs. including the rider. It comes with a tire pump and a dynamo-powered headlight; U.S. versions are battery-powered.

Vehicle Details

The following describes some of the basic realities of operating just about any military vehicle of this time period.

Start Your Engines

Battery-powered electrical starters – much like those used today – were commonplace in WWII ground vehicles. The one main drawback was that batteries of the period usually would cease to work at very low temperatures (generally anything below freezing). Tanks and trucks often had measures to aid the crews in these "extra cold" starts. The later German tanks – including the Tiger and Panther – had heaters for the batteries and coolant; these used built-in blowtorches. Soviet T-34 crews often took the same approach, but had to make do with burning rags placed at the right spots. When turning off their vehicles at night, truck drivers might cover their engines with straw mats to retain more warmth for starting them the next morning.

Electrically starting a vehicle requires a Driving or Mechanic roll modified by its maintenance level, very cold temperatures, and any lack of familiarity (p. 8).

Synchronized Weapons

Propeller aircraft needed a synchronizer gear to allow any nose-mounted automatic guns to fire through the spinning propeller. A problem was that these mechanical devices reduced the rate of fire by 10-40% (usually the larger the caliber, the larger the reduction). This seriously reduced the strike capability of the planes; volume of fire is essential for fast-moving aerial and air-to-ground combat. For example, a synchronized 7.62mm ShKAS machine gun generally fired at RoF 25 vs. the RoF 30 of the unsynchronized weapon. Some aircraft therefore mounted their guns inside the propeller hub or outside the propeller arc in the wings. This, in turn, reduced the number of guns able to be mounted.

In 1940, the Germans began to use electric priming (see p. MF37) to counteract this effect. This replaced the mechanical firing pin with a more precise detonation by electrical current, thus allowing closer timing to the propeller's rotation. These weapons suffered a RoF reduction of only 5-10% when synchronized with a prop. The Luftwaffe was only able to take advantage of this technology with a few of its weapons, including most fixed Mauser MG 151 variants and the experimental Mauser MK 213, as well as the Rheinmetall MG 131, MK 103, MK 108, MK 112, and MK 214. A few other sorts of externally powered guns would share this advantage, when linked to the vehicle's powertrain.

If all the cold-start methods failed – as they frequently did in Russian winters reaching as low as -70° F – crews would need to manually start their engine using inertia starters. (The oldest ground vehicles lacked batteries and always required this process.) This process of hand-cranking would require a ST roll in addition to the Driving or Mechanic roll.

Aircraft engines often used mechanical starting devices, such as squibs (blank cartridges the size of shotgun shells) or compressed-oxygen cartridges. The reason was that the aircraft batteries of the time had very low capacities, which only allowed a couple of tries to start the engine before running out of juice. This often was not enough. Mechanical starters using squibs had revolver-like drums which gave five or more tries.

Some aircraft, such as the Supermarine Spitfire I (see p. W:AKM78), required an external battery trolley to start the engine. This proved to be the downfall of one escaped Luftwaffe POW who tried to fly off with a stolen Spitfire.

Of course, many aircraft engines could also be started manually by spinning the propeller – which required at least one man on the ground and the usual ST roll.

Most military vehicles required a great deal of familiarity from the operator. Even an experienced U.S. Army pilot might take as much as a -4 to start a Luftwaffe plane if he jumped into one without any briefing on its peculiarities. While an unfamiliar jeep or light truck might only be worth a -1 penalty, most armored fighting vehicles were nearly as complex as aircraft.

For instance, the usual starting routine for the early-war U.S. Lee tank (p. 68) consisted of the following: Turn master and ignition switches to off. Place gear shift in neutral. Check engine-oil level. Inspect engine for loose or missing parts. If engine has been off for five or more hours, use inertia starter to rotate crankshaft at least 32 times to check for hydrostatic lock. (Remove lower-bank spark plugs to pump out oil if engine is locked.) Check transmission and differential oil. Check that voltmeter reads zero. Close master switch and check that voltmeter reads 24. Open fuel cocks. Turn on fuel-pressure cock and check for leak. Prime engine if necessary, but more than four pumps will flood it. Check clutch for excess play then depress. Close starter and booster switches simultaneously. Let engine turn for short interval then turn the generators (magnetos in British usage, more well-known as alternators in later vehicles) to the "Both" setting. Check that oil pressure reads 60 to 80 psi within 45 seconds or shut off engine. Check transmission oil flow via tap. Check for leaks throughout engine compartment. Check that each generator will keep engine running. Let engine idle at least 10 minutes and approach operating temperature (oil temperature of at least 80°) before putting tank into gear.

Obviously, much of this routine consisted of maintenance items, which could be ignored by experienced and novice driver alike in an emergency situation. (For instance, while under fire, the driver wasn't likely to check for leaks by climbing out of the driver's position to open the various engine hatches from outside.) Still, a great deal of the procedure – particularly the educated guesswork of priming the engine – depended on experience with that particular model of tank, and indeed, with that particular tank's individual tendencies. The GM will be hard-pressed to overplay familiarity penalties.

On the Road

Traveling in most WWII military vehicles was *rough*. Bombers, tanks, and personnel carriers usually vibrated badly when in motion. Even warships, except for the largest, offered little comfort; destroyers in particular were ill-regarded by many sailors for their tendency to pitch and plunge through waves.

In any aircraft or ground vehicle, or in all but the largest ships in choppy seas, assess a routine travel Fatigue cost of 1 per hour for all crew members and passengers. Bad weather or roads can increase this. ***GURPS WWII: Red Tide*** has more advanced rules for assessing Fatigue in travel.

Recovery Operations

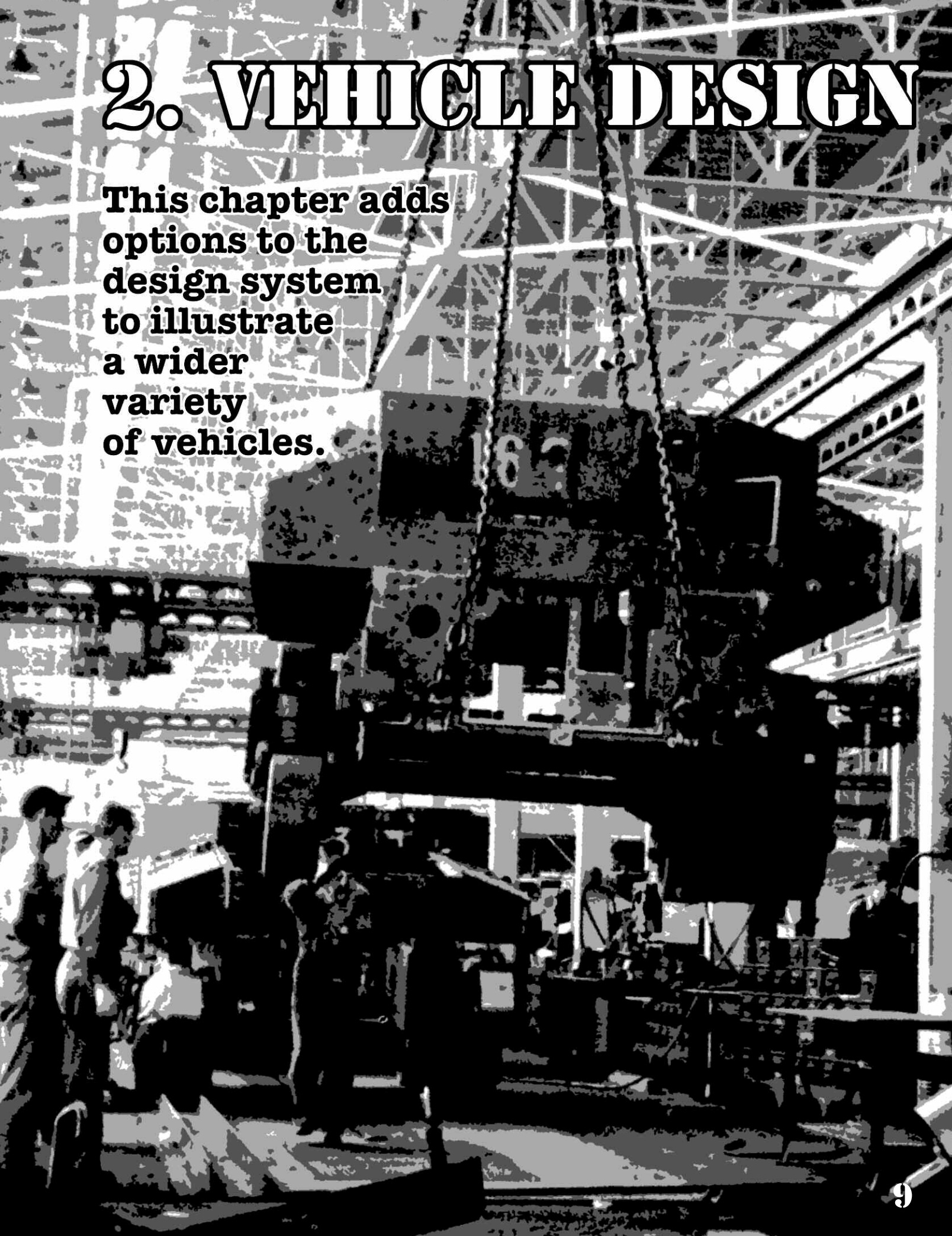
Ground vehicles frequently become stuck when traveling off-road or on roads covered by mud or snow and ice.

Unditching a stuck vehicle may require more power than just that required to move the actual weight of the vehicle. For a "routinely" stuck (see p. W153) *wheeled* vehicle, multiply its loaded weight by 0.75 to find the required power to unditch it using a winch or a towing vehicle. For a "routinely" stuck *tracked* vehicle, multiply its weight by 1. For a "permanently stuck" *wheeled* vehicle, multiply its weight by 1.5, and for a *tracked* vehicle by 1.75.

Many military vehicles mounted winches (see p. 22) for recovery. Using block and tackle, the pulling capacity of a winch can be doubled or even tripled, although this considerably increases the time required.

2. VEHICLE DESIGN

This chapter adds options to the design system to illustrate a wider variety of vehicles.



New Chassis

The following new chassis options help fill out the variety of options presented on pp. W118-119.

Gigantic Tank

The *Colossal Tank* (see p. W120) is best suited for some German projects such as Krupp's E 100. For the Maus and similar lunatic designs, this even larger chassis is necessary.

Mild Slope: Reduce VSPs to 180.

Medium Slope: Reduce VSPs to 160.

Advanced Slope: Reduce VSPs to 125.

Expensive Armor: Change armor to 40 lbs./$80.

Standard Wheeled

This wheeled chassis falls into the midpoint of the existing range of options on p. W118. It can represent a particularly large armored car or smallish truck.

Huge Helicopter

This represents the largest historical helicopter made during WWII. The landing gear has 30 HPs and 30 sf area, and is targeted at +1.

Tiny Plane Wings

This represents particularly small wings mainly used on aircraft with Good streamlining or better.

Tracked Chassis

Chassis	*VSPs*	*Wt.*	*Cost*	*HPs*	*Armor*	*SA*	*Top Size*
Gigantic Tank	200	44K	$4.5K	3,600	50 lbs./$30	600	200 +4
DR 65 Tracks			1,300		300 lbs./$30	430	+4

Wheeled Chassis

Chassis	*VSPs*	*Wt.*	*Cost*	*HPs*	*Armor*	*SA*	*Top Size*
Standard Wheeled	45	2,000	$100	165	25 lbs./$2.50	220	70 +3
4-12 Wheels				110*	50 lbs./$5	75	+2

Helicopter Chassis

Chassis	*VSPs*	*Wt.*	*Cost*	*HPs*	*Armor*	*SA*	*Top Size*
Huge Helicopter	50	2,500	$7,000	360	20 lbs./$12	240	+3
Rotor				100	35 lbs./$21	70	-1

Airplane Chassis

Chassis	*VSPs*	*Wt.*	*Cost*	*HPs*	*Armor*	*SA*	*Top Size*
Tiny Plane Wings	0.8	100	$400	12	32 lbs./$20	65	+0

New Chassis Options

These new chassis options simply replace one or more statistics from the original chassis.

Light Tank Chassis

These represent particularly lightweight construction, often used to develop amphibious or airborne tanks.

Light Option for Midget Tank: Weight is 1,600 lbs., cost $120, and HPs 52 for the body and 19 for the tracks.

Light Option for Very Small Tank: Weight is 3,200 lbs., cost $250, and HPs 100 for the body and 35 for the tracks.

Light Option for Small Tank: Weight becomes 4,700 lbs., cost $370, and HPs 125 for the body and 45 for the tracks.

Light Option for Medium Tank: Weight is 7,700 lbs., cost $615, and HPs 190 for the body and 70 for the tracks.

Light Option for Large Tank: Weight becomes 9,700 lbs., cost $800, and HPs 225 for the body and 80 for the tracks.

Light Option for Very Large Tank: Weight is 13,000 lbs., cost $1,000, and HPs 275 for the body and 100 for the tracks.

Light Option for Immense Tank: Weight is 16,000 lbs., cost $1,300, and HPs 320 for the body and 110 for the tracks.

Light Option for Colossal Tank: Weight is 21,000 lbs., cost $1,800, and HPs 390 for the body and 140 for the tracks.

Light Option for Gigantic Tank: Weight is 24,500 lbs., cost $2,100, and HPs 450 for the body and 160 for the tracks.

Light Halftracked Chassis

These represent especially lightweight construction of halftracked vehicles, used in particular for pre-war halftracked civilian vehicles and wartime halftracked trucks.

Light Option for Very Small Halftrack: Weight becomes 820 lbs., cost $40, and HPs 30, with track HPs 8.

Light Option for Small Halftrack: Weight is 3,700 lbs., cost $150, and HPs 150, with track HPs 40.

Light Option for Medium Halftrack: Weight becomes 6,600 lbs., cost $310, and HPs 240, with track HPs 65.

Light Option for Large Halftrack: Weight is 8,200 lbs., cost $420, and HPs 285, with track HPs 75.

Light Option for Very Large Halftrack: Weight becomes 10,600 lbs., cost $580, and HPs 340, with track HPs 90.

Heavy Wheeled Chassis

This option makes a wheeled chassis more rugged, for use as armored or railroad cars, or as construction equipment.

Heavy Option for Motorcycle: Weight is 680 lbs., cost $40, and HPs 75, with the wheels dividing 60 HP among them.

Heavy Option for Very Small Wheeled: Weight becomes 2,800 lbs., cost $160, and HPs 330, with the wheels dividing 200 HP among them.

Heavy Option for Small Wheeled: Weight is 4,500 lbs., cost $250, and HPs 500, with the wheels dividing 360 HP.

Heavy Option for Standard Wheeled: Weight becomes 5,700 lbs., cost $330, and HPs 660, with the wheels dividing 450 HP among them.

Heavy Option for Medium Wheeled: Weight is 11,400 lbs., cost $670, and HPs 1,300, with the wheels dividing 900 HP.

Heavy Option for Large Wheeled: Weight is 15,500 lbs., cost $900, and HPs 1,800, with the wheels dividing 1,200 HP.

Heavy Option for Very Large Wheeled: Weight becomes 22,800 lbs., cost $1,350, and HPs 2,600, with the wheels dividing 1,800 HP among them.

Heavy Option for Immense Wheeled: Weight becomes 39,000 lbs., cost $2,300, and HPs 4,500, with the wheels dividing 3,120 HP among them.

Multiple Main Rotor Helicopter

Any ***GURPS WWII*** helicopter may take the MMR (multiple main rotor) option. This represents a design that uses two main rotors of equal size, spinning in opposite directions, to achieve stability. (A standard helicopter uses one main rotor with one small tail rotor dedicated to counterbalancing the main rotor's torque.) MMR helicopters can lift 20% more weight than their counterparts, but are slightly more vulnerable and less maneuverable.

Helicopters with the MMR option use the same rotor statistics as those without, except that the listed HPs are split evenly between the two main rotors. The armor and other statistics remain the same; any armor purchased is applied to both rotors, and any attack has a 50-50 chance of hitting either rotor. Only *one* rotor has to be destroyed to make an MMR helicopter unflyable. An MMR helicopter must install a transmission for *each* rotor, though both can be powered from a single engine if desired.

When figuring aerial statistics (see p. W149), an MMR helicopter achieves lift equal to 12 (rather than 10) times its motive power. In the formula for aMR, it uses a multiplier of 150 (rather than 180).

Hydrofoils

A smaller ship chassis can be fitted with hydrofoils, which allow it to skim along over water at higher speeds than usual. If a water vehicle has a wSpeed (see p. W147) of 20 + (body surface area/100) mph or more, it can rise on its foils, lowering water resistance and multiplying wSpeed by 1.5. If wSpeed is high enough to allow planing, calculate planing speed and then apply the hydrofoil modifier. Most WWII-era designs have stability problems; reduce wSR by 1.

A set of hydrofoils is attached on the body sides; it must match the ship's size. It may not hold any components and adds its volume to the overall volume of the ship.

Hydrofoils

Module Type	*Volume*	*Wt.*	*Cost*	*HPs*	*Armor*	*SA*	*Size*
Small Boat Hydrofoils	2.6	240	$18	30	25/$4.5	40	+0
Medium Boat Hydrofoils	7.8	900	$55	115	45/$9	75	+1
Large Boat Hydrofoils	23.4	1.8K	$105	225	90/$18	150	+2
Light Cutter Hydrofoils	58.5	5.4K	$360	900	180/$36	300	+3
Medium Cutter Hydrofoils	156	11K	$720	1.8K	360/$72	600	+4
Heavy Cutter Hydrofoils	312	16K	$1.1K	2.7K	540/$108	900	+5
V. Lt. Corvette Hydrofoils	585	36K	$4.1K	9K	900/$180	1.5K	+5

Sails

These modules fit a ship with sails and rigging; these have become obsolete in military usage but remain the primary means of propulsion for many coastal craft, especially in the Pacific. Even a few clipper-style four-mast ships can still be found crossing the Atlantic as the war began.

A ship can mount up to six Mast & Sails modules, but one to three is a more usual allotment. Each module represents a single mast with all of its sails and rigging. The modules require a minimum chassis size, which is listed in the table, but many vessels will carry a module several steps smaller than allowed.

Each Mast & Sails module has a *Sail Area*. The aquatic motive thrust of the module depends on the Sail Area and the wind force measured on the Beaufort scale, where for instance 2 is a light breeze and 5 is a fresh breeze.

Ath = Sail Area × Wind Force × 0.4 lbs.

Calculate water performance normally for wind forces 1-6. At wind force 7 and above, ships have to furl their sails. The wSpeed is then modified for the wind direction:

On the Stern: The wind comes directly from behind. Use 80% of calculated wSpeed.

On the Quarter: The wind comes from behind, but slightly to the right or left. Use full wSpeed.

Abeam: Wind from right or left gives 90% of wSpeed.

On the Bow: The wind comes from the front of the ship. Use 30% of wSpeed; this represents tacking.

Mast & Sails

Module Type	*Weight*	*Cost*	*Sail Area*	*HPs*	*Size*	*Minimum Chassis*
5' Mast & Sails	16	$1.60	10 sf	1	-4	Raft
10' Mast & Sails	60	$6	40 sf	3	-4	Raft
15' Mast & Sails	130	$15	90 sf	6	-2	Small Boat
20' Mast & Sails	230	$25	160 sf	12	-2	Medium Boat
30' Mast & Sails	500	$50	360 sf	24	-1	Large Boat
40' Mast & Sails	890	$90	640 sf	42	+0	Light Cutter
50' Mast & Sails	1.5K	$140	1,000 sf	80	+1	Light Cutter
60' Mast & Sails	2K	$200	1,440 sf	100	+1	Medium Cutter

New Armor Options

Armor Patches: Many tanks received additional armor, both in the field and often even in the factory. While proper armor plates bolted or welded on top of the original armor offered better protection than improvised methods, they almost universally were added only over specific vulnerable spots.

For example, from late 1943, many Sherman tanks (see pp. 70, W102) received two small, 1" thick armor plates (DR 82) on the right hull side and one on the left side, protecting the ammo racks in the sponsons from side shots.

Such armor patches are special effects against critical hits (see p. W156); if the tables on p. 62 of ***Compendium II*** or p. VE184 are used and an ammo explosion is rolled, check first to see if the patch does not prevent a penetration after all.

Concrete Armor: Concrete was used on quite a few historical vehicles of WWII. On armored vehicles, the Germans employed it to reinforce shot traps and weak spots on the front or roof. This practice was mostly confined to the StuG III (see p. W:FH38) and StuG IV (see p. W:IC80). The U.S. Army placed concrete slabs on some M-4s' (see p. W102) hull front.

A 4" thick layer of concrete adds DR 100 to armor. It weighs 50 lbs. and costs $0.20 per square foot covered.

One practical limitation was the extra strain that the additional weight put on the suspension. Don't forget to recalculate the ground performance.

Concrete was also used in pill boxes mounted on railway flatcars by the Germans and others. These were basically small bunkers strapped to the trains to conserve armor steel.

The most drastic concrete design was used in England, where a concrete company developed the Bison moving pillbox in 1940. This desperate vehicle consisted of an old Morris or Thornycroft truck chassis (or even an AEC London bus chassis) which received a 6" thick (DR 150) concrete driver cab and a pill box in the rear, complete with the usual firing slits and MGs. Considerable numbers were made for Home Guard use, but never saw combat.

Riveted Armor: Many armored vehicles dating from the 1930s and earlier featured armor that was built by riveting and screwing metal plates together. While the rolled steel plates could be of high quality, the seams proved to be vulnerable on the earliest designs, as even rifle bullets could enter them and penetrate the braces to which the plates were riveted.

While by the late 1930s most designs had solved that danger, the rivets themselves still posed problems. Near-miss explosions and non-penetrating hits often popped the rivets and screw heads, causing them to ricochet around the interior with deadly results. If any attack does at least 15 points of damage but fails to penetrate armor, roll 3d for each crew member in that subassembly. On a 16+, that crew member takes 2d of fragmentation damage from a flying rivet.

Improvised Armor: Tank crews were almost invariably not content with the protection of their vehicles, and sought to bolster the armor by various *ad hoc* measures.

Improvised armor included sandbags, tracks links, spare wheels, wood logs, and other sturdy materials. Unless a facing of a vehicle isn't covered totally with improvised armor, the GM should work out a rough percentage of the surface covered, and convert this into a die roll; e.g., a turret side hung with track links covering about half the surface would be protected on a roll of 1-3 with 1d. It is usually dislodged after a single hit to the facing.

Most added considerable weight, which may reduce ground performance.

Sandbags were favored by Allied troops, especially the Americans, but used by all combatants. They were usually added to the body front and sides by stacking them in wooden frameworks. While some troops (and later-day analysts) argued that this added considerable protection against HE shells and shaped-charge warheads (much like *Standoff Armor*, p. W140), others insisted it didn't help much. In any case, the added weight put extra strain on the suspension and reduced mobility, which is the reason that some U.S. unit commanders forbade the practice.

An 8" thick layer of sandbags adds DR 15 and reduces the HEAT armor divisor from (10) to (5). It weighs 65 lbs. and costs $0.01 per square foot covered.

Sandbags were often used *inside* vehicles, reinforcing the floors against mines by adding DR 15 to the underbody.

Spare track links and *spare wheels* were used by all combatants. These items were often needed for repairs and maintenance anyway, and strapping (or welding) them on the body and turret front and sides added a bit of extra protection. Initially, only the vehicle's own spares were used – late in the war, some German tanks were covered with T-34 tracks . . .

Tracks will add their DR to the armor: e.g., Sherman tracks will add DR 45.

Wood logs were mainly used on emplaced vehicles, but also on assault guns, especially by the Finns (see p. W:FH39). They offered little extra protection against AP rounds (DR 3 per inch of diameter), but *may* work as stand-off armor against shaped-charge warheads.

Wood planks were used by the Americans on tanks in the Pacific, where the hull sides of M-4s (see p. W102) were covered with 1" thick hardwood paneling to counter the threat of Japanese magnetic mines. Such wood planks add DR 4, weigh 3.5 lbs., and cost $0.20 per square foot of coverage.

Zimmerit: To prevent the attachment of magnetic antitank devices, the German Zimmer company came up with Zimmerit, a sawdust-laden paste applied to tank bodies, superstructures, and turrets, and then dried with blowtorches into a ridged 0.2" layer. Historically, it was applied exclusively on German tanks and assault guns from December 1943 to September 1944 (even though the Allies did not use magnetic antitank devices). After the German collapse, the British investigated employing it in the Pacific, where the Japanese frequently used magnetic mines. The war ended before this was introduced. Zimmerit also made the vehicle's outline less distinct and reflective, providing a -1 Vision penalty on spotting it at the GM's option. Zimmerit weighs 0.2 lbs. and costs $0.01 per square foot of coverage.

Dead Angles

Vehicular weapons always have so-called dead angles – they can't be used against targets closer than a certain distance due to the minimum elevation of their mounts. For example, the hull machine gun on the T-34 (see p. W105) could not fire at human-sized targets closer than 15 yards, and the main gun and coaxial MG could not fire at targets closer than 25 yards. These distances were similar on other tanks.

These dead angles could be exploited by dedicated infantry using magnetic mines, antitank hand grenades, Molotov cocktails, or similar desperate measures. The troops "only" needed to get that close – but this could be fairly easy in built-up areas, heavily wooded terrain, etc.

Naturally, the crews were aware of these dead angles. Many tanks had one or more gun ports in the turret sides or back, allowing defensive fire with pistols and submachine guns. From 1944, German tanks had the *Nahverteidigungswaffe* (close defense weapon), which was used as a firing port in the turret roof (p. 15). The bizarre StG 44 mit Krummlauf (see p. W:IC62) was an assault rifle with a curved barrel to fire out of firing ports or hatches, specifically to counter this threat. Another defensive measure was installed on early Tiger I Ausf E tanks (see p. W104): a *Schützenmine* (antipersonnel mine, see p. W:IC65) was mounted on each corner and in the center of the hull's left side (where there was no pistol port in the turret side), and could be detonated from within to get rid of attackers.

In 1944, the Germans even experimented with high-voltage cables rigged around the hulls of tanks (use the rules for *Electrified Surfaces*, p. VE93), but this rather impractical device was never used operationally.

And of course, in really close encounters, running over infantry also worked . . .

Powertrain Options

The following new components add to the powertrain design process on pp. W128-129.

Engine Accessories

Methanol-Water Feed: This represents the German MW 50 system and similar designs used by the Americans and Japanese. It is a rudimentary pump and feed-line arrangement connecting a fuel tank with an engine's air (rather than fuel) intake. Each engine to be boosted must have a feed.

Instead of gasoline, the fuel tank is filled with a mixture of methanol and distilled water (7 lbs. and $0.03 per gallon). When activated, the mist of methanol and water greatly increases fuel consumption, primarily by lowering intake temperatures – providing up to a 25% increased in the engine's kW output (a given system can be set to provide less for safety). Multiply fuel usage by six during this period.

The methanol-water mix itself also is consumed. Each gallon lasts for 650 kW-minutes; i.e., it provides an extra 650 kWs of power for 1 minute or 325 kWs for 2 minutes or 65 kWs for 10 minutes, etc.

The process is fairly safe but runs some risk of eroding the spark-plug contacts, blowing a fuel injector, etc. During MW-enhanced operation, roll for each engine vs. HT+8, at -1 per 5% increase in power. On each failed roll, the engine's base kW output declines by 1% for each point the roll was failed by (minimum 1%). On a critical failure, the engine quits working!

Fixing this damage consists of simply changing the spark plugs if the total damage was less than 10%, a complete overhaul otherwise. A critically failed engine becomes scrap metal. German doctrine prohibited using MW boost for more than 10 minutes at a time, but longer usage usually bears no special risk.

Electric Motors

Like engines (see p. W128), these provide motive power, but use no fuel; batteries or an engine provide their power. Either 3,600 kWs of battery power per hour or 1 kW of engine output provides 1 kW of motor output (a simplification for game purposes). ***WWII*** vehicles *cannot* use batteries for motive power without motors. Diesel-engined subs use electric motors when underwater. These motors can use the engine's transmission, up to its top kW rating, when the engine isn't running. Transmissions used *solely* for electric motors have *half* normal weight, volume, and cost. An engine dedicated to run an electric motor cuts fuel usage by 25%.

Module Type	*VSPs*	*Wt.*	*Cost*	*Power*
Methanol-Water Feed	0.1	20	$10	+650 kW/min./gal.
Electric Motor	*	8	$8	1 kW

* Calculate volume as for engines; see p. W128.

Liquid-Fuel Rockets

The liquid-fuel rockets on p. W129 assume a generic "rocket fuel." The following gives real fuel statistics.

To compute the effective thrust of the rocket, use the following formula, where flow rate (in pounds per hour) can be any figure up to a maximum of 75,000 lbs./hour per module for a historical rocket. Impulse depends on the fuel type.

motive thrust = flow rate×impulse/3,600

For example, a module burning kerosene/nitric acid could have maximum thrust of 75,000×240/3,600 = 5,000 lbs. It burns 75,000/8.5 = 8,823.5 gallons per hour, or 2.5 gallons per second.

These rules add some detail to those on p. W129, and were used for the designs in this book.

Propellant Table

Liquid Rocket Fuel	*Impulse*	*Weight*	*Cost*	*Fire*
Aniline/nitric acid	260	10	$0.20	13
Catalyzed peroxide	100	10	$0.20	13
Hydrogen/oxygen	380	2.1	$0.10	13
Kerosene/nitric acid	240	8.5	$0.25	13
Methanol/peroxide	250	10	$0.20	13
Octane/oxygen	320	8.5	$0.10	13

Weight and cost are given per gallon.

Aniline, nitric acid, and peroxide are particularly corrosive, easily ignited, and toxic. Rocket motors and tanks capable of using these fuels cost 1.5× the standard price.

New Weapons

The following vehicular weapons add to the options found on pp. W130-135.

Machine Guns

Assault Rifle: This represents the German 7.92mm Haenel StG 44 assault rifle (see p. W95).

Antitank LMG: This represents the German 7.92mm Mauser MG 141, an experimental weapon that saw limited use on light tanks such as the PzKpfw II Ausf G (see p. W:IC78). It fired the same round as the PzB 39 antitank rifle (see p. W95). The 7.92mm Mauser EW 141 was similar, but fired only semiautomatic (RoF 3~).

Powered Aircraft LMG: This represents the twin-barreled Hungarian 7.92mm Danuvia-Gebauer 26/31M. It is externally powered by the engine. Like modern "chain guns" (see pp. HT120, VE103), a powered MG is very reliable and effectively synchronized for use on propeller aircraft (p. 8). Its power requirement is 1 kW.

Powered Aircraft HMG: This represents the twin-barreled Hungarian 12.7mm Danuvia-Gebauer 40M, a larger version of the Powered Aircraft LMG. Its power requirement is 1.4 kW.

Long Ground HMG: A water-cooled weapon principally used for AA fire on ships, this represents the British 12.7mm (".500-inch") Vickers Mk III. The less common tank versions had slower fire rates (RoF 7* for the Mk II and Mk IV, and RoF 9* for the Mk V).

15mm Very Long Ground HMG: A heavy machine gun mainly used in armored vehicles by the British, this represents the British 15mm BESA Mk I, and the Czechoslovakian 15mm vz. 38 (ZB60) on which it was based. The Germans used a few as FlaMG 39(t).

15mm Very Long Aircraft HMG: A powerful aircraft machine gun, representative of the German 15mm Mauser MG 151, this was quickly superseded by autocannons since its shells could not carry enough explosive. It can also be used for various prototypes, such as the 15mm Mauser MG 215/15 (RoF 23), which had its introduction canceled in 1944, or the experimental British 15mm Rolls-Royce Type AA (RoF 20).

Autocannons

25mm Long Ground Autocannon: Mainly used for AA purposes, this represents the French 25mm Hotchkiss Mle 30, Mle 38, and Mle 39. The Japanese built a copy as the 25mm 96 Shiki Kikanhō. It can also be used for the Soviet 25mm 72K (25-ZP-40) and 25mm 84KM (25-ZP-44), and the Swedish 25mm Bofors Ksp m/32 and Ksp m/38 (both with RoF 3*).

30mm Very Short Aircraft Autocannon: This is the Japanese belt-fed 30mm Hō-155; it can also be used for the 30mm 2 Shiki Kikanhō (RoF 6*), which used a 42-round drum.

30mm Medium Aircraft Autocannon: A powerful aircraft weapon, this is the German 30mm Rheinmetall MK 103 and FlaK 103/38. It can also be used for the 30mm Rheinmetall MK 101 (RoF 4*), which used 30-round drums.

30mm Medium Revolver Cannon: This is the German 30mm Mauser MK 213. This advanced aircraft weapon debuted too late to serve in WWII, but is widely considered to be the best aircraft gun to come out of the war. All the Allies had introduced copies by the 1950s. Two guns with 100 rounds each were proposed as armament for the Bf 110 (see p. W:IC88) and four for the Me 262 (see p. W:IC89).

40mm Short Ground Autocannon: This represents the British 40mm ("2-pounder") Vickers Mk VIII, a water-cooled weapon used for AA on ships.

50mm Medium Aircraft Autocannon: This is the German 50mm Rheinmetall BK 5, which used the same cartridge as the 50mm KwK 39 tank gun, but different projectiles.

55mm Short Aircraft Autocannon: A heavy weapon to take down bombers, this is the German 55mm Rheinmetall MK 112, a scaled-up MK 108. It appeared too late; two with 25 rounds each were proposed to be installed in the Me 262 (see p. W:IC89), two with 50 rounds each below the Ar 234.

Tank Guns and Artillery

15mm Antitank Rifle: This represents the British 13.9mm (".55-caliber") Boys Mk I rifle (see p. W95); it can also be used for the Czech 15mm vz. 41 rifle and Soviet 14.5mm PTRD-41 and PTRS-41 rifles (see p. W95).

20mm Antitank Rifle: A semiautomatic, magazine-fed weapon installed in some armored cars and ground-attack aircraft of the 1930s, this represents the Austro-Swiss 20mm Steyr-Solothurn S18-100, S18-154 (see p. W:FH33), S18-300 also known as the KwK 35(ö), and S18-350.

25mm Long Tank Gun: A light antitank gun representing the French 25mm Hotchkiss Mle 34 and Puteaux Mle 37, this can also be used for the Swiss 24mm Furrer PzwKan 38, which was semiautomatic (RoF 1) with 6-round magazines.

37mm Infantry Gun: A very short-barreled, low-powered WWI design, with marginal effectiveness vs. armored targets, this represents the French 37mm Puteaux SA-17 and SA-18; it can also be used for the Japanese 37mm 98 Shiki aircraft gun and the Soviet 37mm PS-1 (7K) tank gun.

40mm Medium Tank Gun: This represents the British 40mm ("2-pounder") Rifled Ordnance QF Mk IX and Mk X; note that the HE shell for this wasn't available until 1943. Can also be used for the Hungarian 40mm MÁVAG 41M. The 2-pounder tank gun could be fitted with the "Littlejohn adaptor," which was designed by Czech Frantisek Janecek (whose surname translates as "little John") to boost its performance by decreasing the bore. Unlike German squeeze-bore weapons such as the 28mm Mauser sPzB 41 (see p. W130), it used an add-on adaptor rather than a specially-made tapered barrel. The 37-lb., $75 Littlejohn adaptor was added to the muzzle of the gun, reducing caliber from 40mm to 30mm. With the adaptor fitted, it could only fire specially flanged APSV rounds.

50mm Medium Tank Gun: This represents the German 50mm KwK 38; it can also be used for the French 47mm Puteaux SA-35 and Japanese 47mm 1 Shiki Hō.

57mm Medium Tank Gun: This represents the British 57mm ("6-pounder") Rifled Ordnance QF Mk III and ROQF Mk V. It can also be used for the British 57mm ("6-pounder") ROQF Mk II and ROQF Mk IV antitank guns, as well as the American 57mm M-1 antitank gun.

76.2mm Very Short Howitzer: Installed in the hull of some tanks for close support, this is the 76.2mm ("3-inch")

Howitzer Ordnance QF Mk I and Mk I*. Historical installations could not reach Ind range in their low-angle mounts.

87.6mm Short Howitzer: This is the British 25-pounder HOQF Mk I, a howitzer used in field mounts and some self-propelled guns such as the Sexton and Bishop.

88mm Long Tank Gun: A very powerful late-war tank gun based on an antiaircraft design, this is the German 88mm Krupp KwK 43. It can also be used to represent the German 88mm FlaK 18, FlaK 36, FlaK 37, and PaK 43; Italian 90mm Mod 41; and Soviet 85mm 85-ZP-39.

95mm Short Howitzer: Mounted on some British tanks for close-support, this is the British 95mm ("3.7-inch") Howitzer Ordnance QF Mk I.

105mm Short Howitzer: A light artillery piece also installed in armor, this represents the U.S. 105mm M-2A1, M-3, and M-4; it can also be used for the Czech 100mm Skoda vz. 14/19, vz. 28, and vz. 30; Dutch 105mm Bofors M.27; French 105mm Schneider Mle 34 and Mle 36; German 105mm Rheinmetall leFH 18; Hungarian 105mm MÁVAG 43M; Italian 100mm Skoda Mod 14; Japanese 105mm 91 Shiki; Polish 100mm FWU wz. 14/18; Soviet 107mm 107-P-10/30; and Yugoslavian 100mm Skoda M14/19 and M28.

122mm Short Howitzer: This represents the Soviet 122mm 122-G-38 (M-30).

128mm Medium Tank Gun: This represents the German 128mm Krupp PzJgK 80, PaK 44, or KwK 44.

150mm Very Short Infantry Gun: A stubby artillery piece, this represents the German 149mm Skoda sIG 33 and sIG 33/1; it can also be used for the British 152mm ("6-inch 26 cwt") BL How Mk I; Czech 149mm Skoda vz. 25; French 155mm Schneider Mle 17; Italian 149mm Skoda Mod 14; Japanese 149mm Meiji 38 Shiki; and Soviet 152mm 152-G-10/30.

150mm Short Howitzer: A standard heavy artillery piece, this represents the German 149mm Rheinmetall sFH 18, sFH 18/1, and sFH 36; it can also be the Belgian 155mm Mle 24; Czech 149mm Skoda vz. 37; French 155mm Schneider Mle 17; Italian 149mm Ansaldo Mod 37 and Mod 42; Japanese 149mm 96 Shiki; and Soviet 152mm 152-P-10/30, 152-P-10/34, 152-G-38 (M-10), and 152-G-38 (ML-20).

Dual-Purpose Guns

100mm Long DP Gun: This represents the Japanese 100mm 98 Shiki.

102mm Short DP Gun: This represents the British 102mm ("4-inch") QF Mk IV, Mk XII, Mk XIX, and Mk XXII.

113mm Medium DP Gun: This represents the British 113mm ("4.5-inch") QF Mk I, Mk III, and Mk IV.

120mm Medium DP Gun: This is the British 120mm ("4.7-inch/L45") Vickers-Armstrong BL Mk I, Mk II, Mk XI, and Mk XIII. It can also be the British 120mm ("4.7-inch/L50") BL Mk XI; Dutch 120mm Bofors #4 and 120mm Wilton-Fijenoord #5, #6, and #8; Italian 120mm OTO Mod 31, Mod 36, Mod 37, and Mod 40; Japanese 120mm Taishō 3 Shiki, 10 Shiki, and 11 Shiki; Polish 120mm Bofors wz. 34/36; Soviet 120mm M-1905; and Swedish 120mm Bofors m/24.

140mm Short DP Gun: This Japanese 140mm Taishō 11 Shiki also represents the French 139mm Mle 23 and Mle 27.

Vehicle Mortars

51mm Vehicle Mortar: This represents the British breech-loading 51mm ("2-inch") Bombthrower Mk I and Mk IA as well as its U.S. copy, the 51mm ("2-inch") M-3. It was only issued with smoke rounds, and had three fixed ranges regulated by a gas valve: 35, 75, and 150 yards. It *could* fire the HE bombs of the infantry mortar (see p. W98), and some crews acquired HE ordnance.

92mm Vehicle Mortar: This is the German *Nahverteidigungswaffe* (close defense weapon), a 92mm breech-loaded mortar firing smoke rounds at a fixed elevation and range. It was installed in the roof, and traversed manually through 360°. With the breech open, it could be used as a firing port for a 26.5mm flare pistol (see p. W:IC62). Aside from colored smoke and the usual flares, the flare gun (but not the NvW itself) could also fire a HE shell that could be used for close defense.

Hedgehog: This British invention fired 178mm antisubmarine bombs 200 yards ahead of the ship. The projectiles were launched so that all hit the water at once in a circular pattern 130' in diameter. The bombs only exploded upon hitting a sub's hull, to avoid ruining the sonar contact and as sure sign of a hit, doing 6d×60 explosive damage (note that DR is not squared against contact explosions!). The projectiles sink at 8 yards per turn. Reloading takes 30 seconds per bomb; up to four loaders can work at once. The device had a base chance of 4 or less to hit any sub within its pattern with four spigot mortars fired. Add a +1 to hit for each extra four launchers, and add one hit for every 3 points by which the attack roll is made. The historical 24-round launcher gives a 9 or less to hit.

Listed cost and weight is for the fire director and first four launchers. Additional launchers are purchased in units of four. Hedgehogs required 5 square feet of deck space per launcher.

Vehicle Flamethrowers

Heavy Vehicle Flamethrower: This is an improved vehicular flamethrower with longer range.

Rockets

55mm HE Rocket: This represents the German 55mm R 4/M *Orkan* (hurricane) rocket, which was mounted on various German aircraft.

73mm HE Rocket: This represents the German 73mm RZ 73, which appeared late in the war on aircraft; it can also be used for the earlier RZ 65. Used in single mountings or in multi-shot racks, the RZ 73 was also fired from the 35-round Föhn-Gerät for AA use.

88mm HEAT Rocket: This represents the RPzGr 4322 *Panzerschreck* (tank terror), the same rocket as used in the RPzB 43 and RPzB 54 infantry launchers (see p. W98). It was fired from single-round launchers mounted on underwing racks of Fw 190A-8 fighters (see p. W:IC85). Each rack had six launchers. It saw service from early 1945. Six launchers each were also mounted on 56 converted Borgward IV weapon carriers (p. 35) for the last defense of Berlin.

127mm HE Rocket: This represents the U.S. 127mm ("5-inch") FFAR, which was fired from 8-round underwing racks. It was in use from 1944.

127mm HE High-Velocity Rocket: This represents the American 127mm ("5-inch") HVAR (nicknamed "Holy Moses"), which was similar to the older 127mm HE, but faster and more accurate. It used the same firing racks.

130mm HEAT Rocket: This is the *Panzerblitz II* (tank lightning), which mated the 55mm R 4/M rocket motor with a 130mm HEAT warhead. It was fired from single-round launchers mounted on six-shot racks under the wings of the Fw 190F-8 (see p. W:IC85). It entered service in early 1945.

150mm HE Rocket: This represents the German 158.5mm WGr 41Spr. It was fired from 6-round or 10-round launchers.

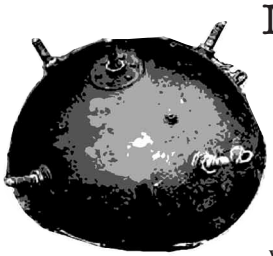
150mm Smoke Rocket: This represents the German 158.5mm WGr 41wKh.

210mm HE Rocket: The German 214.5mm WGr 42Spr inspired a U.S. copy, the T-36, which did not enter service. From 1943, the WGr 42Spr was fired from single underwing launchers on the Bf 109G-6/R2 (see p. W111) and the Fw 190A-8/R6 (see p. W:IC85), and from twin underwing launchers on the Bf 110G-2/R3 (see p. W:IC88).

380mm HE Rocket: This German 380mm RakSprGr 4581 was based on the RakTGr 3, a rocket with a depth charge as its warhead and originally designed for coastal defense. It was fired from the Rheinmetall RW 61 gun/launcher.

380mm HEAT Rocket: This represents the German 380mm RakHLGr 4582 HEAT rocket, which could penetrate almost 9' of reinforced concrete.

Torpedoes



450mm Torpedo: This steam-driven Italian Fiume W 200 airborne torpedo, widely used as F 5w by the Germans, had to be dropped at aSpeed 140-170 and height 100'-130'. It can also represent the British Mk XII (6d×775, Spd 20, End 100) and Mk XV (6d×865, Spd 20, End 125) airborne torpedoes; German LT 1A1 (6d×1,100, Spd 20, End 125) and LT 1A3 (Spd 14, End 468) airborne torpedoes, the latter with inertial guidance (see p. W132); Italian SI 200, W 200, SI 200, SI 170 (6d×750, Spd 21, End 210), W 170 (6d×750, Spd 27, End 41), and the W 110 (6d×485, Spd 24, End 92) used primarily by motor boats; Japanese 91 Shiki 1 Gō (6d×660, Spd 24, End 92), 91 Shiki 3 Gō Shinhōtō (6d×1,060, Spd 24, End 92), and 4 Shiki (6d×1,340, Spd 24, End 68) airborne torpedoes, and 2 Shiki (6d×1,545, Spd 20, End 165) torpedo for midget subs and motor boats; and the Soviet 45-36N (Spd 23, End 143) motor boat torpedo and 45-36AV and 45-36AN airborne torpedoes (both Spd 22, End 199).

483mm Torpedo: This is the steam-driven U.S. Mk 24 airborne torpedo, which was the first successful design using sonar homing (see p. W132). Guidance included in cost. Dropping conditions: aSpeed 145 and height 250'.

500mm Torpedo: This is the battery-driven Italian W 120 airborne torpedo, used as LT 350 by the Germans, which used inertial guidance (see p. W132). Guidance included in cost. Dropping conditions: aSpeed 175 and height 200'-600'.

569mm Torpedo: This steam-driven U.S. Mk 13 airborne torpedo originally was dropped at aSpeed 130 and 50'; this was eventually improved to aSpeed 470 and height 2,400'.

Depth Charges

Light Depth Charge Thrower: This is the U.S. Depth Charge Projector Mk 6 ("K-Gun"), which could launch a 400-lb. depth charge to 60-150 yards. Can also be used for the Soviet BMB-1, which could launch a 400-lb. depth charge to 43-120 yards.

Medium Depth Charge Thrower: This represents the British 9.5" Thornycroft ML Depth Charge Thrower Mk II and Mk IV, which could launch a 400-lb. depth charge to 70 yards and a 600-lb. depth charge to 50 yards.

100-lb. Depth Charge: This is the Italian B TG 50 Mod 27 and Soviet BM-1. It sinks at 3 yards per turn and can be armed to explode at 30' to 300'.

350-lb. Depth Charge: This represents the U.S. depth charges Mk 17, Mk 41, Mk 44, and Mk 53 (all for aerial use), and German WBF. It sinks at 3 yards per turn and can be armed to explode at 30' to 300'.

400-lb. Depth Charge: This represents the U.S. depth charge Mk 6, British depth charge Mk VII, German WBD and WBG, and Soviet BB-1. It sinks at 3 yards per turn and can be armed to explode at 30' to 330'.

600-lb. Depth Charge: This is the British depth charge Mk VII Heavy. It sinks at 5 yards per turn and can be armed to explode at 30' to 600'.

Naval Mines

Naval mines can be categorized as *ground*, *drifting*, or *moored*. The majority used in WWII were moored, to create charted mine fields fixed in specific areas; these include a chain and anchor.

Further, naval mines are either *contact* mines, meaning a ship must touch it to set it off, or *proximity* mines, which detonate when a vessel simply passes close by. Most proximity designs were magnetic-influence mines, detonated by the magnetic field of a ship's metal hull (unless degaussed, p. 22). In 1940, the Germans introduced acoustic mines, triggered by the noise made by a ship's passage; these were later countered by underwater noisemakers. Some mines combined the fuses, which were very difficult to avoid, and made minesweeping a difficult, time-consuming process. The other major combatants gradually introduced their own versions of these fuses, but the Japanese used only contact mines.

Roll 3d per mile spent traveling through the danger area of a mine field for the mine's "attack." If the mines are contact-detonated, then the ship encounters a mine on a "3." If the mines are proximity-detonated, the chance of encountering one is the vessel's Size Modifier or 3, whichever is greater. Ships with wooden hulls have effective Size reduced by 4. Degaussing may reduce effective Size by 5, but it cannot fall below 3; there is always a chance degaussing doesn't work properly.

If a drift mine is encountered, it hits the vessel unless it is spotted first; a spotted mine can be destroyed by gunfire or avoided. Moored mines are usually suspended 10'-20' below the surface, making them impossible to spot and allowing them to break the spine of the ship (multiply damage that penetrates DR by 1.5). Ground mines are likewise impossible to spot, but are limited by how deep the ground is below the surface; they will generally do only half damage (or less) because of this.

Guided Missiles

Germany's engineers developed a variety of guided missiles, although limited production usually minimized their impact on the war. All require Gunner (Guided Missile) skill; see p. W155 for details.

Gleitbombe PC 1400FX

The "Fritz X" was a modified 562mm PC 1400 armor-piercing gliding bomb with a radio-control unit and tail assembly added. Introduced in early 1943, it was used in some numbers, mainly against ships and bridges. It was dropped from Do 217K-2, Fw 200C-5 (p. 77), and He 177A-5 (p. 79) bombers. The Italian battleship R.N. *Roma* (see p. W:GL19) was sunk by a "Fritz X" on September 9, 1943. All use ended in August 1944 due to lack of suitable aircraft. At launch the bomb would be moving at the speed of the aircraft. Every turn the missile will lose 1 yard of altitude for every 7 yards traveled (moving at launch speed/2 yards per turn).

Ruhrstahl Jägerrakete X 4

The X 4, ready in late 1944, was the world's first air-to-air missile but never reached operational status. The basic X 4 was a wire-guided rocket-propelled missile with a 222mm blast warhead. Wire-guidance was selected due to fears of Allied jamming of radio controls, although this limited how much the launching aircraft could maneuver and restricted maximum range to the length of the wires. The operator had to visually track a flare on the rear of the missile. When it neared the target, the acoustic fuze, keyed to the sound of aircraft propellers, would detonate the warhead at a distance of 8 yards. A secondary impact fuze would detonate the warhead if the acoustic fuze failed to do so. Fw 190F-8 (see p. W:IC85) and Me 262 (see p. W:IC89) fighters were to carry the weapon (the Go 229 on p. W:WW85 would be another good candidate), but problems with the tracking and fuses doomed the program, despite missile production having started in summer 1944.

Ruhrstahl Panzerabwehrrakete X 7

The X 7 *Rotkäppchen* ("Little Red Riding Hood") was a wire-guided anti-tank missile with a powerful 150mm HEAT warhead. About 300 had been built after its late 1944 debut, but it never saw use. The missile was intended for use by infantry, and was launched from a 33-lb. rail platform ($100) that could be broken down and carried. If the war had dragged on, vehicle installations would have quickly followed. Although never completed, there were several major upgrades in the prototype stages. A device known as a *Zielsuchgerät* (target tracking device) pioneered the concept of updating the missile's flight path with an automated system that tracked the missile. As long as the operator kept the sights on the target the missile would track correctly and make course corrections. This technique (today known as semi-automatic command to line of sight, or SACLOS, see pp. HT104, VE114) would not be perfected until 20 years after the war. This guidance system adds $300 to the price of the missile. The operator only needs to make Gunner skill rolls every 5 turns, and may take other actions in the meantime.

Henschel Hs 293A-1

Adopted in January 1942, this was a conventional 470mm SC 500 bomb fitted with a radio-control section and rocket motor (suspended under the main body). After release from its controller aircraft (Do 217E-5, Fw 200C-5, or He 177A-5), the early "smart bomb" was visually tracked using a bright flare in its tail. Some 1,250 were built and used fairly successfully. A series of experimental sub-variants was developed, including the Hs 293D-0, which was the first TV-guided missile.

300-lb. Sea Mine: This Japanese 3 Shiki 2 Gō 1 Gata drifting contact mine is parachute-dropped by aircraft. It is +0 to spot or hit in minesweeping.

1,200-lb. Sea Mine: This is the German LMA ground proximity mine dropped by aircraft, and can also be used for the Soviet AMD-1-1000. It had a parachute and a magnetic fuze. Later German variants had acoustic or acoustic and magnetic triggers from 1942.

1,500-lb. Sea Mine: This represents the British A Mk I, Mk II, Mk III, and Mk IV ground proximity mines (with magnetic or magnetic and acoustic fuze) dropped from aircraft or motor torpedo boats. It can also be used for the French Bréguet B3 moored contact mine (6d×485) and Sautter-Harlé H7 moored contact mine (6d×440); Japanese 93 Shiki series of moored contact mines (6d×440); and Swedish Lindholmen-Motala m/18 (6d×660) moored contact mine, all laid by surface vessels except the 93 Shiki 1 Gata could also be dropped by aircraft. It is +0 to spot or hit in minesweeping.

2,000-lb. Sea Mine: This is the German TMB moored proximity mine carried on submarines and deployed through torpedo tubes. Initial production had magnetic fuses, later models acoustic or acoustic and magnetic triggers. The TMB/S was a variant laid from the overwater tubes of the S-Boot (see p. W:IC90). It can also be used for the U.S. Mk 10 Mod 1 moored contact mine and Mk 10 Mod 3 moored proximity mine with magnetic fuze laid from torpedo tubes, and the Mk 10 Mod 6 and Mod 9 moored contact mines dropped by parachute; the Danish Vickers H3 moored contact mine; the Dutch Vickers H2 moored contact mine; Finnish Vickers T2 moored contact mine; and the Soviet PLT and PLT-G moored contact mines. It is +0 to spot or hit in minesweeping.

2,500-lb. Sea Mine: Surface warships carried this British Mk XVII moored contact mine; +1 to spot or hit in minesweeping.

2,800-lb. Sea Mine: This is the German EMC moored contact mine carried on destroyers and other surface ships; +1 to spot or hit in minesweeping.

3,500-lb. Sea Mine: This is the German SMA moored proximity mine carried on subs and deployed from mine shafts (available in two-round and three-round versions). The initial 1942 design was unreliable, often detonating once it was deployed (roll 1d: it explodes on 1-2)! This prevented its use until the triggering mechanism was redesigned in 1943. It is +1 to spot or hit in minesweeping.

Weapon Modules Table

Weapon Type	*VSPs*	*Weight*	*Cost*
Machine Guns			
Assault Rifle	0.1	15	$70
660 rounds Solid	0.1	[25]	[$5]
Antitank LMG	0.2	60	$450
125 rounds APCR	0.1	[25]	[$25]
Powered Aircraft LMG	0.2	60	$450
500 rounds Solid	0.1	[25]	[$5]
Powered Aircraft HMG	0.4	100	$750
150 rounds Solid	0.1	[25]	[$5]
150 rounds AP	0.1	[25]	[$15]
Long Ground HMG	0.3	65	$400
125 rounds Solid	0.1	[25]	[$5]
125 rounds AP	0.1	[25]	[$15]
15mm Very Long Ground HMG	0.5	125	$800
125 rounds Solid	0.2	[50]	[$10]
125 rounds AP	0.2	[50]	[$30]
15mm Very Long Aircraft HMG	0.4	90	$675
125 rounds APEX	0.2	[50]	[$50]
125 rounds APCR	0.2	[50]	[$50]
125 rounds SAPHE	0.2	[50]	[$20]
Autocannons			
25mm Long Ground Autocannon	1	250	$1.1K
165 rounds API	1	[250]	[$250]
165 rounds SAPHE	1	[250]	[$100]
30mm Very Short Aircraft AC	0.5	120	$800
40 rounds SAPHE	0.2	[60]	[$20]
30mm Medium Aircraft AC	1.2	300	$1.3K
30 rounds APEX	0.2	[55]	[$55]
30 rounds APCR	0.2	[55]	[$55]
30 rounds SAPHEC	0.2	[55]	[$20]
30mm Medium Revolver Cannon	0.7	165	$950
100 rounds APEX	0.5	[130]	[$130]
100 rounds SAPHEC	0.5	[130]	[$50]
40mm Short Ground Autocannon	3.6	900	$2.8K
70 rounds SAPHE	0.9	[210]	[$85]
70 rounds AP	0.9	[210]	[$210]
50mm Medium Aircraft AC	4.8	1,190	$3.5K
30 rounds SAPHEC	1	[240]	[$100]
30 rounds APEX	1	[240]	[$240]
55mm Short Aircraft Autocannon	2.4	600	$2K
25 rounds SAPHEC	0.7	[165]	[$70]
Tank Guns			
15mm Antitank Rifle	0.2	40	$75
85 rounds AP	0.1	[25]	[$15]
20mm Antitank Rifle	0.4	100	$750
125 rounds API	0.5	[125]	[$125]
125 rounds SAPHE	0.5	[125]	[$50]
25mm Long Tank Gun	0.7	170	$925
165 rounds API	1	[250]	[$250]
165 rounds SAPHE	1	[250]	[$100]
37mm Infantry Gun	1	200	$1K
30 rounds APEX	0.2	[50]	[$50]
30 rounds HE	0.2	[50]	[$20]
40mm Medium Tank Gun	1.2	290	$1.2K
55 rounds AP	1	[250]	[$250]
55 rounds HE	1	[250]	[$100]
50mm Medium Tank Gun	3.5	875	$1.5K
30 rounds APEX	1	[240]	[$240]
30 rounds HE	1	[240]	[$100]
30 rounds APCR	1	[240]	[$240]
57mm Medium Tank Gun	3	750	$2.4K
20 rounds AP	1	[250]	[$200]
20 rounds APDS	1	[250]	[$250]
20 rounds HE	1	[250]	[$100]
76.2mm Very Short Howitzer	1.3	330	$1.3K
19 rounds HE	1	[250]	[$100]
19 rounds WP	1	[250]	[$100]
87.6mm Short Howitzer	4.5	1,100	$6.6K
7 rounds HE	1	[250]	[$100]
88mm Long Tank Gun	20	5K	$11K
5 rounds APEX	1	[250]	[$250]
5 rounds HE	1	[250]	[$100]
5 rounds APCR	1	[250]	[$250]
5 rounds HEAT	1	[250]	[$150]
95mm Short Howitzer	3.5	870	$2.7K
10 rounds HE	1	[250]	[$100]
10 rounds HEAT	1	[250]	[$250]
10 rounds WP	1	[250]	[$100]
105mm Short Howitzer	4.4	1.1K	$3.3K
6 rounds HE	1	[250]	[$100]
6 rounds HEAT	1	[250]	[$150]
6 rounds WP	1	[250]	[$100]
122mm Short Howitzer	6.4	1.6K	$4.5K
3 rounds HE	1	[250]	[$100]
3 rounds HEAT	1	[250]	[$150]
3 rounds WP	1	[250]	[$100]
128mm Medium Tank Gun	29	7.2K	$15.2K
2 rounds APEX	1	[240]	[$240]
2 rounds HE	1	[240]	[$100]
150mm Very Short Infantry Gun	11.2	2.8K	$8.5K
2 rounds HE	1	[220]	[$90]
150mm Short Howitzer	20	5K	$13K
2 rounds HE	1	[250]	[$100]
Dual-Purpose Guns			
100mm Long DP Gun	26.8	6.7K	$17.3K
4 rounds HE	1	[250]	[$100]
102mm Short DP Gun	11.6	2.9K	$7.8K
5 rounds HE	1	[250]	[$100]
5 rounds Starshell	1	[250]	[$100]
113mm Medium DP Gun	25.2	6.3K	$16.3K
4 rounds HE	2	[460]	[$185]
4 rounds Starshell	2	[460]	[$185]
120mm Medium DP Gun	26.4	6.6K	$17K
3 rounds HE	1	[250]	[$100]
3 rounds Starshell	1	[250]	[$100]
140mm Short DP Gun	34.4	8.6K	$22K
2 rounds HE	1	[250]	[$100]
Vehicle Mortars			
51mm Vehicle Mortar	0.1	20	$45
10 rounds Smoke	0.1	[25]	[$10]
92mm Vehicle Mortar	0.2	40	$50
10 rounds Smoke	0.2	[40]	[$20]

Weapon Modules Table (Continued)

Weapon Type	VSPs	Weight	Cost
Vehicle Mortars (Continued)			
Hedgehog	(5 sf)	2,500	$1K
+4 Launchers	(5 sf)	+2,000	+$100
4 Hedgehog Bombs	1	[260]	[$520]
Vehicle Flamethrowers			
Heavy Vehicle Flamethrower	1.2	300	$1.3K
7 Shots	1	[250]	[$50]
Rockets			
3×55mm HE Rockets	0.1	[25]	[$10]
73mm Aerial Launcher	0.05	[12]	[$30]
73mm 14-Tube Launcher	0.8	[160]	[$300]
73mm 35-Tube Launcher	5.2	[1.3K]	[$1.3K]
7×73mm HE Rockets	0.2	[50]	[$20]
88mm Aerial Launcher	0.1	[25]	[$40]
3×88mm HEAT Rockets	0.2	[50]	[$20]
127mm 8-Tube Launcher	1.6	[400]	[$500]
127mm HE Rocket	0.4	[90]	[$30]
127mm HE HV Rocket	0.6	[140]	[$50]
130mm HE Rocket	0.05	[11.2]	[$10]
150mm 6-Tube Launcher	2.6	630	$2K
150mm 10-Tube Launcher	5.6	1.4K	$4K
150mm HE Rocket	0.3	[70]	[$20]
150mm Smoke Rocket	0.3	[70]	[$20]
210mm Aerial Launcher	1	240	$1.1K
210mm 5-Tube Launcher	7.2	1.8K	$5K
210mm HE Rocket	1	[240]	[$80]
380mm Gun/Launcher	6.8	1.7K	$4.7K
380mm HE Rocket	3.4	[840]	[$590]
380mm HEAT Rocket	3.4	[840]	[$880]

Weapon Type	VSPs	Weight	Cost
Guided Missiles			
562mm APEX Gliding Bomb	14.4	[3,600]	[$37.5K]
222mm HE Missile	0.5	[132]	[$2K]
150mm Vehicle Launcher	0.2	[50]	[$200]
150mm HEAT Missile	0.1	[20]	[$800]
470mm HE Missile	6.8	[1.7K]	[$17.3K]
Torpedoes			
450mm Torpedo Tube	16	[4K]	[$10.5K]
450mm Torpedo	8	[2K]	[$4K]
483mm Torpedo	2.7	[680]	[$4.4K]
500mm Torpedo	3.1	[770]	[$11.5K]
569mm Torpedo	8.8	[2.2K]	[$4.4K]
Depth Charges			
Light Depth Charge Thrower	(5 sf)	310	$1
Medium Depth Charge Thrower	(8 sf)	450	$1.3K
100-lb. Depth Charge	0.4	[100]	[$200]
350-lb. Depth Charge	1.4	[350]	[$700]
400-lb. Depth Charge	1.6	[400]	[$800]
600-lb. Depth Charge	2.4	[600]	[$1.2K]
Naval Mines			
300-lb. Sea Mine	1.2	[300]	[$600]
1,200-lb. Sea Mine	4.8	[1.2K]	[$2.4K]
1,500-lb. Sea Mine	6	[1.5K]	[$3K]
2,000-lb. Sea Mine	8	[2K]	[$4K]
2,500-lb. Sea Mine	10	[2.5K]	[$5K]
2,800-lb. Sea Mine	11.2	[2.8K]	[$5.6K]
2-Mine Shaft for 3,500-lb. Mine	42	10.5K	$26K
3-Mine Shaft for 3,500-lb. Mine	63	15.7K	$40K
3,500-lb. Sea Mine	14	[3.5K]	[$7K]

Vehicular Weapons Table

Machine Guns – Use Gunner (Machine Gun) Skill

Weapon Type	Malf	Type	Damage	SS	Acc	1/2D	Max	Ind.	RoF
Assault Rifle	Crit.	Solid	5d+1	20	8	600	3,100	–	8*
Antitank LMG	Crit.	APCR	13d-1 (2)	20	14	1,200	5,400	8,000	14*
Powered Aircraft LMG	Ver.	Solid	7d	20	13	700	3,900	–	40
Powered Aircraft HMG	Ver.	Solid	9d+	20	13	730	4,000	–	16
		AP	9d (2)						
Long Ground HMG	Crit.	Solid	11d+2+	20	14	1,000	5,000	6,500	11*
		AP	11d+2 (2)						
15mm V. Long Ground HMG	Crit.	Solid	5d×3	20	14	1,400	7,000	9,300	7*
		AP	5d×3 (2)						
15mm V. Long Aircraft HMG	Crit.	SAPHE	5d×3 (0.5) + 1d-4 [2d]	20	14	1,400	7,000	–	11
		APEX	5d×3 (2) + 1d-4 [2d]						
		APCR	7d×3 (2)						

Autocannons – Use Gunner (Cannon) Skill

Weapon Type	Malf	Type	Damage	SS	Acc	1/2D	Max	Ind.	RoF
25mm Long Ground AC	Crit.	SAPHE	6d×4 (0.5) + 1d [2d]	20	14	1,300	6,100	8,200	4*
		API	6d×4 (2)						
30mm Very Short Aircraft AC	Crit.	SAPHE	5d×3 (0.5) + 1d+1 [2d]	20	12	500	3,200	–	9*
30mm Medium Aircraft AC	Crit.	SAPHEC	6d×4 (0.5) + 2d	20	14	1,200	6,400	–	7*
		APEX	6d×4 (2) + 1d+1 [2d]						
		APCR	8d×4 (2)						

Continued on next page . . .

Vehicular Weapons Table (Continued)

Autocannons (Continued) – Use Gunner (Cannon) Skill

Weapon Type	*Malf*	*Type*	*Damage*	*SS*	*Acc*	*1/2D*	*Max*	*Ind.*	*RoF*
30mm Med. Revolver Cannon	Ver.	SAPHEC	6d×4 (0.5) + 2d	20	14	1,200	6,400	–	20
		APEX	6d×4 (2) + 1d+1 [2d]						
40mm Short Ground AC	Crit.	SAPHE	6d×4 (0.5) + 2d+1 [4d]	25	13	700	3,900	6,800	2
		AP	6d×4 (2)						
50mm Medium Aircraft AC	16	APEX	6d×6 (2) + 1d [4d]	25	14	1,200	5,400	–	1
		SAHEC	6d×5 (0.5) + 6d						
55mm Short Aircraft AC	Crit.	SAPHEC	6d×5 (0.5) + 8d	25	13	800	4,200	–	5*

Tank and Antitank Guns – Use Gunner (Cannon) Skill

Weapon Type	*Malf*	*Type*	*Damage*	*SS*	*Acc*	*1/2D*	*Max*	*Ind.*	*RoF*	*Ldrs*
20mm Antitank Rifle	Crit.	SAPHE	7d×2 (0.5) + 1d [2d]	20	13	1,200	5,000	6,700	1	0
		API	7d×2 (2)							
25mm Long Tank Gun	Crit.	SAPHE	6d×4 (0.5) + 1d [2d]	20	14	1,500	7,000	9,000	1/3	0
		API	6d×4 (2)							
37mm Infantry Gun	Crit.	HE	1d [4d]	20	12	550	2,750	3,500	1/3	0
		APEX	6d×3 (2) + 1d-2 [4d]							
		Canister	5d			90	460			
40mm Medium Tank Gun	Crit.	AP	6d×6 (2)	25	13	1,100	5,100	8,000	1/3	0
		HE	2d-1 [4d]							
50mm Medium Tank Gun	Crit.	APEX	6d×6 (2) + 1d [4d]	25	14	1,200	5,400	11,700	1/3	0
		HE	3d [4d]							
		APCR	6d×7 (2)							
57mm Medium Tank Gun	Crit.	AP	6d×7 (2)	25	13	1,300	5,600	10,600	1/3	0
		APDS	6d×12 (2)							
		HE	4d-1 [4d]							
76.2mm Very Short Howitzer	Crit.	HE	6d×2 [6d]	20	11	400	2,500	4,000	1/4	1
87.6mm Short Howitzer	Crit.	HE	6d×5 [6d]	30	13	1,000	4,900	10,300	1/5	1
88mm Long Tank Gun	Crit.	APEX	6d×15 (2) + 4d+2 [6d]	30	16	2,400	8,300	25,300	1/4	1
		HE	6d×4 [6d]							
		APCR	6d×17 (2)							
		HEAT	7d (10)							
95mm Short Howitzer	Crit.	HE	6d×6 [10d]	20	12	540	3,300	6,000	1/5	1
		HEAT	5d×2 (10)							
105mm Short Howitzer	Crit.	HE	5d×8 [10d]	30	13	900	5,000	12,200	1/5	1
		HEAT	11d (10)							
		WP	3d+1 [4d]							
122mm Short Howitzer	Crit.	HE	6d×16 [10d]	30	14	1,200	5,400	16,100	1/6	1
		HEAT	7d×3 (10)							
		WP	6d [4d]							
128mm Medium Tank Gun	Crit.	APEX	6d×17 (2) + 4d×4 [10d]	30	15	1,900	7,100	13,500	1/6	1
		HE	5d×20 [10d]							
150mm Very Short Inf. Gun	Crit.	HE	6d×22 [10d]	30	14	1,100	5,100	10,000	1/8	2
150mm Short Howitzer	Crit.	HE	6d×22 [10d]	30	14	1,400	5,900	16,000	1/8	2

Dual-Purpose Guns – Use Gunner (Cannon) Skill

Weapon Type	*Malf*	*Type*	*Damage*	*SS*	*Acc*	*1/2D*	*Max*	*Ind.*	*RoF*	*Ldrs*
100mm Long DP Gun	Crit.	HE	6d×8 [10d]	30	16	2,500	8,500	21,300	1/5	1
102mm Short DP Gun	Crit.	HE	6d×8 [10d]	30	14	1,100	5,100	10,500	1/5	1
		Starshell	Special							
113mm Medium DP Gun	Crit.	HE	6d×11 [10d]	30	15	1,800	6,900	20,750	1/6	1
		Starshell	Special							
120mm Medium DP Gun	Crit.	HE	6d×14 [10d]	30	15	1,800	6,900	17,000	1/6	1
		Starshell	Special							
140mm Short DP Gun	Crit.	HE	6d×21 [10d]	30	13	1,300	5,600	17,500	1/7	1

Vehicular Weapons Table (Continued)

Vehicle Mortars

Weapon Type	Malf	Type	Damage	SS	Acc	1/2D	Max	Ind.	RoF	Ldrs
51mm Vehicle Mortar	Crit.	Smoke	Special	20	5	–	–	150	1/3	0
92mm Vehicle Mortar	Crit.	Smoke	Special	20	5	–	–	120	1/3	0

Vehicle Flamethrowers – Use Gunner (Flamethrower) Skill

Weapon Type	Malf	Type	Damage	SS	Acc	1/2D	Max	Ind.	RoF	Ldrs
Heavy Vehicle Flamethrower	Crit.	Spcl. (p. W99)	3d	5	8	80	120	–	3~	0

Guided Missiles – Use Gunner (Guided Missile) Skill

Weapon Type	Malf	Type	Damage	SS	Acc	Spd	End	Min	Max	RoF	Ldrs
562mm APEX Gliding Bomb	Crit.	APEX	6d×10 (2) + 6d×1,320 [12d]	30	(0)	–	–	3,000	10,000	1/45	1
222mm HE Missile	16	HE	6d×88 [12d]	30	(0)	330	16	50	5,500	1/30	1
150mm HEAT Missile	15	HEAT	6d×6 (10)	30	(0)	130	12	150	1,500	1/30	0
470mm HE Missile	Crit.	HE	6d×1,365 [12d]	30	(0)	400	55	200	22,000	1/45	1

Rockets – Use Gunner (Rocket Launcher) Skill

Weapon Type	Malf	Type	Damage	SS	Acc	Spd	End	1/2D	Max	Ind.	RoF	Ldrs
55mm HE Rocket	Crit.	HE	6d×2 [4d]	20	10	525	3	870	1,575	7,875	n*	0
55mm HEAT Rocket	Crit.	HEAT	5d×2 (10)					870	1,575			
73mm HE Rocket	Crit.	HE	9d [6d]	20	7	330	14	–	250	4,600	n*	0
88mm HEAT Rocket	Crit.	HEAT	5d×3 (10)	20	9	120	6	150	750	–		0
127mm HE Rocket	Crit.	HE	5d×4 [10d]	20	10	235	7	250	1,750	–		0
127mm HE HV Rocket	Crit.	HE	6d×7 [10d]	20	12	465	11	500	5,250	–		0
130mm HEAT Rocket	Crit.	HEAT	5d×4 (10)	30	6	405	1	50	440	–		0
150mm HE Rocket	Crit.	HE	6d×15 [10d]	25	13	370	4	610	1,480	7,400	5:11	0
150mm Smoke Rocket	Crit.	Smoke	Special									
210mm HE Rocket	Crit.	HE	6d×42 [12d]	25	13	350	5	580	1,750	8,750	6:14	1
380mm HE Rocket	Crit.	HE	6d×550 [12d]	25	12	250	5	400	1,250	6,250	1/13	1
380mm HEAT Rocket	Crit.	HEAT	6d×15 (10)					400	1,250	–		

Torpedoes – Use Gunner (Torpedo) Skill

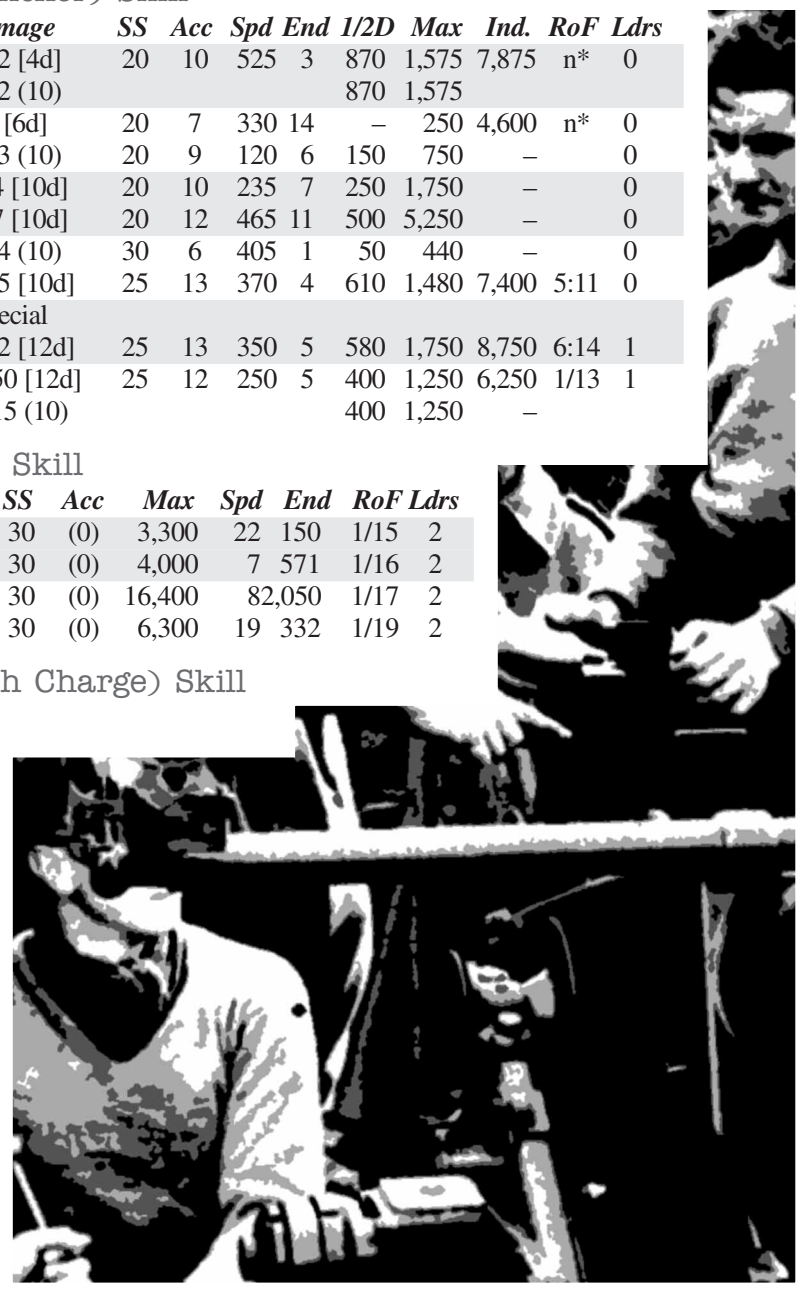
Weapon Type	Malf	Type	Damage	SS	Acc	Max	Spd	End	RoF	Ldrs
450mm Torpedo	15	HEC	6d×880	30	(0)	3,300	22	150	1/15	2
483mm Torpedo	15	HEC	6d×185	30	(0)	4,000	7	571	1/16	2
500mm Torpedo	15	HEC	6d×530	30	(0)	16,400	82,050		1/17	2
569mm Torpedo	15	HEC	6d×1,200	30	(0)	6,300	19	332	1/19	2

Depth Charges – Use Gunner (Depth Charge) Skill

Weapon Type	Malf	Type	Damage
100-lb. Depth Charge	Crit.	HEC	6d×110
350-lb. Depth Charge	Crit.	HEC	6d×450
400-lb. Depth Charge	Crit.	HEC	6d×550
600-lb. Depth Charge	Crit.	HEC	6d×700

Naval Mines – see pp. 16-17

Weapon Type	Malf	Type	Damage
300-lb. Sea Mine	Crit.	HEC	6d×200
1,200-lb. Sea Mine	Crit.	HEC	6d×1,320
1,500-lb. Sea Mine	Crit.	HEC	6d×1,500
2,000-lb. Sea Mine	Crit.	HEC	6d×2,150
2,500-lb. Sea Mine	Crit.	HEC	6d×1,000
2,800-lb. Sea Mine	Crit.	HEC	6d×1,320
3,500-lb. Sea Mine	Crit.	HEC	6d×1,545



See pp. W134-135 and individual weapon descriptions for an explanation of weapons-table terminology and more detail on usage.

New Components

A-Frame: This A-shaped frame lifts like a crane, but only from the facing on which it is installed. Each module provides 10' of height. It requires a separate winch.

Bilge: Ships take on water, so they include empty spaces – bilges – to keep more vital areas from flooding. Each bilge VSP holds 280 lbs. of water. No ship needs more than 7.15 VSPs of bilge per ton of difference between empty weight and flotation rating. Most have far less. Bilge space can be used to store fuel, at 33 gallons per VSP. All taken-on water spoils 3 tons of this fuel per ton of water; this fuel also has a +3 fire rating (p. W144) and makes that bilge space worthless for its usual function. Bilges do not change a ship's flotation rating.

