

ALIENS

Colonial Marines Technical Manual



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Lee Brimmicombe-Wood

A L I E N S[™]

To Dave Hughes, without whom blah, blah, blah...

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A damn fine! production.

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A L O E N STM

Colonial Marines Technical Manual

Lee Brimmicombe-Wood

Edited by Dave Hughes



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"There's this colony - outbound in the arm - on some Terraformed rock-ball orbiting Zeta Reticuli. Apparently, some crazy woman appeared at Gateway six months back, said she landed on the place back in the '20's and some bugs - big alien sonofabitches - overran her ship and ate her crew. She said she escaped by blowing the bugs out the airlock and then froze herself until a rescue ship came along - nearly sixty years later! Anyway, th' ICC asks Space Command to send in some squads of Colonial Marines, armed to the teeth and ready for bear, to recon the planet.

"They never came back.

"True story."

- L/Cpl Jim Kasulka, USCM



ALIENS COLONIAL MARINES TECHNICAL MANUAL

THE UNITED STATES COLONIAL MARINES

1.0 THE CORPS

*"From the balls of Hancock's juniors,
To the shores of Misery;
We will curse our country's leaders,
'Cross the stars, on land and sea;
First to fight the distant corporate wars,
Spill our blood for a sheaf of green;
We will do or die, we ask not why,
'Cuz we're COLONIAL MARINES."*

- Unofficial arrangement of the Marines' Hymn (trad.). Note, the first line refers to Maj.Gen. Gayle B.Hancock, the legendary commanding officer of the Colonial Marine Officers Candidate School, Quantico, VA during the '60s and early '70s. The Misery reference is to Tamburro station, one of the remotest Marine garrisons, orbiting Myssa 340 (78 Nu Ceti III).

1.1 THE UNITED STATES COLONIAL MARINES (USCM)

The **United States Colonial Marine Corps** is America's interstellar force-in-readiness. This role, distinct from that of the US Army, stems from the country's position as a starfaring, colonising power, and its leading role within the structure of the United Americas. Though the term 'Marine' has its roots in describing a soldier who fought from ships at sea, in the modern era it has become synonymous with those elite forces of soldiers who are always ready to fight, regardless of their nation's readiness for war, and who are capable of operating far from their home soil. The Colonial Marine Corps has a dual responsibility. First, to serve on land, on sea, in air and in space; second, to exploit the advantages of readiness and interstellar deployment capability.

The capability to project power across the vast reaches of space to the surface of a distant world is an essential element of national strategy. Colonial Marine forces, operating with the space fleet, are the nation's only major means to forcibly enter any hostile area from space. They are an independent, combined force having all the elements of combat power. Their versatility and responsiveness add a significant dimension to the options available to the National Command Authority in time of crisis.

The National Security Act of 2101 established the Colonial Marines structure as four combat divisions and four aerospace wings, plus the support services organic to these formations. At present, fiscal year (FY) 2179, Colonial Marine Corps strength stands at 165,000 Marines; roughly the same figure as at the turn of the century, though this has declined from a peak of 240,000 in FY 2165 at the end of the Tientsin (8 Eta Boötis A III) campaign. Reserve manpower stands at around 50,000, comprising a fifth division and aerospace wing.

The USCM is fully integrated into the joint command structure of the United Americas Allied Command (UAAC) and forms the major striking element of the UA forces. Within the UAAC, the Colonial Marine Corps is tasked with maintaining the collective security of all UA signatories and their recognized interstellar colonies within the frontiers of the Network. Operating in tandem with local forces, the USCM is often the first line of defense and the vanguard of any counterattack.



"I wouldn't believe it if I hadn't been there. We dropped screaming onto Cristóbal, capturing the spaceport and shield colony and spreading out into the countryside. By nightfall we held half the continent out to the gulf stream. We all felt so studly with our armor and firepower. Psyops broadcast to everyone that Hetos was a schmuck and a crook and that we were there to nail his ass, like we were no more than some simple shamus come around the block to slap the cuffs on a persistent offender. We had some tiny contingents of Panamanians and Argentines with us to wave the UA flag and yell at anyone who'd listen that this was a joint op, legally enacted under the provisions of the Washington Treaty. A lot of people bought that one, just like they bought Space Command's estimate of 254 locals dead. Meanwhile, the cadavers of five hundred colonial militiamen and over fifteen hundred civilians were being bulldozed by USCM engineers into mass graves and seeded with vicious bacterias designed to turn them into pools of goo.

"Nobody at home gave a damn. No one even asked who was accountable. Media coverage was limited to the four Marines who came home in boxes draped with Old Glory, and some form-letter UAAC announcement about the 'restoration of public order'. Meanwhile, the AmArc corporate suits who'd rode shotgun on the assault quietly secured the wellheads and then ordered us to bust the worker's strike with CS gas and baton rounds. We complied.

"Three months after the mission, AmArc announced a record share dividend. On that day I resigned my commission."

— Patrice Riegert, former Captain, USCM

1.2 CORPS ORGANIZATION

The United States Colonial Marine Corps is broadly split into two parts: the supporting establishment and the operating forces. The supporting establishment includes recruiting, training, research and development, administration and logistical support. This essentially non-fighting part of the Colonial Marine organization is essential if the Corps is to perform its mission. The operating forces are the fighting arm of the Marines, organized and maintained as a force-in-readiness. Some 58 percent of all Marines are in the operating forces.

The operating forces are under the direct orders of **US Space Command**, with command posts at Houston, TX and O'Niell station, L-4 Earth-Lunar system. To enable it to project fighting power to the frontiers of the ISC Network and beyond, the Colonial Marine Corps is organized into Marine Space Forces. There are three in all: **Marine Space Force, Sol**, with responsibility for operations throughout the core systems; **Marine Space Force, Eridani**, operating out along the American and Chinese colonised arms; and **Marine Space Force, Herculis**, with responsibility for the Anglo-Japanese arm up to the fringes of the Network. In practice, these are administrative designations, the practicalities of frontier operations requiring the breakdown of operating forces into autonomous taskforces of regimental size or less. Additionally, astrometrical realities of colonised space mean that the operating areas frequently intertwine and overlap, so that combined operations between the Space Forces are a day-to-day necessity.

The Marine Space Forces (MSFs) are integral parts of the **United States AeroSpace Force** fleets, and are subject to the operational control of the fleet commanders. The Marine Space Forces contain both ground and aerospace elements transported aboard USASF ships.

The **Colonial Marine Division** is the basic ground element of the Marine Space Force (although MSF, Sol, consists of two divisions). It is essentially a balanced force of combat, support and service elements. Organized around three infantry regiments, the division is especially designed to execute the orbital assault mission, and is capable of sustained surface operations.

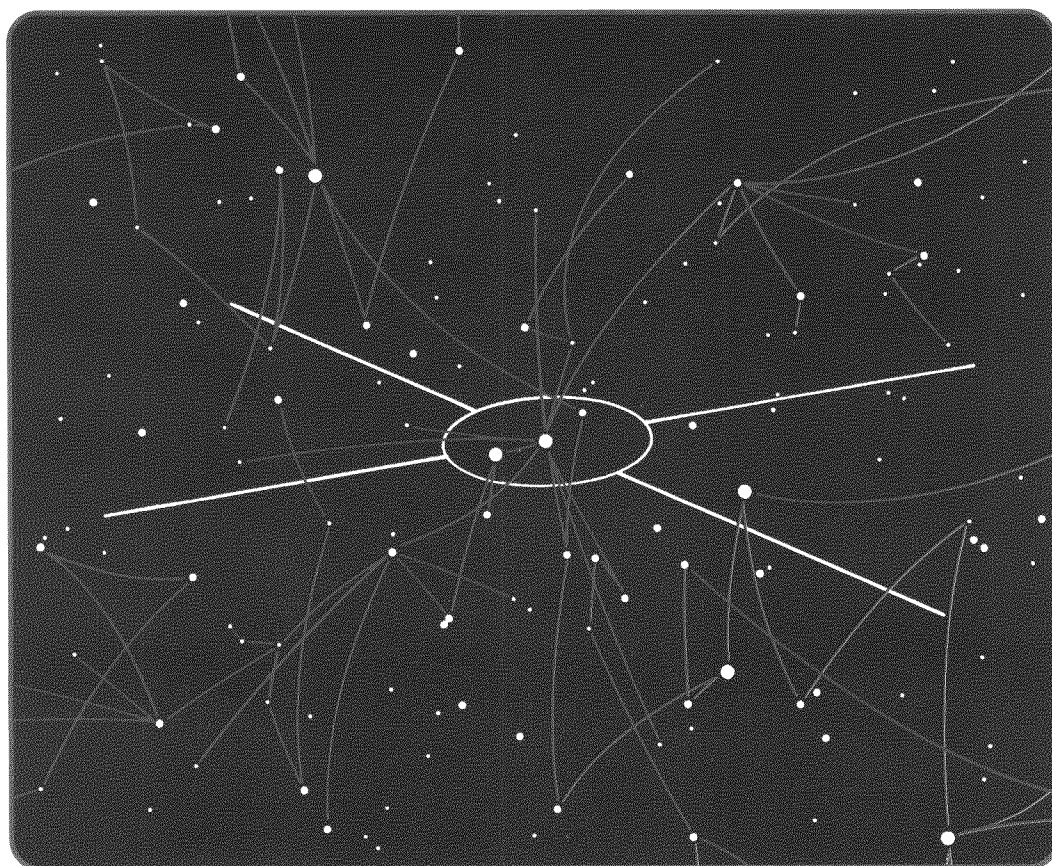


Fig.1.1 Marine Space Force Dispositions

The **Colonial Marine Aerospace Wing** is the aerospace combat element of the Marine Space Force. Designed for aerospace support and the airmobility mission, the aerospace wing is essentially an administrative formation, since much of its fighting strength is directly attached to the Colonial Marine division. Typically, a Marine aerospace wing operates some 300 dropships, 30 heavy-lift shuttles and 100 strikeships.

Using the assets of the division, wing and supporting units, the Marine Space Forces can form task organizations of any size appropriate to the mission.

1.3 DISPOSITION AND READINESS

Marine Space Force, Sol, is headquartered at O'Niell station, L-4 Earth-Lunar system. Its major units consist of the **1st Colonial Marine Division**, **1st Marine Aerospace Wing** and the **1st Marine Brigade**, stationed in Camp Lejeune, NC; Camp Pendelton, CA; Kennedy ASFB, FL; O'Niell station; and Gateway station, Earth-GSO. The **2nd and 3rd Colonial Marine Brigades** and portions of the **2nd Marine Aerospace Wing** are based at Redlake Field ASFB and Glenn GSO station, Aurore 510 (Alpha Centauri A V); Ezell ASFB, Nene 246 (52 Tau Ceti II); and Titleman station, L-1 Lucien-Avril system (Lacaille 8760 IV). Support elements consisting of **Force Troops, Sol**, and the **2nd Colonial Support Group** are located in North Carolina, Florida and the Trobriands, Nene 246.

Marine Space Force, Eridani, is headquartered at Happy Days, Helene 215 (82 Eridani II). It comprises the **3rd Colonial Marine Division** and the **3rd Marine Aerospace Wing**, based largely at Kuat ASFB, Surier 430 (Delta Pavonis IV), and

Unit 1: The United States Marine Corps



at a number of garrison locations along the American arm as far as Thetis (20 Reticuli) and the Solomons (Alpha Caeli V b-h).

Marine Space Force, Herculis, is headquartered at Chinook 91 GSO station, Georgia 525 (70 Ophiuchi A V). This front-line force, comprising the **4th Colonial Marine Division**, the **4th Colonial Marine Brigade**, and the **4th Aerospace Wing** is deployed at a number of UA recognized colonies through the Anglo-Japanese arm from the outer veil up to the fringes of the ISC Network, which extends approximately 35 parsecs along this arm. The largest support contingent includes the **1st Colonial Support Group** at Tithonis Mountain, Bernice 378 (Mu Herculis A III).

All Colonial Marine units are kept in an advance state of readiness, ready to respond to all commitments in their theater of operations. Marine Space Force, Sol, is capable of reinforcing either of the other two MSFs and has earmarked the 1st and 2nd Colonial Marine Brigades as well as the 2nd Marine Aerospace Wing for rapid forward deployment. The Colonial Marine reserves, comprising the **5th (provisional) Division** and the attached Reserve Aerospace Wing, are based mainly in the continental United States and Panama, Earth, though two reserve regiments can be raised on Aurore 510.

1.4 BADGES AND INSIGNIA

Since its incorporation at the end of the last century, the Colonial Marine Corps has vigorously maintained its independence and its strong sense of identity. The battle honors and unit histories of its predecessor, the old 'amphibious' Corps, were carried forward to the to the current 'interstellar' Corps, along with many of its traditions. However, some of these - particularly the badges and insignia - have long since passed into history. The current Corps badge is a geometrical design, depicting a launch column of seven stripes - three red and four white - flanked by four white stars against a blue background. Often jokingly referred to as 'Tiptree's wigwam' after the former secretary of defense who approved the design in 2101, it represents the 'pathway to the stars' forged by the Colonial Marines. The three red stripes signify the ability of the Marines to fight in aerospace, on land and at sea, whilst the starfield represents the limitless American frontier.

The Colonial Marines do not encourage individualized unit badges as the Army does, largely because the Marines prize their unique identity as a service. Individual unit markings are usually limited to providing unit data and ship deployment. However, on distant worlds far from direct command, unofficial unit markings have been known to appear.

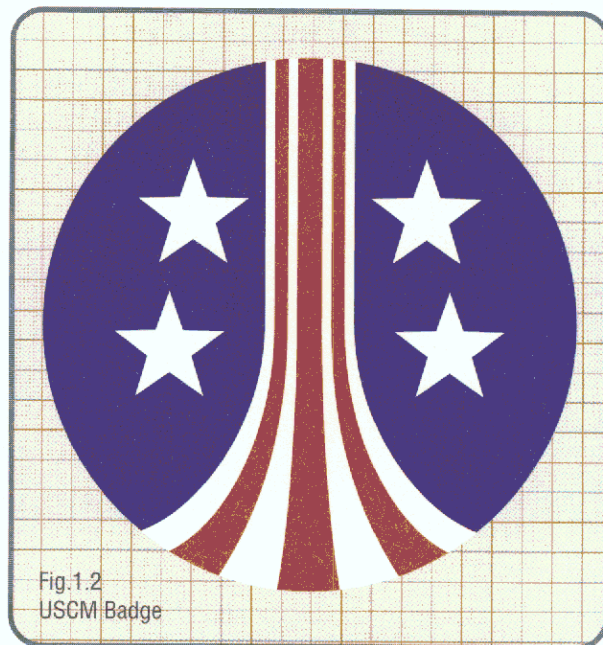


Fig.1.2
USCM Badge



Fig.1.3
Shoulder
Flash



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1.5 MARINE RECRUITMENT AND TRAINING

"I'd read somewhere that at boot camp the DIs [Drill Instructors] were not allowed to touch, abuse or even curse the recruits. First day and we've just arrived at the island on the shuttle and this two-meter tall Gunnery Sergeant who looks like he drinks rocket fuel and craps lightning gets on board and shouts 'GET OFF THE FREAKING BUS. MOVE!'

"'Freaking'. He said 'Freaking'. What kinda pussy word is that? It's the sorta made-up curse they use on video so's not to offend the God-botherers and Hubbard freaks. But the way Gunny says it, it sounds like he's gonna personally pop open your head and spoon out your brains if you so much as look at him funny.

"So, we get off the freaking bus..."

- Recruit Arnie Caulfield, Parris Island, SC

To be eligible to join the Colonial Marines a potential recruit is required to be a high school graduate (or the equivalent), have a clean police record, be between 147cm and 200cm tall and pass a physical examination and some simple written tests. Basic training has changed little in three hundred years, and the Colonial Marines still maintain 'Boot' camps for recruit basic training at Parris Island, SC; San Diego, CA; and Guantanamo Bay, CB.

Statistics show that the average recruit is 178cm tall, weighs 72kg and is a high school graduate. The ratio of women to men in the Corps is approximately 1:2.6. Of the thousands of recruits that apply to the Corps every year, some 24 percent fail to make the grade.

"The technical challenge for recruits is intense. In the modern Corps we fly starships and aerospace shuttles and carry space-age doohickeys into battle. We need men and women who instinctively understand these how these things work, who can learn how to fix them in the field without the aid of a manual, while crouching in a muddy foxhole being pounded by shellfire. Some of the new boots flunk because of the physical or moral requirements, like they can't rappel off a tower or they suffer from severe SAS [Space Adaptation Sickness]; but most of those who fail to hack it are simply not technically minded enough."

- Captain Karen Marquis, Parris Island, SC

Officers are inducted at the Officer Candidates School at Camp Barrett, Quantico, VA, though the Colonial Marines continue the ancient tradition of accepting officers from the 'Blue Water' naval academy at Annapolis, as well as the USASF Aerospace school at Gateway station. After basic training, officers pursue their military speciality. Aerospace crew go to the Aerospace schools at Gateway station or Kennedy ASFB, FL; artillery officers go to the Army field artillery school in Fort Sill, OK; armor specialists go to Fort Knox, KY; however, infantry officers take the specialized infantry course at Quantico and an advanced hostile environments course at Camp Hanneken, Valles Marineris, Mars.

"We still get asked whether there is racism or sexism in the Colonial Marines. I say no. We have 'light green' Marines, we have 'dark green' Marines and we have 'bumpy' Marines; but they're all MARINES!"

- Brigadier General Mike 'Dancing Bear' Norrbom, CO 2nd Marine Brigade

"I heard they sent a section from the 2/9th into some jerkwater sink-hole in the American Arm. Apparently their loot got 'em wasted by a horde o' bugs."

"Bugs, bugs, BIIIG bugs!"

"Hey Sarge, I keep seeing bugs everywhere, gettin' in my bunk, my chow, my jockeys. They talk to me in my sleep an' tell me to frag all my Marine buddies an' 'specially that big badass sergeant, 'cuz he don' like bugs - he 'aint friendly t'my lil' bug buddies. Maybe I should see the doc about it; maybe I'm ready for Section Eight."

"Stow it, Private; iffen that's all you seen, you're still the sanest member of this whole platoon!"

"Man, I mean, who's dumb 'nuff to get 'emselves wasted by bugs fer Chrissake?"

"I tell you who, man - our worst enemy, the most dangerous thing in the whole goddamn universe - th' officer in charge!"

- Marines of 1st Platoon,
Bravo Company, 2/7 Colonial Marine



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COLONIAL MARINE INFANTRY

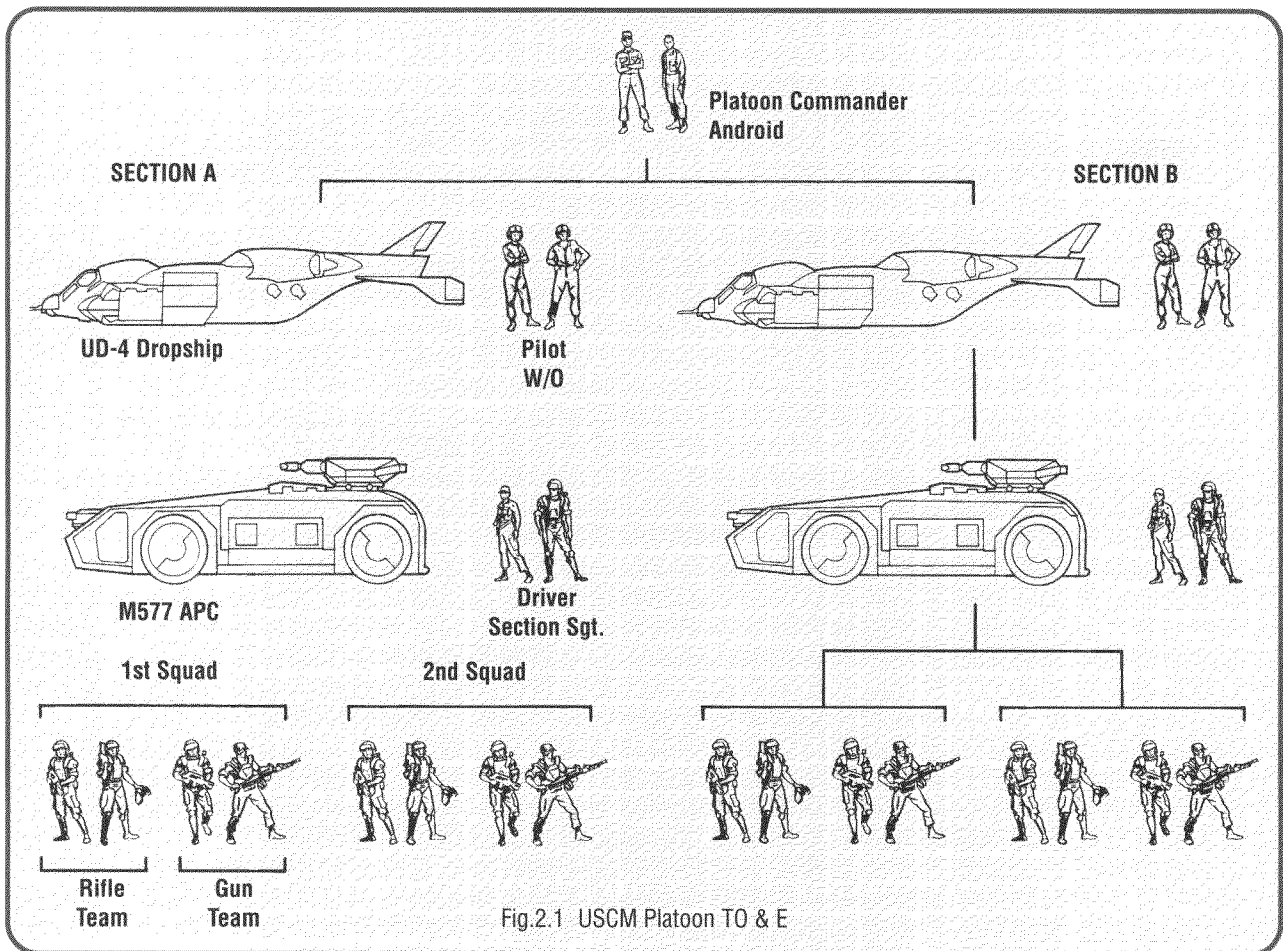
2.0 COLONIAL MARINE INFANTRY

2.1 USCMC RIFLE PLATOON TABLE OF ORGANIZATION AND EQUIPMENT

"Check it out. Me and my team of ultimate badasses..."

USCM doctrine stresses the need for small, autonomous infantry units capable of operating with or without higher level support on the non-linear (ie highly mobile) battlefield. Given the fluid nature of battle at the small-unit level, the rifle unit must be capable of moving great distances rapidly using its own 'organic' transport, must carry its own heavy support weapons and sensors, and be able to apply great concentrations of firepower rapidly. The current organization of the Colonial Marine rifle squad and platoon reflect the ultimate development of this doctrine.

A rifle squad consists of four Marines, including a Corporal, a Lance Corporal, and two Privates/Private First Class. Each squad divides into two-man fireteams: the Rifle Team and Gun Team. The Rifle team consists of a pair of riflemen assigned together on the 'buddy' system, both equipped with the M41



Unit 2: Colonial Marine Infantry



pulse-rifle. The Gun Team is made up of a rifleman with an M41 and a machine-gunner carrying the automatic M56 Smart Gun.

Two squads, led by a Sergeant and riding with a driver in an M577 Armored Personnel Carrier, make up a section. In a drop operation, a UD-4 dropship is attached to the section from the aerospace company team.

Two sections, led by a lieutenant, form a rifle platoon, for a total paper strength of 25 Marines including the APC and dropship crews - though in practice this is often less. Platoons commonly carry one or two synthetic humans in a technical or scientific advisory role, and to assist as medics or backup drivers/pilots. Organic support weaponry available to the platoon usually includes eight M240 flamethrowers, eight UA-571 remote sentry guns, two M78 PIG phased-plasma guns or M5 rocket-propelled grenade launchers, eighteen M83 SADAR anti-tank smart rockets, and a single M402 multiple-launch fire-support mortar. Sufficient sensor equipment to establish an overlapping detection matrix with a frontage of 1,000 meters is also carried.

2.2 M41A PULSE RIFLE

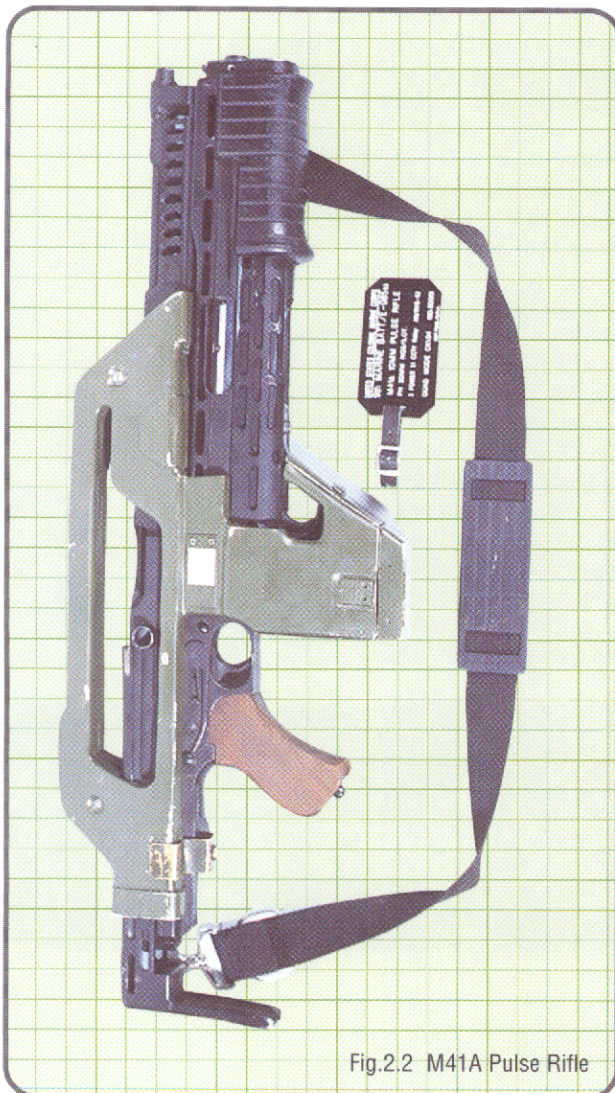


Fig.2.2 M41A Pulse Rifle

"The most dangerous weapon in the world is a Marine and his rifle."

— Unnamed Marine



Fig.2.3 Firing position for M41A



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The Armat M41A is a 10mm pulse-action air-cooled automatic assault rifle, which over the last eight years has become the basic rifle of the US Colonial Marine Corps and the US Army. The standard service variant has an over-and-under configuration incorporating a PN 30mm pump-action grenade launcher. The basic design is similar in concept to the Harrington Automatic Rifle of the early '60s, though incorporating many improvements due to the advances in materials technology.

Lightweight and rugged, the M41 is constructed largely from ultra-light alloy precision metal stampings. The outer casing is made from titanium aluminide alloy and many internal parts are moulded from high-impact, temperature resistant plastics. Layout is conventional, and a spring loaded retractable stock allows the rifle to be used either in carbine format (with stock retracted) or as a rifle, with the 'in-line' stock extended for greater stability during automatic fire from the shoulder. Sighting is made down a groove in the carrying handle, with an adjustable tangent leaf backsight positioned in the rear slot. A 3x power AN/RVS-52 CCD television sight can optionally be fitted to the carrying handle for accuracy at range and under low light conditions.

The M41 fires the standard US M309 10mm x 24 round. This ammunition comprises a 210 grain (13.6 gram) projectile embedded within a rectangular caseless propellant block of Nitramine 50. The propellant content is small but highly efficient, generating muzzle velocities on the order of 840 meters per second. The round is steel-jacketed and explosive tipped, with impact fusing which is pre-set during manufacture. Terminal ballistic characteristics have been optimised for maximum lethality against infantry wearing personal armor. The round is designed to penetrate the armor, exploding just after impact to inflict lethal internal damage. The standard M41 ammunition clip will hold up to 99 M309 rounds in an 'U' bend conveyor, which feeds the rounds mechanically into the rotating breech mechanism. However, in practice the clips are only filled to 95% capacity in order to reduce the autoloader's tendency to jam.

The M41 uses electronic pulse action to fire, controlled directly from the trigger. The internal mechanism, including the rotating breech, is mounted on free-floating rails within a carbon-fiber jacket. This assembly is recoil dampened to reduce the effects of muzzle climb during burst and full automatic fire. From the thumb selector, the weapon can be set to selective, four-round burst, or full automatic fire, the latter allowing a rate of fire up to the weapon's cyclic rate of 900 rpm. A manual cocking handle situated in the upper receiver allows the operator to clear the breech in the event of a stoppage, or to check the chamber prior to stowage. An LED display situated just below the receiver indicates the ammo remaining in the clip. This display can be dimmed for night operations. Electrical power for the gun's motor mechanism is provided by a Lithium battery in the carrying handle. This battery is good for 10,000 rounds and can be recharged either from a rifle rack or a portable power clip.

"We had this barely-human Marine in our platoon who was righteous with the grenade launcher. He'd use it like a mortar; jamming the butt of his rifle in the ground and judging the angle by eye. He'd fire M40s into the upper jungle canopy and watch the airburst shred everything below. Legend had it he could detect the Beebops by smell and even figger the range from a single sniff..."

- L/Cpl Bob Beher Jr. 2/7 Colonial Marine

The underslung 30mm grenade launcher comprises a barrel, breech and a four round internal magazine which is charged by handloading individual grenade cartridges into the mechanism. A pump action is used to load rounds into the breech and cock the firing mechanism. Once loaded, the launcher is primed to fire from a

trigger positioned just in front of the magazine housing, which is used as a handgrip when firing a grenade.

The most commonly used round in the grenade launcher is the M40 High Explosive fragmentation round which is marked with a red plastic cap. It has a muzzle velocity of 78 m/s, an effective range of 400m and an accurate range of around 180 m. The cartridge has a rimmed, separating base, and launches a projectile with an explosive element comprised of a notched steel wire wrapped around a filler of composition B15. When the round explodes, it spreads more than 300 fragments over a casualty radius of five meters. The M40 can be employed as an *ad hoc* hand grenade by flipping off its plastic cap and twisting the nose cap clockwise; this gives a five-second delay before the grenade explodes. Care must be taken not to strike or depress the nose cap, otherwise the grenade will go off immediately.

Other grenade ammunition includes:

M38 High Explosive Armor Piercing (HEAP) round. Capable of penetrating 7 cm of homogeneous steel, the round bursts with a casualty radius of 5 m. This round is marked with a green cap.

M51A Bounding Fragmentation round. This blue-capped round is not point detonating like the M40 or M38. When the round impacts, a small charge propels it two meters into the air, where it airbursts for additional effect against troops in the open or in foxholes without overhead cover.

M108 Canister (Buckshot) round. Essentially a large shotgun round with an range of 30 meters, this small cartridge with a flat, black nose gives the Marine rifleman effective firepower for close-in engagements.

M230 Baton round. Rarely issued to the Colonial Marines, this round fires a low-velocity plastic projectile capable of incapacitating or even disabling an unprotected human. Primarily used during civil disturbances.

M60 White Phosphorous Incendiary round. This white-capped round contains a filler of white phosphorous which spreads up to 15 meters after impact, creating a rising smoke cloud and flame with a secondary incendiary effect against vegetation and material.

M72A1 Starshell. Marked with an embossed letter 'S' on the top, the M72A1 is fired 200 meters into the air where it releases a parachute and ignites, providing illumination of 50,000 candelas for approximately 45 seconds.

The M41 is a robust weapon, fully sealed against corrosion, dirt and moisture, yet easy to disassemble and maintain. The solid state electronics are hardened against TREE and background radiation, and the weapon is perfectly usable in a vacuum environment. However, it is not sufficiently stabilised or recoil dampened for use in free-fall combat operations.

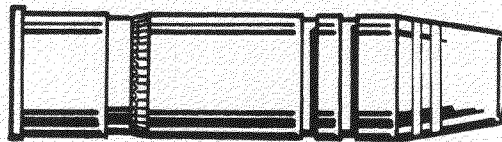


Fig.2.4
M40 grenade Launcher Round

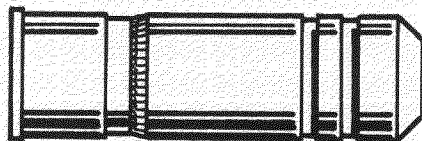


Fig.2.5
M108 grenade Launcher Round



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M41A1 Specifications:

Rifle without magazine and sling	3.2 kg
Full magazine (100 rounds)	1.5 kg
Sling	0.2 kg
Firing weight (fully loaded w/sling)	4.9 kg
Length of rifle (stock retracted)	69.5 cm
Length of rifle (stock extended)	84.0 cm
Length of barrel	24.7 cm
Muzzle velocity	840 m/s
Maximum range	2,100 m
Maximum effective range	500 m
Cyclic rate of fire	900 rpm

The only other service variant of the M41 is the M41AE2, currently being introduced on a trials basis to selected rifle and recon platoons. The 'E2' is similar to a standard pulse rifle except that the grenade launcher has been removed and the gun modified with a replaceable barrel. This barrel is 8 centimeters longer to increase the operating forces on the round and the barrel shroud has been extended to provide a solid mount for a folding bipod. An optional 'L' feed ammunition clip contains up to 300 rounds. The intention is to introduce the E2 as a light support weapon, the replaceable barrel offering greater rates of sustained fire in support of rifle and recon squads.

2.3 M56 SMART GUN

"The M56? Yeah, a spooky gun, man; Jesus, it's just too damned accurate! I 'member checking the bodycount after an ambush on a Beebop cadre. It was beautiful; we'd caught eight of 'em in a triangulated crossfire, and greased 'em with the smarts before they knew what happened. When we checked the bodies afterward, each one had like a single entry wound in the center of mass, depending on how they were standing when they were hit. No grouping, nothing; in each case all the shells had entered thru the same hole. That freaked some of the guys out. After that they kept the tracking switched off... they wanted to hose that thang, man!"

- L/Cpl. Guy 'Goober' Alcalá, USCM

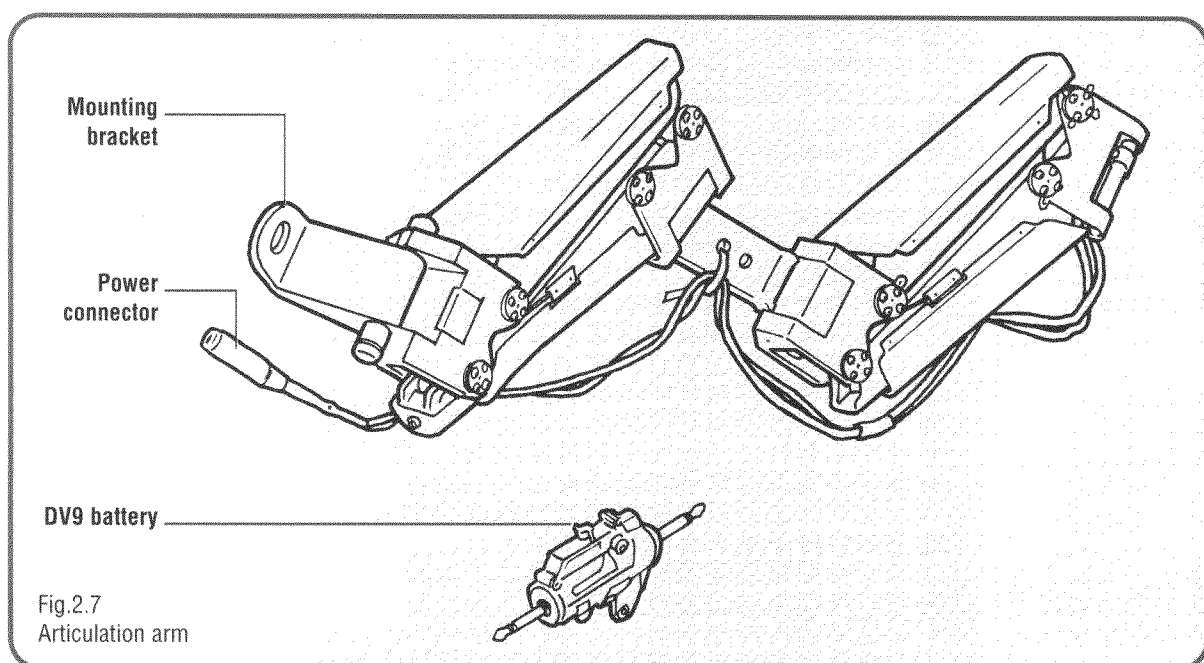
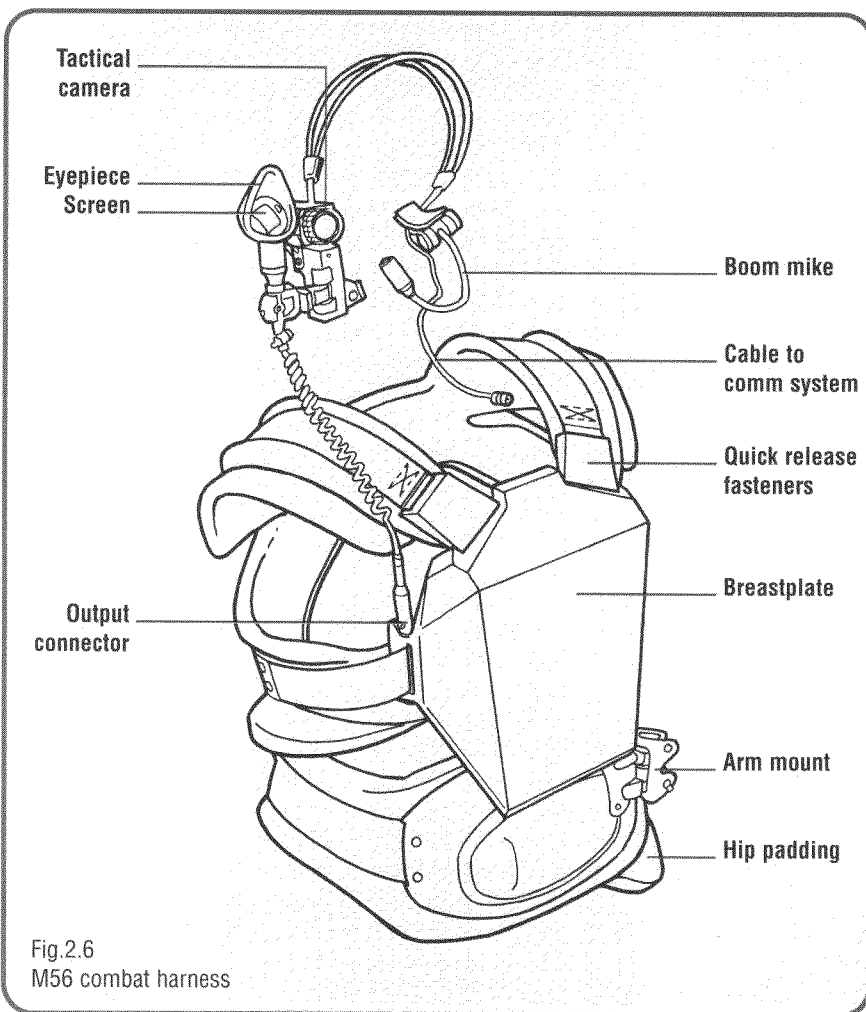
The core of a Colonial Marine squad's fighting power is its machine guns. More effective than a rifle, machine guns can sustain large volumes of continuous fire both in the attack and defense, and are frequently the most decisive weapon in a firefight. The M56 Smart Gun is the Colonial Marines' primary squad machine gun. Lightweight, rugged and reliable, the Smart Gun is carried into battle on a self-aiming stabilised mount - so negating the need to position or set up the gun for full automatic fire - and is linked to an infrared target tracking system for accurate aiming. Flexible and powerful, the M56 system is now deployed in a variety of combat theatres and environments.

GENERAL DESCRIPTION

The M56A2 is a 10mm general-purpose automatic squad support weapon, effective out to 1500 meters. The pulse-action system employs a free-floating recoil-dampened motorised rotating breech mechanism chambered for the M250 series 10 mm x



28 caseless round. The gun also incorporates a muzzle booster to ensure the necessary operating forces from the large round. Cyclic rate is around 1200 rpm. The gun is constructed largely from molded carbon-fiber and light alloy stampings, though some interior parts of the mechanism are made from plastic. The replaceable barrel system is air-cooled, though a heat-sink attachment can be jacketed onto it. The system is mounted on an operator's harness and slaved to an infrared tracking system. The gun is self-steering on the mount, though firing must be commanded manually. The entire gun assembly (including harness and full ammo load) masses 17.82 kg. The length of the gun itself is 122cm, and the length of the barrel is 54.5 cm.





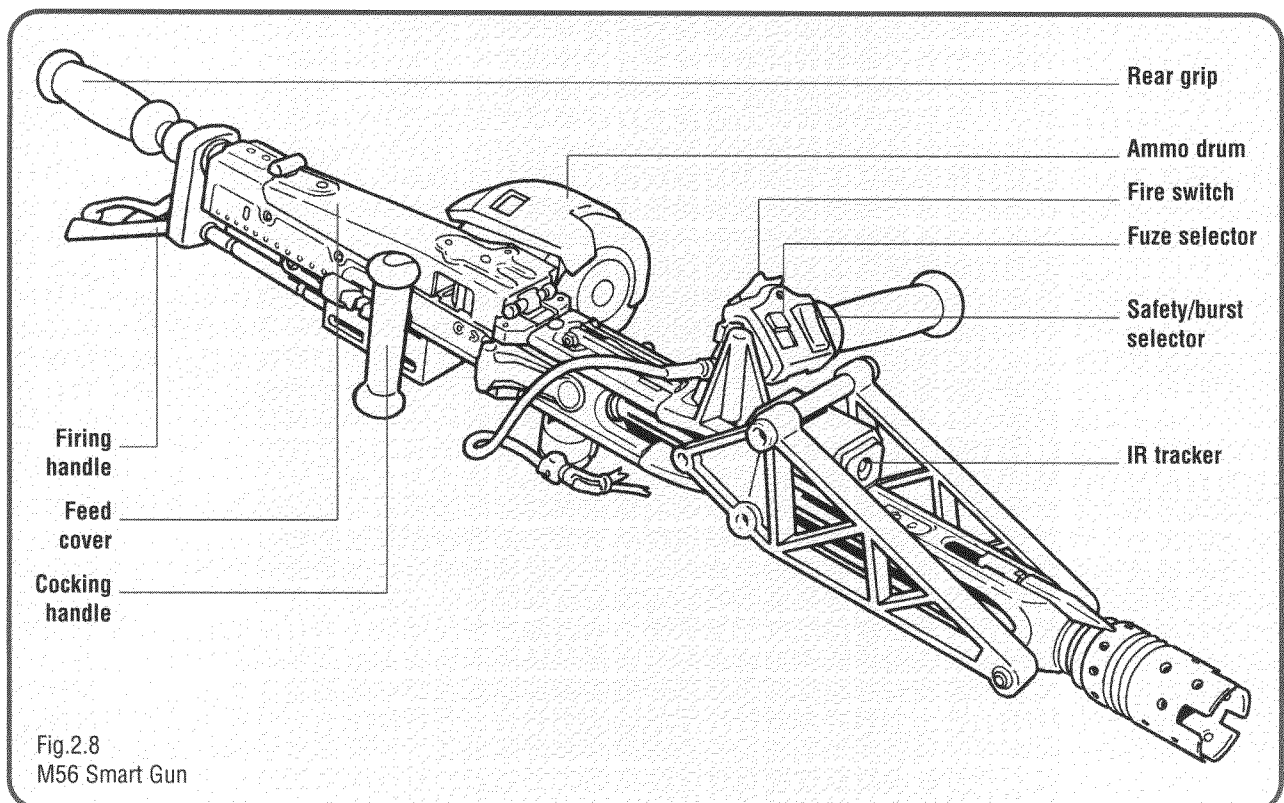
OPERATING THE M56 SMART GUN

WARNING: This is a general description of operation procedures and should not be used for instruction. Operators should refer to field manual 23-14-1 for further details of operation.

Prepping the Smart Gun:

The M56 Smart Gun system consists of four major components: the operator's combat harness; the Head Mounted Sight (HMS); the articulation arm; and the gun itself. To prep the M56 for combat, operators must first don the combat harness. The harness is constructed from composite micromesh ballistic armor and is heavily padded to ease chafing at the shoulders and hips. The armored breastplate holds the PRC 489/4 communications receiver/transmitter and the tracking and targeting processor. Opening a backplate in the armor gives access to the processor, a sealed 'black box' line replacement unit (LRU) which can be easily unplugged and replaced in the field should it fail.

The stabilised articulation arm is attached to the left hip mounting and plugged in via coaxial cable to the processor and power outlets in the breastplate. The gun itself is clipped and secured to the end of the arm. The operator plugs the HMS into the tracking and comms system in the armor. The gun tracker is jacked into the processor by a universal connector, and the gun itself must be powered up before the weapon is loaded. Power for the entire gun system is supplied by standard DV9 Lithium battery units, good for up to 50,000 rounds when fully charged. Both ends of the DV9 unit are plugged into the power leads which run from the articulation arm to the gun; common practice in the field is to let the battery hang free beneath the gun, where it is easily accessed in an emergency.





"I don't like the M56; damn thing's awkward and uncomfortable and unreliable as hell. I remember in the early days, before they'd worked out the kinks, we did an exercise on Aurore, out in the Desert past the Dannenbergs. In the dust and heat the swing arm bearings on nearly all the guns seized up after a day. The particulate dust and the heat shimmer obscured the IR detector, as I knew it would, and at dawn and dusk the reflection of the suns off the salt layers made the tracking almost impossible to use. The mechanism attracted sand and jams were common. It was a bitch to clean, too. By the end of the exercise, we'd broken the old M38s out of their lockers. Damn good gun the '38. You could take a dump in the mechanism, bury it in sand, dig it out three months on, tap out the crud and it would still fire first time!"

— Gunnery Sergeant Ron Huffey, Recruit Weapons Instructor

Smart Gun Movement:

While the operator is standing, the gun is held and steered by its fore and back grips. Operators have a wide degree of motion with the gun and can play it in an arc from their front to their left sides, or point it directly upwards. When prone, operators must lie on their backs and employ the fore grip, while locking the cocking handle forward and using it as a side grip. The articulation arm is gyrostabilised and provides additional recoil dampening to keep the gun steady while the operator is walking or running. When tracking a target, the arm will self-steer the gun barrel so as to boresight the target's center of mass. An operator must be sensitive to these movements of the gun and allow it to aim itself, though they may override the gun's motion at any time simply by steering the barrel elsewhere.

"There's no need to fight the gun; just be firm and it'll point where you want it."

— L/Cpl Bonnie Webster, USCM

Fig.2.9
Firing arcs, standing

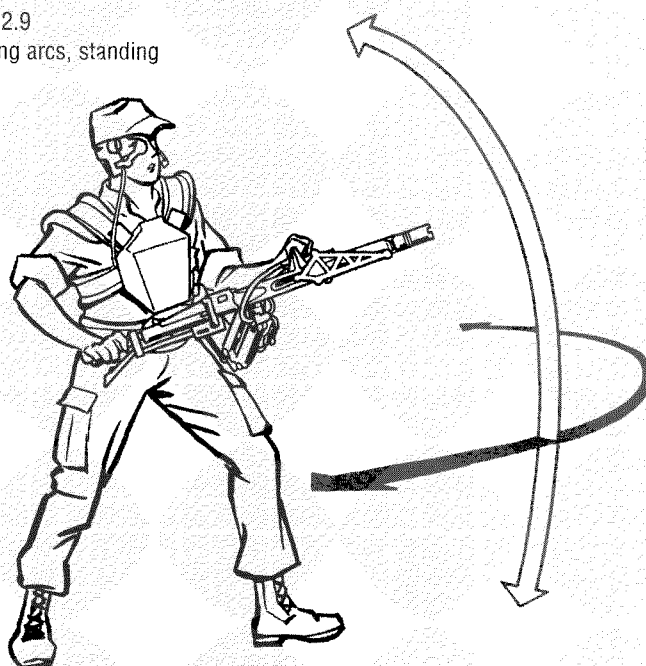
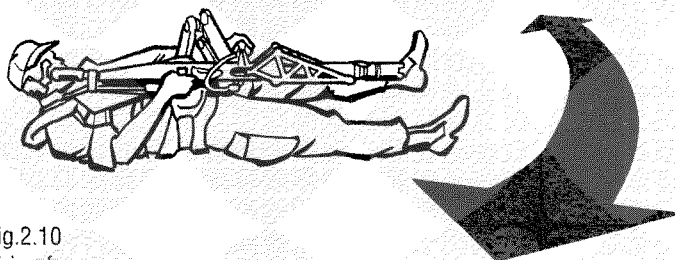


Fig.2.10
Firing from prone



Target Tracking:

When powered up, the gun begins tracking targets via its infrared tracker mounted above the barrel. The tracker consists of a 256 x 256 element Platinum-Silicide focal plane array cooled to 77°K by a tiny cryogenic gas-cooler working on the Stirling principle. This system monitors a 30° cone in front of the gun, and transmits high-resolution thermal images in the 8-10 μm range to a miniature video display in the operator's eyepiece. If a target is detected, the tracker will overlay a lighted box or rectangle on the screen over the target's center of mass. The articulation arm will then self-steer the gun to aim at this point, and as soon as it has done so, a target lock circle on the screen lights to indicate that the target is boresighted. If multiple targets or infrared false-target decoys appear in the sight, the operator simply steers the lighted box to bracket whichever target he actually wishes to engage.

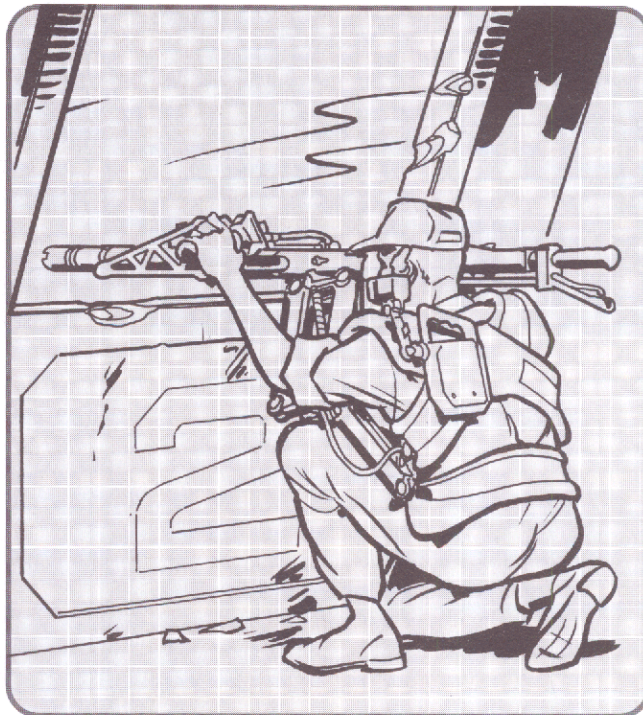


Fig.2.11 Firing from behind cover



Fig.2.12 Marine wearing head mounted sight

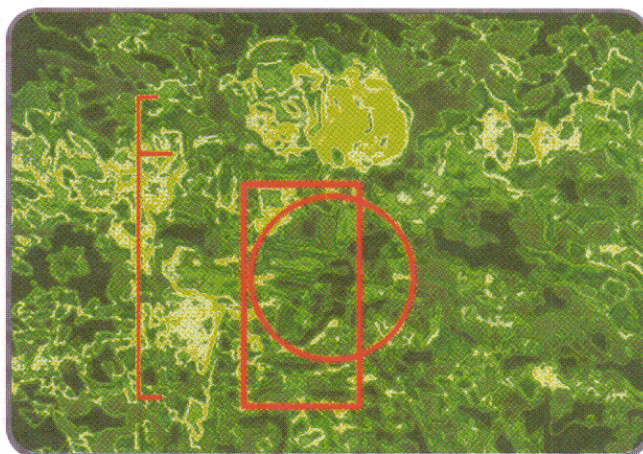


Fig.2.13 View through head mounted sight

"I know this sounds crazy, but I swear this is true; every smart gun was diff'rent, like they had personalities or something. Some guns used to pull lead on the target; some would lag; some would pepper shells around the center of mass without ever hitting the bullseye. On a few guns, the software was so whacked out they'd always be chasing after phantom targets; or the tracking would go haywire at a critical moment. If you found a good gun - one that didn't fritz out on you and which gave a good, tight grouping on the target - the rule was that you never let it go; or at least you were a damn fool if you did!"

- Cpl. Rob Pruden, USCM



Firing the Smart Gun:

All firing is controlled from either the forward hand grip or the rear firing handle; the operator fires the weapon by depressing the red 'fire' switch or pulling the firing handle upwards. A selector at the grip controls the gun's safety features and the rate of fire. There are three settings on this switch: Safe, Burst and Autofire. Clicking off the Safety will automatically charge the weapon. (If there is a round already in the breech, the gun's diagnostics will prevent any further loading.) The Burst setting will fire four round bursts, while the Autofire feature will continue to fire the weapon at its full cyclic rate so long as the fire switch remains depressed.

The M250 10mm x 28 ammunition is a 230 grain (14.9 gram) caseless projectile encased in a rectangular block of nitramine. Higher powered than the M309 round for the pulse rifle, the M250 also significantly differs in having a selectable fuse setting. A switch on the hand grip is used to select the ammunition fusing, which is set electronically as the round is loaded into the chamber. The 'Super' setting is optimised against soft targets and will detonate the round on impact, while the 'Delay' setting explodes the shell only after penetrating the target armor.

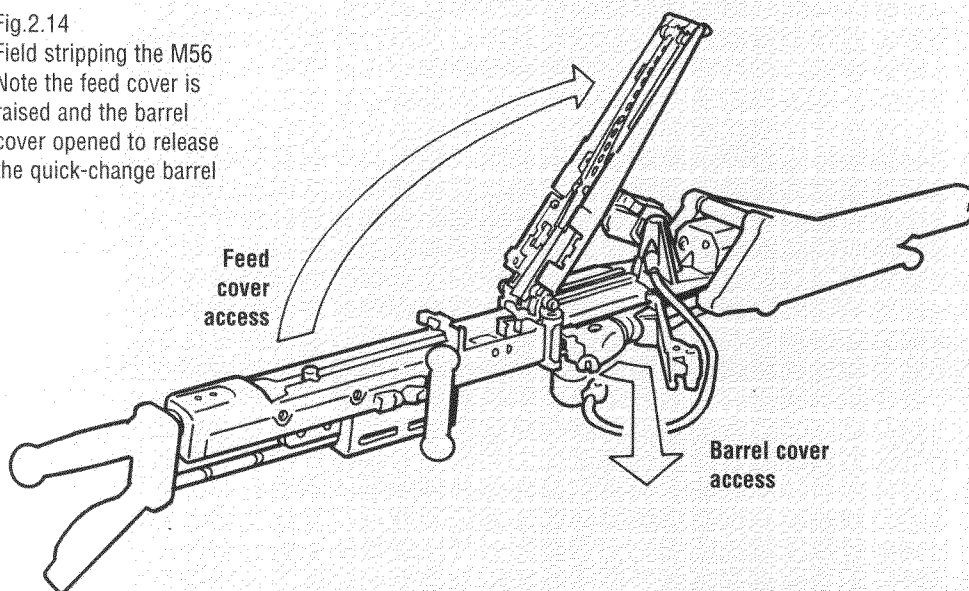
The M250 ammunition is stored on a roll of continuous plastic non-disintegrating link belt in the ammunition drum, which can be reloaded in the field. The gun motor drives the feed mechanism as well as the rotating breech, and automatically loads each round off the belt and into the breech. In the event of a stoppage, the manual cocking handle at the side can be pulled to eject the round and clear the breech. This procedure can also be used to manually charge the mechanism.

"You should always cock the gun manually with each new drum of ammo. The first round off the belt nearly always jams if you let the gun load itself."

- PFC Leigh Fettelberg, 1/9 Colonial Marine

Fig.2.14

Field stripping the M56
Note the feed cover is
raised and the barrel
cover opened to release
the quick-change barrel



For details of reloading and field stripping, refer to USCM Field Manual 23-14-1.



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2.4 M240 FLAMETHROWER

"The incinerator rifles were hardcore, man. We usedta call 'em 'Bake-a-Flakes'... y'know, like the cereal commercial. They were harsh against bunkers and critters, but only a certified crazy would carry one. At Newshine [Neusheune], the bugboy snipers began plinking the flame units, trying to explode the fuel cell with a single shot. If they hit, everything within ten meters would go, like, FOOM! Once we heard about that, we instinctively kept away from the Bake-a-Flakers. Never knew when one was gonna become a flamer!"

- PFC Matt 'Superspunk' Hanna, 2nd Colonial Marine Brigade

The M240A1 is a lightweight, carbine-format flamethrower designed for use in close combat at the squad and fireteam level. Using pressurised, ultra-thickened naphthal fuel as a base and ignited by the nozzle burner, the M240 can shoot flame at targets up to 30 meters. Once a target has been hit, fuel droplets from the flamethrower will stick and continue to burn for approximately thirty seconds. With sufficient fuel in a standard fuel reservoir for a burst of up to twenty seconds, the M240 is undoubtedly one of the most fearsome weapons in the Marine inventory, and has proven especially useful in close combat and exomorph 'critter' cull operations. It is also ideal for use against fortifications because of the ability of the flame to be directed through defensive apertures. However, it is unpopular with many of its operators, partly because of its short range, and also because of the tendency of the fuel reservoir to rupture violently when hit by shrapnel or small arms fire.

The M240 is 88cm long and weighs 2.7 Kg with a full reservoir. A valve at the rear of the incinerator is used to refuel the weapon; alternatively, the reservoir can be screwed off and refilled or replaced separately. A twist-valve on the flamethrower regulates the fuel flow and a thumb switch on the handgrip electrically ignites the nozzle burner when depressed. The weapon is fired by squeezing the handgrip trigger, and will continue firing until the trigger is released. The range of the M240 can be increased by making a high angle shot, firing the flame unit up at an angle of about 45 degrees - the burning fuel then descends onto the target in an arc. In this way, shots can be made up to a range of 50 meters, though it is far less effective than direct fire in penetrating an armored firing slit or aperture.

"It was weird. This beebop just stood there after I'd flamed her; completely motionless. The she began to explode as the ammo in her bandolier pouches began to cook off. I've seen some strange things, but that woman - like some flaming statue, popping fire-crackers all over. Man, it was a beautiful moment. The whole squad just stood there, tripping on it..."

- Unnamed Marine, Tokonigara, Helene 215

One option for the firer is the 'wetshot', where the nozzle burner is switched off and a stream of thickened fuel fired toward the enemy, which 'mists' as it reaches the end of its trajectory. If the nozzle burner is clicked back on, a subsequent shot can ignite the fuel vapor, creating an intense fireball. Another option is the blind angle burst, used during close-in fighting, such as within a built-up area - a flame burst from an M240 can be 'bounced' off facing walls or surfaces to attack an enemy around a blind corner.

Since the thickened fuel is difficult to extinguish, a commander must careful-



ly consider the tactical area before authorising the use of flame. The amount of kindling and burnable debris must be assessed, as well as the environment.

[IMPORTANT: naked flames should not be permitted in any pressurised environment with a high oxygen content.] The potential for collateral damage is a serious constraint on the use of incendiary weapons like the M240.

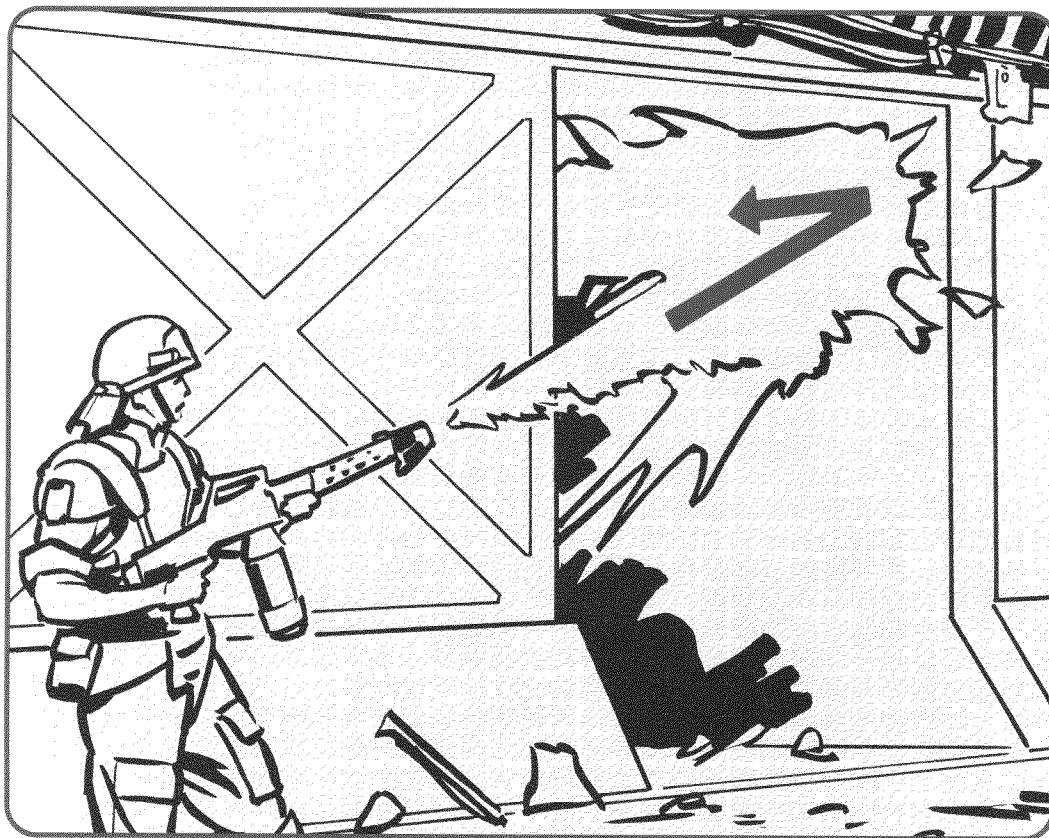


Fig.2.15 Blind angle burst

2.5 M42A SCOPE RIFLE

"I was attached to Echo Company as part of the defense for Sana's Point. From a building at the outskirts of town, my mission with the Scope Rifle was to pass intel back to the Battalion head shed and direct the defensive fire-fields...

