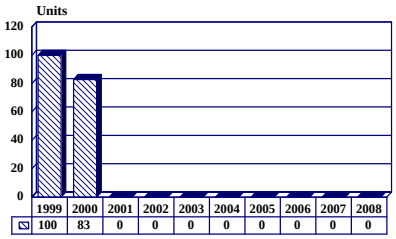
MIM-72 Chaparral - Archived 4/2000

Outlook

- Production of MIM-72 Chaparral is proceeding. The Chaparral air defense missile systems remain in wide service around the world
- Chaparral production has become tenuous as US cut its support for program. Further fabrication of missile is now dependent on purchases by foreign countries
- Future Chaparral orders will likely be filled with remanufactured units or missiles taken directly from the existing US inventory

10 Year Unit Production Forecast
1999 - 2008



Orientation

Description. Surface-to-air missile mounted on tracked vehicles or a towed platform. A shipborne version is also available.

Sponsor. The US Defense Department through the US Army; management by United States Army Missile Command (MICOM), Redstone Arsenal, Alabama (AL); USA, now known as the Aviation & Missile Command (AMCOM).

Contractors. Produced by Lockheed Martin Corporation. The Chaparral was produced by Loral Corporation (formerly Ford Aerospace & Communications Corp), Loral Aeronutronics; Newport Beach, California (CA), USA, prior to its purchase by Lockheed Martin Corporation. The base vehicle is supplied by FMC Corporation, Ordnance Division, San Jose, CA. Final assembly of the MIM-72 missiles takes place at the US Army Red River Arsenal, Texarkana, Arkansas, USA.

Major Subcontractors. Atlantic Research Corporation, FMC Corporation, Hercules Incorporated, Humphrey Incorporated, ITT Gilfillan, Raytheon Company, Sanders Associates, Texas Instruments, US Army Picatinny Arsenal and US Army Harry Diamond Laboratories.

Second Source. Loral Aeronutronics was competing with General Motors Corporation, Hughes Aircraft Company, Hughes Missile Systems Company, Tucson, Arizona, for yearly buys of the Rosette Scan Seeker (RSS). A coproduction line had been offered to Turkey if the system is procured by its armed forces.

Status. In production and service in the United States and several other nations. The Rosette Scan Seeker (RSS) has entered production and is being installed on new production units and retrofitted to existing Chaparral missiles. The Chaparral program has become tenuous as the United States cut its support and production became more dependent on export orders. The Chaparral fire units are being withdrawn from service with active US military units, but will continue to operate within national guard formations. The Chaparral was removed from service with the US active forces by FY95 and with the National Guard in FY97.

Total Produced. Approximately 23,109 MIM-72 missiles (including RDT&E units) of all types had been completed or were in production as of the end of 1998. An optimum production rate of 200 units per month had been mentioned. The US Army had a procurement requirement of 25,210 missiles and 632 fire units (including over 10,000 MIM-72G Rosette Scan Seeker missiles and 88 compatible fire units), with 223 missiles and five fire units for follow-on operational testing. Loral has produced 800 fire units and several thousand missiles. Chaparral is deployed by seven nations in addition to the United States.

Application. Low-altitude, short-range air defense system, static-emplaced (the M54 system), towed or vehicle-mounted (the M48 system). The mobile system is mounted on an M730 tracked vehicle, equipped with four launch rails.

Price Range. The Fiscal 1990/91 documents list the unit price of the Chaparral missile at $72,954, considerably lower than the previous Fiscal Year 1988 cost of $157,355. However, this is based on a procurement of only 368 missiles. A complete Chaparral M48A1/A2 mobile system includes the M730 fully tracked vehicle which transports a five-man crew and a basic load of 12 missiles (four active and eight spare) with launcher. This system costs approximately $1.6 million in Fiscal 1988 dollars. Due to competition between Ford Aerospace and Hughes Aircraft, the per unit price of a MIM-72G missile has been reduced to an average of $81,771 (with the purchase of 441 Rosette Scan Seeker guidance sections). Estimated unit cost of other Chaparral units are as follows: $12,000 for MIM-72A and $50,000 for MIM-72C/F. A single fire unit has an estimated price of $560,000. A complete vehicle-mounted Chaparral system, missiles, and support equipment costs in the area of $2.3 million.