Degaussing Cable: This demagnetizes a ship's hull, to foil magnetic triggers on sea mines (pp. 16-17). Thick bands of wire are strung around the vessel, aligned with the main deck, and fed an electrical current. Cable and ancillary equipment weigh 0.02% of the chassis weight (see p. W119) and cost $1 per lb.

Dischargers: See p. W140. From 1942, German and Japanese subs can deploy two other types of decoys. The *Bold* (for *Lügenbold*, or "liar") is a sonar decoy that chemically generates bubbles resembling the sonar echo produced by a submarine contact, thereby foiling sub hunters if their sonar operator fails an Electronics Operation (Sensors)-5 roll. It works for up to 25 minutes. The *Ölpille* (oil capsule) creates a small oil slick to make the hunters believe that the sub was hit or destroyed. Reloads are $1 for sonar decoys and $0.50 for oil capsules.

Ejection Seat: The occupant can trigger this (1-second action) to blow off any canopy and hurl him out of the vehicle. He must then disentangle himself from the seat in mid-air and deploy his own parachute (2 seconds and a Parachuting roll).

Magnetic Anomaly Detector (MAD): A MAD, available from 1942, detects the fluctuations in the Earth's magnetic field caused by the movement of large ferrous objects, and can locate the position of such objects. Such sensors are used to detect submarines from aircraft flying over the water. Each module provides 0.5 miles of range, using the scan-rating table on p. W138 and the detection rules on p. W154, with the only modifier being the size of the target.

Navigation Instruments, Precision: This navigation table adds a further +1 to Navigation, for a total of +4 to skill. The module requires a crew station, located next to its map table, chartbooks, and other instruments. Naval vessels and aircraft often use this for long-range navigation.

NBC Kit: An environmental system that provides filtered air to the occupants, protecting them from the effects of chemical gases, biological weapons, and nuclear fallout. It requires that the vehicle is sealed. Each module protects five people.

Small Galley: While crew quarters on long-occupancy vehicles include galleys or kitchens at no extra cost, some short-occupancy vehicles also include small galleys.

Small Toilet: While crew quarters on long-occupancy vehicles include showers and toilets at no extra cost, some short-occupancy vehicles also include toilets.

Winch: In order to better model historical winches, multiply the capacity of the winch module on p. W137 by 10; each module comes with 25 yards of cable and pulls 5,000 lbs. The cable length can be adjusted up to 20% if necessary.

Bilge, Brig, Bakery

Ships designed with the Modular Vehicle Design System usually have lots of empty space that the designs don't seem to require, leaving the designer wondering what he did wrong. The fact is that quite a bit of all that empty space isn't empty at all. Ocean-going ships, which could be out to sea for months, required huge amounts of "non-essential" stores, tools, and supplies, not all of which are accounted for under the simplified rules of the MVDS.

For example, even a light cruiser would have a bakery; drinking-water distillery; laundry room; drying room; hairdresser; workshops and storage room for armourers, blacksmiths, carpenters, electricians, mechanics, painters, shoemakers, and tailors; library; reading room; brig; etc. Any spare space would be stuffed with consumables – ranging from fresh produce and hull paint through clothes and cigarettes to the all-essential toilet paper. Conditions were most cramped on submarines – and generally were most comfortable on big battleships and carriers – but all ships at sea for any prolonged time were pretty packed.

New Component Modifiers

Limited Access: The powertrain rules already provide more access space for long-occupancy vessels, but items on p. W143 also require access space if they are to be repaired from *inside* the vehicle. This rule can be ignored for smaller items, which can be moved to a common work space. Larger equipment can take this volume modifier to allow minor repairs at -2. These take extra time, because the gear is hard to reach.

Full Access: As above, but with no penalties.

Minimal Crew Space

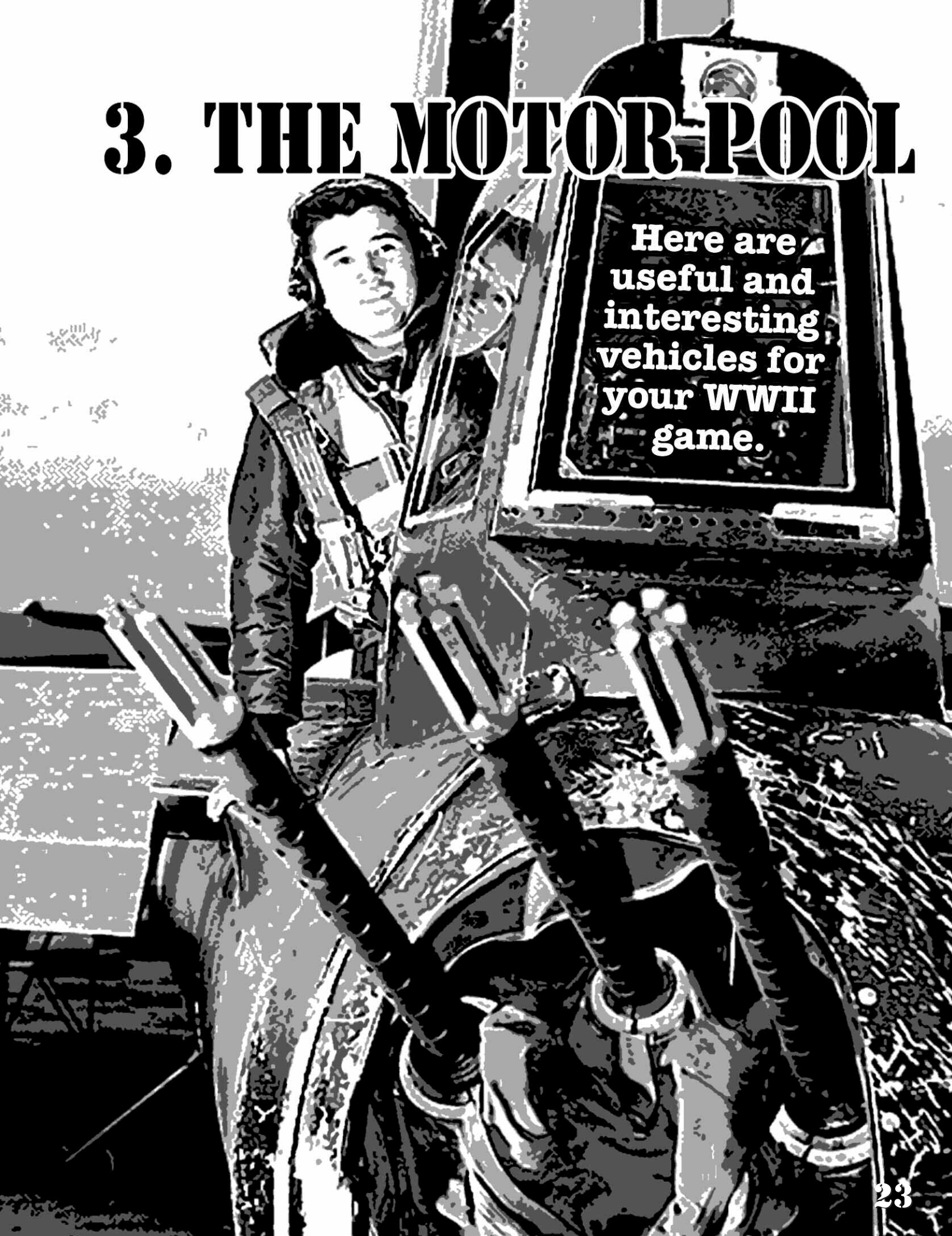
This isn't a component per se, just a design reminder. Some cramped designs, such as WWII subs, don't provide a bunk – and thus, work space – for every member of the crew. These vehicles must install at least 4 VSPs of standing room for everyone not provided either a bunk or work station. Of course, this space can contribute toward the mandatory workspace needs that loaders have (see p. W141).

New Components and Modifiers

Module Type	*VSPs*	*Weight*	*Cost*	*Power*
A-frame	1	500	$15	–
Bilge	1	280*	–	–
Ejection Seat	1	100	$500	–
MAD	0.2	25	$5,000	neg.
Navigation Instruments, Precision	0.1	20	$20	neg.
NBC Kit	0.5	125	$500	1.25
Small Galley	10	100	$5	neg.
Small Toilet	5	40	$20	–
Module Modifier	***VSPs***	***Weight***	***Cost***	***Power***
Limited Access	×2	–	–	–
Full Access	×3	–	–	–

* Only when filled with seawater.

3. THE MOTOR POOL



GURPS WWII and the other sourcebooks in the ***WWII*** line describe scores of vehicles commonly encountered during the fighting. That leaves hundreds – if not thousands – more yet undescribed, many of them quite interesting and capable of adding considerable spice to a campaign.

This chapter provides writeups of many of them. Some vehicles found here were very common in their country's service, but simply could not fit into the sourcebook on that nation. Others were among the more rare and interesting offerings.

Vehicles Key

The military vehicles in this section are presented in the following format:

Descriptive Text

Each vehicle writeup begins with general descriptive text, which usually includes some of the finer details of using the vehicle, such as fuel consumption, turret rotation speeds, etc.

Subassemblies

This lists the chassis and each subassembly, with any options applied to each, followed by the size modifier to see or target that particular structure. The remainder of the writeup will use this structure name or an abbreviation in brackets to indicate the placement of other items. For instance, [OM 1] means the item in question is housed in the subassembly designated Open Mount 1 in this passage. If no placement is described, the item is assumed to be in the body of the vehicle.

Powertrain

This describes the vehicle's engines, transmission, and electric motors (if any), fuel tankage, and batteries carried.

Occupancy (Occ)

This describes where and how the vehicle seats its occupants. (Again, unless otherwise designated, all crew stations are assumed to be in the body.) A "CS" is a crew station while a "PS" is a passenger station. An "SR" would indicate standing room used as makeshift passenger space. An "X" prefix means the station is exposed, while an "M" prefix means the station is a motorcycle seat. Long-term accommodations such as bunks will be covered in the descriptive text. Note that many vehicles in this chapter assign a crew station to their gun loaders, even though they don't have to (see p. W141), to give them a place to sit when not actually performing their job.

Cargo

This heading includes *all* empty space except access space and bilges within the vehicle, which almost always will be design "waste" space rather than a true cargo hold of some sort. Unless specific cargo space is assigned under *Equipment* (see below), assume that the largest single item that this space could hold would be just 10% as big as it is. For instance, a vehicle with 27 VSPs of empty space not truly dedicated to a cargo hold could not fit another crew station, because its single largest "nook" would be only 2.7 VSPs in size. The remainder of the space is scattered about the vehicle in other "crannies" of similar size. Unless specifically designed to haul cargo, the GM should feel free to place these restrictions on any empty space.

Armor

This lists the armor values on each face of each structure as PD value followed by DR value. Though motive subassemblies always will have the same value on all facings in this system, that value is repeated for each facing as a convenience. A "W" following the armor value denotes that it is wooden (and note that many ground vehicles here take advantage of the *Wooden Armor* option presented for planes on p. W121). An "S" indicates it includes DR 15 of standoff armor (see pp. W140-141). "C" indicates cloth armor. Any special notes follow the values.

The DR value of armor per inch of thickness can vary considerably depending on the quality of metal; see pp. W142, 145. Real vehicles often had variable thicknesses of armor along a single facing; usually, an average is used here. Also, period tank guns usually had their own armor plate, called a mantlet. Some protected only the gun, some covered part of the turret front, and a few covered the entire facing. Whether a design calculates turret front DR with or without mantlet is a judgment call.

Weaponry

This lists each weapon (or set of identical weapons) with placement and ammunition stores. Any special notes are below the listings. See pp. W133-135 and pp. 14-21 for statistics.

Equipment

This lists each structure with general equipment installed, followed by the equipment within it. See pp. W136-140 and p. 22 for descriptions of general equipment.

Statistics

Size gives the length, width, and height of the vehicle. *Payload* is the weight of a standard load of fuel, personnel, ammunition, and cargo. *Lwt.* is loaded weight. *Volume* is the amount of space the vehicle would take up if stored within another (presumably larger) vehicle. *Maint.* or *MH* describes either the maintenance interval in hours (see p. W144) or the number of men required to keep up maintenance working eight-hour shifts on a long-occupancy vehicle. *Cost* is the vehicle cost, rounded; note that a "retail" price for the vehicle might be much higher; this figure does not include a profit margin, if any.

HT measures how robust the vehicle is; see p. W144. *HPs* measures the hit points of each structure; see p. W156.

gSpeed, etc. provide the vehicle's performance characteristics in each of its routine modes of travel; see pp. W145-149. Special characteristics for each mode are described under the general statistics line.

Design Notes

To facilitate usage of these vehicles as examples for the ***GURPS WWII*** design process, these notes indicate where components were purchased and then modified to historical values, or where any particularly notable "fudging" of calculated data to historical values had to take place.

Variants

While the description covers the general vehicle type, the statistics are for one particular variant. This section describes some or all of the other subtypes of the vehicle, with appropriate supporting statistics if the variant is much more complex than swapping one component for another.

THE ARMOURY

While tanks and airplanes received a great deal of attention and added a flashy element to the battlefield, these top-notch weapon systems simply weren't that common from the point of view of the average soldier of any nation. The average rifleman served in an infantry unit and was supported by towed guns of various sorts. These low-budget weapons could be hard to move about – especially if the troops attending them lacked a motor vehicle and had to use their own muscles – but they could pack just as much punch as their mobile counterparts, especially when used in a defensive role.

2cm Flakvierling 38

This famous German weapon debuted in 1940 as a highly effective low-level AA system. It featured four 20mm Mauser FlaK 38 cannons and could be transported on its SdAh 52 trailer or emplaced. It was also fitted on trucks and halftracks (see p. W:IC74). The shells had a 12,000' ceiling, and AP ammo was effective against light armor.

Some 2,140 Flakvierling 38s were produced. Historical cost was 20,000 Reichsmark ($4,760).

Sixteen 20-round magazines (21 lbs. each) are stowed on the mount. A full load of ammo costs $70. Some 1,040 spare rounds are normally carried on a tractor vehicle such as the Krupp-Protze (see p. W:IC73) or SdKfz 10 (see p. W:IC74).

The Flakvierling 38 has folding seats for the gunner and two loaders. The gunner has foot pedals; each fires two diametrically opposite guns. By the book, two guns are fired while the other two are reloaded; in an emergency all four may be used at once. The gunner manually turns the mount at 6° per second. A spotter and two ammo bearers complete the crew.

2cm Flakvierling 38

Subassemblies: Very Small Wheeled chassis +0; full-rotation Large Weapon OM [Body:T] +2; two off-road wheels -1.
Occ: 3 XCS OM Cargo: 13 Body, 0.9 OM

Armor	F	RL	B	T	U
Body:	3/15	3/15	3/15	3/15	3/15
Wheels:	3/5	3/5	3/5	3/5	3/5
OM:	4/35	0/0	0/0	0/0	–

Weaponry

4×20mm Long Ground ACs/FlaK 38s [OM:F] (80 each).*
* Linked in pairs. Additional link fires all four.

Equipment

OM: Universal mount.

Statistics

Size: 14'×8'×7' *Payload:* 825 lbs. *Lwt.:* 2 tons
Volume: 28 *Maint.:* 101 hours *Price:* $3,900

HT: 9. HPs: 85 Body, 28 each Wheel, 120 OM.

gSpeed: * *gAccel:* * *gDecel*: * *gMR:* 1.25 *gSR:* 2
Ground Pressure High. 1/6 Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Historical ammo given in place of 315 rounds in design. The loaded weight *does* include the crew weight, as usual.

40mm Bofors Antiaircraft Gun

Swedish arms-maker Bofors designed a 40mm AA autocannon that was adopted in the 1930s by some 30 nations. Germany used captured weapons as the 4cm FlaK 28.

The Swedish Lvakan m/36 and licensed versions such as the American Chrysler M-1, Australian Ordnance Factory ROQF Mk I, Austrian Böhler M.36, Belgian FN Mle 34, British Nuffield ROQF Mk I, Canadian Dominion Bridge ROQF C Mk I, Finnish VTT ItK/38, Hungarian MÁVAG 36M, Norwegian Kongsberg m36, and Polish FWU-FK wz. 36 were all similar. More than 100,000 were made worldwide.

The gun was mounted on a four-wheeled towed trailer; variants were placed on armored vehicles, trains, ships, subs, and even aircraft. Fire could be kept up indefinitely by feeding four-round clips (21 lbs. each) into the eight-round hopper feed.

The commander, gunner, and gun layer sit on the mount; the latter two manually turn the weapon at 7° per second. At least one loader completes the crew.

Luftvärnautomatkanon m/36

Subassemblies: Very Small Wheeled chassis with Heavy option +2; full-rotation Large Weapon open mount [Body:T] +2; four off-road wheels +1.
Occ: 3 XCS OM Cargo: 13 Body, 1.6 OM

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5

Weaponry

40mm Medium Ground AC/Lvakan m/36 [OM:F] (8 rounds).

Equipment

OM: Universal mount.

Statistics

Size: 21'×6'×7' *Payload:* – *Lwt.:* 2.6 tons
Volume: 28 *Maint.:* 130 hours *Price:* $2,355

HT: 12. HPs: 330 Body, 50 each Wheel, 120 OM.

gSpeed: * *gAccel:* * *gDecel:* * *gMR:* 0.75 *gSR:* 4
Ground Pressure High. 1/6 Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Weight was increased 8% to the historical.

As with most artillery pieces, the armor on the chassis and open mount do not represent true armor per se, but rather that they were of rugged design and could take some punishment. It protects the gun crew in no way, whatsoever.

75mm M-1A1 Pack Howitzer

The 75mm M-1A1 howitzer on the M-1 carriage was developed in the '20s with the experience of WWI in mind. Its pieces were lightened – often simply by having holes bored through them – and broke down into four mule loads, or the carriage trails could be replaced with shafts for towing by horses.

The upgraded M-8 carriage of 1936 had pneumatic tires and was further lightened for deployment by parachute or glider. The former required disassembly into seven "paracrates" of 202-326 lbs. each. Two more crates held 18 shells and a 105-lb. hand cart to transport them.

Collecting the nine crates after a drop often was difficult. A jeep (p. W106) could tow the assembled gun.

M-1A1/M-8 Pack Howitzer

Subassemblies: Very Small Wheeled chassis +2; two wheels +1.

Occ: None Cargo: 11.8 Body

Armor	F	RL	B	T	U
Body:	0/0	0/0	0/0	0/0	0/0
Wheels:	2/3	2/3	2/3	2/3	2/3

Weaponry

75mm Short Tank Gun/M-1A1 [Body:F] (0 rounds).

Statistics

Size: 12'×4'×3' *Payload:* – *Lwt.:* 0.7 tons
Volume: 18 *Maint.:* 126 hours *Price:* $2,525

HT: 11. HPs: 43 Body, 14 each Wheel.

gSpeed: * *gAccel:* * *gDecel*: * *gMR:* 1.25 *gSR:* 2
Ground Pressure Low. 1/3 Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Cost, weight, and HP of the body were halved. This is a valid design option as long as all are reduced at once.

Hand Carts

Various hand carts were widely used by all forces, especially in Asia. Even the highly motorized U.S. Army employed them: The *M-3A4* hand cart (1942) was a small, two-wheeled cart originally adopted for use with light infantry such as airborne or mountain units. It could be pulled by two men, or attached to a vehicle, including the Cushman Airborne Scooter, jeep (p. W106), and beep (p. 33). Empty weight was 80 lbs. including a canvas cover, cost $20. It could carry 350 lbs.

The almost identical *M-4A1* cart had three clamp-type brackets to receive the legs of the tripod of a Browning M-1917A1 machine gun (p. W97). Along with gun and tripod, it could carry five 250-round ammo cans (p. W89), a water can, and a spare-parts chest. Empty weight (including cover) was 95 lbs., cost $21.

122mm 122-G-38 (M-30) Howitzer

The *122mm Gaubitsa obrazets 1938g* (122mm howitzer model 1938) or M-30 was adopted by the Soviet military shortly before the war to replace its obsolete Great War designs. During the war, it became the prevalent divisional howitzer of the Red Army. Eventually, more than 13,500 were made. The Soviets often lined these up wheel to wheel by the hundreds, even thousands, to launch their late-war offensives with immense artillery barrages.

Being both a good weapon and and common in Soviet service, the gun often was captured by the Germans and put to their own purposes. They even incorporated some into the Atlantic Wall defenses as the sFH 396(r).

The standard crew consists of eight men. The weapon fires variable-charge ammunition and has a wide variety of shells available, including HE, HEAT, and WP. Starshell rounds are used for night illumination, bathing a 5,600-yard radius in unnaturally bright light for approximately 25 seconds. A leaflet round scatters 2.4 lbs. of propaganda pamphlets or fliers over a radius of 280 yards.

The 122-G-38 is usually towed by ZiS-5 3-ton truck or a team of six horses. Maximum towing speed is 30 mph.

122-G-38 (M-30)

Subassemblies: Very Small Wheeled chassis with Heavy option +2; two wheels +1.

Occ: None Cargo: 8.2 Body

Armor	F	RL	B	T	U
Body:	4/25	3/5	3/5	3/5	3/5
Wheels:	3/5	3/5	3/5	3/5	3/5

Weaponry

122mm Short Howitzer/122-G-38 [Body:F] (0 rounds).

Equipment

Body: Casemate mount.

Statistics

Size: 19'×6'×6' *Payload:* – *Lwt.:* 3.1 tons
Volume: 18 *Maint.:* 90 hours *Price:* $4,910

HT: 12. HPs: 330 Body, 100 each Wheel.

gSpeed: * *gAccel:* * *gDecel*: * *gMR:* 1.25 *gSR:* 2
Ground Pressure High. 1/6 Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Only the front gun shield protects the crew. Loaded weight was increased 26% to the historical figure.

Variants

The *152-G-43* or *D-1* introduced in 1943 mounted a 152mm 152-G-43 (150mm Short Howitzer) on the same carriage used by the 122-G-38. Loaded weight was 4 tons.

15cm Nebelwerfer 41 Rocket Launcher

Despite its misleading name, the German *Nebelwerfer 41* (smoke thrower model 1941) was a very effective multiple rocket launcher used from 1941 in great numbers for artillery bombardment. Initially designed for use with the chemical troops, it fired a 158.5mm rocket with a chemical smoke or HE warhead. The latter proved to be so effective that the launcher's role changed to that of artillery support.

The NbW 41 consisted of a six-tube launcher on the carriage of the 37mm PaK 35/36 antitank gun. All tubes could be fired in a 10-second rippling salvo. This gave one launcher the short-term firepower of a battery of traditional guns.

The crew needed good cover because of the dangerous backblast, which also made it impossible to conceal the launcher's position. Successful Nebelwerfer crews became masters of rapid relocation, in order to dodge the counterbattery fire of their foes, who usually *loathed* the Nebelwerfer.

The launcher was usually towed by a SdKfz 7 halftrack (see p. W:IC74). The 1.6-ton SdAh 33 ammo trailer was designed to go with it, stowing 18 rockets in ready racks.

Some 5,769 launchers were built. Historical cost was 3,350 Reichsmark ($800).

15cm Nebelwerfer 41

Subassemblies: Motorcycle chassis +0; Medium Weapon open mount [Body:T] +2; two off-road wheels -1.

Occ: None Cargo: 2 Body, 2.4 OM

Armor	F	RL	B	T	U
Wheels:	3/5	3/5	3/5	3/5	3/5
All Else:	0/0	0/0	0/0	0/0	0/0

Weaponry

6×150mm HE Rockets/WGrSpr 41 [OM:F].

Statistics

Size: 12'×5'×5' *Payload:* 420 lbs. *Lwt.:* 0.85 tons
Volume: 12.4 *Maint.:* 139 hours *Price:* $2,065

HT: 7. HPs: 20 Body, 8 each Wheel, 75 OM.

gSpeed: * *gAccel:* * *gDecel*: * *gMR:* 1.5 *gSR:* 2
Ground Pressure High. 1/6 Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Generally speaking, a vehicle's superstructure should not be larger than the chassis itself, as explained on p. W127. This design is a bit handcuffed by the fact that it used the 37mm AT gun's chassis (already described on p. W101). Also, the launcher *was* top-heavy, so an exception was made.

Variants

The 1.2-ton *21cm NbW 42* of 1943 used the same carriage, but was fitted with a five-round launcher loaded with the 214.5mm WGrSpr 42 (210mm HE Rocket); 1,487 were built.

155mm M-1 "Long Tom" Cannon

During WWI, the U.S. Army had been equipped with the French *Grande Puissance Filloux* (GPF) high-power gun designed by a Capt. Filloux. This heavy artillery piece, known in U.S. service as the M-1918, was an excellent weapon. It was improved during the 1920s and 1930s, until a new weapon mating its barrel design with a new breech was adopted as the M-1 gun in 1937.

This was put into mass production in 1941 at various arsenals, and became one of the standard U.S. heavy guns, used especially for counterbattery work (see p. W:D31). It earned the nickname "Long Tom," which had traditionally been used for long-barreled artillery. The M-1 and the slightly improved M-1A1 were also supplied to many other Allied nations.

Aside from the HE shell doing 6d×30 [10d], it also fired a chemical smoke shell with 90-yard radius. A WP shell does 6d [10d] explosive damage plus the above smoke effect, with the fragments burning as per the M-15 WP grenade (see p. W98). The same gun on a different mount was also used for coastal defense; these coastal guns had an APEX shell that did 6d×19 (2) + 6d×4 [10d] damage.

The Long Tom was mounted on the M-1 carriage, a sturdy split-trail type with four double-tired wheels. In action, the carriage rested directly on the ground, with the wheels folded upward, to provide a very stable firing platform. The carriage required the 1-ton two-wheeled limber M-2 for towing by tracked prime movers.

155mm M-1 "Long Tom"

Subassemblies: Medium Wheeled chassis with Heavy option +4; Medium TD superstructure [Body:T] +3; eight off-road wheels +3.

Occ: None Cargo: 125 Body, 10 Sup

Armor	F	RL	B	T	U
Wheels:	3/5	3/5	3/5	3/5	3/5
All Else:	3/10	3/10	3/10	3/10	3/10

Weaponry

150mm Medium DP Gun/M-1 [Sup:F].

Statistics

Size: 34'×8'×9' *Payload:* – *Lwt.:* 15.3 tons
Volume: 194 *Maint.:* 42 hours *Price:* $22,510

HT: 12. HPs: 1,300 Body, 113 each Wheel, 360 Sup.

gSpeed: * *gAccel:* * *gDecel*: * *gMR:* 0.25 *gSR:* 5
Ground Pressure High. 1/6 Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Historically, the ammunition fired by this weapon is a bit lighter and more compact than that usually used by a 150mm Medium DP Gun. Two shells and their propellant charges are 255 lbs., 1 VSP, and $255.

THE GARAGE

The truck and tractor – much less the armored car and tank – had just begun to make their impact felt when the Great War ended in 1918. Military planners spent the years between then and WWII's start dreaming of all the havoc they would wreak, primarily with that darling trench-buster, the tank. While the armored behemoths certainly did make an impact on WWII's battlefields, far more humble ground vehicles played roles that were just as important.

Horse Carriage

Even the infamous Soviet sand roads are mastered by the good comrade of our grenadiers, the horse.
– German postcard motto, 1942

The German *leichte Heeresfeldwagen 1* (light army field carriage) was representative of the small horse-drawn carriages widely used by almost all forces except for the Western Allies, which were much more motorized – especially the U.S. Army. Similar vehicles could be encountered in the hands of soldiers, peasants, or refugees in many other nations, especially in eastern and southern Europe, but also in the Far East. The famous Russian panje wagon, in particular, was very similar.

The Hf 1 was a light wooden carriage drawn by two horses, adopted in 1936. Four-wheeled, it was open-topped but could be covered by a tarpaulin. Many thousands of these field carriages were used by the Wehrmacht, Volkssturm, and other parts of the German forces; the Hf 1 transported ammunition, communication gear, food, combat-engineer stores, and medical and veterinary supplies. Minor sub-variants carried field bakeries, smithies, or armorer workshops.

Every German infantry platoon was assigned one to transport ammo and the men's packs. A division was supposed to have a total of 895 horse carriages of various types.

Larger carriages were identical in design, but could carry more cargo and required more horses.

Heeresfeldwagen Hf 1

Subassemblies: Very Small Wheeled chassis +2; four wheels +1.
Powertrain: 2-horse harness.
Occ: 1 XCS, 1 XPS Body Cargo: 11 Body

Armor	F	RL	B	T	U
Body:	2/3W	2/3W	2/3W	0/0	2/3W
Wheels:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: 9.4-VSP cargo hold (total of 22 VSPs of exposed cargo); 65-sf covered deck.

Statistics

Size: 13'×5'×5' *Payload:* 0.8 tons *Lwt.:* 1.5 tons
Volume: 18 *Maint.:* 488 hours *Price:* $170

HT: 12. HPs: 85 Body, 14 each Wheel.

gSpeed: 20 *gAccel:* 1 *gDecel*: 10 *gMR:* 0.5 *gSR:* 4
Ground Pressure High. 1/6 Off-Road Speed.

Design Notes

Wooden armor was bought at 18 lbs./$0.45; see p. 24. Half of a four-horse harness was purchased.

1-ton Cargo Trailer

The 1-ton trailer was a ubiquitous design that could be encountered everywhere. The trailers used by most combatants differed little in design and less in performance.

The U.S. model detailed here was a simple wooden carriage usually covered by a canvas tarp. Normally pulled by a $2\frac{1}{2}$-ton truck (p. W107), it could also be attached to many other motor vehicles, including tanks. It was made by numerous subcontractors, including the Ben Hur Manufacturing Co.

A corresponding German model was the *Einachs-Anhänger 900 kg*, while the Canadian version was the *20 cwt G.S. trailer*.

1-ton Cargo Trailer

Subassemblies: Very Small Wheeled chassis +2; 2 wheels +1.
Occ: None Cargo: 15 Body

Armor	F	RL	B	T	U
Body:	2/3W	2/3W	2/3W	2/2C	3/5W
Wheels:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: 9.6-VSP cargo hold (usually doubled as exposed-cargo space); 35-sf covered deck.

Statistics

Size: 12'×6'×6' *Payload:* 1 ton *Lwt.:* 1.7 tons
Volume: 18 *Maint.:* 853 hours *Price:* $55

HT: 10. HPs: 85 Body, 28 each Wheel.

gSpeed: * *gAccel:* * *gDecel:* * *gMR:* 1.25 *gSR:* 2
Ground pressure High. 1/6 Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Variants

The U.S. *1-ton Water Trailer* of 1940, or "Water Buffalo," replaced the body with a 250-gallon steel tank. A 25' suction hose, manual pump (12.5 gallons per minute), and six faucets were included. A tarp camouflaged it as an ordinary trailer.

The U.S. *M-24 Ammunition Trailer* of 1942 adopted the trailer for towing by the M-15 halftrack (p. 44). It had metal storage lockers (DR 3) for ammunition and spares, including 2,700×.50-caliber rounds, 350×37mm shells, and six replacement barrels for the M-2HB. It weighed 1.8 tons loaded.

The Luftwaffe's *SdAh 401 Feldküche* of 1943 held a field kitchen for a single cook to serve 170 men. Its stovepipe earned it the warm nickname *"Gulaschkanone"* ("goulash gun").

Heavy Motorcycle

All of the combatants employed heavy motorcycles such as the Harley-Davidson model described here. Other examples included the U.S. Indian Model 741B Scout; British BSA M20 and Norton 633 Big Four; French René Gillet 750 (see p. W:RH43); German BMW R 12 (see p. W107), Victoria KR 6 Bergmeister, and Zündapp K 800W; Italian Gilera LTE500 Militare and Moto Guzzi GT17; Japanese Sankyo 97 Shiki (a Harley copy); Polish CWS Sokól 1000; and Soviet Ural M-72 (a BMW copy).

A military variant of what was the commercial 1937 Harley-Davidson Model WL, the WLA was adopted by the U.S. Army as its standard-issue *Chain Drive Solo Motorcycle* in 1940. By the time that production ceased in 1945, more than 88,000 had been delivered, including more than 20,000 of the WLC for the British and Canadian forces, which was modified to suit British driving customs and added a passenger seat behind the driver. The WLA was also delivered to China and the Soviet Union.

The WLA was a heavy motorbike and very similar to its civilian brethren, except for an olive-drab paint scheme, a skid plate on the underbody, an engine optimized for low-octane gasoline, and black-out lights. Two 0.5-cf leather courier bags behind the saddle, a leather holster for a Thompson submachine gun (see p. W96) on the right side of the front wheel, and a small box on the left side (holding five SMG magazines and up two boxes of 50 cartridges) were provided. Special desert tires were available.

The U.S. Army used it for reconnaissance and messenger service. It was notable as the steed of military-police officers (p. W:D58), both at home and abroad. Drivers were trained to use the bike as cover, jump off at speed, leap ditches, etc.

The Harley-Davidson WLA burns 0.8 gallons of gasoline per hour of routine use. Fuel costs $0.50.

Harley-Davidson WLA

Subassemblies: Motorcycle chassis +0; two heavy wheels -1.
Powertrain: 17-kW standard gas engine with 17-kW wheeled transmission and 3.4-gallon light tank.
Occ: 1 MCS Body **Cargo:** 0.2 Body

Armor	F	RL	B	T	U
Body:	2/4	0/0	2/4	0/0	2/4
Wheels:	3/5	3/5	3/5	3/5	3/5

Statistics

Size: 7'×3'×3' *Payload:* 220 lbs. *Lwt.:* 0.4 tons
Volume: 2.4 *Maint.:* 686 hours *Price:* $80

HT: 10. HPs: 20 Body, 8 each Wheel.

gSpeed: 65 *gAccel:* 5 *gDecel*: 10 *gMR:* 1.5 *gSR:* 2
Ground Pressure High. 1/6 Off-Road Speed.

Design Notes

Designed with 3-gallon fuel tanks. Weight was increased 9% to the historical figure; the small battery was subsumed under this extra weight. The design's gSpeed 104 was reduced to the historical maximum of 65 mph, which was (at least partly) a result of the built-in speed governor required by the Army.

Light Sedan

The light sedan was a civilian automobile with two doors and a hardtop (in contrast to the convertibles and open-topped vehicles favored by the militaries of the time). Cars like this were made by the hundreds of thousands during the 1930s and '40s, by dozens of manufacturers in virtually every country with an industrial base of any sort.

During the war, many cars were pressed into military service, doing duty with rear-echelon units, at air bases, as runabouts, messenger cars, or transports for NCOs (officers generally had more prestigious automobiles available). Some even saw service in front-line units. They generally received a coat of matte paint, unit markings, black-out lights, and brackets for fuel cans, rifles, and pioneer tools.

In Europe and Japan, civilian use of cars declined massively during the war, mainly due to fuel shortage. Many civilian cars therefore received a gasifier that ran the vehicle on wood chips (see p. W:RH43).

The German Opel Kadett K38 was made from 1938-43 in huge numbers, some 74,000 being produced for the home and export markets. Thousands of similar models, such as the KJ38, would have just about the same statistics.

The K38 burns 0.8 gallons of gas per hour of routine use. Fuel costs $1.40. Historical cost was 2,350 Reichsmark ($560).

Opel Kadett K38

Subassemblies: Small Wheeled chassis with Civilian option +3; four wheels +1.
Powertrain: 17-kW standard gas engine with 17-kW wheeled transmission and 9.5-gallon standard tank; 2,000-kWs batteries.
Occ: 1 CS, 3 PS Body **Cargo:** 8 Body

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5

Statistics

Size: 13'×5'×5' *Payload:* 0.6 tons *Lwt.:* 1.3 tons
Volume: 36 *Maint.:* 422 hours *Price:* $225

HT: 10. HPs: 65 Body, 7 each wheel.

gSpeed: 61 *gAccel:* 3 *gDecel:* 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure High. 1/6 Off-Road Speed.

Design Notes

Designed with 9-gallon fuel tanks. For this model, gSpeed was increased by 5% to the historical figure, but this statistic would vary considerably for similar models. The other statistics would remain more consistent in most cases.

VW Schwimmwagen

Professor Porsche had long tinkered with an amphibious version of the famous VW Kübelwagen (p. W:IC72). In 1942, the Volkswagen Typ 166 was adopted by the Wehrmacht as the *Kfz 1/20 Kübelwagen 2, schwimmfähig* (bucket seat car type 2, amphibious). Most just called it the Schwimmwagen. Exactly 14,283 were built. It shared the general layout of its land-bound brother, but the body was bathtub-shaped and watertight. A screw at the rear could be lowered into the water for propulsion.

The Schwimmwagen was generally preferred over the VW Kübelwagen, being more useful. It featured all-wheel drive and a more rugged build, and thus had improved off-road mobility over its ancestor. It was initially intended as a replacement for the motorcycles with sidecars then in use, and many served in scout units in the East. It was possible to mount a machine gun such as the MG 42 on a pintle mount in the front and rear. Each MG would add $155 (including 500 rounds) to the cost.

The car burns 0.9 gallons of gas per hour of routine usage. Fuel costs $2. Historical cost was 4,667 Reichsmark ($1,110).

VW Schwimmwagen

Subassemblies: Waterproofed Very Small Wheeled chassis +2; four off-road wheels +1.

Powertrain: 19-kW standard gasoline engine with 19-kW all-wheel-drive transmission, 19-kW screw propeller, and 13.2-gallon standard tanks; 2,000-kWs batteries.

Occ: 1 XCS, 3 XPS Body Cargo: 2.9 Body

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: Ragtop for all seats; two pintle mounts for LMGs [F, B].

Statistics

Size: 13'×5'×5' *Payload:* 960 lbs. *Lwt.:* 1.5 tons
Volume: 18 *Maint.:* 280 hours *Price:* $510

HT: 11. HPs: 85 Body, 14 each wheel.

gSpeed: 50 *gAccel:* 3 *gDecel*: 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure High. 1/4 Off-Road Speed.
wSpeed: 6 *wAccel:* 2 *wDecel*: 10 (11) *wMR:* 0.25 *wSR:* 1
Draft 3'. Flotation Rating 2.3 tons.

Design Notes

The car was designed with 12-gallon fuel tanks but the historical tankage is given. The wSpeed was slightly adjusted down to the historical speed, as well.

The simple pintle mounts were not bought separately; they are considered a special feature of the chassis. A gun mounted on them would take stiff penalties to firing while on the move; they are not as stable as a more conventional vehicle mount.

Draft was increased to the historical; the difference is mostly due to the wheels sticking down below the body's underside, a problem not shared by many ordinary boats.

Steyr Raupenschlepper Ost (RSO)

During the winter and spring of 1941/42, the German army became bogged down in the appalling conditions of the Russian countryside. Everything not mounted on tracks became stuck and impossible to move in the snow and mud. One of the solutions was the privately developed *Raupenschlepper Ost* (tracked tractor for use in the East). This fully tracked vehicle had been designed by Steyr-Daimler-Puch of Austria based on their standard 1.65-ton truck.

The tractor appeared in late 1942 and was instantly adopted. Some 27,950 were through the end of the war. The suspension and tracks as well as the cab were rather crude, resulting in excessive vibration and noise, low speed, and limited creature comfort. The RSO's off-road performance was admirable, however, and the nimble little tractor was well-liked by the troops. Its main task was to tow medium AT guns, light howitzers, or trailers up to 3.3 tons in weight. It was exported to Bulgaria, Hungary, and Romania.

The RSO/01 burns 2.3 gallons of gasoline per hour of routine usage. A full load of fuel costs $7.20.

Steyr RSO/01

Subassemblies: Small Tank chassis with Light option +3; tracks +2.

Powertrain: 52-kW standard gasoline engine with 52-kW tracked transmission and 48-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 1 XCS, 1 XPS Body Cargo: 18.1 Body

Armor	F	RL	B	T	U
Body:	3/5	3/5	3/5	0/0	3/5
Tracks:	4/35	4/35	4/35	4/35	4/35

Equipment

Body: 16.5-VSP cargo hold (for 33 VSPs of exposed cargo); 42-sf covered deck; ragtop for all seats.

Statistics

Size: 15'×7'×8' *Payload:* 1.9 tons *Lwt.:* 5.7 tons
Volume: 48 *Maint.:* 179 hours *Price:* $1,245

HT: 7. HPs: 125 Body, 45 each Track.

gSpeed: 11 *gAccel:* 2 *gDecel*: 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Very Low. 4/5 Off-Road Speed.

Design Notes

The gSpeed was decreased 63% to the historical.

Variants

The *7.5cm PaK 40 (Sf) auf RSO/02* of 1943 lacked the cabin and carried a 75mm Rheinmetall PaK 40/4 (75mm Long Tank Gun) with 28 rounds in the bed, firing over the nose. The only protection was the DR 30 gunshield of the weapon and the DR 15 mild steel nose. A tarp, open to the front, gave limited camouflage but increased height. It had a crew of four.

The 6-ton *RSO/03* of 1944 was a 48-kW diesel variant made by Magirus with 37-gallon fuel tanks; gSpeed was 9.

Gleisketten-LKW Maultier Halftrack

The *Maultier* (mule) was developed in the 1941-42 winter by the 2nd SS-Panzer-Division "Das Reich" to improve the off-road performance of their trucks by replacing the rear axles with tracks. The suspension and tracks were taken from British Carden-Loyd tractors captured at Dunkirk (see p. W15).

The resulting halftrack was cheap, reliable, and useful, though it lost a third of its cargo capacity. From 1942, it entered series production using various trucks straight from the production line, fitting them with Carden-Loyd running gear and Panzer I tracks. Off-road performance was not quite as good as that of a purpose-built halftrack, but it was better than a truck.

Mules were used in great numbers, the German Ford subsidiary alone producing 13,952 from December 1942 to the end of the war based on its Model 3000S truck. Service was mainly confined to the Eastern Front, where they were generally employed for routine supply purposes. Twenty passengers could ride in the back.

The SdKfz 3b burns 3.2 gallons of gasoline per hour of routine usage. A full tank of gas costs $4.35.

Ford SdKfz 3b Maultier

Subassemblies: Medium Halftrack chassis with Light option +4; tracks +3.

Powertrain: 71-kW standard gas engine with 71-kW tracked transmission, 29-gallon standard tanks; 2,000-kWs batteries.

Occ: 1 CS, 1 PS Body Cargo: 60.9 Body

Armor	F	RL	B	T	U
Body:	3/5	3/5	3/5	3/5	3/5
Tracks:	4/20	4/20	4/20	4/20	4/20

Equipment

Body: 55-VSP cargo hold (usually exposed); 75-sf covered deck.

Statistics

Size: 21'×7'×9' *Payload:* 2.2 tons *Lwt.:* 6.5 tons
Volume: 112 *Maint.:* 190 hours *Price:* $1,110

HT: 9. HPs: 240 Body, 65 each Track.

gSpeed: 24 *gAccel:* 3 *gDecel*: 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Low. 1/2 Off-Road Speed.

Design Notes

Design gSpeed had to be reduced 40% to reflect the historically low speed of this field-expedient vehicle. The drivers were instructed to not exceed *half* the lowered speed in combat.

Variants

The *Opel SdKfz 3a Maultier* of 1942, based on the Opel-Blitz 3000S (W:IC73), had a 51-kW engine and 21-gallon tanks, but was otherwise similar. Some 3,400 were built.

The 7.3-ton *Magirus SdKfz 3c Maultier* of 1942, based on the Klöckner-Humboldt-Deutz 3000S, had a 60-kW diesel engine and 18-gallon tanks. Some 1,740 were built.

15cm Panzerwerfer 42 SdKfz 4/1

Because the Nebelwerfer 41 (p. 27) units had to change position so frequently, it seemed like a good idea to both make the launcher self-propelled and to give the crew some protection against shrapnel from counterbattery fire. The cheap Opel Maultier was chosen as a chassis and fitted with armor. The crew, including driver, commander, and gunner, was seated in an armored cab. A 10-round launcher was fitted on a rotating mount with 10°-per-second powered traverse. Reloads were carried in compartments in the armored body. A 7.92mm Rheinmetall MG 42 was placed in an AA mount over the cab.

The resulting vehicle became the *15cm Panzerwerfer 42* (armored 15cm launcher model 1942) and entered service in 1943. Some 300 of these were made. It burns 2.3 gallons of gasoline per hour of routine usage. Fuel and ammo cost $425.

15cm Panzerwerfer 42

Subassemblies: Medium Halftrack chassis w/ Light option +4; full-rotation Mini open mount 1 [Body:T] +0; full-rotation Large Weapon open mount 2 [Body:T] +2; tracks +3.

Powertrain: 51-kW standard gas engine with 51-kW tracked transmission, 21-gallon standard tanks; 2,000-kWs batteries.

Occ: 3 CS Body Cargo: 52.7 Body, 4 OM 2

Armor	F	RL	B	T	U
Body:	4/25	4/25	4/25	4/20	4/20
Tracks:	4/20	4/20	4/20	4/20	4/20
OMs 1-2:	0/0	0/0	0/0	0/0	–

Weaponry

Ground LMG/MG 42 [OM 1:F] (2,000 rounds).
10×150mm Rocket Launchers/NbW 42s [OM 2:F] (20 rounds).

Equipment

Body: Medium radio receiver and transmitter. *OM 1:* Universal mount. *OM 2:* 0.5-kW traversing gear; universal mount.

Statistics

Size: 20'×7'×10' *Payload:* 1.1 tons *Lwt.:* 8.5 tons
Volume: 123 *Maint.:* 81 hours *Price:* $6,080

HT: 8. HPs: 240 Body, 65 each Track, 30 OM 1, 120 OM 2.

gSpeed: 24 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Moderate. 1/3 Off-Road Speed.

Design Notes

The gSpeed was lowered 17% to the historical. Some mounted six smoke dischargers on the body front.

Variants

The 7.1-ton *Munitionskraftwagen für Nebelwerfer SdKfz 4* was the same vehicle without the launcher. It carried 20 reloads under its armor; 289 were made.

The same launcher and similar armor and equipment were also mounted on the mSPW 303(f) halftrack (based on the French SOMUA-Kégresse MCL), as well as on the late-war sWS halftrack.

Aerosanyi Ski Sleds

Some of the most unusual units of the Red Army were the *Aerosanyi* (aerosled) battalions. They employed snow sleds powered by rear-mounted engines and aircraft propellers, a concept first developed during the 1910s. Early patterns were used for regular mail and passenger transportation, and also for several arctic expeditions during the 1920s and '30s. Such civilian cargo vehicles, especially the Tupolev ANT-IVS, were used as ambulances and supply vehicles during the Winter War (see ***WWII: Frozen Hell***), and later in the Great Patriotic War.

From January 1942, 62 aerosanyi battalions were formally raised. A 100-man battalion consisted of a HQ and supply company with 10 NKL-16 cargo sleds and three combat companies with 10 NKL-26 or RF-8-GAZ-98 attack sleds each.

Aerosled battalions were used in winter raids, to combat enemy ski troops, for mopping up retreating motorized forces, and to transport supplies over difficult terrain. They were often employed together with ski rifle troops or tank forces.

Aerosanyi NKL-26

Introduced in late 1941, the boxy, wooden NKL-26 seated the driver/mechanic in front and the commander/gunner in the center. They entered through a left-side door. It ran on four skis, all being steerable. Designed for assaults, the NKL-26 was armor-plated on the front; the other facings were only plywood. Its wooden propeller was prone to damage from brush.

A center hatch had a ring mount for an MG with gun shield. Ammunition drums were stored in the body. The mount was manually rotated at 49° per second; rotation was limited to a 300° arc, because of the rear propeller.

Up to four men could ride on the outside of the aerosled, standing on the skis, with one leg each slung around a shock absorber. This was rather dangerous at high speeds or when the vehicle took sharp turns (see p. W150).

The NKL-26 burns 3.8 gallons of aviation gas per hour at routine usage. Fuel and ammo cost $25.

Subassemblies: Very Small Wheeled chassis +2; Mini open mount 1 [Body:B] +0; full-rotation Mini open mount 2 [Body:T] +0; four skis +1.

Powertrain: 75-kW HP gas engine with 75-kW old prop [OM 1] and 60-gallon standard tanks; 4,000-kWs batteries.

Occ: 2 CS Body Cargo: 2.6 Body, 0.7 OM 2

Armor	F	RL	B	T	U
Body:	4/30	2/3W	2/3W	2/3W	2/3W
Skis:	3/5W	3/5W	3/5W	3/5W	3/5W
OM1:	–	0/0	0/0	0/0	0/0
OM2:	4/25	0/0	0/0	0/0	–

Weaponry

Ground LMG/DT [OM 2:F] (1,260 rounds).

Statistics:

Size: 18'×8'×5' *Payload:* 0.4 tons *Lwt:* 1.8 tons
Volume: 20 *Maint:* 263 hours *Cost:* $575

HT: 10. HPs: 85 Body, 14 each Ski, 30 OM 1, 30 OM 2.

gSpeed: 56 *gAccel:* 4 *gDecel:* 5 *gMR:* 1 *gSR:* 3
Ground Pressure Low. 1/2 Off-Road Speed.

Design Notes

A wheeled chassis was used to model the skis, as the closest available. Wooden armor was bought at 20 lbs./$0.10 for the body and 38 lbs./$0.25 for the skis (p. 24). The gSpeed was reduced 3% to the historical. Ground performance is on *snow*!

Aerosanyi RF-8-GAZ-98

Also of 1941 vintage, the RF-8-GAZ-98 was quite different from the NKL-26. Built by the Gorkovskiy Avtomobilnyi Zavod (Gorki Automobile Plant), it was slim and open, with the crew sitting in exposed tandem seats. (On this vehicle, the commander/gunner sat in front, with the driver behind him.) The RF-8-GAZ-98 featured a cheaper, conventional car engine rather than an aircraft type, but received more modern metal propellers, which were not as easily damaged. Only the front skis were steerable on the RF-8-GAZ-98.

The front seat was fitted with a ring mount mounting a 7.62mm DT MG. Ten ammunition drums and hand grenades for close combat were stored ready to hand in the nose. The mount was manually rotated at 49° per second; rotation was limited to a 300° arc.

The RF-8-GAZ-98 burns 1.7 gallons of gasoline per hour at routine usage. Fuel and ammo cost $10.

Subassemblies: Very Small Wheeled chassis +2; Small Weapon open mount 1 [Body:B] +0; full-rotation Mini open mount 2 [Body:T] +0; four skis +1.

Powertrain: 37-kW gas engine with 37-kW prop [OM 1] and 21-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 2 XCS Body Cargo: 10 Body, 0.7 OM 2

Armor	F	RL	B	T	U
Body:	2/3W	2/3W	2/3W	2/3W	2/3W
Skis:	3/5W	3/5W	3/5W	3/5W	3/5W
OMs:	0/0	0/0	0/0	0/0	0/0

Weaponry

Ground LMG/DT [OM 2:F] (630 rounds).

Statistics:

Size: 17'×8'×6' *Payload:* 0.3 tons *Lwt:* 1.5 tons
Volume: 21 *Maint:* 325 hours *Cost:* $380

HT: 11. HPs: 85 Body, 14 each Ski, 45 OM 1, 30 OM 2.

gSpeed: 50 *gAccel:* 3 *gDecel:* 5 *gMR:* 1 *gSR:* 3
Ground Pressure Very Low. 1/2 Off-Road Speed.

Design Notes

Again, a wheeled chassis was used to model this ski-craft, being the closest to the concept. Wooden armor was bought at 20 lbs./$0.10 for the body and 38 lbs./$0.25 for the skis; see p. 24. In this case, design gSpeed had to be improved 18% to match the historical value.

Once again, the performance figures assume snow (or smooth ice). They would be *much* lower otherwise!

Dodge 3/4-ton Truck "Beep"

The U.S. military adopted this light 4×4 truck in 1942 for all arms and services, and used it to transport weapons, tools, and equipment. Its layout resembled that of a commercial truck, but with folding windshield and removable canvas top.

A carry-all vehicle much like the jeep, only bigger, it became known as the "beep" for "big jeep." Some 171,840 were made. Many were delivered to other Allies, including Canada and the Soviet Union.

The Beep could tow a 0.5-ton load such as the M-3A4 cart (p. 26), a 1/4-ton trailer, or a 37mm M-3A1 antitank gun (see p. W101). It burns 2.5 gallons of gasoline per hour at routine usage. Fuel costs $4.50.

Dodge 3/4-ton Truck WC51

Subassemblies: Small Wheeled chassis with Heavy option +3; four off-road wheels +1.

Powertrain: 56-kW standard gasoline engine with 56-kW all-wheel transmission and 30-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 1 XCS, 7 XPS Body Cargo: 8.2 Body

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: 8-VSP cargo hold (usually configured for 16 VSPs of exposed cargo); ragtop for all seats.

Statistics

Size: 14'×7'×7' *Payload:* 0.9 tons *Lwt.:* 4.4 tons
Volume: 36 *Maint.:* 233 hours *Price:* $735

HT: 12. HPs: 500 Body, 90 each Wheel.

gSpeed: 54 *gAccel:* 3 *gDecel*: 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure High. 1/4 Off-Road Speed.

Design Notes

Design gSpeed was 57, but the historical figure is listed. The rear passenger space could be used to transport cargo instead, up to 20 VSPs enclosed or 40 VSPs exposed.

Variants

The 4.6-ton *WC52* was the same vehicle with a front-mounted 2.5-ton winch. More than 59,000 were built.

The *3/4-ton Ambulance Truck WC54* of 1942 had an enclosed body (DR 5W) in place of the cargo bed, able to carry four litter patients and an attendant. Some 26,000 were built.

The 3.7-ton *37mm M-6 Gun Motor Carriage WC55* of 1942 featured a 37mm M-3A1 AT gun (37mm Medium Tank Gun) on a full-rotation open mount in the cargo bed. A DR 20 gunshield protected the gun crew. It had stowage containers for 80 rounds, a medium radio, and a 2.5-ton winch. The standard crew was four. Some 5,380 were built.

The *3/4-ton Command and Reconnaissance Truck WC56* of 1942 was almost identical to the standard version, but fitted to carry a medium radio and 8,000-kWs batteries.

Ward LaFrance Heavy Wrecker M-1

The U.S. Army standardized its heavy wrecker M-1 in 1937, but very few were then bought. Volume production began in '41, with Ward LaFrance supplying about 3,500 of its Model 1000 and Kenworth some 1,300 of its Model 570; they differed little. British and Canadian forces also received the units.

The vehicle had all-wheel drive and twin wheels on the rear axles. It was designed to recover disabled vehicles of various kinds. A 10-ton winch in front, an 18.75-ton winch in the rear, and a swinging 8-ton crane in the cargo bed were installed for this work. Outriggers, ground spades, and various jacks were provided to take the strain off the truck. The crane could be used to the rear or sides. Floodlights on top of the crane allowed work at night. The M-1 could tow a 30-ton vehicle.

Bows and tarpaulins allowed camouflaging the vehicle as an ordinary cargo truck. Various repair tools including welding and cutting equipment, an 8-ton jack, a 30-ton jack, tow chains, and a complete Mechanic kit (see p. W89).

The M-1 burns 4.9 gallons of gasoline per hour of routine usage. A full tank of gas costs $18.

Ward LaFrance M-1

Subassemblies: Medium Wheeled chassis with Heavy option +4; 10 heavy wheels +3.

Powertrain: 108-kW gas engine with 108-kW all-wheel transmission, 120-gallon standard tanks; 4,000-kWs batteries.

Occ: 1 CS, 1 PS Body Cargo: 42.4 Body

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: 10-ton winch [F]; 18.75-ton winch [B]; 8-ton crane [T].

Statistics

Size: 23'×8'×10' *Payload:* 4 tons *Lwt.:* 19.25 tons
Volume: 150 *Maint.:* 70 hours *Price:* $8,060

HT: 12. HPs: 1,300 Body, 90 each Wheel.

gSpeed: 45 *gAccel:* 2 *gDecel*: 10 *gMR:* 0.25 *gSR:* 5
Ground Pressure Very High. 1/6 Off-Road Speed.

Design Notes

Design gSpeed was 38 mph, but the historical figure is listed, instead.

Eight winch modules were bought and bundled to represent the rear winch.

Technically, the truck could carry a great deal more cargo, but most of the space that would be allocated to this purpose is kept clear to allow unobstructed rotation of the crane. Only the truck's cab interferes with its rotation into the front arc.

Variants

The *M-1A1* of 1944 had an open cabin with exposed seats and a ragtop, but was otherwise identical in game terms.

Austro-Daimler Polizei-Panzerkampfwagen ADGZ

And then came her retinue: machine guns and two trim little armored reconnaissance cars with their names painted on them. And what nice names they had: Ostmark and Sudetenland. What fun they had! Back and forth they drove, rat-tat-tatting from behind their armor, and looking things over . . .
– Günter Grass, ***The Tin Drum***

German police and SS units commandeered the 27 Austro-Daimler M.35 armored cars used by Austrian forces, calling them *Polizei-Panzerkampfwagen ADGZ*. The SS-Heimwehr used them in storming Danzig's Polish post office (p. W:IC11).

The four-axle ADGZ has drivers in the front and back, to allow reversing without turning. Two hull gunners are also carried. The main gunner manually rotates the turret at 4° per second. The commander fires the ball-mounted turret MG. The car burns 5 gallons of gas per hour. Fuel and ammo cost $310.

Austro-Daimler ADGZ

Subassemblies: Standard Wheeled chassis Heavy option +3; full-rotation Small AFV turret +2; 12 off-road wheels +2.
Powertrain: 112-kW gas engine with 112-kW all-wheel drive transmission, 53-gallon standard tanks; 8,000-kWs batteries.
Occ: 4 CS Body, 2 CS Both Cargo: 5.6 Body, 7.9 Tur

Armor	F	RL	B	T	U
Wheels:	3/5	3/5	3/5	3/5	3/5
All Else:	4/35	4/35	4/35	4/20	4/20

Weaponry

Ground LMG/MG 30(ö) [Body:F] (1,000 rounds).
Ground LMG/MG 30(ö) [Body:B] (1,000 rounds).
Antitank Rifle/KwK 35(ö) [Tur:F] (250 rounds).
Ground LMG/MG 07/12(ö) [Tur:F] (3,000 rounds).

Equipment

Body: Backup driver; medium radio receiver and transmitter.

Statistics

Size: 21'×7'×9' *Payload:* 1 ton *Lwt:* 13.2 tons
Volume: 69 *Maint:* 108 hours *Cost:* $3,450

HT: 10. HPs: 660 Body, 38 each Wheel, 150 Turret.

gSpeed: 42 *gAccel:* 2 *gDecel:* 10 *gMR:* 0.25 *gSR:* 4
Ground Pressure High. 1/4 Off-Road Speed.

Design Notes

Design gSpeed was decreased 10%. Weight had to be increased 37%. The car should have Very High ground pressure. This is improved to a functional High (and the cost increased $300) to reflect the all-wheel drive and steering.

Variants

Another batch of 25 vehicles, built in 1942, was mainly used by the 4th SS Polizei Division in Russia. It replaced the Austrian MGs with 7.92mm MG 34s with 5,100 rounds.

AMD Panhard Mle 35 Armored Car

The French cavalry adopted the Panhard 178 armored car as the *Automitrailleuse de Découverte Panhard Modèle 35* (reconnaissance machine-gun car Panhard model 1935). Troops called it *"la Pan-Pan."* Some 539 were made till 1939.

The Germans took over 190 as the PzSpähw 204(f) in 1940 and used them mainly for rear-area police duties with SS units. Another 43 were converted to railway protection vehicles with rail wheels installed, and used on their own or in connection with armored trains (pp. 56-58). Exchanging the wheels took a trained crew 10-15 minutes; needless to say, a Panhard fitted with rail wheels would have an *extremely* difficult time making headway on an ordinary road . . .

The turret (manually rotated at 4° per second) seats the commander and gunner. The driver is seated in the body front; a backup driver/radio operator is seated in the back for rapidly moving in reverse. (The reverse gSpeed is 26.)

The AMD Panhard Mle 35 burns 3.5 gallons of gas per hour at routine usage. Fuel and ammo cost $295.

AMD Panhard Modèle 35

Subassemblies: Small Wheeled chassis with Heavy option +3; full-rotation Large Weapon turret [Body:T] +2; four off-road wheels +1.
Powertrain: 78-kW standard gas engine with 78-kW all-wheel drive transmission and 33-gallon standard tanks; 12,000-kWs batteries.
Occ: 2 CS Body, 2 CS Both Cargo: 5.3 Body, 2.4 Tur

Armor	F	RL	B	T	U
Body:	4/65	4/50	4/50	4/20	4/20
Turret:	4/85	4/50	4/50	4/20	–
Wheels:	3/5	3/5	3/5	3/5	3/5

Weaponry

25mm Long Tank Gun/Hotchkiss Mle 34 [Tur:F] (150 rounds).
Ground LMG/MAC Mle 31C [Tur:F] (3,750 rounds).

Equipment

Body: Backup driver; medium radio receiver and transmitter.

Statistics

Size: 16'×7'×8' *Payload:* 0.8 tons *Lwt:* 9.4 tons
Volume: 46 *Maint:* 118 hours *Cost:* $2,990

HT: 10. HPs: 500 Body, 90 each Wheel, 120 Turret.

gSpeed: 46 *gAccel:* 2 *gDecel:* 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure Very High. 1/6 Off-Road Speed.

Design Notes

Weight was increased 19% to the historical value.

Variants

The French had a few unarmed command vehicles with extensive radio equipment. Some of these were later used by SS field propaganda units, fitted with cameras, audio recorders, and a 7.92mm MG 34 (Ground LMG).

Mercedes-Benz G4 Limousine

This large four-door car was a six-wheeled luxury limousine with limited off-road capability. Only 72 of this open seven-seater were made from 1934-39, and almost all of them ended up in the hands of high Nazi officials, including several field marshals and Hitler himself. Spain's Generalissimo Franco (see p. W10) received one in 1939 as a gift from Hitler. It was called a *Kommandeurwagen Kfz 21* (commander's car).

The right part of the front seat bench could be folded up to allow a passenger to stand up (useful on parades), the middle row had two individual seats, and the back row was another bench seating three. It had a convertible roof. All G4s sported deep coats of expensive lacquer, dozens of gleaming chrome lights, and (usually) small swastika flags.

The car described here is the armored version, with concealed body protection, armored glass windows, and bullet-proof run-flat tires. The convertible roof remained unarmored.

Those used by Hitler – he had several – had three compartments hidden in the seats' and doors' leather upholstery, each containing a Luger P 08 (p. W94) with three magazines for his bodyguards from the *Reichssicherheitsdienst* (SD, p. W50).

The G4 burns 3.7 gallons of gas per hour of routine usage. A full tank costs $5.50.

Mercedes-Benz G4 Kfz 21

Subassemblies: Small Wheeled chassis +3; six off-road wheels +1.

Powertrain: 82-kW standard gas engine with 82-kW all-wheel drive transmission and 37-gallon standard tanks; 4,000-kWs batteries.

Occ: 1 XCS, 6 XPS Body Cargo: 8.1 Body

Armor	F	RL	B	T	U
Body:	4/60	4/60	4/60	2/2C*	3/8
Wheels:	3/5	3/5	3/5	3/5	3/5

* Becomes 0/0 when the convertible top is down.

Equipment

Body: 6-VSP trunk; ragtop for all seats.

Statistics

Size: 17'×6'×6' *Payload:* 0.95 tons *Lwt.:* 4.8 tons
Volume: 36 *Maint.:* 191 hours *Price:* $1,090

HT: 8. HPs: 125 Body, 15 each Wheel.

gSpeed: 42 *gAccel:* 3 *gDecel*: 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure High. 1/4 Off-Road Speed.

Design Notes

Design gSpeed was lowered 36% to the historical. It is given all-wheel drive though only the rear axles were powered.

Note that the armored glass has only DR10 (see p. W144). A knowledgeable assassin could bypass most of the car's side and front DR by aiming through it.

SdKfz 301 Borgward IV Remote Vehicle

The *schwere Ladungsträger* (heavy charge carrier) SdKfz 301, called the Borgward IV by its maker, was one of a series of German remote-controlled demolition vehicles. Like the tiny SdKfz 302 Goliath (illustrated on p. W135), it was intended to be used against mine fields and fortified positions.

In action, a partially exposed driver steered it near the target. He then left, and it was radio-guided from the controlling *Funkleitpanzer* (radio command tank) from a distance of up to 1.25 miles. Once there, it dropped the charge carried on its front glacis and returned to safety before the explosive was detonated from afar. Each Funkleitpanzer – usually a Tiger I Ausf E (p. W104) or StuG III Ausf F/G (p. W:FH38) – had three or four remote units assigned and could control two of them at a time.

Like many German developments, the Borgward IV was a complex solution to a minor problem. It had its successes (e.g., clearing minefields at Kursk) but was often destroyed before it reached its objective. Its construction and the dedicated *Funklenk* (radio-control) companies were both a waste of resources. Nevertheless, almost 1,200 were made in three marks from 1942 to 1944, 616 of these being the Ausführung A.

The SdKfz 301 burns 1.7 gallons of gas per hour of routine usage. Fuel and explosive charge cost $2,000. Historical cost was 28,000 Reichsmark ($6,700).

Borgward SdKfz 301 Ausf A

Subassemblies: Very Small Tank chassis w/ Light option, mild slope +2; Mini superstructure +0 [Body:T]; tracks +2.

Powertrain: 37-kW gas engine with 37-kW tracked transmission, 34-gallon standard tanks; 4,000-kWs batteries.

Occ: 1 XCS Body Cargo: 8.3 Body

Armor	F	RL	B	T	U
Body:	5/60	4/50	4/50	3/10	3/15
Tracks:	4/30	4/30	4/30	4/30	4/30
Sup:	4/25	4/25	0/0	0/0	–

Equipment

Body: 1,100-lb. hardpoint [F]; radio-guided remote control; eight smoke dischargers [B].

Statistics

Size: 12'×6'×4' *Payload:* 0.7 tons *Lwt.:* 3.8 tons
Volume: 32 *Maint.:* 111 hours *Price:* $3,255

HT: 8. HPs: 100 Body, 35 each Track.

gSpeed: 24 *gAccel:* 2 *gDecel*: 20 *gMR:* 0.25 *gSR:* 4
Ground Pressure Very Low. 4/5 Off-Road Speed.

Design Notes

Design gSpeed reduced 22% to the historical.

The superstructure armor represents folding armor panels protecting the driver's upper body. They are folded down when the vehicle is remote-controlled.

A 1,000-lb. HE bomb was purchased for the charge, doing 6d×1,000 [12d] when detonated.

SdKfz 251 Halftrack Variants

More than 15,200 Hanomag SdKfz 251-series halftracks (see p. W:IC75) were built between 1939 and 1945. There were dozens of sub-variants for specialized duties, including several radio-command versions, an ambulance, an 81mm mortar carrier, a 75mm-infantry-gun carrier, a 37mm-antitank-gun carrier, two different 75mm-antitank-gun carriers, a 20mm-AA vehicle, a reconnaissance version with turreted 20mm autocannon, a series of artillery-survey vehicles, an observation vehicle, and ammunition carriers.

SdKfz 251/16 Ausf C

The *mittlere Flammpanzerwagen SdKfz 251/16* (medium flamethrower vehicle) was adopted in January 1943 for issue to combat engineers; 347 were made. It mounted two flamethrowers with gun shields on the sides. Instead of the usual nitrogen bottles, it had a 21-kW engine with 5.5-gallon gas tank powering a compressor to propel the jellied fuel out of the flamethrowers. A FmW 41 backpack unit (see p. W99) was also carried.

The SdKfz 251/16 burns 3.4 gallons of gas per hour of routine usage. Fuel and ammo cost $330.

Subassemblies: Medium Halftrack chassis +4; three limited-rotation Mini open mounts 1-3 [Body:T] +0; full-rotation Mini open mount 4 [Body:T] +0; tracks +3.

Powertrain: 75-kW standard gasoline engine with 75-kW tracked transmission and 42-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 5 CS Body Cargo: 38.5 Body

Armor	F	RL	B	T	U
Body:	4/40	4/22	4/22	0/0	4/17
Tracks:	4/20	4/20	4/20	4/20	4/20
OMs 1-3:	4/25	0/0	0/0	0/0	–
OM 4:	0/0	0/0	0/0	0/0	–

Weaponry

2×Ground LMGs/MGs 42 [OMs 1,4:F] (1,350 rounds each).
2×Medium Vehicle Flamethrowers [OMs 2-3:F] (40 each).

Equipment

Body: six 1.2-VSP cargo bins; medium radio receiver and transmitter. *OM 4:* Universal mount.

Statistics

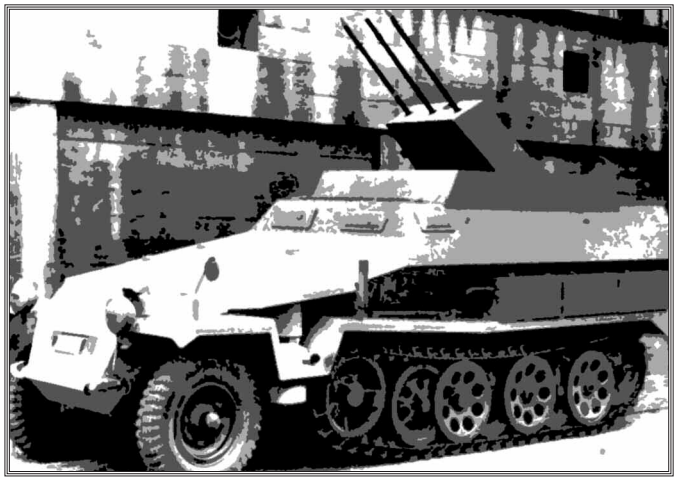
Size: 19'×7'×7' *Payload:* 1.5 tons *Lwt.:* 9.5 tons
Volume: 116 *Maint.:* 103 hours *Price:* $3,805

HT: 10. HPs: 490 Body, 135 each Track, 30 each OMs 1-4.

gSpeed: 33 *gAccel:* 2 *gDecel*: 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Moderate. 1/3 Off-Road Speed.

Design Notes

The engine powering the flamethrowers is subsumed under the weight of the Medium Vehicle Flamethrowers, where it replaces the usual propellant system. The design actually has 90 flamethrower shots and 2,500 7.92mm rounds, but the historical values are given, instead.



SdKfz 251/21 Ausf D

The *mittlere Schützenpanzerwagen (MG 151S Drilling) SdKfz 251/21 Ausf D* (medium armored personnel carrier with triple MG 151 on pedestal mount) was an antiaircraft variant mounting three former aircraft guns on a naval pedestal mount with gun shield. It could be rotated manually at 12° per second. Either the 15mm or the 20mm variant of the Mauser MG 151 was used. Production started in August 1944; 387 were made.

The SdKfz 251/21 burns 3.4 gallons of gas per hour of routine usage. Fuel and ammo cost $490.

Subassemblies: Medium Halftrack chassis +4; full-rotation Small Weapon turret [Body:T] +0; tracks +3.

Powertrain: 75-kW standard gasoline engine with 75-kW tracked transmission and 42-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 4 CS Body Cargo: 45.5 Body

Armor	F	RL	B	T	U
Body:	4/40	4/22	4/22	0/0	4/17
Tracks:	4/20	4/20	4/20	4/20	4/20
Turret:	4/25	4/25	0/0	0/0	–

Weaponry

3×15mm VL Air. HMGs/MGs 151 [OM:F] (1,000 each).*
* Linked.

Equipment

Body: six 1.2-VSP cargo bins, medium radio receiver and transmitter. *Turret:* Universal mount.

Statistics

Size: 19'×7'×8' *Payload:* 1.1 tons *Lwt.:* 9.5 tons
Volume: 114 *Maint.:* 103 hours *Price:* $3,745

HT: 10. HPs: 490 Body, 135 each Track, 45 Turret.

gSpeed: 33 *gAccel:* 2 *gDecel*: 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Moderate. 1/3 Off-Road Speed.

Design Notes

Loaded weight was reduced 4% from the design value.

Rolls-Royce Pattern 20 Armored Car

Despite being introduced in 1920 and based on the Pattern 14 of WWI, this armored car was still in service in WWII. The British employed it in Egypt, Palestine, and Iraq as late as 1942. Other users were India, Ireland, and South Africa.

The Pattern 20 used the chassis of the Rolls-Royce Silver Ghost limousine, but had a fully armored body with a turret over the cab. Access was provided by a twin-door in the rear, leading into the open cargo bed. The sides of the bed were lined with wooden cargo compartments (1 VSP, DR 3/5W on either side) doubling as seats for four.

By the '30s, the improved Mk I operating in the deserts of the Middle East had received a radio and pneumatic tires rather than the old solid ones (the rear axle sporting twin wheels). The RAF called this the *Armoured Car, Rolls-Royce, Type A*.

The turret mounts a .303 Vickers Mk I MG (p. W96). Many vehicles in the Middle East lacked the turret roof for better air circulation, adding a ring mount with a .303 Lewis Mk I MG (p. W96) for air defense. Only the driver has a seat; the three other crew members stand in the turret manning the guns.

The engine burns 1.7 gallons of gasoline per hour of routine usage. Fuel and ammo cost $35.

Rolls-Royce Pattern 20 Mk I

Subassemblies: Small Wheeled chassis +3; full-rotation Large Weapon turret [Body:T] +2; full-rotation Mini open mount [Tur:T] +0; six wheels +1.

Powertrain: 37-kW gas engine with 37-kW wheeled transmission and 31-gallon standard tanks; 2,000-kWs batteries.

Occ: 1 CS, 4 XPS Body; 3 SR Both Cargo: 4.4 Body, 3.9 Tur

Armor	F	RL	B	T	U
Body:	4/25	4/25	4/25	3/15	3/5W
Wheels:	3/5	3/5	3/5	3/5	3/5
Turret:	4/25	4/25	4/25	0/0	–
OM:	0/0	0/0	0/0	0/0	–

Weaponry

Ground LMG/Vickers Mk I [Tur:F] (2,500 rounds).
Ground LMG/Lewis Mk I [OM:F] (470 rounds).

Equipment

Body: two 1-VSP cargo bins; medium radio receiver and transmitter. *OM:* Universal mount.

Statistics

Size: 17'×6'×9' *Payload:* 1 ton *Lwt:* 4.5 tons
Volume: 47 *Maint:* 172 hours *Cost:* $1,355

HT: 8. HPs: 125 Body, 15 each Wheel, 120 Turret, 30 OM.

gSpeed: 50 *gAccel:* 2 *gDecel:* 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure High. 1/6 Off-Road Speed.

Design Notes

Wood armor is 28 lbs./$0.7 per point of DR; see p. 24.

Standard Beaverette Armored Car

After the debacle at Dunkirk (see p. W15), the British Army was desperate for armored vehicles; it had left a good portion of its inventory stranded on the beaches of France. At the initiative of Cabinet Minister Lord Beaverbrook, the *Light Armoured Car Beaverette Mk I* was adopted in 1940 as a stopgap measure.

Built in railway and bus depots, the little armored car was based on a civilian chassis, then armored to the front and sides. The top and back were left open. The resulting vehicle was rather stubby and unwarlike in appearance, and its boilerplate armor was so thin that it had to be "reinforced" with 3" oak planks on the inside.

The cars were armed with either a .303 Bren Mk II MG (see p. W96) or a .55 Boys Mk I antitank rifle (see p. W95) protruding from a simple firing slit.

The Beaverette was adopted by the British Army for training, by the Royal Air Force for the defense of air fields, and by the Home Guard for general internal security and the protection of aircraft factories. Some 2,800 were built in three marks, with gradually improving armor.

None were ever used in combat – which was just as well, as it was a makeshift piece of equipment at best, a deathtrap at worst. Still, in any scenario where the Germans invade England in 1940, the Beaverette would have taken the field.

The Beaverette I has a driver, gunner, and commander. The engine burns 0.5 gallons of gasoline per hour at routine usage. Fuel and ammo cost $15.

Armoured Car Beaverette I

Subassemblies: Small Wheeled chassis with Civilian option +3; four wheels +1.

Powertrain: 10-kW standard gasoline engine with 10-kW wheeled transmission and 7.2-gallon standard fuel tanks; 2,000-kWs batteries.

Occ: 3 CS Body Cargo: 12.8 Body

Armor	F	RL	B	T	U
Body:	4/25*	4/25*	0/0	0/0	3/5
Wheels:	3/5	3/5	3/5	3/5	3/5

* Backed by +0/+12W armor.

Weaponry

Ground LMG/Bren Mk II [Body:F] (1,200 rounds).

Statistics

Size: 14'×5'×5' *Payload:* 0.4 tons *Lwt:* 2 tons
Volume: 36 *Maint:* 286 hours *Cost:* $495

HT: 8. HPs: 65 Body, 7 each Wheel.

gSpeed: 40 *gAccel:* 2 *gDecel:* 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure High. 1/6 Off-Road Speed.

Design Notes

Design has 9-gallon tanks and 1,500 .303 rounds, but historical values given. Wood armor is 25 lbs./$1.3; see p. 24. Design gSpeed was increased 8% to the historical figure.

Alvis-Straussler AC3D Armored Car

The Hungarian Nicholas Straussler designed this 4×4 armored car and the English luxury-car maker Alvis built small numbers as the AC3D. The *Koninklijk Nederlands-Indisch Leger* (Royal Dutch East Indies army) purchased 12 in 1937. Originally serving in one cavalry squadron, they were distributed among smaller units in 1940, serving with about 40 White M-3A1s (p. 43) and 49 Marmon-Herrington IIIs (p. 40). One unit with three AC3Ds met the invading Japanese on Java on March 1, 1942. They eventually surrendered March 9. Though the KNIL's most heavily armed vehicles, the cars were ill-deployed as tank substitutes, and simply too few.

The turret manually rotates at 6° per second. The AC3D burns 4 gallons of gas per hour at routine usage. Fuel and ammo cost $95. Historical cost was 4,570 pounds ($17,600).

Alvis-Straussler AC3D

Subassemblies: Small Wheeled chassis with Heavy option +3; full-rotation Medium Weapon turret [Body:T] +1; full-rotation Mini open mount [Tur:T] +0; 4 off-road wheels +1.
Powertrain: 90-kW gas engine with 90-kW all-wheel transmission and 36-gallon standard tanks; 4,000-kWs batteries.
Occ: 3 CS Body, 1 CS Both **Cargo:** 1.5 Body, 1.6 Tur

Armor	F	RL	B	T	U
Body:	4/40	4/30	4/40	4/20	4/20
Wheels:	3/5	3/5	3/5	3/5	3/5
Turret:	4/40	4/30	4/30	4/20	–

Weaponry

Ground LMG/6.5mm Vickers M.23 [Body:F] (1,125 rounds).
Very Long Gr. HMG/.50 Colt-Browning M.30 [Tur:F] (500).
Ground LMG/6.5mm Vickers M.23 [OM:F] (225 rounds).