"The slinks infiltrated the Company perimeter at 27.00, local time, and hit the central traffic control post 500 meters behind me. I could see some of the grunts already down; the entry wounds were hot on my scope and I could see them cooling in the face. So I engaged the slink point, padlocking them on the EM detector (don't these guys practice radio discipline?) and capping three in under a minute. They didn't stop; just continued to advance. They had avoided the sentry gun arcs and were shaking out a sweep line well within the defense perimeter. Realising they'd be past the control point any moment, I booted PARGET into the net and began to redirect the sentry gun arcs in a one-eighty to face the slinks. I heard Gun A start, then Gun C began to chatter. Within seconds the sentries had laid down impenetrable lanes of fire and stalled the advance..."

— Gunnery Sergeant Brenda Casella, Scout-Sniper, 3/4 Marine

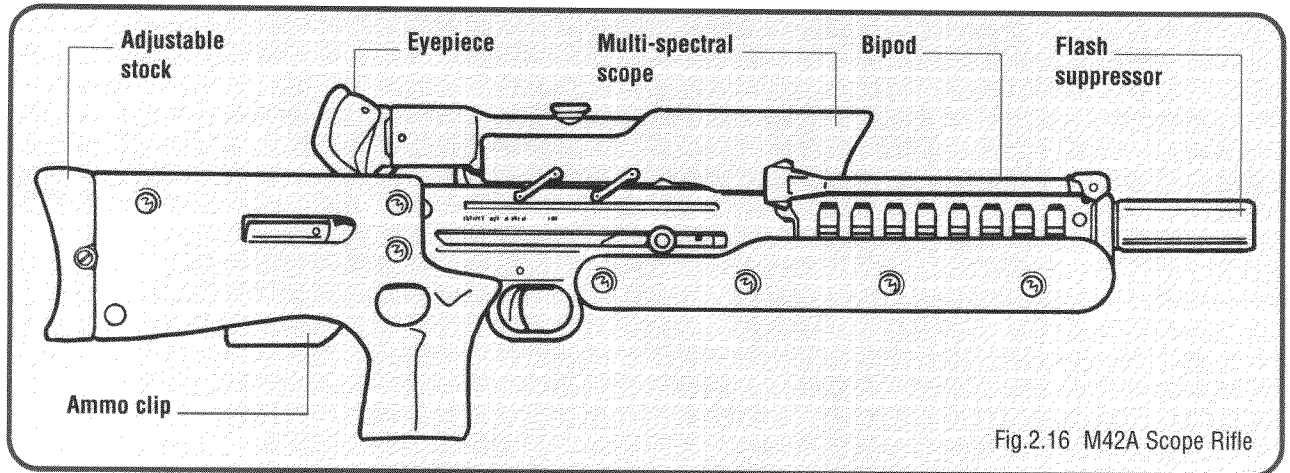


Fig.2.16 M42A Scope Rifle

The M42A is a 10mm pulse action semi-automatic rifle employed as the primary sniper weapon of the USCM. This rifle is a key component of battalion operations; its long range and precision extending the tactical zone of control by up to a kilometer or more, subject to local terrain. The rifle is issued on a scale of one per company, though it is normally held for use in a battalion controlled pool of up to four Scout-Snipers.

The M42 is laid out in a bullpup configuration, with a casing of titanium-aluminide over a duratel frame. Up to six plastic spacers are supplied for adjusting the butt length to the individual Scout-Sniper. An overhead rail carries a folding bipod clear of the barrel. The internal mechanism is designed to have a high degree of commonality with the M41 - using the same rotating breech and feed - though it is chambered for the match-standard 10mm x 28 caseless round. The barrel is free-floating with a right-handed twist and is contained within a protective shroud and receiver housing. Barrel options include a flash suppressor or a muzzle brake for long-range shooting. Ammunition feed is from a 15 round Match Rounds magazine inserted beneath the stock of the rifle, behind the thumb-hole of the pistol grip.

The match-standard batched M252 HEAP round has a maximum effective range of 2,950 meters. A long-range stabilised ball round is also available, with an effective range of 3,800 meters. The factory standard M250 smart gun round can be used with no adaptation, though it has an effective range well under 2,000 meters. Fusing for the M250/M252 ammunition is controlled from a separate selector switch.

A combined, multi-spectral twenty power passive sensor scope is mounted over the receiver. The scope display shows a composite image based on visual, infrared and electromagnetic emissions. The scope display can be augmented by input from the local sensor matrix via a digital comms broadcast or direct optic cable link. Motion trackers, ground radar, lidar and IR sensors may all be linked into the rifle; furthermore, the optional PARGET control system - exact details of which are classified - is apparently able to connect the rifle into the local sentry gun matrix, allowing the Scout-Sniper to redirect sentry gun firing arcs when in hot contact.

M42 SPECIFICATIONS:

Weight	4.26 kg
Length	101 cm
Barrel length	81 cm



Each ghillie suit is custom-made for the wearer. Beneath the natural-fiber camouflage is a suit made from radar-absorbent materials. The sniper carries an M42A scope rifle and wears BiMex M3 day/night goggles with a magnification of twenty power. The pack to his left is a portable heat sink connected by a length of superconducting cable; this optional attachment helps regulate the suit's thermal signature.



Fig.2.17 Scout-sniper in Ghillie suit



2.6 M4A3 PISTOL

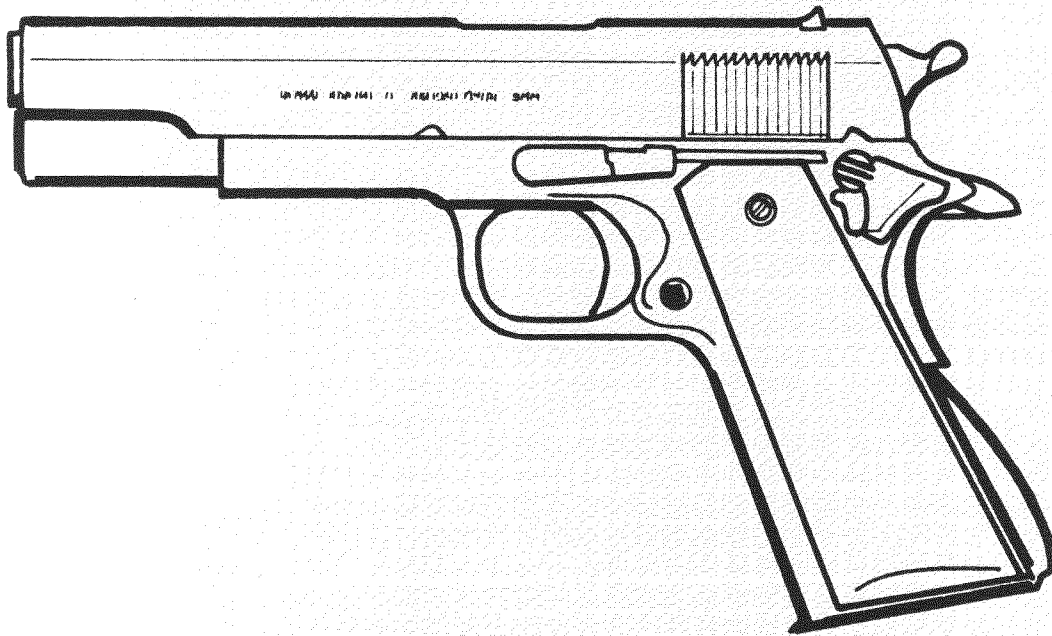


Fig.2.18 M4A3 Pistol

The M4A3, with its older variants, has been the USCM standard sidearm for the past sixty years. It is a 9mm automatic, recoil operated, magazine fed hand weapon. The working mechanism is made of steel alloy with some plastic parts and the outer casing is machined from lightweight alloys. The entire weapon, including a full 12 round magazine weighs no more than 0.95 Kg. The cartridge is a 9mm ball rimless straight round with a bullet weight of 126 grain (8.2 gram). Since the effectiveness of the round, even at close range, is limited against targets wearing body armor, a new ammunition - the M901 - is being introduced, which consists of a subcaliber metal core encased in a high impact resin bullet. Upon impact, the resin case breaks apart, allowing the core to penetrate the target armor; however, some problems are being experienced with the terminal ballistics of this round, and full introduction is not expected for another year.

M4A3 SPECIFICATIONS

Muzzle velocity:	282 m/s
Length:	21.6 cm
Length of barrel:	12.7 cm
Trigger pull:	2.2 to 2.5 kg
Maximum range:	1500 m (approx.)
Max. effective range:	50 m (approx.)



2.7 BATTLEDRESS

BDUs

Standard USCM battledress utilities (BDUs) are two-piece, lightweight polycotton coveralls with pockets secured by silent fasteners. BDUs are issued in several patterns for deployments to temperate, desert and jungle zones. The disruptive pattern of the fabric is printed in at least three colors, dependent on the design, and the different high-temperature dyes used in the print process are each designed to absorb infrared radiation at different frequencies, effectively breaking up the wearer's IR signature. The dyes' IR properties break down after time, especially after repeated washing, and so uniform utilities have to be replaced on a regular basis.

Normal utility fatigues, shirts, caps etc. have no special thermal properties, although USCM issue body warmers, ponchos and arctic clothes are designed to a 'blackbody' standard that provides a complete thermal shield.

"One of the most important pieces of protection I was ever issued were my shades. They were BiMex polarised filters with a non-reflective surface, designed to protect against lasers and nuke flash. I wore them damn things all the time, man. Never once saw a nuke, but I saw too many guys get blinded by sniping lasers."

- PFC Harry Harris, 2/2 Colonial Marine, 8 Eta Boötis III, Chinese Arm

Of the boots issued to Marines in the field, the three main types available are the standard M3 boot, which has a leather upper; the M7 jungle boot with a breathable nylon and leather upper; and the M8A2 thermal lined arctic boot. All of these boots have a synthetic sole incorporating several layers of resin-bonded flexible Venlar micromesh to provide protection against spikes such as caltrops or panji sticks; there is anecdotal evidence to suggest that this armor layer has even saved the feet of some land-mine victims from serious mutilation. Marines engaged in logistics duties involving cargo handling are issued with commercial industrial boots with steel toe protection.

2.8 PERSONAL ARMOR

"It shouldn'ta happened, I swear. They nailed me, square on the chest - no deflections or ricochets or anything. I was knocked on my ass, and when I came to, my face was bleeding from fragments of the round as it blew up. We dug the remains of it outta my breastplate - a Japanese 8.1 mm explosive rifle round. By rights it shoulda penetrated the armor shell and exploded in my belly, but I guessed that somehow Mr. Watanabe had rolled bad dice that day. The fuse had gone off just as the shell impacted me and used up all its energy exploding. Later, I discovered that eight other guys on the line had had the same experience. Looked to me like the Beebop ammo had a quality control problem; but hey, I wasn't gonna tell!"

- PFC Doug Boone, 21st MAU, Helene 215

With the devastating firepower now deployed on the modern battlefield, personal protection for the Marine rifleman is essential. The major threats are not just from small-arms fire, but also from artillery blast and fragmentation. Marine combat armor is designed to balance lightness and comfort with optimum protection. The M3 pattern personal armor is based on the French armed forces'



Cuirasse de Combat and consists of a sandwich of materials moulded to form a rigid shell. The outer layer of the sandwich is an ultra-light titanium aluminide alloy to provide structural strength and ablative protection against lasers. Beneath this is a core, consisting of a layer of boron carbide, resin bonded to a layer of graphite-composite carbon-fiber. Boron carbide is an incredibly hard ceramic designed to shatter a bullet on impact while simultaneously forming a conoid base to absorb its energy. Beneath this, the carbon-fiber layer provides ballistic protection at the point of penetration by delaminating across a large area, so absorbing more energy. Finally, on the inside of the armor is a woven liner made of 1500 denier Venlar fibers. This woven liner dissipates the remainder of the energy by deforming in



Fig.2.19
Marine in
M3 Armor

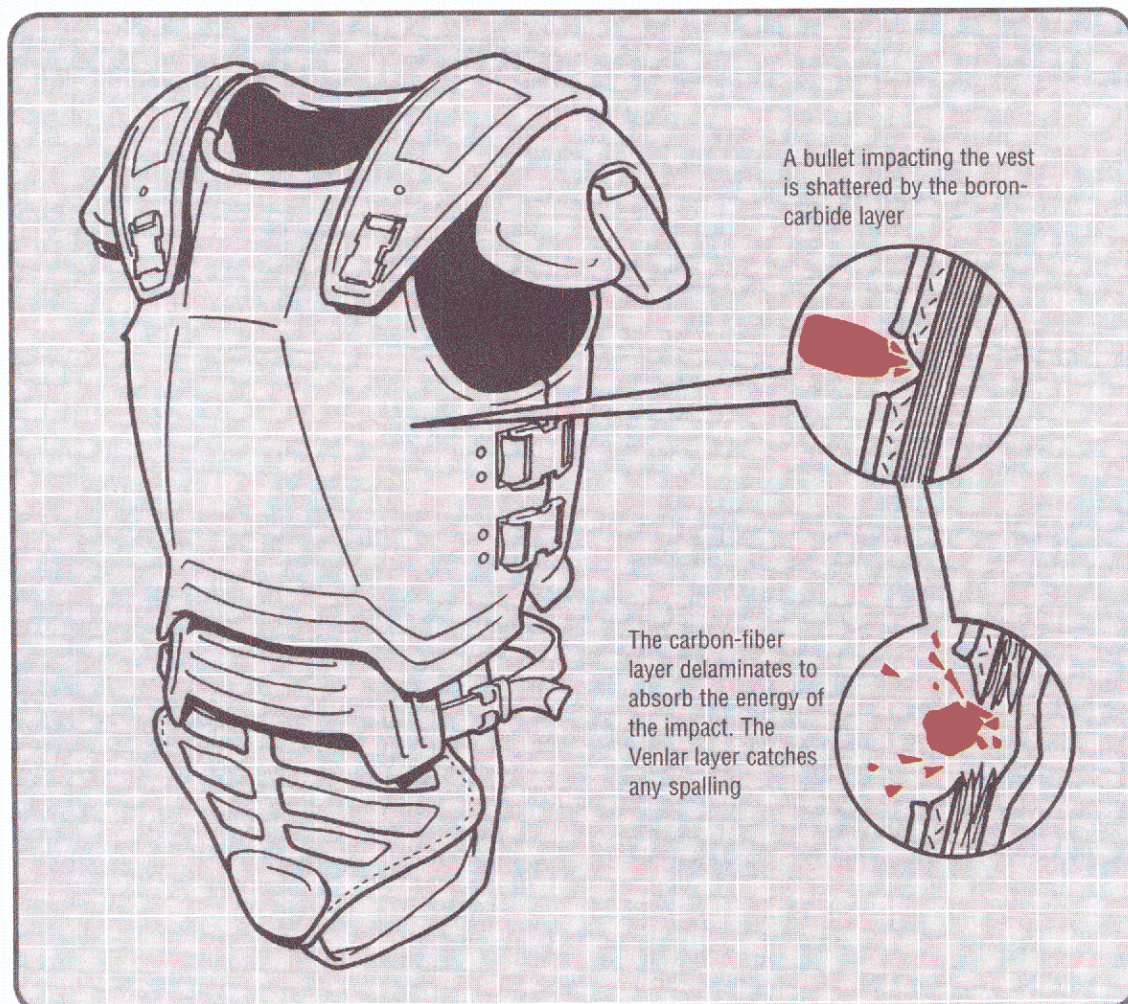


Fig.2.20 The M3 Armor vest



the area of impact, and is also able to catch any spalling or fragmentation from the first three layers. Since any bullet or fragment impact on the armor shell tends to compromise its integrity and ability to provide ballistic protection, it is standard practice to replace any affected sections immediately.

In practice, the stopping power of the armor is somewhat limited versus direct hits, particularly from high-velocity ball ammunition and HEAP small-arm rounds. However, it can be expected to stop low-powered ball ammunition and provide some protection against impact-fused explosive bullets and grenade or artillery fragments. Some stealth characteristics have also been included, such as curved and rounded surfaces to reduce radar signature, and infrared masking.

The M3 armor comes in several pieces. The main component is a rigid vest, which protects the thoracic-abdominal region, front-and-back, between the groin and neck. This comprises a two-piece clamshell secured at the sides by plastic clips. At the top of the clamshell, above each shoulder, is a rigid load-bearing arch from which hang the webbing straps. These arches are padded beneath to protect the wearer's shoulders when the armor is loaded with an IMP frame (see below). Two segmented pieces attached by webbing straps protect the front and side of the shoulders. Inside the clamshell are remote biomonitors which measure the wearer's life-

The Marine illustrated wears a lightweight IMP pack clipped to his M3 armor. Stowed on top of the pack is an M83 SADAR missile and on the back is the ubiquitous entrenching tool

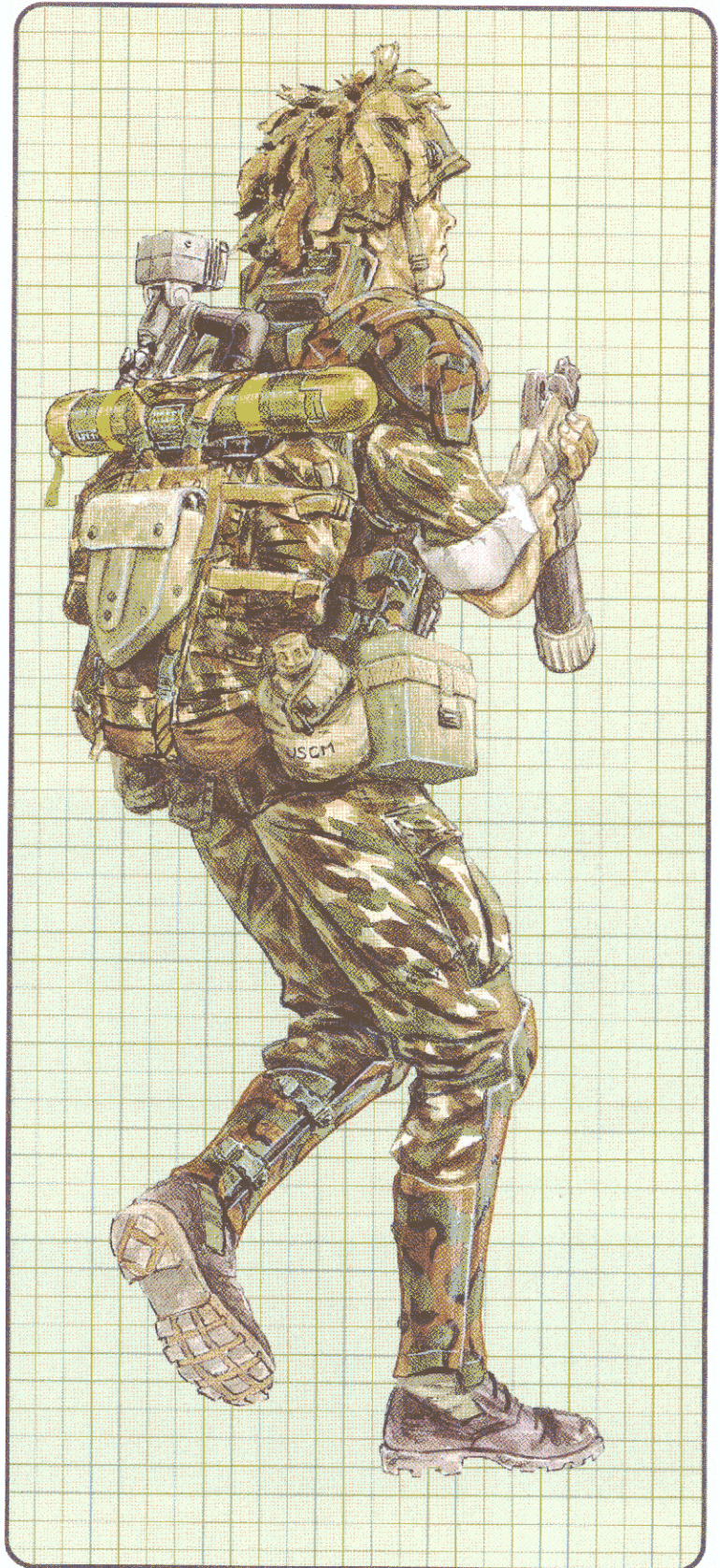


Fig.2.21 Marine with IMP pack



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signs including heart-rate and breathing; an optic cable connects these to the PRC 489/4 transmitter in the M10 ballistic helmet.

On the rear left shoulder of the armor vest is a mounting bracket for a high-powered halogen white-light TNR lamp. The TNR lamp runs off a rechargeable internal battery and incorporates a carrying handle so that it may be detached and used as a hand torch. Also on the back of the armor are three mounting brackets for an IMP frame. IMP (Individual Marine Pack) is a lightweight medium pack designed to carry up to 24 kg; it is attached to an carbon-fiber A-frame which clips onto the rear armor mount. The pack is water repellent but not waterproof, though waterproof liners are issued for each of the main compartments and pockets.

Below the armor vest is a separate section which covers the front abdomen and groin. This is a flexible pad of rheological ballistic armor secured by a 'diaper' harness. A rigid armor plate is fixed to the lowest part of the pad to protect the genitals.

Leg armor consists of a pair of clamshell greaves which cover the whole of the lower leg from ankle to knee. The knee segments are articulated on webbing straps and are tied around the leg above and at the back.

Head protection is provided by the M10 pattern ballistic helmet, which incorporates a tactical camera, audio microphone, IFF transmitter and a PRC 489/4 receiver/transmitter system. In addition, the helmet also mounts a passive infrared sight, which flips down over the right eye. This projects IR images from the thermal imaging facility built into the tactical camera, superimposing them over the background as in a Heads Up Display.

"The situation rapidly deteriorated into a bloody brawl, with the Colonial Marines ripping into the hapless bugboy sappers in the dark, tight confines of the trench complex. Though young and inexperienced, the Marines had the advantage of personal armor and a plentiful supply of M40 grenades, which they were using at close quarters. They would fire or throw a grenade, then turn away from the blast, hunch up and absorb the fragments in their armor vests and the backs of their legs. On several occasions, Captain McCarthy's men used this technique to blow away the enemy at ranges less than ten meters..."

- Unit history, 16th Colonial Marine Regiment

2.9 INFANTRY TACTICS

"Our problem has always been that of defining the mission. The Colonial Marines are the only force-in-readiness the United States possesses, and yet we piss our forces away in penny packets on UA sanctioned police duties or pest control. We're not trained for that. The Corps' mission is the stand-up fight. Someone go steal your car, call a cop. You get roaches under the sink, call an exterminator. Someone invade your planet, call the Marines. Go figure."

- Colonel Joe Kerwin, 2/8 Colonial Marines

The following is abridged from an article in 'Jarhead', the official Colonial Marines bulletin board (Infobahn access INN.511//uscm/ mil/gov/jarhead):



TEN YEARS ON – A MARINE 70 REVIEW

by Capt. Allen Egstad, USCM

[Editor's Note: Captain Egstad views are his own and do not represent any policy or statement of intent of the Colonial Marine Corps]

My family is a Corps family. I'm not sure there are many of them left. Mom was a Colonial Marine, as was Dad, two of his brothers, and Gramps; Mom's Pa was an Army man, so we don't mention him at family gatherings, but you catch my drift. Those occasions we're all on the same world together get fewer and fewer as the years go on, but whenever we meet, we end up running the same old conversation – usually at that point in the evening when plenty of chow and a few tall cool ones have loosened our jawbones. One of the old sweats (sorry guys, but y'all older than me) will puff a smoke ring and proclaim loudly that the battlefield is a scarier place now for a footsoldier than it ever was for them. They then roll out the old saw that the modern Marine is a softer, more technically reliant creature than he ever was. And finally, oblivious to the contradictions with anything said before, they'll cap the conversation by adding that humanity never changes, and that the Corps will always need tough bastards like them to ensure the mission gets done.

It's classic old smoke; talk like it has been heard in bars and mess halls down through the ages. I'm sure that even at the walls of Jericho, some flinty Israelite sergeant complained that the rank-and-file were becoming too reliant on their trumpets and that the new technology would never replace a good, tough spear-carrier. My folks were right about one thing, though. There'll always be a need for a man with a rifle to take and occupy ground. This is our primary purpose; this is our lot. The Colonial Marines are ground-hogs at heart. There's nothing quite like a Marine for squatting in a patch of mud and holding it 'til kingdom come. Destroying the enemy's ability to fight is also important – but only insofar as it helps the primary mission. For the Colonial Marines, the essence of power projection has always been in its sharp end – the aggressive, intelligent and effective employment of the rifle section in battle. All else is bull.

The Marine 70 program has shaken us all up over the past decade, and its only in the last five years that most Marines who served in the 'old' Corps have begun to recognize the tangible benefits of the changes to the 'new' Corps. Marine 70 took the USCMC apart, discarded some bad practices, kept what was good, and reassembled it with a clutch of bold new concepts. The program examined the mission, the battlefield, the equipment and the grunts who have to use it. Ten years on, the jury is just coming back on the program's success. For the most part, its predictions were accurate. In some cases, in need of a tweak; rarely was it just plain wrong. Whatever, it changed the Corps profoundly. The USCM now is a very different Corps from the one in which my family served, although I believe many of the fundamentals remain.

The history of infantry warfare has been a story of ever-increasing dispersal of forces on the battlefield. Improvements in firepower, detection capability and the ever-increasing responsibilities given to the individual soldier have pushed back the boundaries of what small units are expected to achieve. Today, a section can be tasked to hold the kind of frontages a platoon used to ten years ago, and in practice often more. In an age where the limited resources of the Colonial Marine Corps are stretched beyond the point at which it can comfortably fulfil the policy requirements of both the United States government and the UA, it's not unknown for a battalion to be ordered to operate across a continental area and a regiment given responsibility for an entire planet. Such situations



Fig.2.22 United States Colonial Marine wearing 'warm, temperate' BDUs, M3 armor and webbing, standard equipment pouches, combat knife, 30mm grenade bandolier, shoulder lamp, hand welder and wrist location transponder.



are rarely satisfactory, and all too frequently the mission objectives have to be down-scaled, often with painful results.

This problem had been recognized long before Marine 70, but the program was the first time a systematic solution was applied. Largely, this was to define exactly what each level of organization was capable of and what and how mission objectives could be achieved. This part of the Marine 70 review - completed by the beginning of the '70s - served to inform the policymaking process at a political level. However, the most radical part of the fix had yet to come. The program concluded that to make up for the lack of resources available for dispersed operations on distant worlds, not only that technical improvements and innovations had to be made, but that the tempo of operations had to be further increased. The knock-on changes to organization and doctrine nearly tore the Corps apart, but the benefits are now becoming apparent.

Corps doctrine has long been wedded to the principle of non-linear operations - an essential given the size and shape of the colonial theater of operation. On a colony world or a planetary continent where settlements and resource production areas are widely dispersed, the creation of long lines of battle are impractical. Here, mobility is the key. Supply heads or staging areas may be static for short periods, but otherwise the operating forces must remain on the move. There are no flanks in the colonies. The battlefield is where you stand; or better, where you force the enemy to stand. On the offense, aerospace and ground-based mobility allows the Colonial Marines to strike from anywhere and in any

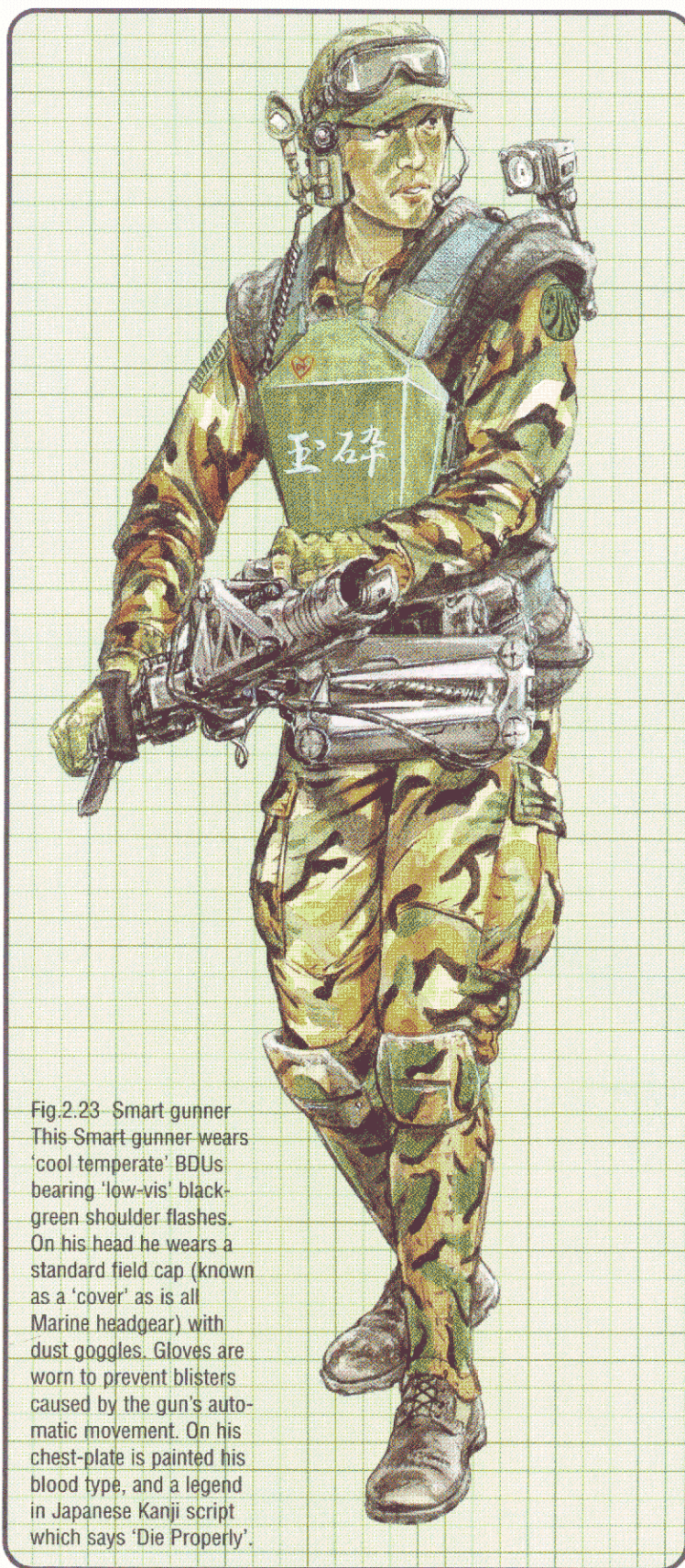


Fig.2.23 Smart gunner
This Smart gunner wears 'cool temperate' BDUs bearing 'low-vis' black-green shoulder flashes. On his head he wears a standard field cap (known as a 'cover' as is all Marine headgear) with dust goggles. Gloves are worn to prevent blisters caused by the gun's automatic movement. On his chest-plate is painted his blood type, and a legend in Japanese Kanji script which says 'Die Properly'.

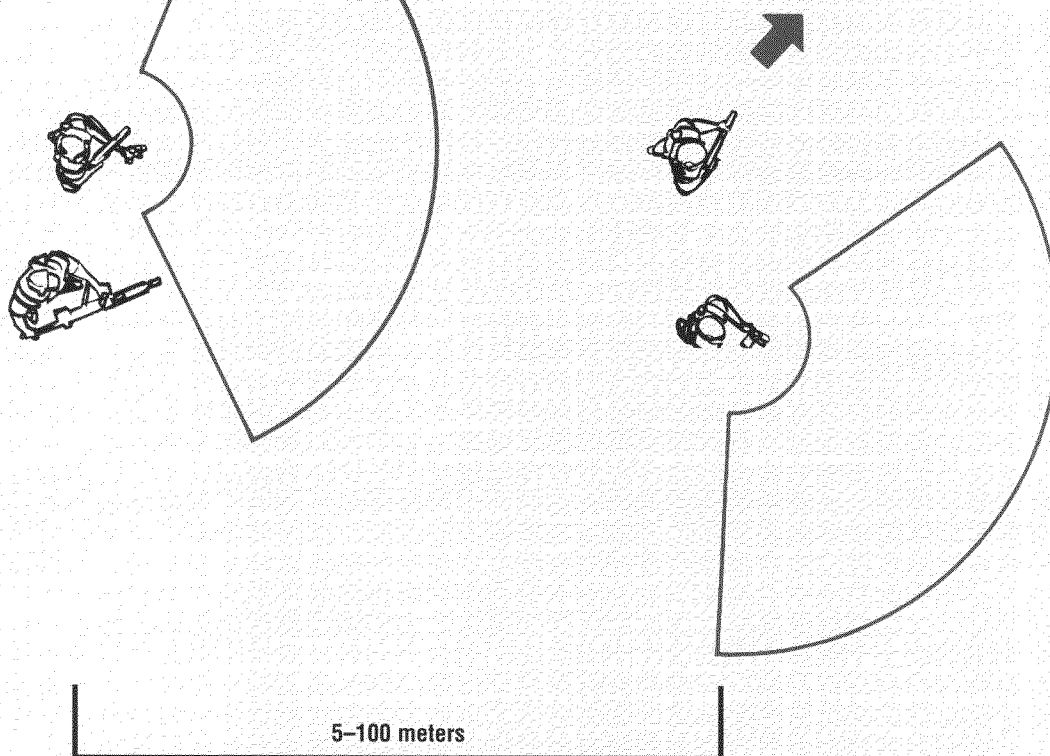


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weather conditions. On the defense, aggressive patrolling in all directions will break up the attack before it ever begins. This is the kind of battle the Colonial Marines have traditionally fought. To increase the tempo of this kind of warfare required the creation of a new Corps, a Corps reliant on ever-smaller autonomous units prepared to operate aggressively for prolonged periods.

The abandonment of the 'triangular' system of organization, and adoption of a 'pair' or 'buddy' system was one of the most radical decisions Marine 70 made. Traditional doctrine was based on the principle of 'two up and one back', with two covering elements supported in attack or defense by a third element in reserve. While such an approach was sound, it was incompatible with the need to increase the speed of operations. Since two elements are more easily maneuvered than three, it made common sense to organize this way on the new fast-track non-linear battlefield. At every level of mobile operations, the 'buddy' system is far more flexible; the commander can operate 'one up, one back' both in the attack and defence; or he can operate 'two up', with one element overwatching the other, or both piling in together at the *schwerpunkt*. However, the organization is less suited to a more static, linear kind of battle; the set-back at Neusheune on Linna 349 is a cautionary example of a Colonial Marine force lulled into a less aggressive, less mobile, defensive mindset. There are ways around this, of course, and even here the 'buddy' system, with

Fig.2.24 Squad in 2 by 2 cover formation.
The point man sweeps with the motion tracker whilst his buddy watches the unscanned area. The gun team move and sweep to cover the lead team.





its ability to break down and cross-attach ever more discrete units has proven to be the solution when local commanders are faced with the need to balance line forces with their reserve.

It is at the 'sharp end' - the level of the infantry section - that the organizational changes have had their most profound effect. Two-man fireteams are easy to deploy and command; soldiers have a natural affinity for working in pairs, and when all echelons of command are organized into two-element pairings, it is easy for even the dumbest grunt to comprehend the job and responsibilities of each part of his unit.

Squads now have two elements: the M56 smart gun team, which provides most of the firepower, and the rifle team. The flexibility of this simple formation is awesome. On the offense, the rifle team can act as an assault element to close with the enemy while the gun team overwatches or supports with heavy fire. However, the M56's ability to fire at full effectiveness while on the move also makes the gun team a potent assault force, allowing the entire squad to remain mobile. On the defense, squads can either fight where they stand, or are free to maneuver, with one team overwatching the other during a counterattack or withdrawal.

The M56 is an excellent example of the way in which new technologies and concepts have helped increase the tempo of operations. Other examples exist. Improvements in the intelligence and discrimination of sensor systems - particularly with regard to automatic sentry systems - have radically increased unit security both on the attack and defense. Interestingly enough, similar advanced sensors are now being sold to the Third World's client colonies. The threat posed by increasingly sophisticated sensor matrices have forced Colonial Marine infantry to rely more on old-fashioned virtues such as fieldcraft and camouflage; this has, in turn, led to further improvements in the low-observable 'stealth' characteristics of our uniforms, armor and equipment. Stealth, both in the literal and technical sense, allows a Marine the advantage of choosing the time and place he wishes to fight. Given the lower troop densities now being deployed by the 'new' Marine Corps, this factor has become even more significant; even the classic stand-up firefight has become more a game of 'cat and mouse' with both sides using advanced sensors and concealment to jockey for a position of advantage. Given the considerable firepower available even at fireteam level, experience has shown that whoever can sneak the first shot in such a contest will win.

Finally, improvements in transport capability have freed the Colonial Marine infantry from a reliance on a large starlift capacity, and allowed the infantry to deploy quickly from smaller starships as part of a combined arms team with armor and aerospace support. The upgunning of the UD-4 dropship at the turn of the decade turned a light shuttle transport into a formidable dedicated close support platform, while the introduction of the lightweight M577 APC allowed us for the first time to drop armored ground transport from orbit without the need for heavy-lift shuttles or starlifters. The Colonial Marine is still expected to fight on foot, but now he can do so as part of an aerospace-mobile, armored team possessing range, flexibility and striking power.

It'll be no surprise to my folks to know that the organizational changes and the new technologies have made the 'new' Corps leaner and faster than ever before. However, the burning question remains: Is it any meaner?

Pass a beer and we'll contemplate that one...

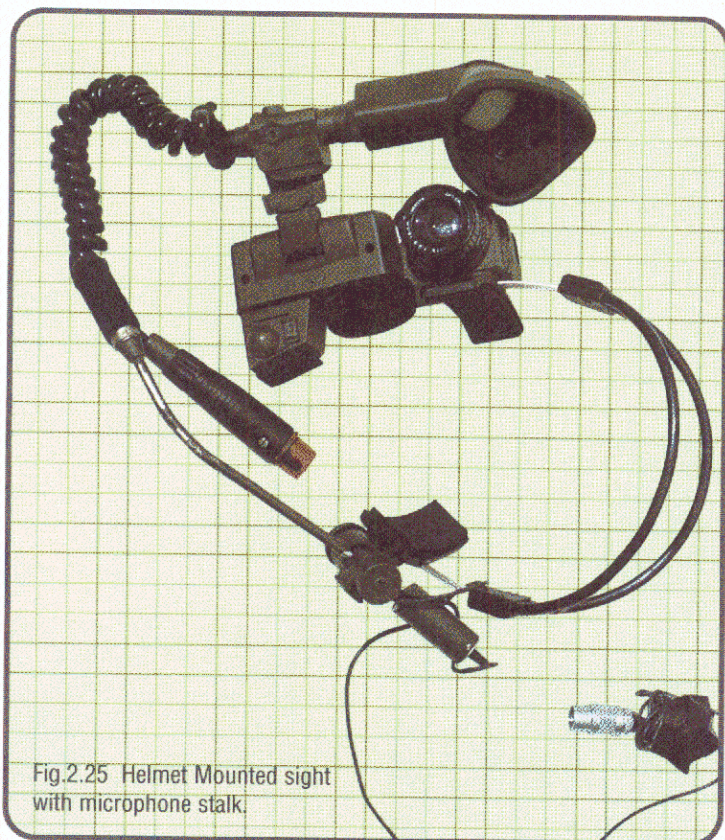


Fig.2.25 Helmet Mounted sight with microphone stalk.

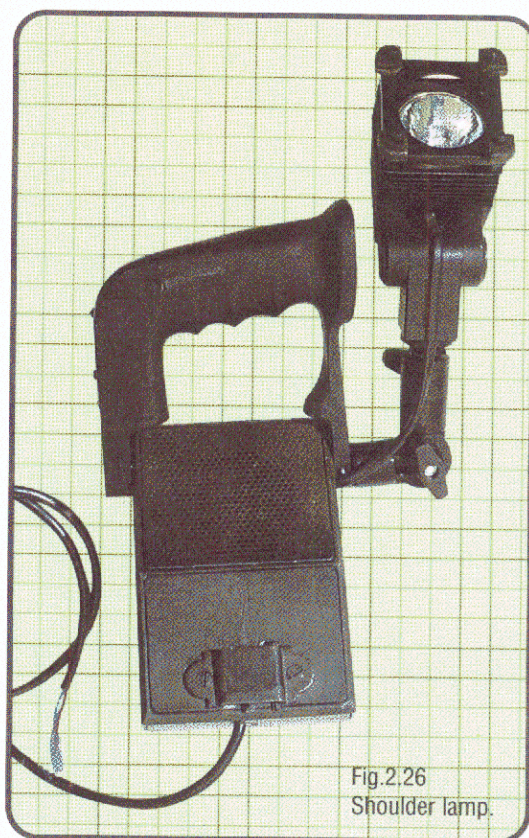


Fig.2.26 Shoulder lamp.

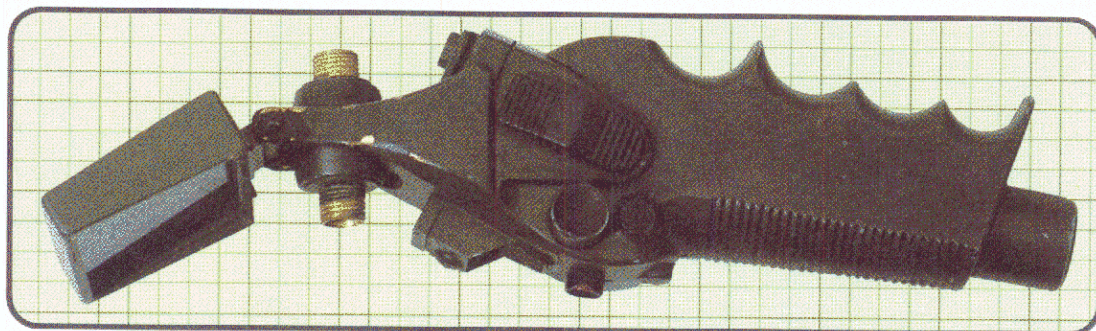


Fig.2.27 Hand welder

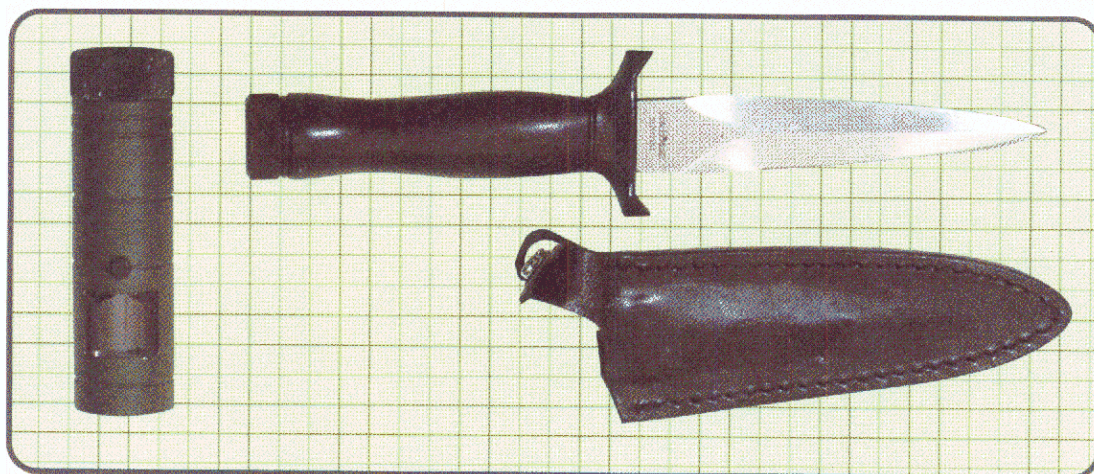


Fig.2.28 Combat knife and personal locator.



Fig.2.29 VP 70 pistol. A popular side-arm in service with the USCM.

Grenade Launcher operation:

Fig.2.30
Handload the grenades into the four-round internal magazine.

Fig.2.31
Use the pump action handle to prime the mechanism.

Fig.2.32
Brace the weapon at the hip and squeeze the launcher's trigger forward of the main magazine.



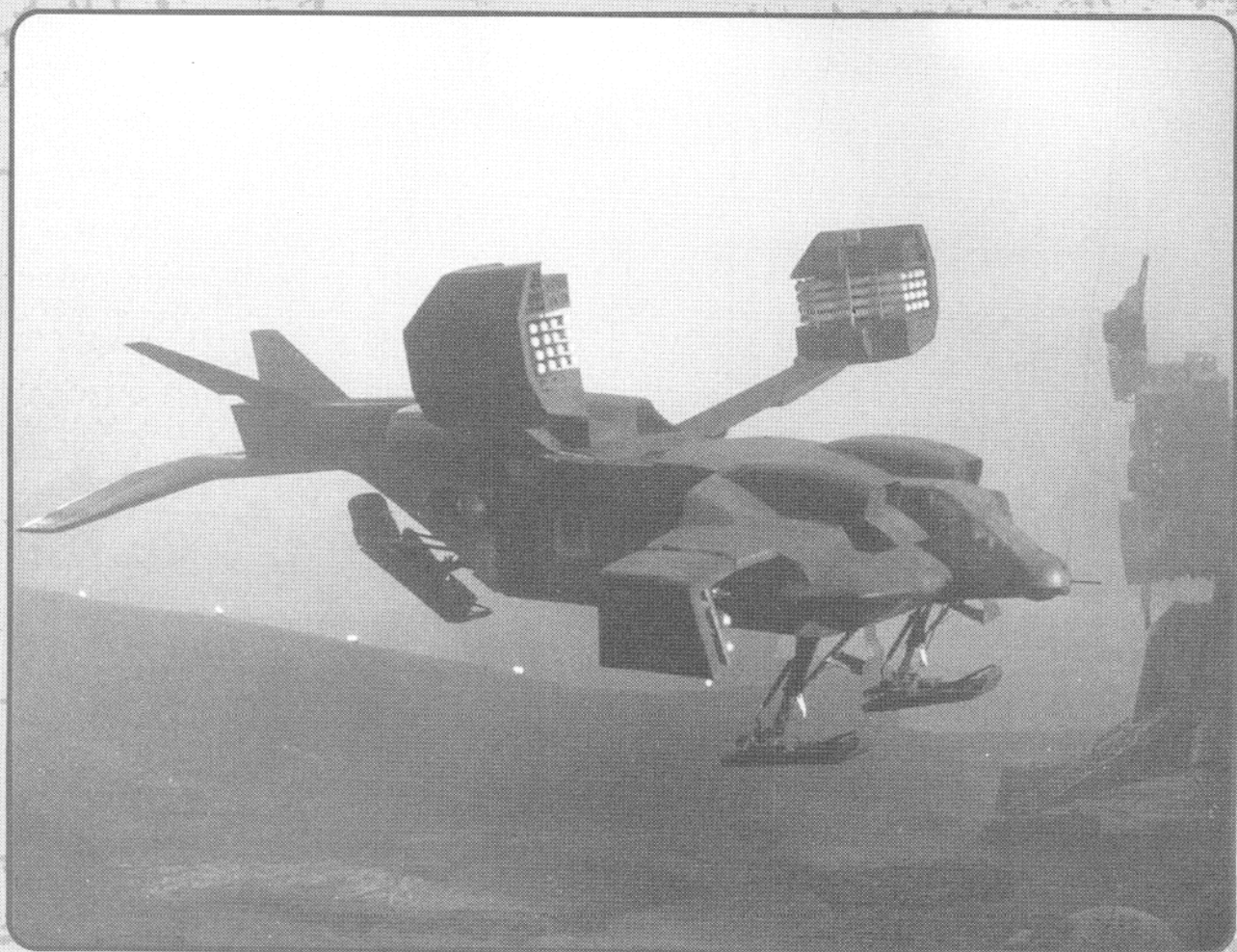
Fig.2.30



Fig.2.31



Fig.2.32



"There's scuttlebutt goin' around about some new alien species nobody's ever encountered before. Great big predatory aliens that grab you and cocoon you and lay their eggs inside. I heard they come from some place beyond the frontier - some chicken-shit colony barely in the Network. They grabbed two hundred colonists and bred hundreds more before Space Command sent the Marines in. I heard they sent a platoon in to recon the LZ; they had their butts kicked by some big mother queen bug who trapped them in her hive an' tried to use 'em to breed more bugs. They say that only a couple got away, and one of the Marines left behind hadda take out the bug hive by squatting at ground zero and pulling th' pin on a nuke.

"That's hardcore. Semper Fi, man. Semper Fi."

- PFC Jim Meehan, USCM



AEROSPACE OPERATIONS

3.0 AEROSPACE OPERATIONS

3.1 THE COLONIAL MARINE AEROSPACE WING

The Colonial Marine aerospace forces essentially have a dual role: fighting as an integrated part of the aerospace/ground team, and providing forward support. Wing tasks include air superiority missions, reconnaissance, close air support, dedicated strike, forward supply, transport, casualty evacuation and search and rescue. The Colonial Marine Aerospace Wing is an administrative formation responsible for the operation of all aerospace craft within the Marine Space Force to which it is attached. In practice, it is an integrated element of the Colonial Marine Division.

The Wing operating forces are divided into three Aerospace Groups. The Drop Group consists exclusively of dropships assigned to operate with the Marine ground teams. Their role is as dedicated support, and they are serviced and maintained by the units to which they are attached. There are approximately 200 dropships in each Wing Drop Group.

The Tactical Group consists of squadrons tasked with the reconnaissance, counterair and attack missions. An average Wing has six to eight squadrons assigned to the Tactical Group, consisting mostly of **AD-19C/D Bearcat** and **AD-17A Cougar** strikehips, and **UD-4 Cheyenne** and **UD-22 Navaho** gunships.

Lastly, the Support Group comprises transports and specialist craft equipped for CasEvac, search and rescue, psyops, special forces insertion, etc. The major workhorses of the Support Group are the **UD-4 Cheyenne** and the **CS-14 Briareos** heavy lift shuttle.



Fig.3.1
Dropship
Nose Art

3.2 UD-4L 'CHEYENNE' UTILITY DROPSHIP

"The guys had a hunnerd differr'n't names fer 'em. In our platoon we tagged 'em 'Alpha-Bravos'; kinda short fer 'Ass-busters', 'cuz you feel like you've been goosed every time you make a drop, if y'know what I mean. But if you wuz pinned down in a hot LZ, then the sight of one o' them mothers buzzing over the horizon to grease them bandits with rockets was the most awesome thing in the world."

- Unnamed Marine

The UD-4 'Cheyenne' is a versatile dropship and tactical transport employed in a primary role in the US Colonial Marine Corps. Derived from an original Department of Defense requirement formulated at the end of the Tientsin conflict for a multi-role light aerospace shuttle capable of lifting heavy payloads up to 16,000 kg, the UD-4 has evolved into the definitive dropship design, influencing the shape of many derivatives and successors.

The Cheyenne's unique flexibility comes from its ability to lift itself into orbit under its own power from unprepared landing sites with the aid of its vertical take-off (VTOL) capability. In addition to carrying its large payload, the Cheyenne can operate in the close-support gunship role by deploying weapons pods and hardpoints for rockets and missiles, as well as using its own internal gun.

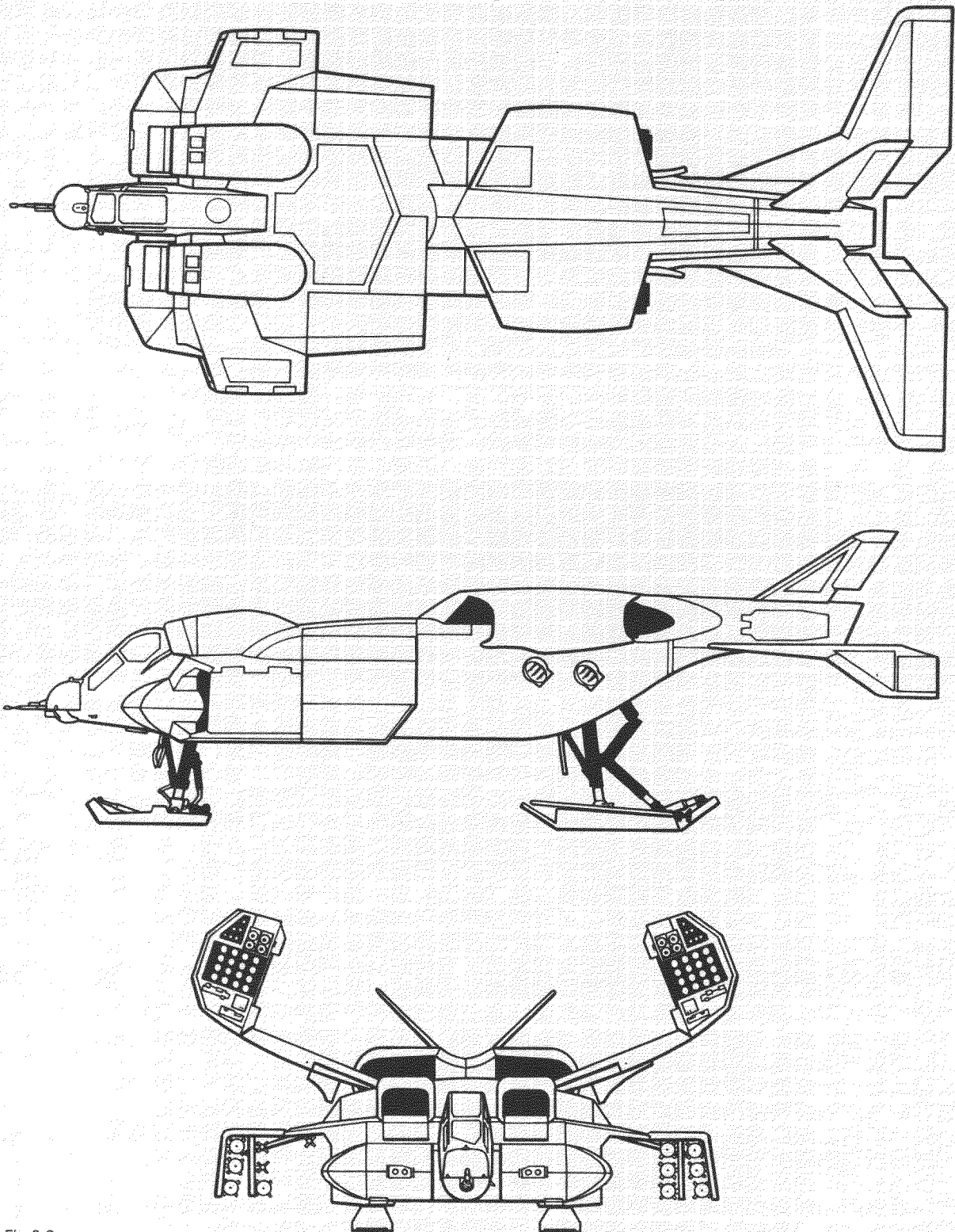


Fig.3.2
UD-4L Three-view diagram



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AIRFRAME

The UD-4's lifting-body airframe is built around its 103.6 cubic meter internal payload bay, flanked to the sides and aft by the tri-skid undercarriage. Forward of the payload space is the cockpit and the mounts for the lift engines. Aft of the space is a raised tail assembly which mounts the ramrocket engines and control surfaces.

The principle frame is constructed from superplastic-formed diffusion-bonded metal matrix composites (MMC). These light, oxidation-resistant MMC structural members are formed from high-modulus, high-strength gold and chrome doped zirconium oxide reinforced fibers in a titanium aluminide matrix. They form a structural web running the length of the fuselage, encompassing the payload volume. Spars and members attached to the main frame are constructed from titanium aluminide MMC and refractive composites with titanium root fittings to transfer bending moments to the structural web. The fuselage skinning comprises tri-layer plates attached to the Titanium Aluminide frame. The inside layer is a carbon-carbon composite (graphite fibers in a carbon matrix) bonded to a middle layer of single-crystal carbon. This crystal carbon layer will not melt on the re-entry and can effectively conduct excess heat away from the leading-edge surfaces. A thin ceramic outer layer provides thermal and oxidation protection in the high-altitude, high speed realm.

"The Cheyennes were damn horrible looking ships; big ugly mothers with fins 'n lumps sticking out all over. But the drop pukes loved 'em; thought they were cosmic, Sierra Hotel, ground-pounding marine movers. If you overflew a LZ you'd see dozens of the things, buzzing around like huge green tiger beetles, settling and taking off. Whenever I saw 'em, I always had an irresistible urge to zap the suckers with Raid!"

- Lt. Zade Rosenthal, VCMA-117

The payload bay is a 9.5 l x 4.5 w x 2.4 h meter (102.6 m³) volume with a 3.92 meter wide deck ramp suspended from four dual-hydraulic assemblies. The deck ramp can comfortably carry a fully-crewed M577 APC (with turret stowed) or a HALOS stores pallet, and is able to raise the cargo completely into the payload space from ground level. Within the bay, detent latches are automatically activated, extending to hold cargoes in place when the deck is raised. A 20 cm cavity to either side of the payload bay separates the cargo volume from the outer skin and contains the main structural members, cable runs and the blower pipes from the forward turbines to the aft lift nozzles.

Aft of the payload bay, a step gantry can be lowered to the port side to allow crew access. Forward of the bay, a small volume accommodates three seats for passengers and additional crew.

To either side of the forward payload space, the structural web extends outwards to form the static load points for the undercarriage, the fuel tank volume and the mounts for the secondary weapon bays. Aft of the payload space is the huge rear skid strut and the fuel tankage for the ramrockets. The UD-4 undercarriage is a tri-skid arrangement in which the skids retract flush with the underside of the fuselage. The ramrocket engines are mounted above the main fuselage module, their intakes accepting the airflow across the upper fuselage. The aft fuselage assembly occupies the space between the engines and extends rearward to the butterfly control surfaces. This volume contains the Fire Control Jamming Suite towed unit and the oxidant tanks for ramrocket operation during exoatmospheric flight, with their associated cryogenic storage equipment. Just aft of the main engine nozzles are a pair of flush fitted extending airbrake panels which can also be deployed



during re-entry for transonic and hypersonic stability. The butterfly control surfaces are designed to provide control authority in all axes at all speed regimes. They also supply tail lift at low speeds when dynamic pressure on the underside of the dropship lifting body drops and shifts the static center of lift forwards.

The turbine engines are mounted above the forward fuselage, either side of the cockpit access corridor. Multi-plate variable compression ramps feed air into the canted engines. Thrust from the plenum chambers is fed aft to the swivelling vertical take-off nozzles and forward to a single lifting nozzle beneath the nose.

The spacious pressurized cockpit is accessed from the payload bay and features two crew positions, seated in tandem. Both crew sit in Martin-Siekert R2102 zero-zero ejection seats which are cleared for operation at any altitude below 10,000 m and speeds below Mach ($M=$) 1. In the event of an emergency, explosive cord blows the canopy off and the crew are ejected clear of the ship. Canopy transparencies are made from single-crystal quartz, flash coated with gold, germanium, molybdenum and iridium to provide protection against bright light and short-wavelength lasers. The coatings also act as a radar reflecting surface, preventing the entire cockpit volume from becoming a radar reflecting cavity.

The main fuselage also features the mounting points for the main weapons pods and the secondary weapons bay. The main weapons pods are attached to cross-folded pylons just forward of the ramrocket intakes, which in supersonic flight are stowed flush against the fuselage sides and the rear of the secondary bays. At subsonic speeds, the 4.4 m pylons can be deployed crosswise to expose the ordnance within the pods. The total span of the pods when deployed is 15.3 m. The pods cannot be deployed at speeds above transonic because of the adverse effects of drag and the torsion caused by dynamic pressure on the pylons. The secondary bays also fold flush against the sides of the lifting body, and can be swung out to expose all the weapon hardpoints and allow exhaust space for weapons launch. Unlike the main weapon pods, the secondary bays can be deployed at supersonic speeds up to $M=2.4$ without adverse effects on dropship handling.