Technical Data

(MIM-72C/F/G/H Missile)

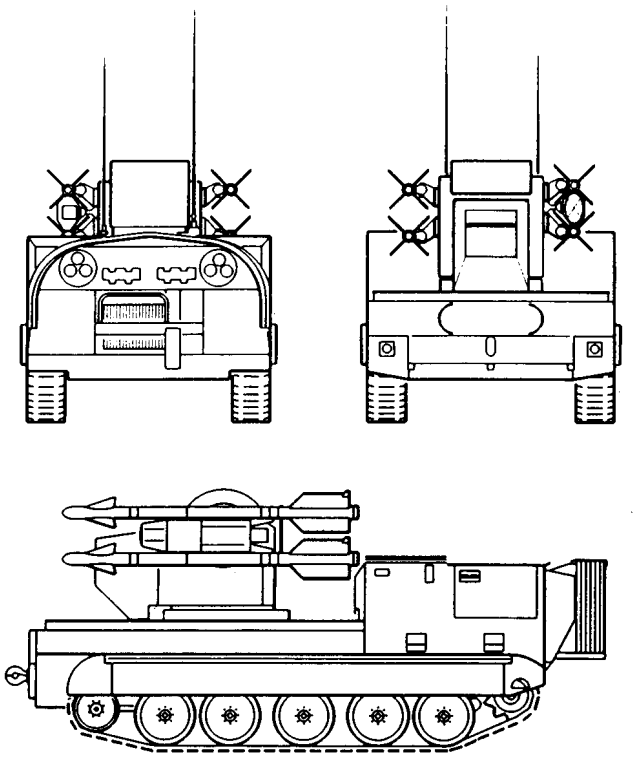
	Metric	US
Dimensions		
Missile Length	291 cm	9.54 ft
Missile Diameter	12.2 cm	4.80 in
Missile Weight	86.2 kg	189.64 lb
Missile Finspan	70 cm	2.29 ft
Performance		
Speed	Mach 2.5	Mach 2.5
Range	6 km	3.24 nm
Altitude	50-3,000 m	164.04-9,842.5 ft

Propulsion. Solid-propellant rocket motor, originally developed and produced by Ford Aerospace & Communications Corp, Newport Beach, CA. Atlantic Research Corporation, Alexandria, VA, has been qualified as a second source for the improved M121 smokeless rocket motor for both new production missiles and modifications of existing inventories. Hercules Incorporated, Allegany Ballistic Laboratory, Rocket Center, WV, was qualified to produce the new smokeless rocket motor for the Chaparral.

Control & Guidance. The MIM-72 missile's DAW-1 guidance section is produced by Loral (formerly Ford Aerospace & Communications). The missile employs an infrared homing system, similar to that of Sidewinder missile, produced by Raytheon Company, Lowell, MA. A new rosette-scan seeker is being incorporated into new production as well as older missiles. A further enhanced all-weather Chaparral may employ General Dynamics' Passive Optical Seeker Technology (POST), a dual mode (infrared/ultraviolet) seeker with a greatly enhanced performance. Early warning is provided by the Sanders Associates MPQ-49 forward area alerting radar. Radars that have been investigated for incorporation into the all-weather system include the TPN-22 manufactured by ITT Gilfillan, the Raytheon Hostile Weapon Locating System, and Marconi Defence Systems DN 181 Blindfire radar used in the Rapier surface-to-air missile system. The Night Chaparral, introduced in late 1984, employs the latest FLIR (Forward Looking InfraRed) technology for greatly enhanced performance at night; this system, mounted between the two port side launch rails, is provided by Texas Instruments. Aerodynamic control is by four fins with warm gas/pneumatic activators. Raytheon Company, Missile Systems Division, Lowell, MA, has been qualified as a second source on the guidance and control sections.

Launcher Mode. In both static and mobile modes, the missiles are fired from turret-assembled launch rails. In the powered mobile mode, turret/launcher assembly is fitted to FMC Corporation's M730 tracked vehicle (a modified M548 cargo carrier). In 1982, a lightweight towed version of Chaparral was introduced. The tracked system is designated M48 while the static version is designated M54. The Sea Chaparral uses a modification of the ground launcher.