Equipment

Body: Backup driver; casemate mount. *OM:* Universal mount.

Statistics

Size: 15'×7'×8' *Payload:* 0.7 ton *Lwt:* 6.5 tons
Volume: 42 *Maint:* 124 hours *Cost:* $2,605

HT: 12. HPs: 500 Body, 90 each Wheel, 75 Turret, 30 OM.

gSpeed: 40 *gAccel:* 3 *gDecel:* 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure Moderate. 1/3 Off-Road Speed.

Design Notes

Design gSpeed was decreased by 33%. The vehicle should have High ground pressure; this has been improved to a functional Moderate – and the price increased $300 – to reflect the sophistication of the all-wheel drive and steering.

Variants

From '38, the British RAF used a variant as the *Armoured Car, Straussler, Type A* for ground security. It was armed with a single .303 Vickers Mk IV (Ground LMG) with 2,500 rounds. Only 12 were acquired; the War Office was suspicious of Alvis' Hungarian connections. They were deployed in Iraq.

Weisz-Straussler 39M Csaba Armored Car

Straussler and partner Manfréd Weisz of Budapest developed a car for the Hungarians based on the AC3D. It received a more modern shape, with sloped armor plates, and a larger turret with a heavier armament. It was adopted as the *Páncélgépkocsi 39M Csaba*, Csaba having been the name of Attila the Hun's son. Some 120 were delivered between 1940 and 1944.

The turret sports a 20mm Steyr-Solothurn Nehézpuska 36M, a light semi-automatic weapon firing AP ammo from eight-round magazines (commercially known as the S18-300). An 8mm Danuvia Géppuska 34/37M (RoF 16*) is mounted coaxially. The turret is manually rotated at 4° per second.

The 39M burns 3 gallons of gas per hour at routine usage. Fuel and ammo cost $285.

Weisz-Straussler 39M Csaba

Subassemblies: Small Wheeled chassis with Heavy option and Medium slope +3; full-rotation Large Weapon turret [Body:T] +2; four off-road wheels +1.
Powertrain: 67-kW standard gasoline engine with 67-kW all-wheel drive transmission and 36-gallon standard fuel tanks; 8,000-kWs batteries.
Occ: 2 CS Body, 2 CS Tur **Cargo:** 3.5 Turret

Armor	F	RL	B	T	U
Body:	5/60	4/30	5/60	4/20	4/20
Wheels:	3/5	3/5	3/5	3/5	3/5
Turret:	4/40	4/30	4/30	4/20	–

Weaponry

20mm Antitank Rifle/36M [Tur:F] (200 rounds).*
Ground LMG/34/37M [Tur:F] (3,000 rounds).*
* Linked.

Equipment

Body: Backup driver option.

Statistics

Size: 15'×7'×8' *Payload:* 0.7 tons *Lwt:* 6.5 tons
Volume: 46 *Maint.:* 125 hours *Cost:* $2,565

HT: 12. HPs: 500 Body, 90 each Wheel, 120 Turret.

gSpeed: 40 *gAccel:* 3 *gDecel:* 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure Moderate. 1/3 Off-Road Speed.

Design Notes

Design gSpeed was decreased by 33%. The vehicle should have High ground pressure; this has been improved to a functional Moderate – and the price increased $300 – to reflect the sophistication of the all-wheel drive and steering.

Normally, MVDS-built cars don't have slope options available. As is done here, this feature may be added fairly simply, though some familiarity with ***GURPS Vehicles*** might be in order. In this case, 30º of slope were added to each of the body front and back facings, reducing interior volume by 20% to a net total of 24 VSPs.

Sumida 91 Shiki "Sō-Mo" Armored Car

This large, boxy vehicle adopted in 1931 was designed by the Japanese *Tetsudōkōhei* (rail engineers) and built for them by the Ishikawajiama Automobile Co., which produced cars and trucks under the Sumida brand name. Indeed, it is often imprecisely referred to as the Sumida armored car.

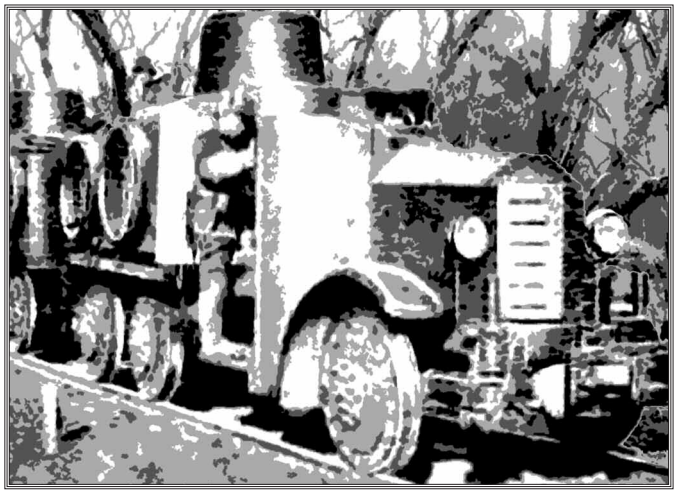
The 91 Shiki "Sō-Mo" was designed on a budget, using a commercial truck chassis and cheap, riveted armor (p. 12). Its main purpose was patrolling the long Manchurian rail lines and escorting the supply trains. Some 1,000 were made.

An ingenious solution also allowed it to leave the tracks and move cross-country. The car carried a few track pieces and spare wheel rings with full tires on its sides. To move off the railroad, the track pieces would be placed crosswise over the tracks, under the four hydraulic jacks. The car was lifted, and the wheel rings were changed. The jacks ended in small rollers. These allowed the crew to push the car sideways, until it was off the railroad. The jacks were lowered, the rail wheel rings and track pieces were retrieved, and the car was ready to move. The Japanese boasted that the whole procedure took less than 5 minutes; well-trained crews probably approached that time, while allowing 10 minutes or more for most crews is reasonable. It was not a job to do under fire; if ambushed, the armored car would withdraw first, then try to take the enemy by surprise by moving off the railroad.

The largish crew (six men) was needed to perform this operation, but it also allowed dismounting a recon team if needed. It also provided the vehicle's firepower, as its only armament was the crew's small arms. The turret could be fitted with a loose infantry LMG, usually a 6.5mm Nambu 11 Shiki (see p. W97). There were three weapon ports on each flank, and one to the back, for the passengers to fire their rifles or additional machine guns (at a -2 penalty, see p. W155). A wide back door allowed for easy access. The cargo space allowed carrying additional passengers, fuel, or provisions.

The exceptional flexibility of this design was somewhat diminished by the poor off-road performance caused by the underpowered engine and by the lack of an all-wheel drive. These vehicles were widely employed in China and elsewhere; about 1,000 were built. When escorting a train, the armored car would often be pushed by the main locomotive in order to save fuel. When on patrol missions, two cars were sometimes coupled back to back, which came in handy if a quick reverse disengagement was needed.

All crew members sit in the hull; there's also standing room for manning the MG. The turret is hand-cranked at about 9° per second. The engine burns 1.4 gallons of gasoline per hour of routine usage. Fuel and ammo cost $23, assuming 1,500 rounds for the MG.



Sumida 91 Shiki "Sō-Mo"

Subassemblies: Standard Wheeled chassis with Heavy option +3; full-rotation Medium Weapon turret [Body:T] +1; six off-road/railway wheels +2.

Powertrain: 30-kW standard gasoline engine with 30-kW wheeled transmission and 55-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 1 CS, 5 PS Body; 1 SR Tur **Cargo:** 4.4 Body, 2.6 Tur

Armor	F	RL	B	T	U
Body:	4/50	3/25	3/25	3/10	3/10
Wheels:	3/5	3/5	3/5	3/5	3/5
Turret:	3/25	3/25	3/25	3/10	–

Weaponry

Ground LMG/11 Shiki [Tur:F] (1,500 rounds).

Equipment

Body: Rail conversion gear (described above).

Statistics

Size: 21'×6'×10' *Payload:* 0.8 tons *Lwt:* 7.1 tons
Volume: 59 *Maint:* 171 hours *Cost:* $1,375

HT: 12. HPs: 660 Body, 75 each Wheel, 75 Tur.

On Road Wheels:
gSpeed: 25 *gAccel:* 2 *gDecel:* 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure High. 1/6 Off-Road Speed.

On Rail Wheels:
gSpeed: 40 *gAccel:* 2 *gDecel:* 10 *gMR:* 0.5 *gSR:* 4
Ground Pressure Very High. No Off-Road Speed.

Design Notes

The conversion gear was purchased as a second wheel subassembly, and a set of retractable skids to represent the jacks, with the aid of ***GURPS Vehicles***. The addition of these is really beyond the scope of the design system.

Variants

The first production runs had a fixed gauge, but later batches could be adapted from the 1,440mm gauge used by the Manchurian rail network to the 1,520mm gauge used in Northern Manchuria and elsewhere.

The similar *93 Shiki*, adopted in 1933, was slightly heavier at 8.25 tons. It had a small observation cupola (a limited-rotation Mini turret) behind the main turret.

Some of the late production vehicles seem to have received a diesel engine, instead.

Marmon-Herrington Armored Car

In 1938, South Africa ordered armored cars from Britain to replace their obsolete WWI-vintage Rolls-Royce cars (p. 37). Britain couldn't deliver, so the South Africans developed an indigenous design. The vehicle eventually used a 3-ton Ford truck chassis from Canada, a 4×4 Marmon-Herrington transmission from the United States, arms from England, and armor plates from the local Iron & Steel Industrial Corp. The parts were assembled by various local companies.

The vehicle was made in several versions, all differing slightly in armament and configuration. The original production was only used by the South African Union Defence Force. It was followed by the widely used *Armoured Car Marmon-Herrington Mk II*, which was built in two minor subvariants. The Mobile Field Force (MFF) type was used from November 1940 by the South Africans only, while the Middle East (ME) type was first delivered in March 1941 to the British and used in combat with Commonwealth units in both North Africa and the Middle East. At the time, it was the only armored car available in sufficient numbers, and used for reconnaissance in the Western Desert. Some ended up in service with the Germans, designated PzSpähw 208(e). Some 887 were built of this mark.

While the MFF was fitted with a single .303 Vickers Mk I water-cooled machine gun (see p. W96), the ME was more heavily armed with a .55 Boys Mk I antitank rifle (see p. W95) and a coaxial .303 Bren Mk II light machine gun (see p. W96). It also had a pintle mount on the rear of the turret fitted with a .303 Vickers Mk I, and another pintle with a Bren on the front, which was used for antiaircraft fire.

The car has a crew of four: driver, hull gunner, turret gunner, and commander. The turret was manually traversed at 5° per second. The engine burns 3.2 gallons of gas per hour at routine usage. Fuel and ammo cost $90.

Armoured Car Marmon-Herrington II

Subassemblies: Standard Wheeled chassis with Heavy option +3; full-rotation Large Weapon turret [Body:T] +2; two limited-rotation Mini open mounts 1-2 [Tur:T] +0; four off-road wheels +2.

Powertrain: 70-kW standard gasoline engine with 70-kW all-wheel transmission and 51-gallon standard fuel tanks; 8,000-kWs batteries.

Occ: 2 CS Body, 2 CS Both **Cargo:** 19.1 Body, 4.7 Tur

Armor	F	RL	B	T	U
Body:	4/40	4/30	4/35	4/20	4/20
Wheels:	3/5	3/5	3/5	3/5	3/5
Turret:	4/35	4/25	4/25	4/20	–
OMs 1-2:	0/0	0/0	0/0	0/0	–

Weaponry

15mm Antitank Rifle/Boys Mk I [Tur:F] (190 rounds).
Ground LMG/Bren Mk II [Tur:F] (1,200 rounds).
Ground LMG/Bren Mk II [OM 1:F] (1,200 rounds).
Ground LMG/Vickers Mk I [OM 2:F] (2,500 rounds).

Equipment

Body: Medium radio receiver and transmitter. *OM 1:* Universal mount.

Statistics

Size: 16'×7'×7' *Payload:* 0.8 tons *Lwt:* 6.6 tons
Volume: 66 *Maint:* 135 hours *Cost:* $2,205

HT: 12. HPs: 660 Body, 113 each Wheel, 120 Tur, 30 each OM.

gSpeed: 50 *gAccel:* 3 *gDecel:* 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure High. 1/4 Off-Road Speed.

Design Notes

Design gSpeed was decreased 4% to the historical.

Variants

Minor variants of the Mk II included a RAF liaison car armed with two .303 Lewis Mk Is (Ground LMGs with RoF 9) in the turret and on an AA pintle, an unarmed ambulance, a command version, and an artillery-observation version.

Many troops replaced the installed small arms with heavier weapons, usually salvaged from the enemy. Common choices were the German 37mm Rheinmetall PaK 35/36 antitank gun (37mm Medium Tank Gun), French 25mm Hotchkiss Mle 34 antitank gun (25mm Long Tank Gun), and the Italian 20mm Steyr-Solothurn Mod 36 antitank rifle (20mm Antitank Rifle; see p. W:GL27), 20mm Breda Mod 35 autocannon (20mm Long Ground AC), or 47mm OTO-Breda Mod 35 antitank gun (47mm Medium Tank Gun; see p. W:GL30). Most of these heavier weapons were installed in an open mount in place of the turret.

The original *South African Reconnaissance Vehicle Mk I* of 1940 was armed with a .303 Vickers Mk I in the turret and another one in a casemate-mount in the left side of the body. Only the rear axle was powered, reducing its off-road performance considerably (1/6 off-road speed). The armor was riveted (p. 12). It was used by the South African army against the Italians in East Africa, but soon relegated to training duties. Some 113 were built.

The *Armoured Car Marmon-Herrington III* of 1941 had a shorter chassis and wheelbase. The rear doors were deleted. It was also made in ME and MFF sub-types. Some 2,630 were built. These were also used in the Far East. Some were used as railway protection cars.

The *Armoured Car Marmon-Herrington IIIA* lacked the turret and instead mounted twin .303 Vickers G.O. Mk Is (Aircraft LMGs) on a ring mount, for antiaircraft fire.

The 6.4-ton *Armoured Car Marmon-Herrington IV*, debuting in 1943, received a larger turret mounting a 2-pounder ROQF Mk X (40mm Long Tank Gun), as well as a coaxial .30 Browning #2 Mk I (Ground LMG) with another one at the commander's hatch. Smoke dischargers were also added. Some 936 were built.

The *Armoured Car Marmon-Herrington IVF* of 1943 featured a Canadian transmission from the Ford F60L 3-ton truck, and technically was not a Marmon-Herrington vehicle at all. Stats are identical, however. Some 1,180 were built.

Landsverk L180 Armored Car

Landsverk of Landskrona, Sweden, was a company specializing in armored vehicles; many were sold to other neutral countries, if in small numbers. One of their more successful designs was a series of medium-weight armored cars based on a commercial 6×4 truck chassis of German production, usually supplied by Daimler-Benz or Büssing-NAG. These were the L180, L181, and L182, which differed only in minor details apart from the locally fitted armament.

The company's main customer was the Dutch army, which first adopted a dozen L181s as the *Pantserwagen M.36*, and then 14 L180s as the *Pantserwagen M.38;* two of the latter lacked the main gun and were fitted with radios for the command role. The 1e Eskadron Pantserwagens, based in the Noord-Brabant province, had twelve M.36s and a M.38 command car. The 2e Eskadron Pantserwagens, based in the Utrecht province, was equipped with 12 M.38s and one M.38 command car.

The M.38 saw combat on the Ypenburg airfield, when German paratroopers landed there in May 1940. The defending units included six of the armored cars. Two were damaged by aerial attacks; the others shot up the Ju 52/3m transports (see p. W:IC86) that landed at the airstrip. The planes' burning wrecks littering the field prevented more Germans from reinforcing the attack.

Later, the armored car was used by German police forces in the Netherlands and by the 227th Infantry Division in Russia as the PzSpähw 202(h).

Like many armored cars of the time, the M.38 has a driver in the front *and* rear, as well as hull-mounted machine guns; the 7.92mm AI-Lewis M.20 #1 MGs (RoF 8) are fitted with armored jackets. Auxiliary tracks are stowed above the rear mudguards. They can be pulled over the four rear wheels, effectively converting it into a halftrack, of sorts. This reduces ground pressure to an effective High and improves off-road speed to 1/4.

The turret is armed with a 37mm Bofors 4 PAW gun, fired by the commander. Typically, 40 APEX and 20 HE shells are carried. A 7.92mm AI-Lewis M.20 #2 machine gun (RoF 8) is mounted coaxially. The turret is manually rotated by the commander at 4° per second.

The M.38 burns 2.2 gallons of gasoline per hour at routine usage. Fuel and ammo cost $185.

Landsverk M.38

Subassemblies: Standard Wheeled chassis with Heavy option +3; full-rotation Large Weapon turret [Body:T] +2; six wheels +2.

Powertrain: 48-kW standard gasoline engine with 48-kW wheeled transmission and 32-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 4 CS Body, 2 CS Tur **Cargo:** 11.7 Body, 2.9 Tur

Armor	F	RL	B	T	U
Body:	4/30	4/30	4/30	4/20	4/20
Wheels:	3/5	3/5	3/5	3/5	3/5
Turret:	4/50	4/30	4/30	4/15	–

Weaponry

Ground LMG/M.20 #1 [Body:F] (776 rounds).
Ground LMG/M.20 #1 [Body:B] (776 rounds).
37mm Medium Tank Gun/4 PAW [Tur:F] (60 rounds).*
Ground LMG/M.20 #2 [Tur:F] (970 rounds).*
* Linked.

Equipment

Body: Backup driver option.

Statistics

Size: 18'×7'×8' *Payload:* 1 ton *Lwt:* 8.6 tons
Volume: 64 *Maint:* 118 hours *Cost:* $2,850

HT: 12. HPs: 660 Body, 75 each Wheel, 120 Turret.

gSpeed: 43 *gAccel:* 2 *gDecel:* 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure Very High. 1/6 Off-Road Speed.

Design Notes

Design gSpeed decreased 8% to the historical figure.

Variants

The 7.6-ton Dutch *M.36* of 1937 was a L181 variant built on a Daimler-Benz chassis with thinner top and underbody armor (DR 15), but essentially the same as the M.38.

Denmark acquired two 8.1-ton L180s in 1936, designating them *Panservogn M/36*. These cars were armed with a 20mm DISA-Madsen M/35 (20mm Long Ground AC) with 300 rounds and two 8mm DISA-Madsen M/29s (Ground LMGs with RoF 8) with 3,000 rounds. They also had radios. These were apparently taken over by the Germans for police duties in Denmark in 1943.

Finland bought a single L182 in 1936, which entered trials with various armaments, including the 13.2mm VKT-Lahti PstKK/35-36 (Very Long Ground HMG; see p. W:FH34). It was scrapped in 1941.

Ireland bought eight L180s in '36 as *Armoured Cars Mk II*, each armed with a 20mm DISA-Madsen Mk I (20mm Long Ground AC) with 240 rounds and two .303 DISA-Madsen Mk Is (Ground LMGs with RoF 11) with 3,000 rounds.

Lithuania received eight L181s in 1934. They were armed with a 20mm Oerlikon 1S (20mm Long Ground AC with RoF 5*) with 300 rounds and two 7.92mm Maxim MGs 08 (Ground LMGs with RoF 8; see p. W:IC64) with 3,000 rounds.

The Swedish army used five L180s as the *Pansarbil m/41*. They were armed with a 20mm Bofors Akan m/40 (20mm Long Ground AC with RoF 6*) with 300 rounds and two 8mm Carl Gustav-Browning Ksp m/39s (Ground LMGs) with 3,000 rounds.

Landsverk L210 Armored Motorcycle

The tiny Danish military could not afford a proper armor force, so it came up with the idea of an armored motorcycle. They owned some Swedish Landsverk armored cars (p. 41), and had the same manufacturer build a prototype to their specifications in 1932. A Harley-Davidson was fitted with armor plates all-around (giving it the sleek, angular look of something out of a superhero comic – or ***Car Wars***). Vision to the front was restricted, with only a small visor provided. The sides were partly open. The permanently attached armored sidecar mounted an 8mm DISA-Madsen M/29 machine gun (RoF 8) on a pintle; its 30-round magazines were stowed in external bags.

The combined weight was too much for any motorbike – it was difficult to control on roads, and off-road performance was abysmal. The L210 thus faded from the scene, being scrapped in the mid-1930s; however, the idea was not without merit. From 1938, the Danes mounted 20mm DISA-Madsen M/35 autocannons on stripped-down sidecars attached to Nimbus M/34 motorcycles. While the cannon couldn't be fired on the move, they managed to disable a handful of German AFVs with these on April 9, 1940.

The L210 burns 1 gallon of gasoline per hour of routine usage. Fuel and ammo cost $5.

L210 Pansermotorcykel

Subassemblies: Motorcycle chassis +0; Motorcycle sidecar +0; three off-road wheels -1.

Powertrain: 22-kW standard gasoline engine with 22-kW wheeled transmission and 3-gallon light fuel tank.

Occ: 1 MCS Body, 1 XPS Sidecar Cargo: 0

Armor	F	RL	B	T	U
Wheels:	3/5	3/5	3/5	3/5	3/5
All Else:	4/25	4/25	4/25	0/0	3/5

Weaponry

Ground LMG/M/29 [Sidecar:F] (450 rounds); see below.

Statistics

Size: 7'×5'×5' *Payload:* 450 lbs. *Lwt.:* 0.9 tons
Volume: 4.4 *Maint.:* 339 hours *Price:* $350

HT: 7. HPs: 20 Body, 20 Sidecar, 10 each Wheel.

gSpeed: 81 *gAccel:* 4 *gDecel*: 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure High. 1/6 Off-Road Speed.

Design Notes

The body is slightly too small for the powerful engine and transmission, but this has been handwaved. Because all three wheels were the same size, the wheel HPs of the two chassis were combined and then divided by 3. The small battery and rudimentary pintle mount were subsumed under body weight.

Design gMR was reduced from 1.25 to 0.5 to reflect the historically poor handling.

M-8 Armored Trailer

This armored trailer adopted in 1942 by the U.S. Army was a two-wheeled vehicle intended to be towed behind armored fighting vehicles or trucks. Its primary cargo is ammunition for fire-support vehicles such as the M-7 Priest self-propelled howitzer (see p. W:D80), M-8 self-propelled howitzer (see p. W:D78), M-16 AA-gun carrier (p. 44), or M-21 halftrack mortar carrier. Typical loads included 42 105mm howitzer shells, 93 75mm howitzer or tank-gun rounds, 222 81mm mortar bombs, 360 37mm tank-gun rounds, or 5,200 .50-caliber heavy-machine-gun rounds. Alternatively, 54 5-gallon fuel cans (see p. W89) or other volatiles and even valuables can be stored.

The trailer has a quick-release hitch for usage in an emergency. A rear pintle permits towing another trailer in tandem.

M-8 Armored Trailer

Subassemblies: Very Small Wheeled chassis +2; 2 wheels +1.

Occ: None Cargo: 15 Body

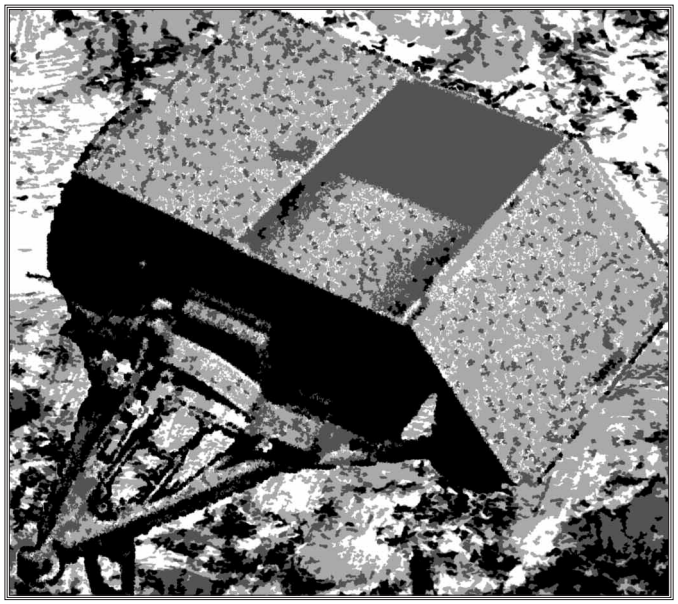
Armor	F	RL	B	T	U
Body:	4/20	4/30	4/30	4/20	3/10
Wheels:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: 11.2-VSP cargo hold.

Statistics

Size: 10'×7'×4' *Payload:* 1.1 tons *Lwt.:* 2.5 tons
Volume: 18 *Maint.:* 446 hours *Price:* $190



HT: 8. HPs: 85 Body, 28 each Wheel.

gSpeed: * *gAccel:* * *gDecel*: * *gMR:* 1.25 *gSR:* 2
Ground Pressure High. 1/6 Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

The designed cargo space was reduced to the historical figure. Historical payloads also take packaging and storage containers into account, and thus may be less than expected using VSPs from the MVDS.

White M-3A1 Armored Car

Entering service in 1939, the M-3A1 scout car was essentially an armored four-wheeled truck. The crew was only fully protected from the front; the sides and rear were rather low, and the top open. A removable canvas top was supported by three bows and the armored windshield.

Used extensively in North Africa, the M-3A1 was obsolete thereafter due to its limited off-road performance and mediocre armor and armament. By 1944, it was mainly used by military police and other second-line units, although Russia and other Allies such as Great Britain, Brazil, and China used it more frequently. Some 20,918 were built; more than half of these were given to Allies, 7,228 to the British alone.

The driver and commander/radio operator sit in the front, with six passengers in the rear; three of them man the MGs fitted to the skate rail that encircles the entire vehicle.

The M-3A1 burns 3.7 gallons of gasoline per hour at routine usage. Fuel and ammo cost $80.

White M-3A1 Armored Car

Subassemblies: Small Wheeled chassis with Heavy option +3; three limited-rotation Mini open mounts 1-3 [Body:T] +0; four off-road wheels +1.

Powertrain: 82-kW standard gasoline engine with 82-kW all-wheel drive transmission and 30-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 2 XCS, 6 XPS Body Cargo: 4.5 Body

Armor	F	RL	B	T	U
Body:	4/20	4/20	4/20	4/20	4/15
Wheels:	3/5	3/5	3/5	3/5	3/5
OMs 1-3:	0/0	0/0	0/0	0/0	–

Weaponry

Very Long Ground HMG/M-2HB [OM 1:F] (700 rounds).
Ground LMG/M-1919A4 [OM 2:F] (4,000 rounds).
Ground LMG/M-1919A4 [OM 3:F] (4,000 rounds).

Equipment

Body: Medium radio receiver and transmitter; ragtop for all seats. *OMs 1-3:* Universal mounts.

Statistics

Size: 18'×7'×7' *Payload:* 2 tons *Lwt.:* 6.2 tons
Volume: 39 *Maint.:* 183 hours *Price:* $1,185

HT: 12. HPs: 500 Body, 90 each Wheel, 30 each OM.

gSpeed: 55 *gAccel:* 3 *gDecel*: 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure High. 1/4 Off-Road Speed.

Design Notes

Design gSpeed was reduced from 58 to the historical.

The crew and passengers do *not* count as exposed if attacked from the front; this is simply a special effect of the vehicle's real-life design.

Ford M-8 Greyhound Armored Car

Conceived as a wheeled tank destroyer, the M-8's small gun and thin armor relegated it to become the M-3A1's replacement. It usually acted as "overwatch" for jeep-mounted scouts, ready to spring forward and provide covering fire. More than 8,500 were made in 1943-45. The British called the 500 that they received the *Greyhound*, in honor of their high speed.

The car lacked creature comforts. The open turret invited hand grenades, the roof hatches leaked, and heating was poor.

The driver and radio operator sit in the hull while the gunner and commander/loader sit in the turret. The gunner manually traverses the turret at 3° per second. The engine burns 3.7 gallons of gasoline per hour at routine usage. Fuel and ammo cost $305. Historical cost was $35,000.

Ford M-8 (Greyhound)

Subassemblies: Standard Wheeled chassis with Heavy option +3; Large Weapon turret [Body:T] +2; full-rotation Mini open mount [Tur:T] +0; 6 off-road wheels +1

Powertrain: 82-kW gas engine w/ 82-kW all-wheel transmission and 56-gallon self-sealing tanks; 4,000-kWs batteries.

Occ: 2 CS Body, 2 CS Both Cargo: 16.2 Body, 3.1 Turret

Armor	F	RL	B	T	U
Body:	4/50	4/30	4/30	4/20	4/15
Wheels:	3/5	3/5	3/5	3/5	3/5
Tur:	4/60	4/60	4/60	0/0	–
OM:	0/0	0/0	0/0	0/0	–

Weaponry

37mm Medium Tank Gun/M-6 [Tur:F] (80 rounds).*
Ground LMG/M-1919A4 [Tur:F] (1,500 rounds).*
Very Long Ground HMG/M-2HB [OM:F] (400 rounds).
* Linked.

Equipment

Body: medium radio transmitter and two medium radio receivers. *OM:* Universal mount.

Statistics

Size: 16'×8'×7' *Payload:* 1 ton *Lwt.:* 8.7 tons
Volume: 65 *Maint.:* 112 hours *Price:* $3,195

HT: 11. HPs: 500 Body, 120 Turret, 60 each Wheel.

gSpeed: 55 *gAccel:* 2 *gDecel*: 10 *gMR:* 0.75 *gSR:* 4
Ground Pressure Very High. 1/6 Off-Road Speed.

Design Notes

Design gSpeed was increased 13%. The M-8 carried two receivers to listen to both platoon and battalion radio nets.

Variants

The *M-20 Utility Car* was an M-8 with the turret removed, intended as a command or cargo vehicle. Benches for four passengers were placed in the body. An M-2HB was mounted on a skate rail around what had been the turret ring, with 1,000 rounds carried. Almost 3,800 were made.

M-3 Halftrack Variants

The White M-3 series of halftracks (see p. W109) was used as the basis for a number of variants for specialized duties. These included 81mm-mortar carriers, a 57mm-antitank-gun carrier, and a 75mm-antitank-gun carrier.

Autocar M-15 MGMC

The M-15 Multiple Gun Motor Carriage was adopted in 1942 with some 680 were built. Instead of the rear cargo area, it had a rotating, armored mount (manually traversed at 2° per second) featuring a 37mm Browning M-1A2 autocannon and a pair of linked .50-caliber Browning M-2HBs (see p. W97) fitted alongside the cannon. Spare ammo was stowed in the trailer (p. 42) which almost invariably came with it.

The M-15 burns 4.3 gallons of gasoline per hour of routine usage. Fuel and ammo cost $490.

Subassemblies: Medium Halftrack chassis +4; full-rotation Small TD turret [Body:T] +3; tracks +3.

Powertrain: 95-kW standard gasoline engine with 95-kW tracked transmission and 60-gallon standard fuel tanks; 8,000-kWs batteries.

Occ: 2 CS Body, 5 CS Tur Cargo: 8.5 Body, 4.1 Tur

Armor	F	RL	B	T	U
Body:	4/20	4/20	4/20	0/0	3/5
Tracks:	4/20	4/20	4/20	4/20	4/20
Turret:	4/20	4/20	0/0	0/0	–

Weaponry

37mm Long Ground AC/M-1A2 [Tur:F] (200 rounds).*
2×VL Ground HMGs/M-2HBs [Tur:F] (600 rounds each).*
* Linked.

Equipment

Body: 80-sf covered deck; medium radio receiver and transmitter. *Turret:* Universal mount.

Statistics

Size: 20'×7'×8' *Payload:* 1.5 tons *Lwt.:* 10.4 tons
Volume: 112 *Maint.:* 89 hours *Price:* $5,050

HT: 10. HPs: 490 Body, 135 each Track, 285 Turret.

gSpeed: 40 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Moderate. 1/3 Off-Road Speed.

Design Notes

In this case, the turret is placed completely inside the chassis, taking up 120% of its own volume.

White M-16 MGMC

The M-16 Multiple Gun Motor Carriage was adopted in 1942. It had the Maxson M-45 mount (with 60° per second of powered traverse) in the otherwise unmodified bed of the M-3A1. This featured four .50-caliber Browning M-2HBs feeding from 200-round belts. It was also effective against ground targets; massed infantry, in particular, could be dealt a stunning amount of damage if caught by this AA weapon. Some 3,614 were built or converted from other models.

The gunner sits between the guns and has armor protection to the front. The two loaders stand beside the mount in the cargo bed of the vehicle. The M-16 burns 4.3 gallons of gasoline per hour of routine usage. Fuel and ammo cost $730.

Subassemblies: Medium Halftrack chassis +4; full-rotation Large Weapon open mount 1 [Body:T] +2; Small Weapon open mount 2 [Body:F] +0; tracks +3.

Powertrain: 95-kW standard gasoline engine with 95-kW tracked transmission and 60-gallon standard fuel tanks; 8,000-kWs batteries. Also 0.3-kW standard gas engine with 0.4-gallon light tank; 2,000-kWs batteries [all OM 2].

Occ: 2 CS, 2 XSR Body; 1 CS Tur Cargo: 37.5 Body

Armor	F	RL	B	T	U
Body:	4/20	4/20	4/20	0/0	3/5
Tracks:	4/20	4/20	4/20	4/20	4/20
OM 1:	0/0	0/0	0/0	0/0	–
OM 2:	4/20	0/0	–	0/0	0/0
Gunner:	0/+20	0/0	0/0	0/0	0/0

Weaponry

4×VL Ground HMGs/M-2HBs [OM 1:F] (1,200 each).*
* Linked.

Equipment

Body: 80-sf covered deck; medium radio receiver and transmitter. *OM 1:* 1.7-kW traversing gear; universal mount. *OM 2:* 5-ton winch.

Statistics

Size: 21'×7'×8' *Payload:* 2.1 tons *Lwt.:* 9.9 tons
Volume: 114 *Maint.:* 94 hours *Price:* $4,485

HT: 10. HPs: 490 Body, 135 each Track, 75 OM 1, 45 OM 2.

gSpeed: 40 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Moderate. 1/3 Off-Road Speed.

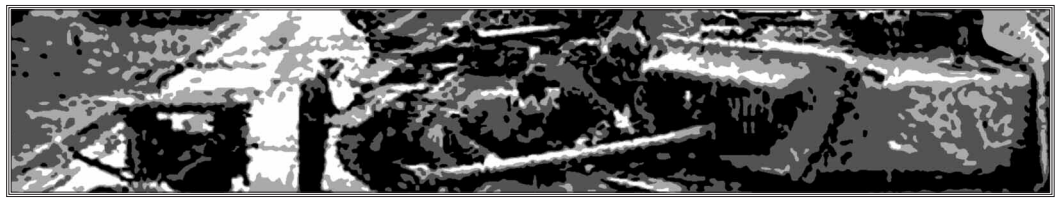
Design Notes

Open mount 1 is completely inside the body, taking up 120% of its own volume. Only one-third of an armored station was purchased for the gunner, to match the historical value.

Variants

The *M-17 Multiple Gun Motor Carriage* of 1942 delivered to the Soviet Union under Lend-Lease was similar, but used the International Harvester M-5 chassis as its basis. This had an 89-kW engine, but achieved only gSpeed 38 because it was slightly heavier. About 1,000 were built.

Ram Tank



In 1940, Canada's Montreal Locomotive Works (a subsidiary of the American Locomotive Corp.) started designing a cruiser tank for the Canadian army. This was based on the M-3 medium tank (p. 68), also produced in Canada, but had its main gun mounted in the turret rather than in the hull front. It ended up looking a lot like the M-4 (see p. W102), but in fact pre-dated it and actually served as a model for the U.S. tank – the prototype had been sent to Aberdeen Proving Grounds in Maryland.

The Canadians adopted it as the *Cruiser Tank Ram I*, featuring a 2-pounder as main armament and a small MG turret on the hull front. Only 50 of these were built before production was changed in early 1942 to the *Ram II*, which received a 6-pounder as main gun and replaced the MG turret with a conventional ball-mounted hull MG. A total of 1,899 Ram IIs were built until production ceased in the summer of 1943. Some 188 M-4A1s were subsequently made in Montreal under the name *Grizzly*.

The Ram was used heavily in training the Canadian armored troops in both Canada and England, but was never employed in combat. In 1944, the 4th and 5th (Canadian) Armored Divisions were re-equipped with Shermans.

Consequently, the obsolete Rams were converted for other uses, the most famous being the *Ram Kangaroo* armored personnel carrier, which made its first appearance in September 1944. Soon afterward, a "Kangaroo" would mean any fully tracked armored vehicle carrying troops, usually after removing the main armament and/or turret. Kangaroos were fashioned out of Shermans, Centaurs (p. 60), and Priests (see p. W:D80) as well as Rams, but the Ram Kangaroo was by far the most common, and was utilized heavily by British and Canadian units in Europe. It gave better protection than halftrack APCs, and also had the same off-road capabilities as the tanks it accompanied.

The turret of the Ram II seats the commander, gunner, and loader. The hull machine gunner (who also operates the radio) and driver sit in the body. The powered traverse rotates the turret at 24° per second.

The tank burns 13.4 gallons of gasoline per hour at routine usage. Fuel and ammo cost $1,320. Historical cost was 24,200 pounds Sterling ($93,080).

Cruiser Tank Ram II

Subassemblies: Large Tank chassis with Mild slope +4; full-rotation Medium AFV turret with Mild slope [Body:T] +2; tracks +3.

Powertrain: 298-kW standard gas engine with 298-kW tracked transmission and 175-gallon standard fuel tanks; 1.5-kW auxiliary engine; 16,000-kWs batteries.

Occ: 2 CS Body, 3 CS Both **Cargo:** 1.5 Body, 0.4 Tur

Armor	F	RL	B	T	U
Body:	5/435	4/250	4/150	4/75	4/95
Tracks:	4/45	4/45	4/45	4/45	4/45
Turret:	5/435	4/200	4/200	4/95	–

Weaponry

Ground LMG/Browning #2 Mk I [Body:F] (2,000 rounds).
57mm Medium Tank Gun/6-pdr. Mk V [Tur:F] (92 rounds).*
Ground LMG/Browning #2 Mk I [Tur:F] (2,000 rounds).*
* Linked.

Equipment

Body: Fire extinguisher. *Turret:* Medium radio and transmitter; stabilization for turret guns; 7-kW traversing gear.

Statistics

Size: 19'×9'×9' *Payload:* 2 tons *Lwt:* 32.5 tons
Volume: 137 *Maint.:* 33 hours *Cost:* $36,100

HT: 11. HPs: 1,800 Body, 600 each Track, 200 Turret.

gSpeed: 25 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Design gSpeed was decreased 17% to the historical.

Variants

The original 31.9-ton *Ram I* of 1941 mounted a 2-pounder ROQF Mk X (40mm Medium Tank Gun) with 171 rounds. In place of the hull MG, it had a small limited-traverse turret on the left front corner of the hull, which mounted a .30 Browning #2 Mk I with 4,250 rounds. Only 50 were made.

The *Ram Kangaroo* of 1944 was an armored personnel carrier with the turret removed. This field conversion could accommodate 8-11 troops in addition to the crew of two; some Kangaroos had benches, but usually the men had to sit uncomfortably on the floor or anywhere they found a spot. Hand and foot grips were welded to the outside of the hull to allow easy access. The turret ring was left open. No armament other than the bow MG was provided.

The *Badger* of 1945 was a Ram Kangaroo with a Heavy Vehicle Flamethrower installed in place of the bow MG. The open top was plated over for crew protection.

The *Sexton I* of 1943 was self-propelled artillery built on the M-7 Priest's (see p. W:D80) lines to fill the British army's preference for the 25-pounder Mk II (87.6mm Short Howitzer) over the 105mm howitzer. The United States could not deliver re-armed Priests, so the Canadians took over that contract after Ram II production had ceased. Some 124 Sexton Is and 2,026 Sexton IIs were made, differing only in minor details. Both mounted a casemated 25-pounder with limited traverse to engage tanks (18 AP rounds carried), but mainly gave artillery support with the 94 HE and smoke rounds stowed. Two loose .303 Bren Mk II MGs (see p. W96) with 1,500 rounds were carried for local defense. Armor was DR 150 on the front and sides; the top was open. The 28.5-ton vehicle had a crew of six.

The *Wallaby* of 1944 was an ammunition carrier for the Sexton, based on the Ram Kangaroo conversion.

Renault FT-17 Tank

The French Renault *Faible Tonnage Modèle 17* (lightweight model 1917) was designed during WWI and the most common tank worldwide until the 1930s. It was exported to many countries, and several nations built it under license or produced close copies. During the 1930s, the FT-17 saw combat in the Japanese invasion of Manchuria (p. W9), Spanish Civil War (p. W10), and Winter War (see ***GURPS WWII: Frozen Hell***).

In WWI its revolving turret was revolutionary. By 1939, the FT-17 was hopelessly obsolete; its riveted hull armor (p. 12) was thin, it had no radio, it was poorly armed, and its weak engine and troublesome suspension resulted in limited mobility. The commander was overburdened with being his own gunner and loader. In short, it was of no use to a modern army.

Regardless, France had more than 500 still in service in 1940. The tanks were fielded by their units in North Africa (244), Syria (54), and Indochina (20), too. The Germans used those captured as the PzKpfw 730(f) for police duty and airfield security. Finland, Poland, Romania, Yugoslavia, and others committed it to battle in the early war years. One famous engagement was the first tank battle involving U.S. troops in North Africa in 1942, when three M-3A1 light tanks (see p. W:D78) under General Patton engaged seven FT-17s of the French Vichy forces, knocking out three and forcing the rest to retreat without having hit the U.S. forces at all.

There were two versions, which were usually deployed side-by-side: The *Char Canon* (gun tank) mounted the low-powered 37mm Puteaux SA-17 or SA-18 cannon, while the *Char Mitrailleuse* (machine-gun tank) was armed with an MG.

The driver sits in the front behind a sloped hatch, with the ammunition stowed behind him. The commander stands in the manually operated turret, traversing it at 3° per second.

The FT-17 burns 1.2 gallons of gasoline at routine usage. A full load of fuel and ammo costs $305.

Renault FT-17

Subassemblies: Very Small Tank chassis with Mild slope +2; full-rotation Medium Weapon turret [Body:T] +1; tracks +2.

Powertrain: 26-kW standard gasoline engine with 26-kW tracked transmission and 27-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 1 CS Body, 1 CS Both **Cargo:** 3.6 Body, 2 Turret

Armor	F	RL	B	T	U
Body:	5/120	4/60	4/60	4/30	4/25
Tracks:	4/30	4/30	4/30	4/30	4/30
Turret:	4/70	4/70	4/70	4/30	–

Weaponry

37mm Infantry Gun/SA-17 [Tur:F] (240 rounds).

Statistics

Size: 10'×4'×7' *Payload:* 0.5 tons *Lwt.:* 7.15 tons
Volume: 37 *Maint.:* 100 hours *Price:* $4,050

HT: 8. HPs: 800 Body, 270 each Track, 75 Turret.

gSpeed: 5 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 4
Ground Pressure Very Low. 4/5 Off-Road Speed.

Design Notes

Design HT was reduced to model the tank's historically very low reliability. As a result of the outdated transmission, the design gSpeed was reduced 73% to the historical figure.

The statistics represent the main production version with cast turret (sometimes called the FT-18) – early production turrets had riveted armor (DR 50 all-around; see p. 12).

The original *Char Mitrailleuse FT-17* mounted the 8mm Hotchkiss Mle 14 (Ground LMG with RoF 7; see p. W:RH38) with 4,800 rounds. Most French vehicles had been updated from 1931 on with the 7.5mm MAC Mle 31C (Ground LMG; see p. W:RH39).

Variants

China bought 36 vehicles from France in 1924 and more from Poland, armed with a cannon or 7.92mm Hotchkiss MG; many were captured by the Japanese.

Finland had acquired 34 FT-17s in 1919-1921; these remained in service until the Winter War, when they were used as stationary "fortifications" (see p. W:FH36). Fifteen were cannon-armed; 19 had a 7.62mm Maxim KK/32-33 (Ground LMG with RoF 16; see p. W:FH34). All but four were destroyed; the last were scrapped in 1943.

The Japanese had a few dozen cannon-armed FT-17s, which they called *79 Shiki Kogata Keisensha.* More were captured in China. They were in service from 1922-40.

In 1939, Poland still had 102 FT-17s (some locally made), 32 of these as armored draisines for use with armored trains (pp. 56-58). The 11.6-ton draisines consisted of a rail car powered by the tank, which could dismount – gSpeed 35 (on rails only). About 60 were cannon-armed; the rest mounted a 7.92mm Hotchkiss wz. 25 (Ground LMG with RoF 8).

Romania had acquired 45 cannon-armed FT-17s and 27 with a .303 Hotchkiss in 1919. The last were removed from service in 1945.

The Republican side in the Spanish Civil War received some Polish FT-17s, which were used in combat there.

Yugoslavia owned a total of 56 FT-17s, most of them bought from Poland in 1930 and armed with a cannon or 7.92mm Hotchkiss. Many were captured by the Germans and used as the PzKpfw 730(j) against partisans.

The Italian *Carro Armato L5/21* (FIAT Tipo 3000B) of 1921 was a slightly improved 5.9-ton copy with a more robust 44-kW engine improving gSpeed to 13. Initially, it was armed with twin 6.5mm FIAT-Revelli Mod 14s (Ground LMGs with RoF 8) with 4,000 rounds, but these were replaced in 1938 with twin 8mm Breda Mod 38s (also Ground LMGs; see p. W:GL27) with 5,760 rounds carried. The Italian tank saw service in Ethiopia, Libya, Albania, and Greece; the last of them fought in Sicily in 1943.

Though not technically the same tank, the Soviets closely copied the FT-17 to produce their *T-18 obrazets 1930g* (originally called the MS-1). Its upgraded weaponry included a 37mm PS-1 (37mm Infantry Gun) with 112 rounds and a coaxial 7.62mm DT (Ground LMG) with 1,449 rounds. The 6.4-ton tank had gSpeed 15. About 160 were still serviceable in 1939 when the Red Army joined the invasion of Poland.

Renault R-35 Tank

In May 1940, the French *Char Léger Renault Modèle 1935* (light tank Renault model 1935) was the most numerous tank on the Allied side, with 1,630 vehicles having been built. Some 945 were available in the front lines. Unfortunately, it was as unsuccessful as many other French armored vehicles. Designed as an infantry tank to replace the obsolete Renault FT-17 (p. 46) – together with the very similar Hotchkiss H-35 – it shared the FT-17's ineffective layout and puny gun. (The armament had only been selected for budgetary reasons, given that thousands of SA-18 guns were at hand from decommissioned FT-17s.) At least its thick armor was superior to anything the German side had to offer at that time – though far from impenetrable for the German antitank guns!

Several hundred were stationed in France's overseas possessions, notably in North Africa and Syria, where many of them were engaged in combat during the war.

Export customers included Poland (50), Romania (41), Turkey (100), and Yugoslavia (54); all had been delivered by early 1940. The Germans captured about 840 R-35s; some 100 were used as the PzKpfw 731(f) for garrison duty in France and on the Channel Islands, or for reconnaissance in Russia. Many more were converted to support roles. The Germans gave some of their war booty to Bulgaria (40) and Italy (124); the latter were employed in Sicily in 1943.

The commander sits in the turret, firing the 37mm Puteaux SA-18 gun and the coaxial 7.5mm MAC Mle 31C MG (see p. W:RH39). He manually rotates the turret at 2° per second.

The R-35 burns 2.8 gallons of gasoline per hour at routine usage. Fuel and ammo cost $235. Historical cost was 1.4 million francs ($37,000).

Renault R-35

Subassemblies: Very Small Tank chassis with Mild slope +2; full-rotation Large Weapon turret with Advanced slope [Body:T] +2; tracks +2.

Powertrain: 63-kW standard gasoline engine with 63-kW tracked transmission and 54-gallon self-sealing fuel tanks; 4,000-kWs batteries.

Occ: 1 CS Body, 1 CS Both **Cargo:** 1.1 Turret

Armor	F	RL	B	T	U
Body:	5/225	4/150	4/150	4/50	4/55
Tracks:	4/30	4/30	4/30	4/30	4/30
Turret:	5/210	5/195	5/195	4/40	–

Weaponry

37mm Infantry Gun/SA-18 [Tur:F] (58 rounds).*
Ground LMG/MAC Mle 35 [Tur:F] (2,400 rounds).*
* Linked.

Statistics

Size: 13'×6'×7' *Payload:* 0.55 tons *Lwt:* 11.7 tons
Volume: 42 *Maint:* 74 hours *Cost:* $7,265

HT: 12. HPs: 800 Body, 270 each Track, 120 Turret.

gSpeed: 12 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 4
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Designed gSpeed was halved to the historical figure.

Variants

The 12-ton *R-40* of 1940 was armed with a 37mm SA-38 (37mm Medium Tank Gun) with 65 rounds and 7.5mm MAC Mle 31C with 3,000 rounds. Body front armor was increased to DR 210, and underbody to DR 65. Some 80 were built.

Romania had acquired 41 R-35s in 1939. They were identical save for the MG: a Czechoslovakian 7.92mm ZB M36 (Ground LMG with selectable RoF 8* or 11*) was installed. In September 1939, 34 Polish army tanks were integrated after their crews' escape from Poland.

In 1944, 30 Romanian tanks were refitted with a Soviet 45mm 20K (50mm Medium Tank Gun) with 35 rounds, receiving the designation *Vânãtorul de Care R-35* (R-35 tank destroyer). The gun was mounted in a forward extension of the turret that contained the recoil gear, but even so the turret could no longer accept the coaxial MG. Plans were to eventually transform all their R-35s, but the Soviet invasion prevented that.

The Germans employed many converted R-35s to replace wheeled vehicles in the appalling conditions of the Russian winter. These lacked the turret. The *Panzerjäger 35(f)* of 1941 carried a Czech 47mm Skoda PaK 36(t) (50mm Medium Tank Gun); at least 200 were converted. The *10.5cm leFH 18 (Sf) auf Gw 35(f)* of 1943 mounted a 105mm leFH 18/1 (105mm Short Howitzer), while the *8cm GrW 34 (Sf) auf Gw 35(f)* mounted a 81mm GrW 34 (81mm Vehicle Mortar; see p. W97).

Fortress Turrets

As tanks became obsolete, the Germans used many of their chassis to mechanize their artillery, antitank guns, etc. The turrets were salvaged for the bunker compounds that lined their *Festung Europa* (Fortress Europe).

The Germans created a small standardized bunker to mount old turrets: the *Ringstand für Panzerkampfwagen-Türme* (ring mount for AFV turrets), introduced on the Atlantic Wall in 1943. Variants fitted turrets of the FT-17 (p. 46), R-35, PzKpfw 38(t) (p. 48), PzKpfw I (p. W:IC77), PzKpfw II (p. W:IC78), PzKpfw III (p. W:IC79), M15/42 (p. W:GL32), T-34 (p. W105), etc.

The *Regelbau 687* (regulated construction type 687) – used mainly in the Gothic Line, West Wall, and defenses of Berlin and Cologne – was standardized to either mount an old Panther turret (p. W:IC81), or more usually, a new one with a simplified commander's hatch and DR 130 roof reinforced against artillery hits. The bunker itself was of 8×8-yard reinforced-concrete construction, with sheltered entrance, resting room with heater, ammo room, and fighting room with the turret and a 6.5-kW generator to power the turret's traverse. It was crewed by three men. The R 687 had a 4.7' roof (giving DR 1,300) as well as 6.7' walls (DR 1,800). Usually it was buried so that only the (camouflaged) roof showed.

Panzerkampfwagen 38(t)

In 1938, the Czech army adopted the *Lehky Tank vzor 38* (light tank model 1938) to supersede the earlier LT vz. 35. Some 150 were ordered from Ceskomoravská Kolben & Danek (CKD) of Prague. When the Germans annexed the country, the factory line was running, but only one had been delivered. All 150 in production were confiscated for use as the *Panzerkampfwagen 38 (tschechisch) SdKfz 140 Ausf A* and the plants kept running under German supervision.

The Panzer 38(t) became one of the mainstays of the Panzertruppe; robust and reliable, it was clearly superior to the German light tanks, and was employed where too few Panzer IIIs (see p. W:IC79) were available. It was used during the invasion of Poland and France, notably with Rommel's *Gespensterdivision*, and in large numbers in Russia.

By 1942, they were obsolete when faced with top-notch Soviet tanks, and removed from front-line service, the majority being converted to self-propelled artillery. A few hundred were used by garrison troops all over Europe. Production of the complete tank continued until 1942. The chassis remained in production through March 1945, serving as the basis for the Jagdpanzer 38(t) Hetzer (see p. W:IC83).

Numbers were supplied to other Axis forces, including Bulgaria (10), Hungary (102), Romania (50), and Slovakia (90 – some were used in the Slovak uprising in August 1944).

The Panzer 38(t) features riveted armor (p. 12). It is armed with a 37.2mm Skoda KwK 38(t) cannon and a 7.92mm ZB MG 37(t) (RoF 8* or 11*, p. W:IC64) in its own ball mount; another MG is mounted in the hull front. The turret manually rotates at 3° per second.

The Panzer 38(t) burns 4.2 gallons of gasoline per hour at routine usage. Fuel and ammo cost $285.

PzKpfw 38(t) Ausf A

Subassemblies: Small Tank chassis +3; full-rotation Small AFV turret [Body:T] +2; tracks +2.

Powertrain: 93-kW standard gasoline engine with 93-kW tracked transmission and 58-gallon standard fuel tanks; 12,000-kWs batteries.

Occ: 2 CS Body, 2 CS Tur Cargo: 3.4 Body, 1.6 Tur

Armor	F	RL	B	T	U
Body:	4/95	4/60	4/60	4/30	4/30
Tracks:	4/35	4/35	4/35	4/35	4/35
Turret:	4/80	4/50	4/50	4/35	–

Weaponry

Ground LMG/MG 37(t) [Body:F] (1,200 rounds).
37mm Medium Tank Gun/KwK 38(t) [Tur:F] (90 rounds).
Ground LMG/MG 37(t) [Tur:F] (1,350 rounds).

Equipment

Body: Medium radio receiver and transmitter.

Statistics

Size: 15'×7'×8' *Payload:* 0.8 tons *Lwt:* 10.3 tons
Volume: 63 *Maint.:* 77 hours *Cost:* $6,755

HT: 12. HPs: 1,000 Body, 400 each Track, 150 Turret.

gSpeed: 25 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Very Low. 4/5 Off-Road Speed.

Design Notes

Design gSpeed was lowered 17% to the historical. HT was capped at 10 to better represent the tank's field record for being reliable, but not exceptionally so.

Variants

There were several minor variants through the early way years. The first one to differ notably was the Ausf E of 1940, which had increased frontal armor (DR 190 on turret and body). The 10.8-ton Ausf G of 1941 had DR 190 on the turret and body front, DR 95 on the turret and body sides, and DR 70 on the turret back.

The 11.8-ton *Panzerjäger 38(t) SdKfz 139 Marder III* of 1942 was a tank destroyer. It replaced the turret with a rather high open superstructure, mounting the 76.2mm PaK 36(r) (75mm Long Tank Gun) – a rechambered gun captured from the Soviets – with 30 rounds. Only the superstructure front (DR 50) and sides (DR 30) were armored. The hull MG was retained with 1,200 rounds; some 363 were built and deployed in North Africa and Russia.

The *Panzerjäger 38(t) SdKfz 138 Ausf M Marder III* of 1943 was a substantial redesign. The 11.6-ton vehicle had a 112-kW engine in the center and a sloped body front (PD 5, DR 115). The superstructure – moved to the rear for better balance – had a lower silhouette and was armored except for the top (DR 80 front, DR 30 sides, DR 30 back). It carried 27 rounds for the 75mm PaK 40/3 (75mm Long Tank Gun) and lacked the hull MG; a loose 7.92mm MG 34 (see p. W97) with 600 rounds was carried. Some 975 were built.

The 12.7-ton *15cm sIG 33 (Sf) auf PzKpfw 38(t) SdKf 138/1 Ausf M Grille* of 1943 was a self-propelled gun mounted on the Ausf M chassis with the central 112-kW engine. It had gSpeed 22. The *Grille* (cricket) had an open superstructure (DR 80 front) armed with a 149mm sIG 33 (150mm Very Short Infantry Gun) with 15 rounds. Some 370 were built.

The *Flakpanzer 38(t) SdKfz 140 Ausf L* of 1943 mounted a 20mm FlaK 38 (20mm Long Ground AC) with 1,040 rounds in an open superstructure (DR 30 all around). It weighed 10.8 tons and had a crew of four. Some 141 were built.

Sweden built a 11.6-ton copy as the *Stridsvagn m/41SI*, the first of 116 being delivered in December 1942. It had a 106-kW engine and 50-gallon tank with gSpeed 27. It was armed with a 37mm Bofors Kan m/38 (37mm Medium Tank Gun) with 100 rounds and two 8mm Carl Gustav-Browning Ksp m/39s (Ground LMGs) with 4,000 rounds.

Switzerland received 24 *Panzerwagen 39s* based on the vz. 38 in late 1939. These weighed 8.5 tons each with a gSpeed of 27. Half of them had the engine replaced with an 81-kW diesel. All had increased armor (DR 105 on turret and body front) and were armed with a 24mm W+F-Furrer PzwKan 38 (25mm Long Tank Gun) with 114 rounds, two 7.5mm W+F PzwMg 38s (Ground LMGs with RoF 20) with 2,500 rounds, and a 7.5mm W+F-Furrer lMg 25 (Ground LMG with RoF 8*) with 300 rounds on top of the turret.

Panzerkampfwagen II Variant: Flamingo

In 1939, the German army introduced a flamethrowing tank for assaults on fortifications. This special version of the PzKpfw II Ausf D (see p. W:IC78) differed from the basic tank in the smaller turret, which mounted only a MG, and the two remote-controlled *Flammspritzköpfe* – small "heads," each with a flamethrower muzzle – on the body front corners. The fuel was carried in the body, but the compressed nitrogen was stored in armored containers on the sides above the tracks.

The *PzKpfw II (Flamm) SdKfz 122* – "Flamingo" to the troops – was produced from 1939-41, a total of 112 being made in two minor versions. It was first used in 1941 Russia for infantry close support, but the thin armor and highly volatile fuel led to many casualties. Most of the remainder were converted to antitank gun carriers in 1942.

The commander in the turret operates the MG 34 *and* the flamethrowers. The driver and radio operator sit in the body.

The Flamingo burns 4.7 gallons of gasoline per hour at routine usage. Fuel and ammo cost $175.

PzKpfw II Flamingo Ausf A

Subassemblies: Small Tank chassis +3; two limited-rotation Mini turrets 1-2 [Body:T] +0; full-rotation Medium Weapon turret 3 [Body:T] +1; 2 Mini pods 1-2 [Body:L,R]; tracks +2.

Powertrain: 105-kW gas engine with 105-kW tracked transmission and 45-gallon standard tanks; 8,000-kWs batteries.

Occ: 2 CS Body, 1 CS Body/Tur 3 Cargo: 2.1 Body

Armor	F	RL	B	T	U
Body:	4/115	4/60	4/60	4/40	4/20
Tracks:	4/35	4/35	4/35	4/35	4/35
Turs 1-2:	4/80	4/80	4/80	4/40	–
Tur 3:	4/115	4/80	4/80	4/40	–
Pods 1-2:	4/50	4/50*	4/50	4/40	*

* The side toward the body and the underside are unarmored.

Weaponry

2×Medium Vehicle Flamethrower [Tur 1-2:F] (20 shots each).
Ground LMG/MG 34 [Tur 3:F] (1,800 rounds).

Equipment

Body: Fire extinguisher; medium radio receiver and transmitter.

Statistics

Size: 16'×7'×6' *Payload:* 0.9 tons *Lwt:* 12 tons
Volume: 57 *Maint.:* 66 hours *Cost:* $9,055

HT: 10. HPs: 1,000 Body, 400 each Track, 30 each Turret 1-2, 75 Turret 3, 30 each Pod.

gSpeed: 34 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Design gSpeed was raised 15% to the historical. HT was capped at 10 to better represent the tank's field record.

Panzerkampfwagen IV Variant: Brummbär

A replacement for the Sturm-Infanteriegeschütz 33 (see p. W:IC77), the *Sturmpanzer IV SdKfz 166 Brummbär* (the "crosspatch" or "grumbling bear," often improperly translated as "grizzly bear") was based on the chassis of the PzKpfw IV (see p. W103).

The Brummbär and its massive main weapon proved highly useful against fortifications and dug-in infantry. Some 60 vehicles debuted in May 1943. The version described below was the main production block, with 166 vehicles built between mid-1944 and the end of the war. Overall, 306 were built from scratch or converted from existing Panzer IVs.

The most unusual feature was placing the 149mm Skoda StuH 43/1 howitzer in a large ball mount, rather than a more conventional mantlet arrangement.

The driver and radio operator/hull gunner sit in the body; the commander, gunner, and loader sit half in the body, half in the superstructure. The Brummbär burns 10.1 gallons of gasoline per hour at routine usage. Fuel and ammo cost $1,780.

Sturmpanzer IV Brummbär

Subassemblies: Medium Tank chassis +4; Medium TD superstructure with Mild slope [Body:T] +3: full-rotation Mini open mount [Sup:T] +0; tracks +3.

Powertrain: 224-kW gas engine with 224-kW tracked transmission and 124-gallon standard tanks [Body]; 16,000-kWs batteries.

Occ: 2 CS Body, 3 CS Both Cargo: 9.3 Body, 6.3 Sup

Armor	F	RL	B	T	U
Body:	4/310	4/135S	4/80	4/40	4/40
Tracks:	4/40	4/40	4/40	4/40	4/40
Sup:	5/480	4/160	4/100	4/60	–

Standoff armor on body sides protects tracks 50% of time.

Weaponry

150mm Infantry Gun/StuH 43/1 [Sup:F] (38 rounds).
Ground LMG/MG 34 [Sup:F] (600 rounds).
92mm Vehicle Mortar/NvW [Sup:T] (20 rounds).
Ground LMG/MG 34 [OM:F] (600 rounds).

Equipment

Body: Fire extinguisher; medium radio receiver and transmitter; Zimmerit. *Sup:* Zimmerit.

Statistics

Size: 19'×10'×8' *Payload:* 3 tons *Lwt.:* 31.1 tons
Volume: 139 *Maint.:* 34 hours *Price:* $33,750

HT: 10. HPs: 1,500 Body, 360 Sup, 540 each Track, 30 OM.

gSpeed: 24 *gAccel:* 3 *gDecel*: 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Low. 1/2 Off-Road Speed.

Design Notes

Design gSpeed was reduced 11% to the historical figure. As is common with tank and AFV designs, expensive armor was used for the superstructure (or the turret on tanks).

Panzer IV Variants: Wirbelwind and Kugelblitz

Early on, the German combined-arms doctrine suggested that it would be prudent to include self-propelled antiaircraft artillery, to allow them to advance with the main assault forces. The Wehrmacht's first dedicated AA vehicle was the Stoewer Kfz 4 of 1936, a 0.5-ton truck with twin 7.92mm MG 34s in the bed. Larger trucks and halftracks mounting cannon up to 37mm were soon introduced.

In order to properly accompany panzer units, the AA carriers needed armor protection, as well. Simple makeshifts such as 20mm guns mounted on turretless PzKpfw I (see p. W:IC77) or PzKpfw 38(t) chassis (p. 48) were finally replaced by dedicated designs from late 1943. Most were based on the PzKpfw IV (see p. W103). Plans to mount AA guns as large as 88mm on the Panther (see p. W:IC81) chassis were never realized.

Flakpanzer IV (2cm) Wirbelwind

The *Flakpanzer IV (2cm) SdKfz 161/4 Wirbelwind* (whirlwind) was the most successful German self-propelled armored AA artillery. It was based on a converted PzKpfw IV Ausf H or J, with the turret replaced by a new one mounting four 20mm Mauser FlaK 38 autocannons. Some 105 were built and issued from August 1944, batteries of three or four being assigned to AA platoons of selected panzer regiments.

The turret accommodates the gunner and two loaders. It is hydraulically powered and rotates at 60° per second, or 4° per second if manually turned by the gunner and one of the loaders. Each cannon feeds from a 20-round magazine; both SAPHE and AP rounds are stowed. The Wirbelwind burns 10.1 gallons of gasoline. Fuel and ammo cost $745.

Subassemblies: Medium Tank chassis +3; full-rotation Medium AFV turret [Body:T] +2; tracks +3.
Powertrain: 224-kW gas engine with 224-kW tracked transmission, 124-gallon standard tanks; 20,000-kWs batteries.
Occ: 2 CS Body, 3 CS Tur **Cargo:** 5 Body, 3.3 Tur

Armor	F	RL	B	T	U
Body:	4/315	4/115	4/80	4/40	4/40
Tracks:	4/40	4/40	4/40	4/40	4/40
Turret:	4/50	4/50	4/50	0/0	–

Weaponry

Ground LMG/MG 34 [Body:F] (1,350 rounds).
4×20mm Long Ground ACs/FlaK 38s [Tur:F] (800 each).*
* Linked in pairs; additional link fires all four.

Equipment

Body: Fire extinguisher; medium radio receiver and transmitter; 6-kW traversing gear; Zimmerit. *Turret:* Universal mount.

Statistics

Size: 20'×9'×8' *Payload:* 1.8 tons *Lwt.:* 24.2 tons
Volume: 108 *Maint.:* 45 hours *Price:* $19,505

HT: 11. HPs: 1,500 Body, 540 each Track, 200 Turret.

gSpeed: 24 *gAccel:* 2 *gDecel*: 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Loaded weight was increased 22% and design gSpeed decreased 20% to the historical figures.

Variants

The *Flakpanzer IV (3.7cm) SdKfz 161/4 Ostwind* (east wind) of early 1944 was very similar, but it mounted a single 37mm Rheinmetall FlaK 43/1 (37mm Long Ground Autocannon) with 416 rounds. The turret's armor was slightly improved to DR 80. The 27.5-ton AA vehicle had a crew of seven. Some 40-45 were built.

Flakpanzer IV (3cm) Kugelblitz

The *Flakpanzer IV (3cm) SdKfz 161/5 Kugelblitz* (ball lightning) was ready in January 1945, but the factory in western Germany was captured before it could see any combat; only a handful were made.

It mounted a fully armored turret with twin 30mm Rheinmetall FlaK 103/38s with 200 belted ready-use rounds each. The ball-shaped turret was an interesting design, with both powered traverse and elevation (23° per second, controlled by two gunlayers). It was too complex for this late stage of the war, as well as too heavy for the chassis.

The Kugelblitz burns 10.1 gallons of gasoline per hour of routine usage. Fuel and ammo cost $835.

Subassemblies: Medium Tank chassis +3; full-rotation Large AFV turret [Body:T] +3; tracks +3.
Powertrain: 224-kW standard gas engine with 224-kW tracked transmission and 124-gallon standard fuel tanks; 20,000-kWs batteries.
Occ: 2 CS Body, 3 CS Tur **Cargo:** 6.3 Body, 3.7 Tur

Armor	F	RL	B	T	U
Body:	4/315	4/115	4/80	4/40	4/40
Tracks:	4/40	4/40	4/40	4/40	4/40
Turret:	4/80	4/60	4/60	4/30	–

Weaponry

Ground LMG/MG 34 [Body:F] (1,200 rounds).
2×30mm Long Gr. ACs/FlaK 103/38s [Tur:F] (600 each).*
* Linked.

Equipment

Body: Fire extinguisher; medium radio receiver and transmitter. *Turret:* 3.5-kW traversing gear; universal mount.

Statistics

Size: 20'×9'×8' *Payload:* 2 tons *Lwt.:* 27.5 tons
Volume: 113 *Maint.:* 48 hours *Price:* $17,765

HT: 11. HPs: 1,500 Body, 540 each Track, 225 Turret.

gSpeed: 24 *gAccel:* 2 *gDecel*: 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Loaded weight was increased 27% and design gSpeed was decreased 15% to the historical values.

Geschützwagen III/IV Variants: Hornisse and Hummel

The *Geschützwagen III/IV* (gun carriage) was created to provide a common chassis for a series of self-propelled artillery vehicles. It used the hull and suspension of the PzKpfw IV Ausf F (see p. W103) and the transmission and other automotive components of the PzKpfw III Ausf J (see p. W:IC79); the engine was the same on both. Armor was thinner than on the tanks, and the engine was moved from the rear to the center of the vehicle, making room for the gun, crew, and ammo.

8.8cm PaK 43/1 (Sf) Hornisse

The *8.8cm Panzerabwehrkanone 43/1 auf Gw III/IV SdKfz 164 Hornisse* (hornet) was a self-propelled antitank gun fitted with the 88mm Krupp PaK 43/1, one of the most effective cannons of the war. It entered service in late 1942; 494 were made right until the end of the war. In February 1944, Hitler officially renamed it the *Nashorn* (rhinoceros), as the insect's name seemed not evocative enough.

While it carried a highly effective gun, it was difficult to conceal because of its height – an important liability for a tank destroyer – and therefore mainly used for long-range shots. It's worth noting that its big gun and thin armor would make the vehicle a priority target for knowledgeable opponents.

It was gradually but never completely replaced in service by the much more streamlined Jagdpanther (p. 52). Aside of the main gun, there was a loose 7.92mm MG 34 (see p. W97) with 600 rounds for local protection.

The Hornisse burns 10.1 gallons of gasoline per hour of routine usage. Fuel and ammo cost $2,020.

Subassemblies: Medium Tank chassis +3; Small TD superstructure with Mild slope [Body:T] +3; tracks +3.

Powertrain: 224-kW standard gas engine with 224-kW tracked transmission and 124-gallon standard fuel tanks; 8,000-kWs batteries.

Occ: 2 CS Body, 3 CS Both Cargo: 1.5 Body, 3.5 Sup

Armor	F	RL	B	T	U
Body:	4/115	4/80	4/80	4/40	4/40
Tracks:	4/40	4/40	4/40	4/40	4/40
Sup:	5/45	4/30	4/30	0/0	–

Weaponry

88mm Long Tank Gun/PaK 43/1 [Sup:F] (40 rounds).

Equipment

Body: Fire extinguisher; medium radio and transmitter.

Statistics

Size: 28'×10'×10' *Payload:* 3.3 tons *Lwt.:* 26.4 tons
Volume: 123 *Maint.:* 44 hours *Price:* $20,550

HT: 11. HPs: 1,500 Body, 540 each Track, 285 Sup.

gSpeed: 26 *gAccel:* 2 *gDecel*: 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Loaded weight was increased 16% and design gSpeed was decreased 10% to the historical figures.

15cm PzFH 18/1 Hummel

The *15cm Panzerfeldhaubitze 18/1 auf Gw III/IV SdKfz 165 Hummel* (bumblebee) was used as heavy artillery by panzer and panzergrenadier divisions from 1942. In February 1944, the name "Hummel" was dropped because it did not sound very martial. Some 714 were built.

They all carried a 149mm Rheinmetall sFH 18/1 howitzer, and a loose 7.92mm MG 34 with 600 rounds was also aboard.

Each panzer division had a single battery of six Hummels, later increased to two batteries. The vehicle saw its first real action at Kursk (see p. W27), where its mobility allowed many to escape being overrun by the Soviets.

The Hummel burns 10.1 gallons of gasoline per hour of routine usage. Fuel and ammo cost $920.

Subassemblies: Medium Tank chassis +3; Small TD superstructure with Mild slope [Body:T] +3; tracks +3.

Powertrain: 224-kW standard gas engine with 224-kW tracked transmission and 124-gallon standard fuel tanks; 8,000-kWs batteries.

Occ: 2 CS Body, 4 CS Both Cargo: 0

Armor	F	RL	B	T	U
Body:	4/115	4/80	4/80	4/40	4/40
Tracks:	4/40	4/40	4/40	4/40	4/40
Sup:	5/150	4/30	4/30	0/0	–

Weaponry

150mm Short Howitzer/sFH 18/1 [Sup:F] (18 rounds).

Equipment

Body: Fire extinguisher; medium radio and transmitter.

Statistics

Size: 24'×10'×9' *Payload:* 2 tons *Lwt.:* 25.8 tons
Volume: 123 *Maint.:* 42 hours *Price:* $22,870

HT: 11. HPs: 1,500 Body, 540 each Track, 285 Sup.

gSpeed: 26 *gAccel:* 2 *gDecel*: 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Loaded weight was increased 19% and design gSpeed decreased 10% to the historical values.

The design actually lacks 1 VSP of capacity; this is assumed to be taken from the access space inherent in the gun team's crew stations, making them a bit cramped.

Variants

The *Munitionsträger Hummel* (ammo carrier) was the same vehicle without the gun and its crew, allowing 40 rounds of ammo to be carried under armor protection. One was issued to each battery. Some 157 were built.

Panther Variants: Jagdpanther and Bergepanther

The chassis of the PzKpfw V Panther (see p. W:IC81) was used as the basis for a few other armored vehicles, though these modifications were not nearly as widespread as with earlier panzer chassis. The more important include:

SdKfz 173 Jagdpanther

In 1943, design began on a tank destroyer based on Panther components and carrying the 88mm Krupp PaK 43/3 gun, a massive weapon that was one of the most effective tank killers of the war. The resulting Panzerjäger V *Jagdpanther* (hunting panther) debuted in 1944.

Extensive sloping ensured that it was well protected, even though the armor plates were only moderately thick. It combined a low silhouette, hard-hitting gun, and good mobility, resulting in a superb fighting machine that could destroy any Allied contemporary. It was never available in sufficient numbers, however, with only 384 being completed until April 1945. It was deployed in platoons of four, usually in mixed units with the Jagdpanzer IV (see p. W:IC80).

The crew included the German's usual complement of driver, hull gunner/radio operator, main gunner, loader, and commander. The Jagdpanther burns 23.5 gallons of gasoline per hour at routine usage. Fuel and ammo cost $3,040.

Subassemblies: Immense Tank chassis with Medium slope +4; Large TD superstructure with Advanced slope [Body:T] +4; tracks +4.

Powertrain: 522-kW standard gas engine with 522-kW tracked transmission and 190-gallon light fuel tanks; 12,000-kWs batteries.

Occ: 2 CS Body, 3 CS Both **Cargo:** 22.7 Body, 8.4 Sup

Armor	F	RL	B	T	U
Body:	6/540	4/190S	4/160	4/60	4/120
Tracks:	4/55	4/55	4/55	4/55	4/55
Sup:	6/620	5/285	5/225	4/60	–

Standoff armor on both sides protects tracks 50% of time.

Weaponry

Ground LMG/MG 34 [Body:F] (600 rounds).
88mm Long Tank Gun/PaK 43/3 [Sup:F] (57 rounds).
92mm Vehicle Mortar/NvW [Sup:T] (20 rounds).

Equipment

Body: Fire extinguisher; medium radio receiver and transmitter; Zimmerit. *Sup:* Zimmerit.

Statistics

Size: 32'×11'×9' *Payload:* 2.6 tons *Lwt:* 50 tons
Volume: 267 *Maint.:* 27 *Cost:* $55,865

HT: 10. HPs: 2,600 Body, 900 each Track, 450 Sup.

gSpeed: 34 *gAccel:* 3 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Loaded weight was decreased 11% and design gSpeed increased 7% to the historical values.

SdKfz 179 Ausf A Bergepanther

The weight and mechanical unreliability of the Panther (and Tiger) made a dedicated recovery vehicle necessary; an immobilized Panther needed at least *three* 19.8-ton SdKfz 9 halftracks to recover it, and they could not work under fire.

The Panzerbergewagen V *Bergepanther* (recovery Panther) consisted of a Panther sans turret. A 44-ton winch with 155-yard cable was installed in the fighting compartment and a massive spade at the rear was used as counterweight and to dig in the vehicle. A 2.2-ton lifting crane was added to allow the removal of engines or similar work. The superstructure over the winch could stow 3.3 tons of cargo, usually a spare engine.

Some 348 were built from mid-1943, but 46 were delivered without the expensive winch and other equipment.

The cannon is above the driving compartment. Pintles to each side can mount MGs, but usually are empty. Crew includes driver, commander/gunner, and winch operator. The vehicle burns 23.5 gallons of gasoline per hour. Fuel and ammo cost $85.

Subassemblies: Immense Tank chassis with Medium slope +4; Medium AFV superstructure [Body:T] +2; limited-rotation Mini open mount 1 [Body:T] +0; limited-rotation Small AFV open mount 2 [Body:T] +2; tracks +4.

Powertrain: 522-kW standard gas engine with 522-kW tracked transmission and 284-gallon standard fuel tanks; 12,000-kWs batteries.

Occ: 3 CS Body **Cargo:** 20 Sup

Armor	F	RL	B	T	U
Body:	6/540	4/190S	4/160	4/60	4/120
Tracks:	4/55	4/55	4/55	4/55	4/55
Sup:	3/5W	3/5W	3/5W	0/0	–
OM 1:	4/25	0/0	0/0	0/0	–
OM 2:	0/0	0/0	0/0	0/0	–

Standoff armor on both sides protects tracks 50% of time.

Weaponry

20mm Long Gr. AC/20mm Mauser KwK 38 [OM 1:F] (180).

Equipment

Body: Bulldozer blade [B]; fire extinguisher; medium radio receiver and transmitter; 44-ton winch. *Sup:* 20-VSP cargo hold. *OM 1:* Universal mount. *OM 2:* 2.2-ton crane.

Statistics

Size: 29'×11'×9' *Payload:* 4.5 tons *Lwt:* 47.3 tons
Volume: 228 *Maint.:* 36 hours *Cost:* $31,585

HT: 10. HP: 2,600 Body, 900 each Track, 200 Sup, 30 OM 1, 120 OM 2.

gSpeed: 34 *gAccel:* 3 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

The spade was treated as a bulldozer blade. The winch uses 18 modules rather than 17.6; this helps cover the extra cable. The crane uses two modules rather than 2.2 as it was a lightweight boom. Crew access space was trimmed by 0.9 VSPs.