Survivability features high on the list of UD-4 features. The airframe has proven crashworthy at low speeds and altitudes. A sandwich of Venlar ballistic armor layers protect the cockpit, fuel tanks and ramrocket cowlings from light ground fire or spent missile fragmentation and the ceramic outer skin layer has limited ablative properties against pulsed lasers. All electronic systems are hardened against the effects of TREE and particle beams. Though not designed to slug it out with ground or space defenses, experience has proven the Cheyenne to be exceptionally rugged, capable of withstanding considerable punishment while still remaining airborne.

However, it must be noted that even light damage can prevent a dropship from lifting into orbit. A breach of the fuselage skin will seriously compromise the ship's high-speed thermal protection, and even a tiny hole can cause oxidation or 'burn through' when atmospheric speeds exceed $M=5.0$. To prevent such accidents, a sensor net is bonded to the inside of the skinning to monitor for breaches, differential hull temperature and ionization. If a breach is detected, a warning is flashed to the cockpit monitors to notify the crew.

"You wanna know why the Cheyenne is so righteous? It's 'cause the failure rate is so low! By rights it shouldn't be. Each one is built from five million parts and is soooooo complex to maintain that we're clueless without the computer diagnostics. However, regardless of all the use and abuse those ships take, our wing never ONCE dropped below 95% operational efficiency."

- Captain Scott Henry, 2nd Colonial Marine Aerospace Wing

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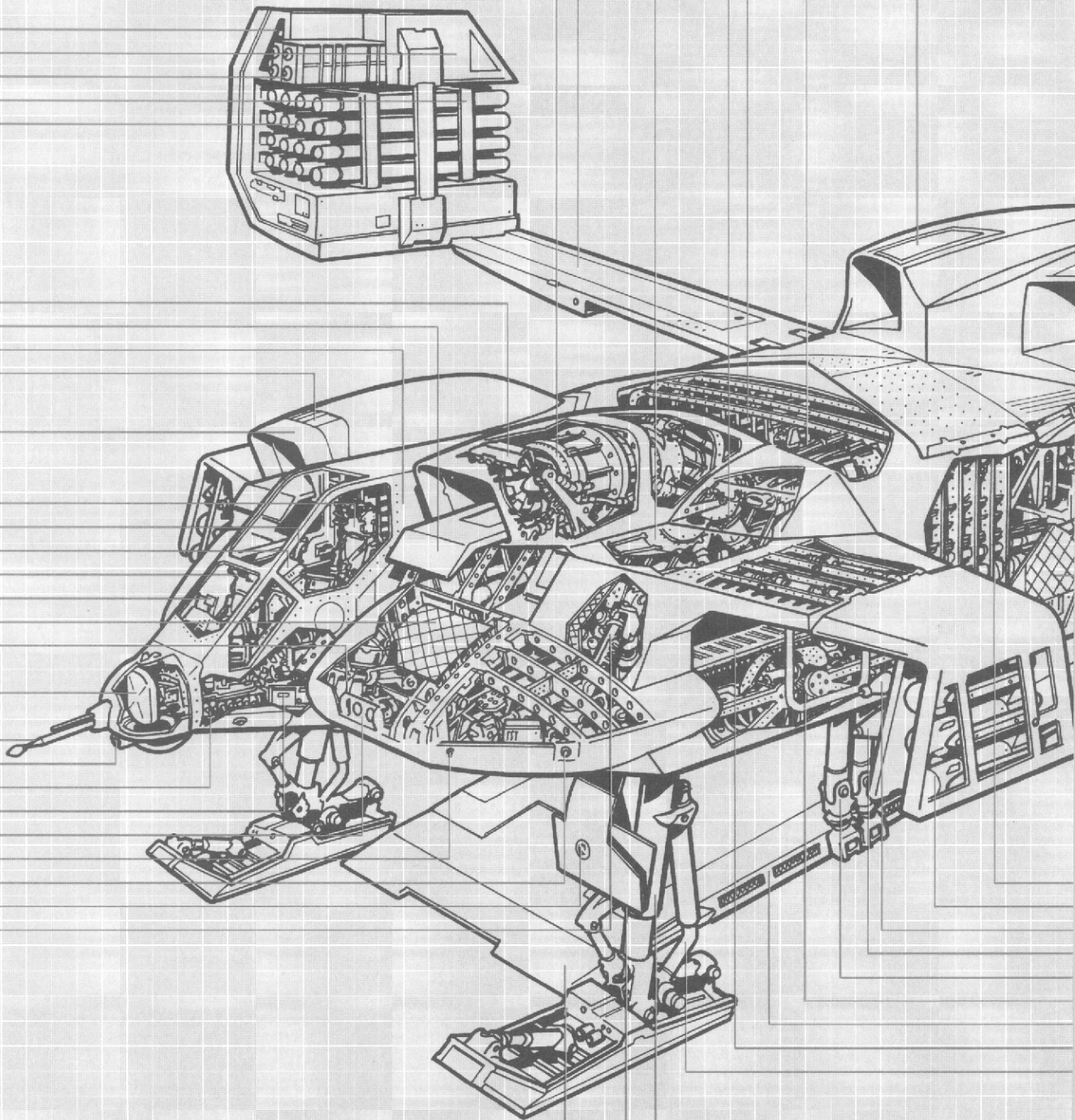
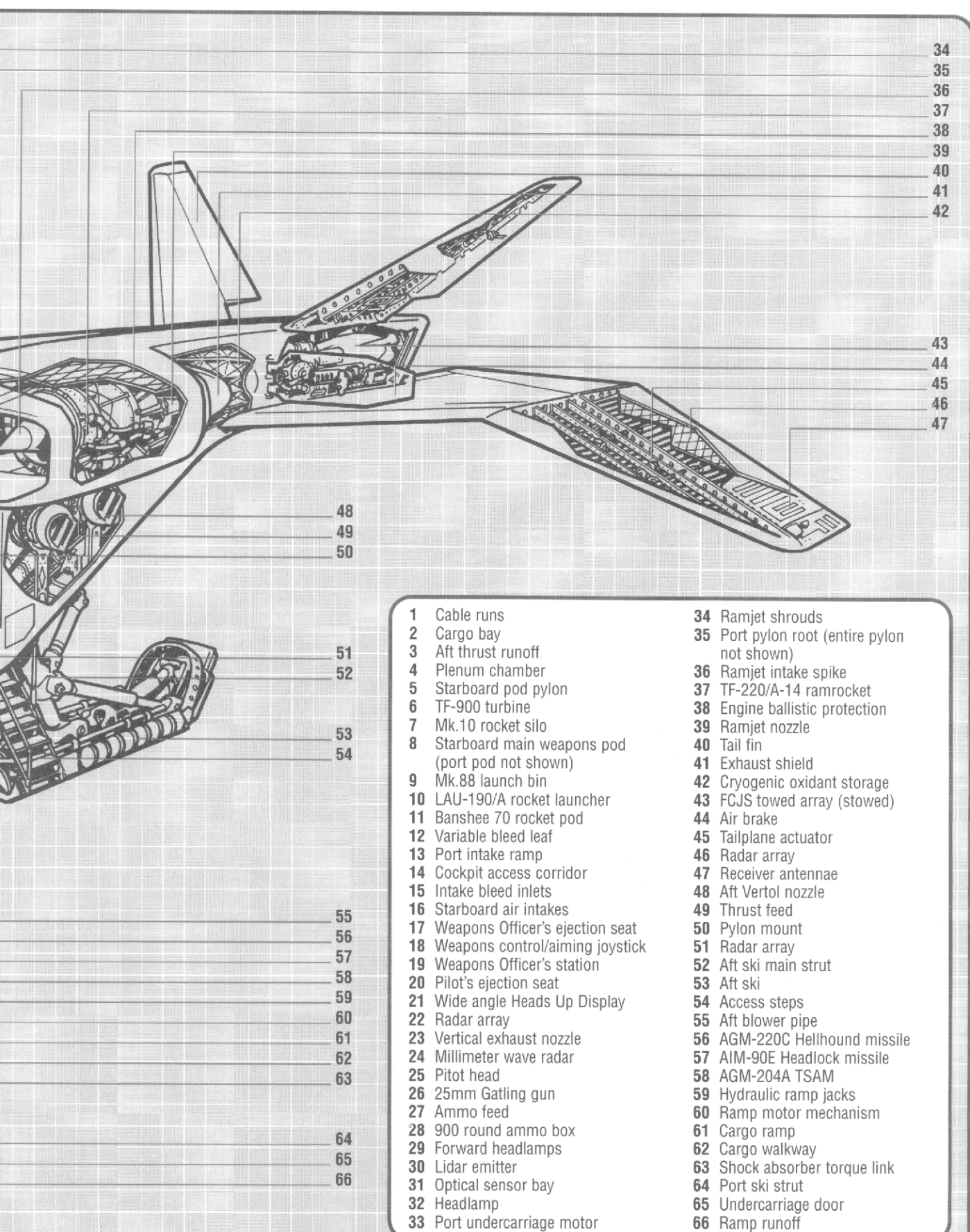


Fig.3.3
UD-4L Internal Schematic



- | | |
|---|---|
| 1 Cable runs | 34 Ramjet shrouds |
| 2 Cargo bay | 35 Port pylon root (entire pylon not shown) |
| 3 Aft thrust runoff | 36 Ramjet intake spike |
| 4 Plenum chamber | 37 TF-220/A-14 ramrocket |
| 5 Starboard pod pylon | 38 Engine ballistic protection |
| 6 TF-900 turbine | 39 Ramjet nozzle |
| 7 Mk.10 rocket silo | 40 Tail fin |
| 8 Starboard main weapons pod (port pod not shown) | 41 Exhaust shield |
| 9 Mk.88 launch bin | 42 Cryogenic oxidant storage |
| 10 LAU-190/A rocket launcher | 43 FCJS towed array (stowed) |
| 11 Banshee 70 rocket pod | 44 Air brake |
| 12 Variable bleed leaf | 45 Tailplane actuator |
| 13 Port intake ramp | 46 Radar array |
| 14 Cockpit access corridor | 47 Receiver antennae |
| 15 Intake bleed inlets | 48 Aft Vertol nozzle |
| 16 Starboard air intakes | 49 Thrust feed |
| 17 Weapons Officer's ejection seat | 50 Pylon mount |
| 18 Weapons control/aiming joystick | 51 Radar array |
| 19 Weapons Officer's station | 52 Aft ski main strut |
| 20 Pilot's ejection seat | 53 Aft ski |
| 21 Wide angle Heads Up Display | 54 Access steps |
| 22 Radar array | 55 Aft blower pipe |
| 23 Vertical exhaust nozzle | 56 AGM-220C Hellhound missile |
| 24 Millimeter wave radar | 57 AIM-90E Headlock missile |
| 25 Pitot head | 58 AGM-204A TSAM |
| 26 25mm Gatling gun | 59 Hydraulic ramp jacks |
| 27 Ammo feed | 60 Ramp motor mechanism |
| 28 900 round ammo box | 61 Cargo ramp |
| 29 Forward headlamps | 62 Cargo walkway |
| 30 Lidar emitter | 63 Shock absorber torque link |
| 31 Optical sensor bay | 64 Port ski strut |
| 32 Headlamp | 65 Undercarriage door |
| 33 Port undercarriage motor | 66 Ramp runoff |

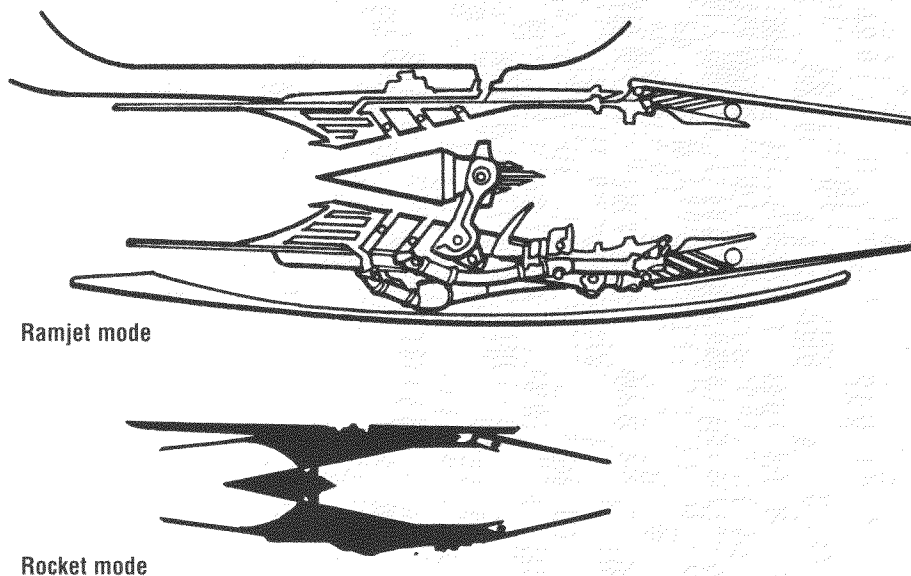


POWERPLANT

In order to be able to operate in all speed and altitude regimes from vertical take-off (VTOL) hover to the hypersonic trans-atmospheric, the UD-4 requires two types of powerplant. The main engines are a pair of Republic Dynamics TF-900 variable-cycle turbines, each producing 310 kN static thrust. The redundancy offered by this dual-engine configuration increases the safety factor, allowing the UD-4 to continue to fly and hover on one engine even while half-loaded. Each engine has a three-stage fan and seven-stage compressor each driven by single-stage turbines to produce exceptionally high thrust for low specific fuel consumption. At subsonic speeds they operate as turbofans, providing the massive thrusts necessary for VTOL operation as well as fuel economy. In this mode, the fan bypass air is ducted through the nose exhaust louvres during the hover, while the core air is fed to the aft side-bleed nozzles. At supersonic speeds, the bypass air is ducted through the core, and the engine becomes a turbojet capable of supercruise.

High-altitude high-speed flight is permitted by the aft TF-220/A-14 ramrockets. The TF-220 is a combined-cycle engine capable of ramrocket and scramrocket operation from the supersonic to hypersonic regimes, and rocket power for trans-atmospheric operation. In atmospheric flight, airflow through the ramrocket intakes is directed past an inlet spike and three rows of fuel injectors. The inlet spike modifies the shock wave through the airflow inlet whilst the choice of injectors depends on the speed of the dropship. Fuel is pressure-fed to the injectors and made to pass along and around the combustion chamber, both to cool it and to precondition the fuel. Heat from the chamber then vaporises the fuel for one or other of the three injector banks. The intensity of the shock wave through the airflow inlet determines the pressure in the combustion chamber which in turn determines the vaporisation rate and the thrust. As the ramrocket engine goes faster, it becomes increasingly efficient. At low speeds - below $M=1.5$ - the ramrocket is extremely inefficient, but becomes progressively more useful as a power source as the dropship approaches $M=2$. At $M=2$ the ramrocket comes into its own, and this is usually the point in flight that the main turbines shut down to standby and the transition is made to ramrocket power. Ramrocket accel-

Fig.3.4 TF-220/A-14 Ram Rocket with inlet spike retracted for ramjet operation. The lower silhouette depicts the engine in rocket mode.





eration from M=2 is rapid, peaking between M=8 and M=12, at which point the engine is operating as a scramjet with supersonic flow operating throughout the ramrocket engine tube.

"At very high speeds - I'm talking about the Mach five plus range - you're travelling so fast that your forward shock wave shatters the diatomic air molecules into their constituent parts. Because this takes place inside the shock layer, the skin of the ship causes a catalytic recombination, creating heat - a lot of heat. When you're this hot, you can kiss goodbye to your communications and most of your sensors; the heat plasma renders you blind and dumb. If someone's sent a missile after you, you won't know it; and even if you do, you can't maneuver much at these speeds. Your options are reduced to two: slow down, or keep climbing straight up for the safety of orbit. I hate climb-outs. 'Til I see black sky I always feel vulnerable..."

- Cpl. Teri Spindler, 2nd MAU

Above 25 km, the ramrocket pushes the inlet spike fully forward to seal the air-flow intake, and the fuel injectors begin pumping oxidant into the combustion chamber for rocket operation. In this mode, the dropship is capable of trans-atmospheric flight. In an assault or shuttle operation, a Cheyenne usually has sufficient fuel to drop from orbit and achieve a low-orbital injection on its return. Descents can be made both powered or unpowered, dependent on the mission profile, though an injection burn from the rocket engines is usually required to reach a descent window from orbit.

FLIGHT CHARACTERISTICS

The flight characteristics of the UD-4 prove it to be a stable and reliable platform in all regions of the aerospace realm and it is popular with its pilots. In the high speed (M=2+) regime the Cheyenne handles steadily, though the response to control inputs is somewhat slow due to the limiters in the flight software. Rolls and turns are difficult at such speeds because of the dangers associated with the reduction of airflow through the ramrockets or loss of lift resulting in departure of controlled flight, and so the dropship is limited to only the most gentle maneuvers. At low altitudes, speeds above M=2 are prohibited due to severe airframe buffet and the tendency of the high mass flow through the ramrockets to cause flameout. High speed flight is therefore almost exclusively reserved for the high altitude climbout or separation maneuver.

"Truth is, the Cheyenne's a rocket, not a fighter. You wind her up to speed an' she'll go like a bat, either straight up or straight down. She 'ain't good for much else."

- Unnamed Colonial Marine pilot

At subsonic speeds the lifting body configuration generates little lift and the pilot becomes increasingly reliant on the flight software and lift from the vectored thrust engines to keep the dropship stable in the air. Stall speed is very high, and as the Cheyenne approaches the stall it tends to fly increasingly nose-high. As transition is made through the stall speed, vertical lift from the nose and stern nozzles are bled in to prevent departure. Though the airframe is nominally stressed to +6 g, maneuvers in conventional flight greater than +3 g are prohibited due to the excessive stall speed, which can cause the Cheyenne to prematurely depart controlled flight. When fully loaded, turns greater than +1 g are

prohibited. At very low speeds and at altitudes below 500m, VTOL hovering flight is recommended. The Cheyenne is at its nimblest in the hover; here, response is crisp in all axes and the dropship is a very steady weapons platform.

"Fact: the Cheyenne handles like a cow. If it's carrying a load, make that a drunken cow. Listen up kiddies; these are righteous words I speak. Do not, I repeat, do NOT get into a dogfight with one of these babies, 'cuz you will BURN! You are not Cool Jo or Panda from No Guts, No Glory and unlike the teevee shows you watched as little boys and girls, popping the airbrakes and throwing the nozzles forward NEVER EVER causes the enemy fighter to overshoot into your guns! If an enemy air threat appears, there are two sensible reactions: Run, which is good; or Hide, which is almost as good. Anyone who tries to fight back is a dumb conehead who will burn in Marine Hell for wasting a perfectly good dropship. Any questions?"

- Major Kathleen Conway, USASF Aerospace School, Gateway station

STEALTH CHARACTERISTICS

As far as is possible, the fuselage has integrated low observable characteristics including rounded leading surfaces, shielded compressor intakes, and a butterfly tail. Much of the composite skinning is radar absorbent and from the forward quarter the Cheyenne has a radar cross-section (RCS) of less than 1.3m^2 , while from the front, where the engine intakes are fully visible, RCS increases to around 2.5m^2 . However, despite the attention paid to keeping RCS low, values for the beam and stern aspects are much greater, in some cases exceeding 50m^2 .

In the infrared, the Cheyenne is far easier to detect. Airframe heating is almost impossible to disguise at ranges under 10 km, and if the dropship has just completed a transatmospheric ascent or descent the detection radius can be 30 km or more in clear skies. Cold air blowers are installed in the side-bleed nozzles and the nose exhaust to reduce the infrared signature from the lift engines.

A variety of laser-absorbent skin coatings provide some defense against lidar and laser-targetting systems by attenuating the reflected strength of the beams. Even against coded beams this can cause range or profiling errors. However, because the coatings tend to be frequency-specific, they only provide coverage against a limited number of systems.

AVIONICS SYSTEMS

"This cockpit has something like a million whistles and bells. When you're schlepping around a friendly neighborhood, everything's nice and peaceful and you can convince yourself that the sales brochure was right when it said that the onboard systems are there to reduce the cockpit workload. But if you get into a fight... oh boy! All the whistles and bells go off at once and you think, 'My God, what the hell is happening?' Times like that, you just want to reach for the loud handle [ejection lever]."

- Capt. William Betts, Senior Pilot, DMLA-210

The Cheyenne has a crew of two, comprising a Pilot and a Crew Chief/Weapons Officer.



Flight control is quadruplex digital fly-by-light with automatic self-monitoring and reversion to back-up modes, all handled through the Herriman-Weston 5/480 flight computer. There is no manual reversion since the dropship is too unstable to be flown with direct control inputs. Engine thrust and nozzle settings are automatically moved to their optimum positions depending on speed, attitude, throttle and stick settings. An intelligent autopilot facility allows the automatics to fly all phases of the mission profile, including ingress and egress to the target zone as well as landing and docking cycles.

The instrumentation and control layout is basically conventional, with a right-hand displacement-type control stick and left-hand throttles. About twenty fingertip controls on these handles give HOTAS (hands-on-throttles-and-stick) control of sensors, weapons, defense-aids etc.

The avionics system is designed to facilitate maximum cockpit efficiency, the semi-intelligent software registering all flight information as required on the pilot's wide-angle, heads-up display (HUD) and the three integrated Lorac multi-function displays (MFDs). These displays provide sensor-fusion presentations, map displays, armament status diagrams, checklists etc. The pilot's workload is reduced by a direct voice input (DVI) system, which may be employed for data entry, the selection of communication channels and operating modes for the MFDs, as well as weapons selection.

Navigation combines an inertial system with ring laser gyros and strapdown accelerometers, backed up by Global Positioning from reference satellites where available.

Dropship communications are handled through a AN/ASC-155 digital datalink offering HF, VHF, UHF and SHF broadcast options. The hardware includes two 12-channel receiver/transmitters with the associated antennae capable of establishing high performance voice, video or computer links in a stressed environment. Antijam features are classified, though they are known to include adaptive HF spectrum techniques to achieve a low probability of intercept and frequency hopping.

SENSORS

The 'L' variant sensor fit has evolved radically from the 'no-frills' package of the earlier model dropships. The demand for ever more capable on-board systems has grown as the Cheyenne's role as a multi-purpose platform has expanded and developed. Today, the UD-4 boasts a sensor suite as state-of-the-art and as capable as that of any strikeship or fighter currently in service.

Raw sensor information from all sources is collated and processed by the Integrated Flight Tactical Data System (IFTDS), which largely handles flight related data and routes all tactical information through to two major sub-processors, both of which are integrated with the offensive and defensive systems. The first is ATLIS (Advanced Threat and Launch Indication System), which is designed to detect and identify threats to the dropship and then direct the defensive countermeasures systems against them. The second is TIAS (Target Identification and Acquisition System), which processes battlefield target data and provides an interface between the crew and the fire control systems.

ATLIS is a powerful logic driver designed to evaluate threats from enemy aerospace craft, anti-aircraft artillery (AAA) and surface-to-air missiles (SAM), and compile a composite picture of the threat environment around the dropship. This picture is fed to the cockpit displays in the form of tactical displays, warnings and menus of defensive options to meet any actual or potential threats.

Crew members can select an option from the menu or, in rare cases, custom create their own; ATLIS then controls the activation and deployment of the onboard AN/ALQ-2004E defensive systems. If reaction times are too fast for the crew workload to cope with, the system has the ability to independently initiate defensive programs against any incoming threats.

The TIAS subsystem is a tactical interface between the crew and the weapons systems. Drawing on data from the primary sensors and ATLIS, it creates a synthetic picture of the tactical zone around the dropship, identifying and prioritizing targets and threats, and computing optimum flight profiles, firing solutions and weapons employment. It also interfaces with the fire control systems, constantly updating them with target information. Like ATLIS, this information is presented in the form of sensor-fusion tactical displays and option menus.

The primary tactical sensors comprise a multi-element package including an array of APQ-1178 active-scanned flat-plane radar antennae built into the airframe skinning. Waveguides are able to run two frequencies simultaneously through the antennae and the beams are electronically steerable to give spherical coverage of the ship. The frequencies are approximately 8,000 MHz for long range navigational scan, and 15,000 MHz for medium range target acquisition and detailed ground mapping functions. Modes include pulse and frequency agile pulse against ground targets, doppler and doppler beam sharpening against air threats, and monopulse. The sideways-looking antennae can also operate in synthetic aperture mode for high resolution ground mapping. The radar is capable of tracking 150 targets simultaneously, and against air threats can track a 2 m² target at ranges up to 250 km. At short range, tactical target identification and fire control functions are handled by a steerable APQ-1800 millimeter wave radar positioned in the nose to give forward hemispherical coverage.

Short ranged thermal and direct view optical sensors are mounted in clusters in eight internal bays situated along the length of the airframe, viewing out through small vision ports. Each cluster includes a 640x480-element focal plane array Platinum-Silicide detector, a miniature CCD optical camera and an ultra-violet sensor on the same pannable mount. Linear motion compensators linked to an image autotracking (IAT) system allow the sensor clusters to maintain a steady lock onto a target image regardless of the maneuvers of the dropship platform. If the image passes beyond the panning limits of one cluster, the IAT will pass it down to the next.

Two laser bays - one in the starboard leading edge and one in the aft fuselage - mount AAS-162 lidar emitters in the 1 Kw to 10 Kw range. Turreted optics and waveguides channel the laser beams into skin-integrated planar arrays to form mechanically steerable, optically alterable beams of variable width, polarization, power and waveform. Lidar coverage is spherical, with the capacity to accurately track up to two targets on a full time basis, or multiple targets on a shared basis. The lidar is capable of providing precise position data for any object within its line of sight. Clear skies maximum range for the lidar is 10 km, though this is frequently much less, depending on ambient atmospheric conditions. In addition to ranging and position information, the AAS-162 has a secondary role as point defense system (see Defensive Systems, below).

The Emission Detection System (EDS) is used to detect electromagnetic emitters in the 1 GHz to 1000 THz range, covering threats from long range radar to x-ray pulses. A series of antennae and receivers situated throughout the airframe provide omnidirectional coverage; detected emissions are fed into the EDS processor which identifies the direction, strength, waveform and polarity information on each signal. The EDS has an expansive threat library which is used to categorize detected signals. The EDS also incorporates an analysis system to evaluate and catalog unknown signals.



"To pinpoint hostile emitters with the EDS you fly a triangulating flight profile - either in elevation, diving toward the target, or in azimuth, flying broadside on. In theory, if you go like a bat the EDS can nail down an emitter in under ten secs. In theory. Trouble is, that's ten seconds flying a vulnerable flightpath exposed to all sorts of badness. If the bogey's on the ball with a peebee or a hyper-vee missile, you won't even live that long."

- Warrant Officer Nick Gillott, DMLA-260

DEFENSIVE SYSTEMS

The AN/ALQ-2004E defensive systems consist of four integrated subsystems mounted throughout the airframe. These are the acquisition jamming suite (AJS), fire control jamming suite (FCJS), missile defense system (MDS) and the decoy dispenser system (DDS).

The AJS is a defensive jamming system cued by ATLIS to prevent enemy radar from locking up or tracking the dropship. The AJS comprises several jammers covering radar wavelengths from 0.5 cm through 1 m. Numerous jamming techniques are available, the particular method being determined by the type of threat and its susceptibility to different jamming modes. Because the number of threats the jammer can simultaneously jam is normally determined by power constraints and/or the sophistication of the threats, fast and intelligent system logics are employed to handle power management and the organisation of part-time jamming.

Like any active jammer, the AJS broadcasts a signal which can give away the presence of the dropship. To prevent this, the AJS can be set to EMCON (EMission CONTROL) mode in which the jammer stays 'silent' until needed and then, when activated by a threat emitter, apportions jamming power to a threat according to the strength and type of threat faced.

"Once or twice the Falangists caught us out by rigging dummy emitters into the far approaches of their air defense nets. We'd ingress wearing EMCON mode, hoping to avoid detection until we were almost on them; but when we picked up the dummy emitters - strobing like they were about to launch a SAM - our active jammers would light up and blow our cover. A hundred kays downrange and we'd be pumping out enough static to gray out half the hemisphere. Each time, DROP COM had to abort before the Falangists sent jam-homers up after us."

- Lt. Drew Foerster, 1st Marine Aerospace Wing

The FCJS is a group of jammers which is cued by either the detection of a hostile emission or the warning of an incoming threat. Most of the suite's jammers are mounted internally in the dropship, but several - and many of the jammer antennae - are contained in a towed unit which can be deployed up to 50 m behind the dropship within one second of the FCJS being alerted. The FCJS is used to break lock-ons in cases where the AJS has failed to prevent acquisition. It utilises deception techniques to break a radar or missile's track or to input angular and range errors into the tracking loop. Jamming capability varies from simple automatic gain deception to sophisticated cross-polarisation. FCJS is effective against pulse, pulse/doppler, continuous wave, sequenced noise and multimode threats using lobing or monopulse tracking.

The towed unit is armored and equipped with aerodynamic snub wings to allow

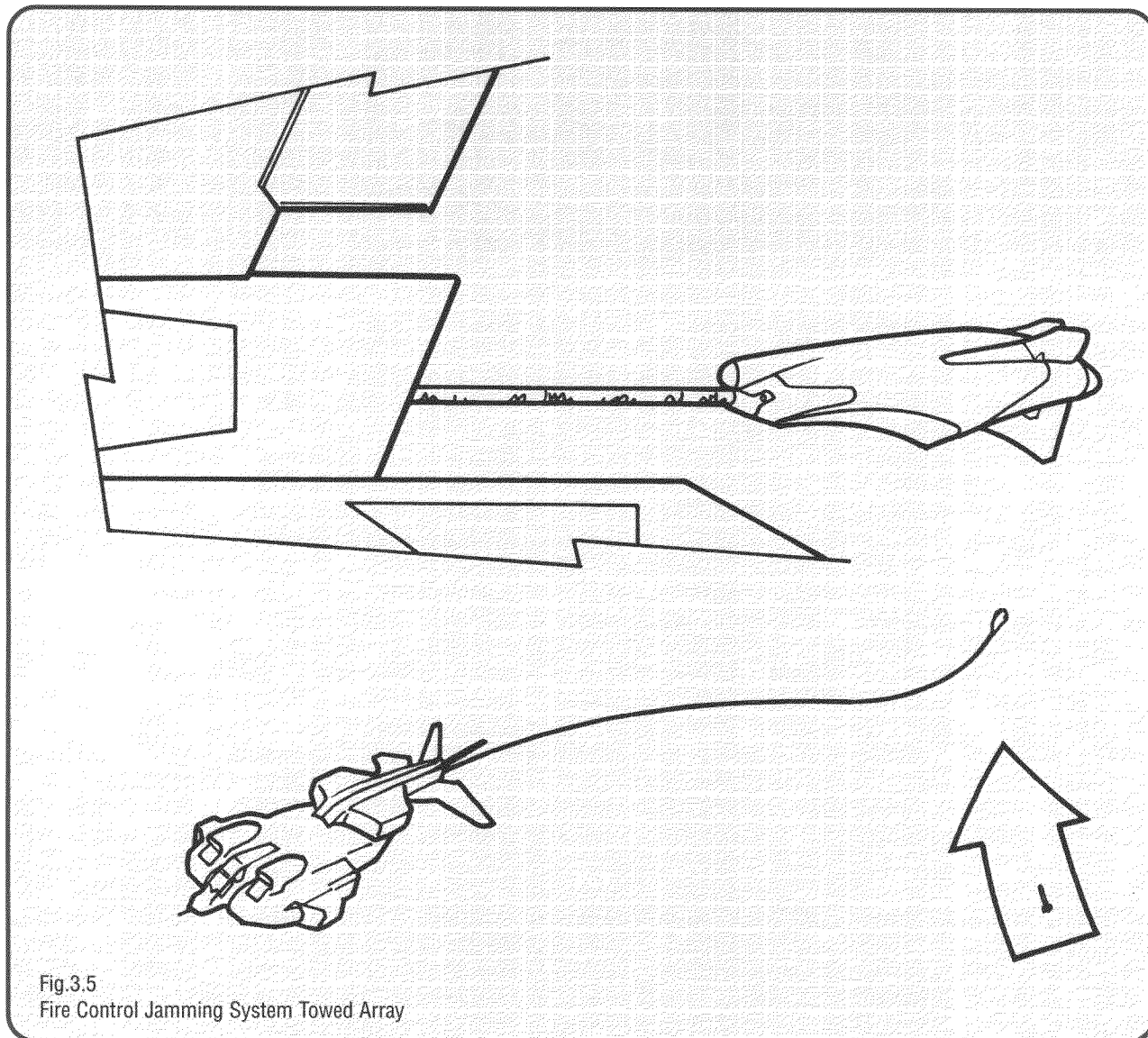


Fig.3.5
Fire Control Jamming System Towed Array

maneuvers - as dictated by the system - up to 100 g. The towed unit provides wide separation between the jammer antennae to enhance monopulse jamming, and acts as a lure for missiles and other projectiles. The towed unit can be used at any speeds between $M=0.3$ and $M=2.9$. If it cannot be deployed because of insufficient speed, the FCJS can still function, though effectiveness is reduced.

The MDS is a point defense system employed against incoming missiles in their terminal phase, usually within 1,500 meters. The AAS-162 lidar acquires a missile then strobes a beam across its nose. This system is capable of dazzling a missile's optical/infrared seeker, or feeding false range information to its laser fusing system. Naturally, the MDS is ineffective against radar or jam-homing weapons not equipped with laser fusing.

The Lascor ELVIRA II decoy dispenser system is a multi-feed rotary launcher capable of firing conventional flare and chaff cartridges as well as the ALE-106 expendable mini-jammer. The ALE-106 can be employed either as a deception jammer or an electronic false target generator and has a secondary role as a decoy for home-on-jam capable missiles.



WEAPONS SYSTEMS



Fig.3.6 Weapons Officer flight suit/helmet details



Fig.3.7
'Victory by Wings'
— unofficial unit
badge of the 3rd
Marine Aerospace
Wing.



Fire control for the dropship can be accessed through TIAS by either the pilot or weapons officer; however, most of the weapons workload is handled by the backseater. When not in combat, the Weapons Officer usually works 'heads down' in the cockpit, monitoring the tactical data output from TIAS and ATLIS. When engaged in combat, or in the tactical zone, the backseater usually flies 'heads up'. The Mk.30 tactical helmet worn by the Weapons Officer includes a eyepiece display which can be snapped down over the left eye to filter tactical data into the wearer's normal vision. The Weapons Officer can look out of the cockpit at a target and TIAS will flash its profile onto the eyepiece display. Punching the fire control switch allows the WO to select tracking or launch functions versus the target and initiate an attack. The pilot has no eyepiece display, though TIAS will flash tactical information onto the forward Heads Up Display.

In practice, the Weapons Officer has responsibility for all targets in the tactical zone, though the pilot can engage targets immediately in front of the ship, and handles all the point-and-shoot attacks, such as with the rockets.

The fire control systems can either fire weapons automatically, as soon as the target is within optimum attack parameters, or can provide a firing indication for manual attacks. In the case of some unguided or unintelligent weapons, TIAS will command the fire control system to set the weapon fusing at the moment of launch according to the target type, and adjusts the aimpoint accordingly. For instance, a Mk.16 rocket with M451 warhead will airburst against soft targets such as infantry, or will be impact fused against armor.

The 'L' variant tactical transport carries a wide array of powerful weaponry that can be used in dedicated support of its troop complement. Two main weapons bays fold out on extended pylons to deploy weapon hardpoints capable of carrying 16 x 150mm unguided rockets, 6 x 70mm unguided rockets and 4 x 120mm guided rockets each. Two secondary bays on the port and starboard side of the fuselage house a further 14 hardpoints for Air-to-Air and Air-to-Surface missiles.

The dropship also mounts a dedicated 25 mm gatling gun in a powered cupola beneath the nose. The GAU-113/B is a six barrel weapon driven by a pneumatic motor turned by the engines at 6,000 rpm and geared down to the rear of the gun. Rounds are caseless, and do not carry their own propellant. Instead, the GAU-113 system uses hypergolic liquid fuels, stored and loaded separately, as a binary propellant. When fed into the chamber via spray nozzles, they react simultaneously to explode and propel the shell. Ammunition comprises a mix of Armor Piercing Incendiary, Armor Piercing Discarding Sabot and High Explosive Incendiary, and is fed from a 900 round drum beneath the cockpit.

VARIANTS

In the Colonial Marines, the UD-4 is employed as an integrated member of the aerospace/ground tactical team, having the capability to deploy troops and its own dedicated firepower direct from orbit to the operational area. Typical payloads into an operational Landing Zone (LZ) may include up to four fully equipped infantry squads or one M577 APC. The Cheyenne also has the capacity to carry up to 16,000 kg of stores. Typical mission profiles include Assault Transport, CasEvac, Search and Rescue, Forward Supply, Close Air Support and Reconnaissance. The UD-4's flexibility as a transport and weapons platform has made it a ubiquitous workhorse within the Corps.

The design of the UD-4 has proved highly successful and through refinement has prompted the production of many variants. These include the following:



UD-4B

- Original production variant powered by Atco Wyoming F23 lift turbines, producing 243 kN thrust each. Shorter by 1.5 m than the later variants and with less payload space, this version was also equipped with the main weapons pods only.

UD-4C

- A gunship variant, this was the first to employ the secondary weapon bays and a dedicated gatling gun system.

UD-4E

- This was the UD-4B re-engined with F29-L-13 turbines to give extended atmospheric range.

UD-4H

- The definitive production variant of this type, the UD-4H included a major redesign of many systems and components. The fuselage was stretched by 1.5m to allow an extra 16 m³ of payload space, making it the first variant capable of carrying the M577 APC, and the lift engines were upgraded to TF-900 turbines. The avionics fit was the first to include a broad-spectrum sensing array and command datalink. Secondary missile bays and the gatling guns were now fitted as standard.

UD-4J

- A USCM life-extension program upgraded all existing UD-4B airframes to 'H' standard. This was designated the UD-4J.

UD-4L

- An upgrade of the 'H' version assault transport, the UD-4L incorporates an improved sensor and fire control system as well as being the first to include a comprehensive defensive suite fit.

SPECIFICATIONS (UD-4L)

Type:	UD-4L Utility Dropship.
Crew:	Pilot and Crew Chief/Weapons Officer.
Engines:	Two Republic Dynamics TF-900 turbines each rated at 310 kN dry thrust. Two TF-220/A-14 combined cycle engines.
Dimensions:	Length 25.18 m; span 12.59 m; height 6.05 m.
Weights:	Loaded 18,620 kg; Maximum Loaded 34,630 kg
Performance:	Power to weight ratio (loaded) 1:3.3; (fully loaded) 1:1.7. Range is variable dependant on mission profile, load and ambient atmospheric conditions, but the UD-4L is capable of dropping a load from low orbit, landing vertically, and lifting to orbit again from a vertical launch.
Armament:	(Typical) 1 x 25 mm gatling gun with 900 rounds; 32 x 150 mm unguided rockets; 12 x 70 mm unguided rockets; 8 x 120 mm guided rockets; 7 x AGM-220 air-to-ground missiles; 3 x TSAM threat suppression missiles; 3 x AIM-90 short range air-to-air missiles.



DROPSHIP PILOT

"The reg'lar drop pilots are always pissed at us for cruising into the noncom bars with our slick g suits on instead of the 'baggies' they wear. But we tell 'em damn' straight that we're the 'attack pukes', riding shotgun to protect their miserable lily-white asses. We go in puckered tighter'n a clam. We don't crap ourselves at the first sign of triple-A, so we don't need no baggies to hold it in!"

Pictured (and quoted) is Warrant Officer Marcia 'Linus' Yansey of DMLA-260, attached to the 3rd Marine Aerospace Wing at Kuat. She is dressed in a g-suit instead of the normal dropship flight suit which would indicate she was flying gunship missions. Gunship pilots fly their ships unloaded, and make a virtue out of pulling hard, instantaneous turns while in hovering flight to avoid fire or acquire new targets, frequently pushing their ships to their structural limits in the process. Velcroed to her right shoulder is a unit flash which would normally be ripped off prior to a 'hot' drop, in case of capture.

W/O Yansey is strapped into a standard parachute rig, which hangs from her back. Across her chest are pouches for basic emergency equipment, including a survival pack, radio beacon and flashlight. It is standard procedure for pilots to wear a sidearm, though it is evident from the picture that this one doesn't. Her helmet is a Mk. 28 'bonedome' with a boom mike attached. Though most pilots wear shades, more for effect than protection, a Polaroid visor can be slid out from the protective housing on top of the helmet to provide additional eye protection from high altitude and orbital glare, nuke and laser flash. This visor must be carefully looked after and kept free of dirt, grease or damage. A slight mark or scratch on its surface could obscure an enemy air threat at long visual range.

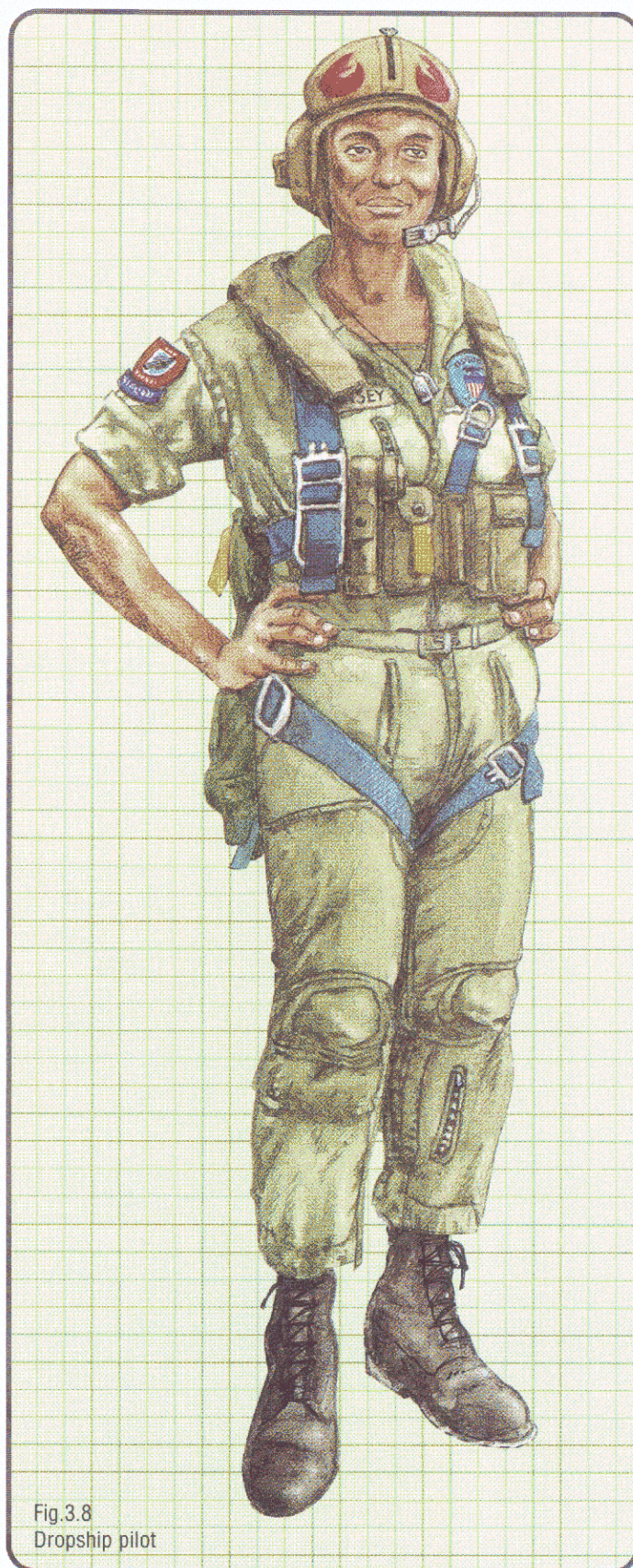


Fig.3.8
Dropship pilot

DROPSHIP COLOR SCHEMES

"Contrary to popular belief, we never paint bomb symbols on the side of the cockpit to indicate successful missions. The way we figure it, if we ever have to force land in enemy territory, we don't want to be lynched by the locals for blowing the bejeesus outta their sons and families. Crazy though it sounds, our plan is to convince them we're something innocuous like a Cas Evac ship..."

- Warrant Officer Mark 'Top Wop' Bovankovich, DMLA-212

Fig.3.9.1
UD-4L 'Ricki's Raiders'

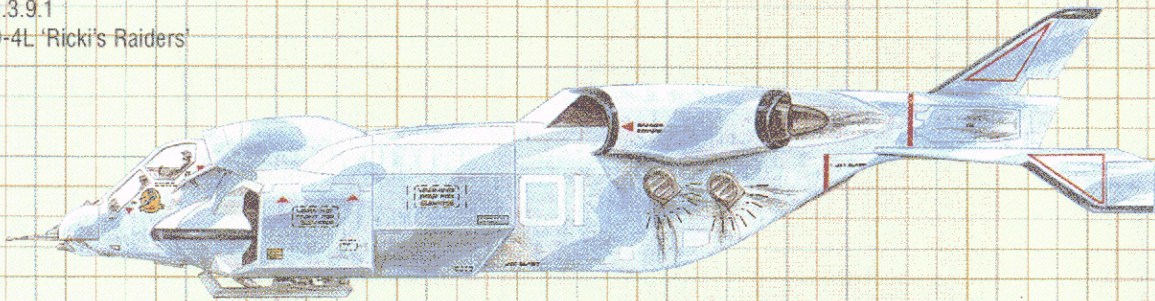
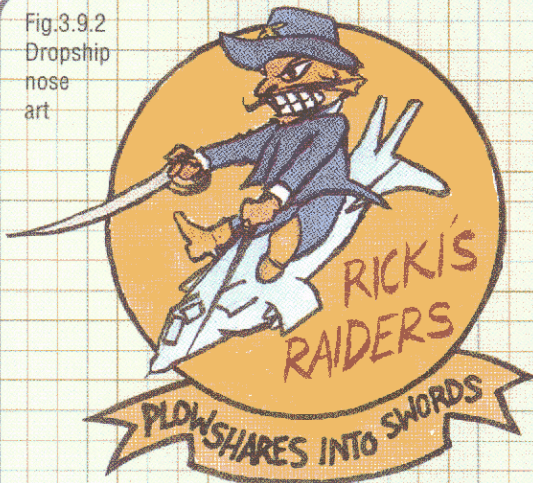
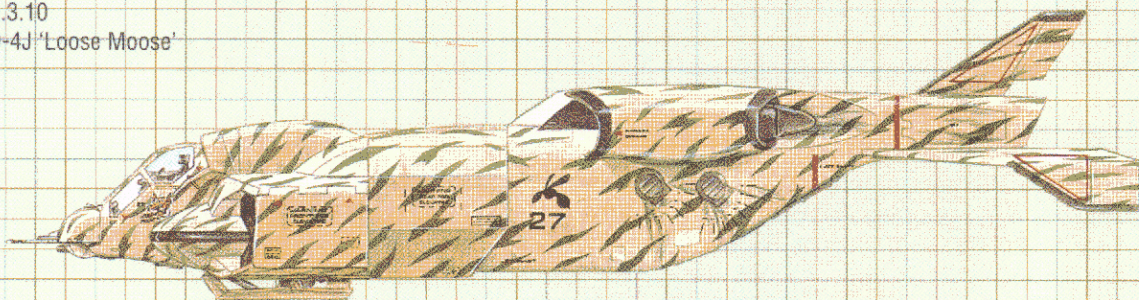


Fig.3.9.2
Dropship
nose
art



Illustrated is UD-4L Cheyenne No.157006/01 Ricki's Raiders attached to DMLA-212, 3rd Colonial Marine Aerospace Wing. This dropship's unit is a Tactical Group squadron primarily assigned to the gunship mission, though it is also expected to perform a wide variety of tasks at short notice, including armed reconnaissance, 'Iron Hand' defense suppression and casualty evacuation. The 'Air Superiority Blue' wrap-round camouflage scheme is a favourite of gunship pilots - the self-styled 'attack pukes' - who prefer to "pound the ground from the sky, not get our feet dirty."

Fig.3.10
UD-4J 'Loose Moose'

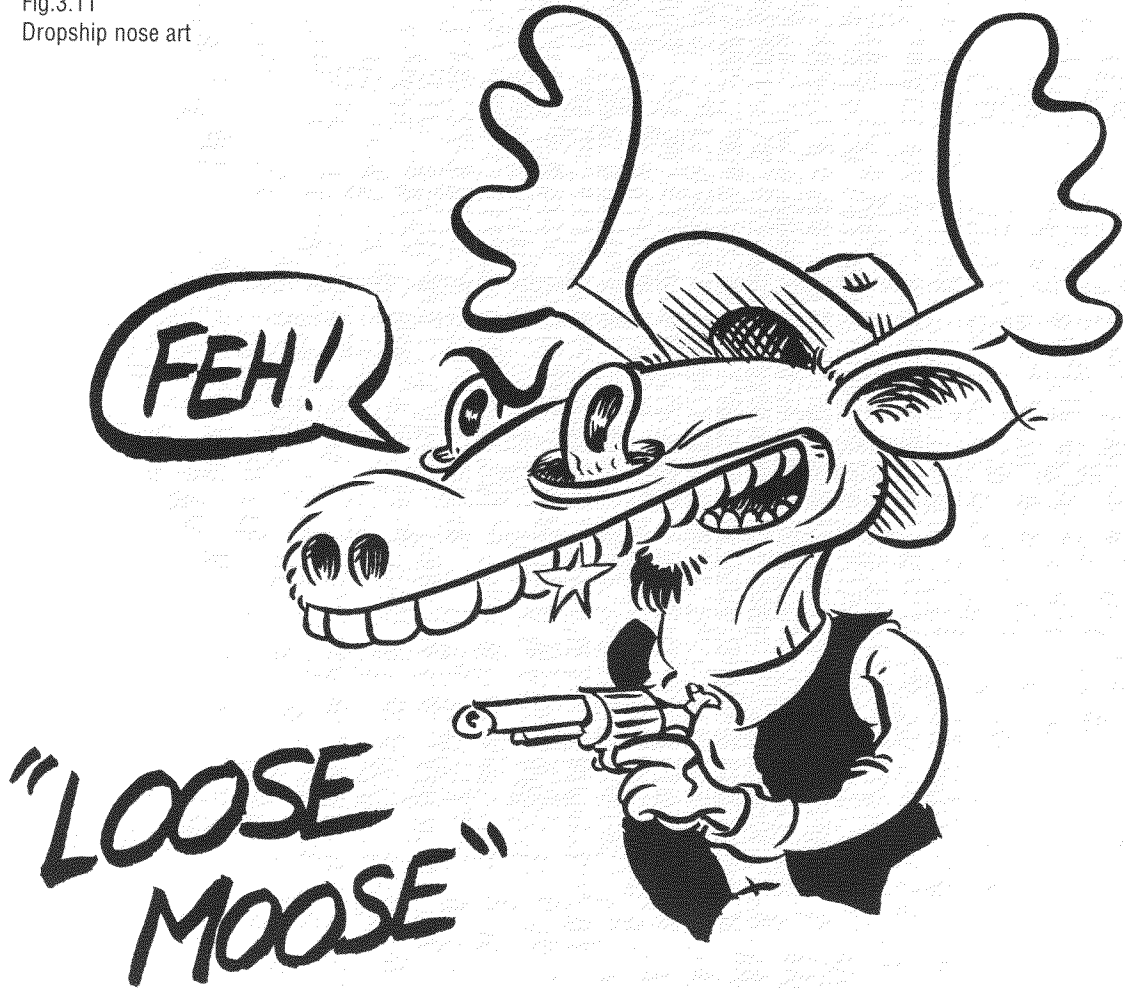




"Christ, the jungle was yellow, vivid yellow! According to the briefing, it was because the local biology was all based on right-handed amino acids. The plants were inedible to us, as well as the Beebops, who were holed up in the reseeded colonies, deep in the interior. Anyway, there we were, sweating our butts off in an LZ surrounded by jungle so alien that it glowed this sick yellow. Then the order comes down from the Colonel: we gotta respray all the line ships the same yellow color. After that, the Battalion was known throughout the Brigade as 'The Flying Bananas'."

- Line Chief Felix Hack, 21st MAU

Fig.3.11
Dropship nose art



Illustrated is UD-4J Cheyenne No.168713/27 Loose Moose attached to the 21st Marine Assault Unit Drop Group, the 'Black Hornets'. The scrappily applied camouflage was a local color scheme adopted during field operations on Helene 215. This particular ship served as an airborne command post during the orbital assault on Shinowa colony during the final phase of the campaign, and later crashed in a non-combat related flying accident. The nose art below the Weapon's Officers position depicts the popular syndicated cartoon character *Moose Harker: Greek Cowboy*.



3.3 DROPSHIP ORDNANCE

LZ Lincoln was ugly as hell; all angry tracer and DEW lines spitting up from the double-canopy. With the APC in the belly, the ship handled like a whale, and the cockpit threat board was strobing bad news. Beaver pumped the pickle button, hurling our precious load of TeeSAMs at the slink radars. I pickled off a Hellhound in 'rover' mode to sniff out some bad guys and then, on my screen, caught the red indicator of a SAM launch in my 3 O'clock. I couldn't help but look and, turning my head, I tallied the tiny flare of a missile motor climbing vertically out of the forest.

Don't think. React.

I punched the decoy launch button with my thumb and pushed the jet nozzles forward. The one thing the ship had no problem with was losing speed. As I watched the ASI sink to less than a hundred, I hauled the nose around and locked up the launch site. The SAM had pulled lead, not expecting me to stop dead in the air, and just couldn't make the intercept. The missile sailed past and exploded behind my tail just as I unloaded a volley of beehive rockets at the treeline. The forest billowed, then shattered into a retreating cloud of leaves and splinters, torn apart by a million tiny darts...

*- excerpt from Long Way Down by Capt. Amanda Mathis, USCM
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The lack of availability of fleet and escort carriers in operations on the outer rim has forced Marine commanders time and again to rely on the workhorse Cheyenne dropship to provide tactical air support to forward units. Over the last ten years, newer, smaller air-launched weapons once reserved for strikeships have been finding their way into the Marine Corps inventory. These now offer the UD-4 even greater flexibility and effectiveness in the gunship role than ever before.

Mk.16 150mm BANSHEE 70

The Banshee 70 system constitutes one of the most important unguided weapons in US service. In the Colonial Marines, it is most commonly associated with the LAU-190/A 16-tube launcher mounted on the UD-4 Cheyenne dropship. Each rocket is spin stabilised by a fluted exhaust nozzle and has three spring-mounted wrap-around fins at the rear. The Mk.16 model has a high-impulse rocket motor, giving a burn-out velocity in excess of 1800 m per second, providing excellent stand-off range and accuracy in the air-to-surface role.

The Mk.16 can carry a useful assortment of warhead types, including the following:

The **M18** is an incendiary warhead intended for target marking and for use against buildings and light fortifications.

The **M451** is a 36 kg High Explosive, blast-fragmentation warhead with a 'smart' fuse for use against a wide variety of targets. The TIAS target analysis system aboard the dropship will set the fuse at the moment of launch according to the target, allowing for airbusts against soft targets or impact fusing against armor.

The **M597** is a multi-dart warhead containing 17 incendiary flechettes designed to penetrate tank armor, field defences and bunkers, and then cause fires within them.

The **M598** is a 'beehive' round for use against battlefield targets such as exposed



personnel, soft vehicles, helicopters and VTOL platforms. The warhead carries a load of approximately 4,800, 7.2 g kinetic-penetrating darts capable of saturating an area the size of a football field. With both the M597 and M598 warheads, the dropship TIAS will set the optimum distribution pattern of the darts at the moment of launch, depending on the primary target.

The **M617**, **M618** and **M680** 'cluster' warheads carry a variety of submunitions including anti-tank, anti-personnel, cratering and incendiary bomblets in different proportions. Loads of up to 98 submunitions in each warhead may be spread across an area up to 1000 m².

Other warheads allow the Mk.16 rocket to deliver smoke, chemical and bacteriological loads against a target.

Mk.10 ZEUS

The Mk.10 ZEUS is a 70 mm unguided rocket system that has been the mainstay of USCM service for some sixty years, in its various forms. A small, spin-stabilised rocket, the ZEUS is now supplied with only two types of warhead: a smart fused anti-personnel fragmenting warhead and a smoke warhead for laying particulate smoke screens.

Mk.88 SGW

The Mk.88 is a 120 mm, short ranged (under 1500m) weapon designed as a low-cost alternative to the Hellhound versus light armor and prepared positions such as sangars or gun emplacements. A simple weapon, it comprises a rocket with a low-impulse motor steered by fold-out fins. Guidance is by an imaging infra-red seeker in the nose, and a 2.2 kg shaped-charge warhead is positioned just behind. The SGW is a fire-and-forget weapon - once locked-up by the dropship, the missile self-guides to the target.

AGM-220C HELLHOUND II

The Hellhound II is a multi-role tactical missile designed for use against point targets such as vehicles, armour, buildings and bunkers. Based around a greatly enlarged version of the Hellhound I airframe, the missile employs a three-stage motor consisting of a launch boost engine, an inflight sustainer motor and a third-stage booster designed to accelerate the weapon during its terminal attack phase. The weapon can be launched in two different modes: in the first, the dropship Weapons Officer locks the missile's seeker onto a target before launch and provided he maintains the lock until the moment of launch, the weapon will then be guided to that target; in the second, the weapon is directed to a grid reference where it then commences a search for a predesignated target, or one selected from an internal menu of potential targets, or for a target of opportunity. The dual-seeker system combines a high-resolution millimeter-wave radar and infrared imager linked to a sophisticated 12 Mb processor which determines the missile's optimal attack profile and warhead fusing to ensure a kill. The 'C' variant of the AGM-220 incorporates a new, jam-resistant radar and improved countermeasures rejection logic to bring it in line with the 'F' version employed by the USASF.