Warhead. This missile uses the M-250 blast/ fragmentation warhead of 2.27 kilograms (4.99 pounds) weight with a continuous rod that was developed by the US Army Picatinny Arsenal, Dover, New Jersey. The M-817 radio frequency Doppler proximity/contact fuze was conceived and is manufactured by the US Army Harry Diamond Laboratories, White Oak, Maryland.



M48A1 CHAPARRAL SYSTEM

Source: Lockheed Martin

Variants/Upgrades

There have been a number of missile versions and system upgrades over the life of the Chaparral program. Among the missile versions are the following: MIM-72A Chaparral; MIM-72C/F Improved Chaparral; MIM-72G Rosette Scan Seeker (RSS) Chaparral; MIM-72H, an early export version of the Chaparral missile; and the MIM-72J, the most recent export version based on a detuned Rosette Scan Seeker. The MIM-72J has a less sophisticated level of infrared counter-countermeasures, but offers a 50-percent improvement in acquisition range over older types. The US Army is also offering a system known as Chapfire – capable of firing Chaparral and HELLFIRE missiles – to the US Navy for its sealift surface ships, and is involved in the Chaparral Chassis Service Life Extension Program (CCSLEP).

For additional information on these and other Chaparral variants/upgrades, please see the pertinent entries under the program review section.

Program Review

Background. The US Army's Chaparral short range air defense system began as a stop gap concept in the early sixties. This followed the failure of two other advanced anti-aircraft systems, the T-249 Vigilante (a 37 mm Gatling gun-based system) and the XM546 Mauler, a tracked missile-based system.

From the outset, the US Navy has been an instrumental factor in bringing the program to operational reality.

Actual development began in 1964 at the Naval Weapons Center at China Lake, California. In mid-1965, a contract was awarded to the then Philco-Ford for the full scale development of the system. Following the contractor and operational test program at China Lake and White Sands Missile Test Range, the Chaparral entered service in 1969. The first Chaparral missile, the MIM-72A, was committed to production in 1966 and fielded three years later.

Missile Models. Several versions of the Chaparral missile and fire unit have been developed over the years including both towed and fully mobile models.

MIM-72A/B Chaparral. The original MIM-72A Chaparral missile, based on the AIM-9C Sidewinder, was produced from 1966-1971. Procurement was handled by the US Navy and the US Army and Navy versions being identical.

During the 1970-74 time frame, the US Army carried out an extensive improvement program to increase Chaparral's overall effectiveness, particularly with regard to the infrared homing guidance system. The upgrade effort completed, the improved Chaparral was designated MIM-72C (the B model was for development purposes only), and initial procurement began with Fiscal 1978 funding.

MIM-72C Improved Chaparral. The improved MIM-72C featured new fusing, better guidance and a new warhead. It went into production in 1977 at Ford Aeronutronics Division. With the improved version, engagements can be initiated from any angle, and a smokeless rocket motor reduces the battlefield signature. By l979, the Army had procured all the Chaparral systems required to meet its inventory requirement and procurement was halted. However, Ford was awarded $10.6 million on January 30, 1984, for 13 towed Chaparral missile systems and spare parts support for 24 months.

Planned in the late seventies and funded in the early eighties, modifications to existing inventory Chaparral systems were completed in early 1988. Smokeless rocket motor procurement and retrofit were also scheduled to be completed by that time.

MIM-72G Rosette Scan Seeker (RSS). The US Army awarded Loral a contract in 1982 for the development of the Rosette Scan Seeker (RSS). This low profile program was to upgrade the Chaparral missile in order for it to meet threats (such as increasing the missile's resistance against infrared countermeasures) into 2000. The RSS substantially improved the missile's performance by providing increased engagement range and system product improvements, including an improved forward looking infrared (FLIR) night sight system.

The US Army type classified the Rosette Scan Seeker in August 1987, and issued a draft request for proposals for production of the new seeker the following November. Among the initial competitors for this requirement were Loral (then Ford Aerospace), Hughes Aircraft and Raytheon Company. Eventually, Loral and Hughes Aircraft were selected to compete against one another for production awards. Loral Aeronutronics was awarded $51.8 million on September 28, 1983, to develop a Rosette Scan Seeker (RSS) for the Chaparral missile.