Panzerkampfwagen Panther II

In 1942, the Germans started thinking of a more powerful version of the basic Panther (see p. W:IC81), then not even yet in service. It was called the Panther II, similar to its intended partner, the Tiger II (see p. W:IC82). While less heavily armored than the Tiger II, it was to have the same gun and improved mobility in a more compact package, essentially embodying the main battle tank of post-war years. Aside of the gun, it was to share as many components with the Tiger as possible, in order to reduce the strain on both production and spare supply lines. It was expected to enter production in early 1945.

The Panther II used a modified Panther hull, with improved protection, some minor simplifications and improvements, and some redesign to accept Tiger II subassemblies. Common components included the tracks, transmission, wheels, and sprockets. A new, more powerful engine was fitted.

The turret was based on the design developed for the Panther I Ausf F, the so-called *Schmalturm* (narrow turret). This was of improved layout, with better protection, new armament, and, notably, a stereoscopic rangefinder. The latter was especially useful, because the main gun outranged practically all of the Allied weapons and the rangefinder allowed the gunner to take even more advantage of this, destroying Allied vehicles at ranges where the Panther II itself couldn't be harmed, at over 2,000 yards and up.

The turret mounts an 88mm Krupp KwK 43/1, which is based on the armament of the Tiger II and fires the same ammunition. A 7.92mm Rheinmetall MG 42 (see p. W97) is installed coaxially, and another can be mounted at the commander's hatch for AA fire. The turret is traversed hydraulically at 7° per second. The hull gunner's customary MG has been replaced by a cheaper and less bulky Haenel StG 44 assault rifle (see p. W95), partly because designing a ball mount for the MG 42 was too expensive and the MG 34 was out of production, and partly because the effective range of the rifle was considered satisfactory. Two more StG 44 rifles with curved barrels for close defense through the gun ports in the turret sides and rear (p. 14) are provided for the crew. There are two 0.6-VSP boxes at the body rear for personal gear.

The Panther II burns 25.2 gallons of gasoline per hour at routine usage. Fuel and ammo cost $3,570.

SdKfz 174 Panther II

Subassemblies: Sealed Immense Tank chassis with Medium slope +4; sealed full-rotation Medium TD turret with Advanced slope [Body:T] +3; full-rotation Mini open mount [Tur:T] +0; tracks +4.

Powertrain: 560-kW turbocharged gas engine with 560-kW tracked transmission and 193-gallon standard fuel tanks; 16,000-kWs batteries.

Occ: 2 CS Body, 3 CS Both **Cargo:** 0

Armor	F	RL	B	T	U
Body:	6/770	4/205S	4/160	4/115	4/120
Tracks:	4/55	4/55	4/55	4/55	4/55
Turret:	5/690	5/345	5/345	4/115	–
OM:	0/0	0/0	0/0	0/0	–

Standoff armor on both sides protects tracks 50% of time.

Weaponry

Assault Rifle/StG 44 [Body:F] (600 rounds).
88mm Long Tank Gun/KwK 43/1 [Tur:F] (70 rounds).*
Ground LMG/MG 42 [Tur:F] (4,050 rounds).*
92mm Vehicle Mortar/NvW [Tur:T] (20 rounds).
Ground LMG/MG 42 [OM:F] (150 rounds).
* Linked.

Equipment

Body: Fire extinguisher; NBC kit; medium radio receiver and transmitter. *Turret:* Stabilizer for turret guns; 4.5-kW traversing gear. *OM:* IR searchlight; universal mount.

Statistics

Size: 22'×11'×9' *Payload:* 3 tons *Lwt:* 55 tons
Volume: 243 *Maint.:* 19 hours *Cost:* $114,000

HT: 10. HPs: 2,600 Body, 900 each Track, 360 Turret, 30 OM.

gSpeed: 38 *gAccel:* 3 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

The body was a bit too small for all the stuff crammed into it; the missing 2 VSPs make all crew stations more cramped by using part of their access space to make up the difference.

Expensive armor is used on both the turret (which is pretty common on armor designs) and the body (which isn't). This was necessary to stay in line with the very limited weight increase expected – however realistic those expectations may have been – but makes the tank unreasonably expensive.

Since the design of the real vehicle was never finalized, and apparently only one incomplete hull was ever built, the Panther II is best suited for an alternative mid- or late-1945 war (though it remains a far more sane "what if" vehicle than the Maus, p. 55).

The write-up represents a somewhat idealized design, based upon the prototype hull, the evolving Panther I Ausf F, the requirements, development plans, and various trials. It is part technological avant-garde, part wishful thinking on the part of the German tankers. For example, a company called Dräger – still in business today – developed an NBC kit (then called a "protective air conditioner") which was installed in a Panther I Ausf G in 1944. Barring some very different historical developments, it is unlikely the German army would have had the resources, or perhaps more importantly, the requirement to introduce such a device in any numbers. The high command never decided which engine that the tank was to receive, a whole series of designs having been slated for trial. It is also unclear whether the tank could really have worked with the powerful gun, which was to lack the muzzle brake it featured on the (heavier) Tiger II.

Both the Panther I Ausf F and the Panther II were to receive infrared equipment and an additional battery to help power it, but whether the gear would actually have seen widespread service is rather speculative. Finally, note that the *Sonderkraftfahrzeug*, or model number, was never assigned; the one given follows the historical pattern, however.

Tiger Variant: Sturmtiger

After Stalingrad (see p. W26), the Germans realized that a vehicle with a weapon even larger than the 149mm sIG 33 was needed for street fighting. Originally, it was planned to mount a 210mm howitzer in a vehicle similar to the Brummbär (p. 49) which was then under development, but using the hull of the Tiger I Ausf E (see p. W104). The armament was eventually changed to the 380mm Rheinmetall RW 61, a gun/launcher originally designed for coastal defense, lobbing a rocket-propelled depth charge over several miles. A single round was able to demolish entire buildings or – as was demonstrated in one engagement – could take out several Sherman tanks at once!

It was designated the *Sturmmörser Tiger* (Tiger assault mortar), but has been commonly referred to post-war as the Sturmtiger. Production did not start until August 1944 and when it ended in December 1944, a mere 18 had been converted from existing battle-weary Tiger Is. While they proved to be excellent defensive weapons, they were unreliable and many were abandoned, broken down in the field. The small number built had no impact on the war.

The commander/loader is stationed in the superstructure, along with the gunner and a second loader. The driver and radio operator/bow machine gunner sit in the body. A small crane is located behind the superstructure to aid in resupplying the Sturmtiger with its massive ammunition.

The Sturmtiger burns 23.5 gallons of gas per hour at routine usage. Fuel and ammo cost $8,325.

Sturmmörser Tiger

Subassemblies: Very Large Tank chassis with Mild slope +4; Large TD superstructure with Mild slope [Body:T] +4; tracks +3.

Powertrain: 522-kW standard gas engine with 522-kW tracked transmission and 141-gallon standard fuel tanks; 12,000-kWs batteries.

Occ: 2 CS Body, 3 CS Both Cargo: 10.7 Body

Armor	F	RL	B	T	U
Body:	5/720	4/270	4/310	4/100	4/100
Tracks:	4/50	4/50	4/50	4/50	4/50
Sup:	5/870	4/310	4/310	4/150	–

Weaponry

380mm Rocket Launcher/RW 61 [Sup:F] (14 rounds).
92mm Vehicle Mortar/NvW [Sup:T] (20 rounds).
Ground LMG/MG 34 [Body:F] (600 rounds).

Equipment

Body: Fire extinguisher; medium radio receiver and transmitter. *Sup:* 1-ton crane.

Statistics

Size: 21'×12'×9' *Payload:* 6.9 tons *Lwt.:* 71.1 tons
Volume: 180 *Maint.:* 24 hours *Price:* $70,115

HT: 8. HPs: 2,300 Body, 800 each Track, 450 Sup, 120 OM.

gSpeed: 28 *gAccel:* 2 *gDecel*: 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure High. 1/3 Off-Road Speed.

Design Notes

Although the 380mm rocket launcher has a theoretical RoF 1/13, the Sturmtiger typically fired its main gun only around once every 10 minutes.

Equipment Stowage

Many are the hours spent by a vehicle's crew in devising the most efficacious way of arranging its possessions so that everything required for effective and comfortable campaigning can be stowed aboard – equipment, it may be added, that has been known to include dogs, rabbits and even chickens to provide the breakfast egg!

– Encyclopedia of Armored Cars and Half-tracks

Along with the crew's personal gear (sidearms, canteens, gas masks, bed rolls, clothing, etc.), any cargo, and any vehicular weapons and their ammunition, a military vehicle typically came with a large assortment of equipment considered part of its accessories. Brackets and cabinets, both inside and out, held spare periscope prisms and light bulbs, camouflage netting and tarpaulins, spare tires or track links, maintenance and pioneer tools – as well as water cans, flashlights, small arms, rations, shovels and picks, etc.

The regulation stowage scheme for a Tiger I Ausf E (see p. W104) is described in detail here as an example. Very similar equipment was carried by all German armored vehicles, and fairly similar gear was used on armored vehicles of other nations.

Externally: Small fire extinguisher; axe (p. B206); crowbar (p. W89); sledge hammer; shovel (p. W89); spade; large wire cutters (p. W:IC59); main-gun cleaning kit; cable to aid in putting on the tracks; 16.5-ton hydraulic jack (p. W89); two 5.5-yard towing cables; and various spare parts.

Internally: Small fire extinguisher; basic first aid kit (p. W90); three 5.3-gallon water cans (p. W89); set of signaling flags; LP 28 flare pistol (p. W:IC62) with 12 each red, green, and white flares; MP 40 submachine gun (p. W96) with six magazines (considered part of the vehicle's rather than the crew's armament); two bipods and shoulder stocks to convert the hull- and turret-mounted MGs 34 (p. W97) to the infantry role; three spare barrels and a small Armoury tool kit (p. W89) for the MGs; small Mechanic tool kit (p. W89); and various spare parts for the vehicle.

PzKpfw VIII Maus

In 1941, Hitler became convinced that the Soviets soon would field supertanks over 100 tons in weight. He ordered development to start on a tank that would be able to face them. The proposed 150-ton design, a veritable land-bound battleship, was to mount a 149mm gun derived from a naval cannon with a smaller coaxial tank gun, and was to have unequaled armor protection from all sides. Initially and quite fittingly called *Mammut* (mammoth), it evolved over the following years, its designation likewise changing several times, until fixed as *Maus* (mouse). At one time, as many as 150 were to be built.

Created by Hitler's favorite designer, Professor Ferdinand Porsche, the Maus was a huge vehicle that took advantage of electric motors for improved efficiency. While armament and armor were very good, other design parameters such as the slow speed and its limited off-road performance were less impressive. The speed was not considered a problem, since it was envisioned to be used as a moving bunker (plugging holes in the Atlantic Wall, according to some). It was surprisingly maneuverable, being able to turn on its own axis. Its off-road performance due to the high ground pressure would likely have proven to be a severe disadvantage, as had already been the case for the much lighter Tiger II (see p. W:IC82).

As it was, it never entered service, only one complete prototype being built in late 1943, plus a few unfinished hulls and turrets. When the Soviets neared the Kummersdorf proving grounds near Berlin in May 1945, the complete vehicle as well as one moving hull was outfitted and the crews tried to withdraw with them. The hull's motive system failed after a few miles, and the one finished Maus was abandoned and blown up not far away. Thus came to an end another of the *Wunderwaffen* that failed to bring victory for Germany.

The turret seats commander, gunner, and two loaders. It mounts a 128mm Krupp KwK 44 gun, with a 75mm Krupp KwK 44 gun and a 7.92mm Rheinmetall MG 34 mounted coaxially, all fired by the gunner. A Nahverteidigungswaffe is installed in the roof. Firing ports in the turret sides and rear allow close defense using small arms. The turret traverses 22° per second electrically or 0.2° if rotated manually by gunner and loader. The driver and radio operator sit in the hull.

The Maus burns 27.2 gallons of gasoline per hour at routine usage. Fuel and ammo cost $9,955.

PzKpfw VIII Maus

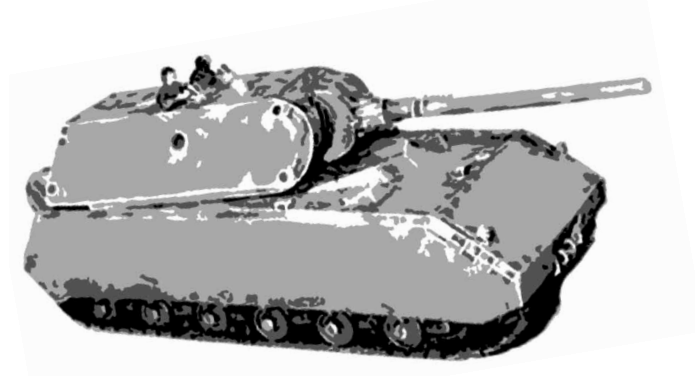
Subassemblies: Sealed Gigantic Tank chassis with Mild slope +4; sealed full-rotation Small Secondary turret with Heavy slope [Body:T] +4; tracks +4.

Powertrain: 805-kW turbocharged gas engine with 805-kW electric motors, 805-kW tracked transmission, and 436-gallon standard fuel tanks; 6-kW auxiliary gas engine; 20,000-kWs batteries.

Occ: 2 CS Body, 4 CS Both **Cargo:** 8.8 Body, 1.3 Tur

Armor	F	RL	B	T	U
Body:	5/1,155	4/770S	4/640	4/290	4/290
Tracks:	4/65	4/65	4/65	4/65	4/65
Turret:	5/1,455	5/1,155	4/770	4/230	–

Standoff armor on both sides protects tracks 50% of time.



Weaponry

128mm Medium Tank Gun/KwK 44/1 [Tur:F] (48 rounds).*
75mm Medium Tank Gun/KwK 44 [Tur:F] (200 rounds).*
Ground LMG/MG 34 [Tur:F] (1,050 rounds).*
92mm Vehicle Mortar/NvW [Tur:T] (20 rounds).
* Linked.

Equipment

Body: Fire extinguisher; 4,000-lb. hardpoint [B]; NBC kit; large radio receiver and transmitter; medium radio receiver and transmitter; 55-kW traversing gear for turret.

Statistics

Size: 33'×12'×12' *Payload:* 9.5 tons *Lwt:* 206.8 tons
Volume: 420 *Maint.:* 13 hours *Cost:* $250,135

HT: 7. HPs: 3,600 Body, 1,300 each Track, 560 Turret.

gSpeed: 12 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure High. 1/3 Off-Road Speed.

Design Notes

The turret has three sloped facings, an option beyond the normal scope of the MVDS rules that reduces VSPs to 70.

The original specifications called for a diesel engine, and while one of the two prototypes actually received one, it is doubtful that production vehicles could have been fitted with diesels; there were numerous technical and production problems. The gas engine was a simple modification of the type made by the thousands for aircraft.

The design specifications of the Maus ambitiously required 60 128mm rounds to be carried; while technical drawings exist, the only remaining prototype and the manual made for it in 1944 cast doubts on whether all this ammo would actually have fitted in the tank. Various sources cite loadouts varying from 32 to 75 main gun shells; a moderate figure was chosen.

Due to its weight, the Maus couldn't use most bridges. It was therefore prepared to ford rivers up to 25' deep by driving underwater. It was fully sealed for this and fitted with an overpressure system to keep the crew alive (an NBC kit was purchased for this, although the tank lacked filters). Instead of using a snorkel supplying air to the engine, like some contemporary designs, it was to take advantage of the electric motors, which didn't require air to run. The necessary current was supplied via power cable from another Maus remaining stationary on the bank of the river. While this worked on the proving grounds, it is highly doubtful whether the stunt would have worked under field conditions, much less under fire.

The hardpoint at the rear was used to carry an ejectable auxiliary fuel drum with a capacity of 396 gallons.

Behelfsmässiger Panzerzug 42 (BP 42)

Armed and armored railroad trains had been successfully employed by various nations in the late 19th century, and saw considerable use during the Great War and the Russian revolution. During WWII, the concept was again widely employed, especially in China, the Balkans, and the steppes of Eastern Europe, where rail tracks allowed fast and safe transport over long distances while the local roads were often marginal at best. Other advantages were low operating costs and their use of cheap coal rather than gasoline.

Various designs were used by several nations, including China, Germany, Hungary, Japan, Poland, and the U.S.S.R. (A somewhat surprising user was the British military, which commissioned more than a dozen for coastal security in England.)

Aside of their few own *Eisenbahnpanzerzüge*, the Germans unhesitatingly employed foreign captured trains. In 1942, they made efforts to standardize their trains on the *Behelfsmässiger Panzerzug 42* design (makeshift armored train model 1942 – the "makeshift" indicating its moderate armor, not an improvised design). It consisted of an engine, two coal tenders, and 10 cars.

The cars were attached in symmetrical half-trains on either side of the locomotive. The outermost car on either end was the expendable *Abstosswagen*, a flatcar which was to detonate any mines on the tracks. It also carried an armored car and repair materials for mending tracks. The second car was the *Panzerträgerwagen*, another flatcar which carried a light tank. The armored cars and the tanks could dismount and reconnoiter the surroundings. Alternatively, they could fire their guns while mounted. The third car was the *Kanonen- und Flakwagen*, with a turreted 76.2mm gun and a quadruple AA installation. The fourth car carried troops (*Infanteriewagen*) at one end and command staff (*Befehlswagen*) on the other end. Next was the *Geschützwagen* with a turreted howitzer and a kitchen or surgery, and then a tender. In the center of the train was the armored *Panzerlokomotive*.

Being filled with crew, weapons, and ammunition, the armored trains carried limited provisions. Each had a number of unarmored supply cars assigned, which were left at a secure base of operations. These typically included seven sleeper cars for the crew as well as five cars holding a maintenance and repair shop, clothing stores, food stores, ammunition stores, and construction tools. Two flatcars carried the VW Kübelwagen (p. W:IC72), Opel-Blitz truck (p. W:IC73), and 13 bicycles (p. 7) assigned for liaison and supply runs.

German armored trains were directly under the Generalstab (see p. W:IC29), which assigned them to the army groups as needed. About 80 of all sorts were in service, mostly in Russia, but also in Poland, the Balkans, France, and Norway. Twelve BP 42 trains were constructed (PZs 61-72).

The most important tasks of the armored trains were anti-partisan actions and keeping the rail lines open. They were mainly used independently against partisans, blocking their retreat over the rail lines, giving artillery support to infantry, or functioning as a mobile HQ in major operations. They also gave escort protection to important trains, supplied security positions along the railroads, and transported infantry up to platoon level within the train.

BP 42 Mannschaft

Each BP 42 was manned by a company of 136 men.

The first platoon consisted of the 18-man HQ section (including medics and runners), 10-man communications section (including radio operators for the armored cars), eight-man technical crew (actually a civilian Reichsbahn engine crew and mechanics), a 10-man heavy-weapons section, a nine-man MMG section (including forward observers), a 20-man LMG section (some of them crewing the armored cars), and an 11-man combat-engineer section.

The second platoon had a five-man HQ element, 23-man artillery section (crewing the train's main guns), 14-man AA section (manning the Flakvierling guns), and an eight-man panzer section (crewing the tanks).

Apart from the weapons mounted on the train and tanks, the men were provided with various small arms, 23 MGs (MGs 34 or 42, p. W97, one with tripod in the MMG role) with more than 100,000 rounds of ammo, three PzB 39 AT rifles (p. W95), two GrW 34 mortars (p. W97) with 254 shells, and one FmW 41 flamethrower (p. W99). Numerous firing ports in the cars' sides allowed the men to use small arms when mounted. The infantry could deploy through hatches in the cars' underbodies, allowing them to keep a low profile if under fire.

Abstosswagen

The outermost Abstosswagen (pusher car) had a plow to push away any obstacles. It carried a PzSpähw 204(f) armored car (French AMD Panhard Mle 35, p. 34), which had its road wheels replaced by railway wheels. The road wheels were stowed on the Abstosswagen, which also carried rail tracks, wood, and cobbles to repair a broken or sabotaged rail.

Subassemblies: Very Large Wheeled Chassis with Heavy option +5; four rail wheels +4.

Occ: None **Cargo:** 350 Body

Armor	F	RL	B	T	U
Body:	0/0	0/0	0/0	0/0	4/20W
Wheels:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: Bulldozer plow; cargo ramp.

Statistics

Size: 39'×10'×5' *Payload:* 15 tons *Lwt.:* 29.9 tons
Volume: 420 *Maint.:* 152 hours *Price:* $1,730

HT: 12. HPs: 2,600 Body, 450 each Wheel.

gSpeed: * *gAccel:* * *gDecel:* * *gMR:* * *gSR:* 4
Ground Pressure Extremely High. No Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Loaded weight was increased 3% to the historical value.

Panzerträgerwagen

The Panzerträgerwagen (tank carrier car) transported a PzKpfw 38(t) (p. 48), or at times a PzKpfw 739(f) (French SOMUA Mle 35, p. W:RH40). The tank's platform was lowered so that the car's armored skirts protected its hull and suspension. The car had to be decoupled to deploy the ramp; offloading the tank takes about three minutes. Some 270 47mm and 7,650 7.92mm rounds were carried as spare tank ammo.

Subassemblies: Very Large Wheeled Chassis with Heavy option +5; four rail wheels +4.
Occ: None Cargo: 350 Body

Armor	F	RL	B	T	U
Body:	0/0	0/0	0/0	0/0	4/20W
Wheels:	4/40	4/40	4/40	4/40	4/40

Equipment

Body: Cargo ramp.

Statistics

Size: 39'×10'×5' *Payload:* 10.7 tons *Lwt.:* 30 tons
Volume: 420 *Maint.:* 138 hours *Price:* $2,115

HT: 12. HPs: 2,600 Body, 450 each Wheel.

gSpeed: * *gAccel:* * *gDecel:* * *gMR:* * *gSR:* 4
Ground Pressure Extremely High. No Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

The DR of the wheels includes the DR 35 armor skirts that extend almost down to the ground.

Kanonen- und Flakwagen

The Kanonen- und Flakwagen (gun and AA car) had a turreted 76.2mm FK 295/1(r) field gun (Russian 76.2-P-39) and a 2cm Flakvierling 38 (p. 25). Six gun ports in the car's sides allowed deployment of the loose MGs carried, and another 22 gun ports could be used for rifles or SMGs. A heavy armored door was located in either side, as well as an armored connection to the cars fore and aft. A full load of ammo costs $3,540.

Subassemblies: Very Large Wheeled chassis with Heavy option +5; full-rotation Large AFV turret with Advanced slope [Body:T] +3; full-rotation Large Weapon open mount [Body:T] +2; four rail wheels +4.
Occ: 10 PS Body, 2 CS Tur, 3 XCS OM Cargo: 207 Body

Armor	F	RL	B	T	U
Body:	4/65	4/100	4/65	4/50	3/10W
Wheels:	4/40	4/40	4/40	4/40	4/40
Turret:	5/150	5/150	5/150	4/50	–
OM:	4/35	0/0	0/0	0/0	–

Weaponry

75mm Short Tank Gun/FK 295/1(r) [Tur:F] (250 rounds).
4×20mm Long Gr. ACs/FlaK 38s [OM:F] (2,175 each).*
* Linked in pairs; additional link fires all four.

Equipment

OM: Universal mount.

Statistics

Size: 39'×10'×12' *Payload:* 5 tons *Lwt.:* 35.8 tons
Volume: 455 *Maint.:* 54 hours *Price:* $13,860

HT: 12. HPs: 2,600 Body, 450 each Wheel, 225 Tur, 120 OM.

gSpeed: * *gAccel:* * *gDecel:* * *gMR:* * *gSR:* 4
Ground Pressure Extremely High. No Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Wheel DR includes DR 35 armor skirts that extend almost to the ground. Turret slope was rearranged to place 30° on all sides. Design weight was decreased 29% to the historical.

Variants

Some later trains replaced the Flakvierling with a Flakpanzer IV Wirbelwind (p. 50) turret. The BP 44 replaced the 76.2mm with a 105mm leFH 18M (105mm Short Howitzer).

Befehlswagen/Infanteriewagen

Each train had one Befehlswagen (command car) and Infanteriewagen (infantry car) occupying the fourth spot on each side; both types were similar in construction.

The Befehlswagen carried the HQ section including four officers and tactical and intelligence personnel, and the radio operators. It had a large rectangular antenna on the roof and several smaller aerials. Twelve gun ports in the sides allowed deployment of loose MGs, and another 23 ports could be used for rifles or SMGs. A heavy armored door was located in either side, as well as an armored connection to the cars front and aft.

The Infanteriewagen carried the second-in-command as well as infantry and a heavy weapons squad.

Subassemblies: Very Large Wheeled chassis with Heavy option +5; four rail wheels +4.
Occ: 5 CS, 22 PS Body Cargo: 19.1 Body

Armor	F	RL	B	T	U
Body:	4/65	4/100	4/65	4/50	3/10W
Wheels:	4/40	4/40	4/40	4/40	4/40

Equipment

Body: Fire direction center; large radio receiver and transmitter; medium radio receiver and transmitter; searchlight.

Statistics

Size: 39'×10'×13' *Payload:* 5 tons *Lwt.:* 35 tons
Volume: 420 *Maint.:* 60 hours *Price:* $11,300

HT: 12. HPs: 2,600 Body, 450 each Wheel.

gSpeed: * *gAccel:* * *gDecel:* * *gMR:* * *gSR:* 4
Ground Pressure Extremely High. No Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Wheel DR includes the DR 35 armor skirts that extend almost down to the ground. Weight was decreased 20%.

Variants

The Infanteriewagen lacked the radio equipment and fire-direction center, having seats for 30 troops, instead.

Geschützwagen

The fifth car was the Geschützwagen (artillery car). It had a turret with a 105mm Skoda leFH 14/19(p) howitzer (Polish wz. 14/19P). The other half of the car was taken up by a small field surgery and beds for patients in one of the cars, and a field kitchen in the other. The latter could supply the entire crew of the train (p. 56).

The turret is manually turned at 2° per second. Six gun ports in the car's sides allowed deployment of the loose MGs carried, and another 22 gun ports could be used for rifles or SMGs. Two heavy armored doors were located in either side, as well as an armored connection to the cars front and aft.

A full load of ammo costs $3,750.

Subassemblies: Very Large Wheeled chassis with Heavy option +5; full-rotation Large AFV turret with Advanced slope [Body:T] +3; four rail wheels +4.
Occ: 17 PS Body, 2 CS Tur Cargo: 3.1 Body, 0.6 Tur

Armor	F	RL	B	T	U
Body:	4/65	4/100	4/65	4/50	3/10W
Wheels:	4/40	4/40	4/40	4/40	4/40
Turret:	5/150	5/150	5/150	4/50	–

Weaponry

105mm Short Howitzer/leFH 14/19(p) [Tur:F] (225 rounds).

Equipment

Body: two hospital beds; surgery.

Statistics

Size: 39'×10'×13' *Payload:* 7 tons *Lwt.:* 35.8 tons
Volume: 445 *Maint.:* 57 hours *Price:* $12,135

HT: 12. HPs: 2,600 Body, 450 each Wheel, 225 Turret.

gSpeed: * *gAccel:* * *gDecel*: * *gMR:* 0.5 *gSR:* 4
Ground Pressure Extremely High. No Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Wheel DR includes DR 35 armor skirts that extend almost to the ground. Weight was reduced 26% to the historical.

Variants

At least one train (PZ 32) added a 37mm Rheinmetall FlaK 36 (37mm Medium Ground AC) AA gun on both Geschützwagen. On the BP 44, the Polish gun was replaced by a 105mm leFH 18M (105mm Short Howitzer).

Kohlentender

The 3 T 16.5 tender was a simple armored car which stowed coal for the engine. A full load of coal costs $112.

Subassemblies: Large Wheeled Chassis with Heavy option +4; Large TD superstructure +4; six rail wheels +3.
Occ: None Cargo: 2 Body, 4.2 Sup

Armor	F	RL	B	T	U
Body:	4/65	4/100	4/65	–	3/10W
Wheels:	4/40	4/40	4/40	4/40	4/40
Sup:	4/65	4/100	4/65	4/50	–

Equipment

Body: 165-VSP coal bunker. *Sup:* 26-VSP coal bunker.

Statistics

Size: 24'×10'×13' *Payload:* 28 tons *Lwt.:* 58.6 tons
Volume: 315 *Maint.:* 76 hours *Price:* $6,860

HT: 10. HPs: 1,800 Body, 200 each Wheel.

gSpeed: * *gAccel:* * *gDecel*: * *gMR:* * *gSR:* 4
Ground Pressure Extremely High. No Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Since the body was too small, it was fitted with a superstructure that exactly fits on top; realistically, this was one and the same assembly. The DR of the wheels includes the DR 35 armor skirts that extend almost down to the ground. HT is low due to the undersized body, and was increased from 8 to 10.

Panzerlokomotive

The engine at the center of the train was a modified freight *Lokomotive Baureihe 57*, which was originally built as the G 10 in 1910-25. It was armored by Krupp in the late 1930s and had twin steam engines working on superheated steam.

Since the driver can see virtually nothing from his armored station in the middle of the train, he is totally reliant on the spotters deployed in the other cars, in contact with him via internal communications. He is assisted by two stokers.

The engines burn 6.6 VSPs of coal per hour of routine usage. A full load of coal costs $31.

Subassemblies: Very Large Wheeled Chassis with Heavy option +5; 10 rail wheels +4.
Powertrain: two 410-kW steam engines with 820-kW all-wheel-drive transmission and 7.7 tons of coal.
Occ: 3 CS Body Cargo: 89.1 Body

Armor	F	RL	B	T	U
Body:	4/90	4/90	4/90	4/50	4/20
Wheels:	4/40	4/40	4/40	4/40	4/40

Equipment

Body: 61.6-VSP coal bunker.

Statistics

Size: 39'×10'×15' *Payload:* 8 tons *Lwt.:* 98.8 tons
Volume: 420 *Maint.:* 64 hours *Price:* $9,700

HT: 8. HPs: 2,600 Body, 180 each Wheel.

gSpeed: 37 *gAccel:* 1 *gDecel*: 10 *gMR:* 0.25 *gSR:* 5
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

Performance was calculated with 450.2 tons of towed weight, representing the rest of the standard armored-train configuration; gSpeed was decreased 5% to the historical.

As for the cars, the DR of the wheels includes the DR 35 armor skirts that extend almost down to the ground.

Weight was increased 41% to the historical. Most of the cargo space should be considered access space for the crew.

Light Tank Mk VII Tetrarch

This tank started out in 1937 as a privately funded design of Vickers-Armstrong in Kent, England. While developed in continuation of the long line of Vickers light tanks (see p. W:AKM73), it had little in common with those earlier designs. It used an American Christie-type tracked transmission with four large road wheels on either side. These had solid rubber tires and allowed the tank to run on the wheels without the tracks. The front axle was steerable to a limited degree, which made it less likely to shed a track, and allowed limited turning without the tracks.

In 1940, it was put into production for the British army, which was at that time desperate for any armor that it could get, even though it didn't really know what to do with the Light Tank Mk VII Tetrarch, as it was by then called. The Metropolitan Cammell & Wagon Co. made 177 of the tanks until production stopped after extensive bomb damage to the plant in April 1941.

When the tank entered service in November 1940, the British had realized the limited actual combat use of light tanks; however, it soon became clear that the Tetrarch could serve with the newly formed airborne troops. A new glider – the General Aircraft Hamilcar (p. 87) – was especially designed to carry it. Nevertheless, its first action was in support of the conventional Operation Ironclad, the invasion of Madagascar in May 1942. Only a few of the vehicles participated in that operation.

In 1942, it was finally reassigned to the airborne forces. The tanks' next major operation was the Normandy landings in 1944. Once landed, the 20 Tetrarchs (mostly of the ICS variant, see below) deployed with the 6th Airborne Armoured Reconnaissance Regiment had a short lifespan against the Germans, thanks to their limited armament and armor. They were next used in the Rhine crossings in March 1945. Twenty were given to the Soviet Union in 1943.

The commander, who also acts as loader and radio operator, and the gunner sit in the turret. The main armament is a 2-pounder Rifled Ordnance QF Mk X, usually fitted with a Littlejohn adaptor (p. 14) by 1944. A 7.92mm BESA Mk I machine gun is mounted coaxially. The turret traverses manually at 4° per second. The driver sits in the body.

The Tetrarch burns 5.5 gallons of gasoline per hour of routine usage. A full load of fuel and ammo costs $280. Historical cost was 6,650 pounds Sterling ($25,580).

Light Tank Mk VII Tetrarch I

Subassemblies: Small Tank chassis with Light option +3; full-rotation Large Weapon turret [Body:T] +2; tracks +2.

Powertrain: 123-kW standard gas engine with 123-kW tracked transmission and 54-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 1 CS Body, 2 CS Both Cargo: 3.1 Body, 1.9 Tur

Armor	F	RL	B	T	U
Tracks:	4/35	4/35	4/35	4/35	4/35
All Else:	4/40	4/25	4/25	4/15	4/15

Weaponry

40mm Long Tank Gun/ROQF Mk X [Tur:F] (50 rounds).*
Ground LMG/BESA Mk I [Tur:F] (2,025 rounds).*
* Linked.

Equipment

Turret: 100-lb. hardpoint [F] mounts searchlight; medium radio receiver and transmitter; two smoke dischargers [R, L].

Statistics

Size: 14'×8'×7' *Payload:* 0.65 tons *Lwt:* 8.4 tons
Volume: 58 *Maint:* 85 hours *Cost:* $5,590

HT: 12. HPs: 1,000 Body, 400 each Track, 120 Turret.

On Tracks

gSpeed: 40 *gAccel:* 3 *gDecel:* 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Very Low. 4/5 Off-Road Speed.

On Wheels

gSpeed: 60 *gAccel:* 3 *gDecel:* 10 *gMR:* 0.25 *gSR:* 4
Ground Pressure Very High. 1/6 Off-Road Speed.

Design Notes

Tracked gSpeed was increased 4%. The gMR on wheels has been adjusted to reflect its limited steering.

Variants

The *Light Tank Mk VII Tetrarch ICS* of 1944 was a close-support version that replaced the main gun with a 3" Mk I howitzer (76.2mm Very Short Howitzer). A fuel drum was added to the body rear.

The *Light Tank Mk VIII Harry Hopkins I* of 1941 used the same chassis and mechanical components, but a better armored hull and turret (DR 120 to the front). Some 100 were built, but never issued to combat troops.

Cruiser Tank Mk VIII Cromwell

Early in the war, the British built light "cruiser" tanks to serve the function of cavalry, moving quickly to strike the enemy at his weak points. The Cromwell was the last of the cruisers produced in large numbers, and arguably the best. While it was better armed and armored than previous cruisers, and much more reliable, it was still undergunned and underarmored compared to contemporary German tanks.

The first Cromwells appeared in early 1943 and by late 1944 it was the most numerous British-produced tank, replacing Shermans with many units. Other units used it only for training, however, and in turn switched to Shermans for reasons of standardization and logistics for the D-Day landings. It was prominently used by the 7th Armoured Division.

Early Cromwells mounted a 6-pounder gun, which was insufficient against unarmored targets. The later 75mm gun, which was essentially the 6-pounder with a new barrel to fire the same ammo as the U.S. M-3 gun, fired an effective HE shell. Ironically, the 6-pounder with its sabot round had slightly better penetration than the 75mm's best antitank round; the tradeoff was considered worthwhile, however.

Some 1,500 Cromwell VIIs were built and in service from 1944. The Cromwell VII was based on the IV, with additional armor bolted on to the hull and turret fronts.

The Cromwell has a crew of five. The turret seats the commander, gunner (who fires the 75mm gun and 7.92mm BESA Mk I coaxial machine gun), and loader (who also operates the radio). Most add a .303 Bren Mk II (see p. W96) with 600 rounds in drums at the commander's hatch for AA fire. The driver sits in the body. Next to him is the hull MG gunner, who fires the hull-mounted BESA Mk I. The turret traverses hydraulically at 24° per second.

The Cromwell uses 19.1 gallons of gasoline per hour at routine usage. A full load of fuel and ammo costs $1,430. Historical cost was 10,350 pounds Sterling ($38,810).

Cromwell VII

Subassemblies: Large Tank chassis +3; full-rotation Medium AFV turret [Body:T] +2; full-rotation Mini open mount [Tur:T] +0; tracks +3.

Powertrain: 425-kW standard gas engine with 425-kW tracked drivetrain and 167-gallon standard fuel tanks; 16,000-kWs batteries.

Occ: 2 CS Body, 3 CS Both Cargo: 0.7 OM

Armor	F	RL	B	T	U
Body:	4/390	4/125	4/125	4/75	4/40
Tracks:	4/45	4/45	4/45	4/45	4/45
Turret:	4/390	4/245	4/220	4/75	–
OM:	0/0	0/0	0/0	0/0	–

Weaponry

Ground LMG/BESA Mk I [Body:F] (1,800 rounds).
75mm Med. Tank Gun/ROQF Mk V [Tur:F] (64 rounds).*
Ground LMG/BESA Mk I [Tur:F] (3,150 rounds).*
51mm Vehicle Mortar/BT Mk I [Tur:T] (30 rounds).
Ground LMG/Bren Mk II [OM:F] (600 rounds).
* Linked.

Equipment

Body: Fire extinguisher. *Tur:* Medium radio receiver and transmitter; 8-kW traverse equipment. *OM:* Universal mount.

Statistics

Size: 21'×10'×8' *Payload:* 1.8 tons *Lwt.:* 30.8 tons
Volume: 133 *Maint.:* 33 hours *Price:* $36,290

HT: 11. HPs: 1,800 Body, 600 each Track, 200 Turret, 30 OM.

gSpeed: 32 *gAccel:* 4 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Very Low. 4/5 Off-Road Speed.

Design Notes

The historical speed listed is with a speed governor installed on the engine. The governor could be removed (and indeed some production Cromwells lacked it), giving the tank gSpeed 40. Removing a governor was expressively forbidden, as high speed overstrained the suspension (-2 to HT).

Many Cromwell crews found the hull MG to be of little worth. They removed it and its gunner to create additional stowage space (+5.1 VSPs).

Variants

The 27.8-ton *Cromwell I* of 1943 mounted a 6-pounder ROQF Mk V (57mm Medium Tank Gun) with 75 rounds; gSpeed 40. Some 358 were built. The *Cromwell II* of 1943 was similar, but lacked the hull MG. Instead of the Bren gun, some of these early Cromwells mounted twin .303 Vickers G.O. Mk Is (Aircraft LMGs, p. W:AKM64) with 960 rounds per gun in a twin AA mounting on the turret roof.

The *Cromwell III* of 1943 was a re-engined Centaur I (see below). Only 39 were so converted.

The 30.8-ton *Cromwell IV* of 1944 was similar to the Cromwell VII, but lacked the appliqué armor (frontal hull DR 230 and turret DR 295); gSpeed 40. Only 70 were built.

The close-support *Cromwell VI* of 1944 was a IV with the tank gun replaced by a 95mm Howitzer Ordnance Mk I (95mm Short Howitzer) with 51 shells; 341 were built.

The *Centaur I* of 1942 was basically the same tank, but fitted with the much less powerful 295-kW Nuffield Liberty engine; gSpeed 27. The Centaur I mounted a 6-pounder and was only used for training. Some 1,061 were built.

The 31.8-ton *Centaur III* of 1943 was upgunned to a 75mm cannon; gSpeed 27. Some 233 were built.

The *Centaur IV* of 1944, of which 94 were built, mounted a 95mm Howitzer Ordnance Mk I (95mm Short Howitzer) with 51 rounds for close support. It was used exclusively by the Royal Marines Armoured Support Group in the Normandy landings.

The *Centaur AA I* of 1944 mounted the same turret as the Crusader AA II, which was armed with twin 20mm POLSTEN Mk Is (20mm Long Ground Autocannons) with 300 rounds each. It was used in the Normandy landings, but soon withdrawn as it had nothing to shoot at! Each vehicle had a crew of four; 95 were made.

The *Centaur Kangaroo* of 1944 was a troop carrier without the turret, similar to the Ram Kangaroo (p. 45).

Churchill Variant: Churchill VII Crocodile

In the British military, flamethrowers and associated equipment were developed by the Petroleum Warfare Department. Its most famous design was the Crocodile, a flamethrower conversion of the Infantry Tank Mk IV Churchill (see p. W:AKM76).

The Churchill VII Crocodile, introduced in 1944, used the Churchill VII model as a basis, which was better armed and armored than earlier variants. As the Crocodile, it had the hull-mounted machine gun replaced by a flamethrower. The fuel for the weapon and the bottles of nitrogen for pressurizing the fuel were carried in an armored, two-wheeled trailer towed behind the tank. A pipe passed from the trailer to a valve coupling (the "link") at the rear of the tank, and from there under the belly of the tank to the gunner's position and inside the tank. The pipe was armor-protected.

The trailer was only relatively thinly armored, which prevented its advance into an artillery barrage; on the other hand, the trailers were seldom directly shot at, the tank clearly being the more dangerous target. It would make for spectacular fireworks when hit. It took about 90 minutes to refuel the trailer and 10-15 minutes to "pressure up" the gas bottles. When empty or when the situation necessitated it, the trailer could be jettisoned from within the towing tank.

Some 800 Crocodiles were made, most being used in Northwestern Europe, first on D-Day (see p. W30). About 250 served in the Far East, including with Australian forces.

Like all of the "Funnies" (see pp. W:D97, p. W:AKM76), the Crocodile was on the Official Secret List, which meant that any vehicle lost that might fall into the hands of the enemy posed a considerable problem. It must either be recovered or completely destroyed to prevent its capture.

The turret seats the commander, gunner, and loader. The gunner fires the 75mm ROQF Mk V gun (uses the same ammunition as the U.S. M-3) and the coaxial 7.92mm BESA Mk I MG. The turret is powered and rotates at 18° per second. Many add a .303-caliber Bren Mk II (see p. W96) with 600 rounds in drums at the commander's hatch for AA fire. The driver and hull gunner (who fires the flamethrower) sit in the body.

The Churchill VII Crocodile burns 11.7 gallons of gasoline per hour at routine usage. Fuel and ammo cost $1,810.

Infantry Tank Mk IV Churchill VII Crocodile

Subassemblies: Large Tank chassis +3; full-rotation Small AFV turret [Body:T] +2; full-rotation Mini open mount [Tur:T] +0; tracks +3.

Powertrain: 260-kW standard gas engine with 260-kW tracked transmission and 180-gallon standard fuel tanks; 16,000-kWs batteries.

Occ: 2 CS Body, 3 CS Both **Cargo:** 4.8 Body, 1.8 Tur

Armor	F	RL	B	T	U
Body:	4/560	4/290	4/190	4/75	4/85
Tracks:	4/45	4/45	4/45	4/45	4/45
Turret:	4/585	4/365	4/365	4/75	–
OM:	0/0	0/0	0/0	0/0	–

Weaponry

Heavy Vehicle Flamethrower [Body:F] (85 shots).
75mm Medium Tank Gun/ROQF Mk V [Tur:F] (84 rounds).*
Ground LMG/BESA Mk I [Tur:F] (6,975 rounds).*
51mm Vehicle Mortar/BT Mk I [Tur:T] (30 rounds).
Ground LMG/Bren Mk II [OM:F] (600 rounds).
* Linked

Equipment

Body: Fire extinguisher. *Turret:* Medium radio receiver and transmitter; 6-kW traversing gear. *OM:* Universal mount.

Statistics

Size: 24'×11'×8' *Payload:* 2.1 tons *Lwt:* 44.7 tons
Volume: 128 *Maint.:* 30 hours *Cost:* $45,680

HT: 9. HPs: 1,800 Body, 600 each Track, 150 Turret, 30 OM.

gSpeed: 13 *gAccel:* 3 *gDecel*: 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Moderate. 2/3 Off-Road Speed.

Design Notes

Flamethrower ammo actually is in towed trailer; see below.

Crocodile Trailer

Subassemblies: Very Small Wheeled chassis with Heavy option +2; two off-road wheels +1.

Occ: None **Cargo:** 3 Body

Armor	F	RL	B	T	U
Body:	4/50	4/75	4/75	4/75	4/50
Wheels:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: 85 Heavy Vehicle Flamethrower shots.

Statistics

Size: 15'×11'×7' *Payload:* 1.5 tons *Lwt:* 7.1 tons
Volume: 18 *Maint.:* 267 hours *Cost:* $560

HT: 10. HPs: 330 Body, 100 each Wheel.

gSpeed: 13* *gAccel:* 2* *gDecel:* 20* *gMR:* 1.25 *gSR:* 2
Ground Pressure Very High. 1/6 Off-Road Speed.
* If towed behind the Churchill VII.

Design Notes:

The "cargo" space should be considered as taken up by fuel lines and access space; it can't be used for ordinary cargo. Weight was increased 29%; the extra weight accounts for the fuel lines and the quick-release coupling.

Sherman Variants: VC Firefly and III BARV

The British used many variants of the U.S. M-4 medium tank (see p. W102). In fact, it was the British who christened it the "Sherman." While many were taken over unmodified – receiving little more than British markings and radios – there were also some specialized versions that originated in England.

Sherman VC Firefly

The British were not content with the tank guns furnished with the various Sherman marks they received. Consequently, the 76.2mm ("17-pounder") Rifled Ordnance QF Mk IV anti-tank gun was mounted in the turret of some of the Shermans (not all models could be used) from early 1944, adding a "C" to their designations. The most common version – the Sherman VC – was based on the Chrysler M-4A4, with its multi-bank engine, welded armor, and thick mantlet.

Like all British Shermans, it lacked the gyrostabilizer. In addition, the hull MG and gunner were removed, much of the main gun ammo being stowed in the bow, instead. About 2,150 Fireflies were made and used by commonwealth units.

The turret seats the commander, gunner, and loader. The driver sits in the body. The powered turret traverses at 24° per second. The Sherman VC Firefly burns 14.3 gallons of gas per hour at routine usage. Fuel and ammo cost $2,390.

Subassemblies: Large Tank chassis with Mild slope +4; full-rotation Large AFV turret [Body:T] +3; Small Weapon pod [Tur:B] +0; tracks +3.

Powertrain: 317-kW standard gas engine with 317-kW tracked transmission and 192-gallon self-sealing fuel tanks; 1.5-kW auxiliary engine; 16,000-kWs batteries.

Occ: 1 CS Body, 3 CS Both Cargo: 0.4 Pod

Armor	F	RL	B	T	U
Body:	5/300	4/150	4/150	4/75	4/75
Tracks:	4/45	4/45	4/45	4/45	4/45
Turret:	4/345	4/200	4/200	4/100	–
Pod:	–	4/75	4/75	4/75	4/25

Weaponry

75mm VL Tank Gun/17-pdr. Mk IV [Tur:F] (77 rounds).*
Ground LMG/Browning #2 Mk I [Tur:F] (5,000 rounds).*
51mm Vehicle Mortar/BT Mk I [Tur:T] (30 rounds).
* Linked.

Equipment

Body: Fire extinguisher. *Turret:* 8.5-kW traversing gear. *Pod:* Medium radio receiver and transmitter.

Statistics

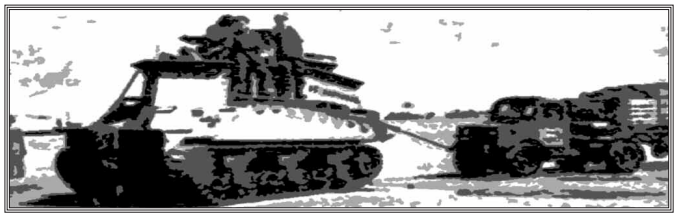
Size: 19'×9'×8' *Payload:* 2.4 tons *Lwt:* 36 tons
Volume: 139 *Maint.:* 32 hours *Cost:* $39,910

HT: 10. HPs: 1,800 Body, 600 each Track, 200 Turret, 45 Pod.

gSpeed: 25 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Design gSpeed reduced 19% to the historical.



Sherman III BARV

For the amphibious landings planned for 1944, the British required a deep wading recovery vehicle, to recover vehicles that drowned and posed an obstacle for the following vehicles in an assault wave. The Sherman III Beach Armoured Recovery Vehicle (BARV) was a Royal Engineer conversion of the M-4A2, which was selected since its welded armor could be better waterproofed and the diesel engines were less affected by the sudden drop in temperature when the vehicle plunged into cold water. The turret was replaced by a boat-shaped superstructure with a funnel for the engine air supply. The entire vehicle was watertight and could operate in water over 9' deep, depending on the surf.

The BARV was unarmed and only used as a tractor vehicle. One of the crewmen was equipped as a shallow-water diver, who would attach a towing cable to the vehicle to be recovered. A wooden ram on the front could be used to push stranded landing ships back into deeper waters.

About 60 were converted by D-Day 1944; they were among the first vehicles to land.

The Sherman III BARV burns 11.2 gallons of diesel per hour at routine usage. Fuel costs $18.

Subassemblies: Waterproofed Large Tank chassis with Mild slope +4; waterproofed Large AFV superstructure [Body:T] +3; tracks +3.

Powertrain: two 140-kW diesel engines with 280-kW tracked transmission and 148-gallon self-sealing fuel tanks; 16,000-kWs batteries.

Occ: 1 CS Body, 3 CS Sup Cargo: 7.7 Body, 10 Sup

Armor	F	RL	B	T	U
Body:	5/500	4/150	4/150	4/75	4/50
Tracks:	4/45	4/45	4/45	4/45	4/45
Sup:	4/50	4/50	4/50	4/50	–

Equipment

Body: Bilge pump; bulldozer plow; fire extinguisher. *Sup:* Medium radio receiver and transmitter.

Statistics

Size: 18'×9'×10' *Payload:* 1 ton *Lwt:* 28 tons
Volume: 137 *Maint.:* 47 hours *Cost:* $18,060

HT: 10. HPs: 1,800 Body, 600 each Track, 200 Sup.

gSpeed: 29 *gAccel:* 3 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Design gSpeed reduced 9% to the historical.

41M Turán Tank

In 1940, the minor Axis nation of Hungary obtained a license from the German overseers who had recently taken over the Skoda works of Czechoslovakia to locally produce one of the Czech tank designs. The T-22, an improved version of the LT vz. 35 (PzKpfw 35(t) in German service), was selected. It was officially known as the *41M Turán 40 Közepes Harckocsi* (model 1941 Turán medium tank with 40mm gun), but commonly called the 41M Turán I. (Turán is the name of the migration-age people from which the Hungarians trace their ancient origins.)

The Turán series became the main battle tank of the Hungarian armored formations, used alongside smaller numbers of tanks supplied by Germany. These included the PzKpfw 38(t) (p. 48), Jagdpanzer 38(t) Hetzer (p. W:IC83), StuG III (p. W:FH38), PzKpfw IV (p. W103), and PzKpfw VI Tiger I (p. W104). Hungarian light tanks included the Italian L3/35 (p. W:GL31) and Swedish Landsverk L160, the latter made under license as the 38M Toldi.

The Turán was initially armed with a 40mm MÁVAG 41M tank gun, which used ammunition interchangeable with that of the 40mm Bofors 36M autocannon (p. 25) also produced in Hungary. From May 1943, the Turán I was superseded in production by the Turán II, as it had been realized that the 40mm gun was inadequate for engaging most Soviet tanks. It was decided that a caliber of 75mm was the minimum acceptable, but unfortunately the 75mm gun chosen had a short barrel (L 25) and fell far short of stopping a T-34 (see p. W105) or other first-rate Red armor. Its official designation was *41M Turán 75 Rovid Nehéz Harckocsi* (model 1941 Turán heavy tank with short 75mm gun).

A total of 139 Turán IIs were built between 1943 and 1944, mainly being allocated to the *1.* and *2. Páncélos Hadosztály* (1st and 2nd Armored divisions). In 1944, Hungarian tank regiments had two companies each of the Turán I and Turán II, even though the Turán I was considered obsolete. The medium companies consisted of 11 Turán Is each, two of them fitted with extra radios for the command role. The heavy companies had 16 Turán IIs plus two command Turán Is each.

The tanks' armor is unsloped, and every face is filled with particularly large rivets (p. 12). This gives them a dimpled appearance that should make it easy to distinguish the Hungarian mount from similar models with welded or more discreetly riveted armor.

From the second half of 1944, the tanks received standoff armor (see p. W140) on the body sides and turret sides and back as additional protection against infantry antitank rockets and HEAT rounds. These armor skirts were made of wire mesh and added DR 15.

The Turán II is of conventional pre-war layout, with a crew of five: The driver and hull gunner sit in the body with the commander, main gunner, and loader stationed in the turret. The turret mounts a 75mm MÁVAG 43M tank gun based on the Austrian Böhler M.18, with a coaxial 8mm Danuvia 34/40M machine gun (RoF 16*) and another one in the hull. The turret is manually rotated at 2° per second.

The 41M burns 8.7 gallons of gasoline per hour at routine usage. Fuel and ammo cost $870.

41M Turán II

Subassemblies: Medium Tank chassis +3; full-rotation Small AFV turret [Body:T] +1; tracks +3.

Powertrain: 194-kW standard gas engine with 194-kW tracked transmission and 70-gallon standard fuel tanks; 12,000-kWs batteries.

Occ: 2 CS Body, 3 CS Both **Cargo:** 8.2 Body, 4 Tur

Armor	F	RL	B	T	U
Body:	4/160	4/80	4/80	4/80	4/25
Tracks:	4/40	4/40	4/40	4/40	4/40
Turret:	4/160	4/80	4/80	4/40	–

Weaponry

Ground LMG/34/40M [Body:F] (900 rounds).
75mm Short Tank Gun/43M [Tur:F] (56 rounds).*
Ground LMG/34/40M [Tur:F] (900 rounds).*
* Linked.

Equipment

Body: Medium radio receiver and transmitter.

Statistics

Size: 19'×8'×8' *Payload:* 1.2 tons *Lwt:* 20.4 tons
Volume: 103 *Maint.:* 55 hours *Cost:* $9,550

HT: 12. HPs: 1,500 Body, 540 each Track, 150 Turret.

gSpeed: 29 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Design gSpeed lowered 6% to the historical value.

Variants

The original 20-ton *41M Turán 40 Közepes Harckocsi* of 1941, or Turán I, mounted a 40mm MÁVAG 41M (40mm Medium Tank Gun) with 101 rounds; it also carried 3,000 rounds for the MGs. Late production vehicles had increased armor on the body front (DR 200). Some 285 were built.

The *43M Turán 75 Hasszu Nehéz Harckocsi* of 1943, or Turán III, replaced the short 75mm gun with a longer weapon, the 75mm MÁVAG 43M (75mm Long Tank Gun) based on the German 75mm PaK 40, with 32 rounds. It was also to have armor skirts and more armor, but didn't enter production.

The 23.8-ton *43M Zrínyi 105 Rohamtarack* of 1943, or Zrínyi II, was a turretless assault howitzer based on the chassis of the Turán, which was slightly widened to make room for the new weapon. Armor was increased to DR 240 on the body front, and fuel capacity to 118 gallons. It had a crew of four. It mounted a 105mm MÁVAG 40/43M howitzer (105mm Short Howitzer) with 52 rounds, plus an 8mm Danuvia-Gebauer 34/40M. Sixty were built until production had to be stopped in 1944. It took its name from Nikolaus Graf Zrínyi, a 16th-century Hungarian hero.

The *44M Zrínyi 75 Rohamagyu* of 1944, or Zrínyi I, was an assault gun of identical construction save for its 75mm MÁVAG 43M antitank gun (75mm Long Tank Gun). Only a single prototype was built.

FIAT-Ansaldo M11/39 Tank

By 1936, the Italians wanted a "breakthrough tank" capable of adding some muscle to the fleet of tiny L3/35s that they had (see p. W:GL31). Ansaldo couldn't come up with a prototype before May 1938. By then, the international situation was deteriorating. The M11/39 was clearly not satisfactory, but it was adopted as a make-do measure, while the designing and testing of the turreted M13/40 (see p. W:GL32) was needlessly hampered by bureaucracy.

The stopgap nature of the new tank, designated M11/39, was evidenced by the limited production: just 100 vehicles. Indeed, it was really a poor tank; tank authority Richard Ogorkiewicz wrote that it was probably the worst design of the era. It shared the weaknesses of its successor, the M13/40: an underpowered and underperforming diesel engine, indifferent off-road capabilities, and cheap riveted armor (p. 12) that was too thin. On top of all that, it deployed its main weapon – a 37mm Vickers-Terni Mod 37 gun – in a hull mount with very limited traverse and elevation, which would prove a deadly liability in battles of maneuver.

The experience of the Spanish Civil War had made the Italians acknowledge the threat of outflanking tactics, which they expected would be performed by enemy infantry. Thus, the M11/39 had an all-round capability, but only in terms of antipersonnel fire, with its two turreted 8mm Breda Mod 38 machine guns (see p. W:GL27). It's not by chance that no other tank had this strange layout.

The tanks fought their brief war in Africa, where their problems were compounded by the lack of radios; only the company commander's vehicle had one. Seventy served in the Western Desert: one battalion with Babini's *Brigata Corazzata Speciale*, another with the *Raggruppamento Maletti*. These battalions were short-changed, each with just two 13-tank companies. Both units fought well during Operation Compass, but they were unavoidably destroyed. Another 24 M11/39s were deployed in East Africa.

The 6th Australian Cavalry Regiment captured and used in Tobruk at least five M11/39s, painting huge kangaroos on them to avoid friendly fire. The Germans used a few specimens as the PzKpfw 734(i).

The driver sits in the hull, while the gunner's station is half in the hull and half in the superstructure, and the commander's upper body is in the turret. (He operates the MGs.) The turret rotates by hand-cranking, at about 5° per second.

The engine burns 3.3 gallons of diesel per hour of routine usage. The loadout costs about $285; normally, only APEX rounds are carried for the gun.

FIAT-Ansaldo M11/39

Subassemblies: Small Tank chassis +3; Large Weapon Superstructure [Body:T] +2; full-rotation Medium Weapon turret [Sup:T] +1; tracks +2.

Powertrain: 82-kW standard diesel engine with 82-kW tracked transmission and 48-gallon standard fuel tanks; 8,000-kWs batteries.

Occ: 2 CS Body, 1 CS Tur **Cargo:** 7.6 Body, 1 Sup, 1.7 Tur

Armor	F	RL	B	T	U
Body:	4/85	4/50	4/50	4/30	4/30
Tracks:	4/35	4/35	4/35	4/35	4/35
Sup:	4/80	4/40	4/40	4/20	–
Turret:	4/80	4/80	4/20	4/15	–

Weaponry

37mm Medium Tank Gun/Mod 37 [Sup:F] (84 rounds).
2×Ground LMGs/Mod 38s [Tur:F] (1,400 rounds each).*
* Linked.

Statistics

Size: 16'×7'×7' *Payload:* 1 ton *Lwt.:* 11 tons
Volume: 63 *Maint.:* 80 hours *Price:* $6,200

HT: 10. HPs: 1,000 Body, 400 each Track, 150 Sup, 75 Turret.

gSpeed: 21 *gAccel:* 2 *gDecel*: 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Design gSpeed was reduced 22% to the historical. Calculated HT was 12, which is too high for this temperamental tank, and was consequently reduced.

Variants

In the desert, most tanks were fitted with a cargo bin behind the superstructure that carried two 5.3-gallon jerrycans (see p. W89).

2 Shiki "Ka-Mi" Amphibious Tank

During the 1930s, the Japanese conducted various experiments with amphibious tanks, and one of them was to fit kapok-filled floats to a 95 Shiki "Ha-Go" light tank, which was propelled by two outboard motors. This project was soon canceled, but development of amphibious tanks continued.

In 1940, the Japanese navy took over development, in order to provide an amphibious tank for their *Rikusentai* marine infantry units. It was decided to redesign the basic 95 Shiki "Ha-Go" with a slightly roomier, watertight hull and two large pontoons on the front and back. The engine, suspension, wheels, and tracks were kept. The turret was a new design, but armed with the same weapons as the earlier army tank. The resultant vehicle was adopted in 1942 as the *2 Shiki Kaijō Sensha* (type 2602 amphibious tank) or "Ka-Mi" (short for Kaminishi, its designer).

The 2 Shiki would only float with the pontoons attached; they could be ditched quickly once the tank was ashore. Reattaching them took 10 minutes. A bilge pump was added, as was a short snorkel for the engine, since the vehicle had very little freeboard and was prone to take on water from waves crashing on the deck. The propellers and rudders were mounted on the rear pontoon and controlled by cables from a steering wheel at the commander's position in the turret.

Compared to the land-bound 95 Shiki, it had an enlarged crew of five, one of them being a mechanic to look after the engine and power traverse to the propellers. It was usually deployed from major ships or landing craft, but could also be launched from submarines – it was lashed to the top deck of the sub for such an operation. Allegedly, some could even carry a torpedo on either side! It's not known whether such a dubious configuration was ever used in combat.

The 2 Shiki was an effective amphibious tank, and used successfully in several operations. Like most Japanese armor, it was used in far too small numbers and mainly for infantry support. Its main gun was useless against Allied tanks, and in the end, most were employed for the static defense of the many islands occupied by the Japanese. Only 180 were made.

The turret seats the commander, gunner, and loader. It mounts a 37mm 1 Shiki gun and coaxial 7.7mm 97 Shiki machine gun (based on the ZB26, p. W97). Traverse of the turret is manual at 3° per second with the gunner turning the handwheel. The driver and hull gunner sit in the body.

The "Ka-Mi" burns 3.4 gallons of diesel per hour at routine usage. Fuel and ammo cost $415.

2 Shiki Kaijō Sensha "Ka-Mi"

Subassemblies: Waterproofed Small Tank chassis +3; Medium TD bow pontoon [Body:F] +3; Medium AFV aft pontoon [Body:B] +2; waterproofed full-rotation Small AFV turret [Body:T] +2; tracks +2.

Powertrain: 86-kW standard diesel engine with 86-kW tracked transmission and 66-gallon standard fuel tanks; two 43-kW screws [Aft Pontoon]; 8,000-kWs batteries.

Occ: 2 CS Body, 3 CS Both Cargo: 0

Armor	F	RL	B	T	U
Body:	4/45*	4/35	4/30*	4/25	4/35
Tracks:	4/35	4/35	4/35	4/35	4/35
Turret:	4/45	4/45	4/45	4/20	–
Pontoons:	3/8	3/8	3/8	3/8	3/8

* If fitted, the pontoons add DR 16 and act as standoff armor.

Weaponry

Ground LMG/97 Shiki [Body:F] (1,500 rounds).
37mm Medium Tank Gun/1 Shiki [Tur:F] (132 rounds).*
Ground LMG/97 Shiki [Tur:F] (1,470 rounds).*
* Linked.

Equipment

Body: Bilge pump; 3,400-lb. hardpoint [F]; 1,800-lb. hardpoint [B]. *Turret:* Backup driver option (only for movement in water); medium radio receiver and transmitter.

Statistics

Size: 25'×9'×8' *Payload:* 1 ton *Lwt:* 12.5 tons
Volume: 133 *Maint.:* 65 *Cost:* $9,350

HT: 12. HPs: 1,000 Body, 400 each Track, 150 Turret, 360 Bow Pontoon, 200 Aft Pontoon.

gSpeed: 23 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 5
Ground Pressure Low. 2/3 Off-Road Speed.
wSpeed: 6 *wAccel:* 1 *wDecel:* 10 (10) *wMR:* 0.1 *wSR:* 4
Draft: 5'. Flotation Rating 12.5 tons.

Design Notes

Design gSpeed was lowered 12% and wSpeed lowered 14% to the historical figures.

The volume of the chassis was a bit too small; as the next size was way too large and heavy, the missing 5.4 VSPs were deducted from the crew stations. (This isn't unrealistic, considering the reality of the cramped crew stations in most Japanese tanks.)

The pontoons were historically 44 and 21 VSPs large, while the design uses 50 and 20 VSPs. The undersized body volume also means the design lacks some floatation (body and pontoons provide only 22,325 lbs. of the 25,000 lbs. needed). The historical floatation rating is listed, instead. The draft was increased from the design 2' to the historical figure.

1 Shiki "Chi-He" Medium Tank

The 97 Shiki "Chi-Ha," the standard Japanese medium tank, was poorly armored and armed. The army belatedly recognized this, after having been deceived by easy victories over the armor-poor Chinese and Dutch forces. They developed the *1 Shiki Chūsensha* (type 2601 medium tank), commonly called the "Chi-He" (medium fourth), as a replacement. Based on the 97 Shiki "Chi-Ha," it had a new engine, welded armor, and a new turret with a 47mm 1 Shiki gun. This armor finally gave the Japanese tankers a fighting chance, although it still was insufficient against most Allied tanks. Some 587 were built.

Driver and hull gunner sit in the body, while commander, main gunner, and loader sit in the turret, which is traversed manually at 3° per second. The "Chi-He" burns 7.2 gallons of diesel per hour at routine usage. Fuel and ammo cost $1,010.

1 Shiki Chūsensha "Chi-He"

Subassemblies: Medium Tank chassis +3; full-rotation Small AFV turret [Body:T] +2; tracks +3.

Powertrain: 179-kW diesel with 179-kW tracked transmission and 62-gallon standard tanks; 12,000-kWs batteries.

Occ: 2 CS Body, 3 CS Tur Cargo: 0.5 Body, 3.5 Tur

Armor	F	RL	B	T	U
Body:	4/190	4/70	4/80	4/50	4/30
Tracks:	4/40	4/40	4/40	4/40	4/40
Turret:	4/190	4/95	4/95	4/50	–

Weaponry

Ground LMG/97 Shiki [Body:F] (2,010 rounds).
50mm Medium Tank Gun/1 Shiki [Tur:F] (120 rounds).
Ground LMG/97 Shiki [Tur:B] (2,010 rounds).

Statistics

Size: 19'×8'×8' *Payload:* 1.3 tons *Lwt:* 18.9 tons
Volume: 103 *Maint.:* 56 hours *Cost:* $12,540

HT: 12. HPs: 1,500 Body, 540 each Track, 150 Turret.

gSpeed: 27 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 4
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Design gSpeed was lowered 12% to the historical.

Variants

The *2 Shiki "Hōo-I"* of 1942 was intended for infantry fire support and issued to armored companies on the Japanese main islands. It mounted a 75mm 99 Shiki (75mm Short Tank Gun) and had a loaded weight of 16.5 tons. Only 30 were made and none saw combat.

The *3 Shiki "Ka-Chi"* of 1944 was an amphibious variant of the 1 Shiki, fitted with large floats much like those deployed on the 2 Shiki "Ka-Mi" (p. 65). It had a loaded weight of 28.7 tons and gSpeed 20, with wSpeed 6 when rigged for amphibious travel. Only 19 were built.

T-38 Amphibious Tank

The Soviet T-38 was a small amphibious tank for airborne units, based on the similar T-37. It had a reversible screw at the rear. Its riveted armor never could be made truly watertight. In 1937, it was slung under a Tupolev G-2 (p. 101) and dropped from low altitude (with crew aboard!) during exercises.

The T-38M2 was built from 1938. More than 1,300 of all versions were made. The Germans captured many and designated them PzKpfw 732(r) for rear-area policing duties.

The commander is seated in the turret, manning the 7.62mm DT machine gun. The turret is manually rotated at 9° per second. The T-38M2 burns 1.7 gallons of gasoline per hour at routine usage. Fuel and ammo cost $22.

Lyokhy Plavayushtshiy Tank T-38M2 obrazets 1938g

Subassemblies: Waterproofed Very Small Tank chassis with Light option +2; waterproofed full-rotation Medium Weapon turret [Body:T] +1; tracks +2.

Powertrain: 37-kW standard gas engine with 37-kW tracked transmission, 37-kW water screw, and 42-gallon standard fuel tanks; 4,000-kWs batteries.

Occ: 1 CS Body, 1 CS Both Cargo: 2.9 Body, 2.1 Tur

Armor	F	RL	B	T	U
Body:	4/35	4/35	4/25	4/20	4/20
Tracks:	4/30	4/30	4/30	4/30	4/30
Turret:	4/30	4/30	4/30	4/15	–

Weaponry

Ground LMG/DT [Tur:F] (1,512 rounds).

Statistics

Size: 12'×8'×5' *Payload:* 0.35 tons *Lwt:* 4.2 tons
Volume: 37 *Maint.:* 122 hours *Cost:* $2,680

HT: 8. HPs: 100 Body, 35 each Track, 75 Turret.

gSpeed: 28 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 4
Ground Pressure Very Low. 4/5 Off-Road Speed.
wSpeed: 4 *wAccel:* 1 *wDecel:* 10 (10) *wMR:* 0.25 *wSR:* 3
Draft: 1.4. Flotation Rating 4.2 tons.

Design Notes

Design flotation rating (3.125 tons) was adjusted to the historical figure. Design gSpeed was reduced 6%, and wSpeed 50%, to the historical figures.

Variants

The 3.9-ton *T-37* of 1932 had a 30-kW engine, 26-gallon tanks, and only 585 7.62mm rounds. It had wooden floats as mudguards over the tracks. Some 250 were built.

The original 3.6-ton *T-38* of 1936 had a 30-kW engine and 31-gallon tanks.

In late 1941, some T-38M2 tanks experimentally received a 20mm TNSh (20mm Long Aircraft Autocannon with RoF 13, a variant of the ShVAK) with 400 rounds in the turret. None of these entered service.

T-35 Heavy Tank

The T-35 heavy tank, based on German and British "land battleship" experiments and designed to breach heavy defenses, made its debut in the Moscow May parade of 1933. It mounted a main turret with a 76.2mm low-velocity gun and coaxial 7.62mm DT machine gun, two turrets with 45mm guns, and two MG turrets. The 45mm turrets were on the right front and left rear of the hull, and the MG turrets on the left front and right rear. The main turret could rotate 360°, while the smaller turrets could only rotate 184-200°, depending on individual location.

The hatches of the smaller turrets could not be opened without obstructing the field of fire of the main gun. Despite this hazard, this was the only way of moving in or out of the small turrets. Likewise, the main turret had only a roof hatch which was dangerous to use under enemy fire as the turret was tall and exposed. The crew relied on an intercom for communications between turrets and driver.

The early prototype tanks had 37mm PS-1 guns instead of the 45mm versions, but these were upgraded by the time that the main production run began. The new 45mm turrets were slightly modified BT-5 turrets, while the turrets with the 7.62mm DT machine guns were taken from the T-37 tank (p. 66). The secondary turrets were of dubious value. Like other tanks of this size in the 1930s, the T-35 was simply too large to adequately armor.

Sixty-one T-35s were built; none of them were exactly alike, since each was essentially hand-built. About half of them were made to the specifications of the *Tyazholyi Tank T-35 obrazets 1935g* (heavy tank T-35 model 1935).

The T-35 probably made its first battlefield appearance in the Winter War, although some sources dispute its presence there at all. Those that were still operational in 1940 were added to the 34th Tank Division. Most of those were lost to mechanical failures by mid-1941. The remaining few saw action in Moscow at the end of 1941. None were used in battle after 1941. Of 47 lost during WWII, only seven were destroyed by enemy fire. The rest succumbed to mechanical problems or terrain.

The T-35 initially had a crew of 11, but this was down to 10 by the time of the Winter War. There are three men in the main turret: the main turret gunner sits to the left of the main gun and serves as gunner for the 76.2mm PS-3 gun and coaxial 7.62mm DT MG. The vehicle commander serves as main gun loader and fires the rear turret MG, while the radio operator assists with loading the main gun; an optional MG was added externally to some vehicles, for use against aircraft. Each of the 45mm turrets has a gunner and loader and each of the MG turrets has a gunner. The driver sits in the steering compartment and drives the tank. These men often kept a large hammer nearby to persuade the stubborn shift lever to take up a new position.

Two mechanics are assigned to each tank, but do not ride in it; they follow behind with the support column. One is responsible for keeping the transmission and running gear operational, and the other is responsible for the engine.

The T-35 burns 16.8 gallons of gasoline per hour at routine usage. A full load of fuel and ammo costs $2,145.

Tyarzhelyi Tank T-35 obrazets 1935g

Subassemblies: Very Large Tank chassis +4; full-rotation Medium AFV turret 1 [Body:T] +2; two limited-rotation Large Weapon turrets 2-3 [Body:T] +2; two limited-rotation Medium Weapon turrets 4-5 [Body:T] +1; tracks +3.

Powertrain: 373-kW standard gas engine with 373-kW tracked transmission and 240-gallon standard fuel tanks; 16,000-kWs batteries.

Occ: See above. **Cargo:** 1.1 Body, 5.8 Tur 1

Armor	F	RL	B	T	U
Body:	4/120	4/100	4/70	4/80	4/80
Tracks:	4/50	4/50	4/50	4/50	4/50
Turret 1:	4/70	4/70	4/70	4/50	–
Turrets 2-5:	4/70	4/70	4/70	4/35	–

Weaponry

75mm Short Tank Gun/PS-3 [Tur 1:F] (96 rounds).*
Ground LMG/DT [Tur 1:F] (1,008 rounds).*
Ground LMG/DT [Tur 1:B] (1,008 rounds).
2×47mm Short Tank Guns/20Ks [Turs 2, 3:F] (110 each).*
2×Ground LMGs/DTs [Turs 2, 3:F] (2,016 rounds each).*
2×Ground LMGs/DTs [Turs 4, 5:F] (2,016 rounds each).
* Linked in each turret.

Statistics

Size: 32'×11'×11' *Payload:* 3.9 tons *Lwt.:* 45 tons
Volume: 227 *Maint.:* 33 hours *Price:* $36,400

HT: 7. HPs: 2,300 Body, 800 each Track, 200 Turret 1, 120 each Turrets 2-3, 75 each Turrets 4-5.

gSpeed: 19 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Loaded weight was increased 33%, and gSpeed reduced 27%, to the historical figures. HT was reduced from 9 to 7 to reflect the historical lack of reliability.

Variants

On the *T-35 obrazets 1937g,* reliability was improved (HT 8). About a dozen were made.

The *T-35 obrazets 1938g* was the ultimate version; all turrets' frontal armor increased to DR 120. Only six were built.

Some tanks had the forward 45mm gun turret (Tur 2) replaced with that from the OT-130 tank (see p. W:FH37), which mounted a KS-25 (Medium Vehicle Flamethrower) with 31 shots in place of the 45mm gun.

After being declared obsolete, some had their motive system removed and were mounted on railway flatcars, to be used by armored-train units much like the one on pp. 56-58.

Medium Tank M-3 Lee

The Blitzkrieg (see p. W16) made it clear that a better tank gun than the 37mm piece was needed. The U.S. M-2 medium tank then in development was unable to accept a 75mm in its turret, so it was mounted in the body, instead. While less than perfect, the resultant M-3 could be placed in production quickly – and the British needed tanks immediately.

The British ordered a slightly altered version as the *Cruiser Tank General Grant*, or just Grant, and also received the unmodified U.S. version under Lend-Lease as the *General Lee*. Both saw first combat in North Africa in May 1942. Grants and Lees were also supplied to the Australian, Indian, and Soviet armies in large numbers.

When the British began receiving Shermans in larger numbers, they transferred their M-3s to the Pacific Theater. The U.S. Army also used the M-3, but less prominently, and declared it obsolete in April 1944. More than 6,300 were built between 1941 and late 1942, 1,157 of them in Canada. Of those, 4,924 were of the basic M-3 (Lee I) variant.

Despite the awkward 75mm mounting, the tanks were appreciated when they appeared. Their main gun, either the M-2 or M-3 (both based on the French Schneider M-1897 field gun, see p. HT122), was more effective than the British 2-pounder, although its AP shot was insufficient. In North Africa, the British took to reloading cartridges with captured German APEX projectiles! The body mount also meant that the tank could not take a proper hull-down position and had restricted elevation (halving indirect-fire range).

The M-3 has a crew of six, leading the Russian to nickname it "a coffin for six brothers," because they did not care for the vehicle much. The commander sits high up in the turret and controls the .30 Browning M-1919A4 cupola gun. The cupola, which also serves as the commander's turret hatch, normally traverses with the turret, but can be rotated manually at 24° per second on its own. Also in the turret is the gunner of the 37mm M-6 gun and coaxial MG, and a loader. The body seats the driver, who also fires the fixed MGs fitted to the hull, the gunner of the 75mm M-2 gun, and the radio operator, who also loads the 75mm gun. The turret traverses hydraulically at 18° per second.

The M-3 uses 11.4 gallons of gasoline per hour at routine usage. A full load of fuel and ammo costs $1,065. Historical cost was $60,000.

Medium Tank M-3 (Lee I)

Subassemblies: Large Tank chassis with Mild slope +4; full-rotation Large AFV turret with Mild slope [Body:T] +3; full-rotation Mini cupola [Tur:T] +0; tracks +3.

Powertrain: 253-kW standard gas engine with 253-kW tracked transmission and 210-gallon standard fuel tanks; 1.5-kW auxiliary engine; 16,000-kWs batteries.

Occ: 3 CS Body, 3 CS Both **Cargo:** 0.9 Body, 0.2 Tur

Armor	F	RL	B	T	U
Body:	5/300	4/150	4/150	4/50	4/75
Tracks:	4/40	4/40	4/40	4/40	4/40
Turret:	5/300	4/200	4/200	4/85	–
Cup:	4/100	4/100	4/100	4/50	–

Weaponry

75mm Short Tank Gun/M-2 [Body:F] (47 rounds).
2×Ground LMGs/M-1919A4s [Body:F] (5,000 rounds).*
37mm Medium Tank Gun/M-6 [Tur:F] (178 rounds).**
Ground LMG/M-1919A4 [Tur:F] (4,100 rounds).**
Ground LMG/M-1919A4 [Cup:F] (100 rounds).
* Linked. ** Linked.

Equipment

Body: Fire extinguisher; medium radio receiver and transmitter; stabilization gear for 75mm gun. *Turret:* Two smoke dischargers per side [R, L]; stabilization gear for 37mm gun; 6-kW traversing gear.

Statistics

Size: 21'×9'×10' *Payload:* 2.1 tons *Lwt.:* 29.8 tons
Volume: 138 *Maint.:* 35 hours *Price:* $32,520

HT: 11. HPs: 1,800 Body, 600 each Track, 225 Turret, 30 Cup.

gSpeed: 26 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Very Low. 4/5 Off-Road Speed.

Design Notes

Loaded weight was reduced 8% to the historical figure.

Variants

The *Grant I* of 1942 used by the British had a different turret that lacked the cupola, added a 2" Bombthrower Mk I (51mm Vehicle Mortar) with 14 rounds, and had the radio in the turret. The Grant also had its ammo stowage rearranged, carrying 65 75mm, 128 37mm, and 4,025 .30 rounds. Many lacked the hull MGs and stabilizers.