AGM-204A TSAM

The TSAM (Threat Suppression Attack Missile) is a low-cost self-protection

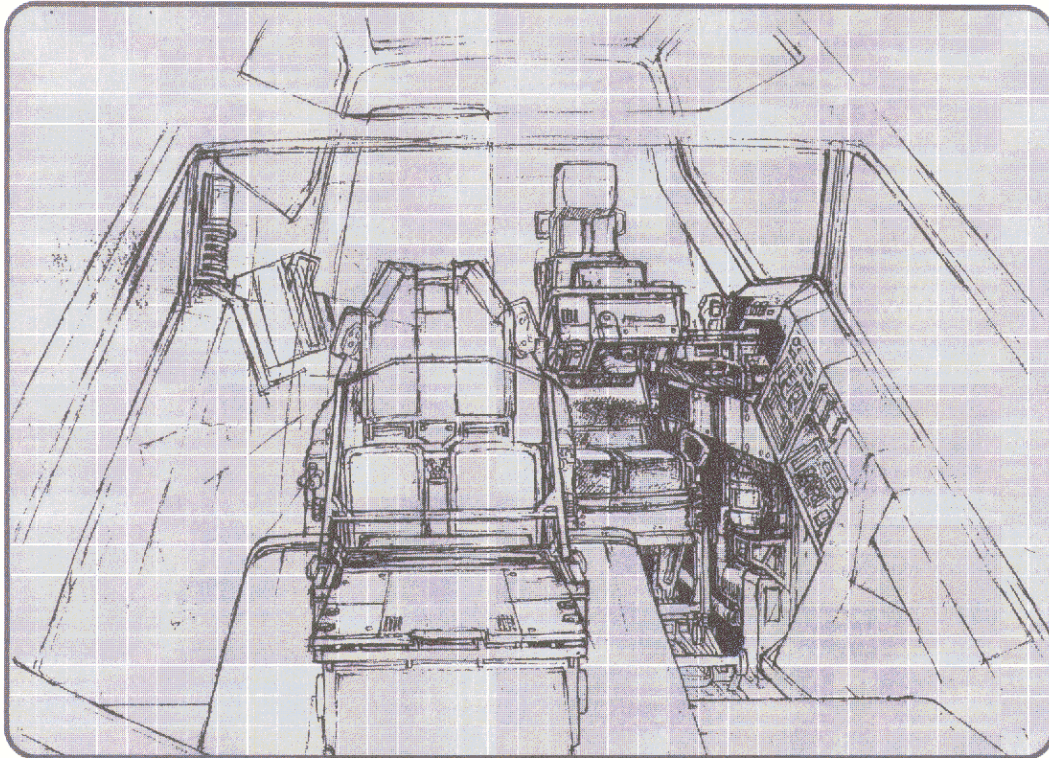
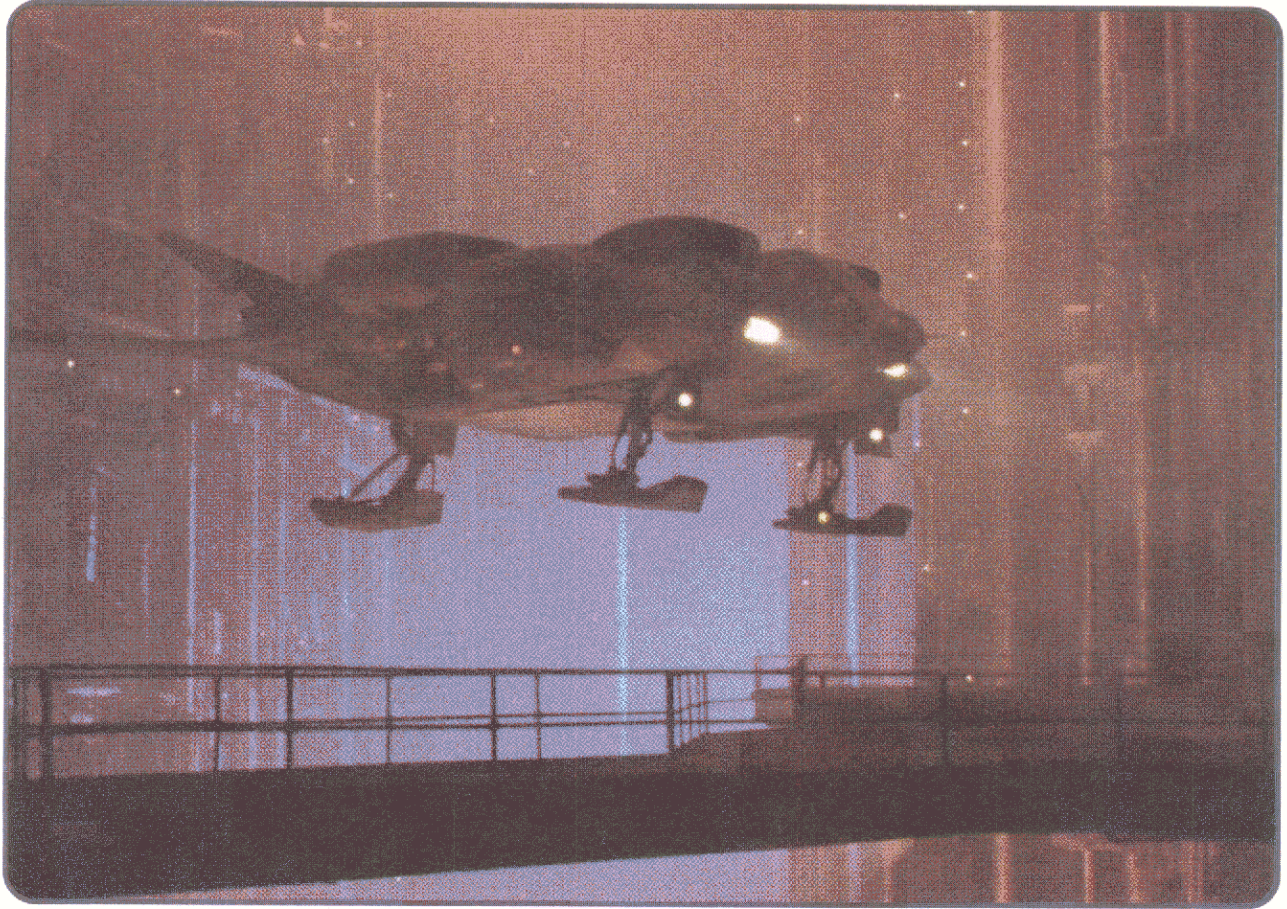


Fig.3.12
Dropship
cockpit



Fig.3.13
Mk.16 150mm BANSHEE 70



Fig.3.14
Mk.10 ZEUS

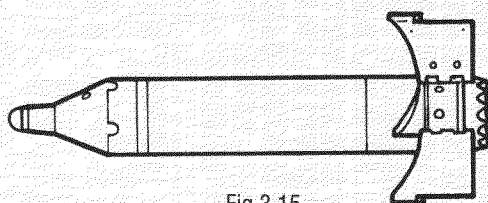


Fig.3.15
Mk.88 SGW

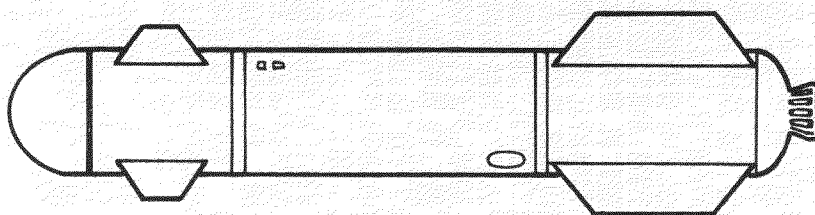


Fig.3.16
AGM-220C HELLHOUND II

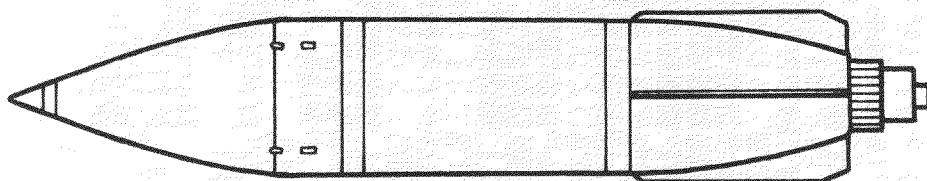


Fig.3.17
AGM-204A TSAM

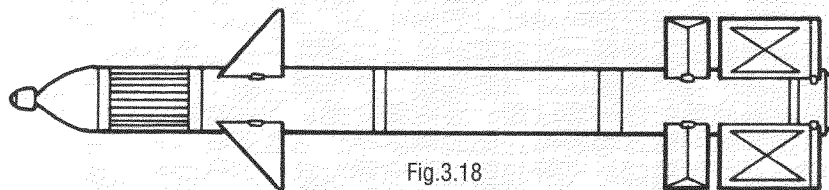


Fig.3.18
AIM-90E HEADLOCK



weapon designed to defend strikeships and dropships against airborne missiles, early warning radars, SAM sites and AAA. Small, short ranged and lightweight, the TSAM design trades off the loiter mode of most modern Threat Suppression Missiles for speed, in order to eliminate a threat rapidly. The Tekell solid motor is a high impulse unit which will accelerate the missile to hypervelocity in less than two seconds; after burnout, the missile coasts to the target. Range varies considerably with launch speed and altitude, though practical limits in an Earth-density atmosphere are 20 km at sea-level up to 60 km at high altitude.

While mounted on its pylon, each weapon is linked to the dropship's ATLIS threat response system, which can automatically launch a missile the moment an enemy radar, missile or guidance laser threat is detected. The missile's passive seeker suite comprises a wide-band superheterodyne receiver cluster with frequency coverage extending from the VHF/UHF to the Millimeter-wave bands. In addition, the outer skin panels of the nosecone are capable of detecting laser energy and determining the direction of the source. The TSAM employs a millimeter-wave radar for terminal homing, which also provides it with a secondary ground-attack capability against non-radiating targets.

AIM-90E HEADLOCK

The AIM-90E is a short-ranged air-to-air missile optimised for dogfight engagements. Guided by a dual optical/active-radar seeker, the Headlock missile accelerates to hypervelocity speeds after launch and then glides the remaining distance to the target. The warhead consists of thirty four explosive darts which are released by the missile as it approaches the target. To ensure a kill, the AIM-90's unique fusing system directs these flechettes into an optimum attack pattern upon release, dependent on the target's current aspect. The 'E' variant of the missile incorporates changes to the countermeasures software and enlarged aerodynamic surfaces to improve lift at high altitudes.

WEAPON SPECIFICATIONS

AGM-204A TSAM

Length: 2316 mm; weight: 303 kg; warhead: 60.6 kg
blast-fragmentation; range: 20-60 km.

AGM-220C HELLHOUND II

Length: 2187 mm; weight: 264 kg; warhead: 107.3 kg
blast-fragmentation; range: 70 km+.

Mk.16 150mm BANSHEE 70

Length: 3455 mm; weight: 70.8 kg with M451 warhead.

AIM-90E HEADLOCK

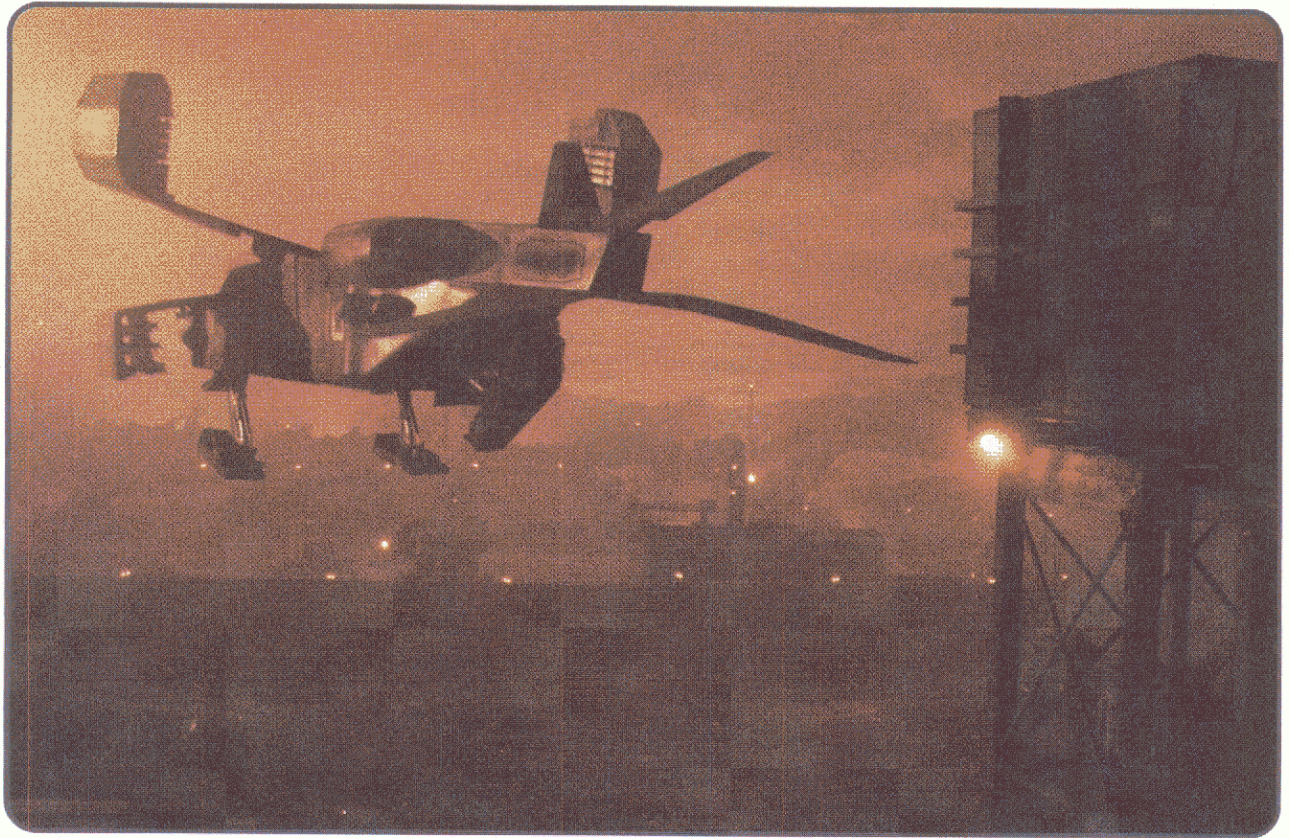
Length: 2630 mm; weight: 95.5 kg; range: 18-24 km.

Mk.10 70mm ZEUS

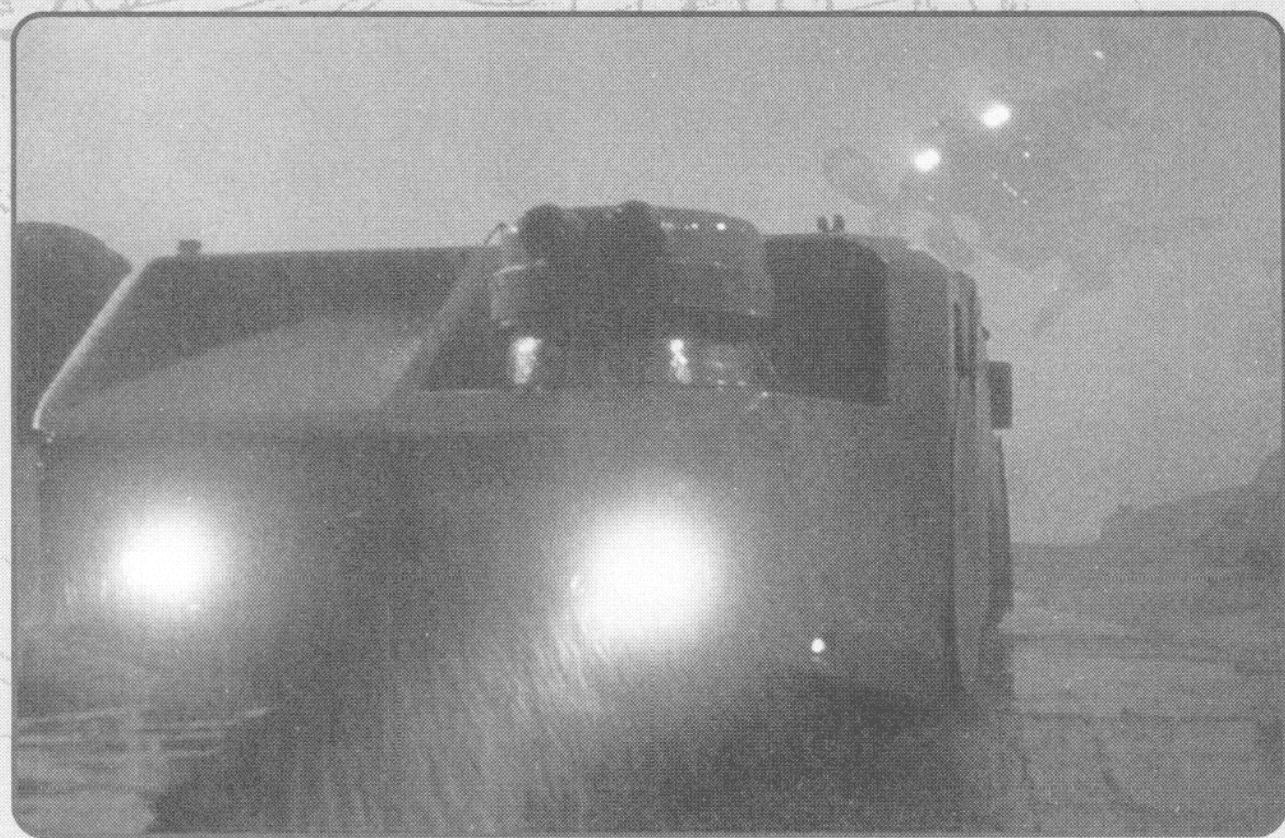
Length: 1640 mm; weight: 15.8 kg.

Mk.88 120mm SGW

Length: 1010 mm; weight: 12.2 kg; range: 1.5 km.







"You know the truth 'bout those new bugs in the Zeta 2 system? See, I got the inside track; my information comes right from the TOP, you dig? Look, lissen up. 'Parrently, some Anglo-Jap company was running an unlicensed research station on this moon, a place called LV426, breeding new bioweapons. They're big bugs - bigger an' meaner than' anything you ever seen, an' they're breeding - gestating them inside human bodies!

"So, Space Command sends in a Marine Assault Unit to shut the place down, and the company men jes' sets the bugs on 'em. Now, I heard these bugs were fast and smart as hell, jus' tore the Marines apart - they didn't know what hit them. Their APCs were ripped open like tincans an' most of the dropships were shredded while still on the ground. The survivors had to nuke the site from orbit. Apparently they left no evidence behind to prosecute the company."

- Cpl Lalla Hirsh, USCM



ALIENS COLONIAL MARINES TECHNICAL MANUAL

HEAVY WEAPONS AND ARMOR

4.0 HEAVY WEAPONS AND ARMOR

4.1 MARINE ASSAULT UNIT TO&E

The building block of the Colonial Marine operating forces is the Marine Assault Unit (MAU), a reinforced battalion combat team designed to operate independently in areas of deep space, far from reinforcement or logistical support. The key to the MAU is its mobility and flexibility; an MAU incorporates its own dedicated starlift capacity, capable of deploying the entire unit swiftly to any trouble-spot planet. This starlift capacity, which varies in size according to the mission, is tasked to supply logistics for a minimum of 30 days of ground combat operations. USASF fleet units are usually attached to the MAU to perform space control, reconnaissance and orbital bombing missions.

The line strength of an MAU is formed from two to four line infantry companies. An aerospace Drop Group and some Attack Group elements accompany the infantry complement. Each line company will usually incorporate support assets which may be attached down to the line platoons, including additional UA-571 remote sentries, M402 multiple-launch fire support mortars, HIMAT anti-tank missiles and the SIM-118 Hornet and LIM-417 Phalanx Surface-to-Air Missile (SAM) systems. If sufficient starlift capacity is available, an armor company of fourteen tanks may be attached to the MAU's line strength.

The MAU is commanded by a headquarters platoon that co-ordinates the command, communication, intelligence and logistics functions of the unit. Attached to headquarters are a number of non-combat sub-units, including a logistics platoon, maintenance company and medical unit. Additional combat sub-units include a reconnaissance platoon, scout-sniper squad, combat engineering platoon and a heavy ordnance company which provides the battalion's heavy fire support and aerospace defense. Command-level support assets include M292 self-propelled artillery guns, M201 multiple launch rockets, HIM-122 Lancer anti-ballistic missile systems and HIM-78 Sprint ground launched space weapons.

4.2 M577 ARMORED PERSONNEL CARRIER

"We came outta that APC spitting sweat and blood. Up ahead we heard screaming as the twenty-mike-mike chopped the bugboys into salad. Sarge screamed 'Split Orange', an' we broke into a four-by-four formation, charging the hill with the smarts in support and the APC on overwatch. The bugboys saw us coming and launched a buzz-bomb. They'd have had us cold if it weren't for the Loot' in the APC - he caught their launch flash and iced the suckers with the peebees before their bomb had even left the tube! S'damndest thing I ever saw!"

- Cpl. Lynda Gerhardt, B Coy. 1/7 Colonial Marine.

The M577 evolved from the Marine 70 battlefield deployment strategy, which proposed a requirement for a low-cost lightweight APC capable of being transported into combat aboard a dropship. Designed as a multi-role vehicle within a lightly-equipped rapid-reaction force, the M577 is mobile and well armed. However, the rigid design restrictions and compromises imposed by the need to be drop-transportable have resulted in a lighter, less capable vehicle than other APCs currently in US service.

CHASSIS AND ARMOR

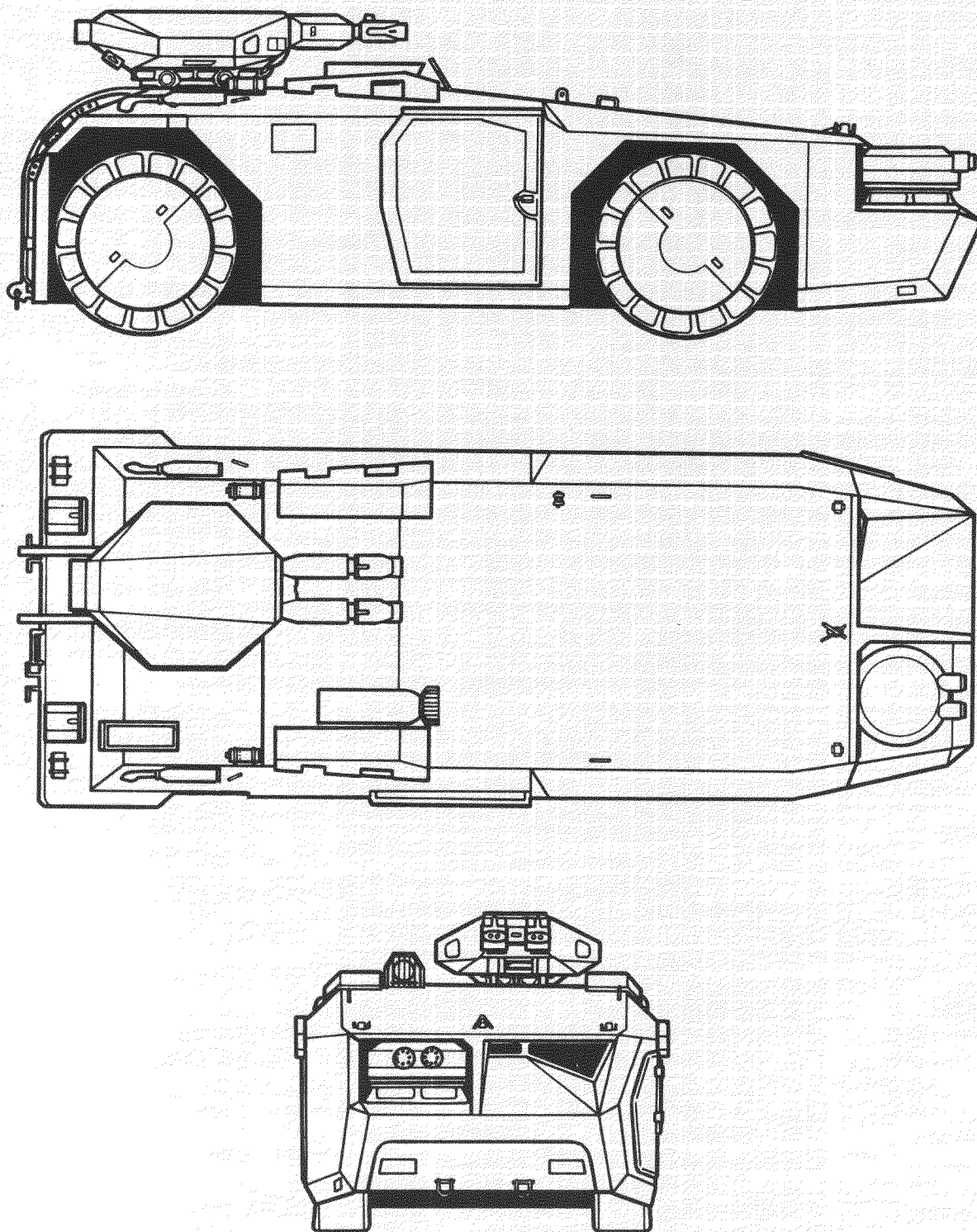


Fig.4.1
M577A3 Three-view diagram



ALIENS COLONIAL MARINES TECHNICAL MANUAL

Because of the USCM requirement that the vehicle's combat weight be kept below 15,000 kg, the M577's components were designed to be as lightweight and sturdy as possible. The chassis chosen for the prototype was based on that of the M570 family of wheeled vehicles which, in the late sixties, was being developed for use in a variety of roles, mainly as a prime mover and mortar platform. The APC is built around a 4 x 4 wheeled layout, powered by a 286 kW multi-fuel gas turbine engine which generates a power-to-weight ratio in the region of 19.7 kW/kN. Although the wheeled configuration does not give as rugged a cross country performance as a tracked vehicle, it does offer considerable savings in terms of weight penalties and reliability. Each of the massive 159 cm diameter wheels receives power independently from the engine via a fully automatic, electronically-controlled transmission system. The tires are armored against small-arms and splinter, and their pressure is controlled by a central regulation system. This allows the driver to reduce the vehicle's ground pressure over soft terrain by deflating the tires, whilst still being able to reinflate them for road travel.

The M577's chassis is made of bonded titanium and incorporates a 5 cm foam-packed floor cavity to protect against forged-fragment mines. Ground clearance is normally only 22 cm, but the vehicle employs a hydro-pneumatic, fully active suspension to allow a clean ride over rough terrain. The suspension is capable of boosting ground clearance by a full 30 cm and allows the M577 to comfortably tackle vertical obstacles up to 0.5 m. The hull is made from welded light alloys and is latched and bonded (rather than welded) to the chassis in order to prevent fatigue and failure from the piezo-electric effects associated with an alloy-titanium interface. The inside of the hull is lined with boron carbide ceramic tiles, each of which has been coated with a polymer resin to prevent cracks or shattering during normal travel; this resin is 2 mm thick on the outward-facing surface of the tile and is said to provide limited ablative protection against pulsed lasers. The tiles are backed with a thick layer of woven fire resistant polymer armor to limit spalling in the event of a hull penetration. Because of weight restrictions, the armor protection is very light. It is capable of defeating fragmentation, small arm rounds and low-velocity armor penetrating ammunition such as rifle grenades; however, its ability to stop dedicated tank-killing weaponry is slight.

CREW AND PASSENGERS

The M577 is operated by two crew (the driver and section commander) and allows twelve positions for passengers, all equipped with yoke harness restraints for orbital combat drop. Entry is via the main starboard side door or port side driver's hatch. The interior is surprisingly spacious, allowing plenty of room for weapons and supply stowage. The Marine 70 requirement called for the ability to carry sufficient ammunition and supplies for up to three days of fighting; in practice this is possible, though the interior of the vehicle becomes somewhat cramped. In tactical areas where re-supply is frequent, no more than two days of supplies and ammunition are usually carried. The rear of the crew compartment houses the Tactical Operations Center; from here the section commander can maintain contact with the vehicle's infantry complement via video and audio linkup, and monitor the battle in real-time via the battle management displays.

SENSORS

The driver's view is limited to a forward window of quartz armored crystal, though this is supplemented by periscope ports providing vision to the sides and forward quarters. Multi-function screens by the driver's and section commander's



positions present a sensor-fusion display of the tactical zone around the APC. The sensors can be activated by the driver, or from the Tactical Operations Center by the section commander. A sensor cluster is mounted with the main searchlight and can be played across a 270 degree zone in front of and around the APC. The cluster comprises a turreted thermal imager, TV optics with magnification from x4 to x20, a UV detector and an ultrasonic motion tracker. Millimeter-wave targeting radars mounted in the forward gun cupola and the main turret can track targets acquired by the main sensors, or may alternatively use their own ground-mapping and search functions to acquire targets. The effective tracking range of these radars against man-sized targets is approximately 3,000m in open terrain. The sensors are supplemented by a forward mounted white-light and infrared searchlight for the active illumination of targets.

STEALTH AND DEFENSIVE SYSTEMS

The slab-sided shape of the APC hull provides for a high radar cross-section on the battlefield. An attempt has been made to reduce this by incorporating radar absorbent materials into the hull skinning, with only partial success. Hull paints are laser absorbent to protect against lidar, and the M577 boasts an infrared camouflage feature in which cooling elements are arranged in patches and stripes beneath the skin to break up the IR signature of the vehicle.

Active defenses for the APC consists of a chaff/flare decoy dispenser mounted to the rear of the vehicle, and a fire control jammer capable of spoofing millimeter-wave tracking radars (available power for this system is limited). The decoy dispenser, which is supplied by a multi-cartridge rotary feed is also capable of releasing particulate smoke as a barrier against ranging or pulsed lasers. These defenses are automatically deployed if activated by the driver or vehicle commander.

"We have this big red button in the TOC labelled 'ECM'. If we tag any incoming we're supposed to slap the button and fire off the flares, chaff and jammers to save our butts. The word on the line is that the system gives you a fighting chance against infrared seeking weapons, but no chance at all against radar homers. One of those puppies catches you, you're toast!"

- Staff Sergeant Billy 'The Ball' Arter, USCM

WEAPONS SYSTEMS

The M577 carries a formidable array of weaponry in support of its infantry complement. A hull mounted cupola covering the APC's forward area carries two synchronised Republic Electric RE700 20mm gatling cannon. Both weapons are supplied by a 1700 round multi-feed ammunition dispenser which offers a selection of High Explosive, High Explosive Armor Piercing and 'Beehive' type Anti-Personnel Fletchette (APF) rounds at the flick of a switch. These caseless rounds carry no propellant and are fed mechanically into the revolving chambers which are then sprayed with hypergolic binary propellants which ignite and launch the round. Binary propellant systems are rare at this caliber (the only other such system in Colonial Marine service is the 25 mm GAU/113 aboard the UD-4 dropship), but aboard the M577 this system offers substantial weight, rate-of-fire and reliability advantages over a standard caseless weapon and provides effective anti-personnel support for the APC. The only drawback of the weapon is that it is mounted to cover only the vehicle's forward arc, traversing between 60

degrees left and right of axis, and cannot be fired from a hull-down position.

The M577's main weapon system is turret mounted, allowing the APC to fire from the safety of a hull-down position. The turret assembly is fully traversable, self contained (including ammunition and power supply) and is carried on a rail track which runs down to the rear of the vehicle. Geared electric motors run the turret along the track and allow it to be depressed to the APC's rear, reducing the vehicle's headroom so that it may be carried inside a shuttle or dropship payload bay. The weapons are stabilised within the turret for firing while on the move and can be elevated and depressed between +85 and -7 degrees. Hydraulic rams on either side of the turret can tilt it up to 15 degrees in all axes to provide additional elevation or maintain a level firing platform for the weapons. Target acquisition and weapons control are controlled by the section commander from the Tactical Operations Center; however, independantly targetting automation systems can handle these functions, so reducing the commander's workload.

"Whoever designed the turret should have their head examined. When we first got the M577, there were no splashguards on the rear wheels or gun barrels. Some guys under my command took a company out for an off-road spin with their turrets stowed, and by the time they got back all the barrels were clogged with mud sprayed up from the rear tires. I'm crapping you negative; it took two months of yelling at the Marine Command in Houston to get a fix for that one."

- Brigadier General Teresa Jayes, 1st Colonial Marine Brigade

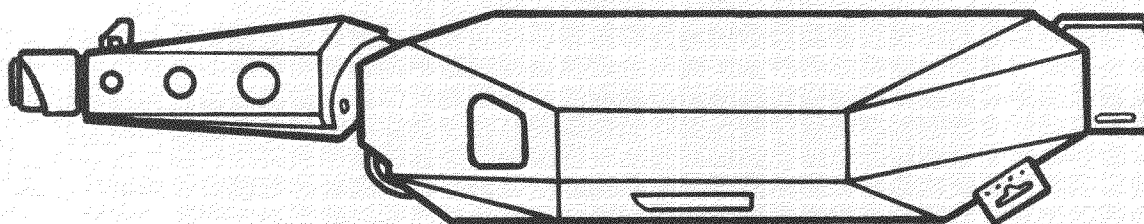


Fig.4.2
M577 A Turret

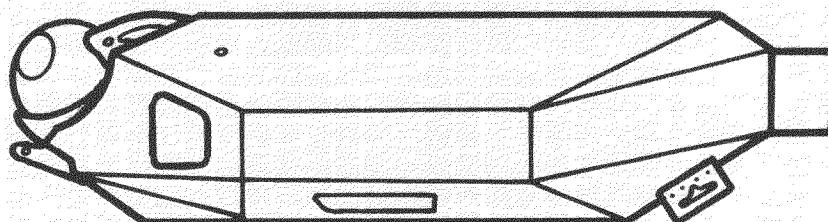


Fig.4.3
M577 A2 Turret



There are three different main weapons currently in service:

The initial production **M577A** mounts two 20 mW Boyars PARS 150 phased plasma cannon. The power source is a 6 mW hydrogen fuel cell capable of powering 3,000 firings before refuelling. The fuel cell drives a homopolar fast-discharge generator which stores power until it has sufficient energy to pulse the plasma gun's laser. When the laser is fired, it creates an ionized trail in the atmosphere which is charged by the gun's electromagnetic coil to form a solenoidal magnetic tunnel. The ammunition - Cadmium Telluride pellets of around five grams mass - is fed mechanically into the tunnel, where it is vaporized by the laser beam into a superheated plasma, which is accelerated by the magnetic coil to velocities in the region of 5,000 m/s. The plasma travels the tunnel until it impacts the target at a focussed point, using its considerable kinetic and thermal energy for maximum effect penetration. Because of the power usage, both guns fire in sequence rather than simultaneously; thus, cyclic rate of fire (allowing for adequate cooling between shots) is 40 rpm. Each gun carries up to 1000 rounds of ammunition. Maximum effective range is dependent upon the ambient atmospherics, but in ideal conditions can be up to 4,000 m.

The variant **M577A2** mounts two Republic Dynamics M2025 40 mW free-electron lasers in the 2.0 - 3.0 micron range, which are effective against both ground and air targets. Beam power is supplied by a 10 mW hydrogen fuel cell driving a homopolar fast-discharge generator. The beam is propagated, without the need for lasants, by the interaction of a particle-accelerated electron beam with a static electric field. The advantage of a free-electron laser in Colonial Marine service is its ability to be tuned to wavelengths that would minimize beam degradation by the local atmosphere. In addition, a reactive tune facility, cued by laser returns from the beam, is incorporated to allow rapid retuning in the event that counter-measures (such as smoke or steam) are deployed to block the beam. The lasers can be used in two modes. In 'dazzle' mode, the beam is used to burn out enemy optical/infrared sensors or blind infantrymen and pilots, has a low output (20 kW - 50 kW). It is in this mode that the beam is at its most efficient, playing continuously across a target without need for pulsing or the associated effects on beam propagation from thermal blooming, ionization or dielectric breakdown. In 'pulse' mode, a beam is pulsed at full power at the target. Damage is caused by the mechanical impulse of the beam as it superheats the target area, and in the case of the M2025 is capable of penetrating infantry personal armor or the skin of a missile or aerospace craft. Range and effectiveness in pulse mode is entirely dependent on the ambient atmospheric conditions, but in ideal conditions, the weapon has an effective range against aerospace craft of up to 3,000 m.

"Yeah, right. What are these 'ideal conditions'? I never get to see them. If the weather is even slightly crappy the beam is screwed. As a rule of thumb I never pulse at anything over a thousand meters 'cause of atmospheric scattering - that and the giveaway DEW line [Directed Energy Weapon trail caused by ionization and thermal blooming]."

- Sgt. Dom 'Happy' Lance, 5th Reserve Colonial Marine Brigade

The most recent version, the **M577A3**, mounts two 20 MeV turboalternator powered charged particle beam cannon. The deployment of these weapons has been made possible due to the introduction of a Martin-Continental micro magnetohydrodynamic turbine capable of generating 20 mW of electrical power to run the big particle accelerator guns. Sufficient turbine fuel exists to power the guns for 50 seconds firing and there is some 300 kg of deuterium tankage to provide particle beam mass. The effective range of the weapons against light armored targets is approximately 3,000 m, though at longer ranges the beams are capable of disrupting unshielded electronics.



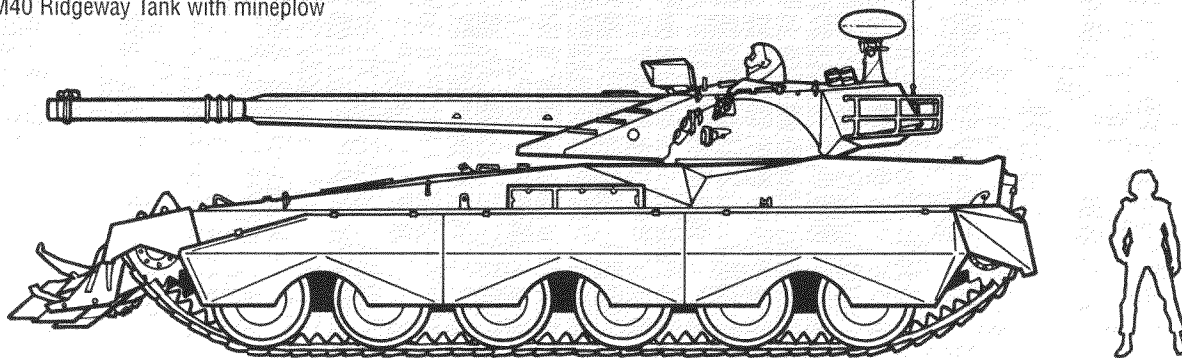
M577 SPECIFICATIONS

Crew:	2 plus 12
Engines:	Arco Continental R-370 Gas Turbine with an output of 286 Kw
Dimensions:	Height (turret stowed) 2.17 m Height (turret raised) 2.81 m Length (turret stowed) 9.22 m Length (turret raised) 8.58 m Width 3.38 m Wheel diameter 158.75 cm Clearance (at rest) 21.59 cm
Armor:	2mm alloy outer skin; 4 mm Boron Carbide plates coated with 2 mm ablative resin; plates backed by a 3 mm woven Venlar liner. Foam packed floor cavity for protection against forged fragment mines.
Combat Weight:	14,500 kg
Road Speed:	150 km/h
Acceleration:	42 km/h in six seconds
Vertical Obstacle:	0.5 m
Gradient:	60%

4.3 COLONIAL MARINE ARMOR

The deployment of Colonial Marine Armor assets is limited by the availability of heavy starlift capability to transport both the tanks and their considerable logistic and service support. For this reason, the six tank battalions of the Colonial Marines rely heavily on medium and light armor such as the **M22A3 Jackson** medium tank and the **M34A2 Longstreet** light tank. One battalion, the 2nd (attached to the 1st Colonial Marine Division) has recently been upgraded with the **M40 Ridgway** heavy tank, which has previously only seen service in the US Army. The current intention is to furnish at least two more battalions with the M40 before making a decision about finally phasing out the M22.

Fig.4.4
M40 Ridgway Tank with mineplow





"There we were on the Kael line in our M22 dinosaurs, and in the unit next door the Army guys were bitching about the missile detection/interception systems, the jamming and decoy systems and the 3D tactical suites in their M40s. We had nothing like they had, and what we had was old and kept breaking down. They had tanks so stealthy they were invisible from nine paces; our stealth was a decade out of date. With all the Third World-supplied detection gear the B-boys were packing in the Trobriands and around Parrot's Beak, they could see us coming a continent away."

- Staff Sgt. Robin Miskolczy, 3rd Colonial Marine Tank Battalion, Linna 349

Armor in the Colonial Marines has retained the traditional infantry support role. Tanks are still the best way to deliver direct artillery fire quickly and accurately against enemy strongpoints and, of course, other tanks. The new M40 particularly demonstrates the continuing value of heavy armor on the modern battlefield, with its ability to fire 115 mm shells at a rate of 60 rpm, deliver particulate barrier smoke, scatterable mines and support fire from its integral 60mm mortars and defend against aerospace craft and incoming missiles with its 20 kW phased plasma point defense gun.

"The Ridge' is a scary tank. Its got stealth, mobility, firepower and point defenses better'n anything we had on the M22. What's so neat is the way the automatics handle the workload - you'd think you need at least three crew to run all this crap, but in fact you can do it with the same two girls you had in the Jackson. The only problem we had in our battalion was running the panzers in after they were delivered, factory fresh - you need to fire the guns a lot and run all the equipment a number of times before the sensors and weapons settle down and fully integrate."

- Capt. Andrea Mae Samona, 2nd Colonial Marine Tank Battalion

Aside from the impressive firepower of modern tanks, their psychological value and their ability to shock even a prepared opponent, is still readily apparent.

"I tell you, I damn near filled my pants; as we ran up that road there were buzzbombs and shit popping off all around us. The bugboys had ambushed us from the low, thorny alien Karyta that lined both sides of Highway Two on the straight stretch up to Suivre. The rear panzer - Harrow's number forty-one - brewed up and Russell's number thirty was immobilized by a track hit before we could shoot off any decoys. I immediately ordered the company off the road and we charged into the Karyta, firing APF [Anti-Personnel Flechette rounds] at point blank and spraying the area with the flamethrowers. At the sight of us coming, the B-Boys cut and run, abandoning all the new anti-tank equipment they'd bought from the Brits and Japs. Those assholes that stayed we ran over or toasted.

"That night, we argued over the bodycount. Sergeant Bulow insisted we'd got nine of theirs for the loss of one panzer crew and another injured. But I pointed out that the fire control trench Murae had run over had been too badly smooshed to count properly. Judging from the mess left behind there could have been three or four people in there together, or just one spread over a wide area. Since the skin and bone was mangled into mush, there was no way to tell. PFC Herbick suggested we go back and see how many teeth we could dig out, but I passed on that one. Against the Sergeant's objections, I had to count the trench as a single enemy casualty..."

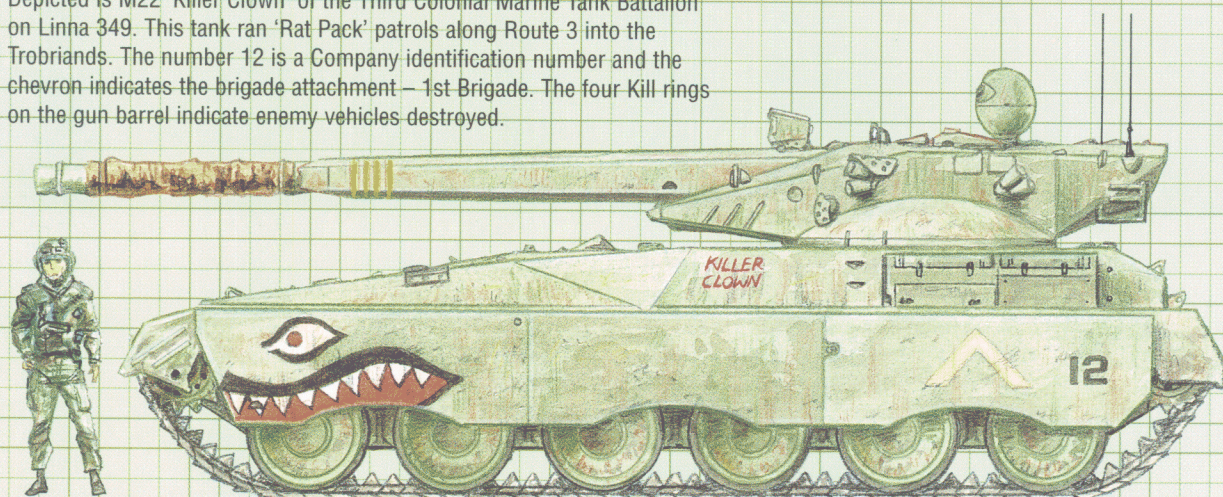
- Captain Hayward J. Lay, Jr., 3rd Colonial Marine Tank Battalion, Linna 349



Fig.4.5

M22 Jackson Tank

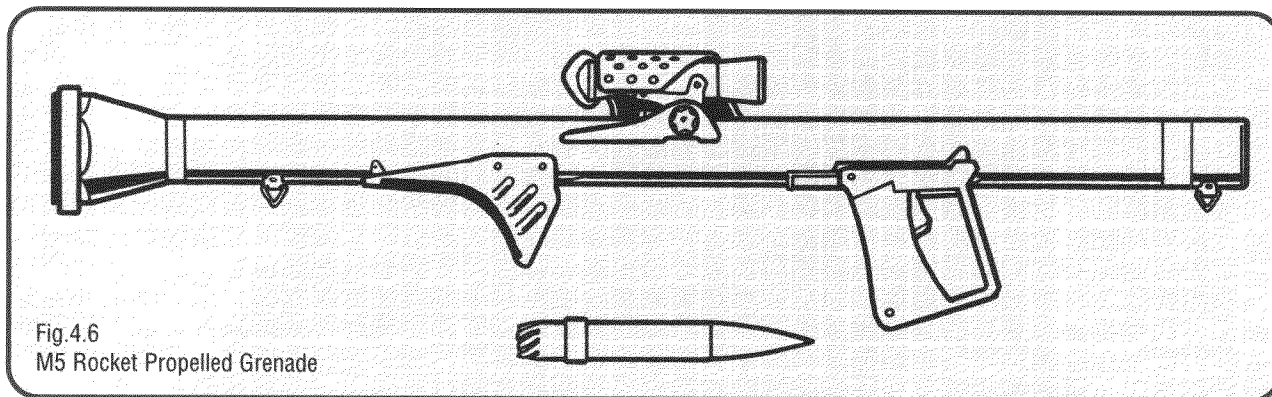
Depicted is M22 'Killer Clown' of the Third Colonial Marine Tank Battalion on Linna 349. This tank ran 'Rat Pack' patrols along Route 3 into the Trobriands. The number 12 is a Company identification number and the chevron indicates the brigade attachment – 1st Brigade. The four Kill rings on the gun barrel indicate enemy vehicles destroyed.



Colonial Marine aerospace/ground teams train in cooperation with the armor units on a regular basis, though there is still opposition to fully integrating heavy armor into the teams. Partly, this is because of the current lack of a heavy dropship capable of carrying a tank into battle; this will be rectified when the production UD-24, with its projected 70,000 kg lift capacity, achieves service in the early 'eighties. Also, it is because of new models and concepts being proposed by the Colonial Marine Tactical Studies School which advocate a reversal of Marine 70 'flexible' armored doctrine in favor of employing dedicated tank-led ground teams. In the tank-led team, the armor is grouped *en masse* with mechanized and airborne infantry in support, rather than the current practice of parcelling out armor piecemeal on an *ad hoc* basis. However, proponents of this scheme wish to see a radical increase in Marine armor capability once the UD-24 is in service before proper integration with the aero/ground teams can take place.

4.4 INFANTRY ANTI-ARMOR SYSTEMS

M5 ROCKET PROPELLED GRENADE



The M5 rocket propelled grenade system is a small reloadable shoulder-launched weapon. The launcher consists of a 140 cm steel alloy tube weighing 2.3 kg, with a rear backblast vent incorporating backblast diffusers, trigger mechanism and 4x power telescopic sight. Each 2.2 kg round is a 60 mm hypervelocity spin-stabilised rocket with an impact-fused supercritical HEAT warhead. The rounds are carried separately and handloaded into the launch tube. Sighted visually, the system has an accurate range of approximately 400 m and a maximum range of around 2,000 m. Though the rocket's warhead has little chance against medium and heavy tank armor, it has proven popular and effective for use in its secondary role against infantry in bunkers and building strongpoints.

"The RPG is a sound weapon. The backblast diffusers make it kick some when you fire, but the launch flash is negligible and it creates a satisfying bang when it hits. Low-tech it may be, but in my opinion it's far more useful than, say, the PIG..."

- PFC Mike Fisher, 1/16 Colonial Marine

M78 PHASED PLASMA INFANTRY GUN (PIG)

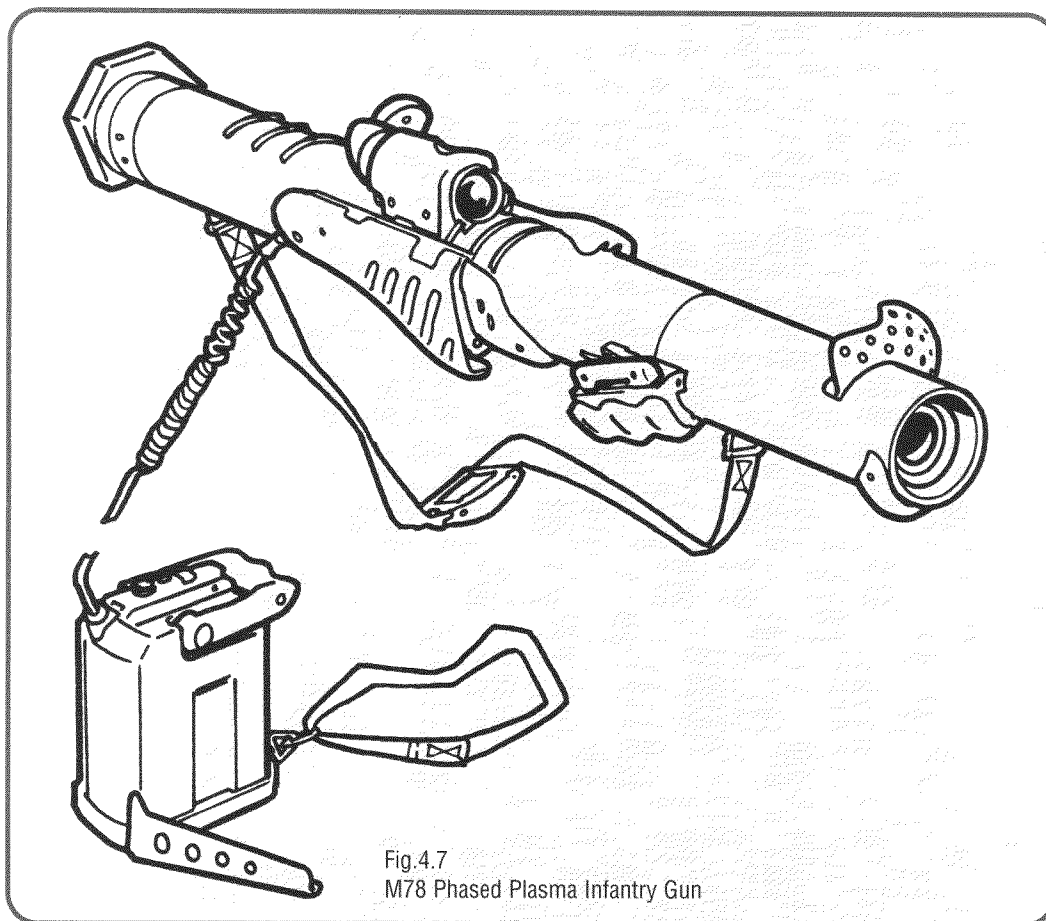
"Meet mah friend PIG. He's big an' fat an' a bitch to carry, an' he don' look like much y'know. But 'f I point him at yo' an' pull this trigger, then he'll blow a hole through yo' big 'nuff to drive a panzer thru'. No use hiding in an APC either; Mister PIG say 'snuff' an' your armored baby carriage suddenly acquire some new air conditioning, stak? So, say 'hello' to Mister PIG befo' he get upset. Oink, oink."

- PFC Jonjo 'Grifs' Torne, 2/16 Colonial Marine, Kuat

The M78 PIG (Phased-plasma Infantry Gun) is a man-portable anti-armor weapon. Weighing 15.2 kg in its entirety, the PIG consists of two parts: the gun and its power pack. The M78 is a 15 mW phased plasma system firing vaporized Cadmium Telluride pellets from a 30 round feed. The fast-discharge system powering the gun's laser and magnetic coil is fed from a 4 mW hydrogen fuel cell in the power pack. The firing cycle takes 3 seconds, most of which time is taken up by the powering up of the discharge generator. The penetrating power of the system is



considerable, and it is claimed to be able to breach the flank armor of a heavy tank at 1,000 m.



M83A2 SADAR

The M83A2 SADAR (Shoulder-launched Active-homing Disposable Anti-tank Rocket) is a lightweight one-shot anti-armor weapon capable of engaging enemy vehicles at ranges up to 1,000 m. Fully disposable, the rocket's launcher is discarded after firing, whilst the rocket, a fire-and-forget weapon, guides itself toward the target. When stowed, the SADAR system consists of a watertight carbon-fiber composite blast tube, inside of which is an aluminum launch tube containing the missile and guidance electronics. The weapon is cocked by unlatching the forward ring of the blast tube and pulling the inner launch tube forwards until it locks. A trigger assembly and thermal acquisition sight are then flipped into position, and the weapon activated by pushing a charge button on the trigger grip. From this point the weapon can be sighted and fired from the shoulder.

The M83 acquires and tracks targets with a cooled infrared imaging seeker mounted in the rocket's nose. When the charge button is pressed, the inert IR seeker is cooled to its operating temperature within two seconds and begins feeding images to the operator's thermal acquisition sight. The seeker remains charged for twenty minutes, after which the rocket may only be fired unguided. When a target (such as a vehicle) enters the acquisition sight, the operator can lock the seeker onto the target. So long as the target image remains clearly within the seeker's field of view, the weapon can be launched at it.

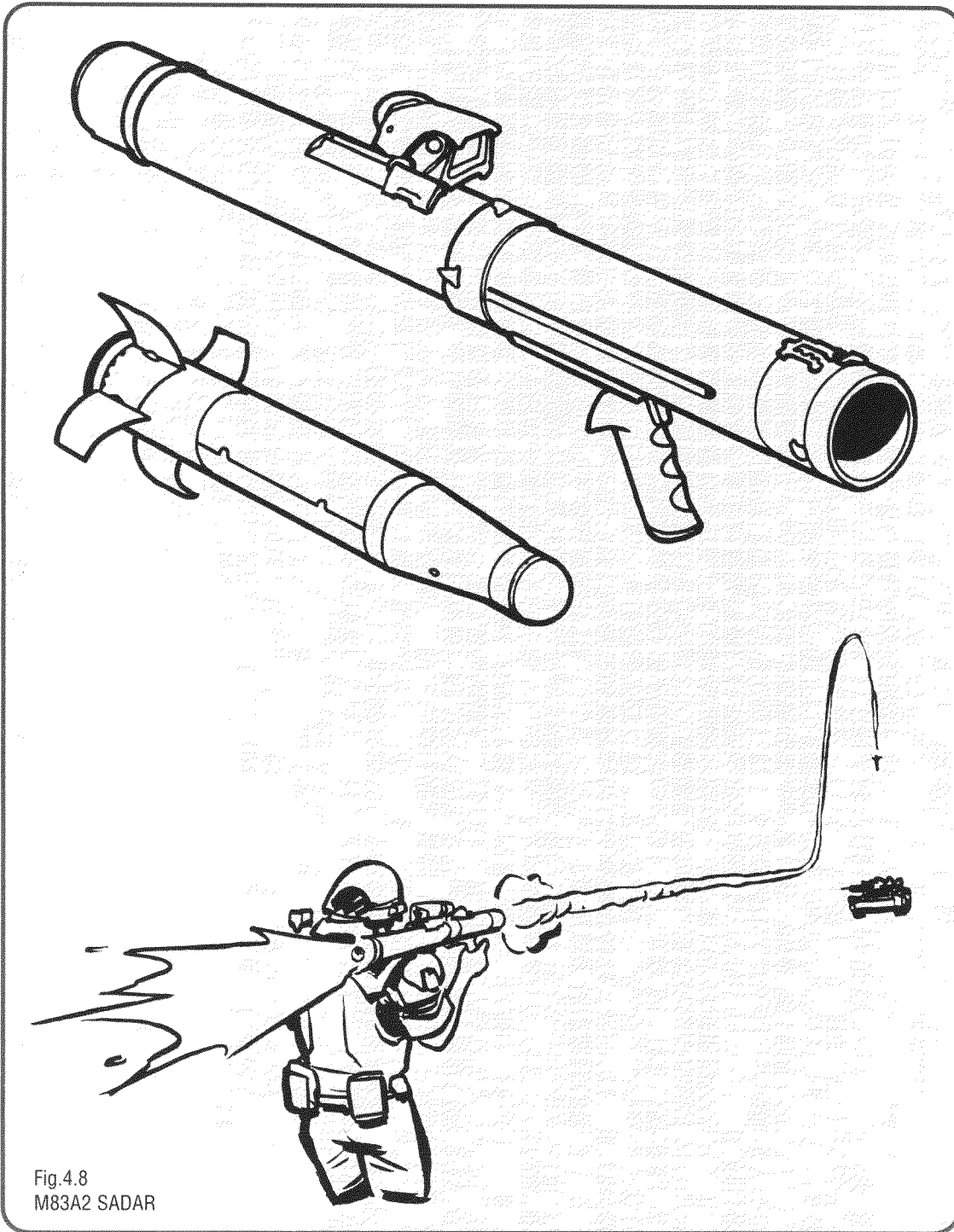


Fig.4.8
M83A2 SADR

"The old 'A1' model M83 was a bitch to use. If the target was throwing out decoys or was partially obscured by vegetation, the damn thing would refuse to lock. By comparison, the new 'A2' is a dream; you get a positive lock indication every time. Now, if only they'd improve the warhead..."

- Cpl. Spad McLoughlin, USCM

When launched, the SADAR rocket accelerates to maximum velocity. As the rocket approaches the target, the guidance system selects the hottest part of the target (on a tank, usually the weakly protected engine deck) and flies an attack profile that offers optimum penetration. Against a tank, it will typically climb briefly before diving on the target's thinner upper surfaces. The M83A2 version is capable of identifying defensive countermeasures such as decoy flares and has improved logic to aid in rejecting them. The shaped-charge HEAT warhead is capable of defeating most light and medium armor.

Since SADAR is an open-chambered weapon, operators must allow for backblast. The rear of the blast tube is packed with small plastic slivers which fire backward on launch of the rocket and absorb much of the backblast. A cleared backblast zone of 10 meters behind the weapon is recommended, and care should be taken in launching the rocket from confined spaces.

SADAR may be fired unguided like an RPG, using a backup reticle sight to aim. This is commonly done in the field against objects like bunkers, pillboxes, crew-served weapons, supply dumps and communications centers - all of which do not give off a characteristic thermal signature. Though the rocket still has a maximum range of about 1,000 m against these targets, unguided aiming is not accurate beyond 200 m.

M83A2 SPECIFICATION

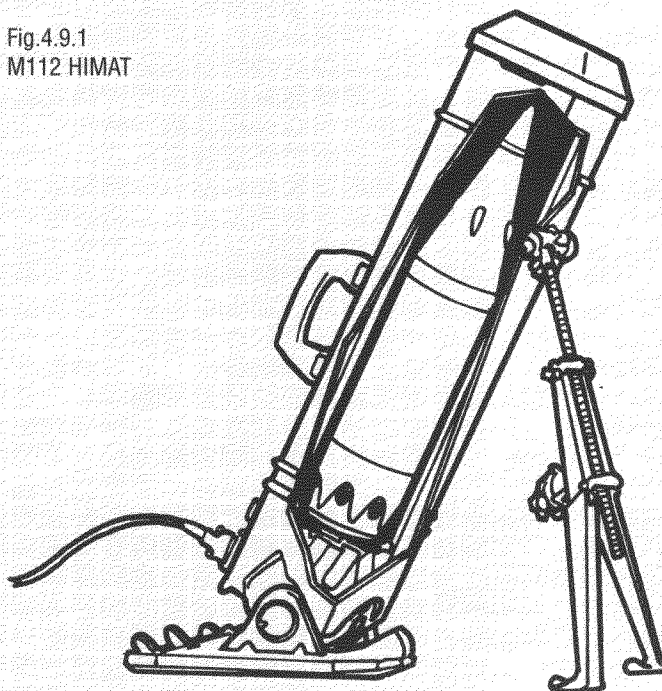
Length (closed)	64 cm
Length (firing position)	90 cm
Weight	3.1 kg
Minimum Range	20 m
Maximum Range	1,000 m

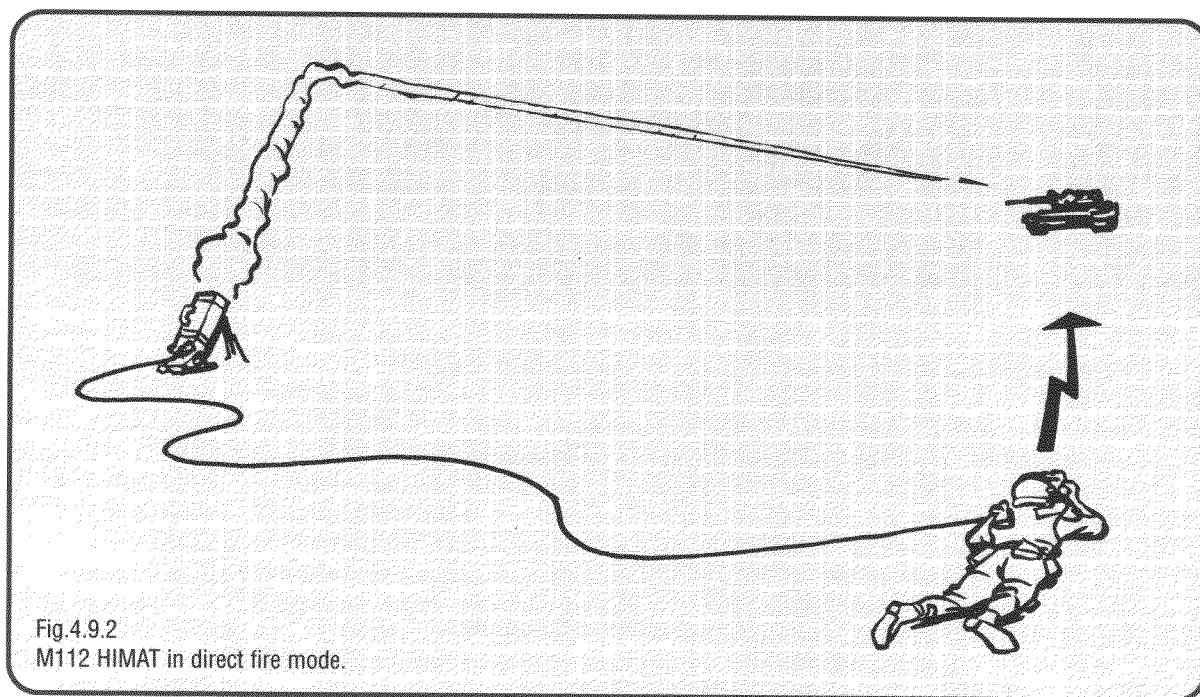
M112 HIMAT

The M112 HIMAT (Hypervelocity Intelligent Missile, Anti-Tank) is a man-portable battlefield 'brilliant' weapon with a range of over 5,000 m. The versatility of the system allows the field commander many options for its deployment and use.

The core element of the system is a 11.3 kg single-round self-contained disposable launcher, which comes with its own bipod stand and baseplate. The launcher is a carbon-fiber composite tube containing the HIMAT round and RTM ports for the fire control system. The bipod can be set to launch the round horizontally or at increasing angles up until the vertical, depending on deployment.

Fig.4.9.1
M112 HIMAT





FIRE CONTROL - DEFENSIVE DEPLOYMENT

Fire control for the M112 varies according to mission. For defensive deployment, the system can be set for either 'Command' or 'Autonomous' configurations. In both cases, one or more launchers are connected by cable to an APS-100 Fire Controller, an 800 Gb intelligent system which imports data from the local sensor matrix, including motion trackers, infrared scanners, lidar, radar and robot sentries. It is also possible to datalink the Fire Control unit into higher-level assets such as surveillance drones or artillery Forward Observers. The APS-100 unit analyses the sensor data, and if it positively identifies a target it will lock-on with one or more missiles under its command and prepare to launch.