The new seeker would maintain the MIM-72's accuracy, but enable it to operate under severe electronic countermeasures conditions. The RSS is more accurate than the existing Chaparral guidance unit because its seeker and guidance electronics provide two-color detector spectral discrimination and scanning spatial discrimination. Thus, the RSS can tell the difference between targets and infrared counter-measures. The use of a small detector that scans in a rosette pattern means the RSS guidance unit is more sensitive and, therefore, more effective at longer ranges. The unusual scanning pattern enables the detector to cover a wide field of view, improving targeting acquisition.

The RSS is similar to the Stinger's RMP variant; the software can be reprogrammed quickly and cheaply to deal with evolving threats, such as varying aircraft heat signatures, flares and other infrared countermeasures. The RSS is electronically reprogrammed by means of an external connector. Removal and replacement of the modules is not necessary.

Production qualification tests of Loral's MIM-72G Chaparral missile equipped with the RSS have demonstrated an improved ability to defeat infrared countermeasures. In 13 test flights under severe countermeasures conditions, prototypes of the modernized Chaparral scored 10 strikes or lethal passes. The seeker's electronics and software were incorporated by Ford into 60 preproduction missile guidance sections during a 44-month testing program. Ford invested three years of independent research and development work on Rosette Scan Seeker development. Ford received an additional $6.4 million on November 11, 1984, for work on this program. During Fiscal Year 1985, the Army carried out RSS guidance flight testing and fielding of the FLIR. The FY86 efforts in this area included development flight and operational testing of the Rosette Scan Seeker and improvement efforts on the FLIR electro-optical counter-countermeasures.

Chaparral modifications included the retrofit of FLIR night sights on Chaparral launchers.

Initial production of the RSS equipped MIM-72G missiles commenced in the second quarter of Fiscal Year 1988. The Rosette Scan Seeker program was expected to result in the production of 13,000 seekers, at a rate of 1,200 units per year. With all the improvements the designation of the Chaparral system changed to the M48A2. However, decreases in the US defense budget could result in a much lower per year production rate for the Rosette Scan Seeker. The export version of the MIM-72G is known as MIM-72J.

Chaparral II. Ford Aerospace was studying an evolutionary Chaparral missile that would have greatly enhanced performance over the MIM-72E/F. The passive seekers of the fire unit remained in this new system, but the missile's guidance and configuration would have been greatly modified. The new on-board sensor suite would contain an infrared search and track set, an acoustic sensor, a passive radio frequency sensor and a range only radar. In addition, the missile's shape was to be modified to reduce drag. The aerodynamic control surfaces were moved to the rear of the missile.

The Chaparral II would have a range of 10,000 meters (10,940 yards), with the launch system expected to be integrated with the 227 mm M270 Multiple Launch Rocket System (MLRS) carrier vehicle. This new application would reduce the overall crew requirement to two. The total weight of the system was to be approximately 6.818 tonnes (7.5 tons).

Chaparral III?. Loral, along with other companies, was trying to interest the US Army and other potential customers in further modifications to increase Chaparral's effectiveness and further extend its service life. This effort involved various options and has been known by the following names: Chaparral 2000, Roadrunner and Chaparral Chassis Service Life Extension Program (CCSLEP). Many of the upgrades offered for the Chaparral were developed privately by Loral and other contractor teams. These upgrades were revealed at the SafeAir 93 demonstrations held at the McGregor Range, New Mexico.

This Chaparral enhancement initiative includes several new configurations, offered under the overall designation Chaparral Chassis Service Life Extension Program (CCSLEP), as well as a new missile load assist device (LAD) that reduced the crew needed to operate the present Chaparral M730 series system. The CCSLEP, previously known as Roadrunner and also called Advanced Chaparral, was an outgrowth of the Chaparral system and included the following derivatives: Universal Carrier, designed XM1108; a modified version of the General Motors of Canada Light Armored Vehicle (LAV) 8x8, designated M1047A; and a trailer-mounted Pedestal design. The CCSLEP was a natural progression from the Chapfire demonstration held in the middle of 1992, the success of which led to development of the launcher hardware.