The *M-3A1* or *Lee II* of 1941 differed by having a cast rather than riveted body. Some 300 were built.

The *M-3A3* or *Lee V* of 1942 had a welded body and twin 140-kW diesel engines and 150-gallon tanks. It weighed 31.5 tons with gSpeed 29. Some 322 were built.

The 32-ton *M-3A4* or *Lee VI* of 1942 returned to riveted armor, and had a troublesome 276-kW multibank engine with 160-gallon fuel tanks fitted. Some 109 were built.

The 32-ton *M-3A5* or *Grant II* of 1942 had the British turret and diesel engines like the A3, but returned to a riveted hull. It had gSpeed 29. Some 591 were built.

The 15.8-ton *M-4 18-ton High-Speed Tractor* of 1942 used the M-3's basic automotive system, but was unarmored and had a 157-kW engine; gSpeed 33. It seated 11. It was used to tow artillery such as the 90mm M-1 AA gun (with 54 rounds stowed) or the 155mm M-1 field gun (p. 27) with 30 rounds stowed. A ring mount with a .50 M-2HB (Very Long Ground HMG) with 500 rounds was provided.

The basic chassis also served as the basis of the *M-7 Howitzer Motor Carriage* (see p. W:D80).

The 32.8-ton *M-31 Armored Recovery Vehicle* of 1942 replaced the 75mm and 37mm guns with wooden dummies (leaving only two M-1919A4 MGs with 2,000 rounds), added a 15-ton boom, and put a 30-ton winch in the fighting compartment. It was based on the M-3. The *M-31B1* was based on the M-3A3 and the *M-31B2* was based on the M-3A5.

Heavy Tank M-6A1

The M-6A1 was the heaviest U.S. tank built during WWII. Its development began in 1940, when the Army wanted a heavy tank to go with its M-3 light (see p. W:D78) and M-3 medium tanks (p. 68). The resultant M-6A1 (and its almost identical brother, the M-6) was adopted in May 1942. It mounted two cannon in the turret and three machine guns in the hull, keeping busy a crew of six.

The first production vehicles were delivered in December 1942 and trials started early the next year. Test reports concluded that the vehicle was unsatisfactory without a complete redesign; for example, the telescopic sight was installed so close to the main gun that the gunner could only use his left eye to sight through it. The 76.2mm gun was considered too small for such a behemoth, and the 37mm gun was considered superfluous. The overall weight was too high, the Armor Force preferring two 30-ton tanks over one 60-ton vehicle for reasons of transportation and mobility. In addition, there was no place for the design in the tactics of the time.

In short, it was nothing the Army really wanted and the program was thus canceled. Nevertheless, a total of 43 tanks of the series were built, the last being delivered in early 1944. None of them ever saw combat. At one point, they were to be off-loaded to the British and other Allies under the Lend-Lease program, but this never was put into motion. The tank became largely a forgotten afterthought.

The turret seats the commander, gunner, and loader. The gunner fires both the 76.2mm M-7 and 37mm M-6 tank guns, while the commander mans the antiaircraft machine gun on the roof. The turret is powered and rotates at 18° per second, or 1° if manually turned by the gunner and loader. The driver, hull gunner, and ammo passer sit in the body. The driver fires the fixed .30-caliber Browning M-1919A4 machine gun in the bow, while the bow gunner mans the twin .50-caliber Browning M-2HB guns. The ammo passer passes ammunition for the main guns to the loader in the turret.

The M-6A1 burns 27.7 gallons of gasoline per hour at routine usage. Fuel and ammo cost $3,000.

Heavy Tank M-6A1

Subassemblies: Immense Tank chassis +4; full-rotation Large AFV turret [Body:T] +3; full-rotation Mini open mount [Tur:T] +0; tracks +4.

Powertrain: 615-kW standard gas engine with 615-kW tracked transmission and 477-gallon self-sealing tanks; 12,000-kWs batteries.

Occ: 3 CS Body, 3 CS Both **Cargo:** 1.76 Body

Armor	F	RL	B	T	U
Body:	4/405	4/145	4/135	4/80	4/80
Tracks:	4/55	4/55	4/55	4/55	4/55
Turret:	4/330	4/270	4/270	4/80	–

Weaponry

2×VL Ground HMGs/M-2HBs [Body:F] (3,400 rounds each).*
Ground LMG/M-1919A4 [Body:F] (2,750 rounds).
75mm Long Tank Gun/M-7 [Tur:F] (75 rounds).**
37mm Medium Tank Gun/M-6 [Tur:F] (202 rounds).**
Ground LMG/M-1919A4 [OM:F] (2,750 rounds).
* Linked. ** Linked.

Equipment

Body: Fire extinguisher; medium radio and transmitter; 8-kW traversing gear for turret. *Turret:* Partial stabilization for the main guns. *OM:* Universal mount.

Statistics

Size: 27'×10'×9' *Payload:* 4.2 tons *Lwt:* 63.15 tons
Volume: 218 *Maint.:* 30 hours *Cost:* $43,300

HT: 9. HPs: 2,600 Body, 900 each Track, 200 Turret, 30 OM.

gSpeed: 22 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Moderate. 1/2 Off-Road Speed.

Design Notes

In order to fit the design into the Immense Tank chassis, the 30° slope on the hull front slope was ignored; instead, 50% more armor was bought for the body front position. Weight still had to be increased 15% (and gSpeed lowered 12%) to match the historical values.

Variants

The *M-6* began production at the same time as the M-6A1, but was the less common variant. It differed mainly in having cast rather than welded armor. It is identical in game terms.

The *M-6A2* was only built as a prototype. It had two electric 307-kW motors driving the tracks, which allowed the engine to operate at its most efficient speed at all times, since there was no direct connection between the engine and tracks, and also allowed an infinitely variable turning radius.

Sherman Variant: M-32B1

The M-32B1 was an armored recovery vehicle based on the chassis of the M-4A1 medium tank (see p. W102), designed to recover and, if possible, repair damaged combat vehicles close to the front.

Instead of the turret, it had a fixed superstructure mounting a folding 18' A-frame boom. A winch capable of pulling 30 tons was installed on the floor directly behind the driver, paying out its 60-yard cable through the roof of the superstructure, or through small holes in the body front or superstructure back. The winch could be used to either tow a disabled vehicle, or, with the help of the A-frame, to lift another vehicle or object (such as an engine or road obstacle) massing up to 15 tons. The winch and boom were controlled by the driver. Storage compartments in and on the vehicle held cutting torch, hydraulic jack, and various other tools amounting to a full Mechanic tool kit (see p. W89).

An 81mm M-1 mortar (see p. W97) was affixed externally to the front of the superstructure; it fired smoke shells to obscure the vehicle's position. In addition, there was a ring-mounted .50-caliber Browning M-2HB machine gun (see p. W97) on top of the superstructure, and a hull-mounted .30-caliber Browning M-1919A4 (see p. W97) as well.

A total of 1,055 M-32B1s were built in 1943-45, making it the most numerous armored recovery vehicle of the entire war. The maintenance section of each U.S. medium-tank company included an ARV, a jeep (p. W106), and an M-3 halftrack (p. W109). A battalion's maintenance platoon had two ARVs, two jeeps, two 2½-ton trucks (p. W107), two 1-ton trailers (p. 28), and two M-1 heavy wreckers (p. 33). The British army used the M-32B1 as the *Sherman II ARV III.*

The superstructure seats the commander, gunner, and two riggers. The driver and hull gunner/radio operator are in the body. The M-32B1 burns 11.8 gallons of gasoline per hour. Fuel and ammo cost $240. Historical cost was $52,217.

Armored Recovery Vehicle M-32B1 (Sherman II ARV III)

Subassemblies: Large Tank chassis +4 with Mild slope; Large AFV superstructure [Body:T] +3; Mini open mount 1 [Sup:F] +0; full-rotation Mini open mount 2 [Sup:T] +0; tracks +3.

Powertrain: 263-kW standard gas engine with 263-kW tracked transmission and 175-gallon self-sealing fuel tanks; 16,000-kWs batteries.

Occ: 2 CS Body, 4 CS Sup **Cargo:** 5.3 Body, 10.9 Sup

Armor	F	RL	B	T	U
Body:	5/300	4/150	4/150	4/75	4/50
Tracks:	4/45	4/45	4/45	4/45	4/45
Sup:	4/140	4/140	4/140	4/100	–
OMs 1-2:	0/0	0/0	0/0	0/0	–

Weaponry

Ground LMG/M-1919A4 [Body:F] (2,000 rounds).
81mm Mortar/M-1 [OM 1:F] (30 rounds).
Very Long Ground HMG/M-2HB [OM 2:F] (600 rounds).

Equipment

Body: Fire extinguisher; medium radio and transmitter; 15-ton winch. *Sup:* 18' A-frame. *OM 2:* Universal mount.

Statistics

Size: 19'×9'×9' *Payload:* 2.9 tons *Lwt:* 31 tons
Volume: 139 *Maint.:* 41 hours *Cost:* $24,190

HT: 10. HPs: 1,800 Body, 600 each Track, 200 Sup, 30 each OM.

gSpeed: 28 *gAccel:* 2 *gDecel:* 20 *gMR:* 0.25 *gSR:* 6
Ground Pressure Low. 2/3 Off-Road Speed.

Design Notes

Three of the superstructure crew are actually half in the superstructure, half in the body.

Variants

There were several sub-variants of the M-32, depending on which M-4 chassis was used as the basis: the *M-32* of 1944 was based on the M-4 with welded hull (563 built); the scarce *M-32B2* of 1943 was based on the M-4A2 with twin 140-kW diesel engines (26 built); the *M-32B3* of 1944 was based on the M-4A3 with a 335-kW engine (318 built); and the *M-32B4* of 1944 was based on the M-4A4 with its 276-kW multibank engine. There were no differences in equipment.

The *M-32A1B3* of 1945 was based on the M-4A3E8 (p. W102) with the horizontal volute suspension system (HVSS). Some 80 were made for the U.S. Marines.

The *M-34* of 1943 was a makeshift conversion to allow its use as a prime mover for the 240mm M-1 howitzer or 8" M-1 gun. It lacked all the weapons, the A-frame, and the tools. The crew of six manned the artillery piece.

The *T-1E1 "Earthworm"* mine-exploder system of 1944 consisted of three heavy mine-roller sets mounted on the front of an M-32. It added 18 tons to the vehicle and required the boom to help steer it. While effective in detonating mines, the system was too heavy to allow easy deployment and made turns difficult. Some 75 were built and some saw experimental front-line usage.

THE HANGAR

The most spectacular evolution of warfare in WWII took place in the air. The romanticized and motorized kites of the Great War gave way to shrieking steel birds of prey. These made the air into a combat theater in its own right. Meanwhile, they retained more than their share of glamour, at least as long as one's particular plane had not become obsolete . . .

Dewoitine D.510

The Dewoitine D.510 was the first French fighter to exceed 250 mph. A single-engined low-wing monoplane with an open cockpit, it was adopted in 1936 by the Armée de l'Air as the D.510-C1. About 120 were built and most of them were employed by France. It didn't see any action during the German invasion, however, being essentially obsolete by then.

The engine burns 32.1 gallons of gas per hour at routine usage. Fuel and ammo cost $40.

Dewoitine D.510-C1

Subassemblies: Light Fighter chassis +3; Light Fighter wings with Fixed Strut option +2; three wheels +0.

Powertrain: 642-kW aerial turbocharged gas engine with 642-kW old prop, 15-gallon standard tank [Body], and 57-gallon standard tanks [Wings]; 2,000-kWs batteries.

Occ: 1 XCS Body Cargo: 3.6 Body, 1.2 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3

Weaponry

20mm Long Air. AC/Hispano-Suiza S.9 [Body:F] (60).*
2×Aircraft LMGs/MAC Mle 34As [Wings:F] (300 each).*
* MGs linked, additional link fires all three.

Equipment

Body: Navigation instruments; medium radio receiver and transmitter.

Statistics

Size: 26'×40'×9' *Payload:* 0.7 tons *Lwt:* 2.1 tons
Volume: 144 *Maint:* 60 hours *Cost:* $11,310

HT: 10. HPs: 100 Body, 70 each Wing, 5 each Wheel.

aSpeed: 249 *aAccel:* 8 *aDecel:* 24 *aMR:* 6 *aSR:* 1
Stall Speed 65.
gSpeed: 232 *gAccel:* 11 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Low. 1/3 Off-Road Speed.

Design Notes

Weight, cost, and HPs of the body were doubled. Design aSpeed was decreased 5% to the historical figure.

Variants

The earlier 1.9-ton *D.500-C1* of 1932 was very similar, but had a 515-kW engine with aSpeed 229. It was armed with a 20mm Hispano-Suiza S.7 (20mm Long Aircraft AC) with 60 rounds and two 7.5mm Darne Mle 29s (Aircraft LMGs) with 300 rounds each. Of the 97 built, seven flew in the Spanish Civil War on the Republican side. It was no longer in French service by 1940.

The 2-ton *D.501-C1* of 1935 had the same armament as the D.510 but a 515-kW engine with aSpeed 223. Of the 143 made, 20 were used by the Republicans in the Spanish Civil War. Some 57 were still in French service in 1940.

Lithuania acquired 14 D.501s in 1937, armed with just two 7.92mm Darne Mle 33s (Aircraft LMGs) with 300 rounds each.

Some 24 D.510s were sold to China in 1937, and saw combat against the Japanese in 1938. These had a S.9 cannon and two 7.5mm Darne Mle 33s with 300 rounds each.

Pilot Survival Kit

While all air forces – sometimes even individual branches and units – used their own survival kits, they were all essentially similar. As an example, the equipment carried by Luftwaffe fighter pilots on single-seaters such as the Bf 109 (p. W111), Me 262 (p. W:IC89), or Hs 129 (p. 80) is detailed here:

Each pilot would wear a parachute (pp. W88, W:HS25), life jacket (usually self-inflating, p. W88), one-man self-inflating dinghy (as seat cushion), and *Kanalhosen* outfit – field jacket, boots, and multipocketed "channel trousers," so called because they were first used in the Battle of Britain.

The accessories carried included a pistol such as the Walther PPK (p. W94) or Mauser C34 (p. W:IC62) with spare magazine; LP 28 flare pistol (either in a holster or tucked in the right boot; p. W:IC62); leg strap worn around the left boot holding 10 assorted flares (more were often stowed in additional bandoleers – the Luftwaffe used an elaborate combination of flares and smoke signals for emergency communication); gravity knife (p. W:IC59); watertight match box with 20 matches; sun glasses (p. W87); individual first aid kit (including burn bandage, compress bandage, two morphine syrettes, iodine antiseptic, frostbite salve, safety pins and stitching needles, and 10 Pervitin tablets; +1 to First Aid; pp. W90, W:IC58); compass (pp. W87, W:IC58); signaling mirror; distress flag; floating signaling lamp (60-hour battery); dye marker (p. W:HS23); orange smoke signal (2-minute duration); and hand-held flare.

Emergency sustenance consisted of the *Absprungverpflegung* (bail-out ration): a waterproof tin filled with *Scho-Ka-Kola* (caffeine-rich chocolate, reduces Fatigue by 1 for 2 hours, but then increases it by 2), chewing gums, dextrose tablets, and a few Pervitin tablets. In addition, the pilot usually wore a 0.5-liter thermos bottle holding his favorite beverage on the belt.

Blohm & Voss Bv 138 Seedrache

The Bv 138 was originally conceived in 1934 as a very long range reconnaissance flying boat for the German *Küstenflieger* (coastal aviation). It had a rather oddly shaped boat hull with a high wing mounting three engines, the two outer engine pods extending back into a twin tail. Its range was increased by using fuel-efficient diesel engines, but these had the drawback of making it slow and limited its ceiling to 16,400'.

The Bv 138 was designed by the Hamburger Flugzeugfabrik, but production took place at the aircraft division of the shipyard Blohm & Voss from 1939. Officially known as the *Seedrache* (sea dragon), it was more commonly called *Fliegender Holzschuh* (flying clog) due to its ungainly appearance. The Bv 138C-1 introduced in 1941 was the most common version, with 227 being made. A total of 164 were modified to the C-1/U1, which added hardpoints under both wings (rather than just under the right wing).

The aircraft was first used in the invasion of Norway, and soon became a common sight over the northwestern seas around Europe, mainly for the shadowing of Allied convoys in the North Atlantic, although some were also used in the Black Sea and the Mediterranean. Its large cargo cabin between the radio operator's cabin and the rear turret could carry up to 10 passengers; this capacity could be used in sea-rescue operations, and was especially useful for the Luftwaffe's KG 200 special-ops squadron, which employed it for insertion and extraction of agents.

The crew consists of a pilot, navigator, radio operator, and two gunners. Armament encompasses two 20mm Mauser MG 151/20 autocannons in turrets in the bow and tail (with powered traverse at 30° per second), and a 13mm Rheinmetall MG 131 machine gun in a rear-facing open mount (manually traversed at 30° per second). An optional 7.92mm Rheinmetall MG 15 machine gun can be installed to fire out of the radio operator's right-side cabin window. Six 110-lb. bombs or four 330-lb. depth charges can be carried under the wings, but these are seldom carried given the usual recon missions.

The engines burn 88.6 gallons of diesel fuel per hour at routine usage. Fuel and ammo cost $590.

Blohm & Voss Bv 138C-1/U1

Subassemblies: Waterproofed Light Bomber chassis +4; waterproofed Heavy Bomber wings with Fixed Strut option +4; two Large Weapon pontoons 1-2 [Body:R, L] +2; two waterproofed Small AFV engine pods 1-2 [Wings:F] +2; waterproofed Small AFV engine pod 3 [Wings:T] +2; waterproofed full-rotation Medium Weapon turret 1 [Body:T] +1; waterproofed limited-rotation Medium Weapon turret 2 [Body:T] +1; limited-rotation Mini open mount [Body:T] +0; fixed gear +2.

Powertrain: three 656-kW aerial HP diesel engines with MW feed and three 746-kW props [Pods 1-3], 201-gallon self-sealing tanks [Body], 1,178-gallon self-sealing tanks [Wings], and 9-gallon light tanks for MW feed [R Wing]; 8,000-kWs batteries.

Occ: 4 CS Body, 10 PS Body, 1 CS each Turret 1-2

Cargo: 48.2 Body, 11.7 Wings, 10 each Pontoon 1-2

Armor	F	RL	B	T	U
Body:	2/3	2/3	2/3	2/3	3/10
OM:	0/0	0/0	0/0	0/0	–
All Else:	2/3	2/3	2/3	2/3	2/3

Weaponry

Aircraft LMG/MG 15 [Body:R] (1,800 rounds).*
20mm Medium Aircraft AC/MG 151/20 [Tur 1:F] (1,000).
20mm Medium Aircraft AC/MG 151/20 [Tur 2:F] (1,000).
Medium HMG/MG 131 [OM:F] (2,000 rounds).
* Optional.

Equipment

Body: Autopilot; backup driver controls; environmental control; IFF; navigation instruments; precision navigation instruments; large radio receiver and transmitter; medium radio receiver and transmitter; small toilet. *Wings:* three 220-lb. hardpoints each [U]. *Turrets 1-2:* 0.25-kW traversing gear; universal mount.

Statistics

Size: 65'×88'×22' *Payload:* 3.7 tons *Lwt:* 16 tons
Volume: 1,080 *Maint:* 24 hours Cost: $69,480

HT: 7. HPs: 375 Body, 80 each Pontoon 1-2, 413 each Wing, 150 each Pod 1-3, 75 each Turret 1-2, 30 OM.

aSpeed: 177 *aAccel:* 4 *aDecel:* 16 *aMR:* 4 *aSR:* 2
Stall Speed 71. -2 aSpeed per loaded hardpoint.
wSpeed: 19 *wAccel:*4 *wDecel:* 2 (4) *wMR:* 0.1 *wSR:* 3
Draft 2.3'. Flotation Rating 22.9 tons.

Design Notes

The historical 1,206-sf wing area was used for performance calculations. Design aSpeed was reduced 17%. Like most seaplanes in both the design system and real life, the Bv 138 has difficulties taking off even with the methanol-water boost; assume a 5-mph headwind is needed. The Bv 138 had no ground landing gear; it could only land on water. The engines are 0.9 VSPs too big for the pods; the overflow was placed in the wings. Weight, cost, and HPs of the wings were halved. The engines develop 746 kW with MW injection.

Two 2,200-lb. solid-fuel rocket packs could be added under the wings for rocket-assisted takeoff. Each weighed 550 lbs. and burned for 42 seconds. (These real-life statistics are *far* more efficient than the generic designs on p. W129.) With rockets, wSpeed becomes 46, wAccel 7, aSpeed 186, and aAccel 7. Alternatively, it can take off at 19.8 tons loaded weight with wSpeed 44, wAccel 6, aSpeed 182, and aAccel 6.

Variants

The *Bv 138A-0* of 1939 had three 485-kW engines, with a 20mm Rheinmetall-Lübbe MG 204 (20mm Medium Aircraft AC) in the bow turret and a 7.92mm MG 15 in the aft turret and rear. It had only three hardpoints below the right wing. Six were built of the 15-ton A-0 version, 25 of the similar A-1 of 1940.

The 16-ton *Bv 138B-0* of 1940 introduced the 656-kW engines and the two MG 151/20 turrets. Ten of the B-0 version and 21 more of the B-1 were produced.

Dornier Do 24

The German Do 24 was a sturdy flying boat designed in the 1930s to a requirement of the Dutch East Indies. In its design, Dornier drew on the earlier Do 15 Wal and Do 18. It had a high monowing, three engines, and two pontoons on the lower body sides, which gave both stability on water and added lift in flight. It was very seaworthy in rough waters.

From 1937, Dornier delivered 11 Do 24K-1s to the Dutch, who built 26 under license. Most of these were used in the Pacific, six ending up in service with the Royal Australian Air Force. When Germany invaded the Netherlands, they captured some and had more built there and in France, until 218 were in service. Most were of the upgraded T-series, which featured more powerful engines and armament.

The Do 24T-2 entered service in 1943. The Germans used it mainly for long-range maritime reconnaissance and for sea rescue in the waters around Europe, including the North Sea, the Mediterranean, and the Black Sea. The Luftwaffe's special-ops squadron KG 200 also employed a few.

The crew of six had four folding bunks and a toilet in the back for extended operations. Up to 18 rescued people could be carried (and on at least one occasion during the evacuation of Crete, as many as 40 were squeezed in). During the war, German Do 24s rescued some 11,600 people, a third of them Allies.

Armament includes two 7.92mm Rheinmetall MG 15s in cupolas in the bow and tail (30°-per-second manual traverse), and a 20mm Mauser MG 151/20 in the dorsal position (with powered traverse at 45° per second). Twelve 110-lb. bombs can be carried under the wings, but are seldom fitted.

The engines burn 111 gallons of fuel per hour at routine usage. Fuel and ammo cost $365.

Dornier Do 24T-2

Subassemblies: Waterproofed Light Bomber chassis +4; waterproofed Light Bomber wings with STOL and Fixed Strut options +4; two Small AFV pontoons 1-2 [Body:R, L]; three waterproofed Large Weapon pods 1-3 [Wings:F] +2; three waterproofed full-rotation Medium Weapon turrets 1-3 [Body:T] +1.

Powertrain: three 740-kW aerial HP turbocharged gas engines with three 740-kW props [Pods 1-3], 528-gallon self-sealing tanks [Wings], and two 360-gallon self-sealing tanks [Pontoons 1-2]; 8,000-kWs batteries.

Occ: 3 CS, 18 PS Body; 3 CS Turs Cargo: 16 Body, 16 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3

Weaponry

Aircraft LMG/MG 15 [Tur 1:F] (1,200 rounds).
20mm Medium Aircraft AC/MG 151/20 [Tur 2:F] (500).
Aircraft LMG/MG 15 [Tur 3:F] (1,200 rounds).

Equipment

Body: Autopilot; backup driver option; 25-man environmental control; navigation instruments; precision navigation instruments; large radio receiver and transmitter; medium radio receiver and transmitter; small toilet. *Wings:* six

110-lb. hardpoints each [U]. *Turrets 1, 3:* Universal mount. *Turret 2:* 0.5-kW traversing gear; universal mount.

Statistics

Size: 72'×89'×18' *Payload:* 6 tons *Lwt:* 18 tons
Volume: 1,080 *Maint:* 20 hours *Cost:* $101,255

HT: 7. HPs: 375 Body, 150 each Pontoon 1-2, 825 each Wing, 120 each Pod 1-3, 75 each Turret 1-3.

aSpeed: 186 *aAccel:* 4 *aDecel:* 16 *aMR:* 4 *aSR:* 2
Stall Speed 62. -1 aSpeed per loaded hardpoint.
wSpeed: 22 *wAccel:* 4 *wDecel:* 10 (10) *wMR:* 0.1 *wSR:* 4
Draft 2.2'. Flotation Rating 23.9 tons.

Design Notes

The historical 1,163-sf wing area was used for performance calculations; the special body pontoons also add 10% of their surface to lift, just like the body. Nevertheless, it requires a 16-mph headwind to take off. Design aSpeed was reduced by 12% to the historical figure. Design aMR was halved to make it more realistic.

The Do 24 had no ground landing gear; it could only land on water. The gunners are half in each turret, half in the body.

Variants

The 13.6-ton *Do 24K-1* of 1937 was the original version in service with the Dutch. It had 556-kW engines. Originally armed with three 7.92mm FN-Browning #3NMs (Aircraft LMGs with RoF 25) with 500 rounds each, it later gained a 20mm Hispano-Suiza #1 (20mm Long Aircraft AC) with 210 rounds installed in the dorsal position. The crew was five.

Those in the Dutch East Indies were armed with the .303 Armstrong-Browning #3; when six of these entered service with #41 Squadron of the Royal Australian Air Force in 1943, they received a .50 Browning #2 Mk II (Long Aircraft HMG) with 500 rounds in the bow and aft.

The *Do 24N-1* of 1940 was the first version employed by the Germans, in this case the civilian *Seenotdienst* (sea rescue service). It was unarmed and sported highly visible Red Cross markings. It was based on the Do 24K-1; 13 were in service.

The *Do 24T-1* of 1941 retained the Hispano-Suiza cannon of the Do 24K-1 (called the MK 404 in German service) and introduced the MG 15s.

The *Do 24T-3* of 1944 received the 13mm Rheinmetall MG 131 (Medium Aircraft HMG) with 500 rounds each for the bow and aft cupolas, and a 15mm Mauser MG 151 (15mm Very Long Aircraft HMG) with 500 rounds amidships. In 1944, a dozen were delivered to Spain, and from early 1945, captured specimens were in use with the French navy. The French aircraft substituted the 7.5mm MAC Mle 34/39 (Aircraft LMG).

Dornier Do 335 Pfeil

One of the most distinctive late-war Luftwaffe fighters, the Do 335 holds the record as the fastest piston-engine fighter in history. It was a streamlined, sleek aircraft (whence its name, *Pfeil* meaning arrow), with an engine in the nose *and* tail, and the propellers synchronized to pull and push. This configuration allowed for clean wings and reduced frontal area, reducing drag. The forward propellers featured variable pitch and could be reversed to shorten the rather long landing run.

In 1943, events led Hitler himself to press for faster development of the Me 262 (see p. W:IC89) and Do 335 programs – however, Willi Messerschmitt persuaded him that the Me 262 would be better suited as a high-speed bomber, and the Do 335 was scaled down in priority, despite its bombload being twice that of the Me 262.

The pre-production A-0 version was finally produced from late 1944, closely followed by a series of trial variants. It was well-liked, the crews nicknaming it *Ameisenbär* (anteater) because of the distinctive appearance of its nose. Some teething problems were the poor vision to the rear, weak undercarriage, and a general unreliability. Due to Allied bombing and the delays in development, it never reached full production – 37 had been completed when the war ended, half of that number being prototypes, and about 70 were awaiting final assembly. Eleven of these were Do 335A-1s, first delivered in January 1945. Some A-0s and A-1s were used by III. Gruppe of Kampfgeschwader 2 (III./KG 2) in spring 1945. No records suggest that the planes ever engaged in combat.

The Do 335A-1 was fitted with an air-powered ejection seat, made necessary to clear the rear propeller. In addition, the tail and propeller could be jettisoned by explosive bolts when required. Two synchronized 15mm Mauser MG 151 machine guns were mounted in the nose, a 30mm Rheinmetall MK 103 cannon in the motor tunnel.

The engines burn 129 gallons of fuel per hour at routine usage. Fuel and ammo cost $240.

Dornier Do 335A-1 Pfeil

Subassemblies: Heavy Fighter-Bomber chassis with Good streamlining +4; Light Fighter-Bomber wings with High-Agility option +3; three retractable wheels +1.

Powertrain: two 1,290-kW aerial HP supercharged gas engines with two 1,290-kW props, 325-gallon self-sealing tanks [Body], and 164-gallon self-sealing tanks [Wings]; 4,000-kWs batteries.

Occ: 1 CS Body **Cargo:** 11.8 Body, 0.8 Wings

Armor	F	RL	B	T	U
Body:	3/5	3/5	3/5	3/5	3/5
Wings:	3/5W	3/5W	3/5W	3/5W	3/5W
Pilot:	0/+10	0/+0	0/+30	0/+0	0/+0

Weaponry

2×15mm VL Aircraft HMGs/MG 151s [Body:F] (200 each).*
30mm Medium Aircraft AC/MK 103 [Body:F] (70 rounds).*
* Links the MG 151s and all together.

Equipment

Body: Autopilot; 2,200-lb. bomb bay; ejection seat; IFF; 0.25-man/day life support; navigation instruments; small radio direction finder; medium radio receiver and transmitter. *Wings:* 550-lb. hardpoint each [U].

Statistics

Size: 45'×45'×16' *Payload:* 2.4 tons *Lwt:* 10.6 tons
Volume: 640 *Maint:* 22 hours *Cost:* $84,500

HT: 10. HPs: 525 Body, 160 each Wing, 50 each Wheel.

aSpeed: 474 *aAccel:* 7 *aDecel:* 12 *aMR:* 3 *aSR:* 2
Stall Speed 101. -10 aSpeed per loaded hardpoint.
gSpeed: 238 *gAccel:* 11 *gDecel:* 10 *gMR:* 0.25 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

Weight was increased 18% to the historical figure. The actual 414-sf wing area was used for performance calculations. The reversible propeller allowed shortening the landing run from 689 yards (1,020 as designed) to 514 yards (658 as designed) by adding half of gAccel to gDecel (see p. W149).

Variants

The *Do 335A-0* of 1944 was the pre-production version. It had different engines, a smaller 1,100-lb. bomb bay, and lacked the wing hardpoints. Ten were built.

The *Do 335A-6* of 1945 was designed as a twin-seat night fighter, with the second cockpit for the radar operator located above and behind the pilot. The bomb bay was replaced by a redesigned 488-gallon fuel tank and the 4-mile targeting FuG 217 Neptun J-2 radar, with its antenna located in the wing leading edges. The engines included a MW-boost system with 39.6-gallon tank. One prototype was begun, but not completed.

The 11.1-ton *Do 335A-12* of 1945 was designed as a twin-seat trainer. The bomb bay was replaced by a second crew seat with the backup driver option. The instructor's position did not have an ejection seat, due to production shortages. Only two prototypes were built.

The *Do 335B-4* of 1945 was designed as a *Zerstörer* (destroyer), with the MG 151s replaced by 20mm Mauser MG 151/20s (20mm Medium Aircraft Autocannons) with 200 rounds each and two additional MK 103 cannons with 100 rounds each in the wings. It had no bomb bay. One prototype was built.

Fieseler Fi 156 Storch

The Fi 156 was designed in the mid-1930s as a light STOL utility plane, entering service in 1937. The Storch (stork) possessed remarkable short-field characteristics, being capable of taking off in 70 yards with a light breeze and landing within 20 yards. Its nickname came from the drooping appearance of the main landing gear in flight. This odd design allowed it to more easily take a hard landing.

Aside from the utility role, the Fi 156 was also used as an ambulance (a stretcher replacing the observer and passenger) and for communications and reconnaissance. The Fi 156C-3 was the first version that was truly multirole.

Some 2,900 Fi 156s of all versions were built. Outside of Germany, the RAF was the largest user, operating roughly 60 captured aircraft. British Field Marshal Montgomery (see p. W:AKM54) preferred the Storch as his personal air transport, as did Feldmarschall Rommel (see p. W:IC54), who often flew the plane himself. Others were exported to Bulgaria (20), Hungary (36), Romania (42), Spain (21), and Sweden (26). From 1943, Romania built it under license, but managed to make only 16 before the war ended.

Perhaps the most famous use of the Fi 156 was the rescue of Benito Mussolini on September 12, 1943 (see p. W:HS9). SS-Sturmbannführer Skorzeny (see pp. W:IC54, W:WW38) had originally planned to use a Fa 223 helicopter (p. 76) to pull the former dictator out of the mountain hotel in which he was held captive. When the helicopter became unavailable, a Fi 156 was used; it landed on a small terrace and, overloaded, was flown off the edge. Twelve Fallschirmjäger held onto the tail as the engine was revved up; suddenly releasing the plane acted as a mild (but important) catapult effect.

A more infamous (for the Germans) incident involving the Storch was the crash of a Fi 156 carrying the invasion plans for France. The plane went down in Belgium in January 1940, delaying the invasion until May while new plans were made.

A Storch was also involved in one of the more bizarre air combats of the war. The crew of an unarmed U.S. Piper L-4 Grasshopper (see p. W:D31) saw a Fi 156 while on an artillery-spotting mission in April 1945 and opened fire with their .45 Colt M-1911A1 pistols (see p. W94). The damaged plane was forced down and the Americans landed behind it, taking the German crew prisoner. It was the only recorded downing of an aircraft by pistol fire in the war.

The normal crew was one, but a gunner/observer manning the 7.92mm Rheinmetall MG 15 and a passenger could be carried as required. There was a small baggage compartment behind the cabin.

The Fi 156C-3 uses 9 gallons of fuel per hour at routine usage. A full load of fuel and ammo costs $13.

Fieseler Fi 156C-3 Storch

Subassemblies: Light Fighter chassis +3; Medium Fighter wings with STOL and Fixed Strut option +2; 3 wheels +0.

Powertrain: 179-kW aerial HP gasoline engine with 179-kW old prop, 39-gallon standard tanks [Wings]; 2,000-kWs batteries.

Occ: 2 CS, 1 PS Body Cargo: 0.9 Body, 2.7 Wings

Armor	F	RL	B	T	U
All:	2/2C	2/2C	2/2C	2/2C	2/2C

Weaponry

Aircraft LMG/MG 15 [Body:B] (300 rounds).

Equipment

Body: Autopilot; navigation instruments; medium radio transmitter and receiver.

Statistics

Size: 32'×47'×10' *Payload:* 0.4 tons *Lwt.:* 1.45 tons
Volume: 144 *Maint.:* 63 hours *Price:* $10,135

HT: 8. HPs: 50 Body, 105 each Wing, 5 each Wheel.

aSpeed: 109 *aAccel:* 3 *aDecel*: 52 *aMR:* 13 *aSR:* 1
Stall Speed 36.
gSpeed: 109 *gAccel:* 9 *gDecel*: 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Very High. 1/8 Off-Road Speed.

Design Notes

Design aSpeed was reduced 13%, and gSpeed reduced 45%, to the historical figures.

Variants

A 54-gallon auxiliary fuel tank could be installed in place of the observer and passenger. Some Fi 156s underwent trials carrying three 110-lb. bombs or a single depth charge. While there was little organized use of Fi 156s in such offensive roles, PCs may be forced to do so (or interested in such operations), especially late in the war.

The *Fi 156A-1* of 1938 lacked the MG and had a less generous glass cockpit; the view was only Fair.

The *Fi 156C-1* of 1939 was optimized for liaison and staff-transport duties. The *C-2* of 1940 carried a crew of two and provision was made for an underfuselage recon camera. Starting with the *C-5* of 1941, the Storch was capable of carrying a 32-gallon drop tank or camera. The *C-3/Trop* of 1940 and *C-5/Trop* of 1941 were the same as the C-3 and C-5 respectively, but with engine and dust filters for desert use.

The *Fi 156D*-series of 1941 was intended for use as an ambulance, with a slightly larger cabin and a rear hatch to take a stretcher patient.

The *Fi 156F-0* of 1942 – often called the Fi 156P (*Polizei*) – was for use against partisans by police units. It was armed with two MG 15s in the sides and had two hardpoints capable of carrying 48 4.4-lb. HE bomblets or 100 2.2-lb. HE bomblets. Few were made.

Focke-Achgelis Fa 223 Drachen

The Focke-Achgelis Fa 223 *Drachen* (kite) was the world's first helicopter to reach production status and was also the largest helicopter of WWII. The first general-purpose design, it was a much more capable machine than Allied counterparts such as the Sikorsky R-4 (p. 109), with a higher speed, payload, and flight ceiling. Despite that, Allied bombing raids successfully prevented it from actually *reaching* full production, and fewer than 20 were completed.

Originally designed for civilian use by *Lufthansa* in 1938, it was redesigned for the military from 1939. Like its smaller forerunner, the Focke-Wulf Fw 61, it had twin counter-rotating rotors (each with a 39' diameter) mounted on skeletal outriggers jutting out from the mainframe on the sides, driven by a radial engine in the fuselage. The helicopter had a roomy cabin amidships, able to carry four men or cargo. Various *Rüstsätze* (add-ons) allowed for its use in rescue operations (with a 250-lb. winch and cradle), offensives (with two 550-lb. bombs or depth charges), or reconnaissance (with a camera package). A 79-gallon jettisonable auxiliary tank was also available.

It first flew in 1940, reaching a record height of 23,300' – the R-4 of 1944 could manage only a third of that.

Pre-production orders were given in 1942, but production was interrupted by the destruction of the factory in Delmenhorst. The plant was moved to Laupheim in southern Germany, but wiped out in July 1944, after production had barely started again. Matters were made worse by the inability of the Luftwaffe to decide how many, if any, of the Fa 223 that it wanted. A new factory in Berlin was finally ordered to produce 400 a month, but managed to finish only a single sample and a few airframes before the Soviets arrived in 1945.

During maneuvers, the copter was able to carry as many as 12 men in addition to the two crew members, four in the cabin and four each on chairs hung onto the outriggers! Two took part in mountain trials in the Alps near Innsbruck, where they provided a taste of things to come: In seven minutes, a Fa 223E-0 could carry cargo to remote areas at a height of 6,500', a feat that would take 20 men on foot a day and a half. It could also lift light artillery or a VW Kübelwagen (see p. W:IC72) as a load slung under its belly.

Eventually, five Fa 223E-0s and a number of Flettner Fl 282A-2 Kolibri reconnaissance helicopters were assigned to the Transportstaffel 40 in Austria, and used for artillery support, communications, and transport duties.

The crew consists of the pilot, a gunner manning the 7.92mm Rheinmetall MG 15, and optionally a third man to operate the winch, if installed.

The Fa 223E-0 uses 37.3 gallons of aviation gas per hour at routine usage. A full load of fuel and ammo costs $30.

Focke-Achgelis Fa 223E-0

Subassemblies: Huge Helicopter chassis with MMR option +3; two rotors -1; three wheels +1.

Powertrain: 746-kW aerial HP gas engine with two 373-kW helicopter transmissions and 129-gallon standard tanks; 2,000-kWs batteries.

Occ: 2 CS, 4 PS Body **Cargo:** 2.9 Body

Armor	F	RL	B	T	U
Body:	2/2C	2/2C	2/2C	2/2C	2/2C
Rotors:	4/20	4/20	4/20	4/20	4/20

Weaponry

Aircraft LMG/MG 15 [Body:F] (900 rounds).

Equipment

Body: IFF; navigation instruments; medium radio transmitter and receiver.

Statistics

Size: 47'×41'×14' *Payload:* 1.2 tons *Lwt.:* 4.7 tons
Volume: 400 *Maint.:* 46 hours *Price:* $18,650

HT: 12. HPs: 360 Body, 50 each Rotor, 10 each Wheel.

aSpeed: 112 *aAccel:* 3 *aDecel*: 6 *aMR:* 1.5 *aSR:* 2
Stall Speed 0. -1 aSpeed per loaded hardpoint (if any).

Design Notes

Loaded weight was increased 27% to the historical, making is slightly higher than the maximum lift of the rotors as designed. The rotor lift should be adjusted accordingly. Design aSpeed was decreased 26% to the historical.

A MW feed with 2.6-gallon tank was optionally available, boosting power to 882 kW; aAccel 3, aSpeed 122.

Variants

After the war, the French company SNCA du Sud-Est copied the Fa 223 as the *SE.3000* of 1948 with help from Dr. Focke, but only a few were made in the late 1940s. It paved the way for further French developments in this area.

Baumgartl Heliofly III

In 1942, the Austrian engineer Baumgartl developed a strap-on one-man helicopter for the Luftwaffe that consisted of little more than two single-bladed counter-rotating rotors (each powered by a 5.9-kW engine), worn with a chest harness like a backpack. The whole assembly weighed only 44 lbs. and could be carried in two canvas bags, the one with the blades passing for a pair of skis . . .

The Heliofly III did not enter production due to problems with the engines, which were both weak and not available in numbers. In an alternate-history campaign, it very well could play a role as special equipment for agents and special-ops soldiers. Issued on a large scale, it could even redefine the role of *Fallschirmjäger* parachute troops, creating the *Helijäger*.

It requires Piloting (Flight Pack) skill. As a "vehicle" it falls outside the design rules. Use the following statistics:

Size: 2'×12'×5' *Payload:* 165 lbs. *Lwt.:* 210 lbs.
Volume: 2 *Maint.:* 164 hours *Price:* $1,500

aSpeed: 45 *aAccel:* 2 *aDecel*: 8 *aMR:* 2 *aSR:* 1
Stall Speed 0.

Focke-Wulf Fw 200 Condor

To the U-boat scourge was now added air attack far out on the ocean by long-range bombers. Of these the Focke-Wulf 200, known as the Condor, was the most formidable, though happily at the beginning there were few of them.

– Winston Churchill, ***The Second World War***

Designed in the 1930s as a commercial long-range airliner for the *Deutsche Lufthansa,* the four-engined Fw 200 Condor became an important antishipping and transport craft.

From 1938, the civil Fw 200A-0 was flown by the *Lufthansa* and passenger lines in Denmark and Brazil. *Dai Nippon* of Japan had also ordered a few and a military variant. This Japanese order spurred development of the warplane models, but the war prevented delivery of either version.

In 1940, the Fw 200C-series entered service with the Luftwaffe. It proved particularly effective in the Atlantic against naval targets, but as the war went on it increasingly fell prey to Allied fighters.

Out of 276 Condors, 263 were of the C-series, 90 of them C-4s, introduced in February 1942. These were equipped with search radar, and heavily armed for use against ships.

The crew consists of pilot, co-pilot, radio operator/gunner, radar operator/gunner, and two gunners. The dorsal turrets rotate at 25° per second, manually in back and powered in the front. The engines burn 164 gallons of aviation gas per hour at routine usage. Fuel and ammo cost $800.

Focke-Wulf Fw 200C-4

Subassemblies: Light Bomber chassis +4; Heavy Bomber wings +4; four Large Weapon pods 1-4 [Wings:F] +2; two full-rotation Medium Weapon turrets 1-2 [Body:T] +1; three retractable wheels +2.

Powertrain: four 820-kW aerial HP turbocharged gas engines with four 820-kW props [Pods 1-4], 1,453-gallon self-sealing tanks [Body], and 676-gallon self-sealing tanks [Wings]; 8,000-kWs batteries.

Occ: 6 CS Body, 2 CS Tur 1-2 Cargo: 29 Body, 27 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Pilot:	0/+0	0/+0	0/+30	0/+0	0/+20
Turret 2:	0/+10	0/+0	0/+0	0/+0	0/+0

Weaponry

20mm Medium Aircraft AC/MG 151/20 [Body:F] (500).
Aircraft LMG/MG 15 [Body:B] (900 rounds).
2×Aircraft LMGs/MG 15s [Body:L, R] (900 rounds each).
15mm VL Aircraft HMG/MG 151 [Tur 1:F] (1,000 rounds).
Aircraft LMG/MG 15 [Tur 2:F] (900 rounds).

Equipment

Body: Autopilot; backup driver option; 2,200-lb. bomb bay; bomb sight; environmental control; IFF; navigation instruments; precision navigation instruments; 12-mile nontargeting radar; large radio direction finder; large radio receiver and transmitter. *Wings:* 1,100-lb. hardpoint each [U]. *Pods:* 550-lb. hardpoint on outer pods [U]. *Turret 1:* 0.5-kW traversing gear.

Hitler's Immelmann III

The *Immelmann III* was Hitler's personal transport (the *Führermaschine*). It was a converted Fw 200A-0 with no arms that replaced the *Immelmann II*, a Junkers Ju 52/3m (see p. W:IC86), in February 1939.

It was outfitted according to Hitler's wishes; the forward cabin seated seven on two sofas and several chairs, including the *Führersitz*, a luxurious armored green brocade armchair on the right front of the cabin (DR 30 for the back, sides, and below). Behind the cabin were a toilet and a galley filled with silverware and china. A small safe (p. W89) was installed. The rear cabin seated 11.

It was destroyed on the ground in '44. In combat areas, both Hitler and Himmler were flown about in converted Fw 200C-4/U1s.

Statistics

Size: 77'×108'×21' *Payload:* 10.45 tons *Lwt:* 25 tons
Volume: 1,080 *Maint:* 17 hours *Cost:* $131,805

HT: 7. HPs: 375 Body, 825 each Wing, 35 each Wheel, 120 each Pod, 75 each Turret.

aSpeed: 224 *aAccel:* 4 *aDecel:* 24 *aMR:* 6 *aSR:* 2
Stall Speed 86. -1 aSpeed per loaded hardpoint.
gSpeed: 167 *gAccel:* 8 *gDecel:* 10 *gMR:* 0.25 *gSR:* 3
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 1,290-sf wing area was used. Design aSpeed was lowered 13% to the historical. An armored 238-gallon auxiliary tank can be carried in the bomb bay, and the pod hardpoints are plugged for 79-gallon auxiliary tanks.

Variants

The 18.7-ton *Fw 200A-0* of 1938 was the original unarmed version with 537-kW engines and 1,152-gallon tanks. It had a crew of four and 26 passengers; 12 were made.

The unarmed *Fw 200B-1* of 1939 had 634-kW engines. The otherwise identical *Fw 200B-2* had 619-kW engines.

The *Fw 200C-1* of 1940 introduced the underbody gondola, used as a weapons bay. It carried two dorsal and one ventral MG 15, plus an Ikaria-Oerlikon MG FF/M (20mm Short Aircraft AC) with 180 rounds in the underbody front. Four hardpoints under wings and pods could carry a 2,200-lb. bombload. It had 740-kW engines, 2,130-gallon tanks, and a crew of five.

The *Fw 200C-3* of 1941 had 820-kW engines. From late 1941, the Fw 200C-3/U4 had 2,460-gallon tanks and was armed with a MG 151/20 in the gondola front, a MG 15 or MG 151 in the front dorsal turret, and a 13mm Rheinmetall MG 131 (Medium Aircraft HMG) with 1,000 rounds in the rear dorsal turret. It had aSpeed 216 and a crew of seven.

The *Fw 200C-5* of 1943 had the same armament as the C-3/U4 but replaced each side MG with an MG 131 with 300 rounds. It could carry two Hs 293 missiles (p. 17). The C-6 of 1943 and the final C-8/U10 of 1944 were similar.

Heinkel He 162 Spatz

Often referred to by its original project name of *Salamander,* the He 162 was a high-performance jet fighter developed for the last-ditch *Volksjäger* (people's fighter) program of September 10, 1944. The *Spatz* (sparrow) was conceived as a simple, cheap fighter that could be piloted by Hitler Youth (see pp. W:IC34, 47) and other individuals quickly rammed through a glider training course. Heinkel won the contract as they already had a workable design that proved simpler than the competing Blohm & Voss proposal. The design entered mass production even before it had received proper testing: the first prototype was built by September 20 and series production began on December 14! This is widely regarded as a world record for the development-to-production cycle of a combat aircraft.

The He 162 saw limited deployment before the end of the war, which alone was remarkable considering the state of the German industry and transportation network at the time. Production was originally planned at more than 2,000 a month, but even optimistically it is unlikely that enough engines and fuel could have been made available to put them in the air.

The aircraft was a short, streamlined cylinder with high, straight wings. The single pod-mounted BMW turbojet was on top of the body with the intake just behind the cockpit; it restricted vision to the rear and a simple ejection seat was installed so the pilot would not be sucked into the engine when bailing out. The fuselage and rudder were of aluminum, the wings and tail plane of wood, with other components in steel.

The He 162 had a reputation for unusual handling characteristics – some of which were well-known and could not be corrected because of the rushed production schedule – compounded by the fact that pilots were given Piloting (Glider) training at the 1/2-point level and expected to default to Piloting (Light Airplane) at -2, in addition to familiarity penalties.

About 280 He 162s had been completed by the end of the war, with another 800 in various stages of construction. Of the 116 delivered, only a few actually saw combat from April 1945.

The plane burns 175 gallons of jet fuel per hour at routine usage. Fuel and ammo cost $120.

Heinkel He 162A-2 Spatz

Subassemblies: Light Fighter chassis with Very Good streamlining +2; Recon Plane wings +2; Medium Weapon pod [Body:T] +1; three retractable wheels +1.

Powertrain: 1,750-lb. turbojet [Pod] with 252-gallon self-sealing tanks; 2,000-kWs batteries.

Occ: 1 CS Body **Cargo:** 1.8 Wings, 0.9 Pod

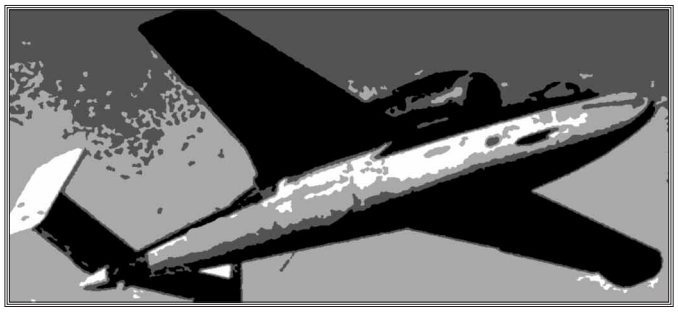
Armor	F	RL	B	T	U
Wings:	2/3W	2/3W	2/3W	2/3W	2/3W
All Else:	2/3	2/3	2/3	2/3	2/3

Weaponry

2×20mm Med. Air. ACs/MG 151/20s [Body:F] (120 each).*
* Linked.

Equipment

Body: Autopilot; ejection seat; IFF; navigation instruments; small radio receiver and medium transmitter.



Statistics

Size: 30'×24'×8' *Payload:* 1 ton *Lwt:* 2.95 tons
Volume: 128 *Maint:* 60 hours *Cost:* $11,100

HT: 7. HPs: 50 Body, 25 each Wing, 75 Pod, 2 each Wheel.

aSpeed: 470 *aAccel:* 6 *aDecel:* 6 *aMR:* 1.5 *aSR:* 2
Stall Speed 103.
gSpeed: 215 *gAccel:* 10 *gDecel:* 10 *gMR:* 0.5 *gSR:* 1
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The actual wing area of 120 sf was used in calculations. The auxiliary wing fuel tanks from the historical craft are in the body for game purposes.

The engine could produce 2,000 lbs. of thrust for very short periods, increasing aSpeed to 500 mph but raising fuel consumption to 400%. The He 162 reached speeds of up to 560 mph at high altitudes, but it was not typical of normal usage, so the design speed was used here as more realistic.

Variants

The *He 162A-1* bomber-interceptor of 1945 mounted two 30mm Rheinmetall MK 108s (30mm Short Aircraft ACs) with 50 rounds each, but the nose mounting proved unsuitable.

The *He 162A-3* of 1945 was an A-2 with a strengthened nose and other improvements that allowed the MK 108 cannons to be installed. By this time, the cannon factory in Posen had been captured by the Soviets, and the A-3 proved impossible to produce.

Two prototypes of the *He 162A-8* of 1945 were produced. It replaced the BMW engine with the same Junkers engine as on the Me 262 (see p. W:IC89). Other than possibly worse reliability, use the same performance.

The *He 162S-0* of 1945 was a tandem-seat training glider. It replaced the fuel tanks with a second crew station and was unpowered. Only two were produced before the war ended.

The *He 162B-1* was planned to go into production in 1946. It would have slightly lengthened the body for additional fuel storage, added slightly larger wings, and replaced the BMW engine with a Heinkel-Hirth generating 2,875 lbs. of thrust. Armed with two MK 108 cannon with 100 rounds each, this proposed variant would use the design weight and wing area. Fuel capacity is increased to 300 gallons, but the fuel use goes up to 287.5 gallons per hour; 1.05 VSP of the tanks is placed in the wings to avoid using a larger body but all tanks should be considered to be in the body. To avoid using an unrealistically large subassembly pod, 0.45 VSPs of the turbojet is shared with the body. Payload is 1.1 tons and loaded weight 3.1 tons with aSpeed 585 and aAccel 9.

Heinkel He 177 Greif

In 1938, Heinkel received the contract to design a heavy bomber, with the strange requirement to be able to dive-bomb like a close-support aircraft. The resulting He 177 became one of the most troublesome and unsatisfactory aircraft of the war – six of the eight prototypes crashed, and the production planes did little better.

Out of high-ranking officers' earshot, the crews called the plane, officially named *Greif* (griffin), the *Reichsfeuerzeug* (Reich cigarette lighter). This referred to the tendency of the engines in early production models to go up in flames, causing many lethal accidents. This was fixed after having finally been traced to an undersized oil cooler, but the crews remained skeptical. Even without enemy action, the griffins kept dropping from the sky like rocks.

Nevertheless, it was the most important heavy long-range bomber of the Luftwaffe. The two engines actually consisted of four smaller engines coupled together and driving two common propellers. Production stopped in 1944 in preference to fighters; 826 of all those made were of the He 177A-5 variant, which had been introduced in 1943.

The Luftwaffe's KG 200 special-ops wing used it from late 1944 to launch the Hs 293 guided missile (p. 17); three could be carried below the fuselage and wings. These elite crews overhauled the engines after *every* mission.

One of these aircraft was modified extensively at Letov in Prague during 1943-44 to provide an enlarged bomb bay to accommodate the planned German atomic bomb, but was never completed. (Nor was the bomb; see p. W:WW67.)

The He 177A-5/R2 carries a 7.92mm Mauser MG 81 in the nose, two 13mm Rheinmetall MG 131s in the forward dorsal turret (remotely controlled and traversing at 85° per second), an MG 131 in the rear dorsal cupola (manually rotated at 45° per second), a 20mm Mauser MG 151/20 cannon and a twin-barreled 7.92mm Mauser MG 81Z in the belly (firing forward and backward, respectively), and a MG 151/20 in the tail. Typical ordnance consists of 16 110-lb. bombs, four 550-lb. bombs, two 1,100-lb. bombs, two PC 1400FX guided bombs (p. 17), two 1,200-lb. sea mines, two 500mm torpedoes, or two Hs 293 missiles.

The engines burn 215 gallons of fuel per hour at routine usage. A full load of fuel and ammo costs $905.

Heinkel He 177A-5/R2 Greif

Subassemblies: Heavy Bomber chassis +5; Heavy Bomber wings +4; two Large AFV engine pods [Wings:F] +3; two full-rotation Mini turrets 1 and 2 [Body:T] +0; five retractable wheels +2.

Powertrain: four 1,085-kW aerial HP supercharged gas engines with two 2,170-kW props [Pods], 2,420-gallon self-sealing tanks [Body], and 920-gallon self-sealing tanks [Wings]; 8,000-kWs batteries.

Occ: 6 CS Body **Cargo:** 33 Body, 16.8 Wings, 3.1 each Pod

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5
Pilot:	0/+0	0/+0	0/+30	0/+0	0/+20
Tail Gun:	0/+60	0/+0	0/+0	0/+0	0/+0

Weaponry

Aircraft LMG/MG 81 [Body:F] (2,000 rounds).
2×Medium Aircraft HMGs/MG 131s [Tur 1:F] (750 each).*
Medium Aircraft HMG/MG 131 [Tur 2:F] (750 rounds).
20mm Med. Aircraft AC/MG 151/20 [Body:U] (300 rounds).
2×Aircraft LMGs/MG 81Zs [Body:U] (2,000 each).**
20mm Med. Aircraft AC/MG 151/20 [Body:B] (300 rounds).
* Linked. ** Linked.

Equipment

Body: Autopilot; backup driver option; 13,200-lb. bomb bay; environmental control; 4,400-lb. hardpoint [U]; IFF; 1-man/day life support; navigation instruments; precision navigation instruments; large radio receiver and transmitter. *Wings:* 4,400-lb. hardpoint each [U]. *Tur 1:* 0.5-kW traversing gear; universal mount. *Tur 2:* Universal mount.

Statistics

Size: 72'×103'×21' *Payload:* 15.65 tons *Lwt:* 34.1 tons
Volume: 1,840 *Maint.:* 16 hours *Cost:* $168,940

HT: 8. HPs: 1,100 Body, 825 each Wing, 60 each Wheel, 30 each Turrets 1-2.

aSpeed: 310 *aAccel:* 4 *aDecel:* 18 *aMR:* 4.5 *aSR:* 3
Stall Speed 86. -1 aSpeed per loaded hardpoint.
gSpeed: 164 *gAccel:* 8 *gDecel:* 10 *gMR:* 0.5 *gSR:* 3
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 1,097-sf wing area was used for calculations. Design aSpeed was increased 3% to the historical.

Variants

The *He 177A-0* of 1941 was the first production variant, with 993-kW engines, aSpeed 298, and aDecel 22. It was the only one with dive brakes for dive-bombing (see p. W155). The chin gun was a 20mm Ikaria-Oerlikon MG FF/M (20mm Short Aircraft AC) with 180 rounds. The single dorsal turret and tail station mounted MG 131s. It had a crew of five; 35 were built.

The *He 177A-1* of 1942 was similar to the A-0, but lacked the dive brakes; Arado built 130 (and most of the A-0s).

In mid-1942, 12 A-1s were fitted with two 30mm Rheinmetall MK 101s (30mm Long Aircraft ACs) with 30 rounds each in the chin pod; aSpeed 279. These *Zerstörer* (destroyer) aircraft were first intended to combat subs and bombers in the west, later trains in the east. In the end, they were never used operationally and rebuilt to the normal bomber configuration.

The *He 177A-3* of 1942 introduced the 1,085-kW engines. It had a lengthened fuselage (negligible in game terms) and minor improvements with the same crew and arms as the A-5; 170 were built. Some had a 50mm Rheinmetall BK 5 (50mm Medium Aircraft AC) with 21 rounds as a field conversion.

The *He 177A-3/R5* was a '43 field conversion with a semi-auto 75mm Rheinmetall PaK 40L (75mm Long Tank Gun, RoF 1/2) with 9-round magazine in the chin pod. Few were built.

The *He 277* of 1944 was intended to replace it, featuring four individual 1,290-kW engines with four props. It had aSpeed 366 but was canceled by the fighter program.

Henschel Hs 129

Given a 1938 specification for an air-support craft to supplement the Ju 87 (see p. W114), Henschel came up with the Hs 129, a single-seat machine with trim lines. The pilot sat in the extreme front for optimum vision. The nose was formed of armor plates with a windscreen of 2.95" bulletproof glass.

The B-series was the main production version and entered service in late 1942. It received more powerful Gnôme-Rhône engines built in France. While an improvement over earlier variants, it was still a poor performer. It was slow, short-ranged, and very sluggish. The cockpit was so cramped that the gun sight had to be mounted externally in front of the windshield, and some other instruments were mounted on the inboard sides of the engine pods, the pilot having to peer through the windows to see them! Additionally, the short control stick required a great deal of strength to operate even in modest maneuvers. The engines were very susceptible to dust and sand, and consequently unreliable. Despite these shortcomings, the Hs 129 was used with success against tanks and other ground targets, especially on the Eastern Front, but also in Italy and France.

Altogether 841 B-series were built, out of a total of 879 Hs 129s. More than 200 B-2s were supplied to Romania.

The Hs 129B-2 carries 20mm Mauser MG 151/20 cannons and 13mm Rheinmetall MG 131s, one of each on each side of the fuselage. A belly hardpoint is usually fitted with an auxiliary fuel tank. Wing hardpoints can carry bombs, but only when no ordnance other than bombs is fitted to the fuselage, due to weight restrictions. Typical loads are one 110-lb. bomb or a cluster bomb with 4.4-lb. bomblets or 9-lb. HEAT bomblets. The fuselage hardpoint can carry a 40-gallon drop tank.

The engines burn 50 gallons of fuel per hour of routine usage. Fuel and ammo cost $95.

Henschel Hs 129B-2/R1

Subassemblies: Light Fighter chassis +3; Light Fighter-Bomber wings +3; two Medium AFV pods 1-2 [Wings:F] +2; three retractable wheels +0.

Powertrain: two 500-kW aerial turbocharged gas engines with two 500-kW props [Pods], 53-gallon self-sealing tanks [Body], and 108-gallon self-sealing tanks [Wings]; 4,000-kWs batteries.

Occ: 1 CS Body Cargo: 8.5 Body, 4.4 Wings

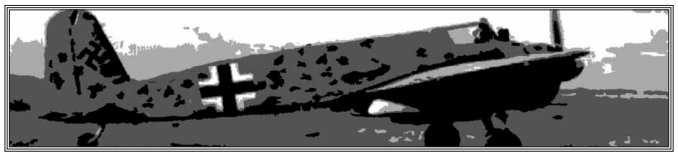
Armor	F	RL	B	T	U
Body:	4/40	3/5	3/5	3/5	3/5
Wings:	3/5	3/5	3/5	3/5	3/5
Pods:	3/7	3/7	–	3/5	4/15
Pilot:	0/+20	0/+40	0/+40	0/+0	0/+40

Weaponry

2×20mm Med. Air. ACs/MG 151/20s [Body:F] (125 each).*
2×Medium Aircraft HMGs/MG 131s [Body:F] (250 each).*
* Linked in pairs; additional link fires all four.

Equipment

Body: Autopilot; 220-lb. hardpoint [U]; IFF; navigation instruments; large radio receiver and transmitter. *Wings:* 110-lb. hardpoint each [U].



Statistics

Size: 32'×47'×11' *Payload:* 1.1 tons *Lwt:* 5.6 tons
Volume: 144 *Maint:* 45 hours *Cost:* $19,450

HT: 7. HPs: 100 Body, 120 each Wing, 75 each Pod 1-2, 5 each Wheel.

aSpeed: 253 *aAccel:* 5 *aDecel:* 16 *aMR:* 4 *aSR:* 1
Stall Speed 82. -3 aSpeed per loaded hardpoint.
gSpeed: 194 *gAccel:* 9 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

Weight, cost, and HPs of the chassis have been doubled. The historical 312-sf wing area was used for performance calculations; aSpeed was reduced from 288 to the historical 253.

Technically, the entire nose was armored rather than just the front and cockpit. The cockpit armor is assumed to cover the instruments and guns, as well.

Variants

The original *Hs 129A-0* of 1941 had 340-kW engines. It was armed with two 20mm Ikaria-Oerlikon MG FF/Ms (20mm Short Aircraft ACs) with 60-round drums and two 7.92mm Rheinmetall MG 17s (Aircraft LMGs) with 500 rounds each. Only eight were built and sent to the Romanians.

The *Hs 129B-0* of 1941 introduced the 500-kW engines; seven were made.

The *Hs 129B-1/R1* of 1941 had better armament; while it retained the MG 17s, it introduced the MG 151/20s and hardpoints under the fuselage and wings.

The *Hs 129B-1/R2* of 1941 mounted a 30mm Rheinmetall MK 101 (30mm Medium Aircraft AC) with 30-round drum below the fuselage.

The *Hs 129B-1/R3* of 1941 added four linked MG 17s with 250 rounds each below the fuselage.

The *Hs 129B-1/R4* of 1941 received a 550-lb. fuselage hardpoint. No ordnance could be carried under the wings for weight reasons.

The *Hs 129B-1/R5* recon variant of 1941 had an Rb 50/30 camera for vertical photography.

The *Hs 129B-2/R2* of 1943 mounted a 30mm Rheinmetall MK 103 (30mm Medium Aircraft AC) with 100-round belt below the fuselage.

The *Hs 129B-2/R3* of 1943 lacked the MG 131s but mounted a 37mm Rheinmetall BK 3.7 (37mm Medium Ground AC) with 12-round magazine under the fuselage. This was a very effective combination for antitank use.

The *Hs 129B-3/Wa* of 1944 was armed with a 75mm Rheinmetall BK 7.5 (75mm Long Tank Gun with RoF 1/2) with 12-round drum below the fuselage and nicknamed *"Fliegender Büchsenöffner"* (flying can opener). While the gun proved very effective against all sorts of targets, it was not ready for series production and tended to jam (Malf 16). Only three were made out of 25 ordered; none saw combat.

Mistel

One of the main issues with WWII bombers was range – the longer the range, the smaller the bombload. In 1942, the Luftwaffe began to develop piggyback aircraft, with a smaller plane mounted on a larger one. Both had their engines running, but only the smaller one was manned. The larger essentially was a huge bomb. After flying it to the target, the smaller one would detach and fly back. As it could draw fuel from the tanks of its mount, this effectively doubled its range.

This basic concept was known as *Mistel* (mistletoe) in reference to the parasitic plant. Operational combinations, codenamed *Beethoven-Gerät* but known to the crews as *Vater und Sohn* (father and son) after a popular comic series, were built on the Junkers Ju 88 (see p. W:IC87) as the carrier and a fighter aircraft on top. There were two main variations: Mistel I, of which 12 were built, consisted of a Ju 88A-4 and a Bf 109F-4 (see p. W111). Mistel II, the main production series with 75 combinations built, consisted of a Ju 88G-1 and a Fw 190A-6 (see p. W:IC85). Some 10 other experimental combinations were also made; these consisted of a Ju 88A-4 and Fw 190A-8 (Mistel IIIa), Ju 88H-4 and Fw 190A-8 (Mistel IIIb), or a Ju 88G-10 and Fw 190F-8 (Mistel IIIc).

The Junkers carriers were generally older, battle-worn aircraft. The complete nose with crew stations, armament, electronics, etc. was removed. In its place, a huge shaped-charge warhead was attached by quick-release bolts, giving the aircraft the appearance of an overgrown antitank missile – which in a way, it was. The 6d×800 (10) warhead penetrated over 26' of steel or 65' of reinforced concrete, enough to sink any battleship of the era or to penetrate any submarine bunker.

The command aircraft was held above the carrier by several struts. It had duplicate controls to steer the carrier aircraft and arm the warhead, making the interior of the small fighters more cramped than already usual. The main problem of the combination was its sheer weight – the landing carriage and tires of the Ju 88 not only had to support its own weight, a full load of fuel, the 4.2-ton warhead, and concrete counterweights in the back, but also the command plane. This pushed its take-off weight to over 21 tons, about a third over normal.

In action, the combination took off together and flew as close to the target as possible. Around a mile from the target, the pilot aimed the Ju 88, disengaged his plane by blowing off the connections, and returned home, the Ju 88 gyroscopically homing onto its target on autopilot. Targets envisioned were battleships, bridges, bunkers, etc., but accuracy wasn't perfect. The pilot must roll successfully under Pilot (Twin-Engine Prop)-2 to aim the flying bomb, under Pilot (Single-Engine Prop) to detach, and under Gunner (Bombs)-4 to arm the warhead and hit the target.

The first operational unit was created in the spring of 1944; eventually, all were combined under the command of KG 200, the Luftwaffe's special-operations wing. They were planned to single-handedly destroy the Soviet war industry by taking out all of its power plants. *Operation Eisenhammer* (iron hammer), as planned in February 1945, hinged on the Mistel as the only German bomber force that still could reach 12 of these plants after the ongoing German retreat. It was an audacious plan and nearly suicidal for the pilots, who, after hopefully reaching their objective and destroying it, would have needed to return on their own in an unarmed plane (it lacked guns to save weight), covering over 1,000 miles. Even with a 317-gallon drop tank, this would mean flying on gas fumes for the final leg of the distance. The operation never happened – 18 of the Mistel rigs prepared for the mission were destroyed on the ground by an American attack. Their final mission was the destruction of a number of bridges east of Berlin in March 1945, in an attempt to halt the Soviets.

The engines of the Ju 88G-1 burn 112.5 gallons of aviation gas per hour at routine usage. A full load of fuel costs $170.

Junkers Ju 88G-1 Mistel II

Subassemblies: Heavy Fighter-Bomber chassis +4; Medium Fighter-Bomber wings with High-Agility option +3; two Large AFV engine pods [Wings:F] +3; three retractable wheels +1.

Powertrain: two 1,250-kW aerial supercharged gas engines with two 1,250-kW props [Pods] and 627-gallon self-sealing tanks [Body] and 219-gallon self-sealing tanks [Wings]; 8,000-kWs batteries.

Occ: None Cargo: 21.6 Body, 3.4 Wings, 2.3 each Pod

Armor	F	RL	B	T	U
Body:	3/8	3/8	3/8	3/15	4/20
All Else:	3/8	3/8	3/8	3/8	3/8

Equipment

Body: Autopilot; 8,360-lb. HEAT warhead [F]; 5-ton external cradle [T].

Statistics

Size: 50'×66'×27' *Payload:* 7.75 tons *Lwt:* 21 tons
Volume: 864 *Maint.:* 23 hours *Cost:* $78,575

HT: 8. HPs: 525 Body, 440 each Wing, 225 each Pod, 50 each Wheel.

aSpeed: 310 *aAccel:* 5 *aDecel:* 20 *aMR:* 5 *aSR:* 2
Stall Speed 99.
gSpeed: 186 *gAccel:* 9 *gDecel:* 10 *gMR:* 0.25 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The statistics assume the combination of the Mistel II with a Fw 190A-6 command fighter. Note that *both* components contribute lift! The historical 590-sf wing area (plus the 197 sf of the Fw 190A-6) was used for performance calculations. Design aSpeed was reduced 4% to the historical.

Focke-Wulf Fw 190A-6 Mistel II

The Fw 190A-6 as modified for use as the upper component of a Mistel II differs as follows from the Fw 190A-8 described on p. W:IC85:

Replace the 6-gallon MW tank with a 25-gallon MW tank. Remove *all* weapons. Add backup driver controls for the Ju 88G-1 mount, and a 2,500-lb. hardpoint [Body:U] for the auxiliary fuel tank.

Messerschmitt Me 323 Gigant

In 1941, the Me 321 transport was introduced, a huge glider requiring three Bf 110s or a He 111Z tug and rocket-assistance for take-off. It was soon decided to fit this craft with its own engines, six French Gnôme-Rhône powerplants being selected as they weren't needed for high-priority combat aircraft. The first Me 323s were rebuilt Me 321s, with a strengthened wing to mount the engines and fuel tanks.

The Me 323 Gigant had a capacious cargo hold (36' long, over 10' wide, and 11' high) replicating the load space of a train flatcar. It could fit, for example, a 88mm FlaK 36 (see p. W:IC71) with complete crew and SdKfz 7 halftrack (see p. W:IC74); two trucks; 52 66-gallon fuel drums; 8,700 loaves of bread; 130 infantry soldiers; 60 stretcher cases; or 200 men standing during evacuation. It was loaded from two massive clamshell doors in the nose; passengers could use small doors at the rear. Loading and unloading was easy due to the low carriage. Good brakes and a drop anchor shortened the required landing strip to only 220 yards!

The Me 323 was covered with cloth and wood, which were susceptible to the weather. The flimsy materials led to the nickname *Leukoplastbomber* (Elastoplast bomber), since they always required repairs. The structure was sturdy, however, and its main disadvantage was the sheer size and corresponding slowness, which made it an easy target. Of the 44 supplying the Afrika-Korps from Italy, all except one were eventually shot down. What's more, the engines were unreliable, overheating quickly and thus leaving the plane to fly on fewer than six engines. The steering required great strength and had sluggish response.

Exactly 201 Me 323s were built until 1944, most of them Me 323Ds. The Me 323D-6 made from 1942 was the most common version. It had more reliable engines and was armed with five 13mm Rheinmetall MG 131 machine guns. The windows in the cargo hold could be taken out and additional machine guns installed; troop transports typically fitted 5-10 7.92mm Rheinmetall MG 42 infantry guns there (p. W97).

Minimum crew consists of pilot, co-pilot, radio operator, and two flight engineers in the wings, each responsible for three engines. The engines burn 221.7 gallons of aviation gas per hour of routine usage. A full load of fuel and ammo costs $670.

Messerschmitt Me 323D-6

Subassemblies: Huge Transport chassis +6; Huge Transport wings with STOL and Fixed Strut option +5; six Large Weapon pods 1-6 [Wings:F] +2; 10 wheels +3.

Powertrain: six 739-kW aerial HP gas engines with six 739-kW props [Pods] and 2,838-gallon self-sealing tanks [Wings]; 12,000-kWs batteries.

Occ: 3 CS Body, 2 CS Wings **Cargo:** 679 Body, 67 Wings

Armor	F	RL	B	T	U
Body:	2/2C	2/2C	2/2C	2/2C	2/2C
Wings:	2/3W	2/3W	2/3W	2/3W	2/3W
Pods:	2/3	2/3	–	2/3	2/3
Pilots:	0/+10	0/+0	0/+30	0/0	0/+20

Weaponry

2×Medium Aircraft HMGs/MG 131s [Body:F] (600 each).
Medium Aircraft HMG/MG 131 [Body:R] (600 rounds).
Medium Aircraft HMG/MG 131 [Body:L] (600 rounds).
Medium Aircraft HMG/MG 131 [Body:B] (600 rounds).

Equipment

Body: Autopilot; backup driver option; 646-VSP cargo hold; IFF; navigation instruments; large radio direction finder; large radio receiver and transmitter. *Wings:* Fire extinguisher in each.

Statistics

Size: 93'×181'×33' *Payload:* 30 tons *Lwt:* 49.7 tons
Volume: 5,440 *Maint.:* 18 hours *Cost:* $124,335

HT: 7. HPs: 1,100 Body, 1,200 each Wing, 120 each Pod, 30 each Wheel.

aSpeed: 161 *aAccel:* 3 *aDecel:* 12 *aMR:* 3 *aSR:* 3
Stall Speed 76.
gSpeed: 137 *gAccel:* 7 *gDecel:* 10 *gMR:* 0.125 *gSR:* 4
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 3,230-sf wing area was used for performance calculations. Design aSpeed was reduced 19% while aMR was reduced from the design value of 4.5 to model its notable sluggishness.

The five gunners, if carried, will take up 25 VSPs in the cargo hold. It can also carry two 240-gallon auxiliary tanks in the cargo hold.

Variants

The *Me 323D-1* of 1942 was the first production version, with 537-kW engines. It was armed with five 7.92mm MG 15s (Aircraft LMGs) with 900 rounds each. The D-2 was similar; 30 D-1 and D-2 aircraft were made.

The *Me 323E-1* of 1943 received 820-kW engines and mounted a powered turret with a 20mm Mauser MG 151/20 (20mm Medium Aircraft AC) with 500 rounds on each wing and a back-firing MG 131 with 750 rounds for the radio operator to better protect the plane from above.

Due to the increased drag, the *Me 323E-2* of 1943 received smaller turrets with a MG 131 with 750 rounds each.

The *Me 323E-2/WT "Rhino"* of 1943 had four turrets with MG 151/20 autocannons on the wings and one on the nose (hence its nickname), plus another six cannon and four MG 131 machine guns in the nose, sides, rear, and ventral positions. This *"Flakkreuzer"* (cannon cruiser) was intended to give convoy protection to cargo aircraft. It carried a crew of 17-21, lots of additional armor (DR 65) for the gunners, and more fuel, but was unable to lift any cargo.

Armstrong Whitworth Whitley

The Armstrong Whitworth Whitley was adopted in 1936 as the standard heavy bomber of the Royal Air Force, entering service in 1937. It was an important asset of Bomber Command, flying the first British bomber attacks on both Germany and Italy, until finally replaced by more capable four-engined machines in 1941-42. It continued to see service in other roles throughout the war.

The Whitley had a boxy, easily mass-produced fuselage with straight sides. The undercarriage retracted into the engine pods, with the wheels partly exposed to reduce damage in wheels-up emergency landings.

Slow and cumbersome, as well as inadequately armed for self-defense, it was nevertheless an effective bomber until its inability to carry the important 4,000-lb. bomb finally relegated it to non-bombing duties.

Its longest and probably most daring mission targeted the Skoda arms works at Plzen in Czechoslovakia during the night of October 27-28, 1940. This required a 1,480-mile flight crossing Germany during daylight.

From early 1940 to 1941 it was used by the SOE (see p. W41) for the clandestine supply of its agents and various resistance groups, until replaced by the Handley Page Halifax (see p. W:AKM81). It could drop up to 15 parachute containers (see pp. 87, W:HS25). The special duties squadrons operating it mainly flew over Scandinavia and northwest Europe.

Whitleys were also used to deliver parachute troops, the planes being used in several commando-style raids on important targets. One was Operation Biting on February 27-28, 1942, when 12 Whitleys dropped 119 men (including seven radar specialists) over Bruneval, France, to learn about the technical details of the new German radar installation there. They photographed the installation, seized vital components (plus one of the German operators), and retreated after blowing up the site. The paratroopers then fought their way to the nearby beach, losing eight men (six of them captured). The rest were extracted by six landing boats.

Later, the Whitley was used as a training tug for the Airspeed Horsa glider. The RAF Coastal Command took it in service in 1940, and used it for antisubmarine warfare.

Its crew consists of the pilot, navigator/co-pilot, bombardier/nose gunner, radio operator/observer, and tail gunner. From 1940, armament of the Whitley V consisted of four .303-caliber Browning Mk II machine guns in the tail turret (20°-per-second powered traverse), and a single Browning in the nose turret aimed by the bombardier (manually rotated at 20° per second). Typically, six 500-lb. bombs are carried in the wings and four 1,000-lb. bombs in the body.

The engines burn 85.4 gallons of fuel per hour at routine usage. Fuel and ammo cost $310.

Whitworth Whitley V

Subassemblies: Light Bomber chassis +4; Heavy Bomber wings +4; two Small AFV engine pods 1-2 [Wings:F] +2; limited-rotation Medium Weapon turret 1 [Body:F] +1; limited-rotation Large Weapon turret 2 [Body:B] +2; three retractable wheels +2.