If set to Command mode, the APS-100 is connected to the terminal of an operator who constantly monitors the Anti-Tank defense plan for the area. If a target is identified, the system will flash a 'Target Lock' indicator to the operator who can authorise a weapons launch or, if the exact identity of the target is unsure, a further IFF interrogation. If enabled for Autonomous mode, the APS-100 will work through its target identification protocols until it is sure it has lock-on to an enemy and then automatically launches one or more missiles.

FIRE CONTROL - OFFENSIVE DEPLOYMENT

On the offense, the M112 can be deployed in a direct fire mode by plugging an infantry-operated target acquisition sight directly into the launcher. The SR-90 is a sight specially designed for the M112 system, combining a passive infrared imaging sight with an active ultrasonic motion tracker. The SR-90 plugs directly into the launch-tube RTM port, and has sufficient optic cable to pay out up to 150 meters, allowing the operator to position themselves safely away from the launcher, with its conspicuous launch flash. The operator gathers the target into the SR-90 sight and uses one or both sensors to lock up the target. This information is passed to the missile, which can be launched on command by depressing the 'Safety' and 'Fire' triggers on the sight simultaneously.



"Tank hunting is a thankless job. Though our AT missiles can knock out a panzer at 5,000 meters, you can't afford to engage anything further than 1,000; partly 'cause of terrain, but mainly because you musn't give the target's defenses time to work. I consider any shot over a thousand meters to be a waste; problem is that panzers are always accompanied by infantry. At these close ranges you only have the chance of one or two shots before their rifle guys flush you out and screw you up!"

- Cpl. Benjamin Nol, 2/14 Tank Hunting Team, Linna 309

HIMAT MISSILE

The HIMAT round is a small, two-stage missile with a multi-sensor seeker in the forward nose section. The missile is launched vertically into the air, the first stage motor firing it clear of the launch tube and then employing the rear steering nozzles to align the missile directly at the target. The second stage fires after 1.5 seconds and accelerates the missile almost instantly to hypervelocity. Maximum speeds at burnout are on the order of Mach 4.5. The seeker unit consists of a Boekhoven-Bonn Infrared imager in the 8-12 μm range, a Thoreson millimeter-wave radar and a superheterodyne receiver aerial for homing in on active radar jamming. The seeker scans the target vehicle upon approach and identifies its exact type and configuration from its memory. If the missile has accidentally been launched at a 'friendly', it will recognise the configuration of the vehicle and abort the attack by steering away and self-destructing. If the target is hostile or unidentified, the missile will assess the optimum point of attack and steer to impact that location.

The warhead is situated just behind the missile seeker assembly and comprises a fifteen centimeter tungsten kinetic penetrating rod surrounded by LX-28 explosive filling. The explosive is detonated just before impact, firing the penetrator rod into the target's armor. In combination with the hypervelocity of the missile, the rod has sufficient energy to defeat almost all but the strongest tank armor.

"Hey, that ain't true. When the bugboys wheeled out the new CDC-80 tanks they'd bought from the French, the HIMAT didn't know what to make of it. It was something to do with the CDC's ass-around layout. Missiles kept aiming for the glacis plate and bounced off. Took us two weeks to get the software sorted out on that one!"

- Major Larry Smolek, 2/14 Tank Hunting Team, Linna 349

HIMAT has also been used with some success against low-flying aircraft such as dropships, helicopters and VERTOL platforms, and the USMC has recently announced plans to allocate funds to develop a multi-purpose warhead for the ground and air-defense role.

A new infantry sight, the SR-105 is now being introduced that replaces the ultra-sonic motion tracker with a millimeter-wave radar. This will allow operators to select targets other than vehicles, such as bunkers, 'soft' command posts and supply dumps, though the weapon will have to wait for the introduction of the proposed new warhead before it can be fully effective against these targets.



4.5 AEROSPACE DEFENSE SYSTEMS

Aerospace defence provides one of the most perplexing technical challenges for the Colonial Marine Corps. The variety of threats - aerospace craft, VERTOL platforms, helicopters, hypervelocity missiles, artillery shells, orbital re-entry bombs - require a wide array of defense systems capable of mutual support and providing overlapping coverage of the tactical zone. Of necessity, many vehicle-mounted ground weapons also have a secondary role against aerospace threats, though their effectiveness is limited compared to most dedicated systems in service.

The threat to infantry can be met with the **SIM-118 Hornet**, a shoulder-launched man-portable SAM (Surface to Air Missile) capable of all-aspect engagement of targets up to 10 km. The millimeter-wave seeker is capable of acquiring as well as tracking targets, allowing the infantryman to fire at craft beyond the range of his vision or obscured by cloud. A no-frills hypervelocity missile, the Hornet has no warhead, relying on its high accuracy and the kinetic energy of its impact to destroy the target.

A number of ADA (Air Defense Artillery) systems also provide short range and point defense. The **M579** is a 20mm quad gatling system mounted on an M570-series armored chassis. Controlled by a highly accurate multi-spectrum sensor, the M579 can track and defeat even hypervelocity threats up to 1,500 m away by filling the sky around them with high explosive and armor-penetrating shells. The **M270** is a mobile phased plasma gun capable of engaging line-of-sight targets with exceptional accuracy and lethality, and is one of the few air defense weapons in service packing sufficient kinetic punch to destroy an artillery round in flight. The **M820** is a rapid-pulsing 40 mW free-electron laser which employs the beam both as a lidar to acquire and track the target, and as a high energy attack. Against missiles, the M820 can be fired in a continuous-wave 'dazzle' mode to blind optical and infrared seekers. Some reports from Linna 349 indicate that this dazzle mode has also been used to permanently blind enemy infantry on the battlefield, in breach of the Geneva Convention on the use of anti-aircraft weapons against ground targets.

"The biggest problem with our triple-A assets is tracking crossing targets. If the bogey is flying straight toward you, no problem; we'll nail his ass good. But if he's flying off by even a few degrees, it's a bitch for the tracking systems to put a beam or a bullet where he's supposed to be; and if he's jamming you, then forget it - you might as well throw rocks at him."

- Captain Pat LeBue, 250th Marine Aerospace Defence Company, 16th MAU

Area defense is still best served by the missile system. The USCM primary SAM is the **LIM-417 Phalanx**, a long-range hypervelocity missile capable of engaging aerospace craft to the limits of the stratosphere. This active homing weapon employs a three-stage booster for the launch, sustain and terminal phases of flight and uses active and passive seekers, including radar, IR, optical, UV and jam-homing, backed by mid-course update from the ground station, to ensure the intercept, regardless of countermeasures. The third-stage booster ensures the missile remains highly agile in the terminal phases of flight, and the multi-dart kinetic penetrating warhead can be adjusted by the fusing mechanism into an optimum 'swarm' pattern prior to impact.

Anti-ballistic missile defense is provided by the **HIM-122 Lancer**, a multi-stage, multi-warhead missile designed to engage aerospace craft, spacecraft and re-

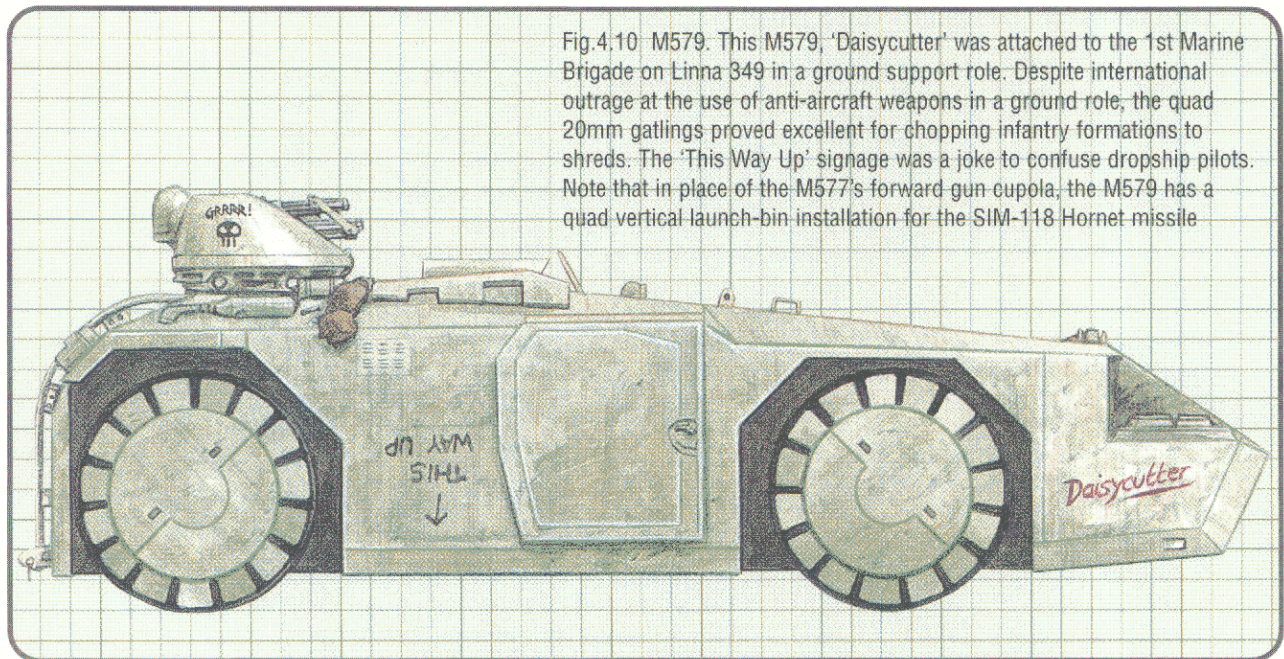


Fig.4.10 M579. This M579, 'Daisycutter' was attached to the 1st Marine Brigade on Linna 349 in a ground support role. Despite international outrage at the use of anti-aircraft weapons in a ground role, the quad 20mm gatlings proved excellent for chopping infantry formations to shreds. The 'This Way Up' signage was a joke to confuse dropship pilots. Note that in place of the M577's forward gun cupola, the M579 has a quad vertical launch-bin installation for the SIM-118 Hornet missile

entry vehicle constellations from medium altitude to the mesopause. In the terminal phase of flight, Lancer can assign each of its ten maneuvering warheads to engage a separate target, as in the case of a constellation attack, or a single target, as in the case of a re-entering starship. An unjammable datalink with the ground launch tracking station ensures high accuracy, and ECCM (Electronic Counter-CounterMeasures) capability.

"If we detect an incoming RV constellation we just go and make some coffee and watch the show on the screens. The electronics are so much faster and more effective than we are at working out which RVs are real and which are decoys and calculating the intercept. Even 'weapons free' and 'go/no-go' decisions are handled by the automatics. It happens so fast we don't touch anything anymore."

- L/Cpl Troy Wortmann, 114th Marine Aerospace Defense Company

Finally, the **HIM-78 Sprint** is a high-speed ground launched space weapon designed to destroy spacecraft and satellites in near orbit. Usually launched in clusters in order to overwhelm any spaceship point defense, the Sprint comprises a two-stage booster designed to insert an ASAT missile with a kinetic warhead into orbit. Against low orbiting targets, the Sprint ASAT payload can be inserted directly into its path; however, a typical injection profile versus a geostationary target involves lofting the payload into a Hohmann transfer orbit before completing a circularization burn into geostationary orbit (GSO). For an Earth-like world, the time from ignition to transfer to GSO is some 3,800 seconds. A special feature of the HIM-78 is its low launch signature which improves the chance of first-strike surprise on an armed or maneuvering target.



4.6 ARTILLERY

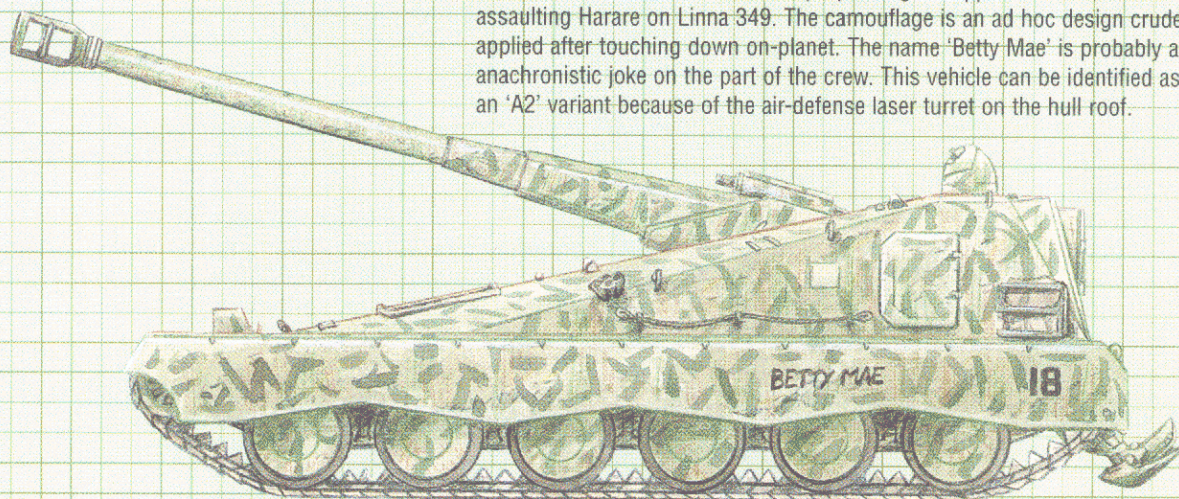
The role of artillery has always been to support infantry and armor in the attack and defense. Though artillery bombardment can sometimes bring about the collapse and surrender of an enemy force, it is not a decisive weapon in its own right. You cannot win battles by artillery alone; however, you are unlikely to win battles without it. An artillery round is cheaper and packs a greater punch than a guided missile, and with its accuracy, small size, and ability to be volley fired is a hard weapon to counter. Furthermore, with the ability to judge position with the aid of inertial navigation and global positioning, and the capability to link into the battlefield sensor matrix, precision fire control makes artillery one of the deadliest forces on the battlefield.

Colonial Marine artillery has been restricted over recent decades by two major considerations: first, that rationed starlift capacity limits the amount of ammunition available to artillery units; and second, that effective enemy counterbattery surveillance curbs the amount of time an artillery tube can remain in one place and fire without itself coming under attack. For these reasons, Colonial Marine artillery has to be highly accurate, to ensure a high kill rate for a small number of rounds, and mobile, so that the launcher can 'shoot and scoot' before an enemy has time to zero on its position.

Infantry small unit fire support is supplied by the **M402 Multiple-Launch Mortar**, an 80 mm twin-tube launcher fed from an automatic ten round rotary magazine. Azimuth and elevation are adjusted by the motorized base from a remote command handset, and the magazine can discharge its ammunition either singly, or in volleys. Firing each tube sequentially, all ten rounds can be volleyed in under 8 seconds. Though man-packable, the entire system, including at least one magazine of ammunition, weighs some 70 kg and must be transported by at least three Marines. More commonly, the system is encountered aboard the M572 armored mortar carrier, which carries up to 200 rounds and can autoloading new magazines in under 6 seconds.

The Colonial Marine standard artillery piece is the 158 mm self-propelled **M292** system. The M292 is a 38,000 kg armored tracked vehicle with a single 41-caliber 158 mm tube. It carries 78 rounds, which are autoloading into the gun chamber and fired by hypergolic liquid binary propellants. The most notable characteristic of the M292 is its rapid fire capability - the system can launch

Fig. 4.11 M292. This M292A2 self-propelled gun supported Marine forces assaulting Harare on Linna 349. The camouflage is an ad hoc design crudely applied after touching down on planet. The name 'Betty Mae' is probably an anachronistic joke on the part of the crew. This vehicle can be identified as an 'A2' variant because of the air-defense laser turret on the hull roof.





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six rounds in under ten seconds, putting the last round into flight before the first has impacted the target - a useful facility when under the threat of counterbattery fire.

Standard ERFB [Extended Range Full Bore] ammunition offers the M292 excellent accuracy up to its maximum range of 39,000 m, while the addition of a base-bleed unit extends this to 48,000 m. A ramjet powered athodyd shell is available, with a maximum range of 62,000 m, though with a less capable warhead. A variety of warheads are available, including HE, self-guided submunitions and area denial mines. The M418 smart shell is designed to home in on vehicles and structures, and uses a fluidic jet reaction system to steer onto the target.

The M201 MLRS (Multiple Launch Rocket System) is the heaviest artillery in Colonial Marine service and comprises a tracked transporter carrying eight 250 mm rockets in large launch bins. The rockets are loaded with submunitions and mines, and can deliver accurate and devastating firepower up to 120 km away. The rockets can be launched singly or volleyed together, though reloading all eight rockets from a specialized ammunition carrier takes some ten to fifteen minutes.

4.7 DEFENSIVE SYSTEMS

UA 571-C REMOTE SENTRY WEAPONS SYSTEM

"Five of us infiltrated the American perimeter, creeping slowly and... wearing our thermal smocks to disguise our heat trace. We knew that our cautious approach and protective clothing would render us invisible to the enemy sensors. As we left the treeline, we encountered a barrier of fragmentation wire and a line of robot sentries emplaced by [the Colonial Marines]. To our amazement, the sentry guns opened up immediately, cutting Private Xong in two, and pinning the rest of us down until the American Marines arrived. It was not until later that we were told that Xong, a novice soldier, had... failed to switch off [his IFF] when he left our lines, not realising it would act as a radio beacon for the robot sentries."

- account of Lieutenant Pang Ho San, 21st Combat Cadre, captured on Helene 215

The UA 571-C is a man-portable automatic perimeter defense system currently deployed by the US Army and the Colonial Marine Corps. A remote sentry unit weighs in at 19.6 kg and can be assembled in under 150 seconds. The major components consist of a snap-open tripod mounting, battery pack, breech and barrel assembly, sensor unit and 500- round ammunition drum. A microwave datalink connects the sentry to a remote command console. Once emplaced, the system may be set to sweep wide arcs up to 360° (subject to terrain and emplacement restrictions), though doctrine is to set several sentries to cover smaller, interlocking fields of fire on a narrow frontage. The UA 571-C mounts a pulse action machine gun, using the M250 10 mm x 28 HEAP round. The weapon has a cyclic rate of 1100 rpm and is air cooled, with an automatic cutout preventing the loading of any more rounds into the breech should overheating cause a chance of ammunition 'cook-off'.

The sentry unit's sensor array is mounted above the barrel, aligned to cover a 60° cone in front of the weapon. This sensing suite consists of a cooled infrared detector in the 3-5 µm and 8-13 µm band, ambient light optics, an ultrasonic motion tracker and a lidar. If a target's visual or thermal profile is known, the system may be set just to monitor these specific targets using infrared or



optical. However, the system is usually set to multi-spectral mode, where the sentry's software cross-correlates received data from the different sensors to obtain a full target profile.

If the sentry is set to 'auto-remote', it will interrogate all targets in its sensor cone, using an Identification Friend Foe (IFF) transponder. All Colonial Marine personnel and vehicles carry an IFF transponder in their communications gear which sends back a coded radio signal when interrogated. If the IFF return is positive, the weapon will let the soldier or vehicle pass; otherwise it will open fire. If the system is set to 'manual override' or 'semi-automatic', this information is flashed back to the command console, where the system operator can decide whether or not to fire.

When the weapon fires, automatic servos in the tripod boresight the weapon on the target. The number and grouping of rounds fired in a burst is dependent on the target profile, so that the most economical use of ammunition is made.

The UA 571-C is one of a family of remote sentry systems including the -D variant, which mounts a 20 mW HF laser, and the -F version, which employs a 40 mm automatic grenade launcher.

MINE WARFARE

Despite the commitment of the Corps to mobile non-linear operations, there is a requirement for mine systems that can be laid rapidly and provide effective barriers to enemy movement. On the defense, mines can delay or hamper the enemy, or force him into preselected kill zones. On the offense, mines can provide flank security or be scattered into the enemy's paths of withdrawal.

"Thank God for rabbits. Them an' 'roaches are God's own survivors. Nearly every world I've landed on, some dumb shmuck has introduced rabbits into the local ecology; and it don't matter how vicious the alien predators are, the damn' bunnies always breed faster than they can be eaten. They're also stupid as hell - they like to snuggle up in the grass where it's warmest - usually where a buried landmine has warmed the earth above it. If they sit on an APERS (Anti Personnel) mine, they'll set it off and get blown to bunny heaven. If they sit on an Anti-Tank mine nothing happens 'cause you need a heap o' pressure to set one o' them puppies off. So the smart thing to do is watch for the piles of rabbit droppings - there's prolly a tank mine there an' it's safe for a man to tread..."

- L/Cpl LEEANNE FRANSON, USCM

"The Beebops knew the bunny dropping trick, so whenever we laid a minefield, we used to dig out a pile of rabbit number twos and sprinkle it all around the APERS mines before we armed them. We got several Watanabes that way... Heh!"

- Corporal Adam 'Moose' RAKUNAS, 3rd Combat Engineering Battalion, USCM

Many types of mine in service are of the 'instant' kind - submunitions delivered by artillery or aerospace craft and rapidly scattered over an area of the battlefield. Some, like the M760 antipersonnel or M862 anti-armor mines, bury themselves in the ground on impact and are set off by pressure, vibration or magnetic induction. The advantage of these weapons is their ability to be deactivated and reactivated by coded signals to allow friendly forces to pass through the mine-



field. The exact nature of these signals is classified, but they are purported to be in 'near-unbreakable' codes, with protocols to prevent the enemy simply bombarding a minefield with random signals in the hope it would deactivate.

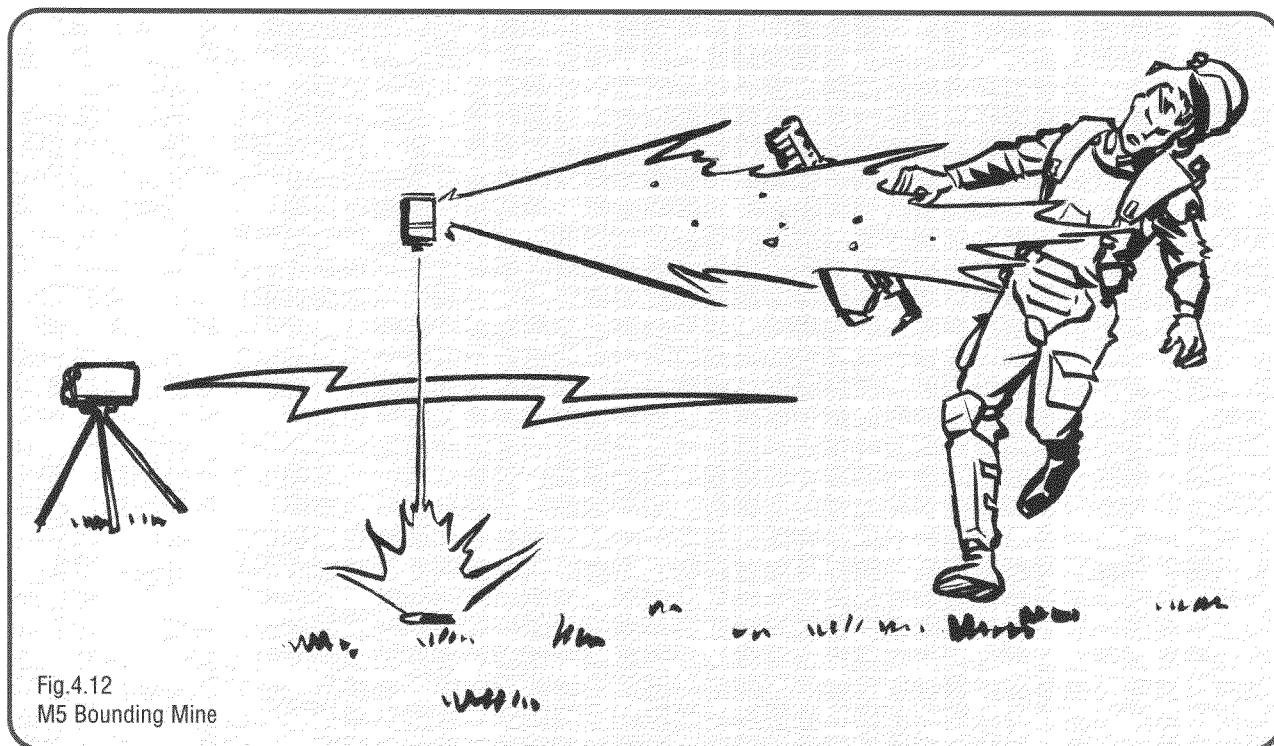


Fig.4.12
M5 Bounding Mine

Infantry laid mines include classic directional, static and bounding types. Many of these mines, such as the M5A3 bounding mine, are 'smart' and can be linked into the local sensor matrix to ensure optimum lethality. If a sensor detects an enemy infantry target in an M5's killing zone, it can launch the mine, which pops up to 2 m from the ground whilst spinning. As soon as the mine's directional charge faces the enemy it explodes, firing a cone-shaped spray of lethal fragments up to 50 meters. Some directional 'Claymore' types mines, such as the M20, incorporate their own active sensors and can be set to scan very wide arcs.

"Though it's not strictly a mine, the stuff I hate is fragmentation wire. Jeez, not only is that stuff razor sharp, but the sheath explosively splinters if you touch it. You always wear armored gloves and goggles if you handle that crap; the bang's powerful 'nuff to take some fingers off."

- unnamed Colonial Marine Combat Engineer





"There's plenty of wild rumors going the rounds in the Mess halls at the moment about an infestation of intelligent predatory aliens. You can take your choice of what to believe. Amongst the stories I've heard, these creatures are taking over the outer veil colonies one-by-one, capturing colonists and impregnating them with alien embryos who eat them from the inside out. I heard a lieutenant in the pay of a company boss let his team of Colonial Marines go unarmed into a bug hive so as to get them all impregnated as breeders for company stock. I even heard that a civilian woman took on a huge queen alien with a powerloader harness and dropped it out the airlock of a starship. I could go on...

"This is some kind of modern urban myth - the 'starfarer's myth' if you like - the myth grows beyond its origin until it fulfils a niche in people's belief systems. The truth is invariably less interesting. Even so, I'd like to know how this one got started..."

- Colonel Sabrina Cary,
1/9 Colonial Marine

COMBAT SUPPORT

5.0 COMBAT SUPPORT

5.1 SYNTHETIC HUMANS (ANDROIDS)

In recent years increasing numbers of synthetic humans have been deployed with Colonial Marine line units. Though the Geneva Convention prohibits the equipping of androids with weapons or uninhibited combat abilities, the Colonial Marine Corps regards them as an invaluable resource, supporting front line units as multi-role team-members and mobile databases. Marine androids are always employed in a non-combatant role, usually as drivers, pilots, medics and scientific advisers to combat units at platoon level and above. Though they are artificial intelligences in the broad sense, legally androids are classified as Corps property and can be ordered to perform hazardous tasks in place of humans; however, their utility and not-inconsiderable unit cost is a disincentive to any Marine field commander who wishes to treat a synthetic as expendable.

The modern synthetic is a highly complex machine: stronger, faster and better coordinated than an average human. The basic chassis is a carbon fiber skeleton with latching points for the artificial musculature. The muscles are vat-grown silicone colloids powered either by pumped microhydraulics or electrical stimulation. Power for the android is supplied by a 25 kW hydrogen fuel cell with a life of approximately 400 days between refueling. As in a human, the skeletal structure is inherently unstable and is effectively suspended by the musculature. No limb locking, joint motorization or gyro-stabilization is present as in other anthropomorphic frames such as powerloaders; instead, the muscles must work actively to keep the chassis standing upright while active feedback systems control its stability. Though the muscles can withstand considerable wear and tear, the lack of a self-repair facility means that they eventually lose their strength and become increasingly elastic over time. It is recommended that the muscle system be overhauled on a regular basis and individual elements replaced fully every two years. Muscle layout and operation, as with certain other internal functions, are homologous with those of the human body; indeed, military synthetics are designed to be virtually indistinguishable in appearance from a human.

Although a synthetic's cosmetic appearance would seem to be a superfluous feature, especially in a military model, practical experience has shown that it is a necessary component to maintaining combat unit efficiency and integrity. Most human soldiers are psychologically unable to interrelate with an inhuman-looking android; as a result, the physical appearance and simulated behaviour patterns of synthetic units are designed to particular specifications. Most synthetics in Colonial Marine service appear as mature, average males or females around 40 years of age. Their personalities, idiosyncrasies aside, can best be described as passive or non-threatening. Some studies published in recent years have suggested that androids have an important role to play within small infantry units, both as an impassive neutral party, and as a maternal/paternal influence in nurturing and sustaining the group dynamic at optimum efficiency.

The synthetic's mind is an integrated Carbon 60 processor with a processing speed of 10^{15} floating point operations per second. Memory capacity includes 1 Terabyte of fast cash buffer RAM and 1.2 Petabyte of non-volatile memory. The system is architected around a very powerful heuristic logic driver, making decisions based upon imported sensory data, information drawn from experience and the android's vast inbuilt databases. Intuitive functions are derived from a suite of nested contextual and semantic programs linked by self-mapping loops of tangled hierarchies. However, an android's ability to understand and process

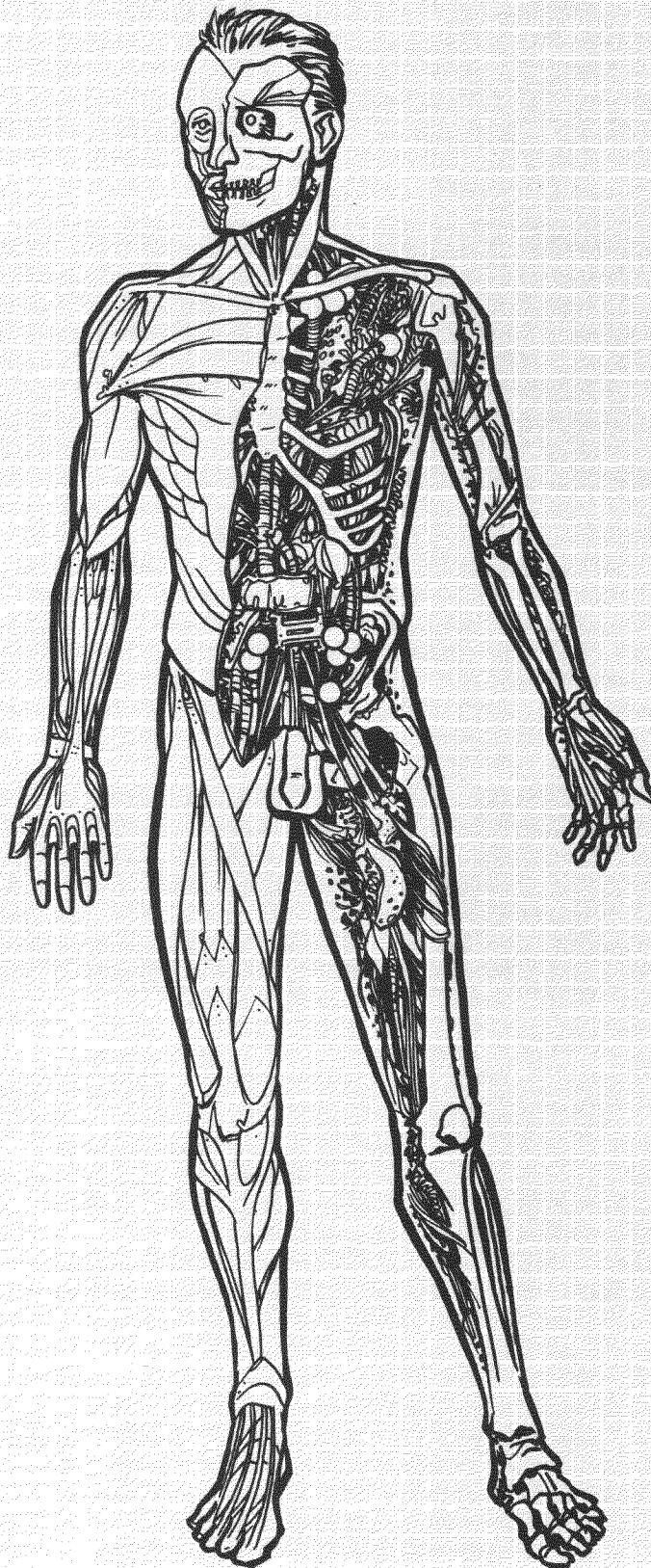


Fig.5.1
Android cutaway



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abstract concepts and symbologies, though powerful, is limited. A synthetic mind and personality is essentially a construct, and there is no true self-awareness as such, though this may not be at all apparent to an untrained observer interacting with a unit. Androids display synthesized emotion, superficially register self-awareness and, most importantly of all, have the ability to reason, conceptualise and offer opinion. However, these capabilities do not infer human-like consciousness, even though for all other intents and purposes synthetics are artificial intelligences.

"We had this synth called Dawn who insisted she was psychic; she could predict the future and tell you exactly what you were thinking in your head. She was right too, ten out of ten times. The lieutenant told us she was playing mind games, that she was using all sorts of fancy reasoning to weird us out; but the Loot knew jack. Dawn was lucky - she radiated 'luck waves' to the entire platoon. While she was with us, no one ever got hurt. The day she was reassigned, everything began to go wrong..."

- PFC Alex Tulae, USCM

Synthetics have proven themselves invaluable in Colonial Marine service across known space. Their chief advantage to unit commanders is their ability to impart knowledge and experience outside of the training of most combat specialists. In combat arenas and environments where an ever greater degree of specialist (usually scientific) information needs to be made available to a unit commander, a synthetic is the ideal vehicle for storing and relaying that information. In addition, they have the capacity to perform many non-combat tasks, freeing manpower that would otherwise be unavailable for actual combat.

"I could get drummed outta the Corps for saying this, but I don't trust those damn robots at all. They're all built by Cyberdyne or whoever. Who knows what the company built into their heads. They give one bad piece of advice and 'poof!' you're history. The one in our platoon; I don't like him. I watch him like a hawk..."

- Unnamed Marine

Despite their advantage in speed and strength over humans and their imperviousness to pain, synthetics are not especially tough; indeed by comparison they are somewhat fragile. Though the graphite composite skeletal structure of an android is sturdy, the electronics and fluid musculature are extremely vulnerable to hydrostatic shock and explosive effects from small arms fire. A direct hit to the central processor or fuel cell will result in immediate deactivation of a unit, though in most cases a partially destroyed android can continue to function, albeit handicapped. In hostile environments, synthetics require similar protection to humans in order to survive. Though synthetics do not require a breathable atmosphere, corrosive atmospheres will melt them, extreme pressure will squash them flat and hard vacuum will explode them. Even prolonged exposure to low atmospheric pressure can cause barotrauma and ebullism in the unit due to the high proportion of fluid colloids used in the manufacture of its musculature and skin.



5.2 USCMC LOGISTICS

"Since when has a supply manager been a glamor job? Never, but never. We're always those Rear Echelon MotherF-kers everyone else beats up on as being lazy assholes on the take. They say that to my face, I tell them 'it's true, I am - but I'm also the asshole who busts her butt to supply your smokes and ammo and fresh issues of underwear, so be nice to me...'"

- Lieutenant Joanna Talbot, 21st MAU

The Colonial Marines primary mission is the projection of military power across vast reaches of space. Given that journeys from a supply base in a friendly star system to the zone of operations may take weeks or months of actual time, it is vital for any Colonial Marine expeditionary force to carry sufficient combat supplies to sustain it for prolonged periods of operations. The Marine 70 program, in reorganizing the Colonial Marine 'teeth' units to make them leaner and more powerful, also recognized that smaller, more powerful units would need as much, if not more, logistic support than the ones they replaced. In a 'hot war' situation, supply expenditure is ferocious; depending on its attack/defense posture, a single Colonial Marine platoon can easily consume more than 25 metric tons of supplies (fuel, batteries, ammunition, food, etc) per day; and in the event that no regular interstellar supply route has been established, all these supplies have either to be available on planet, or aboard the Marine force's in-system starlift transports.

The challenge to Marine logisticians is immense; they must approach their mission with the same aggressive execution as the infantrymen in the assault. They have finite quantities of supplies at hand, yet have to operate a 'push mode' system, anticipating the needs of the forward units and moving loads to them even before they realize the need for it. Inevitably, this can lead to wastage when supplies are pushed forward to units who, for whatever reason, no longer need them; however, such waste is preferable to the disaster that can occur if supplies are not forwarded until after the need has arisen.

Because, even in a 'hot' conflict, Colonial Marine units are often dispersed in small units across continental distances, the USCM logistics prime movers are the ubiquitous **UD-4 Cheyenne** dropship and the **CS-14 Briareos** heavy lift shuttle. In the field, the **M570** all-terrain transport is the land-based prime mover, with powerloaders often used on-site to offload cargoes.

5.3 CATERPILLAR P-5000 POWERLOADER

"One of the toughest jobs we faced was at LZ 'Grumpy' on Helene 215. We dropped a crater bomb on the jungle to blow a hole through the triple canopy and then rappelled down with turbocutters to clear a landing space for the dropships. The place was a mess - the root systems ran so deep we couldn't clear out the tree stumps and we barely had enough plasmattng for the landing pads. This was where the powerloaders came into their own; picking their way across the remains of the tree boles to offload the transports, and wading kilometres through jungle mulch carrying stores to the forward positions. They did everything the forklifts could and more..."

- Major Harrison Gerrity, USCM Corps of Engineers



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The Caterpillar P-5000 Powered Work Loader has been selected by the US Colonial Marines as their prime loader vehicle for logistic and support operations. Configured as an anthropomorphic exoskeletal power frame, the P-5000 offers unprecedented flexibility when handling ordnance and cargo during rough field operations or when conducting heavy maintenance away from fixed workshops. Capable of fine manipulating loads up to 4,000 kg, the P-5000 is a rugged and reliable alternative to conventional forklifts, rigs and cranes.

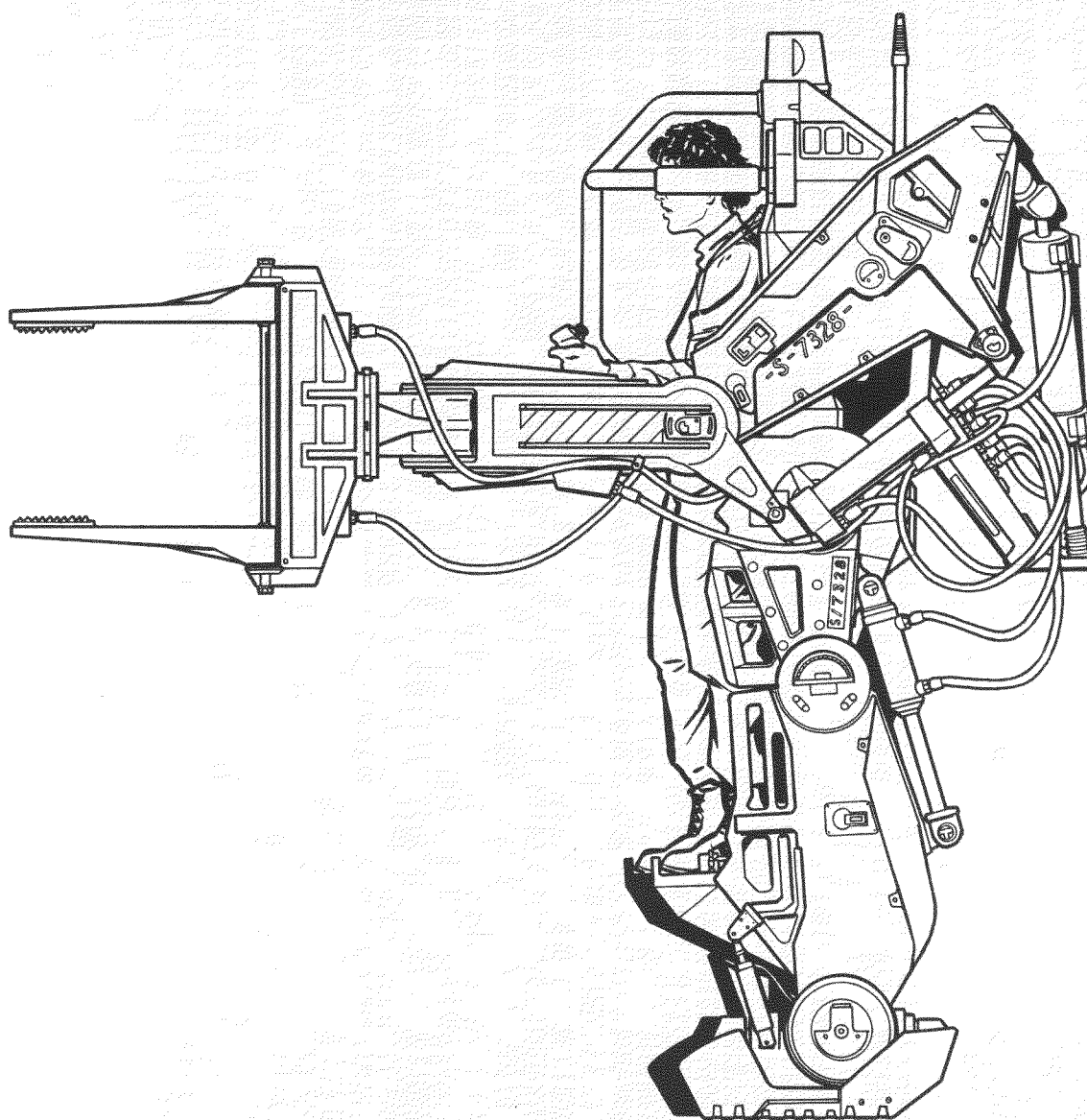
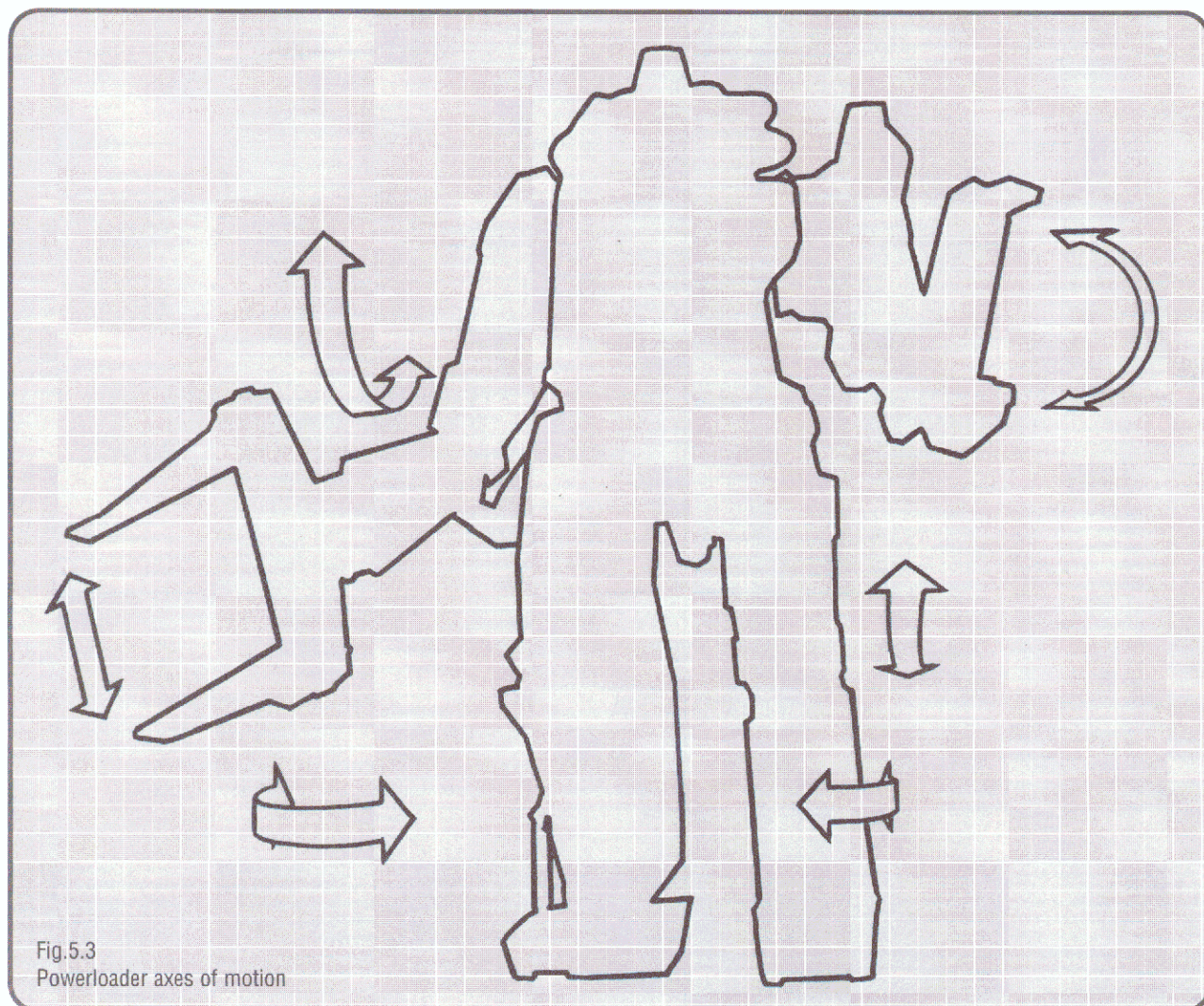


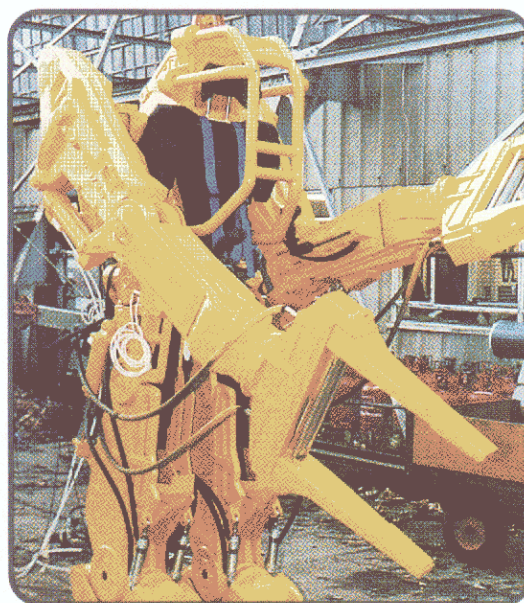
Fig.5.2
P-5000 Powerloader

"Reliable! Who are you kidding? A conventional forklift don't need more'n two hours maintenance a week. Even the best of our powerloader rigs need that much every day! Freaken temperamental beasts!"

- PFC Steve 'Fish Food' Kerns, 14th MAU



The chassis of a P-5000 is a reinforced steel framework with two upper load bearing points for the arms. A hydrogen fuel cell is mounted on the back of the frame, providing up to 65 kW of power for the loader. The articulated legs are attached by two semi-universal bearings to either side of the chassis, allowing up to 60° of 'x' axis (hip swivel) movement; just below these are a set of knee bearings. Leg motions at the hip are controlled by a pair of 20 kW linear motors actuated via a fast-feedback loop slaved to the operator's movements. Below the hip, hydraulic actuators extend from the main load-bearing points to the aft sections of the legs, providing 'z' axis (fore/aft) movement at the knee joints, while pitch control is handled by a second series of actuators at the ankles. To prevent toppling while stationary and under load, the chassis is gyro-stabilised. These gyros can be rotated rapidly out of phase in order to 'decouple' the chassis stabilisation system along determined axes of motion





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and provide the necessary instability required for bipedal movement. For very heavy lifting work, additional stability can be provided by bolting up to 250 kg of concrete ballast to the underside of the chassis.

The arms are attached to the very top of the chassis by a pair of complex universal bearings stressed to operate under loadings up to 4,000 kg. Arm motions in the 'y' and 'z' axes are controlled by linear motors while movement in the 'x' axis and at the elbows is powered by a series of hydraulic actuators. The limbs terminate at a set of vice manipulators configured to handle standard P-60 and O-26 type pallet grips and capable of full 360° rotation. Manipulator function is controlled from an operator handgrip/joystick combination on the inside of each limb. Attachment points for maintenance tools (such as cutters or welders) are situated on the manipulators.

To work a powerloader, an operator first backs into the machine, buckling themselves in with the webbing harness. A roll cage is pulled down to provide protection for the head and torso, while feet are snapped into straps. Powerup and systems diagnostics are handled by a punch keypad built into the operator's handgrips. When powered up, the 'loader is slaved to the operator's limb movements, duplicating their walking and lifting motions almost exactly. Response time to operator input is almost instantaneous, while sophisticated computer controls dampen any system induced 'twitches' or oscillations that arise out of involuntary operator movement. Problems are only likely to arise if the loader is walking or reaching at full extension, as the system is likely to enhance movement beyond the fine-tuning capabilities of the operator. Standard operating procedures usually forbid operators from performing such maneuvers. If operating over rough ground, the powerloader will provide feedback cues to the operator to help keep his or her footing. Automatic lockout systems will generally prevent any movement that will topple the 'loader, and the system has generally proved safe to use over all but the most treacherous terrain.

"I never EVER take a powerloader over rough terrain with a full load. Each of those feet are only 500 centimeters square, so with a two ton load you've got a downforce of something like three kilos per square centimeter. That's intense. I've seen too many loaders get hauled out of the mud to do anything so dumb myself."

- PFC Emmet Kane, 14th MAU

Though simple in principle, considerable practice is required to use a powerloader efficiently and safely, and the equivalent of a Class 2 civilian cargo handling license is needed to operate them in USCM service. Operators must become used to the loader's mass and its tendency to 'lead' the operator's movements. Operators must be careful not to overcompensate for this tendency, otherwise they may induce unwanted oscillations into the control systems. To operate a 'loader requires sureness and economy of movement, since hesitancy and exaggerated motion tend to place undue stress on the load-bearing joints. Training to use a powerloader takes about six weeks of simulator and 'hands-on' experience, though this is extended to eight weeks to qualify USCM personnel and includes training in rough field operation.



5.4 FIGHTING IN ALIEN ENVIRONMENTS

Over the past eighty years, the United States Colonial Marine Corps has conducted military operations on more than two dozen worlds and has been deployed to trouble spots on many more. In all cases, regardless of whether the world has an Earth-like ecosphere or has been a harsh airless planetoid, the Colonial Marines have to be prepared to fight. Marines are trained and equipped to cope with as many varied environments as possible - with extremes of heat, cold, radiation and pressure.

ATMOSPHERIC STANDARD

"To be human-habitable, a world needs an atmosphere remarkably close to that of Earth. Minute differences in density or composition can render a planet completely uninhabitable, or at least in need of substantial atmosphere processing before it becomes tenable. For this reason, most colonies tend to be established on worlds close to Earth in terms of size, density and temperature, all of which factors determine the free molecular retention limits of the local atmosphere - and physical composition - which in turn determines the proportions of atmospheric gases. There's no anthropic principle at work here; colony worlds are Earth-like simply because humans require very specific environmental conditions in which to live."

- General Sam Poitier, USCM planetological survey

The Atmospheric Standard (AS) is a practical measure to the USCM field commander of how well or badly his Marines and equipment will perform in an atmosphere. Earth's own Atmospheric Standard is the baseline upon which nearly all USCM matériel is designed, and all weapon and equipment specifications described in this book are given in terms of performance on Earth.

The two primary components that make up a world's AS rating are its density and composition. Atmospheric density and pressure - themselves a function of the world's gravity and temperature - have obvious effects on the physiology of an unprotected Colonial Marine. For practical purposes, a healthy man or woman cannot be expected to operate for prolonged periods at pressures of less than 76 kPa. If the pressure of air drops much below 70 kPa (equivalent to 3,000 m altitude on Earth) breathing can become so labored that exertion will entirely exhaust a rifleman in a very short time. At this point an oxygen supply is essential if Marines are expected to fight effectively. As air pressure drops, if Marines are not on a full oxygen supply they can suffer the effects of decompression sickness as bubbles of nitrogen form in their blood vessels and joints; saturation of the body with oxygen can aid in avoiding this.

As pressure drops to very low levels, extreme effects begin to occur. Barotrauma is caused as expanding gases within the body cavities begin to rupture tissues; if the Marine is exposed suddenly to such pressures without being decompressed the effects can be catastrophic. At 6.3 kPa, ebullism sets in; pockets of gas coalesce beneath the skin and body tissues begin to vaporize and boil. Additionally, in a thin atmosphere, the effects of thermal and other radiation injury from the local sun(s) can become more acute as there is 'less' atmosphere to provide protection. Generally, such environments are considered extreme enough to require the wearing of some kind of environmental suit.

Atmospheric density also has varying effects on equipment and weaponry. At high pressures, the performance of projectiles and aerospace vehicles is considerably reduced by the effects of drag. The effects of blast and concussion, such

as from a grenade or artillery round, is noticeably greater, as is the hazard from projectile launchers with a backblast. Beam weapon and laser sensor performance degrades significantly in a high density atmosphere due to the increase in the radiation absorption rate and the greater degree of beam scatter.

Low pressures have very different effects. The performance of projectiles tends to increase as atmospheric drag lessens, though the reduced effects of lift may have an adverse effect on the flight characteristics and maneuverability of missiles and aerospace vehicles. The performance of turbine engines degrades with a reduction in air density, while combustion engines for motor vehicles and power generators may need supercharging or turbocharging to ensure adequate aspiration. However, the effectiveness of beam weapons improves considerably at low densities.

Atmospheric composition is the second major factor in an AS rating, and in any discussion of an atmosphere's content, the critical gases on most colonized worlds are oxygen and carbon dioxide. An Earth-type atmosphere is approximately 21 percent oxygen and 79 percent nitrogen, with trace quantities of carbon dioxide (around 0.04 per cent), ozone and other gases. On planets with reducing atmospheres, higher percentages of carbon dioxide are usually present and oxygen levels far less. Such worlds may be developed for terraforming by using fusion atmosphere processors and implanted ecological architectures to reduce CO² levels and increase the quantities of oxygen.

In atmospheres with CO² levels above 0.5 per cent, some breathing apparatus is essential. Exposure of an unprotected Marine to such an atmosphere



Fig.5.4
Mk.35 Pressure suit

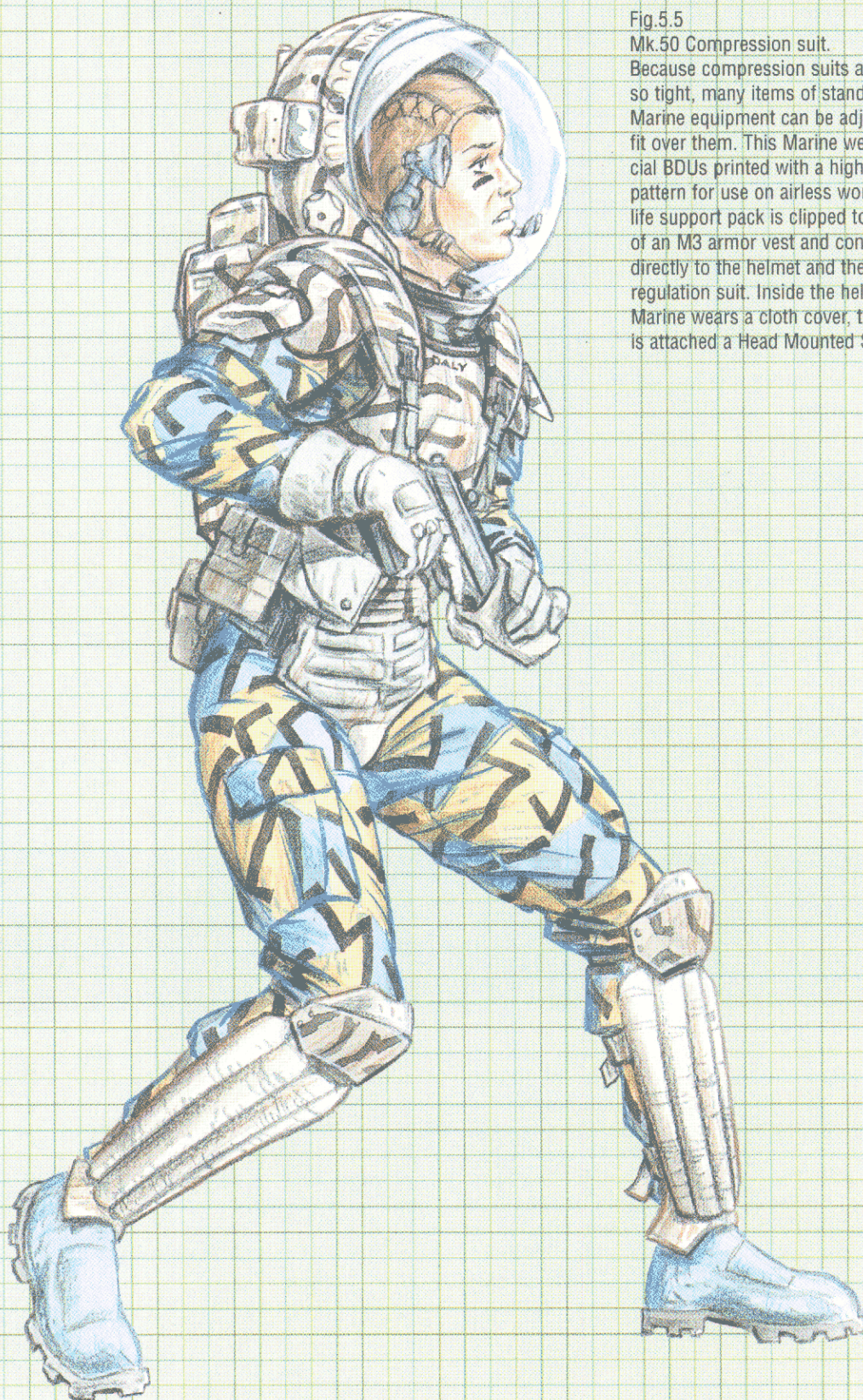


Fig.5.5

Mk.50 Compression suit.

Because compression suits are worn so tight, many items of standard Marine equipment can be adjusted to fit over them. This Marine wears special BDUs printed with a high contrast pattern for use on airless worlds. The life support pack is clipped to the back of an M3 armor vest and connects directly to the helmet and the thermal regulation suit. Inside the helmet the Marine wears a cloth cover, to which is attached a Head Mounted Sight.



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leads initially to carbon dioxide intoxication, with symptoms similar to hyperventilation, and eventual blackout. In atmospheres with very high concentrations of CO², aspirated combustion engines and gas turbines may suffer ignition failure as the temperature required for fuel vaporization rises. Needless to say, atmospheres with very low proportions of oxygen can cause oxygen starvation effects both for Marines and engines.

On some primordial worlds, many naturally occurring trace gases may be present in lethal quantities. Examples include carbon monoxide, sulfur dioxide, nitrogen dioxide, nitric oxide, hydrogen cyanide, hydrogen peroxide and ozone. Most of these gases are harmful if levels exceed 5-10 parts per million (0.1 ppm for ozone) and are lethal at figures ten times as great. Environment suits are essential in such conditions.

The presence of these gases may also have effects on the propagation of radar and radio waves, limiting the effectiveness of Marine detection and communication systems. In the infrared spectrum, the trace gases may alter the infrared absorption rates, so masking the IR signature of an enemy.

ENVIRONMENT SUITS

Given the wide variation of atmospheric standards in which the Colonial Marines have to operate, several models of environment suit exist in Marine service. The multi-purpose pressure suit is most commonly represented by the **IRC Mk. 35**. Bulky but well protected, the Mk. 35 is a single element suit which requires no additional protective or thermal regulation garments. Constant-volume hard joints combined with flexible limb and torso elements allow for full mobility, even in a vacuum, and the suit includes the option of a 100% oxygen supply for use at low pressures, air for normal pressures, or a 2% oxygen supply with nitrogen and helium for operations in high pressure environments. Though comfortable and easy to use, the Mk. 35 is rarely used at low pressure and in hard vacuum, partly because of the need to decompress the wearer to prevent the suit 'ballooning', and also because of the bulky life-support system needed to maintain suit pressure.

"The Mk.35 sucks in a firefight. You have to learn certain ways of moving your limbs or the hard joints lock the wrong way. If that happens it can take a couple of seconds to shake the joint loose - enough time to get yourself shot."

- **Unnamed Colonial Marine**

For low pressure operations, the two most common suits in service are the **IRC Mk.50** and **Halitel CM-2200** compression suits. In both cases, the suit consists of an inner thermal regulation garment and two outer layers of tight fitting elastic fabric with an airtight covering to compress the wearer's body against the effects of low pressure. No decompression period is required before donning the suit, and they provide greater freedom of movement than a pressure suit. Furthermore, without the need to maintain suit pressure, less breathable gas needs to be carried and life support packs can be considerably lighter. However, the suits take longer to put on than pressure suits, are less comfortable over long durations and provide no protection against high pressures.