The launcher pallet allowed for the universal mounting of various pedestals equipped with launch rails specific to the required missile system. The use of identical pallets allowed interchangeable applications and the ability to tailor the weapon system for specific scenarios. The multi-weapon platforms have already been used to test fire HELLFIRE and Chaparral missiles and Hydra-70 rockets. MICOM identified a number of additional weapon candidates for future integration on the CCSLEP including: tail-control Chaparral; Stinger; Sparrow; AMRAAM; a lightweight version of the Line-Of-Sight-Anti-Tank (LOSAT); and even TOW missile, once the latter is finally fire-and-forget. The tracked XM1108 carrier was believed to have been demonstrated for Egypt, which already operates a number of Chaparral SAM systems. Egypt may be interested in a version outfitted with both AMRAAM surface-to-air and HELLFIRE anti-tank missiles. Other interested customers included: the US Marine Corps for the LAV configuration; and the Norwegian army, which has shown interest in a variant carrying the AMRAAM. Both the tracked and wheeled CCSLEP systems remove the gunner from the Chaparral turret and place him under armor in the vehicle crew compartment. The trailer-mounted version of the CCSLEP also carries a combination of missile systems, allowing the weapons platform to be used around airfields and other fixed sites.

A version based on a stretch M113 chassis was developed in cooperation with FMC and the US Army Tank-Automotive Command (TACOM). The M113 armored personnel carrier was cut down and stretched with the addition of a sixth set of road wheels. The carrier crew compartment used the production model armored cab from the MLRS (Multiple Launch Rocket System), also made by FMC, and had space for three soldiers. This provided the crew the same level of ballistic protection found in the M113A3 APC and moved the gunner's position to the armored cab. The system could normally be operated with a crew of only two, although the third person was required to conduct 24-hour operations. The prototype's propulsion system was to be replaced by that to be used in the new XM8 Armored Gun System (AGS). The Roadrunner had a maximum gross weight of 16,329 kg. The M113 Common Carrier was designed to have a combat weight of 10,357 kg with an additional 189 kg dedicated platform growth. The remaining 5,783 kg have been allocated to payload weight capacity. A complete

vehicle could be delivered three months after a contract award.

Loral was also experimenting with the addition of dual spectral (radio frequency and infrared) sensors and interactive missile guidance to expand the operational utility of the system beyond the Improved Chaparral. A dual spectral seeker would enable Chaparral to sense the radio frequency signals emitted when attacking aircraft switch on their radars for target acquisition and an early target approach. The infrared seeker would continue to be used for terminal guidance. Alternatively, target information from both the infrared and radio frequency seekers could be collated by a data fusion system. A tail control missile would provide an extended intercept range beyond 15 kilometers, while modifications to the rocket motor would reduce flight time to target intercept and simplify missile handling.

Other electronic based modifications included the addition of new sensors, such as the Thorn EMI Electronics ADAD (Air Defence Alerting Device) and the McDonnell Douglas Nighthawk target acquisition and designation system, and the adding of an Identification Friend-or-Foe (IFF) system.

Launcher Models. The following describes the various launch platforms that were used by the Chaparral, which includes tracked, towed and shipborne versions.

Tracked Chaparral. The M730 tracked carrier vehicle is derived from the M548 tracked cargo carrier, which in turn was derived from the ubiquitous M113 armored personnel carrier produced by FMC Corporation. The engine and crew compartment are at the front of the vehicle while the launch station is at the rear. The M54 launch station consists of the launcher (with four ready-to-fire and eight reload missiles) and the hydraulically driven turret; traverse is 360 degrees while elevation is +90 degrees and depression is -10 degrees. The gunner's seat is in the turret, which is air conditioned. The launch station is of a telescoping design which is lowered for travel.

In the original version, auxiliary power was provided by a 7.46 kW (10 hp) petrol engine; in the mid-eighties, it was decided to replace this engine with an as yet unknown diesel engine rated at 22.38 kW (30 hp). As the original M730 was considered somewhat anemic in performance, it was also decided to incorporate some of the technology developed for the M113A1E1 RISE program. The existing engine is replaced with the supercharged 6V-53T engine rated at 205.15 kW (275 hp). The TX-100 gearbox is replaced by the X-200-4; the other driveline components are also replaced. This improvement program was completed in by mid-1989. When traveling, the launcher and missiles are protected by a quickly removable tarpaulin and bows. After halting, removal of the covers and readying the missiles for launch takes only a few minutes.