Powertrain: two 854-kW aerial HP turbocharged gas engines with two 854-kW props [Pod 1-2] and 1,004-gallon standard tanks [Wings]; 8,000-kWs batteries.

Occ: 3 CS Body, 2 CS Tur 1-2 Cargo: 88 Body, 2.5 Wings

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5

Weaponry

Aircraft LMG/Browning Mk II [Tur 1:F] (1,000 rounds).
4×Aircraft LMGs/Browning Mk IIs [Tur 2:F] (2,500 each).*
* Linked.

Equipment

Body: Autopilot; backup control option; 4,000-lb. bomb bay; bomb sight; IFF; navigation instruments; precision navigation instruments; large radio receiver and transmitter. *Wings:* 1,500-lb. bomb bay each. *Turret 1:* Universal mount. *Turret 2:* 0.5-kW traversing gear, universal mount.

Statistics

Size: 84'×70'×15' *Payload:* 7.1 tons *Lwt:* 16.75 tons
Volume: 1,080 *Maint:* 22 hours *Cost:* $85,125

HT: 7. HPs: 375 Body, 825 each Wing, 35 each Wheel, 150 each Pod, 75 Turret 1, 120 Turret 2.

aSpeed: 222 *aAccel:* 3 *aDecel:* 36 *aMR:* 9 *aSR:* 2
Stall Speed 74.
gSpeed: 147 *gAccel:* 7 *gDecel:* 10 *gMR:* 0.25 *gSR:* 3
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 1,137-sf wing area was used for calculations. Design aSpeed was increased 12% to the historical.

The nose gunner actually has his crew station half in the turret, half in the body. The landing gear retracts into the pods rather than the wings.

Variants

The *Whitley I* of 1937 had 593-kW engines; aSpeed 192. It was armed with a .303-caliber Lewis Mk IIIA (Aircraft LMG with RoF 10) with 388 rounds in the nose turret and another one with 689 rounds in the rear turret, and could carry a 3,360-lb. bombload; 34 were made.

The *Whitley II* of 1937 introduced 630-kW engines; aSpeed 209. Some 46 were made.

The *Whitley III* of 1938 was armed with a .303-caliber Vickers G.O. Mk I (Aircraft LMG with RoF 16) with 388 rounds in the nose turret and another one with 689 rounds in the rear turret. Also, there was a ventral turret mounting twin .303 Browning Mk IIs with 500 rounds each; 80 were made.

The *Whitley IV* of 1938 mounted 768-kW engines and introduced the four-gun tail turret; aSpeed 244 with 33 made. The *Whitley IVA* had 854-kW engines, with seven made.

The *Whitley VII* of 1940 was a specialized antisubmarine version based on the Whitley V. It featured 1,321-gallon fuel tanks, air-to-surface radar, and a radar operator. Instead of bombs, it carried six depth charges. Some 146 were made.

Boulton Paul Defiant

This 1939 British fighter had a manned turret with 30°-per-second powered traverse. Though it may have surprised a few foes, the design had flaws. It was easy to attack from the front or below, and the turret's weight and drag reduced agility.

Daytime losses quickly mounted, until the fighter was withdrawn after two months of service and 712 had been built. It remained effective for nighttime operations, especially after the installation of the then-new airborne-interception radar.

The engine burns 38 gallons of gas per hour at routine usage. Fuel and ammo cost $60.

Boulton Paul Defiant I

Subassemblies: Heavy Fighter chassis +3; Heavy Fighter wings +2; full-rotation Medium Weapon turret [Body:T] +1; three retractable wheels +0.

Powertrain: 768-kW aerial supercharged HP engine w/ 768-kW prop and 165-gallon self-sealing tanks; 2,000-kWs batteries.

Occ: 1 CS Body, 1 CS Both Cargo: 5.9 Body, 4.7 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Pilot:	0/+10	0/+0	0/+30	0/+0	0/+0

Weaponry

4×Aircraft LMGs/Browning Mk IIs [Tur:F] (600 each).*
* Linked in pairs; additional link fires all four.

Equipment

Body: Autopilot; IFF; navigation instruments; medium radio receiver and transmitter. *Turret:* 0.5-kW traversing gear.

Statistics

Size: 35'×39'×11' *Payload:* 0.8 tons *Lwt:* 4.2 tons
Volume: 224 *Maint:* 35 hours *Cost:* $32,010

HT: 11. HPs: 260 Body, 180 each Wing, 75 Turret, 24 each Wheel.

aSpeed: 303 *aAccel:* 5 *aDecel:* 12 *aMR:* 3 *aSR:* 2. Stall Speed 78.
gSpeed: 197 *gAccel:* 9 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2. Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 250-sf wing area was used for calculations. Design aSpeed was increased 13%, while aMR was reduced from 7.5 to 3 to keep it in line with more agile fighters.

The design installs only half of an armored station, to better model the real protection installed.

Variants

Retrofitted as the *Defiant IA* night fighter of 1941, the plane gained flame damper exhausts, a black paint scheme, and a 3-mile air-search radar.

The *Defiant II* night fighter of 1941 had a 955-kW engine with aSpeed 315. Some 210 were built; most had radar.

Bristol Bombay

Britain's Bristol Type 130 Bombay bomber/cargo plane served between late 1939 and '43. It was an ugly and slow high-wing monoplane with prominent fixed landing gear and extra-large wheels, allowing it to land and take off where modern designs could not. A transport, it doubled as a light bomber. While it had underfuselage racks, it usually carried 20-lb. bombs internally (usually 168); these were thrown out of the right-side door. Notably, it was used for single-plane support missions working with units such as the LRDG (see p. W:HS12). Most of the 50 delivered were based in Egypt, but some were also used for transport and liaison from England.

On August 7, 1942, a Bombay carried Lieutenant General Gott and his staff to assume command of the 8th Army in North Africa. The Germans shot down the unprotected plane. Field Marshall Montgomery (see p. W:AKM54) replaced Gott, which some believe was to the Allies' considerable advantage.

The plane burns 75 gallons of fuel per hour at routine usage. Fuel and ammo cost $100.

Bristol Bombay I

Subassemblies: Light Bomber chassis with Fixed Strut option +4; Huge Bomber wings +4; two Large Weapon pods [Wings:F] +2; three heavy wheels +2.

Powertrain: two 753-kW aerial HP gas engines with 753-kW props [Pods] and 450-gallon standard tanks [Wings]; 4,000-kWs batteries.

Occ: 6 CS, 24 PS Body Cargo: 107.8 Body, 58 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3

Weaponry

Aircraft LMG/Vickers G.O. Mk I [Body:F] (388 rounds).
Aircraft LMG/Vickers G.O. Mk I [Body:B] (576 rounds).

Equipment

Body: Autopilot; 106-VSP hold; eight 250-lb. hardpoints [U]; navigation instruments; large radio receiver and transmitter.

Statistics

Size: 69'×96'×20' *Payload:* 3.2 tons *Lwt:* 10.1 tons
Volume: 1,080 *Maint:* 30 hours *Cost:* $45,195

HT: 9. HPs: 375 Body, 500 each Wing, 35 each Wheel, 60 each Pod.

aSpeed: 192 *aAccel:* 4 *aDecel:* 36 *aMR:* 9 *aSR:* 2 Stall Speed 53. -1 aSpeed per loaded hardpoint.
gSpeed: 178 *gAccel:* 8 *gDecel:* 10 *gMR:* 0.25 *gSR:* 4 Ground Pressure High. 1/6 Off-Road Speed.

Design Notes

The actual 1,340-sf wing area was used for calculations. Design aSpeed was increased 6% to the historical. Ground Pressure was reduced to High due to the extra-large wheels. Weight, cost, and HPs of wings and pods were halved. The passenger stations have only 4 VSPs each, with no access space.

Bristol Blenheim

In 1934, Lord Rothermere of the *Daily Mail* stated his wish to buy a six-seat, twin-engined executive plane. The resulting Bristol Type 142, named "Britain First," embarrassed the Royal Air Force – none of its fighters could catch it! Rothermere donated it to the RAF in 1935, which held trials and a redesign, then adopted the Type 142M as the *Blenheim I* in 1937.

By that time, however, it was no more than adequate, and by the outbreak of war, undeniably obsolete. Its use as a day bomber proved costly, as it could no longer outrun fighters, and its defensive armament was inadequate. Nor did it carry a decent bombload. Nevertheless, it saw considerable service in the early war years. It holds the dubious distinction of losing more crews than any other British aircraft.

The Blenheim was more effective as Britain's first night fighter. Aerial-interception radars were big and heavy, so a nimble and reasonably fast bomber such as the Blenheim was the ideal carrier. Fitted with a pack of forward-firing MGs, it was successfully used against the Luftwaffe in the Battle of Britain. When superseded by more modern designs in this role, it was used as a night intruder supporting standard Blenheim bombers.

The Blenheim IV was the main version used in the war, seeing service until 1943. It was supplied to Britain (3,307), Finland (14), Greece (70), Canada (18), Portugal (16), Turkey (six), and Yugoslavia (20). Some were manufactured under license in Finland.

Its crew consists of the pilot, navigator (who also acts as bombardier and chin gunner), and radio operator/turret gunner. A passenger or cargo can be carried behind the cabin. In an emergency, it is able to carry up to six passengers.

Armament of most Blenheim IVs consists of a forward-firing .303 Browning Mk II machine gun in the right wing, a remote-controlled, rear-firing chin turret with twin Brownings and 45°-per-second powered traverse, and twin Brownings in the dorsal turret (manually traversed at 30° per second).

The engines burn 68.6 gallons of aviation gas per hour at routine usage. Fuel and ammo cost $155.

Bristol Blenheim IV

Subassemblies: Medium Fighter-Bomber chassis +4; Medium Fighter-Bomber wings +3; two Large Weapon pods 1-2 [Wings:F] +2; full-rotation Medium Weapon turret 1 [Body:T] +1; limited-rotation Mini turret 2 [Body:U, facing B] +0; three retractable wheels +1.

Powertrain: two 686-kW aerial HP turbocharged gas engines with two 686-kW props [Pods 1-2] and 562-gallon standard fuel tanks [Wings]; 4,000-kWs batteries.

Occ: 3 CS Body, 1 CS Tur 1 Cargo: 28.3 Body

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Pilot:	0/+0	0/+0	0/+30	0/+0	0/+0

Weaponry

Aircraft LMG/Browning Mk II [Wing:F] (400 rounds).
2×Aircraft LMGs/Browning Mk IIs [Tur 1:F] (1,000 each).*
2×Aircraft LMGs/Browning Mk IIs [Tur 2:F] (1,000 each).*
* Linked.

Equipment

Body: Autopilot; 1,000-lb. bomb bay; bomb sight; environmental control; two 160-lb. hardpoints [U]; IFF; navigation instruments; large radio receiver and transmitter. *Turret 1:* 0.25-kW traversing gear.

Statistics

Size: 43'×56'×24' *Payload:* 2.3 tons *Lwt:* 7.2 tons
Volume: 448 *Maint:* 27 hours *Cost:* $54,630

HT: 8. HPs: 210 Body, 330 each Wing, 20 each Wheel, 120 each Pod, 75 Turret 1, 30 Turret 2.

aSpeed: 266 *aAccel:* 6 *aDecel:* 12 *aMR:* 3 *aSR:* 2
Stall Speed 75. -2 aSpeed per loaded hardpoint.
gSpeed: 201 *gAccel:* 10 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 469-sf wing area was used for calculations. Design aSpeed was increased 6%. A full fuel load precludes the carrying of bombs. Two 60-gallon tanks can be carried in the bomb bay. Some design fuel tankage is actually in the pods; the historical layout is described.

Variants

1937's *Blenheim I* had 627-kW engines and 333-gallon fuel tanks; aSpeed 279. It carried a Browning in the right wing and a .303 Lewis Mk IIIA (Ground LMG) or .303 Vickers G.O. Mk I (Aircraft LMG) with 388 rounds in a dorsal turret. It was operated by Britain (1,134), Croatia, (eight, ex-Yugoslavian), Finland (48), Greece (6), Romania (40), and Turkey (6).

From 1940, the Blenheim I was license-made as the BL in Finland. The first 12 had Tampella-made engines, a 7.62mm Lahti TKK/33-36 (Aircraft LMG with RoF 16) with 525 rounds in the dorsal turret, and a .303 Vickers LKK/39 (Aircraft LMG with RoF 14) in the wing. They carried Swedish bombs. The last 18 were armed with three .303 FN-Browning LKK/39s (Aircraft LMGs with RoF 25), in the turret and both wings.

The Yugoslavian firms Avro and Ikarus built 20 and 16 Blenheim Is, respectively. These were armed with .303 FN-Browning machine guns (Aircraft LMGs with RoF 25).

The *Blenheim IF* of 1938 received a fighter gun pack with four linked Brownings with 500 rounds each under the fuselage, in place of the bomb bay, as well as self-sealing tanks and some crew armor. A 3-mile radar was mounted in the nose, replacing the navigator. About 200 were converted.

The *Blenheim IVF* of 1939 mounted the same fighter gun pack as the Blenheim IF. More than 1,100 were converted. Eight served in South Africa, 12 in Portugal from 1943.

Canada adopted the Blenheim IV as the *Bolingbroke I* in 1939, 18 being made by Fairchild to British standards. The modified *Bolingbroke IV* of 1941 had U.S. equipment and instruments fitted, with 185 made. RCAF Bolingbrokes saw combat in the Aleutians alongside the USAAF, as well as on the Atlantic seaboard. An additional 407 planes of the *Bolingbroke IVT* configuration of 1942 were made as trainers.

The *Blenheim V* of '42 had 708-kW engines, with 945 built.

Fairey Fulmar

The Fairey Fulmar is often overlooked, but played an important part in the early war as the Royal Navy Fleet Air Arm's first true shipborne monoplane. A two-seat fighter, it was based on a light-bomber prototype, and consequently featured the excellent endurance of a bomber, an important advantage for a carrier fighter. Its poor speed, climbing capability, and operational ceiling – all results of its low-powered engine – left much to be desired. It was sluggish compared to single-seat fighters, and routinely outmaneuvered by opponents.

The telegraphist-air gunner (or TAG) sitting behind the pilot had a large working space for his navigation instruments and radio equipment, but despite his title, no gun. Many TAGs improvised by taking along Tommy guns (see p. W96), flare pistols, or even toilet-paper rolls to distract enemy fighters.

While the plane was well-armed at the time of introduction in 1940, it became apparent that even eight .303 MGs were not enough to reliably bring down heavy torpedo bombers and the large recon aircraft that the Germans and Italians used to "shadow" the convoys in the Mediterranean.

A total of 601 were built, 350 of them as the Fulmar II, which entered production in early 1941. It had a more powerful engine. From 1943, the Fulmar was gradually replaced by more effective designs, and many were given to the Soviets.

The HMS *Illustrious* (p. 117) was the first carrier to embark the Fulmar; the *Ark Royal* carried no fewer than 27 on its last convoy in late 1941. Many flew from Catapult Armed Merchantman (CAM) ships.

The engine burns 48.5 gallons of fuel per hour at routine usage. Fuel and ammo cost $120. The hardpoints were usually left empty.

Fairey Fulmar II

Subassemblies: Light Fighter-Bomber chassis +3; Light Fighter-Bomber wings +3; three retractable wheels +1.

Powertrain: 970-kW aerial turbocharged gasoline engine with 970-kW props and 186-gallon self-sealing tanks; 4,000-kWs batteries.

Occ: 2 CS Body Cargo: 3 Body, 5.1 Wings

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5
Pilot:	0/+100	0/+0	0/+20	0/+0	0/+0

Weaponry

8×Aircraft LMGs/Browning Mk IIs [Wings:F] (1,000 each).*
* Linked.

Equipment

Body: Arrestor hook; autopilot; IFF; navigation instruments; medium radio receiver and transmitter. *Wings:* 250-lb. hardpoint each [U].

Statistics

Size: 40'×46'×11' *Payload:* 1.4 tons *Lwt:* 5.1 tons
Volume: 312 *Maint:* 46 hours *Cost:* $19,055

HT: 8. HPs: 165 Body, 120 each Wing, 15 each Wheel.

aSpeed: 273 *aAccel:* 6 *aDecel:* 16 *aMR:* 4 *aSR:* 2
Stall Speed 74. -1 aSpeed per loaded hardpoint.
gSpeed: 201 *gAccel:* 10 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 342-sf wing area was used for performance calculations. Design aSpeed was reduced 2% to the historical.

Variants

The *Fulmar I* of 1940 had an 806-kW engine and carried 750 rounds per gun.

Air Survival Raft

Then Orr began opening up compartments in the raft, and the fun really began. First he found a box of chocolate bars and he passed those around, so we sat there eating salty wet chocolate bars while the waves kept knocking us out of the raft into the water . . . The next thing he found was this little blue oar about the size of a Dixie-cup spoon, and, sure enough, he began rowing with it . . .

– Joseph Heller, ***Catch-22***

Large aircraft usually carried one or more survival rafts, for the crew of a plane that went down over water. These rafts held a basic survival kit to supplement what the crew carried on their persons, which was typically much less than what a fighter pilot would have (p. 71).

As an example, the raft and accessories carried by RAF bombers such as the Armstrong Whitworth Whitley (p. 83) or Avro Lancaster (p. W:AKM80) are detailed here – those of other nations were generally similar:

The dinghy Type H held 3-5 people (use the raft on pp. W119, 125). It was packed in a canvas bag and usually stowed in an armored compartment in the top of one of the wings, where it could be released from inside the cabin. The raft came with topping-up bellows, drift anchor, baling cup, leak stoppers, boarding ladder, rescue line, and two paddles.

An assortment of survival equipment was securely stowed on the raft, including: hand-cranked aircrew survival radio (see p. W:D69), 1.5" Webley #4 Mk I flare pistol with 12 red flares, blunt-tip floating knife (to cut lines and straps), basic first-aid kit (includes four compress bandages, two mittens for burned hands, burn salve, safety pins, and two morphine syrettes; +1 First Aid, p. W90), compass (p. W87), signaling mirror, distress flag, two bags of dye marker (p. W:HS23), and handheld flares. Later, a fishing kit was added.

Food consisted of 12 tins of water and six tins of the Flying Ration Mk II, each with caffeine-enriched chocolate (reduces Fatigue by 1 for 2 hours, but then increases it by 2), chewing gums, candy, malted milk tablets, and four Benzedrine amphetamine tablets (p. W90).

General Aircraft Hamilcar

The General Aircraft GAL 50 glider was originally designed only for the transport of the Tetrarch I light tank (p. 59) in support of parachute troops; however, it was quickly adapted to carry a wide variety of other loads, particularly after the tank proved to be something of a failure.

Officially designated the Hamilcar (after Hannibal's father), it could be described as a wooden barn with wings – huge wings. Entirely constructed of wood and covered with fabric, it was a simple and cheap machine. The crew sat in tandem in a small cockpit above the wings, and the entire nose could be swiveled automatically to the right, to allow the cargo to disembark as soon as the glider touched down; there was even provision for exhaust extraction so that the tank crews could start the engine while still in place.

Typical loads were a Tetrarch ICS light tank (p. 59), a M-22 Locust light tank, two Universal Carrier tankettes (p. W:AKM72), two armored cars, a Morris or Dodge truck towing a 76.2mm (17-pounder) QF Mk II antitank gun or 40mm Bofors QF Mk I AA autocannon (p. 25), or freight up to 17,500 lbs. Passengers were seldom carried, but up to 40 could be accommodated.

The Hamilcar was first used on D-Day, when 70 were landed in Normandy. Fifty-eight carrying tanks were used in the ill-fated Operation Market Garden on September 17, 1944, and its last operation was the Rhine crossing on March 24, 1945 in Operation Varsity. Some also saw service in Burma.

It was towed by an Avro Lancaster I (p. W:AKM80), Handley Page Halifax III (p. W:AKM81), or Short Stirling IV modified four-engined bomber. A total of 412 were built.

General Aircraft Hamilcar I

Subassemblies: Huge Bomber chassis +5; Huge Bomber wings with STOL and Fixed Strut option +4; 3 wheels +3.
Powertrain: 4,000-kWs batteries.
Occ: 2 CS Body **Cargo:** 380 Body, 73 Wings

Armor	F	RL	B	T	U
All:	2/2C	2/2C	2/2C	2/2C	2/2C
Crew:	0/+20	0/+0	0/+30	0/+0	0/+0

Equipment

Body: Autopilot; backup driver; 290-VSP cargo hold; IFF; navigation instruments; large radio receiver and transmitter.

Statistics

Size: 68'×110'×20' *Payload:* 8.75 tons *Lwt:* 18.5 tons
Volume: 3,040 *Maint:* 24 hours *Cost:* $71,530

HT: 12. HPs: 1,500 Body, 1,350 each Wing, 140 each Wheel.

aSpeed: * *aAccel:* * *aDecel:* 26 *aMR:* 6.5 *aSR:* 3
Stall Speed 64. Maximum aSpeed was 150.
gSpeed: * *gAccel:* * *gDecel:* 10 *gMR:* 0.25 *gSR:* 3
Ground Pressure Very High. 1/8 Off-Road Speed.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

The historical 1,658-sf wing area was used for performance calculations. Design aMR was halved.

Airborne Supplies

See p. W:HS25 on dropping parachute supplies for airborne troops.

Supply Containers

The German *Mischlastabwurfbehälter* (mixed load drop container) was a bomb-shaped metal container holding up to 1,585 lbs. or 3.7 VSPs of stores. It was a bit shorter than 5.5' in length. It could be dropped from a hardpoint like a bomb, and had a parachute to brake its fall. It costs $150, weighs 2,200 lbs. loaded, and takes 8.8 VSPs as cargo.

The American *A-4* parachute container was a reinforced canvas container holding up to 300 lbs. or 0.5 VSPs of supplies such as medicines, clothing, rations, or three 5-gallon plastic containers (for water or other liquids). It had to be manually dropped from a plane by a cargomaster. It costs $75, weighs 400 lbs. loaded, and takes 1 VSP as cargo.

The American *A-5* container was a padded canvas roll with end caps for the delivery of 300 lbs. or 0.8 VSPs of rifles, MG barrels, or similar loads. It costs $75, weighs 400 lbs. loaded, and takes 1.6 VSPs as cargo.

Personenabwurfgerät (PAG)

The *Personenabwurfgerät* (personnel dropping device) was used for the infiltration of secret agents. The Luftwaffe's KG 200 squadron used it because large transport aircraft were either not available in sufficient numbers or not feasible for certain operations. In order to deliver men with aircraft such as the Junkers Ju 188 bomber, an infiltration pod was designed. The PAG looked like a large cylindrical bomb, and was supported below the hardpoints of the aircraft.

Made of wood, it could hold three prone men, plus 1.4 VSPs of arms and equipment. The upper part held three automatically deploying parachutes, the lower part was filled with foam rubber to cushion the impact with the ground. The PAG was a very tight fit (only about 2 VSPs per man), and traveling in it must have been a nerve-wrenching experience.

Advantages of the PAG over conventional parachute drops included a higher precision and the ability to drop people unaccustomed to parachuting. Injuries were less common than in traditional parachuting, and a team of agents wouldn't need to search for each other or their equipment after the landing.

The main disadvantage was the sheer size of the device. Once it landed, the team could not conceal it (and thus their own presence) nearly as easily as they could have concealed individual parachute packs.

At least 200 were made by DFS. A PAG costs $450, weighs 750 lbs., and takes 8.5 VSPs as cargo.

Gloster Meteor

The British Gloster Meteor was the first and only jet-powered aircraft developed by the Allies to achieve operational status during World War II.

The first unit entered the war in July 1944, preceding the German Messerschmitt Me 262 (see p. W:IC89) by just a few days. The Meteor was initially deployed against V-1 "flying bombs" (see p. W:IC123), and 13 successful kills were scored by the end of August 1944. While these successes made little practical difference, they proved useful for propaganda purposes.

In January 1945, a few Meteors were moved to the continent, where they performed ground-strafing attacks until the end of the war. They never encountered the Me 262 – WWII didn't see any dogfights between jet-powered planes – nor for that matter did the Meteor ever engage other Axis planes.

Overall, the contribution of the Meteor to the war effort was limited, and something less than that provided by German jets such as the Me 262. By the time that the Meteor became available, the Allies were already winning the war, and there was little point to diverting precious resources from the production of reliable prop-driven planes to a semi-experimental design. It did not help that it offered performance only marginally better than that provided by existing aircraft.

Actually, there were serious doubts about the future of jet-powered planes in general, and of the Meteor in particular. Early jet engines were very unreliable, provided little thrust, and were very fuel-thirsty. But while piston-engine planes had already reached fairly full potential as far as performance was concerned, the development potential of jet-powered flight technology was huge. This was shown by the Meteor itself in its later versions; in the postwar years, the design proved to be a very successful one, serving in a wide variety of roles. When its production finally ended in 1954, 3,947 Meteors had been built in a dozen different versions.

The Meteor was an all-metal aircraft built in a conventional fashion with the exception of its "modular" construction. Because it was conceived during the dark days of 1940, it was deemed necessary to allow for the "dispersal" of production, i.e., the various subassemblies could be built in different places around Great Britain, and only at the end assembled at a central location. This feature was retained even as British fortunes improved, and therefore the Meteor was particularly easy to repair, transport, and salvage.

Overall, the flight characteristics were good, though the pilots complained that visibility to the sides and rear was poor. The first fighter version was underpowered and had heavy controls. Originally, six 20mm Hispano-Suiza Mk III cannons were mounted in the nose, but they jammed quite often, mainly due to the ejection arrangements for the spent cases. This led to the armament being reduced to four cannons on the otherwise improved Meteor III.

Some 210 Meteor IIIs were built until production was halted in favor of improved marks in 1947.

The engines burn 400 gallons of jet fuel per hour at routine usage. A full load of fuel and ammo costs $305.

Gloster Meteor III

Subassemblies: Light Fighter-Bomber chassis with Very Good streamlining +3; Light Fighter-Bomber wings +3; two Medium Weapon pods [Wings:F] +1; three retractable wheels +1.

Powertrain: two 2,000-lb. turbojets [Pods 1-2] with 390-gallon self-sealing fuel tanks [Body and Wings]; 4,000-kWs batteries.

Occ: 1 CS Body **Cargo:** 12.8 Body, 6.7 Wings

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5
Cockpit:	0/+10	0/+0	0/+30	0/+0	0/+0

Weaponry

4×20mm Long Air. ACs/Hispano Mk IIIs [Body:F] (195 each).*
* Linked in pairs; additional links fires all four.

Equipment

Body: Autopilot; 1,000-lb. hardpoint [U]; IFF; 0.25-man/days life support; navigation instruments; medium radio receiver and transmitter. *Wings:* 500-lb. hardpoint each [U].

Statistics

Size: 41'×43'×13' *Payload:* 2.25 tons *Lwt:* 6.65 tons
Volume: 312 *Maint:* 37 hours *Cost:* $29,715

HT: 7. HPs: 165 Body, 120 per Wing, 75 per Pod, 15 per Wheel.

aSpeed: 495 *aAccel:* 6 *aDecel:* 12 *aMR:* 3 *aSR:* 2
Stall Speed 89. -10 aSpeed per loaded hardpoint.
gSpeed: 216 *gAccel:* 10 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 374-sf wing surface area was used for performance calculations. Design aSpeed was increased 7% to the historical. Designed with only part of an armored station.

Variants

The first production run – the *Gloster Meteor I* – mounted two lighter Rolls-Royce Welland engines with 1,700-lb. thrust. Only 20 were built, and were employed essentially for only testing from July-December 1944. After that, they were replaced by the F.III. Reduce aSpeed to 415 and fuel to 360 gallons.

The first 15 Meteor IIIs also had these engines until replaced by the more powerful Rolls-Royce Derwent engines.

Both could be fitted with a non-jettisonable 126-gallon ventral tank on the fuselage hardpoint to increase range.

Intercettore Macchi MC.200 Saetta

In 1936, one of Macchi's premier aircraft engineers, Mario Castoldi, used his experience in designing Schneider Trophy winners to create a modern fighter. The result was the MC.200 *Saetta* ("dart" or "bolt"), a monoplane with an enclosed cockpit and retractable wheels. It was an innovative design by Italian standards, with many details that were taken for granted on other countries' fighters: armor for the pilot, self-sealing tanks, and light-alloy skin. The high cockpit offered the pilot excellent visibility, and the radial engine was sturdy; however, both of these features increased drag.

Notwithstanding its limited firepower of only two synchronized 12.7mm Breda-SAFAT Mod 31 machine guns, the Saetta was a good design overall, but it had a hidden flaw. Its propulsion torque tended to create an autorotation, and Castoldi solved the problem by a slightly asymmetric wing design. Experienced pilots had no difficulties with this, but anybody lacking familiarity will have an additional -4 penalty on landing, as the asymmetrical wings become suddenly unbalanced by the ground effect.

Italian pilots protested the plane's 1940 debut, used as they were to the acrobatic qualities of the FIAT CR.42 (see p. W:GL34). They also wanted open cockpits, so the upper glass panes were removed. Almost 1,500 MC.200s were built, and they served in Europe, Africa, and the U.S.S.R. In the desert, they proved able to face the Hurricanes and P-40s. By 1942, the MC.202 began replacing the MC.200, which was gradually moved to the fighter-bomber role.

The plane burns 31 gallons of aviation gasoline per hour of routine usage. Fuel and ammo cost $45.

Macchi MC.200 Saetta

Subassemblies: Medium Fighter chassis +3; Light Fighter wings +2; three retractable wheels +0.

Powertrain: 627-kW aerial HP gas engine with 627-kW prop and 105-gallon self-sealing tanks; 2,000-kW batteries.

Occ: 1 CS Body **Cargo:** 7.8 Body, 2.8 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Pilot:	0/+20	0/+0	0/+30	0/0	0/0

Weaponry

2×Medium Aircraft HMGs/Mod 31s [Body:F] (370 each).*
* Linked.

Equipment

Body: Navigation instruments.

Statistics

Size: 27'×35'×11' *Payload:* 0.5 tons *Lwt:* 2.3 tons
Volume: 200 *Maint:* 52 *Cost:* $13,855

HT: 10. HPs: 120 Body, 70 each Wing, 12 each Wheel.

aSpeed: 311 *aAccel:* 8 *aDecel:* 22 *aMR:* 5.5 *aSR:* 2
Stall Speed 68.
gSpeed: 240 *gAccel:* 11 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Very High. 1/8 Off-Road Speed.

Design Notes

Design aSpeed was increased 11%. The open cockpit was originally designed as an enclosed one, so while the added drag has been taken into account, the crew station is not considered exposed. Only 82 gallons of fuel were normally carried. An external fuel tank was developed as a non-detachable pod, but it was seldom used; its 7 gallons weren't worth the drag.

Variants

The commanders' airplanes had a large radio set; 10 MC.200s deployed in Sicily were fitted with recon cameras.

The *MC.200 Caccia Bombardiere* (fighter-bomber) had two underwing hardpoints for two 300-lb. bombs or clusters of incendiary bomblets; aSpeed 301, aAccel 9, aMR 5.5 with loaded hardpoints.

The improved *MC.202 Folgore* of 1941 had the same wings as the MC.200, but the body was sleeker (Good streamlining) because of a lower cockpit and, more importantly, because of the new 802-kW engine, a license-built Daimler-Benz. With this, the 2.9-ton Folgore (lightning) could stand up to most contemporary enemy fighters; aSpeed 374, aAccel 11, aDecel 24, aMR 6. It served in all theaters, and it bore the brunt of the Allied bomber offensive over Italy. It had a ceiling of 34,500', and the technology (better heated cockpit, heated guns, oxygen, etc.) to operate at that altitude. The MC.202 had 114-gallon fuel tanks, usually a medium radio, and an enclosed cockpit on most series. The HMGs had 400 rounds each. Two .303 Breda-SAFAT Mod 31s (Aircraft LMGs) with 500 rounds each were added in the wings on later MC.202s. A recon version was fitted with cameras. The *Africa Settentroniale* variant for service in North Africa had dust filters and similar modifications. About 1,100 were built.

The *MC.205 Veltro* of 1943 – the last offshoot of this family – was the finest Italian fighter of WWII. The 3.4-ton Veltro (foxhound) was derived from the MC.202, but had a more powerful 1,100-kW engine, the Daimler-Benz 605A; aSpeed 402, aAccel 13, aDecel 20, aMR 5. The typically poor firepower of most Italian fighters was corrected by adding a pair of German Mauser MG 151/20s (20mm Medium Aircraft ACs) with 125 rounds each in the wings. The MC.205 had a chance of making a dent in four-engined bombers, but was underperforming at very high altitudes, a problem caused by the wings, which were still those of the old MC.200. Its greater weight also meant it was less nimble than its predecessors. The MC.205s were first deployed in the spring of 1943: By that time, Italian industrial output was insignificant in comparison to that of the Allies, and most of the best Italian pilots were dead. Thus, the MC.205 was often in the hands of inexperienced pilots, just as the air offensive against Italy was beginning in earnest. Those who survived became dangerous bomber killers, but it was too little, too late. Strategic materials were in short supply, production was disrupted. Only 262 MC.205s were built, about 115 of them for the RSI (see p. W:GL44). While the RSI pilots fought alongside the Germans in these planes, the few MC.205s pilots who had made it to the Allied south were the first Italian fighters to engage their former ally in combat, with success.

Reggiane Re.2000 Falco

The Re.2000 *Falco* (hawk) was the only one of the four fighter designs offered to the *Regia Aeronautica* (Royal Italian Air Force) in the late 1930s that could be considered internationally competitive. Regardless, it was rejected, with the clearly inferior FIAT CR.42 (see p. W:GL34) and Macchi MC.200 (p. 89) being selected, instead. Closely patterned after the U.S. Seversky P-35, it was a low-wing monoplane with retractable landing gear and internal wing fuel tanks. The latter were the main reason given by the Regia Aeronautica for not adopting the plane. They were seen as too vulnerable.

The Re.2000 was highly maneuverable, and was consequently adopted by the *Kunglika Svenska Flygvapnet* (Royal Swedish Air Force) and *Magyar Királyi Honvéd Légierö* (Royal Hungarian Air Force). The Hungarians also built it under license as the *Héja II* (hawk), which was considerably modified as a result of the shortcomings that became evident on the 1941 eastern front: The Italian engines were not only very unreliable, but almost impossible to maintain in the field. The wing tanks were leaking, and the Italian machine guns fired too slowly. The Swedes liked its agility, but likewise complained about the engine and miserable cold-weather performance.

The Regia Aeronautica eventually acquired a handful of Re.2000s in 1941. These were combat-trialed for a time over Africa and the Mediterranean, but this unit was dissolved in 1942 with no major successes. Meanwhile, the *Regia Marina* (Royal Italian Navy) had displayed interest in the Re.2000 to protect its ships, and eventually acquired 10 modified for catapult launch from battleships. Two each were carried on the RN *Roma* and *Vittorio Veneto*, one on the *Littorio* (see p. W:GL19). The Regia Marina also ordered another version with increased range, to escort transports to outlying African stations.

The Re.2000 Serie I below was used almost unmodified by Hungary (30) and Sweden (60). It was gradually developed into a series of improved models. Armament consists of two synchronized 12.7mm Breda-SAFAT Mod 31 machine guns in the nose. The hardpoint could be loaded with two racks, each holding 44 4.4-lb. fragmentation bombs.

The engine burns 31.4 gallons of fuel per hour at routine usage. Fuel and ammo cost $57.

Intercettore Reggiane Re.2000

Subassemblies: Medium Fighter chassis +3; Light Fighter wings w/ High-Agility option +2; 3 retractable wheels +0.
Powertrain: 627-kW aerial HP engine w/627-kW prop and 184-gallon ultralight tanks [Wings]; 2,000-kWs batteries.
Occ: 1 CS Body Cargo: 7.1 Body

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3

Weaponry

2×Medium Air. HMGs/Mod 31s [Body:F] (300 rounds each).*
* Linked.

Equipment

Body: Fire extinguisher; 440-lb. hardpoint [U]; navigation instruments; medium radio receiver and transmitter.

Statistics

Size: 25'×36'×11' *Payload:* 0.75 tons *Lwt:* 2.7 tons
Volume: 200 *Maint:* 53 hours *Cost:* $14,370

HT: 9. HPs: 120 Body, 90 each Wing, 12 each Wheel.

aSpeed: 290 *aAccel:* 7 *aDecel:* 28 *aMR:* 7 *aSR:* 2
Stall Speed 67. -3 aSpeed per loaded hardpoint.
gSpeed: 222 *gAccel:* 11 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Very High. 1/8 Off-Road Speed.

Design Notes

The historical 220-sf wing area was used for performance calculations. Design aSpeed was increased 7% to historical.

The fuel tanks had to be placed partially in the body, but should be considered to be completely in the wings.

Variants

The 4-ton *Re.2000 Serie II Catapultabile* of 1941 was strengthened for catapult launch. It also had a more powerful 765-kW engine and added two 250-lb. hardpoints under the wings; aSpeed 323. Only 10 were built.

The 17 *Re.2000 Serie III Grande Autonomias* of 1942 had a 765-kW engine and 394-gallon tanks; aSpeed 323.

The *Héja I* of 1939 was the Re.2000 with the Piaggio engine replaced by a Hungarian copy of a French 694-kW Gnôme-Rhône design; aSpeed 301. Some 70 were built.

The *Héja II* of 1942 was completely license-built in Hungary. It received conventional tanks and an armored seat. The MGs were replaced by a twin-barreled 12.7mm Danuvia-Gebauer 40M (Powered Aircraft HMG) with 300 rounds per barrel. Some 192 were built.

The 60 Re.2000s delivered to Sweden in 1941 didn't differ much from the basic Italian version. They were called *Jägare 20* (J 20) in Swedish service. Both Allied and Axis aircraft getting lost over Sweden might face them.

The 3.6-ton *Re.2001 Falco II* of 1941 was fitted with an 876-kW Daimler-Benz engine license-built by Alfa-Romeo; aSpeed 332. Unofficially called the *Ariete* (ram), it added a .303 Breda-SAFAT Mod 31 (Aircraft LMG) with 650 rounds in either wing. The Re.2001 was adopted by the Regia Aeronautica, with 252 built. Of those, 110 were of the *Caccia Notturno* night-fighter variant, which replaced the wing guns with underwing pods, each containing a 20mm Mauser MG 151/20 (20mm Medium Aircraft AC) with 200 rounds.

The *Re.2002 Ariete II* of 1942 was a fighter-bomber version with an 876-kW Piaggio engine and all the improvements of the Re.2001, including the wing guns. It had a 1,100-lb. hardpoint under the fuselage and two 350-lb. hardpoints under the wings. The Re.2002 was heavily used against the Allies during the Sicily landings. Some 149 were delivered to the Regia Aeronautica, 106 to the Luftwaffe.

The final *Re.2005 Sagittario* of 1943 used an 1,100-kW FIAT engine, another licensed Daimler-Benz design; aSpeed 391. It added three MG 151/20 cannons with 200 rounds each, one in the propeller hub and two in the wings. Thirteen were taken over by the Luftwaffe, and some allegedly were used during the defense of Berlin. Some 29 to 48 were built.

Savoia-Marchetti SM.79 Sparviero

This airplane was conceived in the early '30s as a civilian passenger carrier, and as such it set several transatlantic flight records. It was an advanced design – with flaps, retractable landing gear, and variable-pitch propeller blades – but it was built to civilian standards and used very few strategic materials, with a wood and cloth skin. To make it into a bomber, a bombardier station was added to the underside and an aerodynamic MG position to the back. Compared with the civilian version, it had grown a distinctive hunchback, resulting in the nickname *Gobbo Maledetto* (damned hunchback). Propaganda insisted that the curses making it "damned" came from the enemy . . .

The *Sparviero* (sparrow hawk) saw its first military use in the Spanish Civil War (see p. W10), where its success was qualified by the limited threat it faced. Though it was fast and maneuverable, things changed when its opponents were Hurricanes (p. W:AKM77) and Seafires (p. W:AKM78). The crews always loved it, however, in comparison to the slow, sluggish, and poorly armed alternatives serving as Italian bombers. Its long range made the SM.79 suitable for far-reaching torpedo missions against British shipping in the Mediterranean, and in this role it was rather successful. The plane's agility had a cost, though, in that it was not stable, and flying it in high winds over long distances became a feat of endurance.

These bombers flew more combat missions than all other Italian bombers combined; 1,258 of them were built in various versions, plus more than 100 for export. The Luftwaffe also used it as a transport.

On the SM.79-II dating from 1939, the pilot fires the fixed 12.7mm Breda-SAFAT Mod 31 HMG; the co-pilot has duplicate controls. The bombardier/navigator also mans the dorsal Mod 31. The flight engineer and radioman take care of engine controls and communications. When needed, they man the rearward guns – a Mod 31 in the rear ventral position (with 30°-per-second manual traverse) and a single .303 Savage-Lewis Mod 16 LMG (RoF 10) on a sliding mount so that it could fire through a window in either side of the fuselage. Some mounted two of these LMGs. The engines burn 87.3 gallons of aviation gas per hour at routine usage. The standard loadout of fuel and ammo, including 10 220-lb. bombs, costs $4,600.

Bombardiere SM.79-II

Subassemblies: Light Bomber chassis +4; Heavy Fighter-Bomber wings +3; three Medium Weapon pods 1-3 [Body:F, Wings:F] +2; two limited-rotation Mini open mounts 1-2 [Body:T, U]; three retractable wheels +2.

Powertrain: three 746-kW aerial turbocharged HP engines with three 746-kW props [Pods 1-3] and 715-gallon standard fuel tanks [Wings and Body]; 4,000-kWs batteries.

Occ: 6 CS, 2 SR Body Cargo: 58.5 Body, 0.7 OM 1-2

Armor	F	RL	B	T	U
Body:	2/2W	2/2W	2/2W	2/2W	2/2W
Wings:	2/2C	2/2C	2/2C	2/2C	2/2C
Pods 1-3:	2/3	2/3	–	2/3	2/3
OMs 1-2:	0/0	0/0	0/0	0/0	0/0
Cockpit:*	0/+0	0/+0	0/+30	0/+0	0/+0

* Protects the pilot and co-pilot.

Weaponry

Medium Aircraft HMG/Mod 31 [Body:F] (350 rounds).
Aircraft LMG/Mod 16 [Body:L or R] (582 rounds).
Medium Aircraft HMG/Mod 31 [OM 1:F] (500 rounds).
Medium Aircraft HMG/Mod 31 [OM 2:F] (400 rounds).

Equipment

Body: Autopilot; backup driver option; 3,000-lb. bomb bay; bombsight; 20-VSP cargo hold; two 1,435-lb. hardpoints [U]; IFF; navigation instruments; precision navigation instruments; very large radio receiver and transmitter.

Statistics

Size: 52'×69'×14' *Payload:* 4.1 tons *Lwt:* 11.4 tons
Volume: 1,080 *Maint:* 22 hours *Cost:* $82,585

HT: 9. HPs: 375 Body, 450 each Wing, 35 each Wheel, 75 each Pod 1-3, 30 each OM 1-2.

aSpeed: 265 *aAccel:* 6 *aDecel:* 28 *aMR:* 7 *aSR:* 2
Stall Speed 68. -1 aSpeed per loaded hardpoint.
gSpeed: 205 *gAccel:* 10 *gDecel:* 10 *gMR:* 0.25 *gSR:* 3
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

Design aSpeed was reduced 5% to the historical. Though the crew is only five, they have six crew stations. One armored station was shared between the pilot and co-pilot. The engines are a bit too large for the pods, but the wings contain the overflow. The stats above are applicable to the standard loadout with 10 220-lb. bombs. Alternate loadouts (and their consequences) are 12 220-lb. bombs (aAccel 4) or one 450mm torpedo (aSpeed 267, aMR 7.5, aDecel 30).

Variants

The *SM.79-I* of 1936, and flown in the Spanish fighting, had 582-kW Alfa-Romeo engines. It could not carry torpedoes.

The *SM.79-III* of 1943 mounted a fixed 20mm Mauser MG 151/20 (20mm Medium Aircraft AC) with 125 rounds. It lacked the ventral gun, but usually had a Mod 31 HMG with 400 rounds in both sides of the fuselage.

The *SM.79-B* of 1937 had only two 758-kW FIAT engines, and was armed with five .303 Lewis Mk IIIs (Aircraft LMGs with RoF 10). Four were acquired by Iraq, and destroyed by the RAF in 1941.

The Romanians employed the 11.9-ton *SM.79-JR* of 1938 version, with a glazed nose and two 835-kW Junkers engines; aSpeed 276. Instead of the Italian guns, it was armed with a 7.92mm FN-Browning (Aircraft LMG with RoF 25) in either side and a 13.2mm FN-Browning (Long Aircraft HMG with RoF 16) in the dorsal and ventral positions, with no fixed gun. Romania imported 24 and built 16 under license; there were used against the U.S.S.R. from 1941.

Yugoslavia acquired the *SM.79-K* of 1937, which had 746-kW Gnôme-Rhône engines. Some 45 were acquired. It was used against the Germans in 1941.

The civilian *SM.79-P* of 1935 was unarmed and possessed 455-kW Piaggio engines. It had a crew of three and could carry 10 passengers.

Kawasaki Ki-48 "Lily"

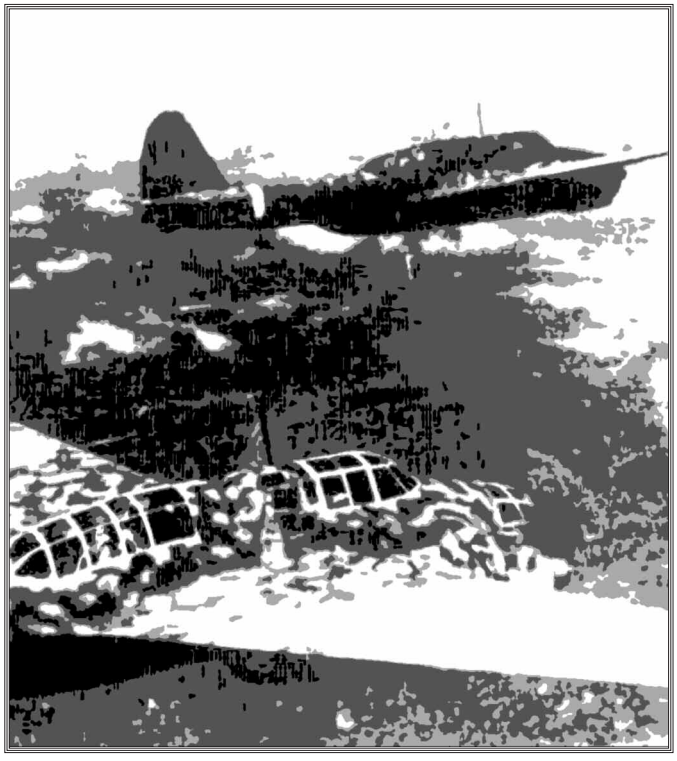
In 1937, Japanese army officials became unpleasantly aware of the Soviet SB-2 bomber, which was nearly as fast as the Japanese Ki-27 fighter just entering service (p. 95). Development of a similar fast, light bomber began shortly afterward. It was adopted in 1939 by the Japanese army as the *99 Shiki Sōhatsu Keibakugekiki* (type 2599 twin-engined light bomber), or "*Kyūjūkyū Sōkei"* (99 twin-light) for short. The Allies called it the "Lily."

Unfortunately, by the time that the Ki-48 entered production, it was already obsolescent. Most contemporary fighters were faster. The three 7.7mm Te-4 (89 Shiki Tan Kikanjū) machine guns – feeding from 69-round drums – were inadequate for defense, and the typical bombload was less than that carried by some front-line single-engine fighters.

The Ki-48 was initially successful over China and Burma, where the opposition was operating older fighters. As P-40 Warhawks and Hurricanes began to filter into the region, the "Lily" ran into serious trouble. One common tactic was to operate it at night, but while this reduced losses, it also reduced effectiveness.

In an effort to improve performance, and hopefully survivability, the Ki-48-II was introduced in 1942. It was even further behind contemporary aircraft than the Ki-48-I had been when new. Meanwhile, the "Lily" was forced to soldier on, despite production ending in 1944. By the end of the war, like many other Japanese aircraft, several had been turned into flying bombs for kamikaze attacks.

Some 1,420 Ki-48-IIs were built. It has a crew of four: pilot, bombardier (who also fires the nose gun), navigator (who fires the dorsal gun) and radio operator (who fires the ventral gun). The Ki-48-IIa uses 76 gallons of aviation gas at routine usage. Fuel and ammo cost $110.



Kawasaki Ki-48-IIa

Subassemblies: Light Fighter-Bomber chassis +3; Light Fighter-Bomber wings with STOL option +3; two Large Weapon pods [Wings:F] +2; three retractable wheels +1.

Powertrain: two 863-kW aerial HP gas engines with two 863-kW props [Pods] and 345-gallon self-sealing fuel tanks [Wings]; 4,000-kWs batteries.

Occ: 4 CS Body **Cargo:** 0.9 Body

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Pilot:	0/0	0/0	0/+45	0/0	0/+20
Bombard:	0/0	0/0	0/+35	0/0	0/0

Weaponry

Aircraft LMG/Te-4 [Body:F] (1,311 rounds).
Aircraft LMG/Te-4 [Body:T] (1,311 rounds).
Aircraft LMG/Te-4 [Body:U] (1,311 rounds).

Equipment

Body: Autopilot; 1,760-lb. bomb bay; bombsight; navigation instruments; medium radio receiver and transmitter.

Statistics

Size: 42'×57'×12' *Payload:* 2.5 tons *Lwt:* 7.3 tons
Volume: 312 *Maint:* 35 hours *Cost:* $31,950

HT: 7. HPs: 165 Body, 120 each Wing, 15 each Wheel, 120 each Pod.

aSpeed: 314 *aAccel:* 15 *aDecel:* 15 *aMR:* 3.75 *aSR:* 2
Stall Speed 70.
gSpeed: 213 *gAccel:* 11 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

Design aSpeed was increased 3% to the historical figure.

The engines were slightly too large; 0.8 VSPs were placed in the wings, instead. Some fuel tanks had to be placed in the body, but all fuel should be assumed to be in the wings.

The design purchased 1.5 armored stations and split them between the pilot and bombardier positions.

The Ki-48-II normally carried only 880 lbs. of bombs or less (typically 24 33-lb. bombs or six 110-lb. bombs). In this case, some stats change: Stall 67, aMR 4, and aDecel 16.

Variants

The *Ki-48-I* of 1939 used two 746-kW engines and lacked armor protection for the crew or fuel tanks. Top speed was 298 mph and maximum bomb load was 880 lbs.; normal load was 440 lbs. Some 557 were built.

The *Ki-48-IIb* of 1943 was capable of dive bombing, with the addition of dive brakes; aDecel 20.

The *Ki-48-IIc* of 1943 added a second 7.7mm Te-4 to the nose and replaced the dorsal LMG with a 12.7mm Hō-104 (1 Shiki Senkai Kikanhō, Medium Aircraft HMG).

The *Ki-48-II-Kai* of 1944 was a kamikaze plane, loaded with a 1,760-lb. explosive charge that was triggered by a long rod extending from the nose. This does 6d×3,520 damage.

Kawasaki Ki-61 Hien "Tony"

The Kawasaki Ki-61 single-seat monoplane was one of the best Japanese army fighters of the war, and a departure from the usual agile but lightly built fighters. It designers had studied under a German head engineer and the plane used a license-built Daimler-Benz engine. The Ki-61 marked the introduction of self-sealing tanks and cockpit armor to the Japanese fighter, and also featured substantial firepower. It finally closed the gap with its U.S. opponents, being considered superior to the P-39 Airacobra and P-40 Warhawk it initially faced over China and Southeast Asia from 1943.

Early Ki-61s had problems with the engine, and many pilots complained about the restricted aft view.

The Ki-61-I-Kai-Hei was the third variant and introduced in early 1944 by the Japanese army as the *3 Shiki Sentōki 1 Hei Gata* (type 2603 fighter model 1C), or "Sansen" (three-fight) for short. The Allies simply called it "Tony." Its official Japanese name was Hien (swallow). Some 1,274 – over half of all Ki-61s made – were of this model. It featured upgraded armament, consisting of two synchronized 20mm Hō-5 (2 Shiki Kikanhō) cannon in the nose and two 12.7mm Hō-103 machine guns (1 Shiki Kotai Kikanhō) in the wings. The hardpoints were usually left empty or fitted with 53-gallon auxiliary fuel tanks, but 220-lb. or 440-lb. bombs were available.

By the time of its introduction, manufacturing standards had slipped due to lack of skilled labor and material shortages. Many later Ki-61s incorporated copper melted down from the ancient Yasukuni Shrine and consequently were marked with the emblem of that shrine. Ironically, this honor mark became symbolic of a lack of reliability and shoddy workmanship.

The engine burns 44 gallons of fuel per hour of routine usage. Fuel and ammo cost $85.

Kawasaki Ki-61-I-Kai-Hei Hien

Subassemblies: Medium Fighter chassis +3; Medium Fighter wings +2; three retractable wheels +0.

Powertrain: 876-kW aerial supercharged gas engine with 876-kW prop and 43-gallon [Body] and 102-gallon self-sealing tanks [Wings]; 2,000-kWs batteries.

Occ: 1 CS Body Cargo: 0

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Pilot:	0/+10	0/+0	0/+40	0/+0	0/+0

Weaponry

2×20mm Med. Aircraft ACs/Hō-5s [Body:F] (120 each).*
2×Medium Aircraft HMGs/Hō-103s [Wings:F] (200 each).*
* Linked in pairs; additional link fires all four.

Equipment:

Body: Autopilot; IFF; navigation instruments; large radio receiver and transmitter. *Wings:* 550-lb. hardpoint each.

Statistics

Size: 29'×39'×12' *Payload:* 0.9 tons *Lwt:* 3.8 tons
Volume: 200 *Maint:* 50 hours *Cost:* $16,150

HT: 8. HPs: 120 Body, 80 each Wing, 12 each Wheel.

aSpeed: 360 *aAccel:* 7 *aDecel:* 16 *aMR:* 4 *aSR:* 3
Stall Speed 80. -4 aSpeed per loaded hardpoint.
gSpeed: 221 *gAccel:* 11 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 215-sf wing area was used for performance calculations. Design aSpeed was increased 11% to the historical figure.

Variants

The original 3.25-ton *Ki-61-I-Kō* of 1942 was armed with two Hō-103 HMGs with 250 rounds each in the fuselage and two 7.7mm 89 Shiki Kikanjū (Aircraft LMGs) with 500 rounds each in the wings; aSpeed 367. The armament of this version was considered inadequate, and since no suitable indigenous autocannon was available, 800 20mm Ma Shiki Kikanhō (Mauser MG 151/20s, 20mm Medium Aircraft ACs) were acquired, delivered to Japan by German submarine in August 1943. Two cannons with 120 rounds each were installed in place of the wing LMGs, the last of 388 conversions entering service in July 1944.

The 3.45-ton *Ki-61-I-Otsu* of 1942 introduced two Hō-103 HMGs with 200 rounds in the wings.

The *Ki-61-I-Kai-Tei* of 1944 replaced the wing guns with two 30mm Hō-155s (30mm Very Short Aircraft ACs) with 80 rounds each, for bomber interception. The cannons proved to be troublesome (Malf 16), and only a few were installed.

To increase performance at high altitude, mainly to intercept U.S. B-29 bombers (p. 102), the Ki-61 needed a more powerful engine. The resultant 4.2-ton *Ki-61-II-Kai-Kō* of 1944 had a 1,119-kW engine; aSpeed 379. It was armed like the Ki-61-I-Kai-Hei. The new engine was very unreliable (frequently providing less power than advertised), but *when* it worked, the Ki-61-II-Kai was capable of holding its own with the best Allied fighters of its class.

The *Ki-61-II-Kai-Otsu* of 1944 replaced the wing HMGs with a pair of Hō-5 autocannons with 120 rounds each.

Production of the engine was very slow and eventually halted when the plant was bombed in January 1945. There were hundreds of airframes still in storage. It was decided to redesign them to accept a new engine, the new variant receiving the designation *Ki-100*. A Mitsubishi 1,119-kW radial was selected. Replacing a liquid-cooled engine with a radial engine posed several problems, including different diameters, thrust lines, and weights. The Ki-100 lost the sleek, pointed nose of its cousins and received a stubby snout.

The 4.2-ton *Ki-100-I-Kō* was adopted as the *5 Shiki Sentōki 1 Kō Gata* (type 2605 fighter model 1A) in early 1945. While marginally slower than the Ki-61-II-Kai, it was more agile and climbed faster; aSpeed 360. It included a 29-gallon MW tank. Armament consisted of two Hō-5 cannons with 250 rounds each in the fuselage and two Hō-103 HMGs with 250 rounds each in the wings. Some 271 were built.

The *Ki-100-I-Otsu* of 1945 used new airframes rather than converted Ki-61s, but was identical save for its canopy, which finally allowed decent rear view. Some 118 were built.

Mitsubishi J2M Raiden "Jack"

The Mitsubishi J2M, designated the *Raiden* (thunderbolt) by the Japanese navy and "Jack" by the Allies, resulted from a request in the late 1930s for a high-speed, land-based naval interceptor. The concept was a significant departure for the Japanese, who had made agility the top priority in their fighters to that point.

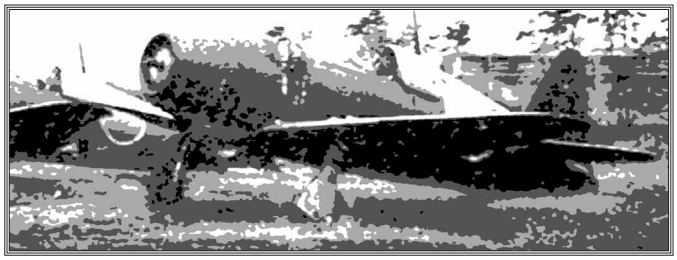
The first flight of the J2M2 was delayed until 1942, partly because of technical problems and partly due to the "Zeke" (see p. W112) receiving priority for production. The prototypes revealed several engine problems, which were never entirely cleared up. Even worse, several J2Ms, both prototype and production models, disintegrated in flight; no reason for these failures was ever found.

The J2M2 entered production in late 1943, but did not enter combat service until mid-1944 over the Marianas. While several were sent to the Philippines, most were kept in Japan for defensive use. The Raiden continued to have problems; production was allowed to proceed at a low rate while a replacement was being developed. It got new life when the B-29 raids (p. 102) started, being the only plane with a sufficient ceiling to deal with the heavy bombers; the four-cannon armament of the improved *J2M3 Raiden 21 Gata* of 1944 was especially valuable. Unfortunately for the Japanese, there were not enough Raidens, and the B-29s began conducting raids at night (during which the radarless Raiden was flying blind) or were escorted by U.S. fighters such as the North American P-51 (see p. W110), which could make easy work of the Raiden.

From certain angles, the Raiden had a passing resemblance to the P-47 (see p. W:D83), and could be mistaken for an Allied plane when first encountered.

Some 260 J2M3s were built. Despite being a navy aircraft, it could not be operated off a carrier. The J2M3 is armed with two 20mm 99 Shiki 2 Gō Kikanhō (copies of the Oerlikon FFL with RoF 9) in the inner wings and two 20mm 99 Shiki 1 Gō Kikanhō (copies of the Oerlikon FF with RoF 8) in the outer wings.

It uses 63 gallons of aviation gas per hour at routine usage. Fuel and ammo cost $95.



Mitsubishi J2M3 Raiden 21 Gata

Subassemblies: Medium Fighter chassis +3, Medium Fighter wings +2, three retractable wheels +1.

Powertrain: 1,395-kW aerial HP turbocharged engine with MW feed, 1,743-kW prop, 133-gallon self-sealing tanks [Wings], and 6-gallon light MW tank; 2,000-kWs batteries.

Occupancy: 1 CS Body Cargo: 1.8 Body

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Cockpit:	0/+20	0/0	0/+20	0/0	0/0

Weaponry

2×20mm Med. Air. ACs/99-2 Shikis [Wing:F] (100 each).*
2×20mm Short Air. ACs/99-1 Shikis [Wing:F] (100 each).*
* Linked in pairs; additional link fires all four.

Equipment

Body: Autopilot; 550-lb. hardpoint (53-gallon drop tank only) [U]; IFF; medium radio transmitter and receiver. *Wings:* 135-lb. hardpoint each [U].

Statistics

Size: 23'×36'×13' *Payload:* 1.7 tons *Lwt.:* 3.8 tons
Volume: 200 *Maint.:* 30 hours *Price:* $43,300

HT: 8. HPs: 120 Body, 80 each Wing, 12 each Wheel.

aSpeed: 363 *aAccel:* 11 *aDecel*: 16 *aMR:* 4 *aSR:* 3
Stall Speed 74. -5 aSpeed per loaded hardpoint.
gSpeed: 279 *gAccel:* 13 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 216-sf wing area was used for performance calculations. Design aSpeed was decreased 11%. Only two-thirds of an armored station was purchased to more accurately reflect historical cockpit armor. A bit of the wings' fuel tankage had to be placed in the body for design purposes.

With the MW system operating, the engine produces 1,743-kW and aAccel improves to 14. The 6-gallon MW tank lasts 11 minutes and 12 seconds.

The ailerons tended to be sluggish over 325 mph; reduce aMR to 3. While the plane gave very little stall warning, it recovered from one easily (+2 to Piloting roll). The plane was considered very stable, so aSR has been increased.

Variants

The 3.1-ton *J2M2 Raiden 12 Gata* of 1943 was the initial production version; aSpeed 371. Instead of the two 99-1 Shiki cannons in the wings, it mounted a pair of synchronized .303-caliber 97 Shikis (Aircraft LMGs) with 550-700 rounds each in the nose. It carried 8.4 more gallons of fuel.

Some 21 J2M3s were built as the *J2M3a Raiden 21 Kō Gata* of 1944, with the two 99-1 Shiki guns removed from inside the wings and a second pair of 99-2 Shiki guns slung below the wings in gondolas. This increased drag and lowered speed, while having no significant benefit.

The *J2M4 Raiden 34 Gata* of 1944 used a new engine with turbo-supercharger to allow high performance to be retained up to 30,000'. Two oblique 20mm 99-1 Shiki (20mm Short Aircraft AC) with 100 rounds each were installed behind the cockpit, firing upward. The turbo-supercharger proved extremely troublesome and only two prototypes were built.

The *J2M5 Raiden 33 Gata* of 1944 used the airframe of the J2M4 but a more reliable engine, capable of 382 mph. Only 34 were built.

Nakajima Ki-27 "Nate"

In December 1937, the Japanese army adopted a new single-seat fighter that would prove to be an important milestone for Japanese aircraft production. Officially designated the *97 Shiki Sentōki Kō Gata* (type 2597 fighter model A) or *"Kyūjūshichi Sen"* (97 fight), its *kitai* (airframe) number was Ki-27-Kō. The Allies called it "Nate."

Paramount in its design was high agility, the Japanese pilots of the day being used to the very maneuverable Kawasaki Ki-10-II (*95 Shiki Sentōki*) biplanes. They were highly skilled in dog-fighting and compared themselves to kendo fighters, flying their planes as if they were wielding swords. The Ki-27 was a small monoplane, very lightly constructed and armed, and the first modern plane built in Japan.

It entered combat against Chinese-flown fighters such as the Polikarpov I-15 over Manchuria in April 1938, instantly proving its worth and routinely outmaneuvering its opponents. These early successes were as much a tribute to the skill of the pilots as to the soundness of the design, and would lead the Japanese army to incorrectly believe that maneuverability was everything in a fighter. When faster and heavier planes such as the Polikarpov I-16 (p. 101) – with cockpit armor, self-sealing tanks, and powerful armament – appeared, the Ki-27 would suffer high losses. It was nevertheless heavily employed in the invasions of Burma, Malaysia, the Dutch East Indies, and the Philippines. Credit for the first Japanese kill of the Pacific War also goes to a Ki-27, which shot down an RAF Consolidated Catalina flying boat (see p. W116) on December 7, 1941.

Production ended in July 1942, and the plane was soon after relegated to home defense and training duties, being no match for the heavy Allied fighters then appearing in large numbers. Despite this, it remained the first-line fighter of the Manchukuo air force, which even tried to intercept the U.S. Boeing B-29s (p. 102) with it. Twelve were used by the Thai air force as the *Bin Khap Lai 12* (B.Kh.12).

The Kō Gata had already in 1939 been superseded by the *Otsu Gata* (model B) with improved rear vision and underwing hardpoints, which could carry flush-fitting 34-gallon drop tanks or four 55-lb. bombs. Only every fourth or fifth had a radio, which was also extremely unreliable, especially the transmitter. Some 1,492 were built.

The Ki-27 is armed with two synchronized 7.7mm 89 Shiki Kikanjū machine guns in the nose (the 89 Shiki being a rechambered copy of the Vickers-Maxim Class E).

The engine burns 26.5 gallons of fuel per hour of routine usage. Fuel and ammo cost $30.

Nakajima Ki-27-Otsu "Nate"

Subassemblies: Light Fighter chassis +3; Medium Fighter wings with Fixed Strut option +2; three wheels +0.

Powertrain: 530-kW aerial turbocharged gasoline engine with 530-kW prop and 97-gallon light fuel tanks [Wings]; 2,000-kWs batteries.

Occ: 1 CS Body Cargo: 2.3 Body, 1.9 Wings

Armor	F	RL	B	T	U
All:	2/2	2/2	2/2	2/2	2/2

Weaponry

2×Aircraft LMGs/89 Shikis [Body:F] (500 rounds each).*
* Linked.

Equipment

Body: Navigation instruments; medium radio receiver and transmitter. *Wings:* 250-lb. hardpoint each [U].

Statistics

Size: 25'×37'×11' *Payload:* 0.5 tons *Lwt:* 2 tons
Volume: 144 *Maint:* 67 hours *Cost:* $8,935

HT: 8. HPs: 50 Body, 80 each Wing, 15 each Wheel.

aSpeed: 292 *aAccel:* 8 *aDecel:* 28 *aMR:* 7 *aSR:* 1
Stall Speed 61. -4 aSpeed per loaded hardpoint.
gSpeed: 237 *gAccel:* 11 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Very High. 1/8 Off-Road Speed.

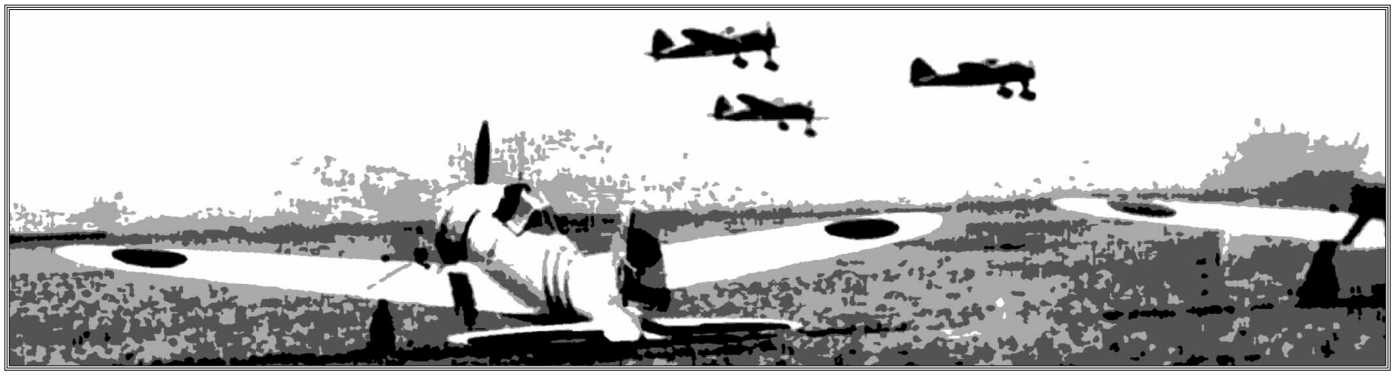
Design Notes

The historical 200-sf wing area was used for all performance calculations. Design aSpeed was increased 11% to the historical figure.

Variants

The 1.8-ton *Ki-27-Kō* of 1938 lacked the hardpoints; 565 were built.

The *Ki-79-Otsu* of 1943 was a two-seat trainer built by Manshu in Manchukuo. It used the same airframe, but had a weaker 380-kW engine; aSpeed 210. The Ki-79-Otsu or *2 Shiki "Kōren"* (type 2602 advance-trainer) served to train many a high-school boy. A total of 1,329 Ki-79s were built.



Yokosuka D4Y Suisei "Judy"

The D4Y was designed in the late 1930s as a replacement for the Aichi D3A "Val" dive bomber. Unlike the D3A, the *Suisei* (comet) had a fully retractable landing gear and an internal bomb bay; both helped the D4Y to achieve a higher speed and bombload than the D3A. The Suisei was based on a prototype Heinkel He 118 that the Japanese tested until it literally fell apart in flight. The most unusual feature was a liquid-cooled inline engine, at a time when virtually all other Japanese aircraft used radial engines. The inline was to be a source of constant problems, and was eventually replaced by a radial engine in the D4Y3.

The plane first flew in early 1941, and exceeded all expectations, until dive-bombing tests were conducted. The wing spars were considerably too weak to deal with the stress of the maneuver. Production was temporarily suspended while the problem was examined. During that interval, someone realized that the D4Y1 was faster and (with drop tanks) longer-ranged than the B5N2 torpedo bomber that was then being used as a carrier reconnaissance plane. The aircraft took on a new role.

The primary model, the D4Y3 with its radial engine, entered service in late 1944. Some late-production units had rocket-assisted takeoff gear to allow use from smaller carriers. Unlike the two earlier models, no recon version of the D4Y3 was built. Normal bomb load was one 550-lb. bomb in the bay and one 65-lb. bomb under each wing, although the Suisei could carry a maximum bomb load of either one 1,100-lb. bomb or two 550-lb. bombs in the bay.

Like many other Japanese planes, the "Judy" suffered from a lack of armor for crew and fuel system. This was illustrated during the "Marianas Turkey Shoot," when F6F Hellcat pilot Alexander Vraciu of the USS *Lexington* (see p. W:D93) downed six "Judys" in only eight minutes, expending a mere 360 rounds of .50-caliber ammo for all of them.

Despite being superior to the D3A in most respects, the D4Y appeared on the scene when Japan's fortunes were on the decline, and the Suisei managed only a handful of notable successes while being shot down in large numbers. This has led to the D4Y being mostly forgotten.

Some 2,038 D4Ys of all types were built. It is armed with two synchronized .303-caliber 97 Shiki Kikanjū machine guns (copy of the Vickers-Maxim Class E) in the nose and a 7.92mm 1 Shiki Kikanjū machine gun (copy of the Rheinmetall MG 15) in the rear seat. It uses 52 gallons of aviation gas per hour at routine usage. Fuel and ammo cost $70.

D4Y3 Suisei 33 Gata "Judy"

Subassemblies: Light Fighter-Bomber chassis +3; Heavy Fighter wings +2; three retractable wheels +1.

Powertrain: 1,164-kW aerial HP turbocharged gas engine with 1,164-kW prop and 275-gallon standard tanks [Wings]; 2,000-kWs batteries.

Occ: 2 CS Body Cargo: 3.2 Body

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3

Weaponry

2×Aircraft LMGs/97 Shikis [Body:F] (500 rounds each).*
Aircraft LMG/1 Shiki [Body:B] (450 rounds).
* Linked.

Equipment

Body: Arrestor gear; autopilot; 1,100-lb. bomb bay; IFF; medium radio transmitter and receiver. *Wings:* 70-lb. hardpoint each [U].

Statistics

Size: 34'×38'×12' *Payload:* 2.4 tons *Lwt.:* 5.1 tons
Volume: 312 *Maint.:* 32 hours *Price:* $39,410

HT: 9. HPs: 165 Body, 180 each Wing, 15 each Wheel.

aSpeed: 357 *aAccel:* 8 *aDecel*: 28 *aMR:* 7 *aSR:* 2
Stall Speed 82. -3 aSpeed per loaded hardpoint
gSpeed: 231 *gAccel:* 11 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Very High. 1/8 Off-Road Speed.

Design Notes

The historical 254-sf wing area was used for performance calculations. Design aSpeed was increased 8% to the historical. A small portion of the fuel tankage is placed in the body, though historically it was all in the wings.

Variants

The *D4Y1 Suisei 11 Gata* of 1942 used an 895-kW engine; aSpeed 343. This was the source of many problems (HT 8). The rear gun was a .303-caliber 92 Shiki Kikanjū (Aircraft LMG with RoF 10, a copy of the Lewis) with 582 rounds.

The *D4Y1-C Suisei 11 Gata* of 1942 was a reconnaissance version. It carried no bombs but did carry a 73-gallon drop tank under each wing and a recon camera in the rear body.

The *D4Y2 Suisei 12 Gata* of 1943 upgraded to a 1,044-kW engine, giving a top speed of 360 mph, and the problem with the wing spars was fixed. The subvariant *D4Y2a Suisei 12 Ko Gata* replaced the flexible gun with a 13mm 2 Shiki Kikanhō (Medium Aircraft HMG, a copy of the Rheinmetall MG 131).

A modification of the D4Y2 was the *D4Y2-S Suisei 12 Gata* of 1943, a night fighter used against B-29s flying at high altitude (p. 102). It carried no flexible gun and no bomb load, but mounted a 20mm 99-2 Shiki Kikanhō (20mm Medium Aircraft AC) with 100 rounds firing upward at a slightly forward angle. Some had provisions for underwing rockets. Without radar and with poor high-altitude performance, the D4Y2-S was not very effective in this role.

The *D4Y2-C Suisei 12 Gata* of 1943 was a reconnaissance version.

The *D4Y3a Suisei 33 Kō Gata* replaced the flexible gun with a 13mm 2 Shiki Kikanho.

The *D4Y4 Suisei 43 Gata* of 1945 was a flying bomb. The gunner and rear machine gun were removed and a 1,764-lb. bomb was semi-recessed in the bomb bay. With aSpeed 350, many had rocket-assisted takeoff units added, either for takeoff from short airfields or added boost on the final kamikaze run. Aichi built 296 of them.

Yokosuka E14Y "Glen"

The E14Y1, officially the *0 Shiki Kogata Suijōki 11 Gata* (type 2600 small seaplane model 11), was a light reconnaissance floatplane used by the Japanese navy from 1941. A total of 126 were built until 1943. It broke down into 12 parts which seven men in about 10 minutes could ready for catapult launch from the deck of a sub (*I-7* to *I-11* and *I-15* to *I-35*). Most missions were flown at night due to its low speed.

A sub-launched "Glen" was used to confirm the damage done at Pearl Harbor shortly after the raid (see p. W:D10).

The E14Y1 has a crew of two, a pilot and an observer who fires the .303-caliber 92 Shiki dorsal gun (a copy of the Lewis gun with RoF 10). It uses 11.5 gallons of aviation gas at routine usage. Fuel and ammo cost $30.

Yokosuka E14Y1 "Glen"

Subassemblies: Light Fighter chassis +3; Recon Plane wings with Fixed Strut, Folding, and STOL options +3; two Large Weapon pontoons [Body:U] +2.

Powertrain: 254-kW aerial gasoline engine with 254-kW old prop and 111-gallon standard fuel tanks [Wings]; 2,000-kWs batteries.

Occ: 2 CS Body Cargo: 1.6 Body, 10 each Pontoon

Armor	F	RL	B	T	U
Pontoons:	2/3	2/3	2/3	2/3	2/3
Wings:	2/2C	2/2C	2/2C	2/2C	2/2C

Weaponry

Aircraft LMG/92 Shiki [Body:B] (582 rounds).

Equipment

Body: Autopilot; 135-lb. hardpoint [U]; navigation instruments; medium radio transmitter and receiver.

Statistics

Size: 28'×36'×12' *Payload:* 0.5 tons *Lwt.:* 1.8 tons
Volume: 72 *Maint.:* 89 hours *Price:* $5,020

HT: 8. HPs: 50 Body, 35 each Wing, 60 each Pontoon.

aSpeed: 152 *aAccel:* 4 *aDecel*: 14 *aMR:* 3.5 *aSR:* 2
Stall Speed 45.
wSpeed: 20 *wAccel:* 4 *wDecel*: 0.7 (2.7) *wMR:* 0.1 *wSR:* 1
Draft 1.3'. Flotation Rating 1.85 tons.

Design Notes

The historical 204-sf wing area was used for performance calculations. Design aSpeed was decreased 7% to the historical figure. Some fuel tankage is in the body, though historically it was all considered to be in the wing.

The pontoons, as the only parts actually in the water, are assumed to have Fine lines for purposes of water-performance calculations. The plane needs a launch catapult or an 8-mph headwind to take off. Weight, cost, and HPs of the pontoons were halved to trim design weight toward the historical.

Yokosuka MXY7 'ka "Baka"

In the defense of the shrinking Japanese Empire of 1944, the high command ordered a desperate new means of attacking U.S. ships: the *kamikaze* (divine wind) suicide attacks. The Yokosuka MXY7, officially the *'ka 11 Gata* (cherry blossom model 11), was a dedicated suicide plane. The Allies inappropriately called it "Baka" (Japanese for fool).

The Oka was essentially a human-guided cruise missile, carried by a Mitsubishi G4M2e "Betty" mother plane, and launched at altitude about 55 miles from the target. Most of the distance (50 miles) was covered by gliding; the pilot then sequentially ignited the three rockets to accelerate to a maximum level speed of 535 mph. Once a target was selected, the pilot maneuvered into a steep dive, at speeds of 576-620 mph. Calculate collision damage as per p. W154, then the huge 2,640-lb. warhead explodes for 6d×2,270 [12d].

The best defense vs. the Oka was to attack the mother planes before launch; afterward, the Oka was difficult to intercept. Still, its successes were few. On April 1, 1945, the battleship USS *West Virginia* was damaged. On April 12, the destroyer USS *Mannert L. Abele* was sunk by a direct hit.

A total of 755 were built through March 1945.

Yokosuka MXY7 'ka "Baka"

Subassemblies: Light Fighter chassis with Good streamlining +3; Tiny Plane wings +0.

Powertrain: three 588-lb. 10-second solid-fuel rockets.

Occ: 1 CS Body Cargo: 2.8 Body, 0.8 Wings

Armor	F	RL	B	T	U
Pilot:	0/+0	0/+0	0/+20	0/+0	0/+0
All Else:	2/3W	2/3W	2/3W	2/3W	2/3W

Weaponry

2,200-lb. SAPHE bomb [Body:F].