ALIEN BIOLOGICAL THREATS

On colony worlds with an indigenous lifsystem, it is not uncommon to find organisms hostile to human settlement. Some of these exist in bacterial or viral forms and must be countered by use of environment suits, rigorous decontamination and quarantine procedures and by pharmacological means. However, some larger predatory creatures may also pose a threat. Colonizers are usually able to deal with xenomorph threats, though increasingly in recent years the Colonial Marines have been asked to help cull populations of exceptionally large or aggressive creatures. The sheer variety of these predatory xenomorphs means that little standardized equipment exists to deal with them; frequently, local commanders are asked to improvise with equipment and weapons from the Colonial Marines' own armory. Engineering materiel such as electrified fencing, fragmentation wire and even barrier minefields - all backed by active sensor matrices - can create safe perimeters for colony installations and farm areas. Where an active defense is needed, weapons such as sentry guns can use their precision fire capability to eliminate any creatures that breach or infiltrate the perimeter. If the creatures are large and able to fly, then air defense artillery may be able to deal with them.

Containment by the establishment of safe havens or perimeters is rarely a permanent solution to a xenomorph threat. The best solution is to reduce or eliminate a predator population by actively hunting them down. Prime targets for this kind of mission are nests and breeding areas, with the young as much targets as fully grown adults. The effectiveness of weapons against xenomorphs vary according to species, though frequently the best weapons are flame, incendiary and nerve chemical types. If eliminating them proves difficult, then another option is to destroy their habitat; slash and burn tactics and the use of defoliants can convert habitats into waste grounds, or help in reclaiming them for human development. One final area of technology that can be employed against a persistent pest threat is the employment of bacteriological warfare. Bacterial and viral strains can be engineered specific to the threat and used to either kill them, render them sterile, or induce harmful genetic mutations that will destroy the species within a few generations.

5.5 COMMAND CONTROL

"It's a creepy experience. You sit in a small dark bay inside an APC, intimately connected by TV monitors and voice links to a squad of Marines. Your Marines. You get to sit and watch and talk to them as they fight and die. It's the ultimate voyeurism - your very own snuff movie played out just for you. But that's not all. You see, you're just a link in the chain of command. Your company commander sits in his dark little glory hole watching you, while the battalion commander sits at his screens watching him. Imagine it, long relays of men and women all watching the same damn' war movie..."

-- 2nd Lt. Valerie Cooper, USCM

In order to win any battle, a Marine force must act and react faster than its enemy. A Marine field commander must continually make decisions based on the flowing battle situation and enact them, ensuring his orders are carried out whilst formulating new decisions. This decision/action cycle is known as Command and Control, or C², and good communications are essential to ensure the cycle isn't slowed or broken.

All field infantry in the US Colonial Marines are equipped with an array of personal communications equipment, of which the most commonly employed is the PRC 489/4

system built into the standard issue M10 ballistic helmet.

The system consists of a separate headset unit clipped inside the helmet, incorporating a boom microphone, earpiece and microstate receiver/transmitter. An interface connects the headset with the Motoca 419 tactical camera mounted on the right side of the helmet, allowing them to use a common transmitter. The tactical camera broadcasts digital optical and infrared images at a standard 25 fps, though in an EW heavy environment it is usually set to reduced frame rates of 12.5 - 1 fps in order to maintain image fidelity. An optic cable link connects the headset with the biofunction monitors inside the Marine's personal armor, which broadcasts constant updates on the wearer's life signs for the benefit of the section commander and medevac paramedics.

Both audio and video systems broadcast at VHF, typically between 1.5 and 40 MHz. The conflicting demands upon the PRC 489/4 system, requiring a wide bandwidth for the transmission of video, while being linked into a multiplex communication net, necessitates that all broadcast signals are encrypted, data compressed and transmitted via a 128 level PCM (Pulse Code Modulated) digital pulse stream. The communications antenna is built into the headset and consists of a tiny fraction-wavelength dipole with an advanced tuning unit capable of electrically simulating a fuller length aerial.

In addition to the communications broadcast, the PRC 489/4 also includes an IFF transponder for returning Identification Friend-Foe radio signals, a beacon for radio location, and a GPS link for position recording when Global Positioning Satellites are available.

All section communications are routed through the field commander's Tactical Operations Center (TOC). A TOC can be run from a command post aboard the squad transport (usually a UD-4 dropship or M577 APC) or from portable laptop terminals carried in the field. A section command post usually features a bank of monitors accepting direct feeds from individual Marines' bio-readouts and tactical cameras. Secondary monitors provide updates from the section motion trackers and robot sentries. A FDMA (Frequency Division Multiple Access) system run from the TOC base transmitter/receiver handles all communications through a single bandwidth without interference or overlap. In the case of a portable TOC, the command post can be run from one or more networked multifunction terminals, which can focus on individuals within the section, or cycle through them one by one.

Audio communication works on a multiplex system, in which all members of a communications net can talk simultaneously with each other; however, in practice, strict radio discipline must be enforced to prevent the net from becoming jammed with calls during combat. For this reason, the field commander has the option of switching his section network to a simplex system, where no more than one person may talk at a time.

In an EW intense environment, the field commander must strive to maintain close links with his command. The PRC 489/4 system is frequency agile, able to keep ahead of enemy Direction Finding (DF), intercept and jamming. (Though in practice, spectral pollution often radically reduces the effectiveness of frequency hopping.) In situations where an enemy is using DF in concert with artillery to locate and strike friendly troop concentrations, field commanders have the option to switch the audio net to a Direct Sequence Spread Spectrum (DSSS) system. This effectively prevents the use of tactical video, but spreads all audio transmissions across a wide band. Such signals are hard to locate by DF because of their similarity to background radio noise.

From his TOC, the field commander can run the battle in realtime, drawing constant information via links to his troops, sensor matrices, robot sentries, and



uplinks to higher level intelligence assets, such as flying recon drones. Colonial Marine doctrine stresses the need to maintain a high tempo of operations in the field, by continually ensuring the decision/action cycle isn't allowed to lag.

Traditionally, command and control works on the principle of 'two up/two down'; an officer commands the echelon below him and knows the status of the echelon below that. Thus a Marine company commander commands his platoons, yet is aware only of the dispositions of the sections in each platoon. Company TOCs are connected to platoon TOCs by radio transmissions, line-of-sight microwave relays or CDMA (Code Division Multiple Access) satellite uplinks. Platoon TOCs are in turn connected to the section TOCs via VHF commlink. The flexibility built into this command network allows the company (or even battalion) commander to route his communications directly through to the field units that are engaged the hardest, receiving reports from section commanders at the heart of the battle. This works both ways, providing higher echelon commanders with eyewitness information on the battle situation, while giving the squad commanders direct access to higher echelon combat assets such as artillery and air support. However, such flexibility would not be possible without proper protocols, which must be rigidly enforced to prevent abuse of the system.

Efficient, responsive Command and Control is one of the most effective weapons in a field commander's arsenal, easily worth more than sheer firepower alone. It is a force multiplier that makes victory possible even when overmatched in terms of numbers or weaponry. The US Colonial Marine Corps' investment in the state-of-the-art communications equipment has made effective C² possible. In turn, this has made it possible for the Marine Corps to continue to fulfill its commitments despite the increasingly limited resources available to it.

5.6 SURVEILLANCE AND RECONNAISSANCE EQUIPMENT

"Remember that saying about the recipe for jugged hare? You want him, I'll find him for you. This here terminal patches in to the ORION reconsat net - get you a tag on that hare down to five centimeters. That don't work, I can access the battalion perimeter sensors - nail that sucker on infrared, millimeter-wave, you name it. He moves, he so much as twitches his nose, we'll track him on ultrasonic and laser designate his butt from the sky. F'you want, I'll even call down a fire mission and waste his cotton-tailed, lop-eared lil' ass."

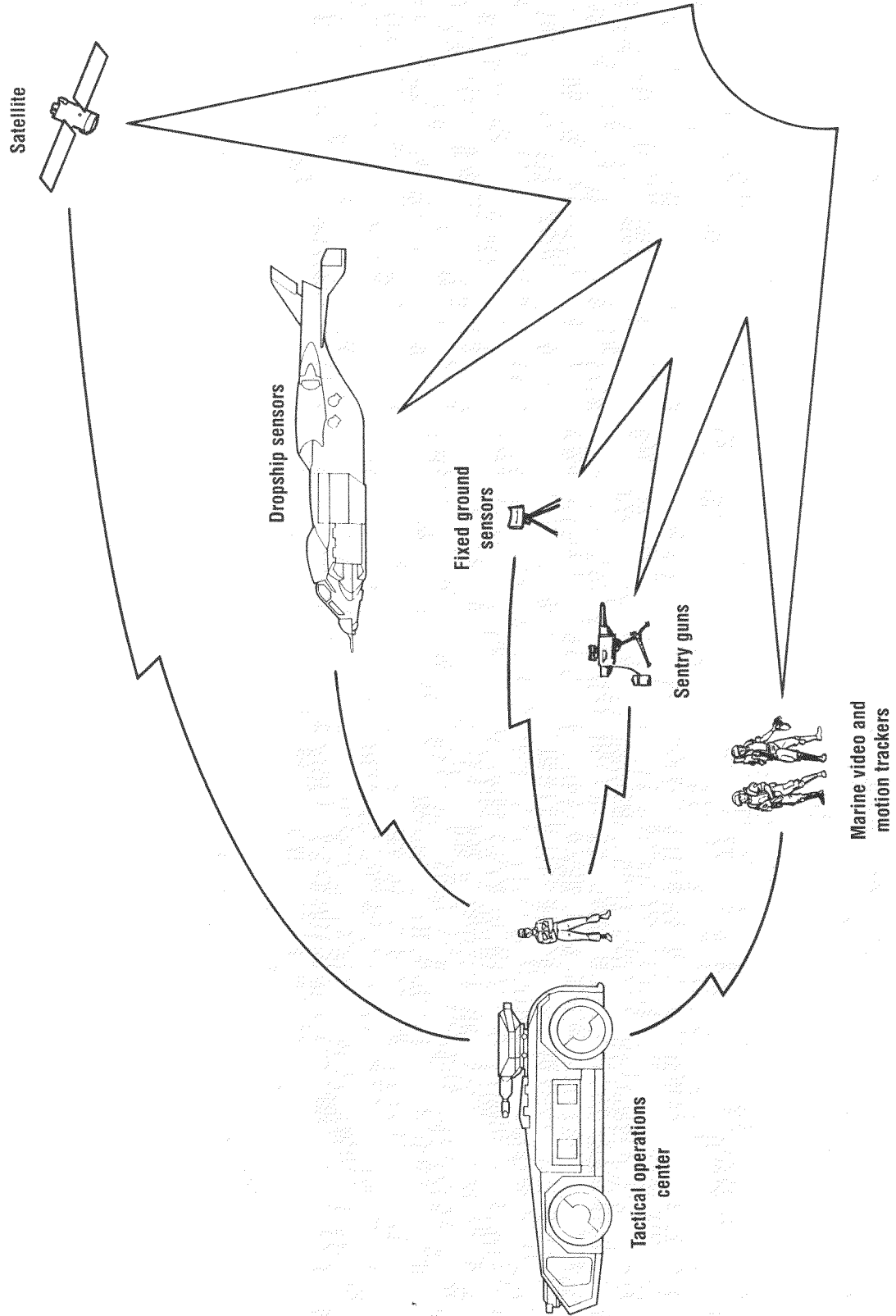
- Sergeant Eddie Wirth, A Coy INTEL, 11th MAU, USMC.

'First find a hare' is not a long way from the military tenet of 'Find-Fix-Destroy'. In a battle, any amount of firepower is useless unless the enemy can first be detected, identified and precisely located. Since battlefields are rarely open and flat, this task is one of the most demanding for the Marine commander both at operational and tactical level. The employment of deep recon teams and constant patrolling to contact is essential to keep track of an enemy. There is also a wide range of technological systems available to aid in this task, and though the following list is far from complete, it gives an indication of the major types of reconnaissance and surveillance assets available.

THERMAL IMAGING SYSTEMS

Thermal (infrared) imaging devices are very common in USCM service and are a primary means of remote detection, as well as of sensing in low light or at

Fig.5.6
Sensor sources





night. A thermal imager is built into every Marine's M10 ballistic helmet, and some weapons such as the M56 Smart Gun and the M83 SADAR acquire their targets with thermal imaging Infrared sights. A variety of hand-held thermal imagers are issued to line Marines and recon troops, as well as a vehicle-mounted types and even remote sensors for defense perimeter duty.

Most IR imagers in service are 'staring' type focal plane arrays based on cooled photo-voltaic detector elements. These imaging systems detect radiation in those bandwidths of the IR spectrum that are allowed by certain 'windows' within an atmosphere for the efficient transmission of Infrared radiation. Generally, these windows cover the short wavelengths of the 3-5 μm range - the 'hot' signatures of vehicle and aircraft engines - or the longer wavelengths between 8 and 14 μm . This last window is militarily the most useful, for it allows detailed resolution of building and vehicle exteriors, human figures and even vegetation. Sophisticated signal processing allows IR images to be resolved even during daylight, when the ambient energy from the sun(s) would threaten to clutter up the signal. Because of the effectiveness of thermal imagers, camouflage protocols must be extended to the infrared. Camouflage pattern uniform, concealment netting, and even the skin surfaces of vehicles must be designed or arranged to radiate heat at the same frequencies as their background, or in disruptive patterns to break up their silhouette.

"Smart Marines know how to avoid thermal detection: by wearing thermal camouflage, or attacking out of the sun, or using the cover of bad weather to sneak through the matrix... whatever works, baby."

- Cpl. Tom Blomberg, USMC

MOTION TRACKERS

The modern motion tracker is a simple surveillance device originally designed for use by rescue and police services. Essentially, it is a high-powered ultrasound scanner that uses doppler-shift discrimination to filter out moving objects from the stationary background.

A moving object is shown on the tracker's display as a series of contours of probable loci, with the range and bearing given to the target. Motion trackers are often employed for perimeter surveillance, able to monitor movements of small animal-sized targets up to a range of 1000 m in open country. The greatest advantage of the motion tracker is its ability to scan through objects; however, intervening terrain can cut this detection range quite drastically, and in built-up areas the presence of walls and partitions can reduce the range to less than 20 m.

Motion tracker operators must become familiar with their limitations. First, they are active sensors, emitting thousands of high energy ultrasound bursts every second, and can be easily located by enemy listening stations to serve as a target for enemy fire. Secondly, the tracker range gate function is calibrated to reject small or slight movements (such as bugs crawling, plants waving in the wind etc.), so that very slow-moving objects can infiltrate a tracker's detection cone (as guerrillas did on many occasions during the Arcturan War). Thirdly, trackers are vulnerable to spoofing by ultrasound jammers, or 'jumping jack' decoy devices. As a result, most commanders prefer motion trackers to supplement other surveillance techniques.



Fig.5.7
Motion tracker



BATTLEFIELD RADAR AND LIDAR

Both radar and lidar are active sensors which can betray the user's position to an enemy. Radar comes in two varieties: long ranged long-wavelength radar for detecting aircraft, missiles and spacecraft; and short-ranged short-wavelength radar for ground-mapping, ground target acquisition and tracking. It is this second type that is most frequently encountered on the battlefield. Ground-based millimeter-wave radars can detect man-sized targets out to 2,000 m or more and even resolve the exact profile of a target. They are hard to jam too; though their high energy, high frequency emissions make the radars themselves easy to detect and eliminate. Lidar has many of the advantages of millimeter wave radar, although it uses scanning laser beams rather than radio waves to detect the target. Lidar detectors are most easily defeated by using particulate smoke clouds to block the beam.

AERIAL AND SATELLITE RECONNAISSANCE

Aerial reconnaissance can provide an overview of the battlefield that ground-based sensors are unable to. Most commanders are able to filter sensor data from overflying dropships and strikeships into their tactical displays. Where dropships and strikeships are unavailable to provide airborne recon, flying drones can be used. Unmanned robot drones such as the Motoca UAV-520 can hover over a battlefield for several days without refuelling, pinpointing enemy movement and positions with synthetic aperture radar, lidar and infrared, and even designating them for missile, artillery or orbital bombardment.

Satellite reconnaissance can provide sensor coverage of continental-sized areas. The most modern reconsats have radar ground-mapping and surveillance capability, allied to powerful optical and infrared telescopes capable of resolving objects as small as 5 mm in ideal conditions. Though these sensors are very powerful, the workload required to interpret data from them means that satellites tend to be tasked to observe high-level targets such as installations, bases and large military force concentrations rather than small units or areas.

5.7 COLONIAL MARINE RECONNAISSANCE

The term 'Marine Recon' conjures images of daring raids and desperate rescue missions in enemy territory. The reality, though less glamorous, still encourages the Colonial Marines' finest to sign up for recon, the most demanding and challenging mission within the Corps.

Reconnaissance Marines train for 'special operations', a term covering many missions, including deep penetration reconnaissance, raids and demolitions, assassination, the training of partizans and guerrillas and rescue operations. Recon Marines have to operate in all environments and are given extensive training in underwater, deep space and hostile planetary environments.

Usually operating in autonomous four-man teams, the Recon Marine's job is to stay hidden in the heart of the enemy's territory, supplying the kind of vital intelligence that satellites or aerospace craft cannot - information that can only be uncovered by an expert man or woman on the ground. Because the recon mission is so flexible, Recon Marines in the field frequently have to perform special tasks - such as demolitions or raids - at short notice, and often with no more equipment than they already carry.

There are many techniques for covertly inserting Recon Marines into an operating zone. Because there are few places inaccessible from space, the most popu-



lar method is an orbital drop, either by aerospace shuttle, or by a dead-drop re-entry vehicle. The dead-drop method is the stealthiest approach, but also the most risky; it involves placing a single Marine inside a small capsule which makes a ballistic re-entry. At low altitude, a drogue shoot slows the capsule, allowing the Marine to eject from it and unfold a parafoil, beneath which they can glide to the landing zone. Where the Colonial Marines already own landing sites on a planet, more conventional methods of insertion are used - by aerospace craft, boat or submarine.

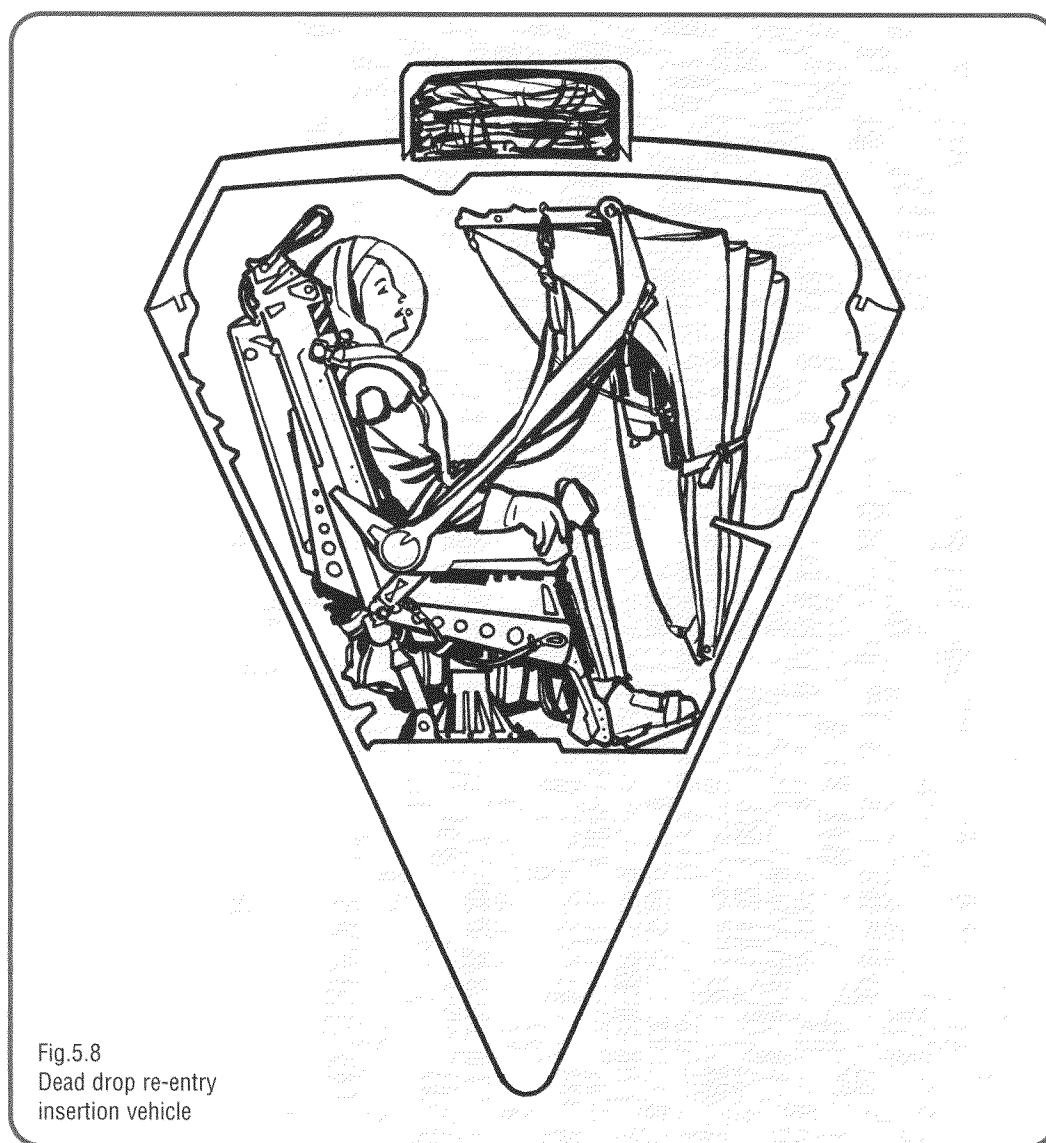


Fig.5.8
Dead drop re-entry
insertion vehicle



5.8 COMBAT ENGINEERING

"Hey, them sappers, they loco sons-of-bitches. I knew this combat engineer who once straightened a poker table by wedging a landmine under one leg. It was two weeks before we found out it was still live..."

- Unnamed Marine

The US Colonial Marine Corps of Engineers have established themselves a reputation as an elite within an elite. Though almost every Marine requires a knowledge of basic sapper skills, such as in handling demolitions and landmines, it is left to the specialists to carry out the most hazardous tasks - demolishing strongpoints, clearing minefields, preparing landing zones and laying bridges - all while under fire. It would be impossible to list all the equipment available to the combat engineers here, though items include all manner of demolitions equipment, bridging vehicles, building equipment, bulldozers, diggers, mineplows, deepcore drills, portable aerospace strips, etc.

5.9 NUCLEAR, BIOLOGICAL AND CHEMICAL WEAPONS

NUCLEAR WEAPONS

Authorization for the release of nuclear weapons can only be given by the senior officer present in theater. Given that some Colonial Marine operations take place in small units on the periphery, access codes are made automatically available to the next in command should the senior officer be incapacitated. Though the decision to use nukes is discretionary, Space Command has strict guidelines on their employment on inhabited worlds, designed to limit collateral damage to inhabited areas, installations and the environment.

The Colonial Marines employ only three means of delivery for nuclear weapons: the nuclear landmine, the aerospace-launched transcontinental cruise missile, and the orbital re-entry vehicle. Because Marine nukes are designed for tactical employment and because of the great accuracy of delivery, their warheads are of comparatively low yield compared to those in Army or USASF service, the absolute largest being no more than 1 megaton nominal yield. With the exception of nuclear landmines, the employment of airburst attacks is recommended to reduce the effects of fallout and residual radiation.

Defense against nukes is largely limited to preventing the delivery of a hostile warhead. Against Marine military equipment, the effects of EMP and TREE (Electromagnetic Pulse and Transient Radiation Effects in Electronics) are almost nil due to the hardening and shielding techniques built into all systems. In the event of a hostile nuclear strike, decontamination procedures and the administration of anti-radiation medical treatments must be immediately implemented.

CHEMICAL WEAPONS

Chemical weapons in Colonial Marine service are deployed for tactical rather than strategic employment. At the low end, they can be used to quell riots or other civil disturbances by the use of riot gases or psychoactive chemicals for incapacitation. At the high end are deadly nerve toxins for use against troops in the field and xenomorph animal populations. The permission of the theatre commander must be sought before employing any chemical agent stronger than riot gas.

Chemical weapons can be employed in two ways - either as a direct attack on the enemy, or as a means to deny ground by contaminating it. For direct attack, chemical agents range from mild non-persistent riot gases such as orthochlorobenzalmalononitrile (CS) and dibenoxazepine (CR), through psychoactive agents such as ALD-91 (a new analog of lysergic acid diethylamide that incapacitates without causing long-term genetic damage) and BZ (3-quinuclidinyl benzilate), to a menu of highly lethal persistent and non-persistent nerve toxins such as VX-80, VZ, CN-20 and GX. Most of these are stored safely in binary form, for delivery as a spray, artillery shell, rocket warhead or orbital reentry vehicle.

BIOLOGICAL WEAPONS

Biological weapons are primarily strategic weapons and are not generally issued to field units. Biological weapons generally come in two forms: bacteriological and exomorphic.

In the past ten years, the primary employment of bioweapons has been in the use of bacteriological warfare to cull indigenous populations of predatory xenomorphs. However, against human populations, viral disease strains can be engineered to meet specific purposes before being introduced into a hostile population along predetermined vectors. Disease vectors include animals (via food animals, rats or biting bugs that may transmit the disease), introduction to a population's water supply, or by airborne delivery.

Exomorphic bioweapons are animals the size of insects or greater. They are usually some form of swarming creature that can be used *en masse* against an area or large population. Such exomorphic weapons can be deadly in themselves - they contain a lethal bite or sting - or can be employed as a carrier for bacterial weapons.

The major problem associated with both types of bioweapon is control - a disease or exomorph swarm can easily 'backfire' on the user. Therefore, careful protocols must be observed when using such weapons; and care must be taken to engineer some means of deactivation into the weapon. The usual method is to ensure that the bioweapon is unable to reproduce and/or has a finite lifespan, after which the weapon is inert or dead.





"Hnn? You heard what happened at Zeta 2? They sent in an entire Colonial Marine regiment, with a taskforce of starships in support, soon as the Acheron colony transmitter went down. The regiment got caught on the ground; from what I heard the lucky ones died - the ones who lived were dragged off by the bugs and used as food for their young. Apparently they invaded one of the transports - the Sulaco I think - and turned it into a nest to cocoon the entire regiment while they blew away the rest of the fleet. I was told some humans managed to survive in the bowels of the ship, where they fought a guerilla war against the bugs. One woman even managed to get at the bug queen using forklifts an' powerloaders and missiles an' stuff. Blew the damn thing into space - made it suck vacuum, man!

"Trouble is, nobody knows what happened after that, or where the Sulaco's gone..."

- Pvt Ross Strasswimmer, USCM



SPACE TRANSPORT

6.0 SPACE TRANSPORT

6.1 USS SULACO

"The Sulaco was considered to be an unlucky ship by many hands throughout the fleet. At Linna 349 she was hit twice by ASAT missiles - the only fleet vessel to be damaged while in orbit - and at Gateway she was involved in a docking accident that killed five people. After that point there were few crew who would handle her."

- General Gregory Fleet, USASF

The *USS Sulaco* is the thirteenth in the series of **Conestoga** class starships to be built. Including the new 'block 74' revisions to the design from her last refit, it is intended that the *Sulaco* should remain in service for another five years before being decommissioned and sent to join her older sisters in commercial service.

The **Conestoga** class vessels were originally designed as troop and logistic transports with a limited defensive capability, however, this role has evolved over years of operational use from a fleet prime mover into that of a light assault ship with secondary responsibilities for space control and orbital bombardment support. Of the 36 **Conestogas** built, 27 remain in service, filling a niche in the USASF/Marine inventory that will not be filled until the commissioning next year of the first of the new **Bougainville** class attack transports.

Over 385 meters in length and massing some 78,000 metric tons, the **Conestogas** are designed to an 8-17-0 layout, an asymmetric configuration which offers the optimum cargo capacity within a compact and well-armored hull. The spaceframe extends forward and aft of the vessel's primary power system, a Westingland A-59 fusion reactor with a maximum generating output of 3.6 Terawatts. Like most military vessels, the **Conestogas** use a lithium-hydride or 'dry' fusion plant. The basic fuel for the plant is the crystalline powder form of lithium-hydride (LiH). The specific gravity of the fuel is 0.82 metric tons per cubic meter, making it extremely space efficient, avoiding the problems of cryogenic storage associated with civilian reactors fueled by heavy hydrogen isotopes such as deuterium and tritium. The LiH plant accepts the powder in very fine form, allowing it to be shipped and pumped as if it were a liquid, and administered into the powerplant as a blown dust. The powder must be stored in double-lined containers to prevent contact with water, otherwise it will dissociate and react violently.

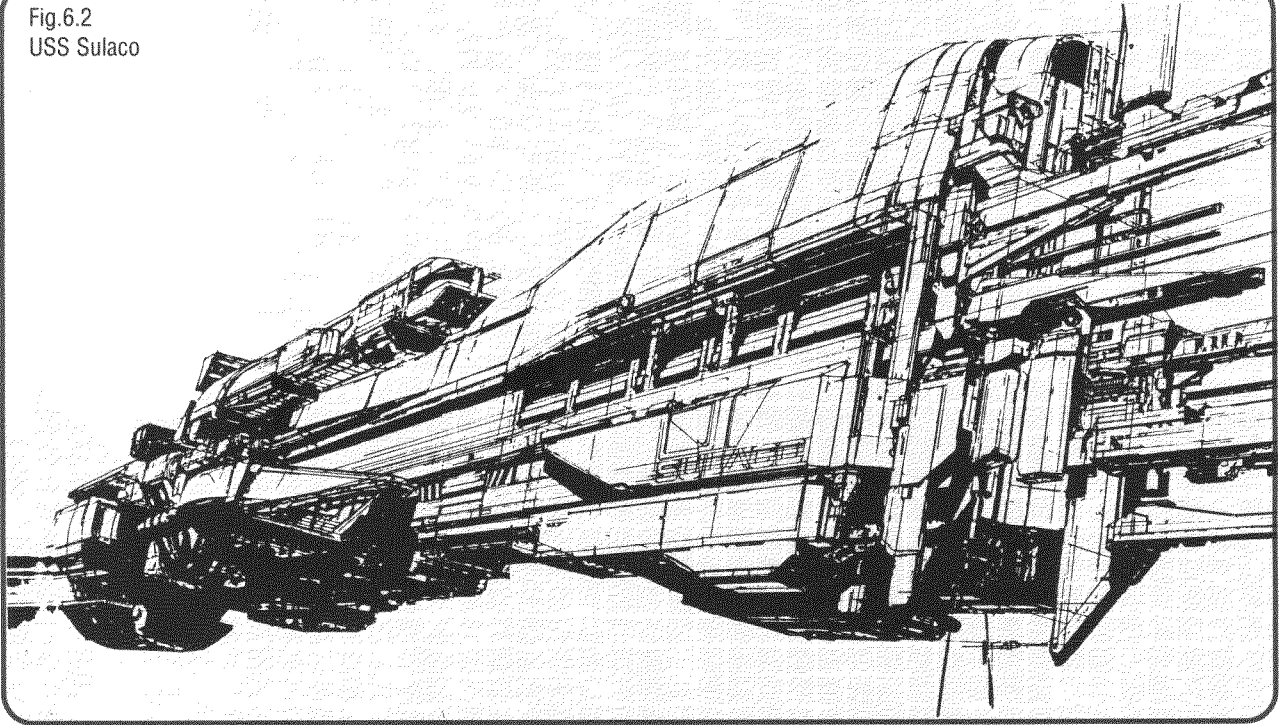
The fusion process comes directly from dissociated LiH, liberating considerable energy from the fuel with no waste product. Activation energy is extremely high, requiring magnetic containment field densities and confinement times much greater than conventional fusion reactors. Typical core temperatures run at about 600 million degrees Kelvin and densities are maintained at around 5×10^{15} nuclei per cubic centimeter. With typical conversion efficiencies, this yields about 40 mW per liter of plasma in deliverable electrical power, mostly generated by magnetohydrodynamic coupling. Fuel consumption is approximately

Fig.6.1
Unit badge
of USS
Sulaco
Marine
complement





Fig.6.2
USS Sulaco



one-quarter of a milligram per second per liter. At this rate, about 900 metric tons of fuel will supply the plant at maximum power for one year.

The reactor is fully safeguarded against battle damage and is designed to go to 'cold shutdown' the instant the reaction chamber is breached. In the event the cooling system is ruptured by hostile fire, cold shutdown protocols are initiated and the dangerously hot coolant is vented directly into space. In such an instance, auxiliary power would be provided by a battery of four Continental Electric AS-4B and AV-5 series Magnetohydrodynamic turbines, generating between 20 and 40 megawatts each.

Astern of the fusion torus is the drive section. The Conestoga Class vessels employ a dual drive system for Faster-Than-Light (FTL) and sublight travel and maneuver. For sublight thrust and maneuver, the vessel employs four Gates-Heidmann GF-240 rocket motors, powered directly by the fusion drive. Reaction mass is simply placed in contact with the fusion plasma, which heats it; the heated gas is then expelled as for a rocket engine. The reaction mass is industrial carbon-diamond, which sublimates easily in the high reaction heat and creates gaseous thrust without requiring combustion. Carbon-diamond is preferred to water and other reaction masses because of its ease of manufacture, storage and high density; it also leaves no tell-tale radio emissions in the spacecraft's wake as it cools. Thrust is controlled by changing the flow rate of carbon through the engine. High flow rates result in little heating; consequently a high-thrust, low-efficiency burn. Allowing the carbon mass to come to near equilibrium with the fusion plasma requires much lower flow rates, and produces a very efficient, albeit low thrust, drive. Running wide open, each engine can generate thrusts in excess of 35,100 metric tons per engine, the total power giving the vessel a Specific Excess Power ration of over 1.8:1, although fuel consumption is extremely high, and the thrust can only be sustained for short periods. More commonly, the engines run at a fraction of maximum, allowing for a gentle, fuel-efficient burn.



ALIENS COLONIAL MARINES TECHNICAL MANUAL

For FTL travel, a Romberg-Rockwell Cygnus 5 hyperdrive tachyon shunt is used to accelerate the vessel through the light barrier. The hyperdrive initiates tachyon quantum jumps by creating an intense virtual mass field while at sublight velocity. As the mass field expands to supercritical levels approaching infinity, a sub-quantum transition to a tachyonic state takes place, and the mass of the starship is converted into mirror image tachyons of the same energy. In a tachyonic state, the vessel can travel no slower than the speed of light whilst remaining in real space. Speed is controlled by altering the energy state and mass of the ship - shedding mass will speed the ship, whilst increasing mass will slow it. Hyperdrive field density and the intensity of the virtual mass field is controlled from a bank of 480-510 mTY tachyon field accelerators. For regular operations, the system is capable of sustaining a high cruising speed of 0.74 light years per sidereal day.

"The problem with the tachyon shunt is the way it screws around with conventional physics. Given that your mass and gravitational constant at supralight fluctuate with speed, so does the relative flow of time. Instead of the time dilation experienced at high sublight velocities, the occupants of vessels in hyperdrive flight suffer the effects of time expansion, a phenomena which is directly proportional to the square of the speed. This places a practical limit to the maximum speed you can travel at before subjective journey times become untenable; it also makes starships ever more reliant on hypersleep freezers to prevent excessive crew aging."

- General Michele Kurama, USASF

Forward of the fusion torus, the spaceframe is constructed of bonded alloy and composite spars which are resilient enough to withstand great accelerations, but sufficiently pliant to bend and flex during the stresses of atmospheric reentry. The hull cladding is for the most part a single, armored skin. This skin is heavier than that found on conventional space transports and consists of a laminated shell of insulators, alloy micrometeorite shielding, composite armor protection and aerogel layers. Protection against kinetic kill weapons is (as with all space vessels) limited, but the aerogel layers can dissipate absorbed radiation doses of up to 180 Kilograys from directed energy weapons.

The foremost section of the starship forms the vessel's capacious cargo hangars. Access to these hangars is via the five 25 x 10 m loading doors to either side of the hull, and two movable H-frame cranes slide on exterior tracks to assist in loading at any of these doors. The cargo hangars have a capacity of 1.2 million cubic meters and may be used for logistic transportation, troop transport, or as *ad hoc* shuttle launch bays. Below the cargo area there is a dedicated shuttle/dropship hangar and launch bay, with the capacity to handle up to four shuttles at any one time. Shuttles and their cargoes may be moved between the cargo and launch hangars via a 30 x 30 m cargo hoist.

LIFE SUPPORT

Due to the heavy demands on the life support systems and the inverse relativistic effects of travel at supralight speeds, crew and transported personnel are usually stored for extended periods in cryogenic hypersleep capsules. While in hypersleep, the ship's automated systems maintain the crew's body functions at enormously slowed rates, reviving them when they reach their destination. This revivification process can take up to 30 minutes and is a perfectly safe process for a healthy individual. There are sufficient capsules for up to 90 crew and passengers aboard each starship, although facilities exist for installing up to 2,000 more in the cargo hangars for the transportation of troops.

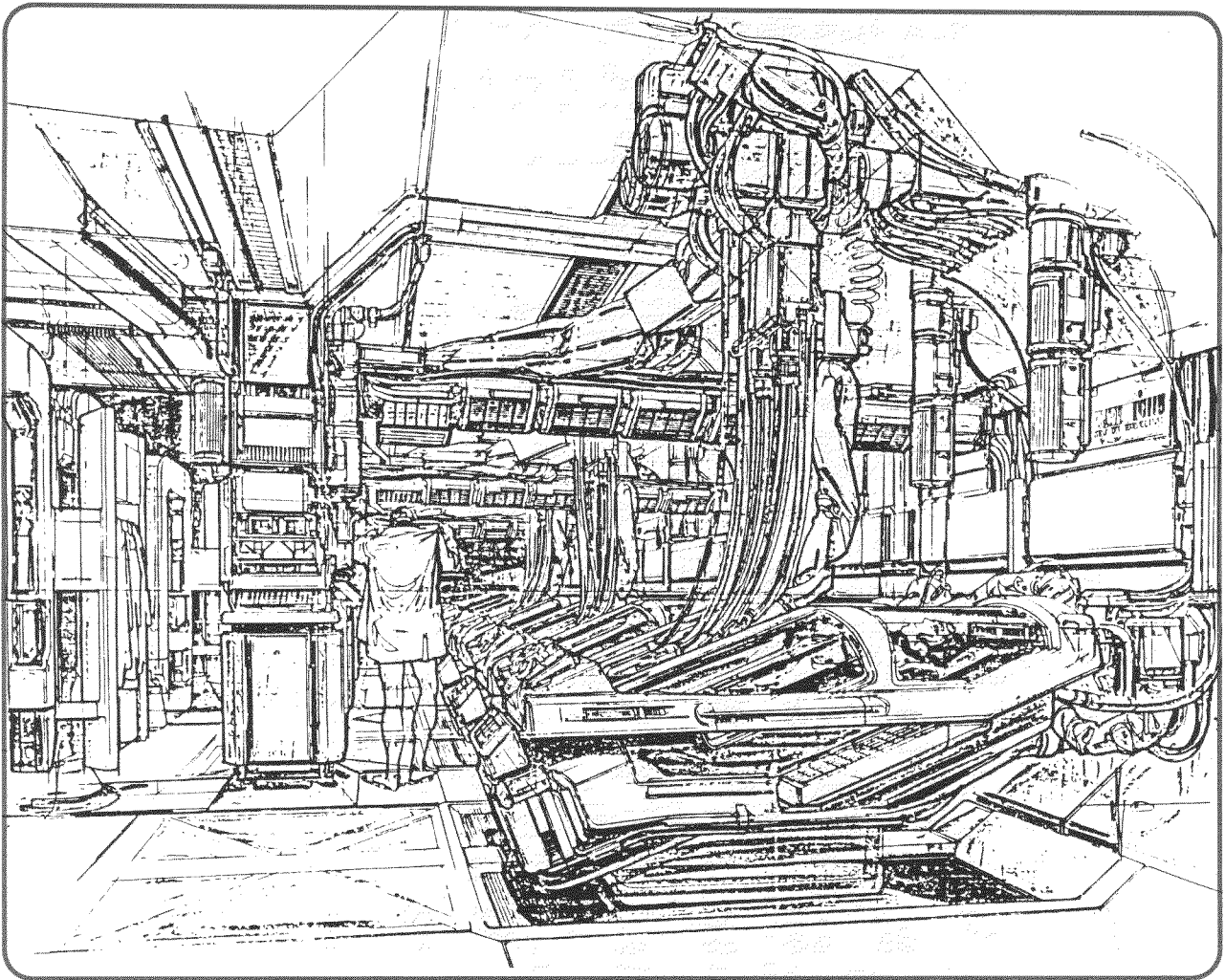


Fig.6.3 Hypersleep capsule chamber.

Artificial gravity, a necessity for the maintenance of health and operational efficiency during prolonged spaceflight, is produced by a bank of synchronised gravity field generators situated throughout the habited length of the space-frame. These established a polarised 'up-down' axis at a steady acceleration of 1.0 gee, though this may be altered to allow crews and troop personnel to acclimatise to differing terrestrial gravities. An inertial dampening system, based on a series of additional laterally coupled gravity generators, protects the crew and contents from accelerations at sublight speeds.

"The Sulaco was a smart ship – too smart for its own good. While in orbit over Linna 349 we detected the launch flares of an ASAT missile cluster fired from the surface. The Sulaco immediately launched a couple of decoy ballutes and then maneuvered as if to protect them. This double-bluff almost worked. Four of the missiles mistook the Sulaco for a mobile decoy and went for the ballutes. Unfortunately, two of the ASATs didn't take the hint and smashed into the cargo hangars, detonating fuel and stores. The ship was a mess, and only barely escaped disaster by opening hangars to space and jettisoning the cargo..."

– Colonel Barton H. Susman, USCMC



Hangar Doors

Flight deck
and main
cargo hangars

Life support

Sensor array

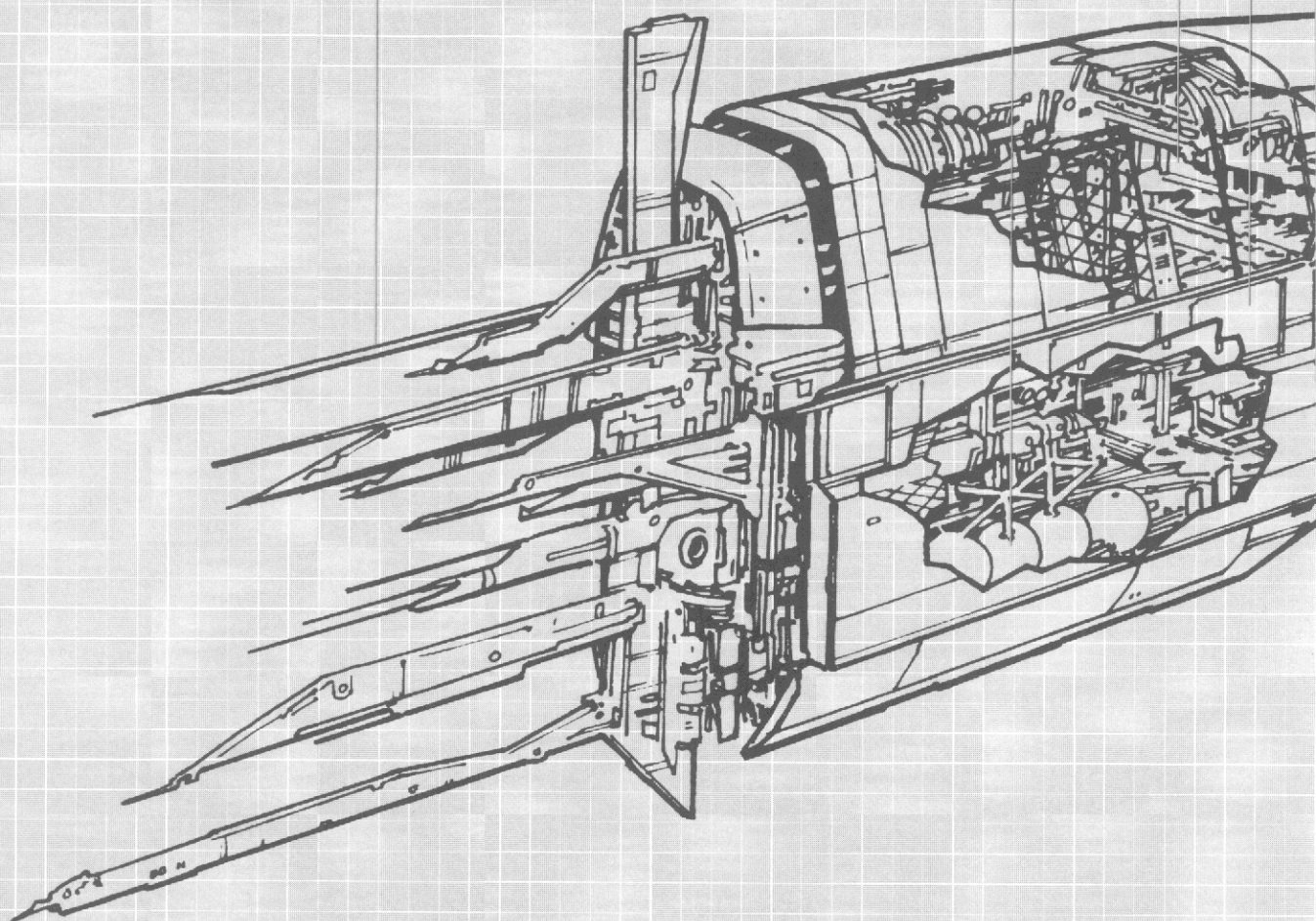
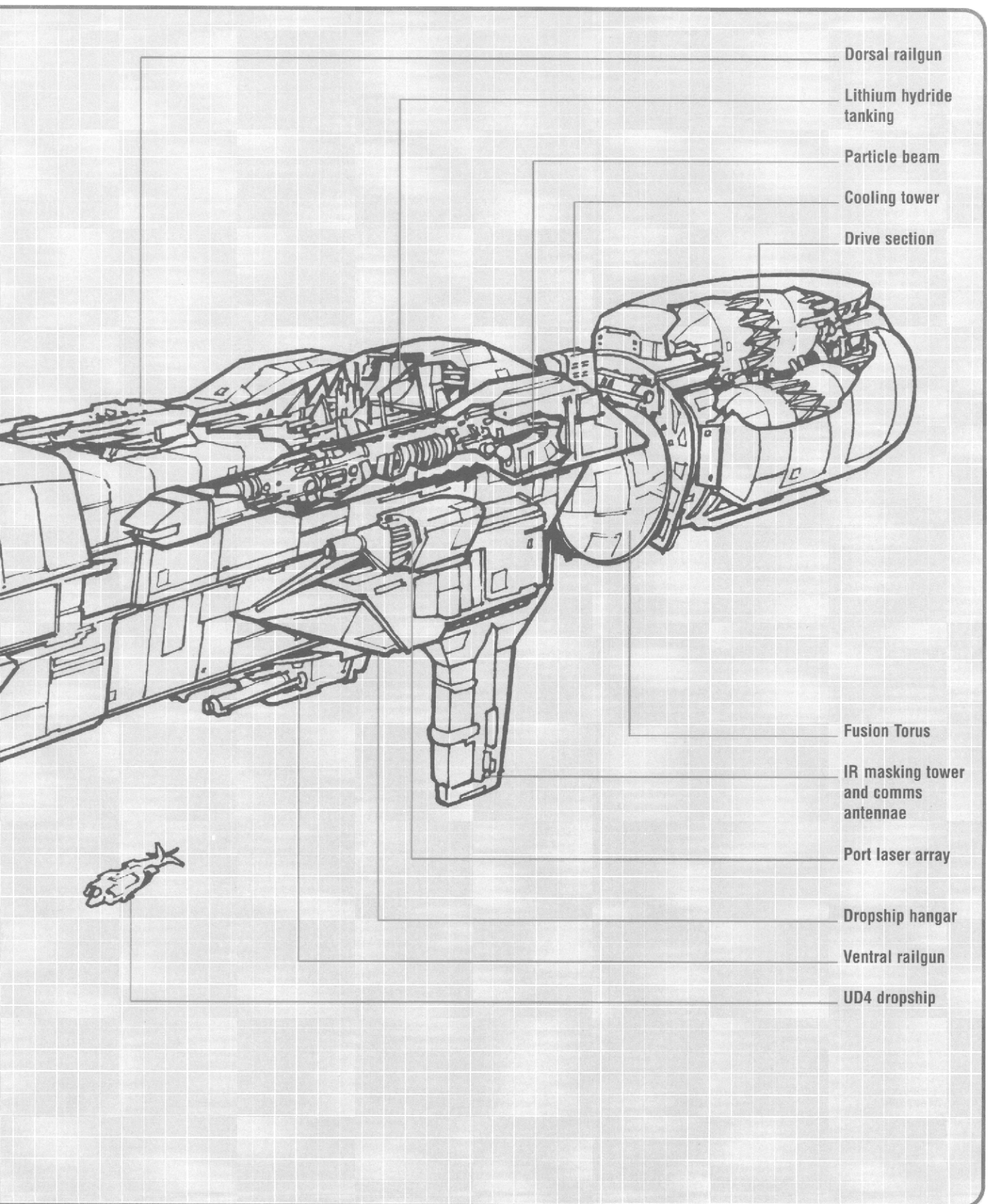


Fig. 6.4
USS Sulaco





ALIENS COLONIAL MARINES TECHNICAL MANUAL

In keeping with USASF and USCMC requirements for safety and the trend towards the reduction of crew workloads, the operation of the *USS Sulaco* and her Conestoga Class sister ships is fully automated. To run the onboard systems the *Sulaco* employs a 28 Terabyte Carbon 60 core mainframe situated behind the flight deck. While part of the system regulates all the starship's autonomic functions, including power generation, life support, auto repair and emergency subsystems, most of the main computer's capacity is used to run a powerful logic driver commanding the navigation, drive and defense functions. This effectively permits the vessel to pilot itself and fight space battles without the assistance of a crew, who might be incapacitated or in hypersleep. A starship's central processor is intelligent enough to make informed decisions regarding navigation, rules of engagement, pursuit and escape - though these decisions may be overridden at any time by the vessel's commanding officer.

Access to the computer is available from the main flight deck, and command consoles in several locations including the processor core and the drive engineering section. The system is self-diagnostic and redundancy is provided by an 8 terabyte backup mainframe situated forward of the fusion torus. In the event of a total system failure, a third tier of localised systems can continue to regulate the vessel's autonomic functions until the main computers can be brought back on line.

EMERGENCY SYSTEMS

Damage control in battle is handled mainly by the automatics. In the event of catastrophic damage to the fusion torus, the entire reactor assembly can be jettisoned before it explodes and the back-up power systems brought on line. Since the entire hull is compartmentalised, hull breaches can be easily isolated and valuable life support cut off from damaged sections. Internal fires are usually dealt with by opening the affected areas to space, though the system is directed not to do this in sections occupied by personnel, unless authorised by the commanding officer.

If the vessel is sufficiently damaged such that it can no longer maintain viable life-support, the starship's commanding officer or the automatic crisis management systems can initiate emergency evacuation. Each vessel carries twenty Type 337 Emergency Escape Vehicles (EEV) which may be launched within seconds of the decision to abandon ship. If the crew are unable to reach an EEV because they are in hibernation, the automatics will load their hypersleep capsules aboard the escape vessels and launch them.

Should the starship's commanding officer wish to scuttle the ship, they can do so by overriding the main reactor's cooling system, so initiating a supercritical nuclear reaction. This self-destruct system must be activated manually, and it is primed to allow the crew fifteen minutes to evacuate the ship and reach a safe distance from the center of the explosion.

SENSORS

Forward of the main hull, the Conestoga Class starships mount their main sensor arrays. Pylons up to 90 m in length project the sensors well away from the ship so that the bulk of the hull does not interfere. The sensor array incorporates two optical and two infrared telescopes, the largest of which has a twelve meter aperture. Optical and spectrographic (including UV spectrum) data from these are supplemented by a 60 m planar radio telescope array and a backup 20 m array for the passive monitoring of the electromagnetic spectrum. Active sensors include three main radomes mounting centimetric wave radar for navigation and deep space scanning. These radars can detect a 2m² object at ranges up to 1,000 km and a

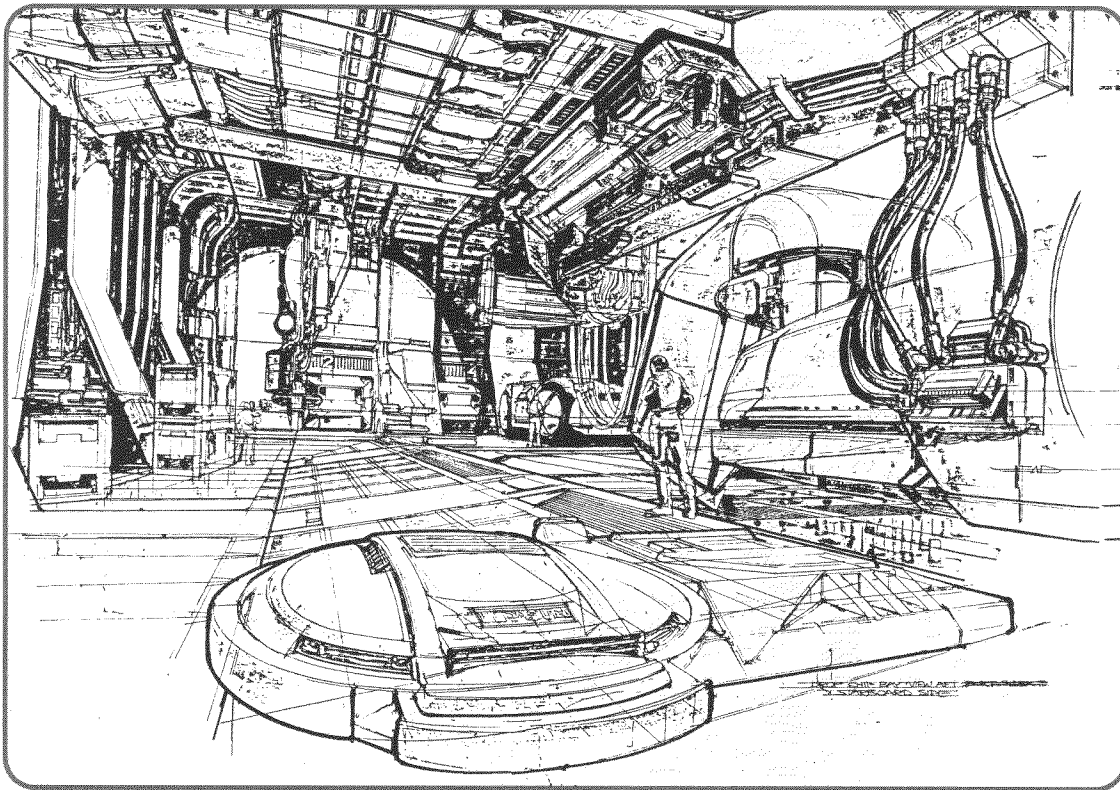


Fig.6.5 Sulaco cargo hangar

100m² object at 80,000 km. Five further centimeter wavelength phased radar arrays mounted along the length of the ship provide target tracking data for the weapons systems. Lastly, the dorsal antenna mast mounts a mass counter for navigation at supralight speeds, when sensory data from the outside universe is distorted by the Rohremann Effect.

Just forward of the drive section is situated the main communications array. This consists of a 64 m hyperstate antenna for FTL communication over interstellar distances. A secondary 16 m antenna and a battery of microwave relays provide intrasystem communication, while receivers for low band transmissions exist mainly for the monitoring and interception of surface communications.

STEALTH CHARACTERISTICS

Hull panels made of radar absorbent material serve to reduce the radar cross section of the vessel to less than 10 m² from the forward aspect and 260 m² from abeam. Engine outlets have infrared suppressors to disguise the engine flare, while a cooling tower beneath the hull reduces the ship's infrared signature. Hull coatings are laser absorbent to reduce lidar reflection, while the overall color scheme is a dark 'battleship' grey to minimize the ship's albedo.

MAIN ARMAMENT

All the vessels of the Conestoga Class carry a light armament to expedite their secondary role as warships. Although weapon fits vary widely within the class, the loadout and armament arrangement of the *Sulaco* is typical of a vessel of this type and mission requirement.

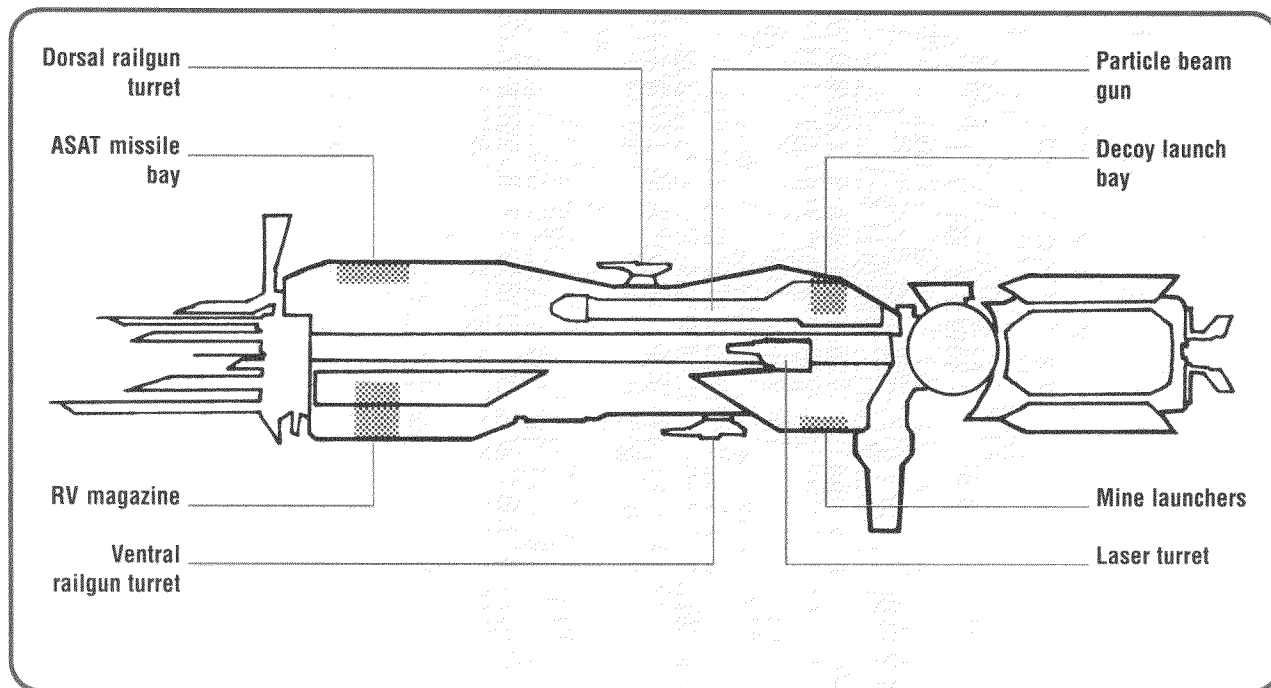


Fig.6.6 Weapons layout

For its main armament, the *Sulaco* carries eight XIM-28A Long Lance ASAT missiles in its dorsal launch bay. The XIM-28A is a 5.6 m Anti-Satellite Missile powered by a two-stage Lockmart LP-XII solid-rocket booster. Upon release from the launch bay, the first-stage motor ignites and accelerates the missile away from the launching ship. After four seconds the first stage burns out and the missile coasts the rest of the way toward the target. The second stage ignites when the missile enters its terminal phase to provide the necessary burn to complete the intercept against the target. A coolant jet system in the tail helps mask the motor's infrared and UV signature when it burns.

The weapon is designed to be launched under inertial guidance to the vicinity of an enemy ship, at which point the passive and active sensors aboard the missile begin to scan for the target. The option of a midcourse update is included to allow corrections to the missile's velocity vector as new or more accurate target solution data is compiled back in the launching ship. Terminal guidance for the missile is provided by an X-Band monopulse active radar, coupled with a wide-band photo-voltaic Cadmium-Zinc-Telluride detector capable of high-resolution scan imaging of objects in the infrared. Superheterodyne receiver aerials ringing the missile allow it to home in on any EM emissions from the target ship and provide a secondary home-on-jam capability. As soon as a target is acquired, the missile locks on and initiates a second stage burn to make the intercept. Intelligent logic protocols prevent susceptibility to target countermeasures such as false target generators and ballute decoys.

The warhead consists of a forged-fragment ring, fused to explode such that it creates a lethal cloud of penetrating fragments. The warhead's lethality is greatest in a head-on intercept where relative velocities are highest, though the intercept geometries are harder.