The entire system is designated M48 and is deployed with the US Army in composite battalions with the M163 Vulcan AAA unit. Each battalion is equipped with two batteries each with 12 M48 launchers, and two batteries each with 12 M163 Vulcan self-propelled AAA systems. Each battalion is provided with an MPQ-49 forward-area alerting radar (FAAR) manufactured by Sanders Associates. This early warning radar tracks the target until the missile's guidance takes over. Identification Friend or Foe (IFF) units are being installed on each fire unit. Forward looking infrared (FLIR) sights, retrofitted on Chaparral launchers, provide night and limited bad-weather capability. A Tracked Chaparral platoon of four fire units can be moved by two C-141B transport aircraft.

Towed Chaparral. The original towed Chaparral system consisted of the M-54A1 aerial intercept guided missile system with identification-friend-or-foe (IFF) capability and an equipment trailer carrying four missiles mounted on launch rails and four stored reload missiles. The towed system weighs 5,681.82 kilograms (12,500 lbs), about half the weight of the Tracked Chaparral. A four-unit towed Chaparral platoon can be airlifted by one C-141B, and can be towed by any 5-ton truck. A towed unit also can be airlifted by a CH-47D Chinook helicopter.

New Towed Version. Loral developed a lightweight towed version of Chaparral for the US Army's new light divisions, under the program name Light Air Defense System. The launcher trailer, weighing about 5.5 tonnes (6.06 tons), carries four missiles at the ready and four in reserve. It is self-contained with its own generation unit. This program, funded for the procurement of 13 systems, was being evaluated by the 9th Infantry Division as well as a part of the US Army's overall air defense requirements.

Sea Chaparral. The US Navy had planned to equip 14 of its *Knox*-class (FF-1052) frigates with the Sea Chaparral variant for anti-air defense. However, this modification was canceled due to higher naval priorities, which led to the sale of these systems to Taiwan in late 1979 under the FMS program. Sea Chaparral remains available only from the contractor; it is not a standard US system.

Chapfire. The US Army Missile Command and Loral have developed the Chapfire system, which is capable of firing both MIM-72 Chaparral anti-aircraft and AGM-114 HELLFIRE anti-tank missiles. The system is equipped with a new Allstar radar, an improved version of the Lockheed Sanders forward area alerting radar (FAAR) fielded with Chaparral units. This radar

unit provided cueing and targeting information for Chapfire demonstrations. The Chapfire system uses a modified Chaparral launcher mounted on a wheeled trailer and equipped with two ready-to-fire Chaparrals and two HELLFIREs. The launcher is outfitted with a Texas Instruments FLIR target acquisition unit and a laser designator/rangefinder for the HELLFIRE missiles. The Chapfire also can be mounted on a fighting vehicle, trailer ship or fixed ground position. The Chapfire unit, without extra missiles, would be roughly $2.5 million.

The system has been demonstrated for various allied countries and the US Navy has been offered the system for use on its cargo vessels (although the latter service has declined the offer). The Chapfire concept originated with the US Navy, which is seeking a low-cost shipboard air/surface defense system for defending lightly armed cargo vessels in coastal waters. The system eventually selected by the US Navy would be known as the Rapid Deployment Integrated Defense System.

Funding

Although the Chaparral survived previous attempts to terminate its funding, the US Army has made no procurement request since 1990. Support for the Chaparral program had been offered upon the block in order to reduce the overall US defense budget. Although, in 1989, the US Army was eventually ordered to replace all funding for Chaparral, the service deleted its request for this program once more in Fiscal 1991.

In Fiscal 1988, 122 Rosette Scan Seeker Chaparral missiles were to be procured with $30.2 million. An additional $57.9 million was requested in Fiscal 1989 for the acquisition of 368 RSS missiles. However, this was reduced to 38 and 139 respectively. The Fiscal 1988-1989 buys included both new and modification units. In Fiscal 1988, 38 new and 66 modification missiles were purchased, while in Fiscal 1989, 139 new and 15 modification units were acquired. However, actual results achieved from competition (utilizing competitive price as a negotiation tool in the procurement program), resulted in the acquisition of 122 new and 574 modification units in Fiscal 1988, and 368 new and 48 modification missiles in Fiscal 1989. Competition enabled the US Army to purchase 313 more new and 541 more modification units, for a total of 490 new and 622 modification missiles.