Equipment

Body: Navigation instruments.

Statistics

Size: 20'×16'×4' *Payload:* 1.9 tons *Lwt:* 2.4 tons
Volume: 144 *Maint:* 88 hours *Cost:* $6,030

HT: 7. HPs: 50 Body, 12 each Wing.

aSpeed: 403 *aAccel:* 7 *aDecel:* 4 *aMR:* 1 *aSR:* 1
Stall Speed 114.

Design Notes

With no landing gear, the body has 18.5 VSPs. A 2,200-lb. SAPHE bomb was purchased for the warhead, but the historical 2,640-lb. weight was used. A 3,300-lb. solid-fuel rocket motor was purchased; the historical thrust and endurance are given rather than the much more modest design figures.

Despite this enhancement, design aAccel is still too modest for the plane's historical acceleration on its attack run; either diving contributes most of the increased speed or a higher aAccel must be provided.

PZL P.11 "Jedenastka"

In the early 1930s, the Polish air force adopted the P.11 fighter aircraft made by Panstwowe Zaklady Lotnicze (PZL). At the time, it was considered one of the best fighters in the world, but already by the mid-1930s it had been outpaced by more advanced designs, such as the German Bf 109, which would become its main opponent when Germany attacked Poland in September 1939 (see p. W12).

Popularly known as the *Jedenastka* (eleventh), it was a gull-wing monoplane with an open cockpit and fixed landing gear. The P.11a was armed with only two machine guns in the fuselage, and lacked a radio. The improved P.11c of 1934 added another pair of machine guns in the wings and a radio, and gave better sightlines for the pilot by lowering the engine and raising the pilot's seat, as well as by using a new tail and redesigned wing.

About two-thirds of the P-11c fighters were only fitted with two guns, due to delays in production; radios were likewise only installed in one-third of the planes. Thus, most of the 128 P.11s deployed against the Germans were inadequately equipped, slow, and possessed a limited ceiling compared to the German aircraft. Nevertheless, they accounted for themselves fairly well, due to their high agility, and shot down considerable numbers of their adversaries.

About 40 P.11 crews fled to Romania in late 1939, where the birds were interned and later used by the Romanian air force, which also had imported it and made it under license.

The P.11c is armed with two synchronized 7.92mm PWU-FK wz. 33a machine guns (Browning variants with RoF 16) in the sides of the fuselage and two more in the wings. Wing hardpoints can carry tiny 27-lb. bombs.

The engine burns 21.6 gallons of fuel per hour at routine usage. Fuel and ammo cost $40. Historical cost of a P.11c was 178,500 zloty ($33,615).

PZL P.11c "Jedenastka"

Subassemblies: Light Fighter chassis +3; Recon Plane wings with Fixed Strut and High Agility options +2; three wheels +0.

Powertrain: 481-kW aerial gas engine with 481-kW old prop and 84-gallon standard tanks; 2,000-kWs batteries.

Occ: 1 XCS Body Cargo: 2.5 Body, 1.8 Wings

Armor	F	RL	B	T	U
All:	2/2C	2/2C	2/2C	2/2C	2/2C

Weaponry

2×Aircraft LMGs/wz. 33a [Body:F] (600 rounds each).*
2×Aircraft LMGs/wz. 33a [Wings:F] (500 rounds each).*
* Linked in pairs; additional link fires all four.

Equipment

Body: Navigation instruments; medium radio receiver and transmitter. *Wings:* 30-lb. hardpoint each [U].

Statistics

Size: 25'×35'×9' *Payload:* 0.7 tons *Lwt:* 2 tons
Volume: 144 *Maint:* 70 hours *Cost:* $8,125
HT: 8. HPs: 50 Body, 35 each Wing, 5 each Wheel.

aSpeed: 242 *aAccel:* 6 *aDecel:* 14 *aMR:* 3.5 *aSR:* 1
Stall Speed 62. -3 aSpeed per loaded hardpoint.
gSpeed: 196 *gAccel:* 10 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Very High. 1/8 Off-Road Speed.

Design Notes

The historical 192-sf wing area was used for performance calculations. Design aSpeed was increased 8% to the historical.

Variants

The *P.11a* of 1933 had a 373-kW engine. It was armed with twin fuselage-mounted 7.92mm PWU-FK wz. 33s (Aircraft LMGs with RoF 16) with 700 rounds each.

The *P.11b* of 1934 was exported to Romania, fitted with a Romanian-made 444-kW engine. It mounted two 7.92mm FN-Brownings (Aircraft LMGs with RoF 25); 50 were acquired as trainers.

The *P.11f* of 1937 was made under license in Romania, with a 477-kW engine and four LMGs; 95 were made.

The much improved P.24-series used the rear fuselage, wings, and tail of the P.11c, with a new nose, enclosed cockpit, and French 694-kW engine. The *P.24a* of 1936 was armed with twin 7.92mm FN-Browning MGs with 700 rounds each in the fuselage, and two 20mm Oerlikon FF (20mm Short Aircraft ACs) with 60 rounds each and two 55-lb. hardpoints under the wings; aSpeed 257. Turkey bought 14 and assembled 20 more.

The *P.24b* of 1938 in Bulgarian service was the P.24a with two more MGs replacing the cannons; 12 were acquired.

The *P.24c* of 1938 was identical to the P.24a except for its 110-lb. hardpoints. Turkey put 26 in service.

The *P.24e* of 1939 in service with Romania had a 671-kW or 701-kW engine and was armed with four 7.92mm FN-Browning MGs. Five were bought, and 25 made under license.

The 2.2-ton *P.24f* of 1937 had a 723-kW engine; aSpeed 267. Armament was two 7.92mm FN-Browning M1937s (Aircraft LMGs) and two 20mm Oerlikon cannons. Greece had 30. The *P.24g* used by Greece had four MGs – six were in service. All except one of the 36 Greek planes were destroyed by Italian and German fighters in 1941.

Bereznyak-Isayev BI-1

The U.S.S.R. built the first rocket fighter in the world. Designed from 1941 by Aleksandr Bereznyak and Aleksei Isayev, it was a streamlined, very sleek fighter with small wings and a liquid-fuel rocket engine in the tail. It was completely made of wood, with plywood wings and fabric covering for the fuselage. The BI-1 was intended as an interceptor, gliding home after having spent its fuel and ammo.

The rocket engine was powered by a kerosene/nitric acid mix. Unfortunately, the tanks and fuel lines were not corrosion-proof, and there were several fuel spills during tests; one engine exploded on the ground in February 1942. The aircraft made its first powered flight in May 1942, but problems with the fuel as well as flight stability continued to haunt it. In March 1943, the latest prototype went straight to the ground, killing the pilot, and the design was abandoned. An order for 50, already in effect, was canceled.

The BI-1 burns 2.4 gallons of a kerosene/nitric acid fuel per *second* at full thrust. Fuel and ammo cost $65, plus any dropped ordnance (standard load was to be 38 2.2-lb. bombs).

Bereznyak-Isayev BI-1

Subassemblies: Light Fighter chassis w/ Very Good streamlining +3; Tiny Plane wings +0; three wheels or skis +0.

Powertrain: 2,425-lb. liquid-fuel rocket engine fed from 183-gallon standard tanks; 2,000-kWs batteries.

Occ: 1 CS Body Cargo: 2.8 Body, 0.3 Wings

Armor	F	RL	B	T	U
Body:	2/3C	2/3C	2/3C	2/3C	2/3C
Wings:	2/3W	2/3W	2/3W	2/3W	2/3W

Weaponry

2×20mm Long Aircraft ACs/ShVAKs [Body:F] (45 each).*
* Linked.

Equipment

Body: 100-lb. bomb bay; navigation instruments; medium radio receiver and transmitter.

Statistics

Size: 23'×21'×8' *Payload:* 0.9 tons *Lwt:* 1.8 tons
Volume: 144 *Maint:* 97 hours *Cost:* $4,295

HT: 8. HPs: 50 Body, 24 each Wing, 5 each Wheel.

aSpeed: 621 *aAccel:* 13 *aDecel:* 10 *aMR:* 2.5 *aSR:* 1
Stall Speed 98.
gSpeed: 323 *gAccel:* 15 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Very High. 1/8 Off-Road Speed.

Design Notes

The historical 75-sf wing area was used for performance calculations. Weight, cost, and HPs of wings were doubled. The engine has its flow rate (p. 13) fixed at 36,375. Design aSpeed was decreased 7% to the historical value.

Beriev MBR-2 (Be-2)

The Soviet *Morskoi Blizhnii Razvydechik-2* (marine short-range reconnaissance) was a small, high-wing seaplane introduced in 1934. The original model was superseded by the MBR-2bis in 1937, some 1,400 being made of all versions. Later renamed the Be-2, its production ceased in 1942.

It gave good service in the coastal areas of the Baltic and Black Seas, as well as the Arctic seaboard, being easy to fly, with good maneuverability and excellent seaworthiness. Its main disadvantages were slow speed and token armament.

The MBR-2bis has a navigator/bow gunner, two pilots, and a radio operator/dorsal gunner. It carries two 7.62mm ShKAS in an open mount in the bow and a dorsal turret with 30°-per-second manual traverse that retracted into the body.

The engine burns 31 gallons of fuel per hour at routine usage. Fuel and ammo cost $60.

Beriev MBR-2bis (Be-2)

Subassemblies: Light-Fighter Bomber chassis +3; Medium-Fighter Bomber wings with STOL and Fixed Strut options +3; two Medium Weapon pontoons 1-2 [Body:R, L] +1; Large Weapon pod [Wings:T] +2; full-rotation Mini open mount [Body:T] +0; full-rotation Medium Weapon turret [Body:T] +1. All except open mount waterproofed.

Powertrain: 642-kW aerial HP gas engine with 619-kW prop [Pod] and 234-gallon self-sealing fuel tanks [Wings]; 4,000-kWs batteries.

Occ: 3 CS Body, 1 CS Body/Tur Cargo: 8.9 Body, 5.2 Wings

Armor	F	RL	B	T	U
All Else:	2/3*	2/3*	2/3*	2/3*	2/3*

* Wooden armor on body and pontoons.

Weaponry

2×Aircraft LMGs/ShKASs [OM:F, Tur:F] (600 rounds each).

Equipment

Body: Autopilot; backup driver option; navigation instruments; medium radio receiver and transmitter. *Wings:* 550-lb. hardpoints each [U].

Statistics

Size: 44'×62'×18' *Payload:* 1.7 tons *Lwt:* 4.7 tons
Volume: 312 *Maint:* 44 hours *Cost:* $20,320

HT: 9. HPs: 165 Body, 220 each Wing, 60 Pod, 38 each Pontoon, 30 OM, 75 Turret.

aSpeed: 151 *aAccel:* 4 *aDecel:* 36 *aMR:* 9 *aSR:* 4
Stall Speed 44. -1 aSpeed per loaded hardpoint.
wSpeed: 20 *wAccel:* 4 *wDecel:* 10 (12) *wMR:* 0.1 *wSR:* 4
Draft 1.4. Flotation Rating 7 tons.

Design Notes

The historical 592-sf wing area was used for calculations. Design aSpeed was cut 7% to the historical. The retractable turret takes up 120% of its volume in the body. Weight, cost, and HPs of wings, pod, and pontoons were halved.

Ilyushin DB-3 (Il-4)

The Ilyushin *Dalni Bombardirovshchik-3* (medium bomber) was an important bomber of WWII. It was a successful twin-engined design, relatively simple but sturdy, and reliable like many Soviet aircraft of the era.

The original DB-3B entered production in 1937. This was heavily used in the Winter War against Finland (see ***GURPS WWII: Frozen Hell***). During the 1940s, the Finnish air force had 11 captured DB-3Bs, but did not put them to much use.

From 1938, 24 were used by the Russian volunteer group of the Chinese air force in the Sino-Japanese War.

In 1939, it was superseded by the improved DB-3M, which had better engines and other upgrades. This in turn was replaced by the DB-3F, which was to become the standard type of the Great Patriotic War. Its appearance was noticeably different, with a slimmer nose featuring a large glazed area, new wings, and more powerful engines. In keeping with new naming conventions, it was re-designated the Il-4 in reference to its designer of 1942. No fewer than 5,256 were built until early 1945.

The armament, which had been found lacking against the Finns and Japanese, was improved, although the aircraft's defensive capability would remain mediocre for its service life. This generally confined it to night attacks. The nose turret of the older models was replaced by a swivel mount on the DB-3F.

The bomber was in service both with the long-range aviation command of the Red Army as well as naval aviation. It is credited with the first attacks on Berlin, bombing the German capital on August 8, 1941. Apart from long-range bombing raids, it was also frequently used for short-range, maximum payload attacks on tactical targets immediately behind enemy lines. The navy used it as a land-based torpedo bomber with the Baltic, Black Sea, and Northern fleets. In the reconnaissance role, it was fitted with a recon camera in the bomb bay, and late in the war, it was used to tow A-7 or G-11 gliders.

Those built from 1942 had more powerful supercharged engines and a wooden nose, wings, and fuselage deck due to a shortage of light alloys. The final production returned to metal parts again when new factories in Siberia picked up production.

The DB-3F is crewed by a pilot, navigator/bombardier (who also fires the 12.7mm UBS machine gun in the nose), radio operator (who also fires the 7.62mm ShKAS in the ventral position), and gunner (who fires the 12.7mm UBT in the turret with 28°-per-second manual traverse). The bomb bay will hold ten 220-lb. bombs, and the external hardpoints will usually carry three 550-lb. bombs.

The engines burn 82 gallons of aviation gas per hour at routine usage. A full load of fuel and ammo costs $320.

Ilyushin DB-3F (Il-4)

Subassemblies: Heavy Fighter-Bomber chassis +4; Light Bomber wings +4; two Large Weapon pods 1-2 [Wings:F] +2; full-rotation Medium Weapon turret [Body:T] +1; three retractable wheels +1.

Powertrain: two 820-kW aerial HP supercharged gas engines with two 820-kW props [Pods 1-2], 1,018-gallon self-sealing tanks [Wings]; 4,000-kWs batteries.

Occ: 3 CS Body, 1 CS Both Cargo: 46.6 Body, 1.2 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Pilot:	0/+0	0/+0	0/+30	0/+0	0/+0
Bombard:	0/+20	0/+0	0/+0	0/+0	0/+0
Radio Op:	0/+0	0/+0	0/+0	0/+0	0/+20
Gunner:	0/+30	0/+0	0/+0	0/+0	0/+0

Weaponry

Long Aircraft HMG/UBS [Body:F] (200 rounds).
Aircraft LMG/ShKAS [Body:U] (1,100 rounds).
Long Aircraft HMG/UBT [Tur:F] (500 rounds).

Equipment

Body: Autopilot; 2,200-lb. bomb bay; bombsight; 2,200-lb. hardpoint; IFF; navigation instruments; precision navigation instruments; large radio receiver and transmitter. *Wings:* 550-lb. hardpoint each. *Turret:* Universal mount.

Statistics

Size: 48'×70'×14' *Payload:* 4 tons *Lwt:* 11.1 tons
Volume: 640 *Maint:* 24 hours *Cost:* $68,720

HT: 10. HPs: 525 Body, 300 each Wing, 50 each Wheel, 120 each Pod 1-2, 75 Turret.

aSpeed: 251 *aAccel:* 4 *aDecel:* 20 *aMR:* 5 *aSR:* 2
Stall Speed 76. -1 aSpeed per loaded hardpoint.
gSpeed: 177 *gAccel:* 8 *gDecel:* 10 *gMR:* 0.25 *gSR:* 3
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 718-sf wing area was used for performance calculations. Design aSpeed was increased 5% to the historical figure. Weight, cost, and HPs of the wings were halved to reduce weight – this also represents some of the effects of the wooden construction.

From 1943, the Il-4 was rearmed to mount a 20mm ShVAK (20mm Long Aircraft AC) with 120 rounds in the nose and another ShVAK with 240 rounds in the turret.

Variants

The *DB-3B* of 1937 had 570-kW engines and was armed with a 7.62mm ShKAS (Aircraft LMG) with 500 rounds in the nose, a ShKAS with 1,100 rounds in the turret, and a ShKAS with 1,100 rounds in the ventral position. Some had an optional remote-controlled ShKAS with 300 rounds in the tail, fired by the pilot with an effective Acc of 0. Some 1,528 were built.

The 7.1-ton *DB-3T* of 1937 could carry a single 450mm torpedo under the belly; aSpeed 245.

The *DB-3M* of 1939 received new 694-kW engines, which were upgraded in early 1940 to 709 kW, and again in 1941 to 820 kW. That latest version also had increased fuel tankage to 756 gallon; aSpeed 277.

Tupolev TB-3

This aircraft established the four-engine configuration that would become standard for heavy bombers. During the 1930s, it gave the Soviet Union the greatest strategic bomber fleet in the world. It entered service in 1932 as the *Tyazholyi Bombardirovshchik-3* (heavy bomber).

It was a huge all-metal monoplane, with a glazed nose for navigator and bombardier, side-by-side open cockpit, and wings so large that they could be crawled through by the crew.

The TB-3 was used against the Japanese in 1938 and against the Finns in the Winter War (see ***GURPS WWII: Frozen Hell***). By 1941, the Soviets still had 516 in service, which were shot down in droves during desperate daylight attacks. They then changed tactics to night raids, but the plane's time was largely over. Many were transferred to transport duties, including flying supplies to besieged Leningrad and in support of partisans. Most were retired after 1942.

More than 800 were built, some 140 with AM-34RN engines. The TB-3/AM-34RN of 1935 was the penultimate of the series. It featured 7.62mm ShKAS MGs in the nose, dorsal turret, tail mount (all with 33°-per-second manual traverse), and ventral hatch. The engines burn 122.4 gallons of aviation gas per hour. Fuel and ammo cost $450.

Tupolev TB-3/AM-34RN

Subassemblies: Heavy Bomber chassis +5; Huge Transport wings with Fixed Strut option +5; four Large Weapon pods 1-4 [Wings:F] +2; limited-rotation Small Weapon turret 1 [Body:F] +0; two full-rotation Small Weapon turrets 2-3 [Body:T, B] +0; three large wheels +2.

Powertrain: four 612-kW aerial supercharged gas engines with four 612-kW old props [Pods 1-4] and 2,061-gallon light tanks [Wings]; 8,000-kWs batteries.

Occ: 2 XCS Body, 3 CS Tur 1-3 **Cargo:** 183 Body, 100 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3

Weaponry

Aircraft LMG/ShKAS [Body:U] (600 rounds).
3×Aircraft LMGs/ShKASs [Tur 1-3:F] (1,100 rounds each).

Equipment

Body: Autopilot; backup driver controls; 6,160-lb. bomb bay; bombsight; two cameras [U]; four 550-lb. hardpoints [U]; navigation instruments; medium radio receiver and transmitter; large radio receiver and transmitter. *Wings:* three 550-lb. hardpoints each [U].

Statistics

Size: 82'×137'×28' *Payload:* 7.5 tons *Lwt:* 20.8 tons
Volume: 1,840 *Maint:* 24 hours *Cost:* $67,395

HT: 10. HPs: 1,100 Body, 900 each Wing, 100 each Wheel, 120 each Pod 1-4, 45 each Turret 1-3.

aSpeed: 179 *aAccel:* 3 *aDecel:* 16 *aMR:* 4 *aSR:* 3
Stall Speed 56. -1 aSpeed per loaded hardpoint.
gSpeed: 180 *gAccel:* 9 *gDecel:* 10 *gMR:* 0.25 *gSR:* 3
Ground Pressure Very High. 1/8 Off-Road Speed.

Design Notes

The historical 2,524-sf wing area and aSpeed are given. Design aMR was halved to better model handling.

Variants

The *G-2* of 1939 was an unarmed transport based on the TB-3/M-17F with 545-kW engines. It could carry 7.7 tons of cargo, 35 paratroops, or a slung T-38 (p. 66); 170 were made.

The Zveno Experiments

The *Zveno* (link) trials evolved around a "flying aircraft carrier" concept. The Zveno-6 was a TB-3/AM-34RN carrying an I-16 *Sostavnoy Pikiruyushchnyi Bombardirovshchik* (composite dive bomber) under each wing. The I-16SPB, based on the *I-16 Tip 5* fighter of 1935, was fitted with dive brakes and reinforced wings to carry two 550-lb. bombs. With the bombs, it was unable to take off on its own. The TB-3 released its duo near their target. After their attacks, the pilots could re-attach to the TB-3 (a Piloting-4 roll) or land under their own power.

The Zveno-6 was introduced in 1938. An experimental squadron with six Zveno-6s fought in Romania in 1941-42.

The I-16 burns 23.5 gallons of fuel per hour of routine usage. Fuel and ammo (including bombs) cost $2,235.

Polikarpov I-16SPB

Subassemblies: Light Fighter chassis +3; Recon Plane wings +2; three retractable wheels +0.

Powertrain: 522-kW turbocharged aerial engine w/ 522-kW old props and 112-gallon light tanks; 2,000-kWs batteries.

Occ: 1 CS Body **Cargo:** 0.9 Wings

Armor	F	RL	B	T	U
Body:	2/3W	2/3W	2/3W	2/3W	2/3W
Wings:	2/2C	2/2C	2/2C	2/2C	2/2C
Pilot:	0/+0	0/+0	0/+25	0/+0	0/+0

Weaponry

2×Aircraft LMGs/ShKASs [Body:F] (900 rounds each).*
* Linked.

Equipment

Body: Navigation instruments; medium radio receiver and transmitter. *Wings:* 550-lb. hardpoint each [U].

Statistics

Size: 20'×30'×8' *Payload:* 1.1 tons *Lwt:* 2.4 tons
Volume: 144 *Maint:* 75 hours *Cost:* $7,185

HT: 7. HPs: 50 Body, 25 each Wing, 5 each Wheel.

aSpeed: 272 *aAccel:* 5.5 *aDecel:* 8 *aMR:* 2 *aSR:* 1
Stall Speed 120. -5 aSpeed per loaded hardpoint.
gSpeed: 98 *gAccel:* 9 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Very High. 1/8 Off-Road Speed.

Design Notes

Stall speed increased and gSpeed decreased to keep the design unable to take off, as was historically the case.

Boeing B-29 Superfortress

The "most complicated moving machine created by man up to that time," the B-29 Superfortress was probably the best bomber of WWII. The Boeing Model 345 was a four-engined strategic bomber with superior range, speed, altitude, bomb capacity, and crew comfort. Its planned service ceiling was over 33,000', unreachable for most Japanese fighters. The first of more than 3,000 were produced in late 1943, and operational service began in June 1944.

Navigational and meteorological problems, compounded by reliability issues with the engines at high altitude, made the planned high-altitude daylight bombings a failure, and the U.S. Army Air Force switched to relatively low-altitude night attacks. Due to the poor Japanese AA system and their decimated and ineffective night-fighter force, these were very effective. At the lower altitudes and lighter weights (with less fuel and only the tail guns being carried), the engines were more reliable. The bombloads mainly consisted of incendiaries, which caused devastating destruction in Japanese cities built of wood and paper. The Tokyo bombings of May 1945 are considered the most deadly series in the war, with more immediate casualties than even the atomic bombs.

Those atomic weapons were, of course, also dropped by B-29s. The 12.5-kT uranium bomb "Little Boy" was released on Hiroshima by the B-29 "Enola Gay;" the 22-kT plutonium bomb "Fat Man" was dropped on Nagasaki by the B-29 "Bockscar." See p. W:D74 and p. W:WW75 for details on the bombs. Both aircraft were considerably modified.

The B-29 routinely carried 10 .50-caliber Browning M-2 machine guns in remote-controlled turrets traversing at 60° per second. The gunners in the fuselage acquired targets through transparent domes, tracking them with gun sights which in turn fed data into the targeting computers that controlled the guns. One or more turrets could be assigned to fire at a target, or the target could be "handed over" from one turret to another as it crossed from one field of fire to the next. A 20mm Hispano-Suiza M-2 cannon was installed in the manned tail position.

Even so advanced a defensive suite probably had mediocre results on average, but there is a story of a B-29A that shot down 12 fighters over Tokyo on January 27, 1945, then took down two more that tried to suicide-ram it. It flew 1,500 miles back to Saipan on three engines, but had to be written off due to damage from the combat and its subsequent crash landing.

The crew consists of pilot, co-pilot, flight engineer, navigator, radar operator, bombardier/forward gunner, radio operator, top gunner, two side gunners, and tail gunner. They have three fully pressurized and heated compartments, allowing them to dispense with the bulky gear worn by other air crews.

The B-29 burns 328 gallons of aviation gas per hour. Fuel and ammo cost $1,910. Historical cost was $650,000.

Boeing B-29 Superfortress

Subassemblies: Huge Bomber chassis with Good streamlining +5; Huge Bomber wings with STOL option +4; four Small AFV pods [Wings:F] +2; four full-traverse Mini turrets [2×Body:T, 2×Body:U] +1; six retractable wheels +3.

Powertrain: four 1,641-kW aerial HP supercharged engines with four 1,641-kW props [Pods 1-4], 1,120-gallon self-sealing tanks [Body], and 5,828-gallon self-sealing tanks [Wings]; 16,000-kWs batteries.

Occ: 11 CS Body Cargo: 56.6 Body, 0.2 each Tur

Armor	F	RL	B	T	U
All:	3/10	3/10	3/10	3/10	3/10
Pilots:	0/+0	0/+0	0/+30	0/+0	0/+0

Weaponry

8×Long Aircraft HMGs/M-2s [Tur 1-4:F] (1,000 each).*
2×Long Aircraft HMGs/M-2s [Body:B] (1,000 each).**
20mm Long Aircraft AC/M-2 [Body:B] (100 rounds).**
* Linked in pairs. ** Linked.

Equipment

Body: Autopilot; backup driver option; two 10,000-lb. bomb bays; improved bombsight; casemate mount for HMGs and AC [B]; IFF; 11-man/day limited life system; navigation instruments; precision navigation instruments; 20-mile radar; very large radio receiver and transmitter; five mini targeting computers. *Turrets 1-4:* 0.5-kW traversing equipment; universal mount.

Statistics

Size: 99'×142'×28' *Payload:* 30.25 tons *Lwt:* 67.5 tons
Volume: 3,040 *Maint:* 12 hours *Cost:* $275,860

HT: 7. HPs: 1,500 Body, 1,000 each Wing, 200 each Pod, 70 each Wheel, 30 each Turret.

aSpeed: 357 *aAccel:* 3 *aDecel:* 10 *aMR:* 2.5 *aSR:* 3
Stall Speed 126.
gSpeed: 150 *gAccel:* 7 *gDecel:* 10 *gMR:* 0.25 *gSR:* 3
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 1,736-sf wing area was used for performance calculations. Design aSpeed was reduced 4% to the historical. A bit of engine volume is displaced to the wings, and a bit more than the historical fuel-tankage listed is actually in the body. The pilots share a single armored station.

The original design had four bunks allowing the crew to rest, but these were replaced by the radar equipment and operator. Late planes had four MGs in the front dorsal turret, but deleted the autocannon in the tail turret. Four 640-gallon fuel tanks could be carried in the bomb bays for increased range.

Variants

The *B-29A* of 1944 had a different wing, but identical game statistics. It, too, received another pair of MGs in exchange for the autocannon. Some 1,119 were built.

The *B-29B* of 1945 had no armament except for two tail guns. These were controlled by a 2-mile targeting radar. The crew was reduced to seven, but 10 were often carried to better operate the various radar systems. The lack of the turrets allowed a greater bombload (up to 22,800 lbs.) and also allowed aSpeed to increase to 364. A total of 311 were built.

Curtiss C-46 Commando

Designed during the '30s by Curtiss-Wright in competition with the Douglas DC-3, the CW-20 entered service with the U.S. Army Air Force in 1942 as the C-46 Commando. Its fuselage was designed as a cross-section of two circular segments intersecting at a common chord line, giving the impression of a "double decker" – which in a way it was, as the floor was located at the line, dividing the body into the upper main cabin and a lower cargo hold, a novel feature at the time.

The C-46A was the main production version, 1,491 having been built. It featured a strengthened floor for greater payload, an enlarged cargo door on the left side, and folding passenger seats. It could carry 40 fully equipped troops (in addition to general cargo), 33 stretcher patients and four attendants, or the equivalent in bulk cargo.

Despite the reinforced floor, the plane's cargo density was quite low. It did not benefit all that much from the spacious cargo areas. Despite that, it could carry 25% more than its more common counterpart, the C-47 Skytrain (see p. W:D86).

The C-46A would see its main use in the Far East, crossing the Himalayan Mountains from the Assam region in India to Chunking in China, after the Japanese had closed the ground route via Burma. These air operations, known as "flying over the Hump" (see p. W:D35) began in May 1943. They were performed under very difficult conditions; the largely unpaved airfields on either side were often primitive, the ground crews having to manually pump fuel and load cargo. Crossing the mountains required flying at very high altitudes, resulting in icing problems and turbulence. Under these conditions, the Commando required extensive maintenance and had a high loss rate. The perils didn't end there; with dangerous cargoes such as fuel and ammunition, the unarmed transports also presented attractive targets for the Japanese fighters – at least most of the time. One Nakajima Ki-43 fighter was shot down by a feisty C-46 crew firing a Browning Automatic Rifle (see p. W96) *through* the plane's windshield . . .

In the European theater, the planes were also active as cargo carriers, and additionally dropped airborne troops. They could tow two Waco CG-4A cargo gliders each.

Some 160 C-46As were used by the U.S. Marine Corps as the R5C-1, which didn't differ apart from the designation. They entered service in 1944 and were used to support operations at Saipan, Guam, Iwo Jima, and Okinawa.

The Chinese air force received 23 in 1942.

The crew consists of pilot, co-pilot, navigator/radio operator, and flight engineer/loadmaster. The engines burn 149.2 gallons per hour at routine usage. A full load of fuel costs $280. Historical cost was $233,000.

Curtiss C-46A Commando

Subassemblies: Huge Transport chassis +6; Huge Bomber wings +4; two Small AFV pods [Wings:F] +2; three retractable wheels +3.

Powertrain: two 1,493-kW aerial turbocharged HP engines with two 1,493-kW props [Pods 1-2] and 1,400-gallon self-sealing tanks [Wings]; 8,000-kWs batteries.

Occ: 4 CS, 40 PS Body Cargo: 647 Body, 6 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3

Equipment

Body: Autopilot; backup driver option; 460-VSP main cargo hold; 91-VSP lower cargo hold; navigation instruments; precision navigation instruments; very large radio receiver and transmitter; toilet.

Statistics

Size: 76'×108'×22' *Payload:* 10.5 tons *Lwt:* 25.3 tons
Volume: 5,440 *Maint:* 17 hours *Cost:* $137,025

HT: 9. HPs: 1,100 Body, 1,000 each Wing, 80 each front Wheel, 40 tail Wheel, 150 each Pod.

aSpeed: 270 *aAccel:* 4 *aDecel:* 28 *aMR:* 7 *aSR:* 3
Stall Speed 81.
gSpeed: 158 *gAccel:* 8 *gDecel:* 10 *gMR:* 0.125 *gSR:* 3
Ground Pressure Very High. 1/8 Off-Road Speed.

Design Notes

The best-fitting chassis remains a bit too large, as evidenced by too much "waste" space and low design speed; aSpeed was increased 22% to the historical. Better streamlining would have improved things, but was ignored in order to keep Good and better streamlining for those aircraft that really deserve it. The 460-VSP main cargo hold includes the (folding) passenger seats; i.e., with 40 troops, some 260 VSPs remain for access and general cargo. The historical 1,358-sf wing area was used for performance calculations.

Variants

The original CW-20 prototype of 1940 with 1,193-kW engines was sold to the *British Overseas Airtransport Company*, which flew it as a 24-seat passenger airliner between Gibraltar and Malta from 1941-43.

The *C-46* of 1941 was the first version; it could carry only 5 tons of cargo. A total of 26 were built before production changed to the C-46A.

The 26-ton *C-46D* of 1943 was designed for personnel transport with a second door on the right side. It received extra radio and navigation equipment and new three-bladed props, which gave less maximum speed but better reliability, at almost the same cruising speed; aSpeed 245. Some 1,410 were built.

The *C-46E* of 1943 was the utility version of the C-46D; 17 were built. The *C-46F* of 1944 reverted to the original layout of the C-46A with 234 built.

Curtiss Hawk 75

The Curtiss Hawk 75 fighter was designed for the U.S. Army Air Corps, which reluctantly bought a few hundred on the eve of WWII; most of them were exported.

The primary customer was the *Armée de l'Air* (French Air Force, see p. W:RH21), which ordered it in 1938. France eventually received 291 in various configurations, all called H.75-C1. These went into action against the Germans in late 1939; Hawk 75A-2s shot down two Bf 109Es on September 8, 1939, the first French aerial victories of WWII. The H.75-C1 was the most important French fighter next to the MS.406-C1 (see p. W:RH42) and scored 290 confirmed kills.

Those French aircraft that didn't manage to escape to Britain were employed by Vichy France in North Africa or sold to Finland by the Germans. A number of smaller countries acquired variants, which also saw considerable use.

The second batch for the French, delivered in 1939, consisted of the Hawk 75A-2 detailed here. Armament was two synchronized 7.5mm FN-Browning Mle 38 MGs (RoF 25) in the nose and four in the wings. On the rare missions when bombs were carried, only 105 gallons of fuel could be carried.

The engine burns 39.2 gallons of fuel per hour at routine usage. Fuel and ammo cost $55. Historical cost was $23,000.

Curtiss Hawk 75A-2

Subassemblies: Medium Fighter chassis +3; Light Fighter wings with High-Agility option +2; three retractable wheels +0.

Powertrain: 783-kW aerial supercharged gas engine with 783-kW prop, 162-gallon light tanks; 2,000-kWs batteries.

Occ: 1 CS Body Cargo: 1.7 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Cockpit:	0/+0	0/+0	0/+15	0/+0	0/+0

Weaponry

2×Aircraft LMGs/Mle 38s [Body:F] (600 rounds each).*
4×Aircraft LMGs/Mle 38s [Wings:F] (500 rounds each).*
* Linked in pairs; additional links fire all wing guns or all six.

Equipment

Body: Navigation instruments; medium radio receiver and transmitter. *Wings:* 200-lb. hardpoint each [U].

Statistics

Size: 29'×37'×10' *Payload:* 0.7 tons *Lwt.:* 3 tons
Volume: 200 *Maint.:* 53 hours *Cost:* $14,280

HT: 9. HPs: 120 Body, 90 each Wing, 12 each Wheel.

aSpeed: 309 *aAccel:* 8 *aDecel:* 26 *aMR:* 6.5 *aSR:* 2
Stall Speed 68. -4 aSpeed per loaded hardpoint.
gSpeed: 235 *gAccel:* 11 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Very High. 1/8 Off-Road Speed.

Design Notes

A bit of fuel tankage was diverted to the wings, though historically it was all in the body. Only one-quarter of an armored station was used, to better represent historical protection.

Variants

France acquired 100 *Hawk 75A-1s* in '39 with 709-kW engines and four LMGs in nose and wings. It also got about 60 *Hawk 75A-3s* in 1940 with 895-kW engines; aSpeed 311.

The British *Mohawk I, II,* and *III* were former French Hawk 75A-1s, A-2s, and A-3s obtained after the fall of France. *Mohawk IV* was the 1940 designation for about 190 Hawk 75A-4s originally ordered by France, but diverted to Britain, and included 10 Hawk 75A-9s captured in Iran. Mohawks were refitted with British equipment, including six .303 Browning Mk IIs (Aircraft LMGs), and given to India and South Africa. They saw combat in Burma in 1942-44.

The Dutch East Indies had 20 *Hawk 75A-7s* of 1940 with 895-kW engine, a .50 Colt-Browning M.30 (Long Aircraft HMG) with 200 rounds and a .303 Colt-Browning M.36 (Aircraft LMG) with 600 rounds in the nose, and two more M.36s with 500 rounds each in the wings. All were destroyed in combat with the Japanese in 1941-42.

Finland received 44 Hawk 75s as German aid from 1941, which included former French A-2s and Norwegian A-6s. Most were rearmed with twin synchronized .50 VKT-Browning LKK/42s (Long Aircraft HMGs) with 200 rounds each in the fuselage and two or four .303 FN-Browning LKK/39s (Aircraft LMGs with RoF 25) with 500 rounds each in the wings. These saw service in the Continuation War (see p. W:FH21).

China received 30 *Hawk 75Ms* in 1938, plus 82 kits of which most were not assembled. The simplified Hawk 75M had a fixed strut and 653-kW engine. Armed with twin .30 Colt-Browning 27 Shis (Aircraft LMGs) with 400 rounds each in the nose and two more with 500 rounds in the wings, it had aSpeed 280. The plane achieved few successes against the Japanese.

Thailand obtained 12 *Hawk 75Ns* in 1938, designated *B.Kh.11.* Similar to the Hawk 75M, these were armed with two synchronized 8mm Vickers Baep 69s (Aircraft LMGs with RoF 14) with 400 rounds in the fuselage and a 20mm DISA-Madsen Baep 81 (20mm Long Aircraft AC with RoF 8) with 100 rounds under each wing. The B.Kh.11 was used against both the French and the Japanese in 1941, and after Thailand had allied with Japan, against the Allies in Burma.

The P-36 at Pearl Harbor

The Hawk 75 served the United States as the P-36. The fighter had its brief moment in history when four of the 39 P-36s stationed on Hawaii scrambled to fend off the attack on Pearl Harbor (see pp. W22, W:D10). They shot down two Nakajima B5N1 "Kate" torpedo bombers of the second wave, the first U.S. Army kills of the war.

The *P-36A* of 1938 was armed with a .30 Colt-Browning M-2 (Aircraft LMG) with 500 rounds and a .50 Colt-Browning M-2 (Long Aircraft HMG) with 200 rounds in the nose; aSpeed 300. Some 180 were in service, but soon relegated to training duties.

The 30 *P-36Cs* of 1939 had 895-kW engines and two more .30 M-2s with 500 rounds in the wings; aSpeed 311.

Douglas A-20 Havoc

The A-20 Havoc light bomber originated in a 1936 design known as the DB-7; the first order came from the French in 1939. When France fell, most of its order was diverted to England, and the rest taken over by the U.S. Army Air Force, which ordered more planes. Eventually, 7,478 of the aircraft were built. The Soviet Union was a major user, with some 3,125. The British received another 1,000.

The statistics below reflect the most common production blocks of the A-20G ground-attack model. Approximately 2,850 A-20Gs were built in 1943-44.

The A-20G has a crew of three: the pilot (who also fires all forward-firing .50 Brownings), the navigator/bombardier, and the radio operator/turret gunner. Both the pilot and gunner can remote-fire the rear-facing tunnel HMG. The hardpoints are usually left empty.

The engines burn 107 gallons of aviation gas per hour at routine usage. Fuel and ammo (less bombs) cost $275.

Douglas A-20G Havoc

Subassemblies: Medium Fighter-Bomber chassis +4; Medium Fighter-Bomber Wings +3; two Small AFV pods [Wings:U] +2; full-rotation Medium Weapon turret [Body:T] +1; three retractable wheels +1.

Powertrain: two 1,194-kW aerial HP turbo/supercharged gas engines with two 1,194-kW props [Pods], 540-gallon self-sealing tanks [Wings]; 8,000-kWs batteries.

Occ: 2 CS Body, 1 CS Tur Cargo: 16 Body, 2.9 each Pod

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Pilot:	0/+10	0/+0	0/+30	0/+0	0/+20
Bombard:	0/+0	0/+0	0/+20	0/+0	0/+30
Gunner:	0/+0	0/+0	0/+20	0/+0	0/+30

Weaponry

6×Long Aircraft HMGs/M-2s [Body:F] (350 rounds each).*
2×Long Aircraft HMGs/M-2s [Tur:F] (400 rounds each).**
Long Aircraft HMG/M-2 [Body:B] (400 rounds).
* Linked in pairs; additional link fires all six. ** Linked.

Equipment

Body: Autopilot; 2,000-lb. bomb bay; improved bombsight; IFF; navigation instruments; precision navigation instruments; large radio receiver and transmitter. *Turret:* 0.5-kW traversing gear; universal mount. *Wings*: two 500-lb. hardpoints each [U].

Statistics

Size: 38'×61'×17' *Payload:* 4.1 tons *Lwt.:* 12.1 tons
Volume: 448 *Maint.:* 21 hours *Price:* $92,725

HT: 8. HPs: 420 Body, 330 each Wing, 20 each Wheel, 150 each Pod, 75 Turret.

aSpeed: 317 *aAccel:* 6 *aDecel*: 20 *aMR:* 5 *aSR:* 2
Stall Speed 98. -1 aSpeed per loaded hardpoint.
gSpeed: 195 *gAccel:* 10 *gDecel*: 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 465-sf wing area was used for calculations. To better match historical weight and durability, the chassis cost, weight, and HPs were doubled. Some fuel tankage is in the body, though historically all of it was in the wings.

The fixed HMG in the ventral tunnel has an effective Acc of 0; it mainly served to discourage fighters from getting too close behind the plane.

Variants

The first 250 A-20Gs differed in having four 20mm Hispano-Suiza M-2s (20mm Long Aircraft ACs) with 60 rounds each and two .50 Browning M-2s with 350 rounds each in the nose. A single flexible HMG was located behind the cockpit and there were no wing hardpoints. Most of these were eventually sent to Russia.

The *DB.7-B3* of 1939 was the French version. A third of the 270 ordered were delivered before May 1940. It was armed with the 7.5mm MAC Mle 34/39 (Aircraft LMG); four fixed in the nose, one flexible in an open mount behind the cockpit, and one in the ventral tunnel, and carried a 2,080-lb. bombload. It had 783-kW engines with 270 gallons of fuel; aSpeed 280. Those that survived the German invasion were sent to North Africa before France surrendered and were later operated by the Vichy French.

About 36 French and Belgian DB-7s were taken over by the RAF as the *Boston I*, refitted with British equipment. Due to their short range, they were only used as trainers.

Some 100 of the original French order were used as RAF night fighters, called the *Havoc I* of 1941. They were fitted with radar and up to 12 .303 Browning Mk IIs (Aircraft LMGs) with 500 rounds each in the nose. The crew was only two.

The 10-ton *Boston III* of 1941 was the main British version, with aSpeed 311. It was armed with four .303 Brownings with 500 rounds in the nose, two .303 Brownings in a flexible dorsal position, and a .303 Vickers G.O. Mk I (Aircraft LMG, see p. W:AKM64) in a flexible ventral position. A second gunner was added for the ventral gun. About 781 were built. Some were converted to intruders by adding a black paint job and a fuselage undertray carrying four 20mm Hispano-Suiza Mk IIs (20mm Long Aircraft ACs) with 60 rounds each.

The 10.5-ton, 350 mph *A-20B* of 1942 was the first mass-produced U.S. model. It had a crew of four and was armed with twin .50 Brownings in the nose, with another one in an open mount in the rear cabin. The ventral-tunnel gun was a .30 Browning M-2 (Aircraft LMG) and a fixed rear-firing .30 M-2 was in each engine nacelle. It carried a 2,400-lb. bombload. Exactly 999 were made, with two-thirds sent to the Soviets.

The *A-20H* of 1943 had more powerful 1,268-kW engines; aSpeed 330. Some 412 were built.

The *P-70A-2* of 1943 was the U.S. night-fighter conversion of the A-20G, with aSpeed 338. At the time of Pearl Harbor, the P-61 (p. 108) was still several months away from delivery. In the interim, a radar set was installed in this plane's nose. The P-70 had a crew of two: pilot and radar operator. It was armed with six forward-firing .50 Brownings in blisters on the nose sides. Some 65 were converted and based at Guadalcanal.

Goodyear K-Class Blimp

Airships had grown out of fashion in the late 1930s, with even the enthusiast Germans conceding that hydrogen-filled balloons were quite dangerous for travel. Only the U.S. Navy still used them in WWII; not coincidentally, the United States had most of the world's helium reserves. Airships filled with this inflammable gas, such as the K-class blimp adopted as early as 1938, proved to be quite a success.

The K-class had been developed by the Goodyear tire company in the 1930s, but less than a dozen were in service when Pearl Harbor was attacked. Production quickly picked up, and 148 had been delivered by the end of the war. Its main advantage over conventional aircraft – and indeed surface ships – was its ability to fly very low and extremely slow combined with its excellent endurance. It was used for patrol, photo reconnaissance, convoy escort, search and rescue, minesweeping (by firing the MG at the mines), and antisubmarine warfare. Skimming low over the water allowed its crew to quickly spot surfacing submarines, which could then be attacked with the onboard depth charges, or, preferably, by radioing nearby destroyers or other more potent combatants.

Of the 89,000 ships escorted by blimps, not one was lost. Enemy submarines refrained from attacking a convoy accompanied by an airship, as they made success far less likely.

The patrols in blimps were mind-numbingly boring, endless hours spent in search of suspicious shapes and movements. Most lasted 12-24 hours, but the K-class was outfitted with folding bunks, reclining chairs, a galley, and toilet facilities to stay aloft up to three days at a stretch.

Most blimps were based on the Atlantic and Pacific coast of the United States, but some operated as far south as Brazil, and late in the war, even in the Mediterranean.

The most famous incident involving a K-ship took place on July 18, 1943, when the Florida-based *K-74* encountered *U-134*, a German Typ VIIC sub (see p. W:IC91), while on patrol duty in the Caribbean. Uncharacteristically, both opened fire with their automatic weapons. *K-74* was soon hit and brought down over the sea. The U-boat was also damaged and, being unable to dive, limped homeward, until two RAF Coastal Command B-24 Liberator bombers finished it off near the Spanish coast. The *K-74* crew, clinging to debris to stay afloat, was later picked up by rescue vessels – however, the bombardier was attacked by sharks and didn't make it. *K-74* was the only blimp to be lost in action.

The K-class' huge balloon contained 456,000 cubic feet of helium, but when deflated, the 5-ton envelope could fit into a 12'×6'×6' crate for transport. The control car supported below was the size of an overland bus and featured two decks, the lower holding the main crew compartment, the upper the gunner's station and the fuel tanks. The engines were housed in external pods.

A K-ship has a crew of 10: pilot/captain, two co-pilots (one also acting as bombardier), two riggers, navigator, two mechanics (one also acting as gunner), and two radio operators (who also operate the radar and MAD gear). It requires two men for steering, one controlling altitude, the other yaw. It is armed with a .50-caliber Browning M-2 machine gun in the upper deck front and can carry two bombs or depth charges in the bomb bay and two more on hardpoints. Usually, depth charges are carried. Many crews take M-1918 Browning Automatic Rifles (see p. W96) along to fire out of the windows.

The engines burn 31.7 gallons of aviation gas per hour at routine usage. A full load of helium, fuel, ammo, and provisions costs $1,480. The historical cost was $299,000.

Goodyear K-Class Blimp

Subassemblies: Medium Blimp chassis +10; Medium Conning control car [Body:U] +5; two Medium Weapon pods 1-2 [Car:R, L] +1.

Powertrain: two 317-kW aerial turbocharged HP engines with two 317-kW props [Pods 1-2] and 2,000-gallon ultralight tanks [Car]; 240-gallon ultralight ballast tanks [Car]; 8,000-kWs batteries.

Occ: 10 CS Body **Cargo:** 61 Car, 1.8 each Pod

Armor	F	RL	B	T	U
Body:	2/2C	2/2C	2/2C	2/2C	2/2C
Car:	2/3	2/3	2/3	–	2/3
Pods:	2/3	2/3	2/3	2/3	2/3
Gunner:	0/+25	0/+0	0/+0	0/+0	0/+0

Weaponry

Long Aircraft HMG/M-2 [Car:F] (1,000 rounds).

Equipment

Car: Backup driver options; 1,000-lb. bomb bay; four bunks; small galley; two 350-lb. hardpoints [U]; IFF; 1-mile MAD; navigation instruments; 30-man/day provisions; 90-mile non-targeting surface radar; large radio direction finder; medium radio transmitter and receiver; very large radio transmitter and receiver; searchlight; toilet.

Statistics

Size: 253'×55'×65' *Payload:* 7.8 tons *Lwt.:* 18 tons
Volume: 296* *Maint.:* 24 hours *Price:* $67,425
* Only when deflated and stowed for transport.

HT: 8. HPs: 450 Body, 600 Car, 38 each Pod.

aSpeed: 77 *aAccel:* 1 *aDecel:* 0.5 *aMR:* 0.12 *aSR:* 3
Lift 14.25 tons.

Design Notes

Design aSpeed was only 39; this was increased to the historical figure. Weight, cost, and HPs of the car and pods were halved to reduce weight; expensive armor was used when possible for the same reason.

Technically, the balloon's maintenance needs make the historical flights exceeding 24 hours into a risky proposition. The GM can rule that, even though the engines aren't really situated for in-service maintenance, the crew can perform partial maintenance on the rest of the K-ship during flight.

This blimp was historically too heavy to lift off vertically. It instead used the lifting qualities of the body to take off with the engines running.

The carried ballast is usually nothing more than seawater, at 8.3 lbs. per gallon.

Grumman TBF Avenger

The TBF Avenger was designed in the late 1930s to replace the aging TBD Devastator as the U.S. Navy's primary torpedo bomber. (The T stood for "torpedo" and the B for "bomber" on both planes, with the F being Grumman's Navy designation.) Both planes saw action at Midway (see pp. W25, W:D13), with almost equally disastrous results. The Devastator squadrons were virtually annihilated and only one of six Avengers returned to its carrier. None of the planes scored a torpedo hit. The Devastators were quickly retired after the battle and replaced by Avengers.

The Avenger gained various nicknames for its appearance, from "turkey" to "pregnant Wildcat" because it resembled a swollen F4F Wildcat (see p. W:D81). Despite its ungainly appearance, it proved to have good handling characteristics. The TBF and its cousin the TBM – which was nearly the same plane, but built by General Motors because Grumman was unable to increase production – went on to become useful and effective aircraft for the Allies.

Somewhat ironically, the TBF did not prove particularly useful as a torpedo bomber, partly because of the poor quality of the Mk 13 torpedo that it carried. In the Atlantic, the Avenger (called the Tarpon by the British for most of the war) was mainly used as an antisubmarine platform, where it helped sink at least 35 U-boats, using depth charges, bombs, rockets and (late in the war) homing torpedoes. In the Pacific, it also served as a glide bomber, strike aircraft, reconnaissance plane, nighttime pathfinder (using radar to lead fighters to Japanese aircraft formations until the fighters could visually spot the enemy planes), and minelayer.

The TBF-1C (and TBM-1C) were used after Midway and into late 1944. Despite its size, the Avenger could be operated from escort carriers, which became vital to convoy operations. Grumman produced 764 TBF-1Cs and General Motors built 2,332 TBM-1Cs, with nearly 10,000 Avengers of all types being built.

The TBF-1C has a crew of three. The pilot fires the wing .50-caliber Browning M-2 machine guns. The gunner fires the turret gun (with powered traverse at 32° per second) and operates the radio. The bombardier navigates, drops any ordnance carried, and fires the rear tunnel .30 Browning M-2.

The Avenger uses 57 gallons of fuel per hour at routine usage. Fuel and ammo cost $335.

TBF-1C/TBM-1C Avenger

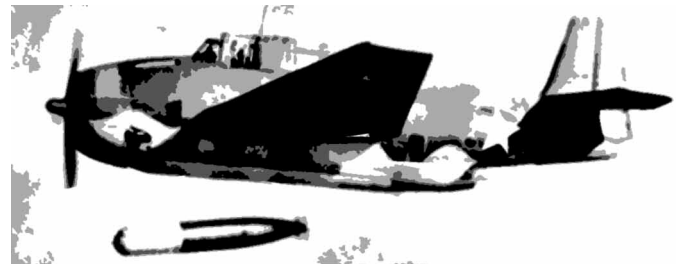
Subassemblies: Medium Fighter-Bomber chassis +4; Medium Fighter-Bomber wings with Folding option +3; full-rotation Medium Weapon turret [Body:T] +1; three retractable wheels +1.

Powertrain: 1,268-kW aerial supercharged gas engine with 1,268-kW prop, 155-gallon self-sealing tanks [Body], and 180-gallon self-sealing tanks [Wings]; 4,000-kWs batteries.

Occ: 2 CS Body, 1 CS Both **Cargo:** 0.4 Body, 3.6 Wings

Armor	F	RL	B	T	U
All:	3/5	3/5	3/5	3/5	3/5
Crew:*	0/+10	0/+20	0/+40	0/+10	0/+20

* Reverse F and B values for the gunner.



Weaponry

Aircraft LMG/M-2 [Body:B] (500 rounds).
2×Long Aircraft HMGs/M-2s [Wings:F] (600 rounds each).*
Long Aircraft HMG/M-2 [Tur:F] (400 rounds).
* Linked.

Equipment

Body: Arrestor hook; autopilot; 2,000-lb. bomb bay; bombsight; IFF, navigation instruments; medium radio transmitter and receiver. *Wings:* 1,000-lb. hardpoint each [U]. *Turret:* 0.5-kW traversing gear; universal mount.

Statistics

Size: 40'×54'×17' *Payload:* 3.3 tons *Lwt.:* 8.7 tons
Volume: 224 *Maint.:* 36 hours *Price:* $31,455

HT: 9. HPs: 210 Body, 330 each Wing, 20 each Wheel, 75 Tur.

aSpeed: 270 *aAccel:* 4 *aDecel:* 28 *aMR:* 7 *aSR:* 2
Stall Speed 81. -1 per loaded hardpoint.
gSpeed: 167 *gAccel:* 8 *gDecel:* 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 490-sf wing area was used for performance calculations. HT was increased from designed 7 to 9 to reflect its historical sturdiness. Design aSpeed was increased 4% to the historical figure.

The TBF-1C/TBM-1C could carry other dropped ordnance, typically two 1,000-lb. or four 500-lb. bombs, depth charges, or an extra 275-gallon fuel tank in the bay.

With two 58-gallon wing drop tanks and the auxiliary bay tank, the TBF-1C/TBM-1C carried 726 gallons of fuel.

Variants

The *TBF-1* of 1942 was the initial production model, with around 1,540 built. It differed from the TBF-1C in having a synchronized .30 Browning M-2 (Aircraft LMG) with 600 rounds in the nose and no machine guns in the wings. It also lacked provision for drop tanks, wing tanks, and the bay tank, carrying only 335 gallons internally. The *TBM-1* was virtually identical and entered production in September 1942; 550 were built. A total of 63 TBF-1s went to New Zealand and 334 TBM-1s to Britain, where they were known as the *Tarpon II.*

The *TBF-1B* of 1943 was a slightly modified TBF-1 made for British service. Some 400 were sent to the British starting in early 1943 and known as the *Tarpon I.*

The *TBM-3* of 1944 had a larger 1,417-kW engine, but speed was not increased due to higher loads. The wings were strengthened and up to eight 5" HVARs, drop tanks, or a radar pod could be mounted. Many removed the turret. There was also provision for RATO (rocket-assisted takeoff). Some 4,700 were built, 222 being adopted by Britain as the *Tarpon III.*

Northrop P-61 Black Widow

The P-61, America's first dedicated night fighter, began development in early 1941 but didn't enter combat until 1944, downing its first plane on July 7. It was a large, twin-engine, twin-boom design, slightly resembling the P-38 Lightning fighter (see p. W:D82) but nearly as big as the B-25 medium bomber (see p. W:D84). Until it entered service, the United States had to rely on the makeshift P-70 (p. 105). Overall, some 700 P-61s were built.

By the time that the Black Widow joined the war, there was a scarcity of Axis aircraft for it to go after. Regardless, it proved to be a rude surprise to the Japanese, against whom it was primarily deployed. The P-61 also saw action in Europe, first against V-1 "buzz bombs" (see p. W:IC123) and later over continental Europe. By the end of the war, the Black Widow was used more as a ground-attack night intruder than a night interceptor. The wing pylons could carry either bombs (two 1,600-lb. bombs per wing) or drop tanks (two 250- or 300-gallon tanks per wing).

The P-61 was guided to the general location of its target by ground- or ship-based radar, using its own radar only after arriving in the immediate area. Final target acquisition required visual confirmation by the pilot. During the P-61B production run, infrared binoculars usable for targeting were introduced, and were refitted to existing Black Widows.

The dorsal turret caused buffeting problems when not locked forward and level; the first 200 P-61Bs lacked the turret, but it was installed on the later 250 P-61s as the problem was corrected. Turretless planes often left the gunner position empty; others carried a third crewman as an extra observer.

The P-61B has a crew of three. The pilot fires the 20mm Hispano-Suiza M-2 cannons and drops the ordnance, if any is carried. The radar operator also navigates. The gunner remotely controls the turret with the .50 Browning M-2 machine guns (50°-per-second powered traverse). If the turret is locked forward, the pilot can also fire its guns.

The plane burns 151 gallons of fuel per hour at routine usage. A full load of fuel and ammo costs $425. Historical cost was $170,000.

Northrop P-61B Black Widow

Subassemblies: Medium Fighter-Bomber Body chassis +3; Heavy Fighter-Bomber Wings +3; two Medium AFV pods [Wings:F] +2; full-rotation Small Weapon turret [Body:T] +0; three retractable wheels +1.

Powertrain: two 1,678-kW aerial HP supercharged engines with two 1,678-kW props [Pods], 236-gallon self-sealing tanks [Wings], and 410-gallon self-sealing tanks [Pods]; 4,000-kWs batteries.

Occ: 3 CS Body **Cargo:** 33.2 Body, 4 Wings

Armor	F	RL	B	T	U
All:	2/3	2/3	2/3	2/3	2/3
Crew:*	0/+10	0/+10	0/+20	0/0	0/+10

* Reverse F and B for gunner position.

Weaponry

4×Long Aircraft HMGs/M-2s [Tur:F] (560 rounds each).*
4×20mm LAACs/M-2s [Body:F] (200 rounds each).*
* Linked to fire in pairs; a second link fires all four.

Equipment

Body: Autopilot; bombsight; IFF; navigation instruments; 10-mile non-targeting air radar; large radio receiver and transmitter. *Turret:* 0.5-kW traversing gear; universal mount. *Wings*: two 1,600-lb. hardpoints each [U].

Statistics

Size: 66'×50'×15' *Payload:* 6 tons *Lwt.:* 16.2 tons
Volume: 448 *Maint.:* 18 hours *Price:* $118,935

HT: 8. HPs: 420 Body, 450 each Wing, 20 each Wheel, 200 each Pod, 45 Turret.

aSpeed: 369 *aAccel:* 15 *aDecel*: 20 *aMR:* 5.5 *aSR:* 2
Stall Speed 93. -2 mph aSpeed per loaded hardpoint.
gSpeed: 224 *gAccel:* 11 *gDecel*: 10 *gMR:* 0.5 *gSR:* 2
Ground Pressure Extremely High. No Off-Road Speed.

Design Notes

The historical 664-sf wing area was used for performance calculations. Design aSpeed was increased by 2%. Fuselage cost, weight, and HP were doubled to increase weight topward the historical and raise HT.

The design has a considerable amount of free space available. In real life, some of this was later used for additional fuel tanks; another substantial difference is that period aircraft radar sets were considerably bulkier than the rules suggest.

Variants

The *P-61* of 1943 and *P-61A* of 1944 lacked the hardpoints of the B-model and used 1,492-kW engines. The first 37 P-61s were delivered with dorsal turrets while the final 43 and all the 120 P-61As were not.

The *P-61C* of 1945 used 2,088-kW engines, increasing top speed to 420 mph. Some aircraft were tested with radar-controlled guns, but were not successful. Only 41 were built before the war ended, and the contract was cancelled.

Sikorsky R-4 Hoverfly

A two-seater variant of Igor Sikorsky's prototype helicopter was developed by Vought-Sikorsky in 1942. The little R-4 may not have been the first production helicopter (p. 76), but it was the first helicopter to land aboard a ship and the first to perform a combat rescue. It was used in Burma from early 1944. A hundred R-4Bs were built from 1943; the U.S. Coast Guard used 20 as the HNS-1 and the RAF 45 as the *Hoverfly I.*

The R-4B is crewed by a pilot and co-pilot.

The helicopter burns 6.7 gallons of aviation gas per hour at routine usage. A full load of fuel costs $4.80.

Sikorsky R-4B (Hoverfly I)

Subassemblies: Medium Helicopter chassis +2; Medium Helicopter rotors -1; three wheels +1.

Powertrain: 149-kW aerial turbocharged HP engine with 149-kW helicopter transmission and 24-gallon self-sealing tank; 2,000-kWs batteries.

Occ: 2 CS Body Cargo: 0.2 Body

Armor	F	RL	B	T	U
Body:	2/2	2/2	2/2	2/2	2/2
Rotor:	3/10	3/10	3/10	3/10	3/10
Wheels:	3/5	3/5	3/5	3/5	3/5

Equipment

Body: Backup driver option; navigation instruments; medium radio receiver and transmitter; 500-lb. winch.

Statistics

Size: 48'×38'×12' *Payload:* 515 lbs. *Lwt:* 1.3 tons
Volume: 120 *Maint:* 80 hours *Cost:* $6,185

HT: 11. HPs: 82 Body, 22 Rotors, 8 each Wheel.

aSpeed: 75 *aAccel:* 6 *aDecel:* 6 *aMR:* 2 *aSR:* 1
Stall Speed 0.

Design Notes

Weight had to be increased a hefty 24%. Unsurprisingly, aSpeed then had to be decreased 31% to fit the historical value. The lower speed also stems from the R-4 devoting much more power than most copters to lift (rather than thrust). Its lift (as measured by historical loaded weight) is nearly double the design-system standard for its powertrain!

Variants

The pre-production *YR-4B* of 1943 had a weaker 134-kW engine. Fifteen went to the U.S. Navy, three to the U.S Coast Guard, and seven to the RAF.

Vought OS2U-3 Kingfisher

In 1940, the OS2U-3 became the Navy's first catapult-launched monoplane. It was primarily used for observation, but also served antisub (carrying two 325-lb. depth charges) and rescue roles. It most famously rescued Captain Eddie Rickenbacker (p. W:D6) and a B-17 crew in 1942. The overloaded OS2U-3 could not take off so taxied 40 miles to an island! More than 1,000 were built. The British flew 100 as the *Kingfisher I.*

The plane served throughout the U.S. war in the Pacific; it was present when Pearl Harbor was attacked and was carried on the battleship *USS Missouri* (p. 125) when the Japanese officially signed the surrender papers on the ship's deck.

The pilot fires the synchronized .30 Browning M-2 in the nose. The observer fires the rear M-2 and operates the radio.

The engine uses 15 gallons of fuel per hour at routine usage. Fuel and ammo cost $40.

Vought OS2U-3 (Kingfisher I)

Subassemblies: Medium Fighter chassis +3; Medium Fighter wings with Fixed Strut and STOL options +2; Medium AFV pontoon 1 [Body:U] +2; two Medium Weapon pontoons 2-3 [Wings:U] +1; three skids +1.

Powertrain: 336-kW aerial HP engine with 336-kW prop, 133-gallon self-sealing tanks [Body], and 74-gallon self-sealing tanks [Wings]; 2,000-kWs batteries.

Occ: 2 CS Body Cargo: 6.5 Body, 1.5 Wings

Armor	F	RL	B	T	U
Body:	2/3	2/3	2/3	2/3	2/3
Wings:	2/2C	2/2C	2/2C	2/2C	2/2C
Pilot:	0/+0	0/+0	0/+20	0/+0	0/+10
Gunner:	0/+20	0/+0	0/+0	0/+0	0/+10

Weaponry

2×Aircraft LMGs/M-2s [Body:F, B] (500 rounds F, 600 B).

Equipment

Body: Autopilot; IFF; navigation instruments; medium radio transmitter and receiver. *Wings:* 325-lb. hardpoint each.

Statistics

Size: 34'×36'×15' *Payload:* 0.7 tons *Lwt.:* 2.8 tons
Volume: 200 *Maint.:* 62 hours *Price:* $10,475

HT: 9. HPs: 60 Body, 53 each Wing, 100 Pontoon 1, 38 each Pontoons 2-3.

aSpeed: 164 *aAccel:* 9 *aDecel*: 14 *aMR:* 3.5 *aSR:* 2
Stall Speed 50.
wSpeed: 22 *wAccel:* 4 *wDecel*: 1 (3) *wMR:* 0.1 *wSR:* 1
Draft 1.2'. Flotation Rating 2.75 tons.

Design Notes

The historical 262-sf wing area was used for calculations. Design aSpeed was increased 8%. Weight, cost, and HPs of body, wings, and pontoons were halved. This reduces HT quite a bit, so it has been raised by 2 to a more realistic level. The plane needs a launch catapult or 9-mph headwind to take off. It had a maximum takeoff weight of 3 tons.

Variants

The 2.5-ton *OS2U-1* of 1940 carried 120 gallons of fuel in standard tanks. It carried no depth charges; 54 were built.

The *OS2U-2* of 1940 had a different engine than the OS2U-3, but was otherwise the same. Some 158 were built, 113 as land-based planes with fixed landing gears.

THE DOCK

Though overshadowed by the new weapons of war making their impact in the European theater, shipping remained a vital component of every nation's military might. Moving things by water is much cheaper than by land, and vastly less expensive than by air – and warfare often boils down to moving large numbers of men and large amounts of supplies over large distances. This cargo-hauling, in turn, required warships to protect it, vessels that also could strike at any land targets near the coast. The general who ignored what admirals could do to help or hinder his cause did not last long in this or any conflict.

Lifeboat/Whaler

This is a small lifeboat, typical of those carried by many smaller naval vessels. It can also be used as a small fishing boat, ship's launch, etc. Such boats were often unpowered, fitted with oars and/or a detachable mast and sail.

As a lifeboat in the Royal Navy, it would usually stow a boat bag with basic equipment to keep it afloat; a boat box holding a compass (see p. W87), four battery-powered lights (see p. W88), a flare pistol with a dozen shells, and a lead and line. Of course, food and water were also carried.

The performance quoted below assumes that four men are pulling the oars. Up to 20 men can be squeezed into the boat, but carrying so many people makes proper use of the oars next to impossible.

The provisions cost $12.

25-foot Lifeboat

Subassemblies: Wooden Medium Boat chassis +3.
Powertrain: 4-man rowing station.
Occ: 4 XCS, 12 XPS Body Cargo: 2 Body

Armor	F	RL	B	T	U
Body:	2/3W	2/3W	2/3W	0/0	2/3W

Equipment

Body: 20-man/days of provisions.

Statistics

Size: 25'×9'×3' *Payload:* 1.7 tons *Lwt:* 4.4 tons
Volume: 52 *Maint:* 339 hours *Cost:* $350

HT: 8. HPs: 375 Body.

wSpeed: 5 *wAccel:* 0.1 *wDecel:* 1 (1) *wMR:* 0.1 *wSR:* 2
Draft 1.7'. Flotation Rating 6.7 tons.

Too Little to Live, Too Much to Die . . .

A crew forced to abandon ship was in for a rough time. Bobbing on the waves in a tiny nutshell, trying to cover huge distances with insufficient oars or bedsheet-sized sails, navigating using primitive instruments or even just the stars, the survivors aboard also had to get along with severely restricted rations.

A lifeboat usually had a single barrel of water, with about 6.5 pints per person for which it was intended, and 3.5 lbs. of iron rations per person.

The highest-ranking man aboard would set and distribute the rations, guided by a manual. A typical *daily* ration for a British crew on the Atlantic specified 1 pint of water, one ship's biscuit, 1 oz. of pemmican (a meat-flavored mixture of fat and grain), four malted-milk tablets, and three squares of chocolate – these supplies were calculated to last for six days.

See pp. B128 and W205 for more discussion of dehydration and starvation.

Pinnace

This is a typical small powered boat as carried by many larger naval vessels for day-to-day activities such as ferrying personnel or supplies from ship to ship (or submarine). It has a covered compartment in the bow, an open steering wheel amidships, and exposed seats in the stern.

The engine burns 2.1 gallons of diesel per hour at routine usage. A full load of fuel costs $24.

30-foot Pinnace

Subassemblies: Wooden Large Boat chassis +4.
Powertrain: 52-kW marine diesel engine with 52-kW screw and 200-gallon standard tanks; 8,000-kWs batteries.
Occ: 2 CS, 30 XPS Body Cargo: 34 Body

Armor	F	RL	B	T	U
Body:	2/3W	2/3W	2/3W	0/0	2/3W

Equipment

Body: Autopilot; bilge pump; 30-VSP cargo hold; navigation instruments; medium radio receiver and transmitter.

Statistics

Size: 30'×8'×9' *Payload:* 3.8 tons *Lwt:* 10.2 tons
Volume: 156 *Maint:* 170 hours *Cost:* $1,380

HT: 12. HPs: 750 Body.

wSpeed: 10 *wAccel:* 0.8 *wDecel:* 1 (1.4) *wMR:* 0.1 *wSR:* 3
Draft 3'. Flotation Rating 16.9 tons.

Design Notes

The design wSpeed was reduced 23% and draft was increased 36% to better reflect typical historical figures. Of course, these could vary considerably between actual boats.

Fishing Boat

European fishing boats were widely used in WWII. Their most famous role was in the "Dunkirk Miracle," where fishermen were instrumental in evacuating Allied forces (p. W15). The Royal Naval Patrol Service operated some 6,000 during the war for mine-sweeping and anti-submarine patrols, and for convoy escorts from the Barents Sea to the U.S. eastern coast, the Mediterranean, the Indian Ocean, and beyond.

Fishing boats also were widely used in clandestine operations in all coastal areas around Europe and North Africa. For example, British boats met with Danish, Norwegian, and French resistance fighters in the North Sea or off the Breton coast. Danish boats evacuated almost the entire Danish Jewish community to Sweden in 1943.

The boats differed *widely* in size and equipment. Those used by the British were often upgraded with better engines and fitted with light arms. The ones employed by resistance movements continued to operate normally as fishermen by day.

One of the former was *Le Dinan*. Constructed in France as a motor trawler in the 1930s, the boat entered service with the Royal Naval Patrol Service in 1940. First, it served as patrol boat *N51*, stationed in New Grimsby Harbour in Tresco. At the end of 1941, it was assigned to the Secret Intelligence Service (SIS), which used it for clandestine channel crossings to collect agents, passengers, supplies, and mail. Part of its fish hold was modified to allow passengers to be carried. After refitting and repainting to blend into the Breton fishing fleet again, *Le Dinan* went on its first covert mission in April 1942.

Its most famous operation was the evacuation of Frenchman Gilbert Renault (code name "Rémy") and his family. Renault was head of the resistance network *Confrérie de Notre-Dame* and delivered to the British the secret German plans for all coastal defenses between Cherbourg and Honfleur.

Le Dinan has a crew of eight and 12 .303 Vickers G.O. Mk I MGs on six twin pedestal mounts, traversed manually at 60° per second. They would be hidden below decks outside of British waters. The engine burns 1.8 gallon of diesel per hour. A full load of fuel costs $180. Ammo, if carried, costs $115.

Le Dinan

Subassemblies: Wooden Medium Cutter chassis +6; waterproofed Small TD superstructure [Body:T] +3; six Mini open mounts 1-6 [Body:T] +0.

Powertrain: 45-kW marine diesel engine with 45-kW screw and 1,500-gallon standard tanks; 8,000-kWs batteries.

Occ: 2 CS Sup **Cargo:** 495 Body; 25 Sup

Armor	F	RL	B	T	U
Body:	3/5W	3/5W	3/5W	3/5W	3/5W
Sup:	2/3	2/3	2/3	2/3	–
OMs 1-6:	0/0	0/0	0/0	0/0	–

Weaponry

12×Air. LMGs/Vickers G.O. Mk Is [OM 1-6:F] (970 each).*
* Linked in pairs.

Equipment

Body: 100-VSP bilge; bilge pump; 10 bunks; 400-VSP cargo hold; 1.25-ton external cradle (for 20' rowboat). *Sup:* Autopilot; navigation instruments; medium radio receiver and transmitter. *OMs 1-6:* Universal mount.

Statistics

Size: 65'×18'×9' *Payload:* 36.8 tons *Lwt:* 70 tons
Volume: 1,081 *Maint:* 84 *Cost:* $5,630

HT: 12. HPs: 5,400 Body, 285 Sup, 30 each OM.

wSpeed: 8 *wAccel:* 0.1 *wDecel:* 0.5 (0.5)*wMR:* 0.05 *wSR:* 4
Draft 4.2'. Flotation Rating 112.5 tons.

Junk

The junk is the most common East Asian sailing vessel, made in a bewildering number of shapes and sizes. They were a common sight during the war in the Pacific, and many were used for supply or clandestine uses like European fishing boats.

Called *ch'uan* by the Chinese, the junk detailed here is a fishing boat as used on the Chinese coast near Formosa; it is simpler and smaller than a trading junk and lacks a cabin. It has three masts with the traditional rectangular bamboo and cloth sails. The crew consists of the *lao ta* (junk master), three helmsmen, eight deck hands, 16 fishing hands, and six female helpers. They sleep on mats on the deck. As is common practice in the Strait of Formosa, it carries eight *chu fa* (bamboo rafts) used for hook-and-line fishing away from the boat.

Provisions for one week at sea cost $145.

70-Foot Junk

Subassemblies: Wooden Medium Cutter chassis +6; 50' Mast & Sails assembly +1; two 30' Mast & Sails assemblies -1.

Powertrain: 1,720-sf Sails.

Occ: 3 CS **Cargo:** 746 Body

Armor	F	RL	B	T	U
Body:	2/3W	2/3W	2/3W	2/3W	2/3W

Equipment

Body: 50-VSP bilge; bilge pump; two bunks; 700-VSP cargo holds; navigation instruments; 240-man/day provisions.

Statistics

Size: 70'×18'×70' *Payload:* 25 tons *Lwt:* 53.5 tons
Volume: 1,040 *Maint:* 135 *Cost:* $2,200

HT: 12. HPs: 5,400 Body; 80 50' Mast, 24 each 30' Mast.

wSpeed: 11 *wAccel:* 0.3 *wDecel:* 0.5 (0.6) *wMR:* 0.05 *wSR:* 4
Draft 5'. Flotation Rating 112.5 tons.

Design Notes

The wSpeed is calculated for a light breeze on the stern. Draft was increased 33% to the historical figure.

Leichtes Sturmboot 39

The Germans used *Sturmboote* (assault boats) in several sizes on inland and coastal waters. The *leichte Sturmboot 39* (light assault boat model 1939) was used by *Landungspioniere* (amphibious combat engineers), *Küstenjäger* (coastal rangers), and *Sturmboot-Kommandos* (assault-boat commandos). It was built in Germany from 1936 from a Hungarian design. It could carry six assault troops, a mortar team with four men, or a small load of supplies. The outboard engine was fitted with a water screw on a long outrigger. It could be fitted with a removable wooden top, improving conditions in high surf. It was quite seaworthy, but not intended to be used too far off the coast.

Three boats were transported on the four-wheeled SdAh 108 6.6-ton trailer, which was towed by a truck like the Opel-Blitz (see p. W:IC73) or a SdKfz 6 halftrack. The *Pionierlandeboot 41*, a 78-ton craft for amphibious landings, could carry three StuBo 39 on external racks on its sides.

Some 700 StuBo 39s were made until production ceased in 1942. The engine burns 1 gallon of fuel per hour at routine usage. A full tank of gasoline costs $0.75.

Leichtes Sturmboot 39

Subassemblies: Wooden Small Boat chassis +2; waterproofed Small Weapon engine pod [Body:B] +0.

Powertrain: 22-kW standard gas engine with 22-kW water screw and 5-gallon light tank [Pod].

Occ: 1 XCS, 6 XPS Body Cargo: 0.5 Pod

Armor	F	RL	B	T	U
Body:	2/3W	2/3W	2/3W	0/0	2/3W
Pod:	2/3	2/3	2/3	2/3	2/3

Statistics

Size: 20'×5'×2' *Payload:* 1.2 tons *Lwt:* 2.2 tons
Volume: 18.9 *Maint:* 307 hours *Cost:* $425

HT: 9. HPs: 90 Body, 45 Pod.

wSpeed: 16 *wAccel:* 2 *wDecel:* 3 (4) *wMR:* 0.25 *wSR:* 1
Draft 1.3'. Flotation Rating 2.2 tons.

Design Notes

Design wSpeed was increased 14%, and the flotation rating was increased 20%, to the historical figures. The limited-access engine uses the volume factor for ground vehicles. Length increases to 28' with the engine outrigger deployed.

Variants

The *Ladungsschnellboot 41* (speedboat with charge model 1941) was remote-controlled with two smoke dischargers and a 660-lb. explosive. It was to ram its target (collision damage per p. W154), sink, then explode (6d×1,320) after a delay of 3 or 7 seconds, attacking the victim's underbody and spine (multiply damage that penetrates DR by 1.5). The radio guidance had a 3.5-mile range. *Küstenjäger* units of the Brandenburger (see pp. W50, W:HS14) used all 30 delivered in 1941-44.

Tragflächen-Schnellboot (TS)

During WWII, the German navy experimented with more than a dozen different hydrofoil designs in sizes up to corvettes. Most had stability or weight problems and were never introduced, but a small pre-series of the *Tragflächen-Schnellboot* (hydrofoil speedboat) was built between 1940 and 1943, the first entering service in 1942.

It had originally been designed as the *Tragflächen-Wachtboot* (hydrofoil guardboat) for reconnaissance and guard duties in the Norwegian fjords, with a planned production of 36 units. The TW displayed only limited seaworthiness and was rejected by the Kriegsmarine for that purpose, but was put into use as the TS with *Wasserschutzpolizei* police units on rivers and in coastal areas. Five were made.

The TS has a crew of four and carries a 20mm Mauser MG 151/20 autocannon in a bomber-style plexiglass turret with powered rotation at 30° per second.

The engine burns 15.1 gallons of gas per hour of routine usage. Fuel and ammo cost $130.

Tragflächen-Schnellboot (TS)

Subassemblies: Large Boat chassis +4; Large Boat hydrofoils +2; waterproofed full-rotation Medium Weapon turret [Body:T] +1.

Powertrain: 336-kW turbocharged gasoline engine with 336-kW water screw and 171-gallon standard tanks; 8,000-kWs batteries.

Occ: 3 CS Body, 1 CS Both Cargo: 52 Body, 0.8 Tur

Armor	F	RL	B	T	U
Body, Foils:	3/5	3/5	3/5	3/5	3/5
Turret:	2/3	2/3	2/3	2/3	–
Gunner:	0/+30	0/+0	0/+0	0/+0	0/+0

Weaponry

20mm Medium Aircraft AC/MG 151/20 [Tur:F] (640 rounds).