SECONDARY ARMAMENT

Secondary armament consists of a pair of 800 MeV turboalternator powered Neutral Particle Beam weapons, firing into the starship's forward 'cone', each capable of

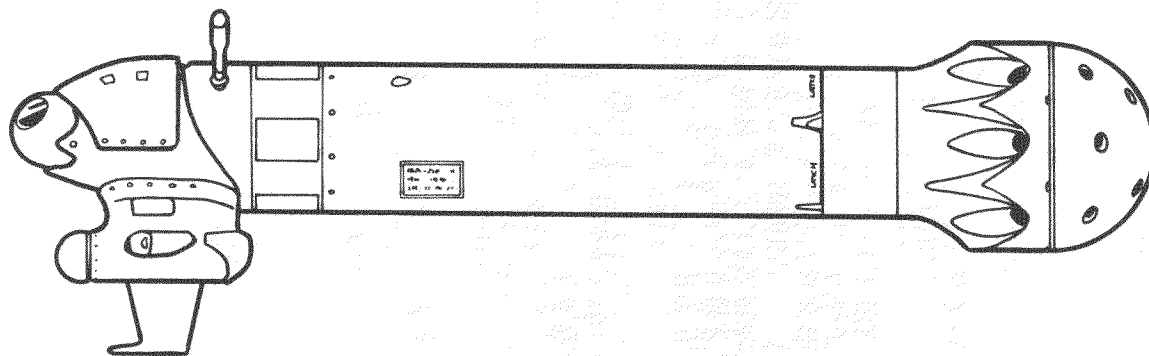


Fig.6.7
Long Lance Missile

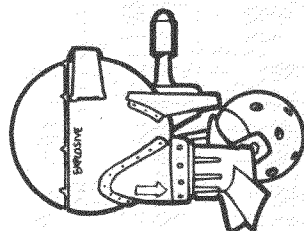


Fig.6.8
Fragmentation mine

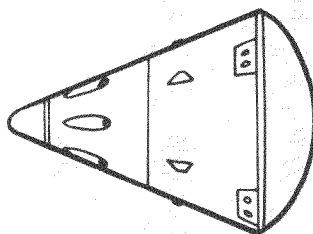


Fig.6.9
Re-entry vehicle

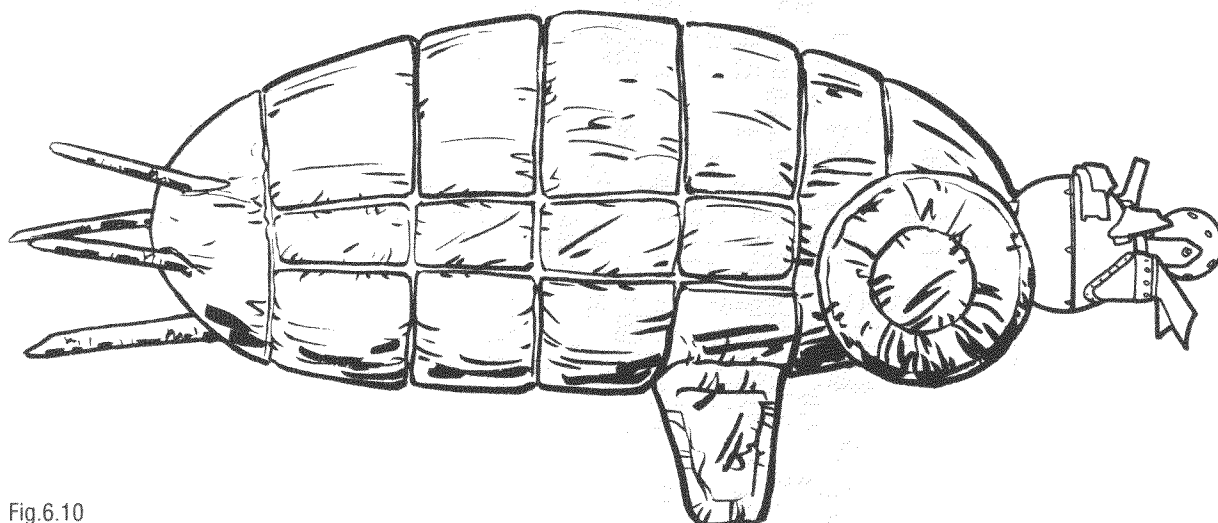


Fig.6.10
Decoy ballute



disabling a target's electronics and instrumentation at ranges up to 100,000 km. Sufficient deuterium tanking exists for up to 230 seconds of firing.

Short range armament consists of a dorsal and ventral turret, each mounting twin railgun launchers that fire kinetic ammunition at velocities over 12 km per second. Despite their high rate of fire, these weapons are less accurate than beam weapons against maneuvering starships or missiles, and have a practical engagement range less than 100 km. However, since a single hit from a railgun round is capable of causing catastrophic damage to a space target, they remain the most powerful close defense weapon in the starship's inventory.

The railguns work by accelerating a charged plasma to high velocities and using it to propel a kinetic round at the target. They fire up to 30 rpm each and are fed from an autoloader. Common ammunition loads include alternating KPI and KCP rounds. KCP (Kinetic Core Penetrating) rounds mass 220 grams each and are composed of steel-sheathed tungsten. KCP rounds that hit their target punch straight through the ship's hull, breaching every airtight compartment until they exit or come to rest and leaving a wake of secondary damage from hypersonic shockwaves and superheating in the pressurised areas. KPI (Kinetic Penetrating Incendiary) mass 202 g each and are composed of tungsten capped plastic composites. They are designed to penetrate the pressure hull, vaporizing after impact into a directed plasma hot enough to ignite the very structure of the target ship. In addition, they create a blast overpressure capable of blowing out several sections of the ship.

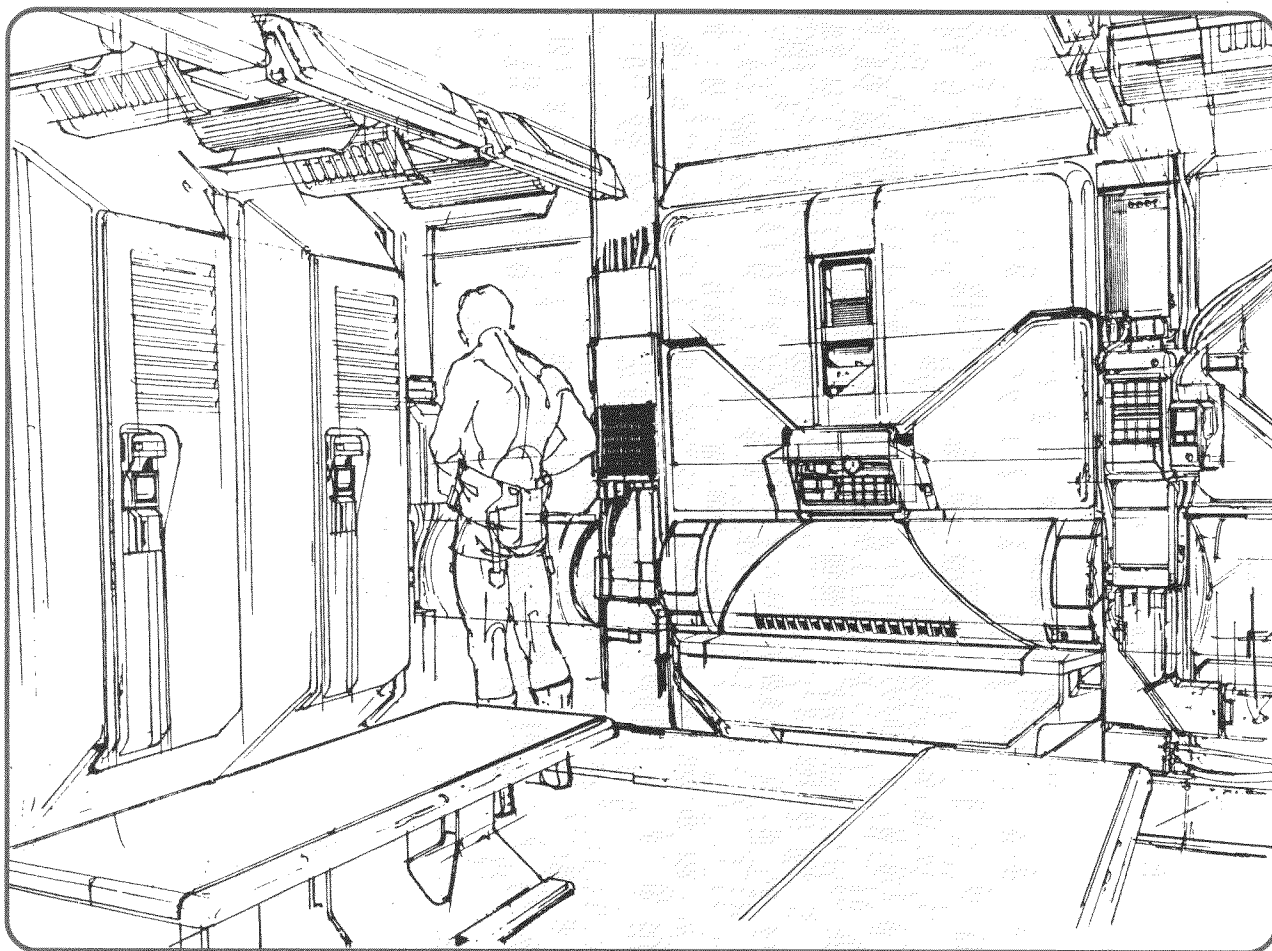


Fig.6.11 Marine locker room



Point defence for the Conestogas is provided by the port and starboard laser turrets. These mount 80 mW free-electron laser capable of vaporising small targets such as railgun rounds, or disabling incoming missiles and fighters at ranges up to 20 km.

A ventral dispenser can deliver 60 orbital fragmentation mines for kinetic kills against low-orbiting spacecraft, while an aft bay is equipped to launch up to twenty decoy ballutes and two maneuvering decoy drones against incoming enemy spacecraft.

A main magazine forward of the shuttle launch bay stores the orbital bombardment ordnance. The Sulaco carries 80 free-fall guided re-entry vehicles (RVs) capable of carrying a variety of warheads from bunker-busting kinetic penetrators to high explosive and nuclear, as well as decoys.

This armament, though light, is formidable enough to give the Conestogas a large degree of autonomy when operating far from a fleet or taskforce. Not only may they carry a considerable Marine complement but they may defend and control their immediate space and support their surface component with orbital fire. It is this flexibility that has made the class a mainstay of the Colonial Marines starlift arm for nearly twenty years.

6.2 EMERGENCY ESCAPE SYSTEMS

Twenty years ago, the Interstellar Commerce Commission laid down the first of a sweeping series of directives intended to standardise all starship escape systems in service. The need for commonality had long been recognised by the ICC, due to recurring problems in starship emergency evacuations, involving unfamiliarity with escape equipment, procedures and protocols. Recently, the directives have borne fruit with the installation of a new generation of standardised equipment aboard new-build starships. The **Bodenwerke Gemeinschaft Type 337** is typical of the current trend in EEV design and is the escape vehicle employed by the USASF and USCM aboard their **Valley Forge** and **Conestoga** class starships.

The Type 337 is a small escape vessel capable of carrying up to five people, and is 13.2 meters long with an L-shaped wedge configuration. At the trailing edge of the craft are three large titanium support struts which house ICC standard retaining lugs for connection to the mother ship. the EEV's underside is latched directly to the mother ship's escape hatches and access is made through these hatches via a large docking ring. The asymmetrical 'L' section of the wedge contains the life support equipment and drive section, and is connected to the mother ship via an outboard umbilical up until the moment of launch. The hull is made from carbon, alloy and ceramic composites and is capable of withstanding re-entry at severe angles.

Mission profiles for the EEV vary according to the situation. In the event of a disaster aboard a starship, the decision to abandon ship is normally given by the vessel's commanding officer. However, the nature of modern interstellar spaceflight forces starship crews to spend prolonged periods in hypersleep. If a crisis should occur while a crew is still in hibernation, there may be insufficient time available to revive them and the escape procedures would have to be handled by the automatic systems. In such a situation, the burden of decision making would be made by the crisis management computers aboard the mother ship. The ICC sets rigid protocols for the crisis management systems to ensure the evacuation of a ship is initiated when, and only when, failure to do so would result in the loss of life. If this point is reached, the mother ship's computers will send out a distress signal and begin the escape procedure.



Immediately, all EEV units aboard ship will begin to prep for launch. EEVs are kept on a permanent 30 second standby, and at this point their onboard computers and flight recorders will boot up their command menus and have mission data downloaded to them from the ship's main computer. Aboard ship, the automatics will disconnect the crew cryogenic umbilicals and then drop the hypersleep modules via a series of transport tubes down to the escape hatches where they are autoloading aboard available EEVs. As soon as the modules are secure aboard the EEV and plugged into the Escape Vehicle's life-support system, the onboard computer logs out of the mother ship's computer network and initiates its launch program.

At launch minus five seconds, if the signal to abort has not yet been received from the mother ship, the retaining lugs securing the EEV to the ship are pulled clear and the outboard umbilical detached. At launch minus two, the primary hull latches around the docking ring release so that the vehicle is attached only by two explosive retaining bolts. At launch minus zero, the onboard computer blows the bolts, allowing the pressure of the ship's atmosphere to flush the vehicle clear of the ship. The entire EEV evacuation procedure, from the decision to abandon ship to launch should have taken no more than 45 seconds.

Immediately the EEV is clear of the mother ship, the onboard computer begins to initiate search and rescue procedures, switching on a powerful distress and location beacon, while scanning the immediate sector of space for a suitable landing site or rescue vessel. The optimum flight profile and landing site would, in most situations, have already been determined by the mother ship computers prior to launch and downloaded to the EEV; however the onboard systems are fully autonomous and are capable of overriding the mother ship's decision should a better alternative present itself.

In general, an EEV will attempt to home in on the nearest navigation beacon (such as a space station or colony world) and set course for that location. The Type 337's hyperdrive unit has a range of approximately 1.4 parsecs and the guidance systems will ensure that it retains sufficient thruster fuel for an in-system docking or a powered re-entry. Since the EEV's life support capabilities are limited, it will keep the crew in hibernation for the duration of the journey, monitoring their status by use of the internal bio-function monitors and catscanners, waking them only for the terminal phase of the mission when rescue is imminent.

If a rescue ship appears within the EEV's scanning range, the onboard computer will attempt to hail the ship via the communications beacon and will maneuver to meet it. If no rescue ship appears, the EEV will continue on to its destination and will attempt planetfall there. The Type 337 has sufficient fuel for a single powered re-entry, but not enough to sustain any prolonged atmospheric flight; therefore, if a colony beacon exists, the EEV will follow the colony's landing beam directly down to its landing pad. If no such beam exists, the EEV will select a suitable site from orbit and attempt a touchdown there.

The Type 337 is a dead drop vehicle designed to fall unpowered from orbit until it reaches the lower regions of a planetary atmosphere, where it will use its thrusters to brake its descent. At this point the EEV deploys its tricycle undercarriage and jockeys on its remaining fuel for a landing site. If a planetfall is made on an uninhabited or unexplored world, the onboard systems may elect to keep the crew in hibernation, awaiting rescue. However, in most cases the automatics will complete the revivification of the crew once touchdown is achieved. If the crew survive the touchdown and find that they have a prolonged wait in order for help to arrive, storage lockers are provided containing essential survival rations for each crew member and first aid equipment.



The 337 EEV system is noted for its flexibility and reliability; however the nature of space disasters makes egress from a starship a most hazardous affair and, despite the advances in technology, many lives are still lost. Escape procedures are so elaborate that the malfunction of a single component (very likely when a starship is suffering a catastrophe) can jeopardise the entire evacuation, and even if all systems function perfectly, there is no guarantee of a successful rescue from the vastness of space. However, some chance is better than none, and given the lethality of most space emergencies it is hard to despite the accepted wisdom of old space hands who insist that 'When in doubt, bail out'.

6.3 SPACE CONTROL – Theory and Practice

"Radar Sir!"

"Certain?"

"Aye, Sir! I have three sweeps, search mode, followed by a short lock-on. Bearing... two-three-eight mark niner-two, approximate"

"Correlate track on optical. Can you get a solution?"

"Negative. There are no tracks against the starfield, sir. Nothing on IR either. If he's there he's coming straight at us."

"Christ! He has us cold! Go to active radar and get me a fix on that bogey. Weapons - prep two fish for launch on that bearing. Set for a midcourse update and stand by to pop a decoy the moment we've flashed the bogey."

"ZIPPO ONE! Incoming, Sir!"

"CONFIRM ZIPPO! I have three ASATs, lighting their search radars. No lock-on yet."

"Engage point defence. Helm - two second Zulu burn. GO!"

"GO FOR BURN!"

"No lock. They're still in search mode, Sir. Popping decoys now!"

"ASATs are green, Sir."

"You have him yet?"

"Aye, Sir! He's lit up his tracking radars; continuous pulse. Same bearing, range two-three-zero-zero. Fixed and locked."

"WEAPONS AWAY!"

- extract from bridge log of USS Savo at the Battle of Ceti Epsilon IV

Excerpted from the STARTAC '76 introductory seminar to the USCM staff college by Colonel James Mortimer, USASF:

"There's an old military axiom that whoever holds the high ground has the advantage. In the space age, that high ground is not to be found on the surface of a world, but in orbit. It is now accepted wisdom that whoever owns the skies owns the planet! The benefits of winning control of space are awesome. The victor can deploy reconsats to give him omnipotence over the surface. He can establish vital satellite communication networks and provide accurate global navigation for the grunts on the ground. He has command of the main supply routes to other star systems; and last, but not least, he has the ability to hurl warheads with impunity down from orbit onto the heads of his enemy. In short, ladies and gentlemen, space is the force multiplier for the Marines deployed on the surface, and is increasingly becoming an essential factor in the prosecution of the land battle. The logical corollary is that the first step to winning the ground war should be the control of space.

"In the hope that you will come to know our job better, I'm going to try and paint a picture of what we, the aerospace guys you Marines so quaintly refer to as your 'chauffeurs' (Audience laughs), do to earn our crust from Uncle Sam."



THE BATTLEFIELD

"The battle for the control of space cannot be fought in the interstellar regions. There, encounters are rare, largely because the detection radius of a starship's sensors is so relatively small. Even if you did, against all odds, manage to intercept a bogey in deep space, the velocities would almost certainly be too high for combat. Most importantly, there's nothing in deep space worth fighting over. The natural focus for the battle is the orbital space above a disputed planet, if only because taking and holding areas of mud - your job - is the most important part of prosecuting any war. Without you guys on the ground, our job is pointless.

"So what is our job? Well, the objectives are simple and can be summed up in one sentence: deny the sky to the enemy and provide support for the troops on the surface. In this initial seminar we're going to deal with the first part of this sentence. Space control works in two ways. First, you can hamper the enemy on the ground to prevent him from launching into orbit. Secondly, if he has ships in space, you can either chase him off, or force him to suck vacuum. Make no mistake, it's a dirty kind of war, with no fixed battle lines, no hard and fast rules - other than the harsh laws of physics - and no, repeat, no prisoners.

"There are two realms where the battle must be fought, which we term high orbit and low orbit. Both have their unique characteristics:

"Low orbit is a risky place to stay for any length of time, close to the surface where starships have little time to react to attacks from ground defences or enemy ships which appear over the horizon. Unfortunately, it is also the place you must be when you want to launch strikeships and dropships against the surface. The enemy on the ground can easily launch space denial weapons into a low orbit - weapons such as cluster bomb clouds or hundred-kilometer diameter barrier nets. These kind of kinetic defences are hard to detect and can shred any ship that impacts at orbital velocities. On the positive side, in low orbit ships move very fast, have more maneuver options and can surprise a surface enemy by swiftly appearing over the horizon.

"By contrast, the high orbital realm, which include the geosynchronous orbits, commands a better view of the battlefield. Ships and satellites are tougher to sneak up on here because distances are greater and there's less horizon to block the view. On the other hand, ships in high orbit travel slower relative to the surface and stay in the enemy's line of sight for much longer. From a geosynchronous station, you can scrutinize the enemy on the ground, but he can eyeball you as well!"

WEAPONS

"Like a gunslinger of the old west, a starship captain must be careful with his or her choice of weapons in space. There are, generally, two kinds of weapons: directed energy weapons and kinetic kill weapons.

"Directed energy weapons, including laser and particle beams, have the advantage of being near-instantaneous, since their beams travel close to the speed of light. They're accurate too; at a hundred-thousand clicks, beam divergence can be measured in terms of a few centimeters. The limitation with these weapons is that of killing power since they attenuate energy relative to the square of the range; a particle beam that can punch a hole in the ship's hull at ten kilometers will at best fry its electronics at a hundred. Another problem is that of countermeasures. Most modern starships carry shielding, such as dissipating aerogel layers, against beam attack, and they can reduce the effect of a beam by maneuvering to play it across their hulls rather than allowing it to settle



in one spot for maximum damage.

"Kinetic weapons are far deadlier. A one hundred gram railgun round impacting a starship at over twenty kilometers-a-second will cause catastrophic damage, and no-one has yet succeeded in equipping a ship with armor tough enough to withstand this kind of punishment. The problem with these weapons lies in hitting the target. First, they are not accurate enough; at five thousand kilometers the dispersal on a volley of railgun rounds can be dozens of meters - sufficient to miss a starship. Second, they're not fast, taking many seconds to reach the target. At long range, both railgun rounds and missiles can be dodged, decoyed or shot down long before they reach the enemy."

TACTICS

"There are three things you must remember when engaged in a space battle. One: he who shoots first wins. Two: range determines the shape of the battle. Three: it is hard to radically change your velocity vector in space. Before we examine the first point on this list, it is worth looking at the other two.

"Range determines the shape of the battle for the simple reason that your weapons are optimised for different ranges. To give you an idea about what we mean by range, we consider the longest range to be the limit of a starship's detection range - up to a hundred-thousand kilometers. Short range is anything below a hundred kilometers, while a target at ten kilometers is considered to be at point blank.

"The primary ship-killing weapon of most spaceships is the ASAT missile. ASATs are long-ranged, small and hard to detect until they're up close. If a launching ship can place an ASAT close enough to a target, the missile will use its own sensors to acquire the enemy and hunt it down for a hard kill. Particle beams are capable of obtaining a hard kill at point blank range, but at longer ranges they are less effective. In a long range engagement they are best employed to play across the target starship's sensor array and blind the enemy.

"Lasers and railguns are most effective at close range, though they both have peculiar traits regarding accuracy and hitting power. These are most often used as point defense against incoming ASATs and railgun rounds. If you're close enough to trade punches with an enemy ship using these weapons, then you're probably too close. You'd better pray you get your shot in first.

"My third point was that it is hard to radically change your velocity vector in space. Remember that starships aren't aerospace fighters; they can't dogfight. When you make a burn and commit to a delta-vee during a space battle, you're gonna keep going in that direction until you pass through and out of the enemy's engagement range. Sure, you can alter it a little and dodge about a bit, but you're not gonna bootleg around ninety degrees and come back at the bad guy. If you're that desperate to fight him, you're going to have to wait for his next orbit to come around - assuming he's stupid enough to stay in that same orbit and doesn't pull any sneaky tricks of his own.

"The velocity rule is very important when employing your ASATs at long range. If you can't plant those missiles right on the target from the launch, then they're not going to have enough thruster fuel in their terminal phase to alter their delta-vee sufficiently to intercept the enemy ship.

"And this brings us back to my first point about tactics. If you're gonna win, you have to have the drop on the bad guys. Forget any illusions you have from watching teevee; starships do not sidle up alongside and knock the stuffing out of each other at a thousand meters! No. Space battles are short, sharp, brutal

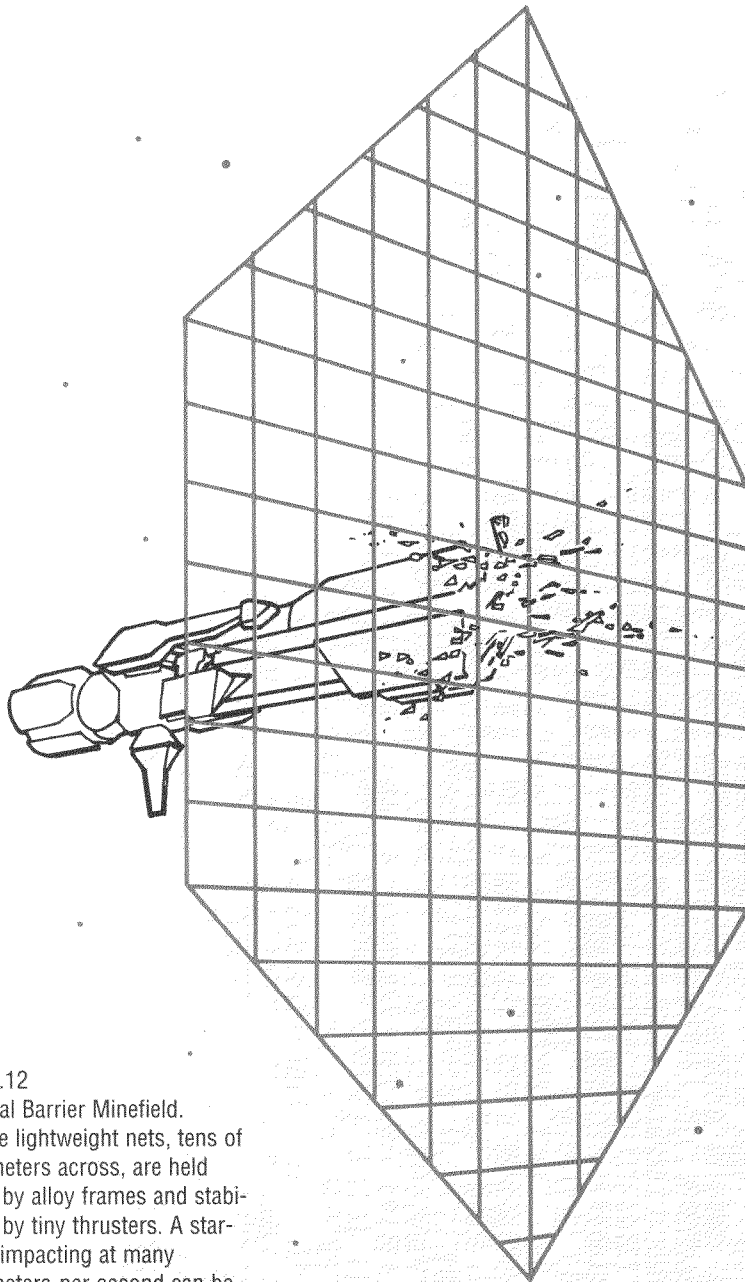


Fig.6.12
Orbital Barrier Minefield.
These lightweight nets, tens of kilometers across, are held rigid by alloy frames and stabilized by tiny thrusters. A starship impacting at many kilometers-per-second can be disabled by such an object.

fights, with the decision going to the ship who spots the enemy first and gets his best shot in.

"Good captains should have an assassin mentality - prepared to sneak up on an enemy and stab him in the back before he can react. Almost 90 percent of space battles are settled this way - without even an exchange of fire. The key phrase here is 'emission control'. A starship captain can't always use his radar and lidar, broadcasting electromagnetic emissions which are gonna light him up like a beacon for everyone to see. The good captains, the ones that survive at least one battle, stay invisible. They control their infrared and EM emissions to

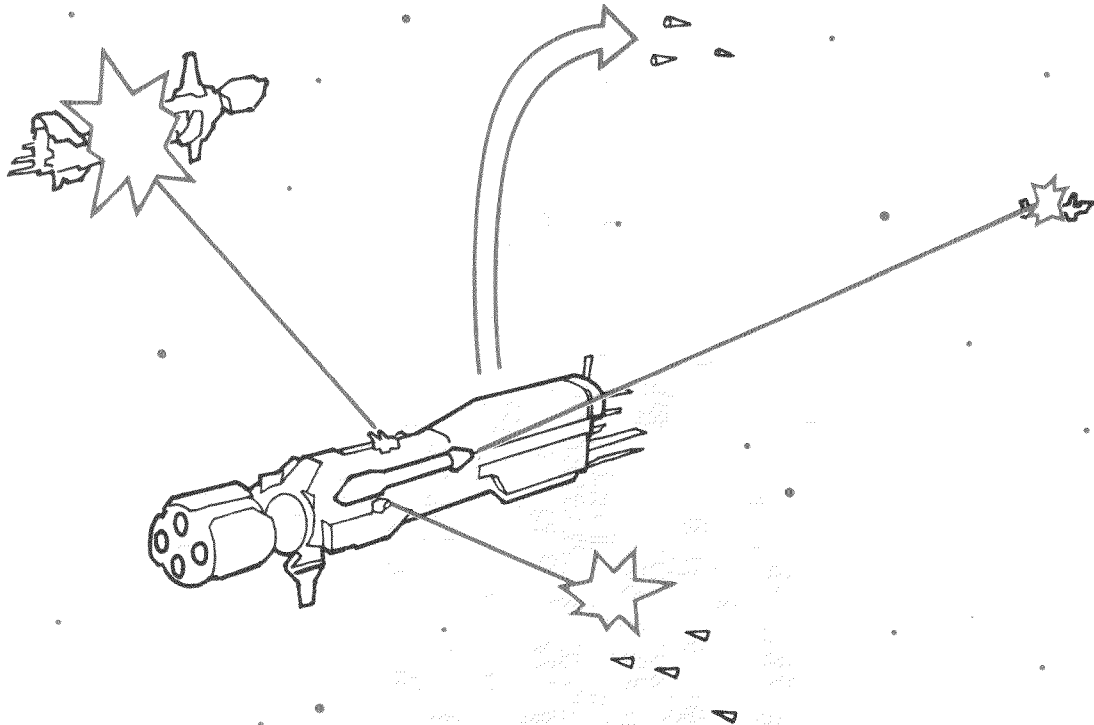


Fig.6.13

Weapons ranges.

ASATs and particle beams can engage targets at great distances. Railguns provide 'hard kill' capability at close range while lasers protect the ship against incoming missile constellations and fighters.

become an invisible 'blackbody' in space; they limit their relative motion against the starfield so as to prevent visual detection; they plan their attack pass to fall on the enemy from a sensor blind spot such as a system's star; and they disguise the flare of their ASAT launches. When they light up their radars, it'll be to obtain a firing solution for their weapons, and by that time it'll hopefully be too late for their enemy.

"Stealth is everything, and in a battle in which both sides are attempting to find each other in a vast, vast sky, the winner will be the smartest, most alert and best trained.

"This is the essence, the Zen of space combat..."

6.4 USCM STARLIFT COMMAND

The USCM **Starlift Command** is an allied branch of the **USASF Transport Command**. Starlift Command is essentially an administrative organization, arranging for the attachment of USASF transports to fulfil individual missions. Where additional USASF vessels are required for escort, space control and aerospace support, Colonial Marine transports and assault vessels come under the command of the USASF fleet commander. However, for missions that do not require USASF support, transports remain under USCM command.

The three major classes of ships employed by Starlift Command include the **Conestoga** class light assault ship, the **Henderson Field** class transport and the **Okinawa** class assault carrier.

ALIENS

7.0 ALIENS

7.1 WEYLAND YUTANI, GATEWAY

PLAYBACK A//2884879/w-yut.Gwy/Res/Com9
Aug 12 09:32:18 2179

"Michael, we have a redball on Zeta 2 and according to CONRAD it's all your fault. Your Tokyo boys are wetting their collective pants over ICC intervention and hinting we should keep well upwind of you; I guess they're preparing to hang you out to dry."

"What for? They have nothing."

"That's just it. US Space Command just lost a starship and they want to know why. They're going to ask questions, and unless you get some help they're gonna track it straight back to your company office."

"Okay Colonel, so what help do you think I need?"

"That depends on what you can offer, doesn't it?"

7.2 SPACE COMMAND, O'NEILL STATION

"Waco, Waco. This is T-Bone. We have a recovery."

"Roger, T-Bone, what have you got for us?"

"We have a CARTWHEEL trace pickup on Network, ingressing at a hundred-forty cee. Approximate coordinates: positive three, one-seven, four-three, negative six-two, three-nine, four-eight, by thirty-five point two."

"According to my chart, that's out by Zeta 2 Reticuli. Does DEPCOM have a beacon signal?"

"That's a negative, Waco. We have no ident. Just a mass trace."

"T-Bone, check the A-22 log. What do we have in that bit of sky?"

"I have a confirm on that A-22, Waco. I think we've tagged the Sulaco."

7.3 WEYLAND YUTANI, GATEWAY

PLAYBACK B//8037093/w-yut.Gwy/Res/Com9
Sep 05 14:20:02 2179

"What in hell happened out there?"

"You want an honest answer? I can't tell you yet. There's a rights situation that has to be resolved first."

"But what did Carter Burke do?"

"Burke's dead."

"Whoa. Was this confirmed?"

"Yes, a few days ago. "

"So you've recovered some data?"

"I can't say."

"Has this anything to do with Epsilon Eridani?"

"Listen, CONRAD and Tokyo have given me a wide degree of latitude on this, but I'm under orders. All I can say is that Bioweapons and D15 have got the situation locked down tight. I can't tell you anything else."



PLAYBACK C//0985609/w-yut.Lon/Res/Com14
Sep 06 10:50:12 2179

"The purpose of this briefing is to reconstruct the known encounters with the alien lifeforms with the information we have to date. As yet, no actual specimen of the creature has been captured – everything we have is based on first and second-hand accounts, a handful of pictures taken by the extraction team, and the data from the Sulaco flight recorder. Mission objectives are to collate all intelligence on the aliens and formulate strategies for locating, extracting and handling a specimen – preferably alive. As you are aware, the potential team bonuses for a successful capture are substantial. Tokyo's posted nothing yet, but we're currently in negotiation on the share issue.

"Of course, all this is dependent on a positive result. May I also remind you we are working against the clock on this one. Mister Cueller, if you please –"

"Okay – the initial encounter took place over 57 years ago; reference 6/3/2122. Most of the information we have here comes from the record of the woman Ripley's testimony to the ICC inquiry earlier this year – the full transcripts are in the first appendix to your briefing notes. The veracity of Ripley's account may be the subject of some discussion; though we can assume her story to be generally true, some of the specifics are almost certainly inaccurate or at least exaggerated. Unfortunately, corroborating data is not available, for reasons which will become apparent later.

"Ripley was second officer aboard the USCS *Nostromo*, an M class commercial towing vehicle hauling an ore refinery from Thetis to Earth. Uh, specifics on the *Nostromo* are also in the appendix to the briefing notes—"

7.4 UNITED STATES COMMERCIAL STARSHIP NOSTROMO 180286

The *Nostromo* is an M class starcruiser registered to the Weyland-Yutani Corporation out of the US state of Panama. Refitted as a commercial towing vehicle in 2116, the *Nostromo* has largely been employed running automated ore and oil refineries between the Sol system and 20 Reticuli.

Massing 63,000 metric tons, the *Nostromo*'s spaceframe is based on a modified **Lockmart CM-88B Bison** transporter. The *Nostromo* is designed to an 6-10-4 layout with three pressurized decks and four main cargo holds. Most of the spare volume is taken up by fuel tanking for the fusion reactor and the reaction mass for the thrust engines. An off-axis hood frame mounts the docking latches for the towed cargo. The *Nostromo* is a sturdy vessel capable of withstanding atmospheric re-entry and for surface landings is supported by three main landing shocks. Micrometeorite and particulate shielding is sufficient to withstand the roughest re-entries.

In-flight systems are controlled by the central 'Mother' processor. Mother is a 2.1 Terabyte intelligent mainframe which monitors all ship's flight and autonomic functions. A 2.0 Terabyte backup mainframe comes on line in the event of CPU failure, and a third tier of automatics is capable of sustaining autonomic functions should the backup fail too.

The communications fit is standard, comprising a 10 and 4 meter hyperstate antenna for interstellar communications and short-range UHF/VHF/HF radio/video links. Sensors are mounted on pylons clustered around the forward hull of the ship and comprise two 2 m aperture telescopes capable of optical, spectrographic and



infrared resolution; a gas chromatograph; centimetric navigation and landing radar; a synthetic aperture ground-mapping radar; and a mass counter for supra-light navigation.

The power core is a **Laretel WF-15** 2.8 Terawatt fusion reactor. The fusion process is a deuterium/tritium reaction that fuses the fuel elements in a containment sphere using conversion lasers. The He^4 byproduct of the reaction is stored separately and vented at regular intervals. Power is drawn off the reactor by a closed-cycle liquid potassium cooling system. This runs off into an induction torus which uses the intense magnetic fields created by the superheated potassium to generate electrical power. The ship may be scuttled by an authorized crewmember by overriding the reactor cooling system and bleeding off coolant, which in turn initiates a supercritical reaction in the containment sphere. After activation the crew have ten minutes to get clear of the ship before the reactor explodes.

Supralight drive is a **Yutani T7A NLS** tachyon shunt capable of unladen high cruise up to 0.42 ly per sidereal day (153 cee). When towing large mass cargoes such as automated refineries, the maximum sustainable cruise speed drops radically, to approximately 0.1-0.12 ly per sidereal day (40-45 cee). For maneuver at sublight speeds while towing a large mass, immensely powerful mass reaction engines are required. Aboard the *Nostromo*, the original **Saturn J-3000** engines have been replaced by two **Rolls-Royce N66 Cyclone** thrust tunnels with bipolar vectoring for midline lift function. Each powerplant develops 65,830 metric tons thrust, using water for reaction mass. Running wide open, both engines give a high impulse thrust total of 131,660 kN.

The lifesystem comprises three decks, including the bridge, crew quarters and mess areas, science station, CPU module, medical bay, four main cargo bays, stores and engineering stations - all comprising some 1.1 million cubic meters of pressurized volume including the air ducts and air scrubbing plant. The *Nostromo* has an operating crew of seven - Ship's Master, First Officer, Executive Officer, Navigation Officer, Science Officer, Chief Engineer and Engineer's Mate. Seven hypersleep capsules have been installed for long-duration flight. Polarized gravity generators provide internal gravity and inertial dampening. Beneath the hull is an external docking bay for a shuttlecraft. The shuttle is capable of acting as a lifeboat in the event a ship evacuation is required.

PLAYBACK C/ cont// ref 10:59:53

"-In addition to the seven-man crew, you may wish to note that ICC dispensation had been given to the *Nostromo's* master to carry a ship's cat, ostensibly to cope with a rodent infestation-

(Laughs)

"Okay, approximately ten months into the flight, the *Nostromo's* CPU picked up a radio beacon emanating from the vicinity of Zeta 2 Reticuli. According to Ripley, the beacon was an analog acoustic signal, repeating every twelve seconds or so in an unused waveband just above the hydrogen line. When it picked up the beacon, the CPU dropped the *Nostromo* to sublight and defrosted the crew. When later interrogated by the ship's master - uh, Captain Dallas - the CPU claimed that the beacon was a distress signal and it was responding automatically under the usual ICC directives regarding mayday calls. The signal was being broadcast from LV426, a moon of the fourth planet -"



7.5 ZETA 2 RETICULI

Zeta 2 Reticuli is a G1 V class main sequence star located approximately 36.7 ly from Earth. Coordinates for Epoch 2122 were: RA 3.17.31 Dec. -62.40.28; coordinates for Epoch 2179 are: RA 3.17.42 Dec. -62.39.50. Absolute Magnitude is 5.22 (approx. 0.72 solar luminosity), Mass is 1.12×10^{27} metric tons (approx. 0.56 solar masses). Zeta 2 has a distant binary companion: Zeta 1, a G2 V class main sequence star with an Absolute Magnitude of 5.513 (approx. 0.57 solar luminosity). The two stars orbit each other at a mean distance of 5,800 AU and have a period of approximately 50,000 years.

Zeta 2 has a habitable life zone between 0.68 and 1.02 AU. Zeta 1 is too distant to provide sufficient radiation to extend the life zone - from a planet in the Zeta 2 system, the companion sun would appear merely as a very bright star in the sky. Of the eight planets in the Zeta 2 system, only two orbit within the habitable region; they are both aggregated rock balls with trace atmospheres, incapable of sustaining life. The fourth planet is a Jovian supergiant - a brown dwarf protostar - notable for a relatively low albedo and a well developed ring system. Zeta 2 IV has a mass of 1.899×10^{25} metric tons (approx. 10 Jovian masses) and an equatorial diameter of 306,400 km. It orbits just beyond the life zone at a mean distance of 1.08 AU.

The second major moon of Zeta 2 IV is the planetoid LV426, named Acheron. Acheron orbits its primary at a distance of 1.79×10^6 km. It has an equatorial diameter of 12,201 km, a density relative to water of 1:5.075, and a gravity of 0.86 g. Its orbital period around Zeta 2 IV is 5.07 sidereal days, and its rotation is 5.07 sidereal days. For an observer on the surface, Zeta 2 IV has an apparent size in the sky of some $9^\circ 45' 36''$.

The crust is made up from aluminum silicates, though there is plenty of evidence of magnesium silicate intrusion, manifest on the surface as basalt, rhyolite and microgranite lava flows. Despite the ample evidence of activity in the planetoid's core, there is no discernible volcanism or tectonic activity present, which would be consistent with a tidally-locked body. The indigenous atmosphere, prior to reclamation, was primordial, consisting largely of nitrogen, water vapor, carbon dioxide, some oxygen, and concentrations of methane and ammonia.

PLAYBACK C/ cont// ref 11:04:30

"According to the appendix, the world was unsurveyed at the time of the Nostromo's encounter. Given that the world is only 11 parsecs away, how do you account for that?"

"When it was first cataloged by a, -uh, French fly-by probe, the presence of IV's well-developed ring system seemed to indicate that none of its moons were particularly massive - it was assumed they were all low-density Galilean-type ice balls with an ice crust over a silicate core. It wasn't until the first comprehensive system survey back in the '30's that the actual composition of LV426 was ascertained. It's been hypothesized that Acheron is a recent captured body - acquired in the past 40 million years, maybe - and that the rings orbiting the brown dwarf may be the debris from a smaller body fractured by the tidal stresses inflicted by LV426's appearance. In time, the rings should break up again. This could explain many things: the presence of cometary material in the system; debris at the L- points; and the shattered nature of Acheron's geography - despite the relative lack of tectonic or seismic activity."



PLAYBACK C/ cont// ref 11:42:03

"The Rubis survey also discovered that Zeta 2 IV was pumping out a massive amount of radiation in the infrared. This supplementary energy, with the radiation from the primary, is enough to create a habitable zone of its own. LV426 sits slap bang in the middle of that zone. All the terraformers had to do was scrub the atmosphere and--"

PLAYBACK C/ cont// ref 11:07:49

"Upon the recommendation of the Nostromo's CPU, Captain Dallas set down on the surface at -uh, coordinates +0°6'20", +39°0'2" within 2,000 meters of the beacon. Three of the crew: Captain Dallas, Navigator Lambert and Executive Officer Kane went to investigate. They encountered some kind of derelict alien craft of unknown configuration and origin at the beacon coordinates. According to Ripley and the account she received later from the Captain, the vessel was large - possibly several hundred meters in length - and was crashed, embedded in the surface. The ship - and the description isn't clear here - was asymmetric and shaped like a 'hook' or part of an arch. It was ribbed and striated and described by the Captain as--"

PLAYBACK C/ cont// ref 11:09:23

"In your briefing notes you have the second-hand description of Dallas, Lambert and Kane's exploration of the vehicle. Of particular note is the account given of the alien 'crewmember'. We have no exact description, but the creature was obviously inhuman and the Captain was of the opinion it had been dead for some great period of time - the corpse had completely calcified, and appeared to have died from a large exit wound in its thorax. Note also the brief description of the egg chamber below the crewmember's podium and the results of Kane's approach. After being attacked, Kane was rushed back to the Nostromo. Ripley tried to refuse them entry to the ship for quarantine reasons, but was overruled by the ship's Science Officer, Ash. Kane's body was then taken to the infirmary and cut out of his suit--"

PLAYBACK C/ cont// ref 11:14:07

"Section three in your notes contains a description of the parasite phase of the creature, based on Ripley's account and the flight recorder data downloaded to Network. It is large enough to completely cover the face, which it grips on to with eight three-knuckle digits. Pulsing 'flaps' at the sides completely seal the face off. A segmented tail wraps around the neck and the creature runs a breathing tube into the subject's lungs to keep them alive. There were no signs of a breathing intake or any other orifice such as an anus. According to Ripley, Ash claimed that the parasite had an outer layer of protein polysaccharides and was replacing its tegument with polarized silicon to give it greater resistance to the elements. How this was done was not explained."

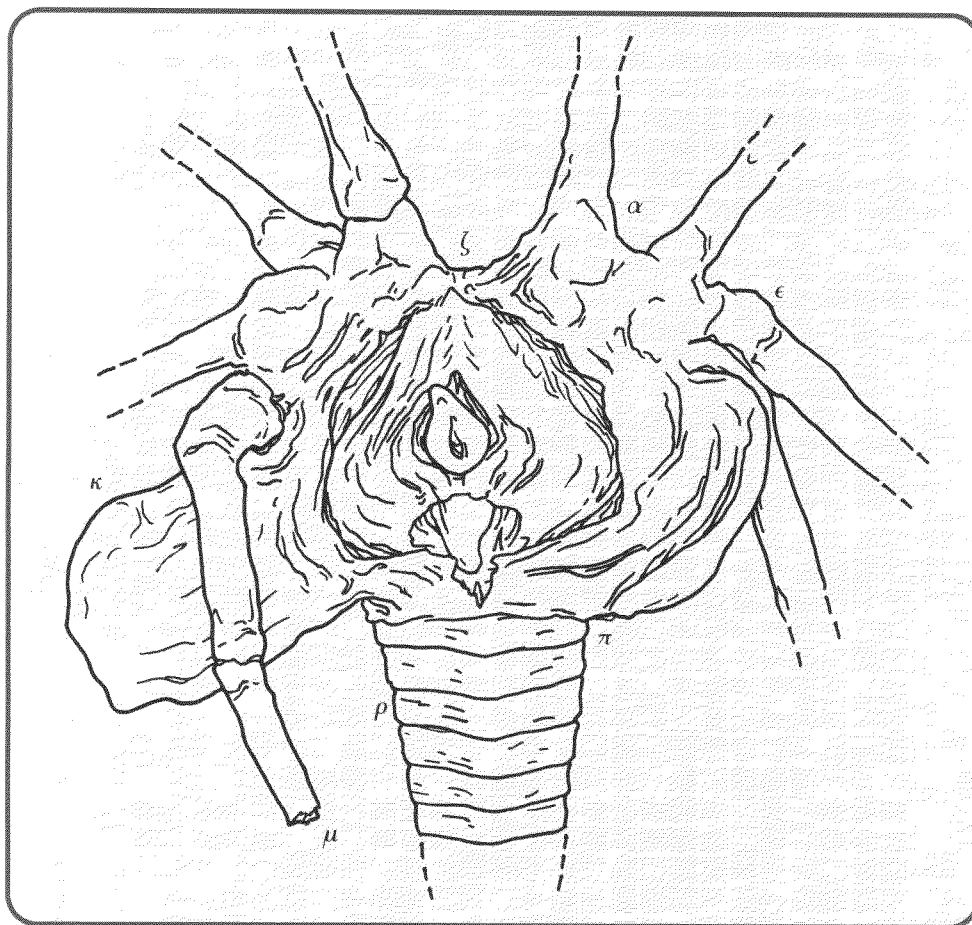
"Excuse me, was the parasite shedding and replacing its own skin, or was it also doing this for its host as well?"

"That's not clear from the transcript - Ripley's account is not specific enough, though that would certainly fit the modus operandi. This creature works actively keep its host alive."



"Anyway, as we now know, the breathing tube or some other apparatus was used by the parasite to implant an alien embryo into Kane's body. The creature is sightless and there are no obvious sensory organs - I'll ask for speculation on that in a moment.

"An attempt to remove the parasite was made by Ash and Captain Dallas. A laser scalpel was used to cut into one of the parasite's digits; immediately a 'yellow, pus-like fluid' - assumed to be blood - spurted out onto the operating table and floor. The stuff immediately ate through the flooring and the next floor as well."



PLAYBACK C/ cont// ref 11:56:58

"Excuse me - how do we know this to be blood? As far as we know, the creature could carry this stuff in its skin capillaries or an acid sac purely as a defensive measure. There's no implication from the account here that it is actually a blood medium."

"You're right, it is an assumption and we can't leave out the possibility that it may use another fluid for blood."

"Michael, we have a working theory at the moment that the alien creatures' physiology may be based around fluorocarbons and hydrofluorocarbons. The blood itself may be a compound based on fluorines; maybe a working medium based around hydrofluoric acid -"

"-Shoot! That's evil stuff! Splash some of that stuff on your hand and your best cure is to cut off your arm at the shoulder before it works its way up through the capillaries and the nervous system to the brain!"

"What stops that - nothing, right? It dissolves glass, steel, any hydrocarbon polymer--"

"-You can't stop it. The only things it won't touch are fluorine compounds--"

"-PTFE--"

"-Polytetrafluoroethanes, teflon, whatever."

"Well, that would explain why it ate through the hull. If it was a fluorine-based lifeform it wouldn't need any oxygen at all to convert energy - when the adult form eats, its digestive system would snip-up all the long-chain molecules, throw out the oxygen as waste and manufacture fluorocarbons and chlorofluorocarbons--"

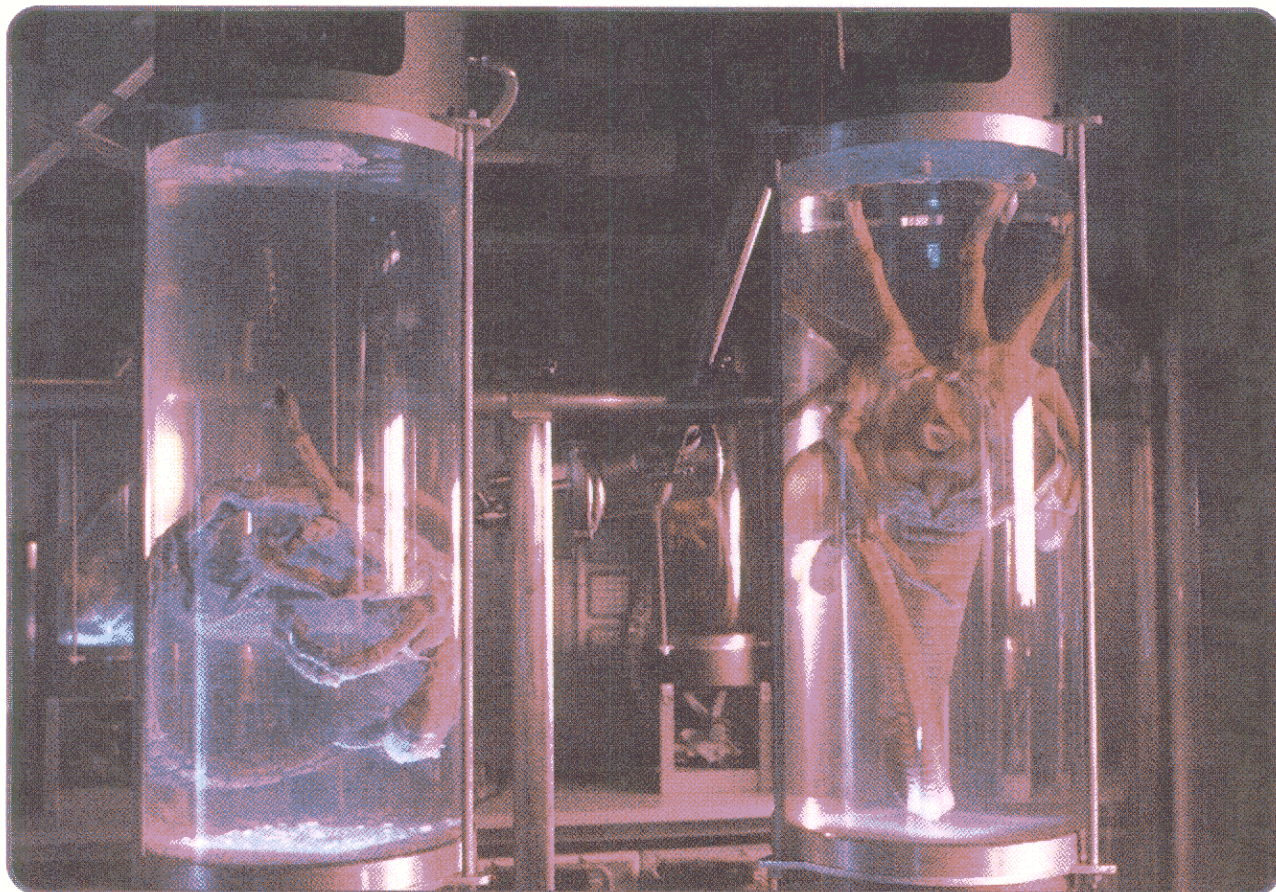
"-Assuming this hypothesis is correct,^h the adult form would operate like those breeds of insect which use their blood to digest their food--"

"-Jesus H. Hubbard! That's damned efficient!"

"Hold it, but what about the polysaccharide tegument? That would indicate a structure around carbohydrates - some kind of chitin or glycosaminoglycan. Assuming Ash's analysis was correct, this is a hydrocarbon based life form. Any fluorine-based medium would dissolve it--"

PLAYBACK C/ cont// ref 12:16:48

"So, if we hypothesize that the alien blood is fluorine-based, when it eats a human, it would extract mainly carbon compounds, along with the fluorine components it needs to manufacture the saturated fluorine compounds--"



"—Rumiko, I'm still having problems working out all the enzyme kinetics needed for these theoretical fluorine-based enzymes to convert a hydrocarbon based mass into usable energy. I'm sorry, I'm not convinced this hypothesis stands up. We know the tegument of the parasite has a hydrocarbon base. What other molecular acid options are there for the blood medium?"

PLAYBACK C/ cont// ref 12:19:35

"It would work as a hydrofluoric/hydrochloric mix. The preferred concentration in the blood is HF. However, an embryo implanted in a human body would have access to a ready supply of HCl from the host's stomach. It starts life with an HCl imbalance which could alter as it grows. Of course, it could take on additional chlorine and fluorine from its prey, or it could 'salt' it with sodium chloride or sodium fluoride."

"Sorry, this model is just too elaborate for my tastes. I still don't buy it. Even with PTFE coated cell membranes, wouldn't the body chemistry of a fluorine-based embryo be so hostile that it would just eat through the linings of the host's body?"

PLAYBACK C/ cont//
ref 12:45:01

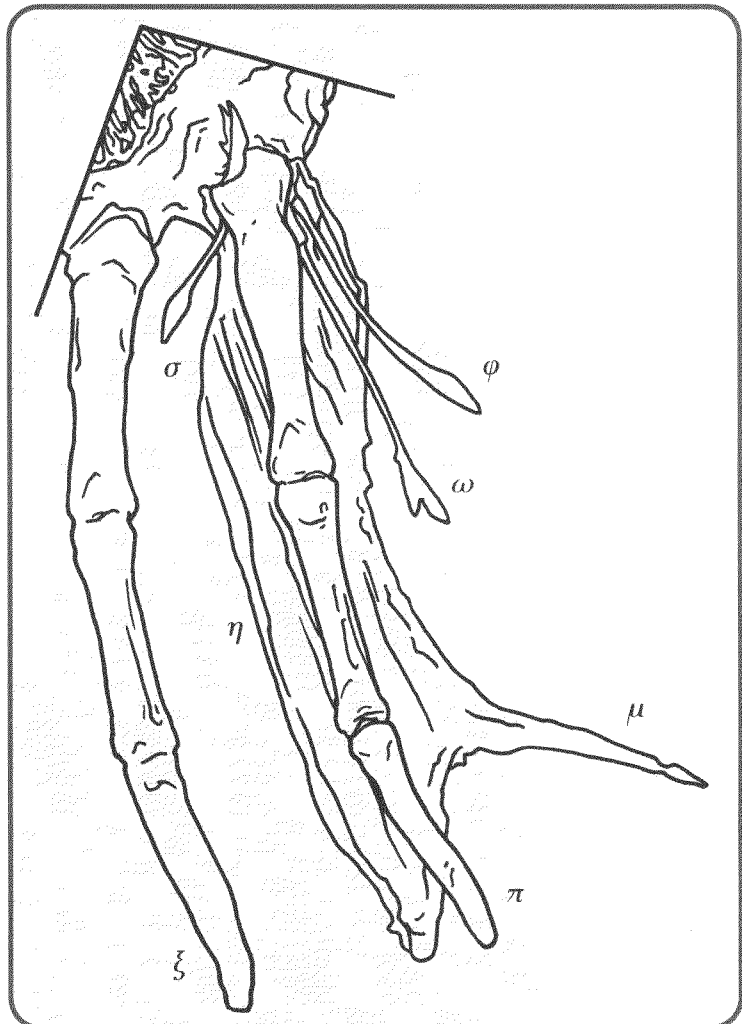
"I wouldn't like to torch one of these suckers!"

"Hnn?"

"If Rumiko's theory is right, the alien blood could be highly reactive to fire. But think — if one goes up in flames, releasing all those hydrofluorocarbons, then BOOM! Your ozone layer goes to hell! Heh!—"

PLAYBACK C/ cont// ref 13:22:51

"Sorry Rumiko, I still can't get the chemistry to work. What other options are there that fit the data. Assuming, that is, Ripley's account is accurate. Do we know for sure this stuff ate through the hull? Was it really a blood spurt or could the parasite have spat it from a sac or gland?"



PLAYBACK C/ cont// ref 13:29:20

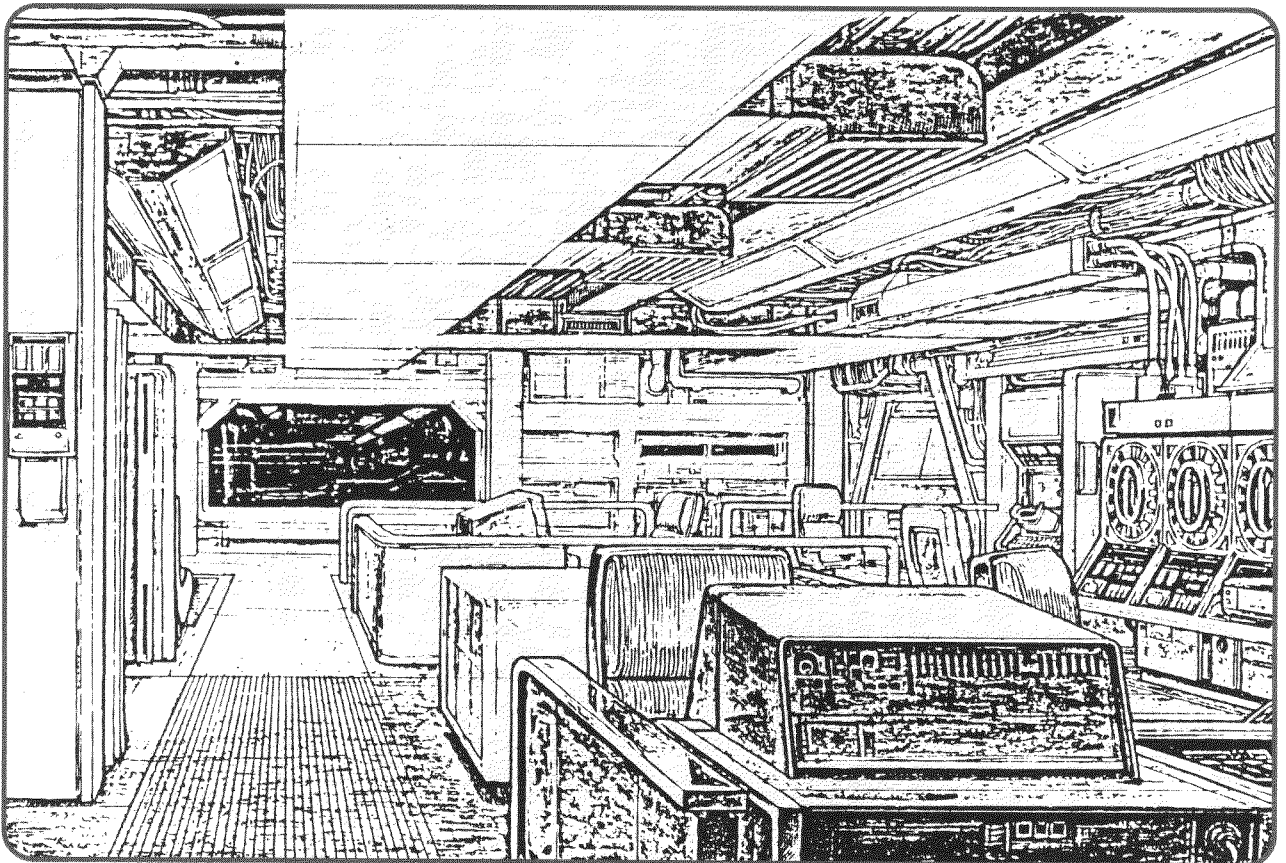
"We have another working possibility based around a hydrocarbon structure. This assumes that the acid compound works slower than described. The blood consists of sulphate and nitrate groups and would probably - as in the earlier model - aid directly in food digestion. This would allow it to extract proteins from its prey easier than in the fluorine-based model - though the creature would require an atmosphere with at least some free oxygen. This doesn't quite square with the observed conditions on the pre-terraformed LV426. One wacked-out idea completely out of left-field has the acids acting as a bio-electric battery. This way, the creature would need no oxygen at all; unfortunately, we've not yet hypothesized a mechanism for replenishing or 'recharging' the battery."