No specific Chaparral missile RDT&E funding is mentioned in current US government documents. It is possible that work relating to the Chaparral program is contained within other research and development funding lines, but a major enhancement effort is not anticipated. Total estimated program costs are as follows: total RDT&E, $253.1 million; total procurement, $2.1 billion; total modifications, $784.5 million.

Recent Contracts

Loral (then Ford Aerospace) and Hughes Aircraft began head-to-head competition for Chaparral annual production buys in 1990. Previous production contracts were directed awards. Loral received a contract in March 1989 for the production of 441 Rosette Scan Seekers (RSS) with an option for 687 units. This award was worth $38.3 million. These systems included 368 new, 48 modification and 25 test units. Loral has received $74.3 million for its work on the Chaparral program, since the commencing of the second source effort.

Hughes Aircraft received a similar US Army contract on September 22, 1988, for $39.1 million. The Hughes award calls for the production of 865 RSS units. The buy was for 122 new missiles, modifications of the guidance section totaling 574, with 25 of those being for test. Hughes has received $92.9 million for this program, so far. Hughes will have delivered 295 Rosette Scan Seeker guidance sections prior to the awarding of the Fiscal 1990 production contract.

Timetable

Month	Year	Major Development
	1964	Research and development initiated
Feb	1965	Chaparral RDT&E program initiated
	1966	Low-rate production began
	1969	Initial operating capability tested

Month	Year	Major Development
Nov	1970	System type classified
	1970-74	MIM-72 improvement program initiated
FY	1972	Buy-out of missile in current configuration took place
Nov	1974	Improved Chaparral (less smokeless motor) type classified standard
FY	1975	Chaparral modification program first funded
Jul	1975	IFF effort begun
Nov	1975	Initiated smokeless motor development
	1976	Initial MIM-72C procurement funding allocated
Sep	1977	IFF approved for production
Jul	1977	Initial operating capability (MIM-72C) tested
	1978	Stinger IFF modification began
	1979	IFF modification completed
		Smokeless rocket motor initial procurement began
	1980	Infrared engineering development completed
Mar	1980	Smokeless motor approved for production
	1981	Infrared contract awarded
	1981	Chaparral modifications for fire control systems initiated
	1982	Fire control modifications completed
	1982	Loral received first contract for Rosette Scan Seeker
	1983	FLIR seeker flight trials began
	1984	Infrared upgrade completed
		FLIR seeker flight trial completed
Late	1984	New production decided for 3,000 Chaparrals (MIM-72E/F)
	1986	Interim operational capability E version of Chaparral tested
Mid	1988	Production, modernization and development of system continued
Sep	1988	Hughes received RSS production award
Mar	1989	Loral received RSS production award
	1990s[(a)]	Production continuing for existing and overseas orders

[(a)] Estimated

Worldwide Distribution

The Chaparral has not enjoyed the sales success of the MIM-23 HAWK or similar systems. By early 1985, 677 Chaparral systems had been built, of which 544 had been purchased by the US Army. The total US Army procurement objective is 632 systems, of which 64 were procured in Fiscal 1986. Of these 64, 24 were authorized, and the remaining 40 were to be reprogrammed from the cancellation of Sgt. York. Identified users include Israel, Morocco, Nationalist China, Tunisia, and the United States. As the US retires its systems, they will be made available for export, possibly incorporating various improvements as part of the Chaparral Chassis Service Life Extension Program (CCSLEP). Presently, there is a pending order for an additional 500 Chaparral missiles to replenish the US inventory as older missiles are exported.

Egypt is one of the largest operators of the Chaparral air defense system outside of the United States. In February of 1984, a sale was made to Egypt for 28 M730A1 vehicles and 478 missiles worth $160 million. The deal included seven M577A2 command post vehicles. Egypt accepted this offer (which was made in 1983), and first deliveries were made early in 1988. Loral delivered the first of 25 Chaparral mobile surface-to-air missiles to Egypt in 1988. The company also provided a training package to Egypt. As part of the contract, Sanders Associates provided its TRACKSTAR (Tracked Search and Target Acquisition Radar Systems) mounted on a modified FMC M577A2 command post vehicle chassis. TRACKSTAR was developed as a private venture, with the first prototype being completed in 1985. The radar has a maximum range of 60 km, and when the target has been confirmed as hostile, the Chaparral unit best able to engage the target is alerted, and target is aligned to the gunner's sight. Lockheed Sanders supplied additional TRACKSTAR L-band mobile acquisition radars to Egypt under an additional $38 million contract. Egypt has expressed an interest in the possible procurement of upwards of 24 Advanced Chaparral systems (see Chaparral III entry) and 300 MIM-72J model missiles. However, no formal agreement has been reached.