Equipment

Body: Autopilot; bilge pump; navigation instruments; medium radio receiver and transmitter. *Turret:* 0.5-kW traversing gear; universal mount.

Statistics

Size: 39'×13'×6' *Payload:* 1.5 tons *Lwt:* 6.9 tons
Volume: 185 *Maint:* 93 hours *Cost:* $4,665

HT: 10. HPs: 375 Body, 225 Hydrofoils, 75 Turret.

wSpeed: 46 *wAccel:* 7 *wDecel:* 0.7 (4.2) *wMR:* 0.1 *wSR:* 1
Draft 2.8'. Flotation Rating 14.4 tons.

Design Notes

The chassis is a bit too large for the historical vessel; weight, cost, and HPs of the body were halved to adjust the weight toward the historical value. The GM should consider much of the "cargo" space to not really be useable. Only half of an armored station is installed to more accurately model historical protection. Design draft was 2'.

Zerstörer 1934

The *Zerstörer 1934* (destroyer model 1934) and its derivatives were the only German destroyers of the war. The first were finished in early 1937, with 43 built by '44. *Z 1* to *Z 22* received names of dead Reichsmarine heroes (KMS *Leberecht Maass* to KMS *Anton Schmitt*); the following were just called *Z 23-43*. From 1937-39, 12 were built as the Zerstörer 1934A sub-series.

While decently armed, the design had defects. They were very "wet" ships, frequently soaking their crews. Later refinements failed to improve this. The immature high-pressure steam turbines, though light and compact, were too complex. They frequently lost speed, guzzled fuel, or simply broke down, confining the ships to their berths for months. This lack of seaworthiness restricted operations to the European coast, while Allied destroyers with more reliable engines sailed everywhere.

The destroyers' most famous operation was *Unternehmen Weserübung* in April 1940 (see p. W:IC12); 14 Zerstörer led by the battleships *Gneisenau* and *Scharnhorst* were to land troops at Norwegian ports. Each carried 200 mountain troops and their light arms and motorcycles. A storm caught them, causing engine troubles, destroying cutters and superstructures, and sweeping men into the sea. Battered and bruised, low on fuel, and soon cornered by superior British forces, 10 Zerstörer put up a last stand in the narrow fjord of Narvik on April 13. All were lost, six scuttled by their crews after depleting their ammo.

The *Z 5 Paul Jacobi* was the first of the 1934As, commissioned in '37. It took part in the Norway invasion, but docked in Trondheim and avoided the Narvik defeat. *Z 5* later operated near the British southern coast, returning to Norway on several missions. In 1945, it fought in the Baltic vs. Soviet units and escorted fleeing German passenger ships (see p. W:IC109). It was taken over by the French navy in 1945 and scuttled in '54.

Unusually, the Germans referred to this ship class in the masculine; a sailor would say "he" rather than the usual "she."

A Zerstörer 1934A has a crew of 325. It is armed with five 128mm Rheinmetall SK C/34 guns in individual turrets (3°-per-second powered traverse), eight torpedo tubes in two four-tube launchers capable of firing to either side, four 37mm Rheinmetall SK C/30 AA guns in twin mounts (9°-per-second manual traverse), and six 20mm Rheinmetall MG C/30 autocannons in single mounts (37°-per-second manual traverse).

The main engines burn 3,139 gallons of fuel oil per hour. Fuel, ammo (less mines), and provisions cost $197,310. Historical cost was 12.2 million Reichsmark ($2.9 million).

KMS Paul Jacobi (Z 5)

Subassemblies: Heavy Destroyer chassis +9; Small Ship superstructure 1 [Body:T] +7; Small Secondary superstructure 2 [Body:T] +4; Small Naval superstructure 3 [Body:T] +5; three limited-rotation Medium TD turrets 1-3 [Body:T] +3; two limited-rotation Medium TD turrets 4-5 [Sup3:T] +3; two full-rotation Medium AFV open mounts 1-2 [Sup2:T] +2; two full-rotation Mini open mounts 3-4 [Body:T] +0; two full-rotation Mini open mounts 5-6 [Sup1:T] +0; two full-rotation Mini open mounts 7-8 [Sup3:T] +0; two full-rotation Medium Secondary open mounts 9-10 [Body:T] +4. All except open mounts are waterproofed.

Powertrain: two 26,110-kW steam turbines with two 26,110-kW water screws and 160,062-gallon standard fuel tanks; two 60-kW marine diesel engines and 30-kW marine diesel engine with 5,865-gallon standard tanks for electrical power; 40,000-kWs batteries.

Occ: See above. Cargo: 8,558 Body, 88 each Sup 1-3

Armor	F	RL	B	T	U
Body:	4/180	4/60	4/60	4/60	4/60
Sup 1-3:	4/30	4/30	4/30	4/30	–
Tur 1-5:	4/25	4/25	4/25	4/25	–
OMs 1-10:	0/0	0/0	0/0	0/0	–

Weaponry

5×127mm Short DP Guns/SK C/34s [Tur 1-5:F] (120 each).
4×37mm VL DP Guns/SK C/30s [OM 1-2:F] (2,000 each).*
6×20mm L Ground ACs/MG C/30s [OM 3-8:F] (2,000 each).
8×533mm Torpedo Tubes [OM 9-10:F] (16 total rounds).**
4×Light DC Throwers [Body:T facing R and L].
2×400-lb. 3-round DC Rails [Body:T facing B] (30 total).
* Linked in pairs. ** Linked in quadruples.

Equipment

Body: 2,000-VSP bilge; eight bilge pumps†; 14 bunks; eight cabins; 3,000-VSP cargo hold (includes 60 2,800-lb. sea mines); 3-ton crane (for whaler); two 2-ton cranes (for torpedoes); two 10-ton cranes (for pinnaces); 325-person environmental control†; two fire extinguishers†; hall; 137 hammocks; 5,880-man days of provisions; 2-mile active/passive sonar†; four workshops (one each type). *Sup 1:* Autopilot; two fire-direction centers; hall; 166 hammocks; two hospital beds; two navigation instruments; two precision navigation instruments; 16-mile non-targeting surface radar; large radio direction finder; two large radio receivers and transmitters; two very large radio receivers and transmitters; surgery. *Sup 2:* Searchlight; 80-VSP cargo hold. *Sup 3:* Luxury cabin; cabin; hall. *Turrets 1-5:* 0.5-kW traversing gear. *OMs 1-8:* Universal mount.

† Includes full access.

Statistics

Size: 394'×37'×100' *Payload:* 1,012 tons *Lwt.:* 3,472 tons
Volume: 59,896 *MH:* 15 man/hours *Price:* $1 million

HT: 9. HPs: 150K Body, 6.6K Sup 1, 560 Sup 2, 1.9K Sup 3, 360 each Turrets 1-5, 200 each OMs 1-2, 30 each OMs 3-8, 750 each OMs 9-10.

wSpeed: 44 *wAccel:* 2 *wDecel:* 0.1 (1.1) *wMR:* 0.02 *wSR:* 5
Draft 14'. Flotation Rating 5,040 tons.

Design Notes

Design wSpeed was increased 7%, and draft reduced 15%, to the historical figures. The ships had to keep a 30% fuel reserve as ballast at all times. If it is burned, wSR becomes 4.

Paul Jacobi was rearmed several times, losing its middle 128mm gun and eventually mounting four 128mm guns, four 37mm twin guns, two single 37mm guns, and 20mm guns in four twin, one single, and one quadruple mount.

HSK 4 KMS Thor

The KMS *Thor* was a German *Hilfsstörkreuzer* (auxiliary diversion cruiser). Allied crews called them "Black Raiders." The HSKs resembled merchant ships, with no two like, but were armed to act as modern corsairs, harassing the Allied merchant navies by sinking and boarding ships, even sending some home as prizes (see pp. W20, W:IC33). Ten were outfitted and sent out on year-long cruises from 1940-43. They were not equipped to slug it out with the many warships that hunted them. When detected, they were sunk – except for the *Thor*.

Built in 1938, *Thor* had been the 3,862-ton banana tramp *Santa Cruz*, sailing between Hamburg and Africa. Code-named "Schiff 10," the ship received the nom de guerre *Thor* after refitting as a HSK in 1940; the British called it "Raider E." The smallest raider, *Thor* was the third-most successful, sinking or taking 22 ships exceeding 95,000 tons on two cruises.

Thor was the only HSK to meet a heavily armed foe and get away. On June 28, 1940, *Thor* encountered the British armed merchant cruiser HMS *Alcantara*, which was faster, better armed, and five times larger. *Thor* escaped under smoke screen after severely damaging *Alcantara*. After a similar duel with *Castle Carnavon*, *Thor* met with *Voltaire* on April 4, 1941. Following a fierce gun battle, the raider emerged victorious, sinking the larger ship. *Thor* went on a second cruise, but accidentally burned at port in Yokohama on October 9, 1942.

In action, an HSK would try to get as close as possible to a cargo ship under one of several guises, preferably by pretending to be a cargo ship under neutral flag. The most important concern was to prevent its prey from radioing its position and that a raider was attacking it. Under some pretense, the target was told to keep radio silence; if it didn't, the HSK would jam its messages. Sometimes, the HSK's seaplane was used to tear down the radio antennae or strafe the bridge. The ultimate method was a full broadside (after hoisting the Kriegsmarine flag), aiming for the bridge, the radio room, and the merchant's aft gun. If the prey gave up or could be fooled into allowing an "inspection," a boarding team was sent over, sometimes disguised as Royal Navy personnel until the last moment.

The crew of the target, whether it gave up or had to go for the lifeboats, was picked up and detained as POWs; at times, up to 360 POWs lived aboard the *Thor*. The ship was either sunk or sent home with a skeleton prize crew.

Thor has a crew of 345. Armament consists of six obsolete 149mm SK C/13 guns (even the actual ammunition dated from 1916!), four on the deck and two below deck, in Hold 2; a broadside consisted of four guns with 2°-per-second manual traverse. Alternatively, three guns can fire aft, but only one forward. Twin 37mm SK C/30 guns aft (9°-per-second manual traverse) and four single 20mm MG C/38 autocannons (with 36°-per-second manual traverse) near the masts and on the sides of the bridge are installed for AA fire. A twin torpedo launcher is available on either side, below deck but well above the water line. All the weapons are concealed behind folding panels or fake cargo or superstructures on the deck.

A disassembled Arado Ar 196A-1 seaplane (see p. W:IC84) is carried in Hold 3.

The engines burn 210 gallons of fuel per hour of routine usage. Fuel, ammo, and provisions cost $475,000.

HSK 4 KMS Thor

Subassemblies: Light Cruiser chassis with Average lines +10; Small Ship superstructure 1 [Body:T] +7; Large Conning superstructure 2 [Sup 1:T] +5; four limited-rotation Medium Secondary open mounts 1-4 [Body:T] +4; two full-rotation Mini open mounts 5 and 8 [Body:T] +0; two full-rotation Mini open mounts 6-7 [Sup 1:T] +0; full-rotation Medium AFV open mount 9 [Sup 2:T] +2. All except open mounts are waterproofed.

Powertrain: two 2,424-kW marine diesels with 4,848-kW screw and 830,600-gallon standard tanks; 411-kW marine diesel engine for electrical power; 40,000-kWs batteries.

Occ: See above. **Cargo:** 34,287 Body, 1,775 Sup 1

Armor	F	RL	B	T	U
Body:	4/40	4/40	4/40	4/40	4/40
Sup 1-2:	4/15	4/15	4/15	4/15	–

Weaponry

2×150mm Med. DP Guns/SK C/13s [Body:L, R] (300 each).
4×150mm Med. DP Guns/SK C/13s [OMs 1-4:F] (300 each).
4×20mm L Ground ACs/MG C/38s [OMs 5-8:F] (2,000 each).
2×37mm VL DP Guns/SK C/30s [OM 9:F] (2,000 each).*
4×533mm Torpedo Tubes [Body:L, R] (24 total carried).*

Equipment

Body: 5,000-VSP bilge; 20 bilge pumps†; 650 bunks; two casemates for 150mm guns [L, R]; two casemates for two torpedo tubes [L, R]; two 10,000-VSP cargo holds; 4-ton crane; two 10-ton cranes; 600-person environmental control†; two 6.5-ton external cradles (pinnaces); 20 fire extinguishers†; three halls; 105,000 man-days of provisions; 1-mile active/passive sonar†; stage; four workshops (one of each type). *Sup 1:* Autopilot; 20 cabins; two 3.75-ton external cradles (lifeboats); fire-direction center; two navigation instruments; two precise navigation instruments; large radio direction finder; medium radio jammer; very large radio receiver and transmitter; immense radio receiver and transmitter; three searchlights. *Sup 2:* 75-VSP cargo hold; four hospital beds; surgery. *OMs 1-9:* Universal mount.

† Includes full access.

Statistics

Size: 390'×56'×105' *Payload:* 4,720 tons *Lwt.:* 10,120 tons
Volume: 114,219 *MH:* 15 man/hours *Price:* $958,720

HT: 10. HPs: 480,000 Body, 13,200 Sup 1, 3,000 Sup 2, 750 OMs 1-4, 30 each OMs 5-8, 200 OM 9.

wSpeed: 21 *wAccel:* 0.01 *wDecel:* 0.2 (0.2) *wMR:* 0.02 *wSR:* 6
Draft 27'. Flotation Rating 11,830 tons.

Design Notes

Weight, cost, and HPs of body and superstructures were doubled, but loaded weight still had to be increased 39%. The volume of the 150mm guns, torpedo tubes, and mounts was increased to reflect concealment. The "historical" wSpeed is very suspicious for a converted merchantman, but the design value was raised 60% to reflect it.

U-Boot Typ XB

Naval mines had worked well for the Germans in the Great War. As the Kriegsmarine rearmed in the 1930s, work started on new mines and the means to deploy them. While most submarines of WWII could lay mines through their torpedo tubes, this was unsatisfactory. A dedicated mine-laying sub was developed, its hull based on the abandoned Typ XA cargo submarine.

The Typ XB – the largest German U-Boot – was literally built around the SMA mine (p. 17), with 30 free-flooding, vertical mine shafts in the hull. Six shafts in the bow held three SMAs each, 24 along the sides held two each. The mines were loaded from above and laid through openings in the keel.

The initial SMAs proved unreliable, so the Typ XB ended up being used mostly for supply, carrying provisions, ammo, and 80,000 gallons of fuel to support attack subs at sea. This was a dangerous occupation. The need to coordinate via radio with the other boats made tracking the supply boat easy. Its slow crash dive (minimum of 35 seconds) made it vulnerable. Six out of the eight built in 1941-44 were sunk. Of the other two, *U-219* was briefly used by the Japanese from April 1945.

When the last one, *U-234*, surrendered to the U.S. Navy on May 14, 1945 (see p. W:WW121), it had been on its way to Japan with a unique load. Its mine shafts and other spaces were filled to the brim with 286 tons of cargo in watertight containers, including disassembled Me 163 and 262 jets (p. W:IC89), Panzerfaust rocket launchers (p. W98), infrared proximity fuses, electronic instruments, plus 8 tons of blueprints and technical specifications for all these and the Hs 293 missile (p. 17), V-2 rocket (p. W:IC123), and Ju 88 bomber (p. W:IC88).

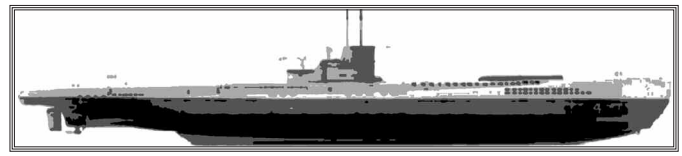
Its bilges filled with lead and mercury, the boat's most infamous cargo consisted of 1,233 lbs. of uranium oxide in gold-lined containers, intended for Japan's atomic research (see p. W:WW68). The uranium was removed in Portsmouth, N.H.; some claim it was processed into the U.S. atom bombs dropped on Japan (see p. W:D74). The timing makes this unlikely.

U-234 also carried 12 passengers: the Luftwaffe military attaché to Japan, General Kessler, seven military and two civilian technical specialists, and two Japanese aviation officers who committed suicide prior to the boat's surrender. At the time, the American public believed that the subs were used to evacuate high-ranking Nazis. Newspapers carried the rumor that Hitler or Himmler had been passengers!

The Typ XB has a crew of 52. Its active armament in 1945 consists of two torpedo tubes in the stern, a 37mm Rheinmetall SK C/30 AA gun with 12°-per-second manual traverse, and four 20mm Mauser MG C/38 autocannons in twin mounts with 24°-per-second manual traverse. The engines burn 143 gallons of diesel per hour of routine usage. Fuel, ammo, and provisions cost $595,300. Historical cost was 6.35 million Reichsmark ($1.51 million).

U-Boot Typ XB

Subassemblies: Medium Destroyer chassis with Sub option +9; sealed Small Secondary superstructure [Body:T] +4; limited-rotation Medium Weapon open mount 1 [Body:T] +1; two full-rotation Small Weapon open mounts 2-3 [Sup:T] +0.



Powertrain: two 1,790-kW marine diesels with snorkels, two 1,790-kW screws, and 96,280-gallon standard tanks; two 410-kW electric motors w/ 17.728 million-kWs batteries†.
Occ: See above. Cargo: 5,122 Body, 92 Sup

Armor	F	RL	B	T	U
OMs 1-3:	0/0	0/0	0/0	0/0	–
All Else:	4/60	4/60	4/60	4/60	4/60

Weaponry

37mm Very Long DP Gun/SK C/30 [OM 1:F] (2,500 rounds).
4×20mm L Gr. ACs/MG C/38s [OMs 2-3:F] (2,000 each).*
2×533mm Torpedo Tubes [Body:B] (15 total carried).*
6×3,500-lb. 3-round Sea Mine Shafts [Body:U] (66 total carried).
24×3,500-lb. 2-round Sea Mine Shafts [Body:U] (See above.).
* Linked in pairs.

Equipment

Body: Autopilot; 5,814-VSP bilge; 20 bilge pumps†; 40 bunks; cabin; discharger with 20 reloads [B]; 20 fire extinguishers†; 75 man-days life support†; navigation instruments; precision navigation instruments; 17,000 man-days provisions; large radio direction finder; two very large radio receivers and transmitters; 2-mile passive sonar. *Sup:* three backup driver options; navigation instruments; two 26' 15× periscopes; searchlight. *OMs 1-3:* Universal mount.
† Includes limited access space.

Statistics

Size: 295'×30'×30' *Payload:* 540 tons *Lwt.:* 1,939 tons
Volume: 26,109 *MH:* 18 man/hours *Price:* $1.4M

HT: 11. HPs: 108,000 Body, 560 Sup, 75 OM 1, 45 OMs 2-3.

wSpeed: 20 *wAccel:* 0.3 *wDecel:* 0.5 (0.7) *wMR:* 0.05 *wSR:* 4
Draft 14'. Flotation Rating 3,140.6 tons.
uSpeed: 8 *uAccel:* 0.05 *uDecel:* 0.5 (0.5) *uMR:* 0.05 *uSR:* 4
uDraft 30'. Crush Depth 330 yards.

Design Notes

The historical Typ XB was slightly smaller than this chassis (displacing 19,274 VSPs including superstructure and OMs); given that the design system underestimates the space required by submarine components, the surplus 935 VSPs were ignored; they are neither listed as cargo nor bilge space.

Design wSpeed was decreased 37% to the historical figure. The historical 2,753-ton submerged weight was used for underwater performance calculations. Design uSpeed was increased by 14% to the historical figure. The calculated underwater draft is 59' but was capped at the actual height. Crush depth was increased 77% to the historical figure.

Originally, the Typ XB was armed with a 105mm Rheinmetall Utof C/36 (105mm Medium DP Gun) with 200 rounds in an open mount and only one MG C/38 with 4,000 rounds; the big gun was removed from 1943 and more cannons added.

Flower-Class Corvette

In the 1930s, the Royal Navy requested a small corvette to escort coastal convoys. A design based on a modified commercial whaler was selected, and 60 were ordered before the outbreak of the war, but it didn't enter service before 1940. Eventually, 135 ships of the basic design were built in Britain until 1943, and another 79 in Canada.

All received flower names, from *Anemone* to *Zinnia.* The type was primarily used by the Royal Navy and Royal Canadian Navy, but a few were delivered to the Free French, Greek, and Norwegian forces, as well. The U.S. Coast Guard operated 18 as the Patrol Gunboat (PG) from 1942.

The *Flower* class was extensively used for escort duties protecting Allied convoys, mainly on the Atlantic, but also in the Arctic and Indian seas. Despite being good sea vessels, they suffered from being "wet" ships, with much sea spray on the decks, and bobbed heavily on the waves, making life for the crew rather miserable. A fortnight of constant rolling and pitching on transatlantic convoy duty exhausted everyone who sailed in them.

The original design had a mercantile bridge, but it was quickly replaced in production by a more warlike open bridge with a radar system on top. This was one of the great innovations of the sea war, allowing the previously blind escorts to see at night and in fog. In contrast to the good radar, the ship had an outdated sonar system that lost contact when the ship passed over a submarine to drop depth charges. (This problem was circumvented when it received the Hedgehog antisubmarine mortar, allowing it to attack from a distance.)

The ship's primary opponent was the German U-boat, even though it was fairly vulnerable against torpedoes and mines: Having few compartments below the waterline, the corvette could sink in seconds, with few survivors, if severely holed. A total of 35 *Flowers* were lost during the war.

The ship has a crew of 85. The main armament is a 102mm ("4-inch") QF Mk XIX gun in a forward turret with 4°-per-second manual traverse. A gun tub on the aft superstructure carries a quadruple .500 Vickers Mk III machine gun mount for AA fire (12°-per-second manual traverse); Canadian and U.S. ships mount twin .50 Browning M-2WC guns (see p. W:D73). Twin .303 Lewis Mk IISS machine guns (see p. W:AKM64) are mounted on the bridge house siderails, with 60°-per-second manual traverse. For antisubmarine work, there is a depth-charge thrower on either side, and depth charge rails are installed aft. This armament was considerably upgraded over the course of the war.

The *Flower*-class corvette's engine burns 130.9 gallons of fuel oil per hour of routine usage. Fuel, ammo, and provisions cost $74,810. The historical cost was 70,000 pounds Sterling ($269,230).

Flower-Class Corvette

Subassemblies: Heavy Corvette chassis +8; waterproofed Small Secondary superstructure [Body:T] +4; waterproofed limited-rotation Small TD turret [Body:T] +3; full-rotation Large Weapon open mount 1 [Body:T] +2; two limited-rotation Mini open mounts 2-3 [Sup:L, R] +0.

Powertrain: 2,148-kW steam turbine with 2,148-kW water screw and 48,300-gallon standard tanks; two 25-kW marine diesel engines; 40,000-kWs batteries.

Occ: See above. Cargo: 2,741 Body, 68 Sup

Armor	F	RL	B	T	U
Body:	4/100	4/50	4/50	4/30	4/50
Sup:	4/30	4/30	4/30	4/30	–
Turret:	4/20	4/20	0/0	4/20	–
OM 1:	0/0	0/0	0/0	0/0	–
OMs 2-3:	4/20	0/0	0/0	0/0	–

Weaponry

102mm Short DP Gun/QF Mk XIX [Tur:F] (350 rounds).
4×Long Gr. HMGs/Vickers Mk IIIs [OM 1:F] (2,500 each).*
4×Ground LMGs/Lewis Mk IIs [OM 2-3:F] (2,350 each).**
2×Medium DC Throwers [Body:T toward R, L].
2×600-lb. 3-round DC Rails [Body:T toward B] (50 total).
* Linked. ** Linked in pairs.

Equipment

Body: 2,500-VSP bilge; 12 bilge pumps†; nine bunks; six cabins; 1,500-VSP cargo hold; degaussing cable; 100-man environmental control†; two 3.75-ton external cradles (16' lifeboats); 12 fire extinguishers†; 70 hammocks; 1,200 man-days of provisions; 2-mile passive sonar†; three workshops (Electronics, Engineer, Mechanic). *Sup:* Autopilot; IFF; navigation instruments; precise navigation instruments; 10-mile non-targeting surface radar; large radio direction finder; large radio receiver and transmitter; very large radio receiver and transmitter; searchlight. *OMs 1-3:* Universal mount.
† Includes full access.

Statistics

Size: 205'×33'×75' *Payload:* 250 tons *Lwt.:* 1,160 tons
Volume: 14,447 *MH:* 7 man/hours *Price:* $200,685

HT: 12. HPs: 120,000 Body, 1,120 Sup, 285 Turret, 120 OM 1, 30 each OMs 2-3.

wSpeed: 18 *wAccel:* 0.3 *wDecel:* 0.3 (0.5) *wMR:* 0.05 *wSR:* 4
Draft 13'. Flotation Rating 1,320 tons.

Design Notes

Weight, cost, and HPs of body and superstructure were doubled. Loaded weight had to be increased 36%.

From mid-1941, a 24-barrel Hedgehog antisubmarine mortar with 120 rounds was fitted.

From late 1941, most replaced the HMGs with a single 2-pounder Vickers Mk VIII (40mm Short Ground AC) with 720 rounds and DR 40 gunshield, and added a 20mm Oerlikon Mk IV (20mm Long Ground AC) with 1,800 rounds each to either superstructure side.

In 1943, four more Oerlikons were added aft. Also in 1943, a few added a 6-pounder ROQF Mk II (57mm Medium Tank Gun) on the superstructure to fire at submarines.

The number of depth charges carried aboard was eventually increased to 100.

Illustrious-Class Aircraft Carrier

The British *Illustrious* class of aircraft carriers introduced the concept of a fully armored hangar for the aircraft. While this reduced the number of planes that the ship could carry– to half as many as the first modern British carrier, the *HMS Ark Royal*, at roughly the same size – it made the ships much less vulnerable. The *HMS Illustrious* alone survived several battles with numerous direct bomb hits, as well as a Ki-48 kamikaze plane (p. 92) that would have sunk an unarmored carrier.

Illustrious entered service in 1940, followed by *Victorious* and *Formidable* and the modified *Indomitable*. *Illustrious* served with distinction in the Mediterranean in 1940-41 (protecting the Malta convoys), in the western Indian Ocean in 1942-43 (attacking the French on Madagascar), the Mediterranean again in late summer 1943 (taking part in the Salerno landings), and in the eastern Indian Ocean and China Sea in 1944-45 (attacking the Japanese on Sumatra, Java, and Formosa). The carrier was decommissioned in 1956.

Due to its armor, the hangar held only 33 planes: 15 Fulmar I fighters (p. 86) and 18 Fairey Swordfish I torpedo bombers. Three disassembled aircraft were carried as spares. From late 1942, the ship was fitted to park planes on deck, increasing its capacity to 57. These were Fulmar II or Martlet II fighters (p. W:D81) and Tarpon II torpedo bombers (p. 107), then Corsair II fighters (p. W113) and either Avengers or Fairey Barracuda I bombers. *Illustrious* stowed about 200 tons of air ordnance, including 250 500-lb., 650 250-lb., 100 100-lb., and 600 20-lb. bombs, as well as 42 450mm torpedoes.

Illustrious carries a crew of 842 sea and 434 air personnel early in the war; this increases to 1,297 and 700 late in the conflict. The eight turrets mount twin 113mm ("4.5-inch") QF Mk I guns (15°-per-second powered traverse). There are six octuple AA mounts armed with the 40mm ("2-pounder") QF Mk VIII "Pom-Pom" autocannon (15°-per-second powered traverse). Eight 20mm Oerlikon Mk II autocannons are mounted on single mounts (37°-per-second manual traverse).

The main engines burn 4,984 gallons of fuel oil per hour of routine usage. Fuel, ammo, and provisions (excluding aircraft fuel and ordnance) cost $851,010.

HMS Illustrious

Subassemblies: Light Battleship chassis +11; Small Capital superstructure [Body:T] +8; eight limited-rotation Small Secondary turrets 1-8 [Body:T] +4; six full-rotation Medium TD open mounts 1-6 [Body:T] +3; eight full-rotation Mini open mounts 7-14 [Sup:T] +0. All but OMs waterproofed.

Powertrain: six 13,801-kW steam turbines with three 27,602-kW water screws and 1,618,002-gallon standard fuel tanks; two 200-kW diesel engines with 3,000-gallon standard fuel tanks; 120,000-kWs batteries.

Occ: See above. **Cargo:** 54,402 Body, 1,252 Sup

Armor	F	RL	B	T	U
Body:	4/360	4/360	4/360	4/360*	4/120
Sup:	4/120	4/120	4/120	4/120	–
Tur 1-8:	4/40	4/40	0/0	4/40	–
OM 1-14:	0/0	0/0	0/0	0/0	–

* See *Design Notes* for an additional DR 110 and DR 100.

Weaponry

16×113mm Med. DP Guns/Mk Is [Tur1-8:F] (385 each).*
48×40mm SGACs/2-pdr. Mk VIIIs [OM 1-6:F] (720 each).**
8×20mm LGACs/Oerlikon Mk IIs [OM 7-14:F] (1,800 each).
* Linked in pairs. ** Linked in sets of eight.

Equipment

Body: 30,000-VSP bilge; 100 bilge pumps†; 400 bunks; 300 cabins; 30,000-VSP cargo holds; 4,000-VSP cargo holds (for primarily air ordnance including 72 600-lb. depth charges and 24 2,500-lb. sea mines); eight 4-ton cranes; 2,000-man environmental control†; two 10-ton external cradles (pinnaces); four 15-ton external cradles (cutters); 10 fire-direction centers (two for the 113mm guns, eight for the 40mm guns); 100 fire extinguishers†; 63,650-sf flight deck; 26,001-gallon aircraft fuel tanks; 20 halls; 550 hammocks; 60,000-VSP hangar bay; two launch catapults†; 200,000 man-days of provisions; four searchlights; two 2-mile active/passive sonars†; two stages; 10 surgeries; 25 workshops (7 Armoury, 7 Electronics, 8 Mechanic, 3 Engineer). *Sup:* Autopilot; 50 cabins; five luxury cabins; 10 halls; two IFF; two navigation instruments; two precision navigation instruments; 40-mile nontargeting air radar; 20-mile nontargeting surface radar; five immense radio receiver and transmitter; four very large radio receiver and transmitter; 10 large radio receivers and transmitters; two searchlights. *Tur 1-8:* 6.25-kW traversing gear; universal mount in each. *OMs 1-6:* 2.5-kW traversing gear; universal mount in each. *OMs 7-14:* Universal mount in each.

† Includes full access.

Statistics

Size: 753'×96'×128' *Payload:* 7,000 tons *Lwt.:* 28,661 tons
Volume: 410,028 *MH:* 39 man/hours *Price:* $6.8M

HT: 9. HPs: 1,140,000 Body, 12,000 Sup, 560 each Turrets 1-8, 360 each OMs 1-6, 30 each OMs 7-14.

wSpeed: 35 *wAccel:* 0.4 *wDecel:* 0.1 (0.3) *wMR:* 0.02 *wSR:* 6
Draft 28'. Flotation Rating 36,840 tons.

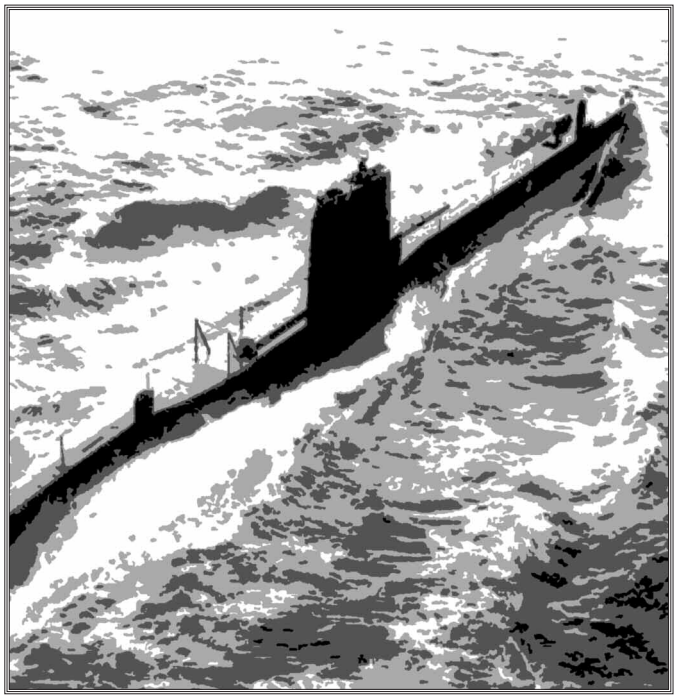
Design Notes

Illustrious was the first carrier to use three layers of top armor, a feature that became a staple in late-war designs. The DR 360 flight deck protects the hangar and triggers most bombs, rendering explosion damage *non-contact* for the lower decks. The DR 110 hangar deck is the second armor layer. Below it, the main deck, which holds personnel areas, has DR 100 protecting the machinery, fuel, and ammo stores below it. The ship also introduced side armor for the hangar, which was as thick as the body's side.

Weight, cost, and HPs of the body were doubled. Weight had to be increased 20% and wSpeed 17%. The historical flight deck surface area is listed.

Late in the war, the light AA armament consisted of five octuple 2-pounder cannons, three single 40mm Bofors cannons, and 52 single 20mm Oerlikon cannons.

T-Class Submarine



The T class was the standard patrol submarine of the Royal Navy. Designed in the 1930s under the limits of the London Treaty, it was rather small for an ocean-going submarine, but powerfully armed and superior to many of the larger British designs. Simple and robust, it was reliable and easy to operate, its sole limitation being its somewhat slow surface speed.

The boat was heavily armed with 10 torpedo tubes fitted, all firing to the front. Six of these were mounted in the pressure hull, two amidships near the conning tower, and two in a bulge above the bow. This gave the boat an odd appearance. The "bulge" tubes could not be reloaded from inside.

The T class Group 1 included 22 units built from 1937-43, including *Triton*, *Triumph*, *Thunderbolt, Trident*, *Triumph*, *Tribune*, *Taku*, *Thistle, Tarpon, Triad, Truant*, *Tuna*, *Tigris, Tetrarch*, *Torbay*, and *Talisman*. Another 31 were built in Group 2, which was slightly modified, notably having the two midships torpedo tubes angled aft, and an 11th tube added to aft as well. Two vessels of this type were handed to the Royal Netherlands Navy, which used them as the *Zwaardvis* and *Tijgerhaai.*

They were made by four yards, each installing engines of their preference – thus, those built by Vickers-Armstrong had Vickers diesels, those by Royal Dockyards used Admiralty engines, those by Cammell Laird had Swiss Sulzer diesels, and those by Scotts had German MAN engines.

The T class was used in all areas of operations; as a consequence, 16 were lost, mainly in the Mediterranean, which was unsuited for a large submarine. They were especially effective against enemy subs, 13 boats sinking 13 Axis boats.

In December 1942, three were modified to carry two-man Chariot manned torpedoes on the deck for Operation Principle, which involved attacks on Palermo, Cagliari, and Maddelena.

The sub has a nominal crew of 56, but carries 62 in wartime. The secondary armament consisted of a 102mm ("4-inch") QF Mk XII gun in an open mount on the forward part of the tower (3°-per-second manual traverse). Three .303 Vickers G.O. Mk I machine guns (67°-per-second manual traverse, p. W:AKM64) can be fixed to the railing for AA defense.

The engines burn 74.6 gallons of diesel fuel per hour of routine usage. Fuel, ammo, and provisions cost $194,935.

T-Class Submarine

Subassemblies: Heavy Corvette chassis with Sub option +8; sealed Medium Secondary superstructure [Body:T] +4; full-rotation Small AFV open mount 1 [Sup:T] +2; three limited-rotation Mini open mounts 2-4 [Sup:T] +0.

Powertrain: two 932-kW marine diesels with two 932-kW screws and 44,100-gallon standard tanks; two 540-kW electric motors with 25.4 million-kWs batteries†.

Occ: See above. Cargo: 838 Body, 111 Sup

Armor	F	RL	B	T	U
OM 1-4:	0/0	0/0	0/0	0/0	–
All Else:	4/60	4/60	4/60	4/60	4/60

Weaponry

102mm Short DP Gun/QF Mk XII [OM 1:F] (300 rounds).
3×Air. LMGs/Vickers G.O. Mk Is [OM 2-4:F] (2,350 each).
10×533mm Torpedo Tubes [Body:F] (total of 26 carried).
* Linked.

Equipment

Body: Autopilot; two backup driver controls; 2,500-VSP bilge; 12 bilge pumps†; 32 bunks; cabin; 75-VSP cargo holds; 2-ton crane (torpedoes); 75-man environmental control†; fire-direction center; 15 fire extinguishers†; 120 man-days of life support†; navigation instruments; precision navigation instruments; 2,620 man-days of provisions; 2-mile passive sonar. *Sup:* Navigation instruments; 2 20' 15× periscopes; 23-mile nontargeting air radar; 37-mile nontargeting surface radar; large radio direction finder; two very large radio receivers and transmitters; searchlight. *OMs 2-4:* Universal mount.

† Includes limited access.

Statistics

Size: 275'×27'×30' *Payload:* 250 tons *Lwt.:* 1,326 tons
Volume: 14,468 *MH:* 13 man/hours *Price:* $691,020

HT: 10. HPs: 60K Body, 750 Sup, 150 OM 1, 30 each OM 2-4.

wSpeed: 18 *wAccel:* 0.2 *wDecel:* 0.3 (0.4) *wMR:* 0.05 *wSR:* 4
Draft 15'. Flotation Rating 1,398 tons.
uSpeed: 10 *uAccel:* 0.1 *uDecel:* 0.3 (0.4) *uMR:* 0.05 *uSR:* 4
uDraft 30'. Crush Depth 210 yards.

Design Notes

The 1,575-ton historical submerged weight was used for underwater performance. Design wSpeed and uSpeed were slightly increased to the historical figures. Draft was increased 25%, while uDraft was capped at the historical height.

Many of these boats later received a single 20mm Oerlikon Mk II (20mm Long Ground Autocannon) equipped with 600 rounds to improve their AA protection.

600-Class Adua-Series Submarine

In 1933, the Royal Italian Navy adopted the first of the 600 class of submarines, so-called because of their nominal surface displacement. (All were actually larger than that.) This was numerically the largest class of Italian submarines, a total of 39 being constructed. They were small, short-ranged boats optimized for operations in the Mediterranean Sea. Although rather slow on the surface, they were well-liked craft, being robust and maneuverable. The 600 Class was heavily used and suffered accordingly, only five surviving beyond the armistice of September 1943.

The class was built in several sub-variants. The original 12 were of the *Sirena* series of 1933, followed by 10 of the *Perla* series of 1936, and 17 of the *Adua* series of 1936. They first saw action during the Spanish Civil War, when several *Sirenas* and *Aduas* participated on the side of the Nationalists.

Two additional *Aduas* were sold to Brazil in 1937; they didn't see combat. *Perla* was captured by the British on July 9, 1942, after a surface battle off of Beirut, and given to the Greek navy in 1943, which used it in action. Two were taken over by the Kriegsmarine in 1943, but were destroyed in port before they could see service under the swastika.

Both two *Perlas* (*Ambra* and *Iride*) and two *Aduas* (*Gondar* and *Scirè*) were modified between 1940 and 1942 to carry SLC underwater assault craft (see p. W:GL36) on the deck, for the attack of ships in harbor. SLCs attacked Gibraltar, Malta, and ports in Egypt and Palestine. The *Scirè* was particularly effective in this role. On November 19, 1941, its three SLCs sank the battleships HMS *Queen Elizabeth* and *Valiant* together with a tanker in the port of Alexandria. Both *Gondar* and *Iride* had failed in the same place in earlier attacks.

The *Adua* series was commonly known as *l'Africana* (the African) to the Italian sailors, as all were named after places and battlefields in the African possessions – *Adua, Alagi, Aradam, Ascianghi, Axum, Beilul, Dagabur, Dessiè, Durbo, Gondar, Lafolè, Macallè, Neghelli, Scirè, Tembien, Uarscieck,* and *Uebi Scebeli*. These 17 were built by three yards between 1936 and 1938. Five took part in the Spanish fighting from 1937, mostly on special-operations missions. During WWII, they operated from bases in Italy and North and East Africa.

The *Adua*-series submarine has a crew of 46. Like all of the 600 class, it is armed with six torpedo tubes, a 100mm OTO Mod 35 deck gun (5°-per-second manual traverse), and two 13.2mm Breda Mod 31 heavy machine guns (see p. W:GL27) on the tower (45°-per-second manual traverse).

The engines burn 41.8 gallons of diesel fuel per hour of routine usage. Fuel, ammo, and provisions cost $89,800.

600-Class Adua-Series Sub

Subassemblies: Medium Corvette chassis with Sub option +8; sealed Small Secondary superstructure [Body:T] +4; limited-rotation Medium AFV open mount 1 [Body:T] +2; two limited-rotation Mini open mounts 2-3 [Sup:T] +0.

Powertrain: two 522-kW marine diesels with two 522-kW screws and 14,202-gallon standard tanks; two 298-kW electric motors with 3.556 million-kWs batteries†.

Occ: See above. **Cargo:** 2,032 Body, 78 Sup

Armor	F	RL	B	T	U
OMs 1-3:	0/0	0/0	0/0	0/0	–
All Else:	4/50	4/50	4/50	4/50	4/50

Weaponry

105mm Medium DP Gun/Mod 35 [OM 1:F] (144 rounds).
2×VL Ground HMGs/Mod 31s [OMs 2-3:F] (3,000 each).
4×533mm Torpedo Tubes [Body:F] (12 total carried).*
2×533mm Torpedo Tubes [Body:B] (See above.).**
* Linked. ** Linked.

Equipment

Body: Autopilot; 1,500-VSP bilge; 20 bilge pumps†; 24 bunks; four cabins; 200-VSP cargo hold; 50-man environmental control†; 20 fire extinguishers†; two hammocks; 50 man-days life support†; navigation instruments; precision navigation instruments; 1,500 man-days of provisions; 2-mile passive sonar†. *Sup:* Navigation instruments; two 17' 15× periscopes; large radio direction finder; two large radio receivers and transmitters; very large radio receiver and transmitter; searchlight. *OMs 2-3:* Universal mount.

† Includes limited access.

Statistics

Size: 197'×21'×32' *Payload:* 90 tons *Lwt.:* 768 tons
Volume: 10,522 *MH:* 9 man/hours *Price:* $318,595

HT: 12. HPs: 76.5K Body, 560 Sup, 200 OM 1, 30 each OM 2-3.

wSpeed: 16 *wAccel:* 0.2 *wDecel:* 0.3 (0.4) *wMR:* 0.05 *wSR:* 4
Draft 16'. Flotation Rating 1,016 tons.
uSpeed: 9 *uAccel:* 0.1 *uDecel:* 0.3 (0.4) *uMR:* 0.05 *uSR:* 4
uDraft 32'. Crush Depth 220 yards.

Design Notes

The historical sub was slightly smaller than this (displacing 6,050 VSPs). The surplus 467 VSPs were ignored; they are not listed as cargo or bilge space. Weight, cost, and HPs of the body were multiplied by 1.5. Design uSpeed was increased 12% to the historical. Draft was increased by 60% to the historical figure. The calculated underwater draft is 41.3' but was capped at the actual height. Crush depth as designed was 180 yards, but was increased to the historical figure.

Many added two 6.5mm Breda Mod 30 machine guns (Ground LMGs per p. W:GL27) to the railings.

Those fitted for deployment of the SLC had the deck gun removed and three waterproofed Medium AFV containers mounted on the deck.

Daihatsu Landing Craft

The *Daihatsu Kō Gata* (large engine boat model A) was the most common Japanese landing craft. It was mass-produced from 1932, with more than 6,000 eventually seeing service. It was used for beach assault, coastal traffic, and various small-boat operations, including as lifeboats on larger vessels. Many were carried on the deck of subs that carried assault troops.

It was based on a common Japanese fishing-boat design with twin keels, a steel bottom, and wooden sides. A wooden ramp in the bow allowed easy unloading.

The Daihatsu was surprisingly maneuverable despite its clumsy looks. Its thick belly, heavy bow, and protected screw made it very serviceable in the rock-infested waters of the Pacific islands. It could carry up to 120 men on assaults or 50 on long hauls; alternatively, it could carry a light tank or a 150mm howitzer with crew and ammo.

Its crew consists of five to seven men. The skipper has a vertical armor plate with vision slits in front of the steering wheel. The boats mount at least two automatic weapons on single mounts, typically two 13.2mm 93 Shiki Kōsha Kikanjū machine guns manually traversed at 40° per second.

The engine burns 2.4 gallons of diesel fuel per hour of routine usage. Fuel and ammo cost $135.

Daihatsu Kō Gata

Subassemblies: Light Cutter chassis with Mediocre lines +5; two full-rotation Mini open mounts 1-2 [Body:T] +0.

Powertrain: 45-kW marine diesel engine with 45-kW water screw and 370-gallon light tanks; 4,000-kWs batteries.

Occ: 1 XCS Body Cargo: 316.7 Body, 0.4 OMs 1-2

Armor	F	RL	B	T	U
Body:	3/5W	3/5W	3/5W	0/0	3/15
OMs:	0/0	0/0	0/0	0/0	–
Skipper:	0/+25	0/+0	0/+0	0/+0	0/+0

Weaponry

2×VL Ground HMGs/93 Shikis [OMs 1-2:F] (900 each).

Equipment

Body: Bilge pump; 300-VSP cargo hold; navigation instruments. *OMs 1-2:* Universal mount.

Statistics

Size: 49'×12'×7' *Payload:* 15 tons *Lwt:* 20 tons
Volume: 392 *Maint:* 112 hours *Cost:* $3,215

HT: 12. HPs: 1,500 Body, 30 each OM 1-2.

wSpeed: 11 *wAccel:* 0.3 *wDecel:* 1 (1.2) *wMR:* 0.05 *wSR:* 5
Draft 4'. Flotation Rating 49.9 tons.

Design Notes

Weight, cost, and HPs of the body were halved. Only half of an armored station was used for the crew armor. Design wSpeed was increased 29% to the historical figure.

Kaiten Human Torpedoes

The failure of the Japanese conventional forces to stop the Americans led to the development of suicide tactics such as the kamikaze planes (p. 97). In November 1944, the Japanese submarine force introduced its own version of this concept, the "human torpedo." This became the primary weapon of the Japanese submarine arm in 1945. Some 330 were built.

The *Kaiten 1 Shiki 1 Gō* (turning of the heavens type 1 modification 1) was a midget sub incorporating the engine and tail assembly of a 610mm 93 Shiki 3 Gata torpedo (p. W132). The bow and mid sections held a huge warhead and the pilot's compartment. There was no provision for recovery, and while there was an escape hatch, no pilot is known to have used it.

In action, the pilot entered from an access tube in the deck of the host sub and sat in the vehicle until given last orders and navigational data via telephone. Released about 7,000 yards out, he would briefly rise to periscope depth at 500-1,000 yards to verify his bearings, then crash into the target (collision damage as per p. W154) and explode (6d×3,300).

In action, the mounts displayed reliability and navigational problems. Many were destroyed or exploded harmlessly. Kaiten only sunk a single merchant ship, one tanker, and the destroyer escort *USS Underhill*, while the Japanese command estimated (due to faulty intelligence and wishful thinking) that they sunk one ship per human torpedo! The program cost them around 40 Kaiten, eight submarines, and almost 900 lives.

The engine burns 17.5 gallons of jet fuel per hour of routine usage. Fuel and warhead cost $3,305.

Kaiten 1 Shiki 1 Gō

Subassemblies: Medium Boat chassis with Sub option +3; sealed Medium Weapon superstructure [Body:T] +1.

Powertrain: 388-kW turbocharged gas engine with 388-kW water screw and 27-gallon standard tanks.

Occ: 1 CS Both Cargo: 0.1 Sup

Armor	F	RL	B	T	U
All:	4/15	4/15	4/15	4/15	4/15

Weaponry

3,300-lb. HE Warhead [Body:F].

Equipment

Body: 0.2 man-days life support; nav. instruments. *Sup:* periscope.

Statistics

Size: 48'×3'×4' *Payload:* 0.15 tons *Lwt:* 9.15 tons
Volume: 57 *Maint:* 48 hours *Cost:* $17,230

HT: 9. HPs: 375 Body, 75 Sup.

uSpeed: 35 *uAccel:* 8 *uDecel:* 0.7 (4.7) *uMR:* 0.1 *uSR:* 2
Draft 8.8'. Crush Depth 150 yards.

Design Notes

The engine is an approximation that matches the weight; it really used a mixture of jet fuel, oxygen, and seawater to generate steam. Design uSpeed was increased 16%.

Aircraft Carrier Taihō

Taihō (great phoenix) was the largest, newest, and technically most advanced *Kōkū Bokan* (aircraft carrier) of the *Nihon Kaigun*, or Japanese navy. Ordered in 1939, it was based on the *Shokaku* class, but incorporated modern features seen on Allied carriers such as an armored hangar, an enclosed bow, and an off-set island with slanting funnel.

It was completed in March 1944, and after a short trip to Singapore it became the flagship of Vice Adm. Ozawa. In June 1944, *Taihō* departed for the Philippines. Its first major battle – later known as the Battle of the Philippine Sea (see p. W31) – would prove to be its last.

After *Taihō* launched its first wave of aircraft on the morning of June 19, the *Gato*-class sub USS *Albacore* (see p. W:D91) fired six torpedoes at the prize target. Only one of the spread hit, and did only minor damage, jamming the forward elevator and starting a small fire. An aviation gas tank also had been breached, and fuel vapors soon began trickling through the ship.

An attempt to ventilate the fumes actually spread them throughout the entire aircraft hangar. In the early afternoon, despite the ship's modern fire-extinguishing system, the volatile fumes exploded, splitting the armored deck open and instantly killing most crew members stationed in the hull. The vice admiral and the tower crew escaped in the lifeboats before *Taihō* sank two hours later.

The hangar could carry a complement of 27 Mitsubishi A6M5 "Zeke" fighters (p. W112), 18 Nakajima B6N2 "Jill" torpedo-bombers, 18 Yokosuka D4Y2 "Judy" bombers (p. 96), nine Aichi D3A2 "Val" dive-bombers, and three Yokosuka D4Y1-C "Judy" scout planes (p. 96). The ship's magazines carried about 290 tons of aircraft ordnance, including 90 1,760-lb. bombs, 468 550-lb. bombs, 468 132-lb. bombs, 144 66-lb. bombs, and 45 450mm torpedoes.

Taihō has a crew of 1,751.

The six turrets mount twin 100mm 98 Shiki Sokusha Hō guns with powered traverse at 16° per second. There are 17 triple AA mounts armed with 25mm 96 Shiki Kōsha Kikanhō autocannons manually traversed at 11° per second; 11 twin AA mounts carried 13.2mm 93 Shiki Kōsha Kikanjū HMGs with manual traverse at 11° per second.

The engines burn 7,194 gallons of fuel oil per hour of routine usage. Fuel, ammo, and provisions (excluding aircraft fuel and ordnance) cost $512,660.

Kōkū Bokan Taihō

Subassemblies: Medium Battleship chassis +11; waterproofed Small Capital superstructure [Body:T] +8; six waterproofed limited-rotation Small Secondary turrets 1-6 [Body:T] +4; 17 full-rotation Medium AFV open mounts 1-17 [Body:T] +2; 11 full-rotation Large Weapon open mounts 18-28 [Body:T] +2.

Powertrain: four 29,840-kW steam turbines with four 29,840-kW screws and 1,929,231-gallon standard tanks; four 200-kW marine diesel engines with 5,001-gallon standard tanks; 120,000-kWs batteries.

Occ: See above. **Cargo:** 111,300 Body, 1,359 Sup

Armor	F	RL	B	T	U
Body:	4/360	4/360	4/360	4/310*	4/120
Sup:	4/130	4/130	4/130	4/130	–
Turs 1-6:	3/10	3/10	3/10	0/0	–
OMs 1-28:	0/0	0/0	0/0	0/0	–

* See *Design Notes* for an additional DR 50 and DR 250.

Weaponry

12×100mm Long DP Guns/98 Shikis [Tur 1-6:F] (400 each).*
51×25mm LGACs/96 Shikis [OM 1-17:F] (2,000 each).**
22×VL Ground HMGs/93 Shikis [OM 18-28:F] (2,500 each).*
* Linked in pairs. ** Linked in groups of three.

Equipment

Body: 40,000-VSP bilge; 100 bilge pumps†; 200 bunks; 50 cabins; 30,000-VSP cargo holds; 5,800-VSP cargo holds (aircraft ordnance); 1,775-man environmental control†; six 7.5-ton external cradles (lifeboats); 4-ton crane; 10 fire-direction centers (two for the 100mm guns, eight for the 25mm guns); 100 fire extinguishers†; 69,290-sf flight deck; 176,001-gallon aircraft fuel tanks; two 50,000-VSP hangar bays; 20 halls; 1,450 hammocks; 30 hospital beds; two launch catapults†; 160,000 man-days of provisions; three searchlights; two 2-mile active/passive sonars†; two stages; 10 surgeries, 25 workshops (7 Armoury, 7 Electronics, 8 Mechanic, 3 Engineer). *Sup:* Autopilot; 50 cabins; five luxury cabins; 10 halls; two IFF; two navigation instruments; two precision navigation instruments; 54-mile nontargeting air radar; 19-mile nontargeting surface radar; six immense radio receivers and two transmitters; four very large radio receivers and one transmitter; nine large radio receivers and 18 transmitters; searchlight. *Tur 1-6:* 5.3-kW traversing gear; universal mount. *OMs 1-28:* Universal mount.

† Includes full access.

Statistics

Size: 855'×91'×105' *Payload:* 8,000 tons *Lwt.:* 34,200 tons
Volume: 570,050 *MH:* 43 man/hours *Price:* $7,9M

HT: 9. HPs: 1,440,000 Body, 12,000 Sup, 560 Turrets 1-6, 200 each OMs 1-17, 120 each OMs 18-28.

wSpeed: 38 *wAccel:* 0.5 *wDecel:* 0.1 (0.4) *wMR:* 0.02 *wSR:* 6
Draft 31'. Flotation Rating 50,400 tons.

Design Notes

Taihō had three layers of top armor. The DR 310 flight deck protects the hangar and triggers most bombs, rendering explosion damage *non-contact* for lower decks. The DR 50 lower hangar deck is the second armor layer. Below it, the main deck holding personnel areas also has DR 250 protecting the machinery, fuel, and ammo stores below it.

Weight, cost, and HPs of the body were doubled to better reflect historical weight. Design wSpeed was increased 15% to the historical value. The GM should feel free to greatly reduce the ship's usual chances to avoid fire and explosion, assuming that some of its systems were faulty.

B1 Shiki Sensuikan Submarine

The *B1 Shiki Sensuikan* (type B1 submarine) was the largest class of Japanese fleet scouting sub, with 20 made from 1940-43. It had a watertight hangar in front of the conning tower for a disassembled Yokosuka E14Y1 seaplane (p. 97). This could be assembled at sea and catapulted into reconnaissance flights. Initially, the fleet subs were primarily used against Allied warships, rather than merchant ships. They were quite successful in this, but it hardly mattered in the course of the war.

On September 15, 1942, at 2:42 p.m., *I-19* fired what was probably the most lucky torpedo salvo in submarine history. The six 93 Shiki "Long Lances" had been aimed at the carrier USS *Wasp* (p. W:D93) from 500 yards away. Three hit and damaged the carrier so badly that it sank five hours later. The three other fish passed their target and sped toward another task group more than 5 *miles* behind it. One of them damaged the battleship *North Carolina* and another one ripped a sizeable chunk out of the destroyer *O'Brien*, which sank three days later.

As Allied air superiority increased, the subs increasingly took on safer jobs. From late 1942, they mainly served as *mogura* (mule) transports to supply outposts and evacuate wounded and equipment. The crack crews felt these missions were beneath them. From late 1944, the subs returned to a combat role, of sorts, by carrying the Kaiten human torpedoes (p. 120) to war.

A B1 Shiki has a crew of 94, of which two are pilots and four maintenance crew for the seaplane. The main gun is a 140mm Taisho 11 Shiki Sokusha Hō with 4°-per-second manual traverse aft of the conning tower. Twin 25mm 96 Shiki Kōsha Kikanhō autocannons (6°-per-second manual traverse) are mounted on the tower for AA fire. The engines burn 370 gallons of diesel per hour of routine usage. Fuel, ammo, and provisions cost $244,400 (minus the plane and its fuel).

B1 Shiki Sensuikan I-19

Subassemblies: Medium Destroyer chassis with Sub option +9; sealed Large Secondary superstructure [Body:T] +4; limited-rotation Medium TD open mount 1 [Body:T] +3; full-rotation Medium AFV open mount 2 [Sup:T] +2.

Powertrain: two 4,625-kW marine diesels with two 4,625-kW screws and 150,000-gallon standard tanks; two 746-kW electric motors with 20 million-kWs batteries†.

Occ: See above. **Cargo:** 785 Body, 37 Sup

Armor	F	RL	B	T	U
OMs 1-2:	0/0	0/0	0/0	0/0	–
All Else:	4/60	4/60	4/60	4/60	4/60

Weaponry

140mm Short DP Gun/11 Shiki [OM 1:F] (250 rounds).
2×25mm Long Gr. ACs/96 Shikis [OM 2:F] (4,000 each).*
6×610mm Torpedo Tubes [Body:F] (17 total carried).**
* Linked. ** Linked.

Equipment

Body: Autopilot; 7,000-VSP bilge; 20 bilge pumps†; 50 bunks; cabin; 640-VSP cargo holds; 2-ton crane (seaplane); 3-ton crane (whaler); 20 fire extinguishers†; 2,100-gallon fuel tank (plane); launch catapult; 188 man-days life support†; navigation instruments; precision navigation instruments; 8,500 man-day provisions; 2-mile passive sonar†; 40-VSP vehicle bay (20' whaler). *Sup:* Backup driver option; navigation instruments; two 20' 15× periscopes; large radio direction finder†; large radio receiver and transmitter†; very large receiver and transmitter†; searchlight; 120-VSP vehicle bay (seaplane). *OMs 1-2:* Universal mount.

† Includes limited access.

Statistics

Size: 357'×31'×49' *Payload:* 800 tons *Lwt.:* 2,589 tons
Volume: 32,770 *MH:* 14 man/hours *Price:* $845,750

HT: 9. HPs: 108,000 Body, 900 Sup, 360 OM 1, 200 OM 2.

wSpeed: 27 *wAccel:* 0.5 *wDecel:* 0.3 (0.6) *wMR:* 0.05 *wSR:* 4
Draft 17'. Flotation Rating 3,156 tons.
uSpeed: 9 *uAccel:* 0.1 *uDecel:* 0.3 (0.4) *uMR:* 0.05 *uSR:* 4
uDraft 49'. Crush Depth 275 yards.

Design Notes

Design wSpeed was increased 8%, uSpeed 13%, to the historical figures. Calculated crush depth was only 187'.

In 1942, *I-15, I-19*, and *I-26* had the hangars converted to a gasoline-storage area with refueling capabilities for other seaplanes; 3,385 gallons of aviation gas could be carried.

Unkato

The *Unkato* (stores carrier) was a submersible supply container towed by a sub. It was intended for the supply of surrounded Japanese garrisons and isolated islands which could no longer be reinforced by surface vessels.

The containers had their own ballast tanks and could be submerged to 130 yards, but it was difficult to maintain trim during towing operations, and few reached their destinations.

In action, the container was towed near shore and unhooked. It surfaced, then was towed ashore by motor boat.

Subassemblies: Light Corvette chassis with Sub option +7.
Occ: None **Cargo:** 4,000 Body

Armor	F	RL	B	T	U
Body:	3/7	3/7	3/7	3/7	3/7

Equipment

Body: 2,640-VSP cargo hold.

Statistics

Size: 135'×16'×16' *Payload:* 377 tons *Lwt:* 544 tons
Volume: 6,500 *Maint:* 31 man/hours *Cost:* $42,000

HT: 12. HPs: 36,000 Body.

wSpeed: * *wAccel:* * *wDecel:* * *wMR:* 0.05 *wSR:* 4
Draft 8.9'. Flotation Rating 625 tons.
uSpeed: * *uAccel:* * *uDecel:* * *uMR:* 0.05 *uSR:* 4
Draft 16'. Crush Depth 330 yards.
* Use towing vehicle's statistics after adding towed weight.

Design Notes

Crush depth was increased to the historical figure.

Vesikko Submarine

Though forbidden by treaty, prewar Germany secretly developed a new coastal sub in the Netherlands. The first boat was built in Turku, Finland, launched in 1933, and tested by the Germans before joining the Finnish navy in 1936.

Called *Vesikko* (mink), it was one of five Finn subs serving in the Winter War. It sunk the Soviet freighter *Vyborg* in 1941, but never fought a warship. It handled well, but had short range, noisy diesels, and a slow diving speed of 45 seconds.

The *Vesikko* has a crew of 20 and carries three bow torpedo tubes and a 20mm DISA-Madsen ItK/40 autocannon (37°-per-second manual traverse) on deck. The engines burn 20.9 gallons of diesel per hour. Fuel, ammo, and provisions cost $35,625. Historical cost was 19.4 million Finnmark ($425,000).

Sukellusvene Vesikko

Subassemblies: Very Light Corvette chassis with Sub option +7; sealed Medium TD superstructure [Body:T] +3; full-rotation Mini open mount 1 [Sup:T] +0.

Powertrain: two 261-kW marine diesels with two 261-kW screws and 2,364-gallon standard tanks; two 112-kW electric motors with 2.832-million-kWs batteries†.

Occ: 8 CS Body, 3 CS Sup Cargo: 1,144 Body, 34 Sup

Armor	F	RL	B	T	U
Body:	4/40	4/40	4/40	4/40	4/40
Sup:	4/50	4/50	4/50	4/50	–

Weaponry

20mm Long Ground AC/ItK/40 [OM:F] (1,000 rounds).
3×533mm Torpedo Tubes [Body:B] (5 total, or 12 mines).*

Equipment

Body: Autopilot; 390-VSP bilge; five bilge pumps†; 16 bunks; five fire extinguishers†; 50-VSP cargo hold; 20 man-days life support†; navigation instruments; precision navigation instruments; 200 man-day provisions; small, medium, and large radio receivers and transmitters; 1-mile passive sonar†. *Sup:* Backup driver option; navigation instruments; two 25' 15× periscopes; searchlight. *OM:* Universal mount.

† Includes limited access space.

Statistics

Size: 134'×13'×28' *Payload:* 19.3 tons *Lwt.:* 279.4 tons
Volume: 3,951 *MH:* 6 man/hours *Price:* $150,495

HT: 12. HPs: 27,000 Body, 360 Superstructure, 30 OM.

wSpeed: 16 *wAccel:* 0.3 *wDecel:* 0.3 (0.5) *wMR:* 0.05 *wSR:* 4
Draft 13'. Flotation Rating 383 tons.
uSpeed: 8 *uAccel:* 0.1 *uDecel:* 0.3 (0.4) *uMR:* 0.05 *uSR:* 4
uDraft 28'. Crush Depth 275 yards.

Design Notes

Most of the "cargo" space should be ignored, as the body is slightly too large.

85-Foot Crash Rescue Boat

The U.S. Army Air Force operated hundreds of crash rescue boats (CRBs) to recover air crews who crashed over water. They were stationed along both U.S. coasts and overseas.

The 85' Wooden Crash Rescue Vessel mounted an A-frame crane aft and a fully stocked dispensary for up to eight patients. The crew of 12-14 cross-trained in medical care and gunnery. It carried a 20mm Oerlikon Mk 4 autocannon with 29° manual traverse recessed into the aft deck, and two twin .50 Browning M-2HB machine guns (27° manual traverse) in gun tubs.

The main engines burn 89.5 gallons of aviation gas per hour at routine usage. Fuel and ammo cost $1,625.

85-Foot Crash Rescue Boat

Subassemblies: Medium Cutter chassis with Mediocre lines +6; waterproofed Small TD superstructure [Body:T] +3; full-rotation Small Weapon open mount 1 [Body:T] +0; Medium Weapon gun tubs 1-2 [Sup:T] +1; two full-rotation Small Weapon open mounts 2-3 [Tub 1-2:T] +0.

Powertrain: two 895-kW HP gas engines and two 60-kW gas engines with two 895-kW water screws and 3,840-gallon self-sealing fuel tanks; 20,000-kWs batteries.

Occ: See above. Cargo: 86 Body, 19.9 Sup

Armor	F	RL	B	T	U
Body:	3/5W	3/5W	3/5W	3/5W	3/5W
Sup:	3/5	3/5	3/5	3/5	–
Tubs 1-2:	4/25	4/25	4/25	0/0	–

Weaponry

20mm Long Ground AC/Oerlikon Mk 4 [OM 1:F] (1,200).
4×VL Ground HMGs/M-2HBs [OMs 2-3:F] (2,500 each).*
* Linked in pairs.

Equipment

Body: 10' A-frame [B]; 40-VSP bilge; three bilge pumps; 14 bunks; cabin; 20-VSP cargo hold; environmental control; three fire extinguishers; precision navigation instruments; 160 man-day provisions; large radio direction finder; medium radio receiver; two medium radio transmitters; large radio receiver; very large radio receiver and transmitter; eight stretchers; 2-ton winch. *Sup:* Autopilot; navigation instruments. *OMs 1-3:* Universal mount.

Statistics

Size: 85'×20'×33' *Payload:* 19 tons *Lwt.:* 50.9 tons
Volume: 1,091 *Maint.:* 41 hours *Cost:* $23,525

HT: 12. HPs: 5,400 Body, 285 Sup, 75 each Tub, 45 each OM.

wSpeed: 40 *wAccel:* 5 *wDecel:* 1(3.5) *wMR:* 0.05 *wSR:* 5
Draft 4.8'. Flotation Rating 135 tons.

Design Notes

The chassis combines a "metal" hull option with wooden armor. The design cannot quite plane (p. W147) but is assumed to do so to reach the historical wSpeed. The auxiliary engines are used for slow cruising (wSpeed 7).

Liberty Ship

I think this ship will do us very well . . . She isn't much to look at, though, is she? A real ugly duckling.
– President Roosevelt

The U.S. strategy in the Battle of the Atlantic was to build cheap ships to supply allies faster than the Germans could sink them (p. W:D15). The Liberty ship was said to pay for itself if it delivered its cargo only once. One in 10 didn't make it . . .

An updated British tramp design dating to 1879, 2,710 Liberty ships were built from 1941-45. Apart from the U.S. Merchant Marine, British and Canadian merchant fleets used 182; 12 were given to Norway, seven to Belgium, two to the Netherlands, 13 to Greece, 43 to Russia, and four to China.

Aside from mines, subs, raiders, and hostile aircraft, Liberty ships fell afoul of collisions (made likely by convoy conditions) and shoddy work. The welds joining the prefabricated modules were often poor and led to many structural failures, with some ships breaking in two, especially in cold waters. Some 12% had weld defects; one in 30 suffered major fractures.

All differed slightly depending on which yard had built them when. A typical ship would have a bow gun platform with 76.2mm (12-pounder) Mk 10 gun (5°-per-second manual traverse), four deck tubs with .50 Browning M-2WC HMGs (40°-per-second manual traverse; p. W:D73), four gun tubs amidship with 20mm Oerlikon Mk 4 cannons (29°-per-second manual traverse), and a main gun platform atop the aft house with 102mm (4") Mk 9 gun (3°-per-second manual traverse).

The civilian crew included the master; chief, second, and third mates; chief engineer and first, second and, third engine assistant; chief steward; purser; radio operator; boatswain; nine seamen; carpenter; three firemen; three oilers; two wipers; deck engineer; chief cook, second cook, and night cook/baker; galley man; and six mess men. Up to 36 Armed Naval Guards (often less than half as many) man the guns. The engines burn 115 gallons of fuel oil per hour. Fuel, ammo, and provisions cost $73,830. Historical cost was $1.5-2.1 million, depending on the yard (which received a flat $60,000-160,000 per ship).

EC2-S-C1 Liberty Dry Cargo Ship

Subassemblies: Medium Cruiser with Mediocre lines +10; waterproofed Large Ship superstructure 1 [Body:T] +7; waterproofed Medium Naval superstructure 2 [Body:T] +6; limited-rotation Large Weapon open mount 1 [Body:T] +2; four full-rotation Mini open mounts 2-5 [Sup 1:T] +0; four full-rotation Mini open mounts 6-9 [Body:T] +0; limited-rotation Medium AFV open mount 10 [Sup 2:T] +2.

Powertrain: 1,865-kW steam turbine with 1,865-kW water screw and 560,000-gallon standard tanks; three 25-kW marine diesel engines for electrical power.

Occ: See above. **Cargo:** 113K Body, 3,741 Sup 1, 500 Sup 2

Armor	F	RL	B	T	U
Body:	4/30	4/30	4/30	4/30	4/30
Sup 1-2:	4/15	4/15	4/15	4/15	–
OMs 1 , 6-10:	0/0	0/0	0/0	0/0	–
OMs 2-5:	4/40	0/0	0/0	0/0	–

Weaponry

76.2mm Medium DP Gun/Mk 10 [OM 1:F] (100 rounds).
4×20mm LGACs/Oerlikon Mk 4s [OM 2-5:F] (2,000 each).
4×VL Gr. HMGs/Browning M-2s [OM 6-9:F] (2,000 each).
105mm Medium DP Gun/Mk 9 [OM 10:F] (100 rounds).

Equipment

Body: 290-VSP bilge; 20 bilge pumps†; 2,325-VSP general stores; 16,836-, 29,121-, 19,286-, 18,823-, and 18,638-VSP cargo holds 1-5; 383-VSP reefer; five 5-ton cranes; 30-ton crane; 50-ton crane; two 4,908-VSP deep tanks; degaussing cable; 150-man environmental control (also cools reefer)†; 20 fire extinguishers†; 2,500 man-day provisions; three workshops (Mechanic, Engineering, Electronics). *Sup 1:* Autopilot; 64 bunks; 11 cabins; four 5-ton external cradles (lifeboats); five fire extinguishers†; two navigation instruments; two precise navigation instruments; immense radio receiver and transmitter; very large receiver and transmitter; two searchlights [Sup 1:L, R]. *Sup 2:* six bunks; two hospital beds; surgery; 75-VSP medical stores. *OMs 1-10:* Universal mount.

† Includes full access.

Statistics

Size: 442×57'×65' *Payload:* 11,940 tons *Lwt.:* 14,245 tons
Volume: 193,333 *MH:* 13 man/hours *Price:* $690,730

HT: 7. HPs: 312,000 Body, 6,600 Sup 1, 2,300 Sup 2, 120 OM 1, 30 OMs 2-9, 200 OM 10.

wSpeed: 12 *wAccel:* 0.02 *wDecel:* 0.2 (0.2) *wMR:* 0.02 *wSR:* 6
Draft 28'. Flotation Rating 17,290 tons.

Design Notes

Design wSpeed was increased 33% to the historical figure. The two deep tanks could carry dry cargo or water ballast.

Variants

Several major variants included the Z-ET1-S-C3 tanker (2.723 million gallons of fuel) and the EC2-S-AW1 collier (94,560 VSPs of coal). Many were converted to troop transports (504 men), hospital ships, repair ships, or animal transports (carrying mules, pigs, sheep, and even zebras on deck).

A Little Bit of Everything . . .

The 7,894-ton cargo capacity of the Liberty ships – equivalent to 300 railroad train cars – allowed them to carry widely differing payloads. This is a *partial* list of what such a ship could carry on a *single* trip to Europe:

Below deck: Mack 10-ton trucks, Ford 1.5-ton trucks, Willys jeeps (p. W106), canned pork, dry beans, steel bars, train wagon wheels, Browning M-1919A4 MGs (p. W97), gunpowder, munitions, and 32 mail sacks.

On deck: Two Curtiss P-40 fighters, 10 M-4 Sherman tanks (p. W102), and 10 Valentine infantry tanks (p. W:AKM73).

Iowa-Class Battleship

The *Iowa* class was the last battleship series built for the U.S. Navy. It was conceived in the late '30s, in fear that Japan would break the Washington Treaty limiting warship tonnages. Plans for the *Essex*-class aircraft carriers (p. W:D93) had been finalized, and to keep up with them the *Iowa* class had to be faster than any previous battleship. A bit of armor and armament size was sacrificed to achieve this, though the *Iowa*'s quality guns may have been more than a match for larger bores such as those on the Japanese *Yamato* class. Regardless, the Navy no longer needed battleships to fight other battleships, but rather to protect the carriers against smaller ships and aircraft by virtue of their powerful AA suites. The carrier's aircraft could protect the battleship itself from other battleships, if need existed.

The *USS Iowa* (BB-61), *New Jersey* (BB-62), *Missouri* (BB-63), and *Wisconsin* (BB-64) entered service in 1943-44; the *Illinois* (BB-65) and *Kentucky* (BB-66) were canceled. *Iowa* began operations in the summer of 1943 in the Atlantic. In November, it took President Roosevelt to the Teheran conference. From January 1944, it operated in the Pacific, and took part in the invasion of the Marshall Islands (where it was lightly damaged by Japanese coastal artillery), the Battle of Leyte Gulf (p. W:D22), and the occupation of Japan. All four were reactivated for the Korean War, *New Jersey* saw action in the Vietnam War, and *Missouri* and *Wisconsin* served in the 1991 Gulf War.

Despite its speed, the *Iowa* featured thick armor on the sides, top, superstructure, and turrets; the bridge had 17.3" plating. The very long hull tapering to a fine bow was necessary for its high speed; as an added bonus, it allowed the installation of additional AA gun mounts. Two catapults and a crane were installed on the stern for the handling of aircraft; three Vought OS2U-3 floatplanes (p. 109) were carried.

Iowa has a crew of 1,921 in 1943; in 1945, after having received additional AA guns and electronics, the complement had risen to 2,788. The three main gun turrets each mount triple 16" Mk 7 guns (4°-per-second powered traverse). Ten turrets mount twin 5" Mk 12 guns (25°-per-second powered traverse). AA guns include 76 water-cooled 40mm Bofors Mk 2 guns in quad mounts (29°-per-second powered traverse) and 52 single 20mm Oerlikon Mk 4 cannons (29°-per-second manual traverse). The engines burn 9,489 gallons of fuel oil per hour of routine usage. Fuel, ammo, and provisions cost $5,190,435.

USS Iowa (BB-61)

Subassemblies: Heavy Battleship +12; Medium Capital superstructure [Body:T] +8; three limited-rotation Huge Naval turrets with Mild slope 1-3 [Body:T] +6; 10 limited-rotation Large TD turrets 4-13 [Sup:T] +4; 18 full-rotation Small TD open mounts 1-18 [Sup:T] +3; full-rotation Small TD open mount 19 [Tur 3:T] +3; 34 full-rotation Mini open mounts 20-53 [Body:T] +0; 18 full-rotation Mini open mounts 54-71 [Sup:T] +0. All but OMs waterproofed.

Powertrain: four 39,538-kW steam turbines with four 39,538-kW screws and 2,236,002-gallon standard tanks; two 250-kW marine diesels with 60,297-gallon standard tanks for electrical power; 120,000-kWs batteries.

Occ: See above. **Cargo:** 381,464 Body, 281 Sup

Armor	F	RL	B	T	U
Body:	4/1,000	4/1,000	4/1,000	4/125*	4/160
Sup:	4/1,440	4/1,440	4/1,440	4/605	–
Turs 1-3:	5/2,460	4/790	4/1,000	4/605	–
Turs 4-13:	4/210	4/210	4/210	4/210	–
OMs 1-71:	4/35	0/0	0/0	0/0	–

* See *Design Notes* for an additional DR 420 and DR 50.

Weaponry

9×16-inch Naval Guns/Mk 7s [Tur 1-3:F] (134 rounds).*
20×127mm Short DP Guns/Mk 12s [Tur 4-13:F] (663).**
76×40mm MGACs/Bofors Mk 2s [OM 1-19:F] (1,250).†
52×20mm LGACs/Oerlikon Mk 4s [OM 20-71:F] (1,500).
Linked in * triple mounts, ** pairs, † quadruple mounts.
Ammo allotments are *per gun*.

Equipment

Body: 50,000-VSP bilge; 100 bilge pumps†; 1,850 bunks; 100,000-VSP cargo holds; 4-ton crane; 2,500-man environmental control†; two 5-ton external cradles (for 25' lifeboats); 4-ton crane; 100 fire extinguishers†; two fire-direction centers (command center); 80 halls; 30 hospital beds; two launch catapults; 284,400 man-day provisions; two 2-mile active/passive sonars†; stage (cinema); 10 surgeries; 9,039-gallon standard tanks (aircraft fuel); 20 workshops (all types). *Sup:* Autopilot; 110 cabins; two luxury cabins; 26 0.04-ton external cradles (for life rafts); 11 fire-direction centers (three for main guns, four for secondary guns, four for 40mm AA guns); two fire-direction centers (command center); 20 halls; two IFF; two navigation instruments; two precise navigation instruments; 23-mile air radar; 115-mile nontargeting air radar; 23-mile surface radar; 25-mile nontargeting surface radar; radar detector; large radio direction finder; five immense radio receivers and transmitters; four very large radio receivers and transmitters; 10 large radio receivers and transmitters; four searchlights; two mainframe targeting computers; five workshops (all types). *Turs 1-3:* four 0.04-ton external cradles (life rafts); 125-kW traversing gear. *Turs 4-13:* 20-kW traverse gear; universal mount. *OMs 1-19:* 2.5-kW traverse gear; universal mount. *OMs 20-71:* Universal mount.

† Includes full access.

Statistics

Size: 888'×108'×210' *Payload:* 12,400 tons *Lwt.:* 63,945 tons
Volume: 897,167 *MH:* 72 man/hours *Price:* $22.6M

HT: 7. HPs: 960,000 Body, 20,000 Sup, 4,200 Turrets 1-3, 450 Turrets 4-13, 285 OMs 1-19, 30 OMs 20-71.

wSpeed: 38 *wAccel:* 0.4 *wDecel:* 0.1 (0.3) *wMR:* 0.02 *wSR:* 6
Draft 37'. Flotation Rating 80,280 tons.

Design Notes

Design wSpeed was increased 21% to the historical figure.

The ships have three armored decks. The DR 125 top deck triggers most bombs, rendering explosion damage *non-contact* for lower decks. The next deck is DR 420. The DR 50 deck below it protects the machinery, fuel, and ammo stores beneath.

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