PLAYBACK D//0985746/w-yut.Lon/Res/Com9
Sep 07 15:14:56 2179

"So, the alien 'calf' bursts from the chest cavity--"

"--Ripley told the ICC that the alien that aced Brett had grown from a tiny thing the size of her forearm to a six-foot tall monst--"

"--An exaggeration. Nothing could grow that big that fast. She was seeing shadows. The one that killed Brett couldn't have been much larger than a small dog. My guess is that it would have needed to feast on all the crew and metabolize their body mass before it grew to even half the size of a man, and even then--"



Acheron Med lab



"What about other nutrient sources: food supplies, vermin."

"Get real. There's no vermin on the Nostromo. They turn off the life support while the crew are in hypersleep; any vermin would freeze or suffocate. The ship's cat was there for decoration."

"—So the thing Ripley blew out of the airlock was..."

"Probably not much larger than a Rottweiler—"

PLAYBACK F//8562850/w-yut.Lon/Res/Com9
Sep 08 21:06:18 2179

"What has the taskforce come up with?"

"Oh, they're working on a bunch of theories at the moment. Some of the team have some working ideas on containing a specimen. They're trying to decide which materials are most acid resistant for protective clothing and restraints. Problem is, we're still in the dark; without the data held by D15—"

"—I'll have to ask you for more time on that. CONRAD's gone deep, deep underground and I can't get access. I'm trying to get in via ATRP and T-LAR, but Network's not the ideal access node. It's not easy, and my budget doesn't run to—"

"—Yeah, okay. What do you need?"

"Nothing yet, but I may require some funds soon. I have a transfer point in the Phillipines— Uh, what success have you had with the ERDOM files?"

"What about them. They're virtually useless. Whoever ordered the Nostromo to stop off at LV426 took a lot of pains to cover their tracks."

"Why?"

"Who knows. Some bunch of bright sparks who didn't want to split their bonus share too many ways ordered a starship and a valuable cargo off on a harebrained mission, chasing some weird signal that may — or may not — have been an alien warning beacon rather than a distress beacon. From what Ripley says, they punched in a 'crew expendable' directive to the ship's Mother to protect against contamination or contagion and put a 'minder' on board. Then the ship never came back. My guess is that they got scared and covered up rather than followed up. Of course, I could be wrong but—"

"—Put yourself in their shoes, eh?"

"Christ, yeah. Oh, the one thing that did check out was Ripley's claim about Ash. Someone did order a synthetic aboard the Nostromo as a replacement Science Officer shortly before it left Thetis. I don't know who it was made the order, but it would imply that Science Division was running the show—"

"—As they are now. What goes around—"

PLAYBACK K//2983411/w-yut.Lon/Res/Com9
Sep 10 09:19:03 2179

"So, Ripley sets the Nostromo's reactor to explode and runs for the Narcissus with her goddamn cat for Chrissake! She says she sees the Nostromo go kablooey, and then — get this — then finds the thing has gone to sleep in her ship!"

"Do you buy that?"

"Do you?"

"My wife keeps a shrine at home to the holy trinity of Jesus, Hubbard and Elvis — I'll buy anything."

"Heh."

"So Ripley then calmly suits up and blows the damn xeno— uh, where are those specs on the shuttle?"

7.6 SHUTTLECRAFT NARCISSUS

The *Narcissus* is a small interstellar shuttlecraft and lifeboat, modified from a **Lockmart Starcub** light intrasystem shuttle. Massing 48 metric tons, the *Narcissus* is configured around a single 108 m³ pressure cabin, with storage space and lockers for supplies and equipment. The spaceframe itself is of conventional composite construction, with a ceramic and composite outer skinning. A tricycle undercarriage extends for surface landings. There are three crew stations, for pilot, co-pilot and a scientist, though additional seating can easily be installed. For long duration in-system flight or interstellar travel, two hyper-sleep capsules are installed. The *Narcissus* is powered by a 9 GW microfusion reactor which drives two **Newington A-24** rocket motors employing water as reaction mass. Rocket thrust is vectored through four aft or two forward thrust tunnels. For interstellar travel, a **Romberg 100C** tachyon shunt can drive the shuttle at low supralight speeds. On full fuel the shuttle has a range up to 13 parsecs.

PLAYBACK K/ cont// ref 09:34:15

"So the shuttle keeps trucking 'til it runs out of fuel, straight through the core systems where by an amazing stroke of luck — man, this just gets better and better — it's picked up by a deep salvage team, some 57 years after the *Nostromo* disappears."

"With one bound, Jill was free!"

"Yeah, yeah. So, let's cut to the chase — they thaw Ripley out and she gives this wild story to the Commerce Commission about alien monsters eating her crew alive — we've read that. Her story is fantastic, but very detailed, completely self-consistent and she believes it; sounds to everyone like textbook false memory syndrome triggered by god-knows what — maybe she was abused by her daddy, whatever. The ICC tell her she's at best deluded, at worst nuts, and strip her of her licence. They also tell her that Acheron has been a happy colony now for twenty years.

"Now, see this file here. Carter J. Burke sends an order dated 6/12/79 to Hadley's Hope colony complex, blah blah... look here — he's requesting that someone check out a bunch of coordinates, here, just beyond the Ilyium mountain range. Bingo! So what happens next?"

"Presumably, someone checks out the coordinates. Three weeks later the colony transmitters go off the air. The company then places a formal request to the UA and United States Space Command for a Marine taskforce to scope out the colony—"

"—Who fall over themselves to respond with a starship and a section of Colonial Marines. Question is, why were they so quick off the mark?"

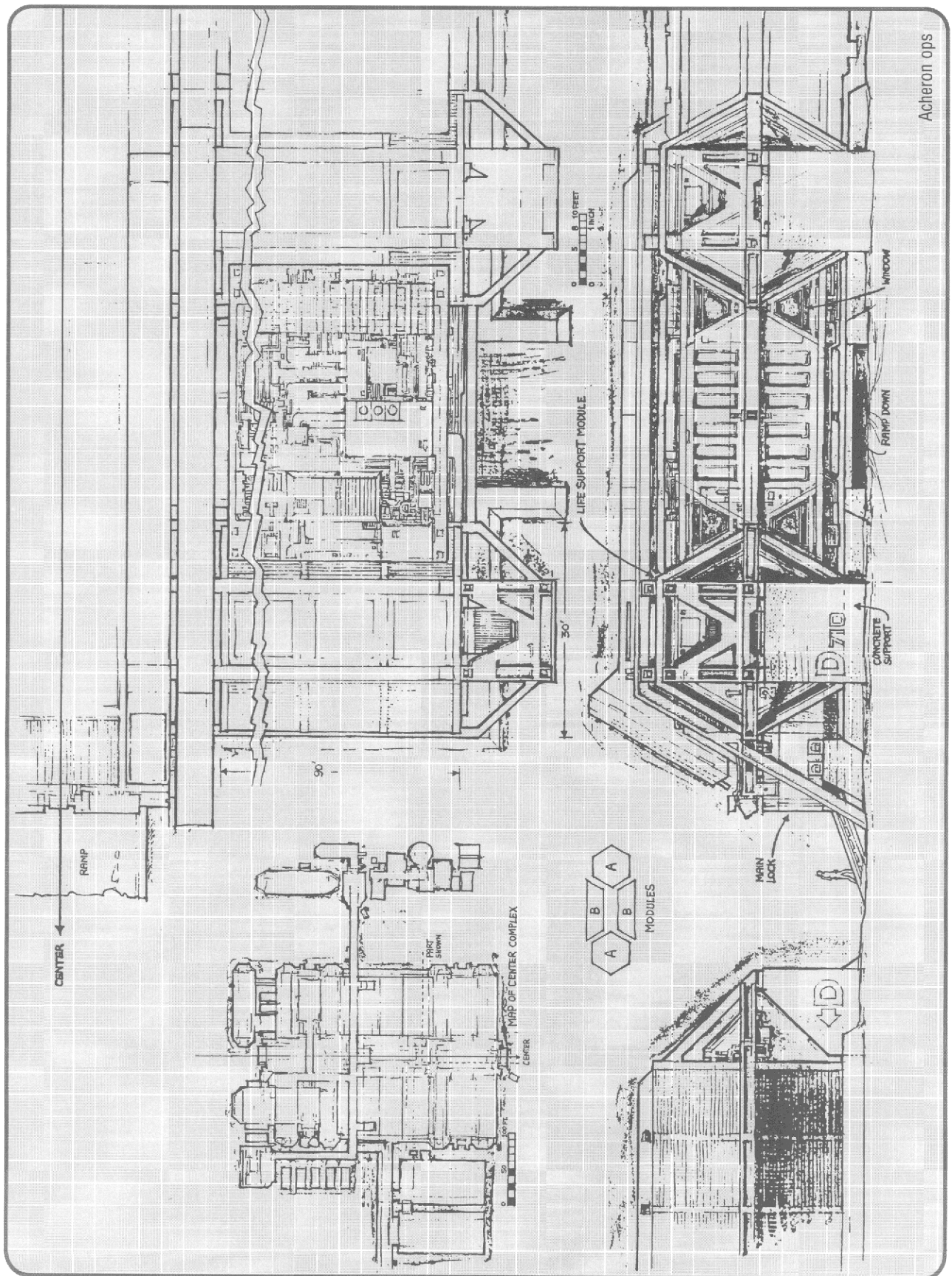
"Mmm?"

"Take a look at this section of Burke's company file—"

PLAYBACK N//3248734/w-yut.Tkyo/Res/C18
Sep 11 16:52:41 2179

"So what if Burke was a little fast-track toady; tell me something I don't already know."

"What we weren't aware of was how much leverage Burke and the Weyland





office on Gateway had with Space Command. Seems there are a few Marine and USASF Generals with large Weyland share portfolios. They sent in a Colonial Marine section with Burke riding shotgun. Note how carefully they sized the force; as far as anyone at O'Neill's concerned, they sent in a recon detachment to scope things out. But from the Gateway office's point of view a section's big enough to handle a bug threat; small 'nuff not to be a nuisance to the company man, and cheap to pay off if need be--"

PLAYBACK N/ cont// ref 17:43:22

"As soon as you get me the Sulaco data I'll be ready to move. We have an extraction team already en route to Zeta 2 Reticuli. Unless we get any leads on another specimen source, my taskforce is already assuming that we go to the original source coordinates and start looking there."

"Who's in charge on the ground."

"Seiji Tanaka - R-DIV tecdec - a sound man."

"Muscle?"

"Yeah, plenty. Enough to cope with any trouble they find."

"I take it you don't mean the aliens--"

PLAYBACK T//9725456/w-yut.Lon/Res/C39
Sep 12 20:14:13 2179

"Rumiko, have you read this?"

"Yes, I had the testimony downloaded to my terminal."

"Where in hell did they get this from?"

"I do not know. Science Division are saying they have a new data source. They are holding back until the bonus situation is cleared."

"Is this anything to do with Epsilon Eridani?"

PLAYBACK T/ cont// ref 20:50:00

"--Question is, how much is growth rate and morphology determined by the size and shape of the host? Since the alien wasn't specifically engineered to use a human host, I'm assuming you could farm embryos in almost any mammal. Assuming the alien is that adaptable - how small could it go?"

"Given what we know, I'd make an educated guess - probably it couldn't go any smaller than a small child, or a large dog maybe. But don't hold me to that--"

"In which case that begs the other question; is it adaptive? Could it alter its structure in the embryo stage, mess about with the host DNA at some molecular level, taking on the gross structural features of its host?"

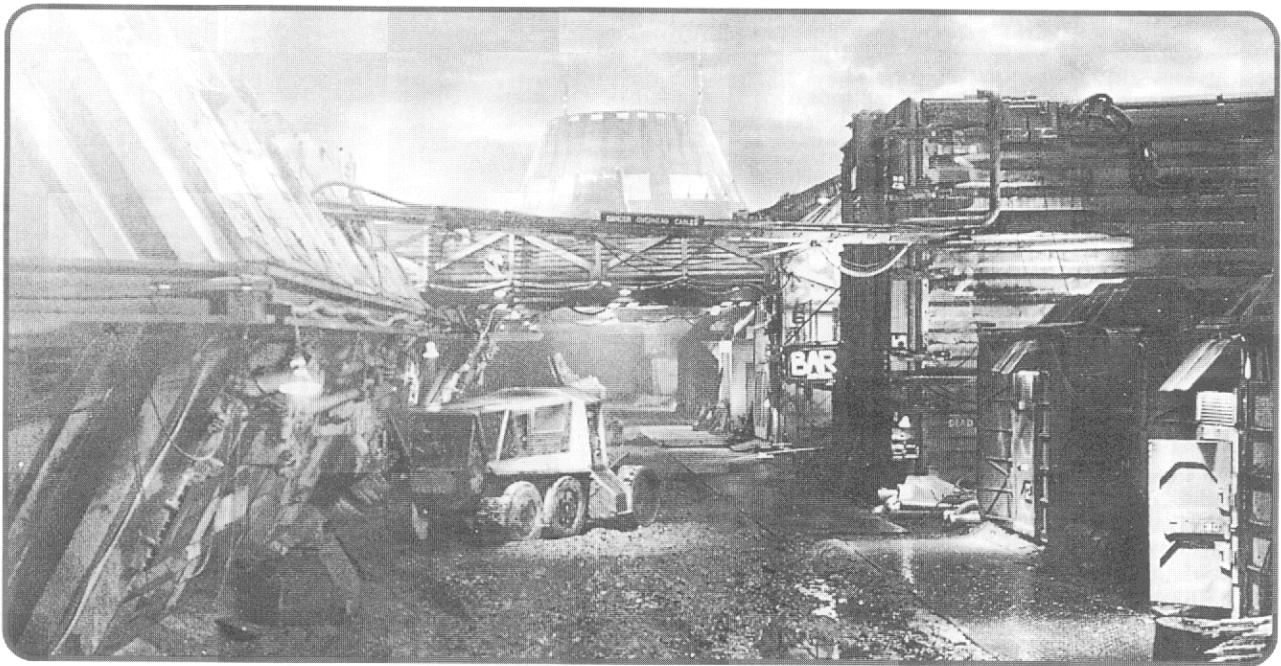
"I don't get you."

"Well, look at the description of the beast. A bipedal creature around two meters tall. Is that an evolved configuration, or is it based on the structure of the host creature?"

PLAYBACK X//23578/w-yut.Tkyo/Res/C18
Sep 12 10:11:34 2179

"What's the status on the android?"

"Well, as far as I know the hardware is so much scrap. The Science boys would admit to that much at least. But apparently the software survived. Science Division want a forty share, but I hope to beat them



View of the Acheron colony

down. I hope to have the database for you within the next twenty-four to forty-eight hours."

"I need it sooner. If I'm going to get a briefing to the Shinyo Maru by the time they arrive, I need to send the message to Network within eighteen to twenty-four hours."

"Okay, I'll see what I can do to expedite retrieval, but I make no promises."

"What about the Epsilon Eridani material? There's been rumors that R&D have a specimen."

"R&D are locked tighter'n a clam. Delhi and Osaka are completely embargoed. If they found anything out there they're not telling nobody. However, I wouldn't get too worried if I were you; A little bird told me that Eridani was a complete bust—"

PLAYBACK CC//83112/w-yut.Lon/Res/C39

Sep 13 13:10:44 2179

"I'm still trying to work out what happened at Gateway. It looks like the Gateway office levered the Colonial Marines into the Acheron operation. Burke gets Ripley reinstated, promoted to lieutenant for Chrissake, and has some wet-behind-the-ears weak-chinned academy wonder put in charge—"

PLAYBACK EE//87212/w-yut.Lon/Res/C01

Sep 13 18:53:53 2179

"—The words 'kids' and 'candy shop' come to mind — they went berserk!"

"Glad to be of service. How long will it take them to collate the android data?"

"Oh, weeks at least; point is, we can get a preliminary briefing out to the extraction team within the next six hours. I'm only hoping Cuellar can reign them in enough to get some kind of coherent report written."



PLAYBACK DD// 84962/w-yut.Lon/Res/C39
Sep 13 15:01:43 2179

"Jesus, this is good; look at that exoskeletal structure. Do we have any good images of the drone workers? I want to run a comparison."

"Only what the android saw in the lab records - the images aren't that great. What in hell is that stuff?"

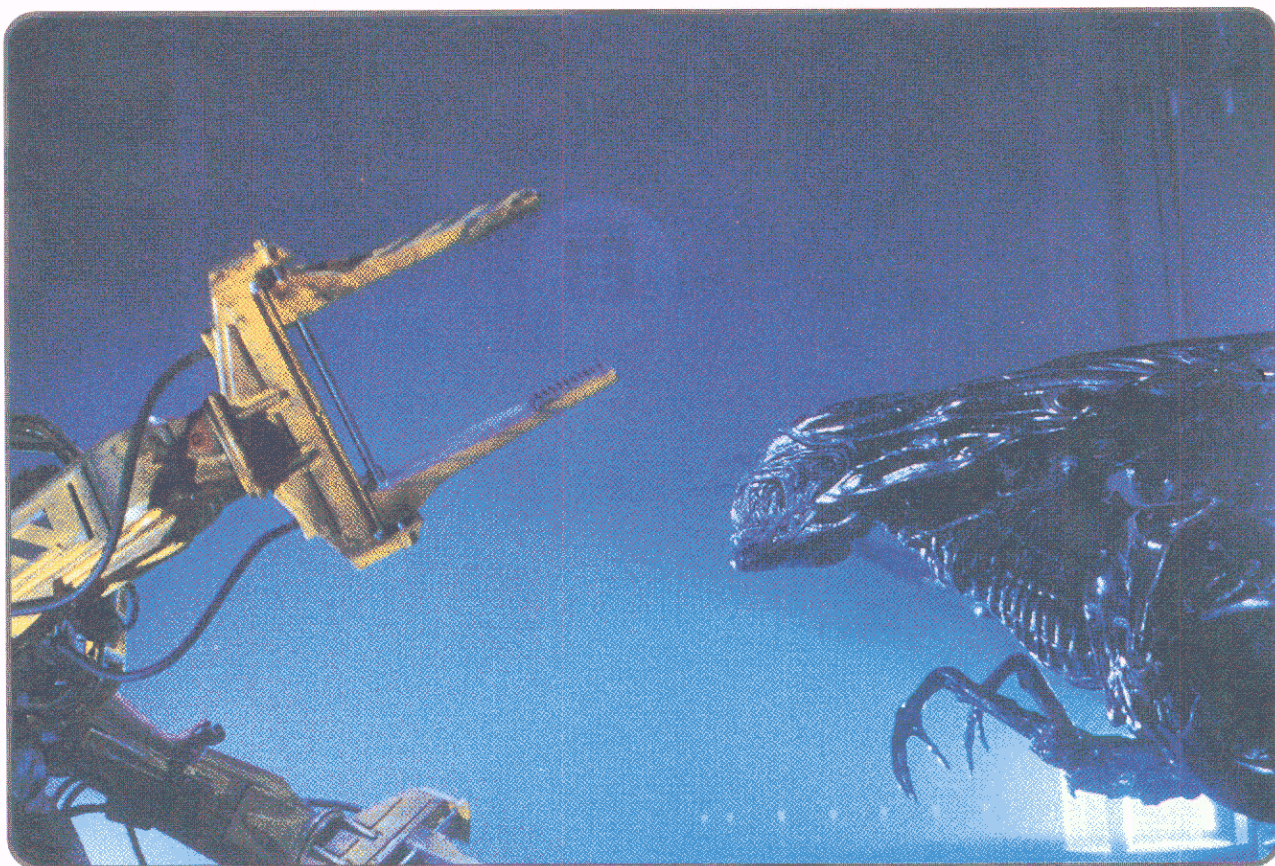
"Well, it's not bulletproof, if that's what you mean. The sentry gun rounds tore them apart."

"Some kind of crystal lattice, according to this - with a fluorine content because of the F compounds in the blood, but with hydrocarbon chains and some weird kind of levo amino acids I've never seen-"

"Rumiko's gonna hate this. By rights, that thing shouldn't exist. The chemistry is impossible. Organic PTFEs and hydrocarbon crystal lattices coexisting in harmony; how can it support the fluorine elements in its structure and bloodstream without falling apart?"

"Christ on a bike! Look - run that back two seconds, do you see what she just did?"

"Ripley tried to drop the queen into the airlock! Look, run that back three frames and enhance-"



PLAYBACK DD/ cont// ref 17:04:08

"He did what?"

"Gorman ordered the section to unload their pulse rifles in order to prevent an accident. The hive was beneath the atmosphere processor primary heat exchanger. A round penetrating the roof of the hive could



have ruptured in the cooling system, sending the reactor supercritical."

"So the workers or drones, or whatever they were, attacked and tore the section apart. Sounds like command failure."

"Unh. Check the transcript here. The Bishop android was listening in on audio. The Marines unloaded and proceeded into the hive. When the crap started going down, the Marines switched to infrared tracking - they have these heads-up scopes in their helmets. Let me playback:"

"The tracker's off the scale man, they're all around us, man! Jesus!"

"Maybe they don't show up on infrared at all"

"That's when the first one, I think it was Dietrich, gets wasted. But get those comments, and these other ones earlier. Seems that the aliens were dormant in the hive around them and they didn't show up on infrared. No signature at all. Then all hell breaks loose."

"We don't know what this hive looked like or was made of - uh, two of the Marines comment it

was made of 'some kind of secreted resin; but secreted from what?'. There could have been tunnels or holes the aliens were hiding in to mask their signature. Another possibility was the atmosphere - apparently it was humid - so there was plenty of water vapor and a lot of condensation runoff. Any of those things could have messed up an IR reading."

"True. But get this - I did a comparison analysis later. On the audio, someone must've disobeyed orders, 'cause they start firing their guns. According to the analysis it's the report of an M56 smart gun."

"So?"

"The smart gun tracks by infrared. What I'd like to know is were they tracking their targets on IR, or were they just spraying blindly at anything that moved?"

"Anybody's guess, though I reckon once the aliens showed themselves they would have appeared on IR."

"But we can't discount the possibility that they're naturally shielded. That exoskeleton might show up as a blackbody on a 'scope."

"So, how did they get out?"

"They had the flamethrower units. God knows what the flames did to the bugs. If Rumiko's right they should have gone up like a fireworks display - but there's little audio evidence of explosions except for the one near the beginning of the engagement--"

"--The ammo cooking off, right?"

"Guess so. So, Ripley drives the damn APC down to the hive entrance to picks up Hicks, Vazquez and Hudson. On audio we hear the smart guns and some buckshot reports - either from canister rounds from the pulse rifle launchers or from Hick's pump-action. Evidence suggests that these bugs can't stop lead but--"

"--But I've just thought of a big problem."

"What?"

"Imagine you're trying to stop one of these things. Those guns use explosive bullets--"

"--True. The M56 has a facility for different fuse settings - one for impact and another for letting the shell bury itself inside the target before it goes off."

"So if one of those shells hits an alien, it'll crack it open, letting all the blood spray out under pressure."

"Jesus! I'd better ask the tactical guys; see if they've got anything that'll drop one of these things with the minimum of backspray."

"We may have to think in terms of non-penetrating weapons to deal with live adults - riot guns firing plastic gloop or other restraints. Did anyone get sprayed?"

"Uh, yeah. Hudson apparently, and later Hicks. Apparently they survived, though it may have been a very minor spray--"

PLAYBACK DD/ cont// ref 18:15:29

"This changes our whole conception of the species. We took the facehugger parasite to be the first stage of the creature. In fact, the egg/facehugger symbiote is the first stage. This ovomorph contains the facehugger which contains the embryo--"

"--Big bugs have little bugs--"

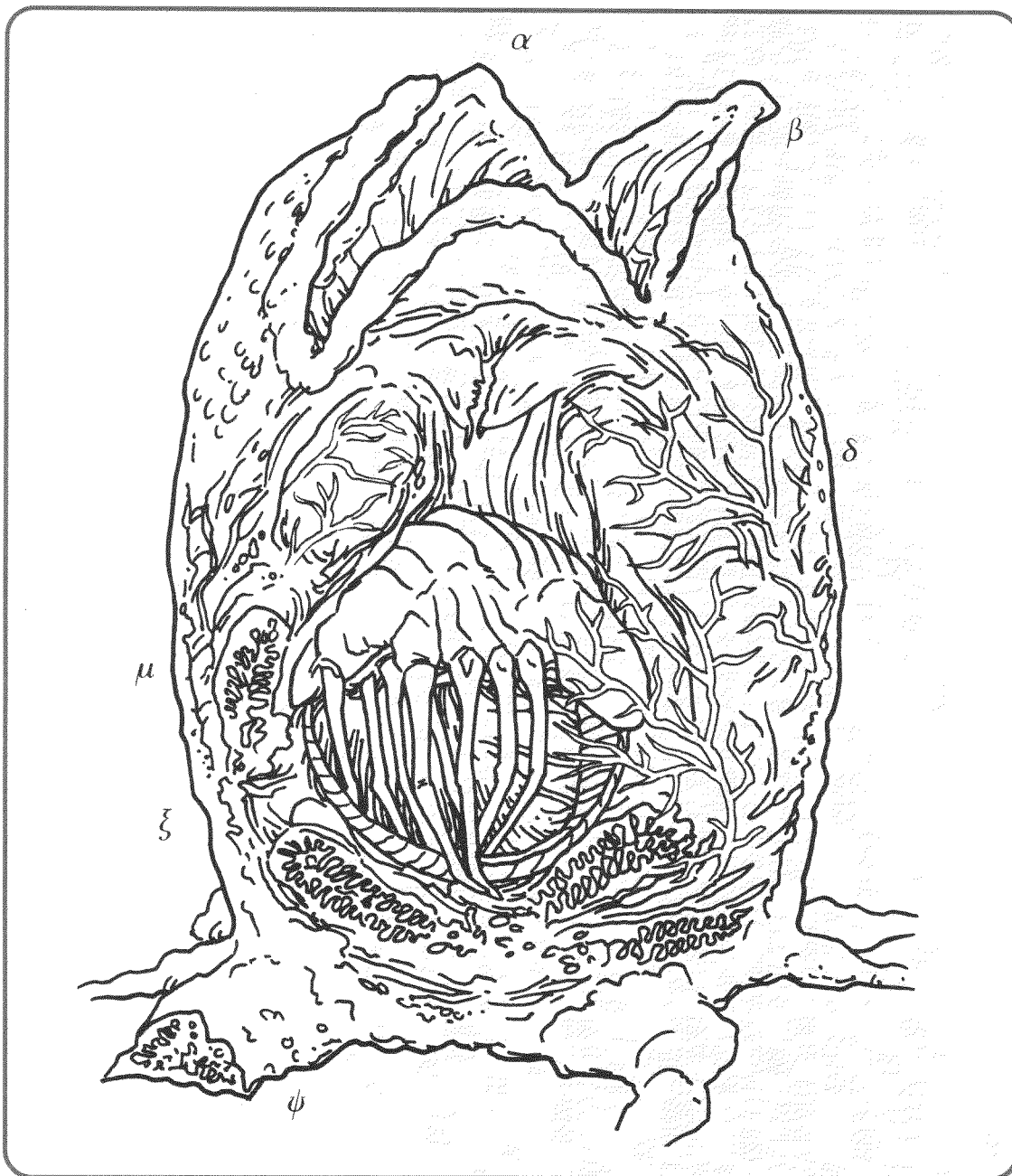
"--Yup. And from Ripley's description to Bishop - sorry, the android - the egg probably arrives fully formed. Now, this ovomorph root system described in the lab notes and from Ripley's account to the synthetic could indicate a sensor matrix, triggered by thermal, bioelectric, you name it. Its skin could also contain some kind of sensing mechanism to ensure the facehugger and the hugger's ovipositor are pointed in the right direction."

"So how does it know a potential host is suitable? For instance, could it impregnate an invertebrate, however big?"

"Don't know; at least not without a dissection or experimentation. My guess there are some kind of body-mass range and configuration requirements before the ovomorph is triggered. Maybe it can taste the victim at a distance - some kind of sense like a snake's tongue. Another possibility is that the facehugger is indiscriminate and will attempt to impregnate anything over a certain mass."

"In which case you could configure an android to act as bait, and capture an embryo that way."

"Good one. File that thought for later. Look, these veins beneath the ovomorph skin could indicate a thermo/pressure sensitive network linked to some rudimentary central nervous system. What I'd like to find out is how long it takes to prime the facehugger. From what we know the ovomorph can presumably lie dormant for phenomenal periods of time - maybe decades or centuries before it dies, and the parasite with it."



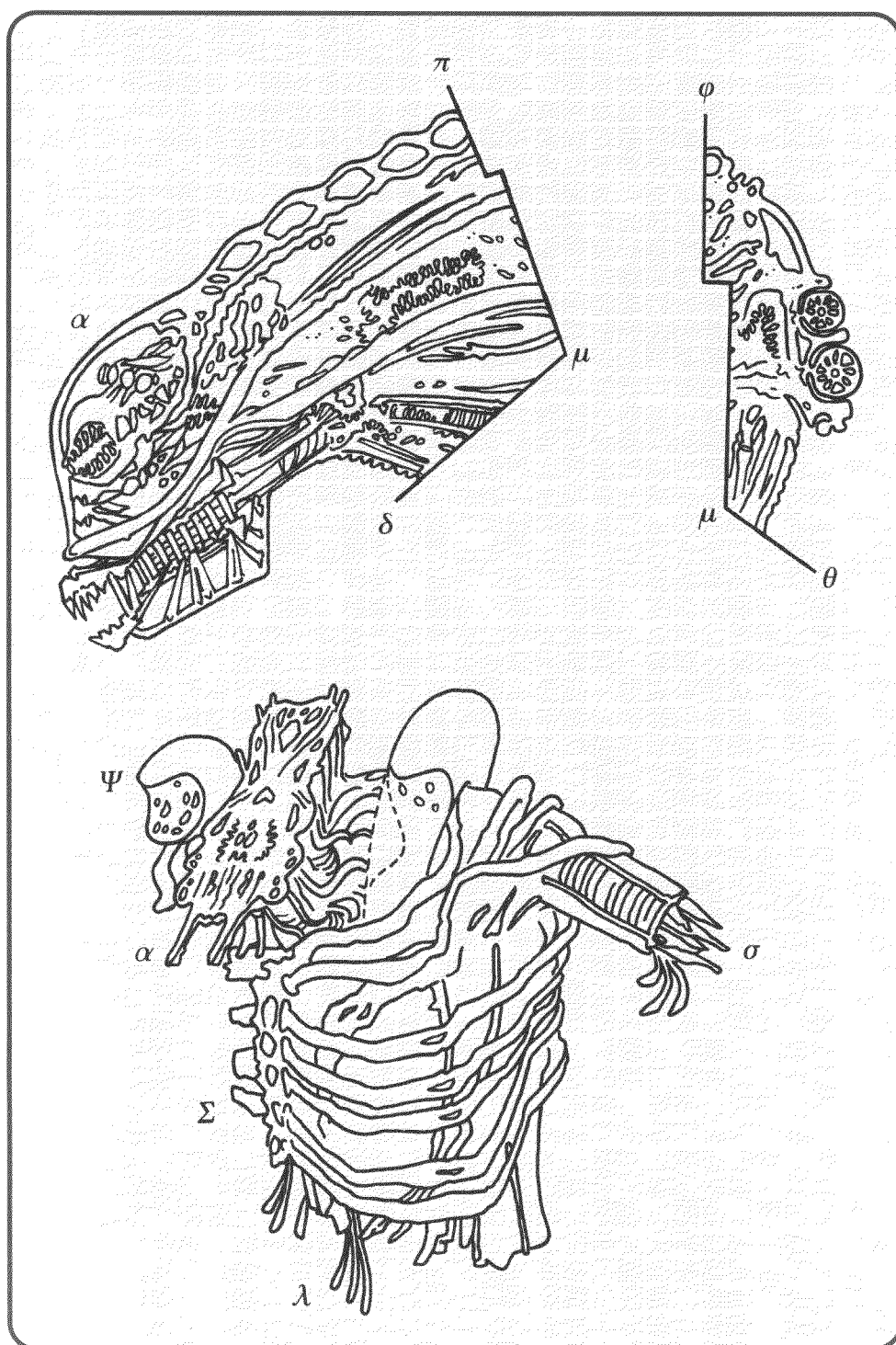
However, the facehugger probably has a limited lifespan before it, or maybe the embryo it carries, stops being viable. So, if a potential host appears, it has to go from hibernation mode to a running start very quickly to ensure the implantation before the facehugger dies. What is that mechanism? Furthermore, how long can a parasite continue to hunt for a host if it fails to catch the first?"

PLAYBACK DD/ cont// ref 17:10:28

"This is verrry strange, Leigh."

"Hmm? What have you come up with?"

"Look at the android data we captured here. All we received, more or



less, were the android logs - all it saw or heard or downloaded; but this comes with a lot of contextual and semantic baggage - code from the operating system. It looks really odd - I've tried running it through ERAP, but my computers just can't make head nor tail of it."

"A custom mod?"

"More than that. This was one verrry special android. Just look at these responses - this thing was a lot smarter than your usual synthetic; it was making up some of its own emotional responses to events."

"Well, it's a company-built machine. I would have been surprised if it didn't have something buried deep in the system."

"Yeah, but this is more than that – there are these weird reactions to Ripley~"

PLAYBACK DD/ cont// ref 18:39:29

"So Bishop was sure the parasite used a DMSO-delivered cyanose-based toxin to immobilise its host."

"Presumably the dose was measured on the basis of the host's body mass and composition. It reduces vital signs to the absolute minimum."

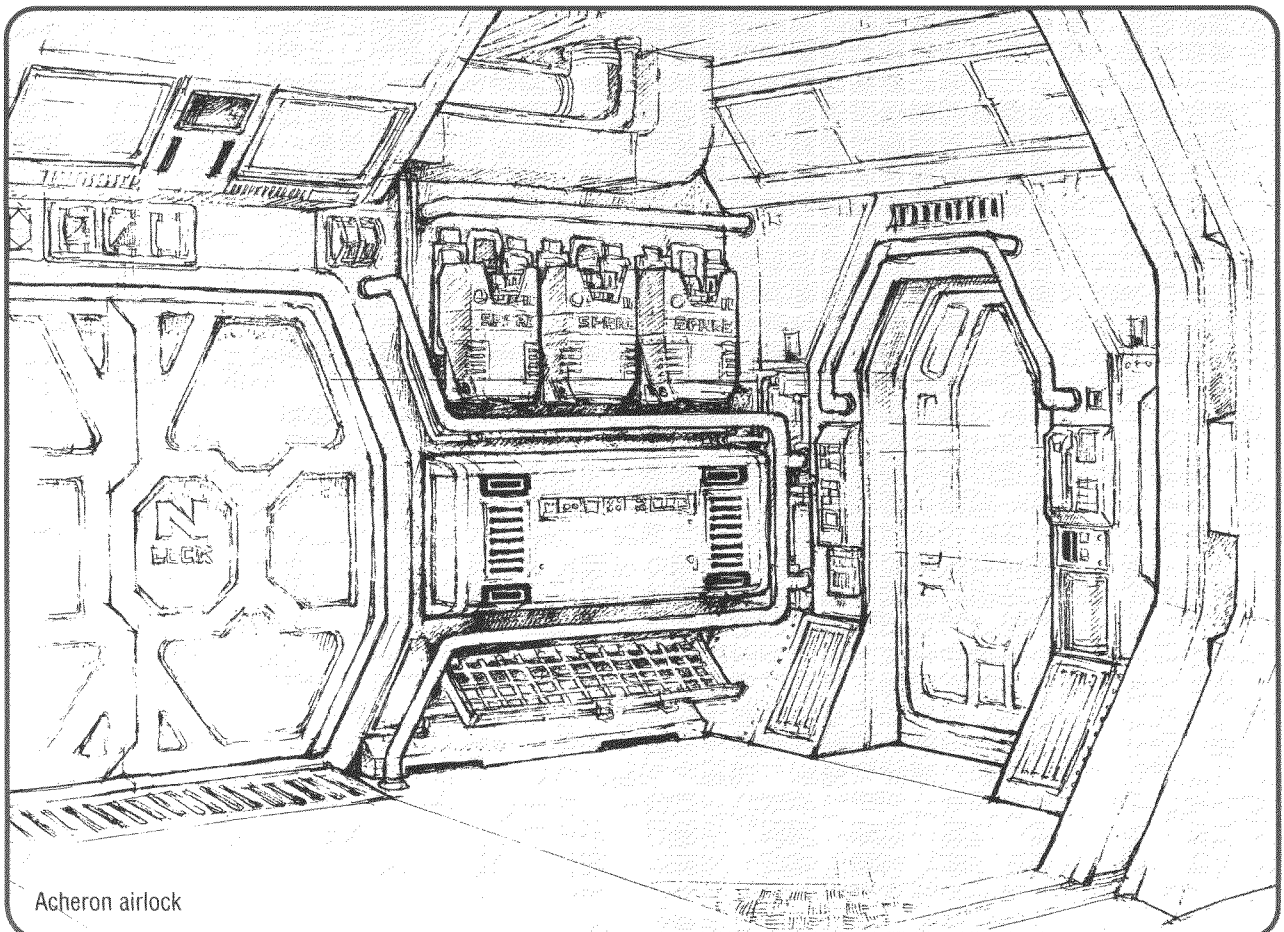
"But if the dose was off even slightly, the victim could suffer toxic shock or take a lethal dose."

"Well, toxic shock would be a natural hazard anyway, unless the facehugger has a natural method of suppressing the body's immune function."

"Which it would seem to, if it is able to emplace an embryo."

"Uh-huh. By the way, I wouldn't talk to Rumiko right now if I were you. She's just bought a hundred hours of running time on a Singapore AI, trying to work out how the blood in the parasite oxidizes after death. I don't know who's got the bigger headache – her or the AI. If she ever figures it out, she'll get a Nobel prize."

"Okay, back to the parasite. I'm trying to figure out how it lets the subject breathe while they are immobilized. Remember, Kane from the Nostromo was zapped in a reducing atmosphere. How did it keep him alive?"



Acheron airlock



"Well, if you see the tube here, which goes back to this ventral pipe; it has the option of feeding the ambient atmosphere back to the subject, or it could sample the subject's respiratory system to ascertain the composition of preferred breathing atmosphere. It looks like these membranes in the side flaps can alter the balance of reactive compounds within the parasite's metabolism to form byproducts similar to the atmosphere, like a breathing mask."

"So, it'll do anything to keep the host alive."

PLAYBACK DD/ cont// ref 18:50:47

"Is that true? The story about the attempt to impregnate Ripley and the kid?"

"Yeah, he locked them in and turned over the facehugger stasis tubes. Almost got away with it as well."

"Jeez, that takes some balls!"

"Obviously executive material, I'd say. Anyway, so when Burke sent the directive to Hadley's Hope, the gang-boss sent some prospecting family, the Jordens, to check out the coordinates."

"Yeah, I guess they were closest. They also had an all-terrain tractor to get them there."

7.7 DAIHOTAI TRACTOR

"Each Thanksgiving Day on Lucifer, all us wildcatters would get high on rye and run a tractor race. Some o' the guys'd tek it real serious an' strip their Daihotais down to the bare minimum; then we'd set off, thirty tractors bumping an' boring across the hot ash flows toward the volcanic crater we called 'The Devil's Bowl'. One year, ol' Schafer wuz in the lead, bouncing along the lip of the caldera, when DeFalco rammed him an' toppled him over the edge into the lava flow. We fished the Daihotai out two days later. Its bogies were melted to slag an' the driver's cab crushed, but Schafer wuz still alive, locked behind the main bulkhead with the refrigeration unit on full and a half case o' Jack laying around him, crazy as a cougar an' threatening to fight ev'ry one of us..."

- Christo Morse, independent prospector, Lucien 411.

Since the earliest days of colonisation, the need for a go-anywhere, do-anything ground transport has long been recognised. Daihotai have long been market leaders in this field and their range of all-terrain commercial tractors have become a byword for quality and reliability.

The Daihotai series are all based around the same 8 x 8 wheeled layout, with a 6.59 meter wheelbase and a track of 5.86 meters, a configuration designed to give stability over the roughest terrain. Each of the four two-wheel bogies are connected to the chassis by two swinging-arm Anderson suspension units. These units are cantilevered at the chassis bearings and sprung internally on torsion bars. Dampening is handled by telescopic shock absorbers, while hydro-pneumatic rams control the whole suspension assembly. A central computer processor monitors the suspension assembly as it travels on rough ground and instructs the rams to alter the configuration of the Anderson units to provide the best stability and traction over uneven terrain. This system can also adjust the ground clearance of the vehicle to account for the prevailing terrain, allowing for clearances between 1.48 and 0.90 meters.



Powerplants vary from model to model on the Daihotai series tractors, the most common types used being the J-160 and J-180 series gas turbines, generating from 140-150 kW. Power is transmitted from the plant to the wheels via a drive train that runs directly through the struts of the Anderson units to the bogies. Each wheel has its own individual independent transmission system which is computer controlled to provide optimum traction; the antilock braking system is also handled by the central processor. Road speeds for the Daihotai are typically around 110 km/h, and the off-road capabilities of the tractors are equally prodigious, thanks in part to its ability to tackle vertical obstacles up to 1.10 meters and gradients of over 70%.

On most models of tractor, a fully-enclosed cabin comes as standard. All cabins are self-contained biosystems with life support capability, sealed against poisonous atmospheres, biohazard and low-level ionising radiation. Cabins are configured around a central living area, incorporating a galley and berths for up to five people. These living spaces are best described as 'utilitarian', although economical use of space does allow plenty of stowage for equipment and supplies. Each central cabin is reinforced by a steel roll-cage and can be sealed fore and aft by a sliding bulkhead door.

Forward of the central cabin is the driver's cab, which can also double as an airlock while travelling in hazardous environments. At the rear of the tractor is a workstation cab, which duplicates the driving controls of the forward cab, allowing the tractor to drive as effectively backwards as it does forwards. It also controls all specialist tools and attachments mounted on the tractor. Options for attachments include (but are not limited to) mechanical diggers, cutters, cranes bore drills, core samplers, spring stampers, welders, waldoes and 'dozer blades. The ruggedness and versatility of the Daihotai chassis allows almost any heavy duty function to be carried out, and its ubiquitousness has made the type a popular purchase for corporate fleet buyers everywhere.

PLAYBACK DD/ cont// ref 19:21:36

"I'm interested in the whole hive structure concept. We know there are at least two types of alien - queen and worker drone. Could there be any more?"

"Possibly. We don't have enough visual evidence to make a guess. It would seem consistent that there was some kind of caste polymorphism in the species based on function, though it's also credible that the worker drone is a multi-function type, acting as a soldier, hunter-gatherer and nursemaid to the queen."

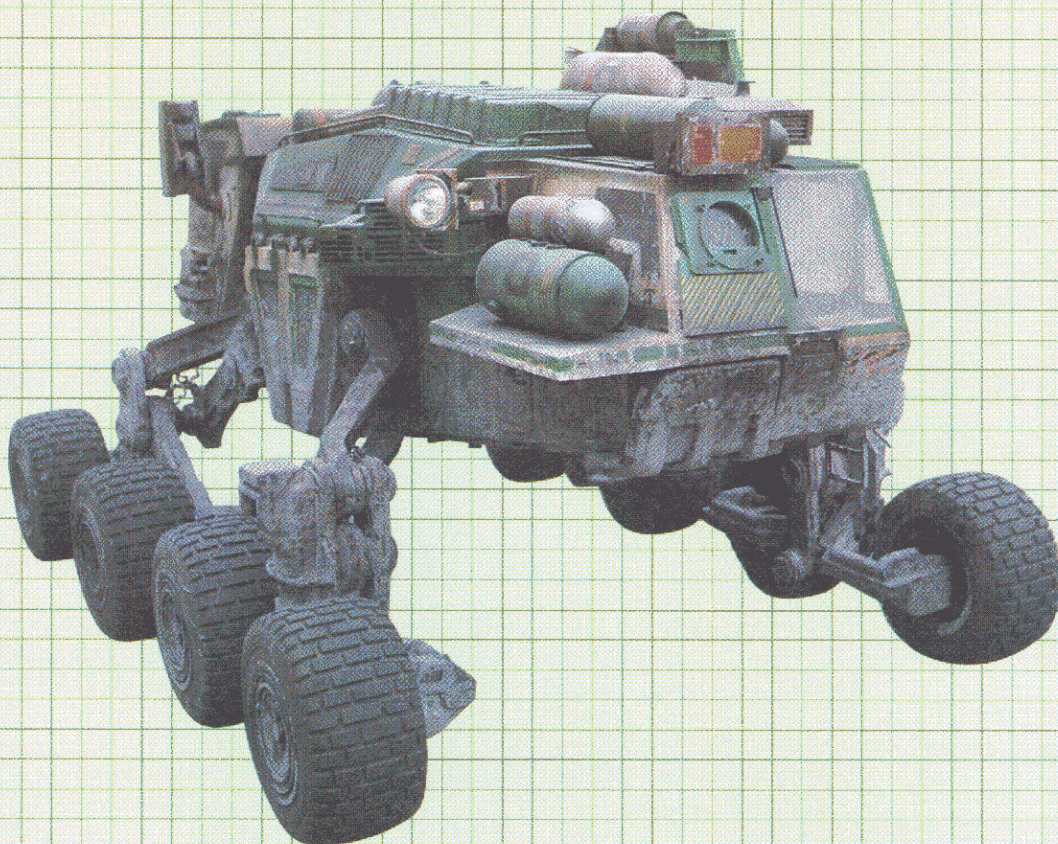
"So how do queens get created? You would think that in the Nostromo encounter, the first creature out of the egg would have been a queen so that it could lay new eggs."

"Not necessarily - the first several could be workers in order to ascertain the environment and the presence of viable rival queens. If there are none, they could broadcast that information back to an ovomorph, probably via enzymes, and prime the egg so that the next host they find and capture would be impregnated by a queen embryo--"

PLAYBACK DD/ cont// ref 18:53:24

"Jeez, look at the damage. They tore the complex apart."

"Their mechanical lifting and punching strength has been established, as has their growth rate. One mystery I can't deal with is how fast they grow."



Daihotai Tractor

"Jan's Rottweiler theory goes out the window - Ripley was telling the truth about the one she blew out the Narcissus."

"So that leaves us with the problem of determining how the hell they get so big so fast!"

PLAYBACK DD/ cont// ref 20:02:44

"So what do we have on the alien sensory apparatus?"

"Very little in truth. Optical is possible, though it's likely to be monocular, in which case it either isn't reliant on sight, or uses some other sense for measuring distance. That could be ultrasound, or simply good hearing. Having a long head case would suggest it might have audio sensors at the front and back ends. If those are duplicated left and right, it would have quadraphonic hearing and hyper-accurate ranging capability."

"If that's the case, would sonic weapons work against it?"

"No idea. Ask me when we've got a specimen. I'd guess it has good hearing, can sense floor and surface vibrations, some secondary visual capability. Whether that stretches into the infrared is another matter entirely."

PLAYBACK DD/ cont// ref 21:30:18

"Their nest in the atmosphere processor - why there?"

"Warmth and humidity I suppose. They were, -uh, here beneath the



primary heat exchanger. There would have been a lot of condensation runoff into the area below."

"What's the structure of the hive?"

"Not known really, though I would guess there'd be tunnels running to a central chamber. That's where the queen lives and drops her eggs. It seems from Ripley's story to the android that the eggs remain there until a host is found. The host is captured by workers, cocooned in resin in a 'nursery' area, and has an ovomorph taken to it for impregnation. That seems to be what happened to most of the colonists."

"And almost happened to the Jorden kid."

"Yeah."

"So what about the first 'hive' in the derelict alien ship."

"Possibly the same kind of deal. The queen establishes a hive in the warm, wet bowels of the ship. My guess is that the ship's crew crashed the ship - by design or accident, you decide - on a lifeless ball of rock. When the aliens run out of hosts, the queen lays as many eggs as she can before she and her workers die, knowing the ovomorphs can look after themselves should someone else turn up. This is all speculative, of course, but would fit the pattern."

"I'm interested in the selection of a warm, humid environment for the hive. Darkness too seems to be a factor. What did the Jorden girl say about them coming out only at night?"

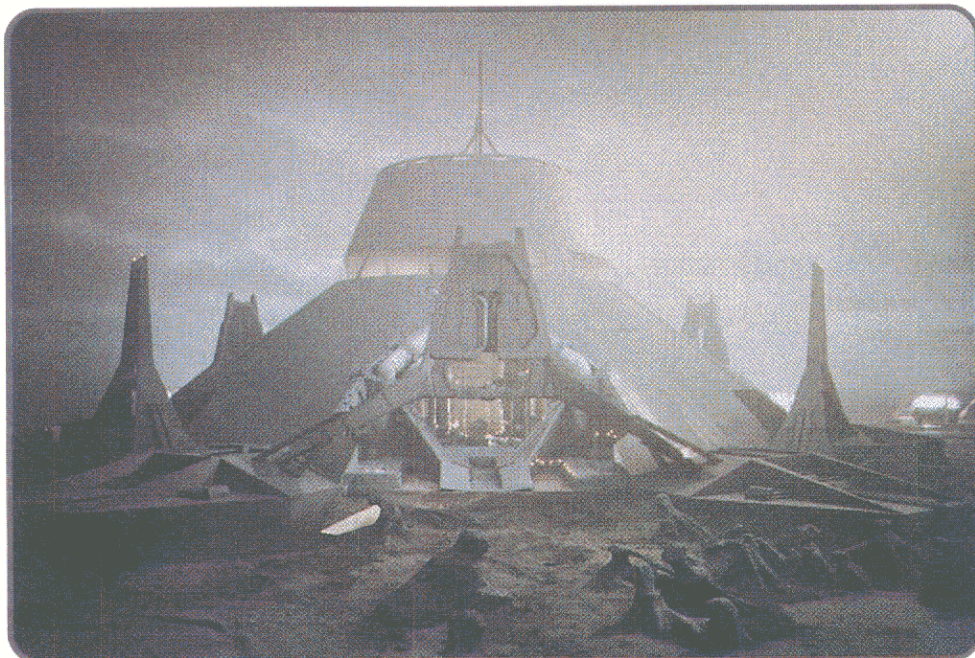
"Yeah, but remember the way the day/night cycle runs on Acheron: 24 hours of day, 24 hours of night and 72 hours of perpetual twilight."

"So, don't they like daylight, or do they simply have an affinity for hunting in the dark while their prey is at a disadvantage?"

"Whatever. It would at least seem to imply that sight is not their primary sense, though."

"Yeah, yeah. That may give us some clues to the aliens' origins. What's the specs on that atmosphere processor?"

7.8 WEYLAND-YUTANI ATMOSPHERE PROCESSOR

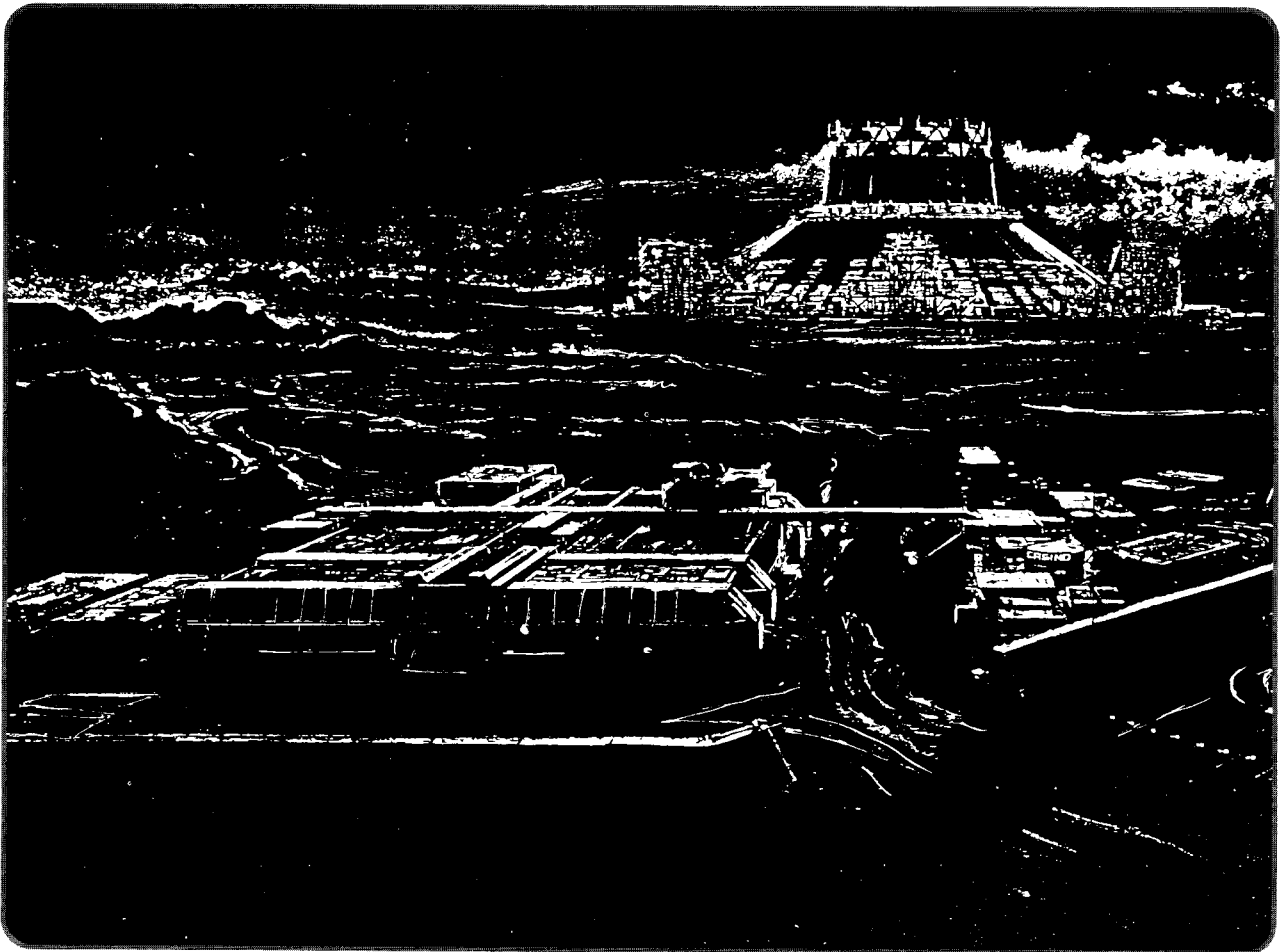


Weyland-Yutani atmosphere processor at Acheron



The lack of habitable worlds within a short distance of Earth has encouraged the development of marginal worlds to create viable colonies. Potential colony worlds with reducing atmospheres can be terraformed over a period of decades by reducing the unbreathable components of their atmospheres and increasing levels of breathable gases such as oxygen. Two techniques are used to do this, often both used in tandem. First, it is possible to establish ecological architectures - usually with specially engineered mosses, grasses and small flowering plants - to convert certain gases (mainly carbon dioxide) into usable oxygen. The second technique is to supplement this long-term strategy with a number of atmosphere processing plants.

An atmosphere processor is a cone-shaped tower some 1500 meters high. Powered by a 1.0 Terawatt fusion reactor, it draws in the planetary atmosphere through a series of louvres in the base and sides. This atmosphere is then drawn up through a series of hot mass processors arranged in a ring around the fusion core. Each processor draws in the atmosphere through a battery of turbines, which compress and accelerate the gas. This is then passed through a high temperature electrical arc which heats the gas and ionizes it. Magnetic coils then heat the gas to near plasma temperatures in the region of 5,000 °K and the molecules within the gas are dissociated into their component atoms. The hot streams of monatomic gas are then sorted by a series of magnetic fields into their constituent elements. Some of these (such as carbon) can be drawn off as waste by-product (such as graphite dust), while the remaining hydrogen, nitrogen and oxygen atoms are expelled back into the atmosphere, where they cool to form as H_2 , N_2 and O_2 .





PLAYBACK DD/ cont// ref 21:38:52

"So if one of these things exploded, how big a crater would you get?"

"Big."

"But how big?"

"Uh- forty megatons? According to the android that's a thirty kilometer blast radius."

"Fallout?"

"Ground burst explosion - lots, I'd say. How far it would carry depends on local weather patterns."

"But here, behind the Ilyium range, everything would be sheltered, right?"

"Probably."

"So if the derelict is still there, there's probably eggs still there. Bingo - and we get a bona-fide alien artifact as well."

"Yoishida! Get me Wells, and try to arrange a direct uplink to the Shinyo Maru, immediately"

"Yes Mister Cuellar."

COMFILE /28//sic.shinyom/1119476/savA

SAFARI FLASH.

TO: MANDEC RDIV

SUBJ: REDDOG ONE. EXTRACTION TEAM ON STATION EFFECTIVE SEP 132130. OBJECTIVE 2,000 METERS NE. WILL EXPEDITE. CAMLAC 2 OUTFIRE REPORTS FRIENDS PRESENT IN FORCE. REPEAT, IN FORCE. REQUEST WEAPONS FREE. STANDBY.

PLAYBACK FF//3945698/w-yut.Gwy/Res/C39 Sep 14

23:59:00 2179

"The Shinyo Maru confirms, sir. Science Division are on-site at the derelict. Tanaka wants orders. Should he arrange an accident?"

"Not yet. Tell him to keep his powder dry. First I need to negotiate with Trudeau on a secure line. If he's smart, he won't try and muscle us out of the bonus share."

COMFILE /28//sic.shinyom/234288/savH

FLASH.

TO: MANDEC RDIV

SUBJ: REDDOG ONE. ALL ONE BIG HAPPY FAMILY HERE. HAVE RECOVERED TWO LOST BABIES. SHARE PROSPECTS EXCELLENT. MSG ENDS.

END PLAYBACK

Acknowledgements

Since beginning work on this book, I have been amazed by the goodwill shown by many people - all fans of the movies - some of whom I hadn't previously met. Many of these people got off the cart and helped push; I can't thank them enough. Here's the roll call:

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The *damn fine!* medal of honor with oakleaf and bar goes to John and Liliana Bolton. Liliana especially deserves praise for giving the project the initial thumbs up, and then helping resuscitate it when it looked dead.

Also mentions in dispatches for the following:

Adrian Sington - Boxtree head honcho and *Tatler* columnist, for having faith in a writer who'd done no actual books, just twenty-seven simulated ones.

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Last of all, Mom and Pop, who supplied finance and photographs on demand with no questions asked. Who could want more?

ALIENS™

Colonial Marines Technical Manual

"Check it out!

**We've got tactical smart missiles,
phased plasma cannon, pulse
rifles, RPGs; we've got nukes,
we've got knives, sharp sticks...!"**

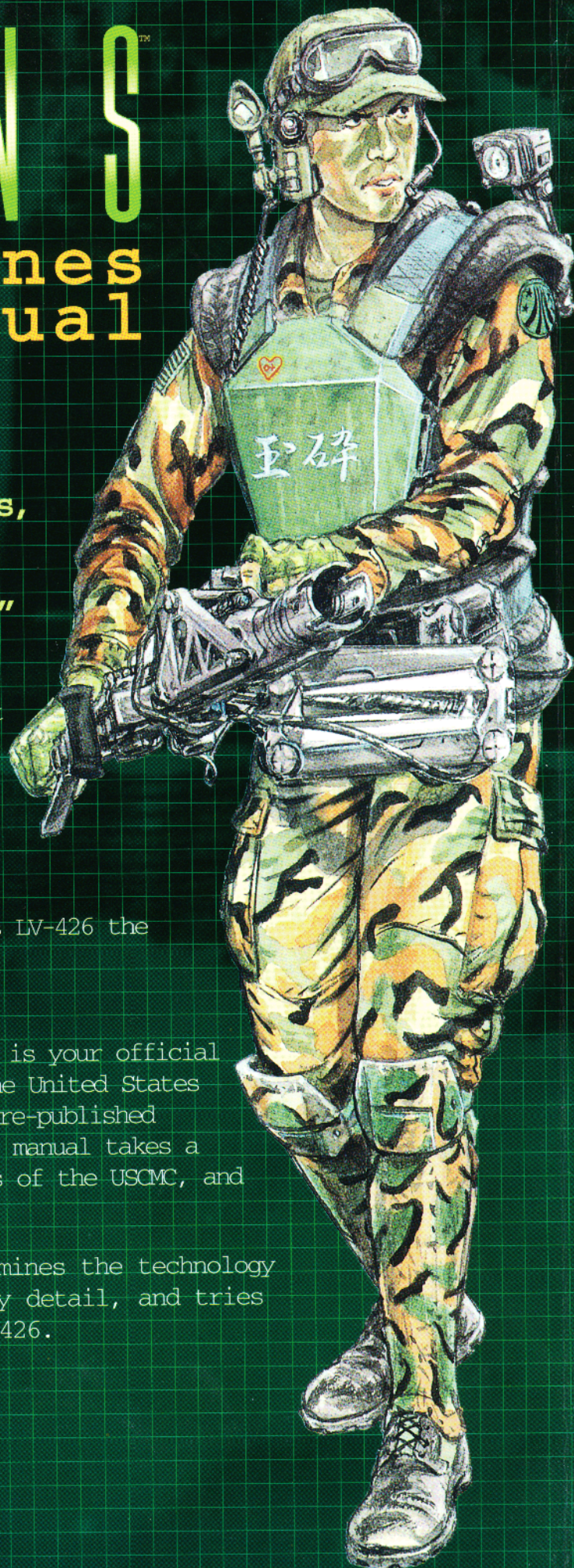
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