In early 1990, Loral announced a $220 million deal with Egypt for the supplying of additional Chaparral surface-to-air missile systems. The contract included provisions for the purchase of 432 MIM-72H missiles, 25 mobile fire (launcher) units, mobile surveillance radars and an Identification, Friend or Foe (IFF) system. In 1996, Egypt again mentioned an interest in additional Chaparral fire units and missiles. Cairo is considering the purchase of 26 fire units and an unknown quantity of missiles.

The **Federal Republic of Germany** has had plans to develop a surface-to-air version of AIM-9L Sidewinder to be used in a Chaparral-like system to defend Luftwaffe bases as a supplement to Rheinmetall 20 mm MK RH 202 twin-gun systems and Roland air defense systems.

Morocco is in the process of finalizing its new Chaparral requirements. The country has given no indication at to the quantity of fire units and missiles it may wishes to procure. Morocco already operates a number of Chaparral fire units and could be interested in upgrading their capabilities.

In July of 1986, in a $45 million deal, **Portugal** purchased five M48A2 launch systems and 28 missiles along with associated equipment. This agreement was worth $45 million. Portugal, like Egypt and Thailand, has also expressed interest in the Advanced Chaparral as has **Israel**.

Spain is considering the acquisition of the MIM-72 Chaparral, in order to upgrade its army's air defense capabilities. No information has been provided concerning the final purchase date for this equipment, or the actual size of the order.

The Republic of China (on **Taiwan**) operates the Chaparral air defense system, and is the only customer for the Sea Chaparral. A July 15, 1983, letter of offer to the Coordinating Council for North American Affairs, covered the sale of 384 MIM-72F Improved Chaparral missiles and 24 launchers with vehicles, 120 MIM-72F Improved Sea Chaparral missiles, and 18 MIM-72F Improved Chaparral missiles for a lot acceptance. The sale included 309 tank conversion kits at an estimated total package cost of $291 million. The American Institute in Taiwan, representing the US Army, had primary responsibility for transactions relating to this offer. This was followed by a June 26, 1985, letter of offer for the sale to Taiwan of 262 MIM-72F Chaparral missiles, 16 launchers with vehicles, training and spare parts for $94 million. The missiles were to complement Taiwan's Nike-Hercules and Improved Hawk air defense systems. In 1986, Taiwan ordered 52 Chaparral fire units and associated spare parts valued at $29 million. The final deliveries on this order were scheduled for 1989. In late 1992, it was revealed that Taiwan was considering an additional purchase of some 300 missiles that would be equipped with an export version of the rosette scan seeker (the MIM-72J models). Taiwan's most recent purchase was in 1996. The country acquired 60 MIM-72J model missiles for use on with its Sea Chaparral air defense units. Taiwan will outfit its new *LaFayette* class frigates with the Sea Chaparral, some six ships in all. A separate proposal covered the acquisition of eight Chaparral fire units with 148 MIM-72J missiles for use by Taiwan's marine corps. The latter deal has not been finalized.

In late 1984, **Thailand** requested to purchase four Chaparral systems. As of mid-1988, this request had not been acted upon. However, Thailand's recent decisions to emphasize conventional warfare and the upgrade of a number of Royal Thai Army divisions to a mechanized status could help to stimulate action on this proposal. Supposedly, the Royal Thai Armed Forces have mentioned an interest in the Advanced Chaparral.

Tunisia may procure some 200 MIM-72E model missiles to upgrade its existing Chaparral fire units. No decision is known to have been made, although one has been pending since 1996.

User Country(s). Besides the **United States Army**, identified Chaparral users include: **Republic of China** (on Taiwan), **Ecuador** (reported), **Egypt**, **Greece** (not confirmed), **Israel**, **Morocco**, **Portugal**, **Spain** (not confirmed) and **Tunisia**.

Forecast Rationale

Little high profile activity has occurred over the last year concerning the MIM-72 Chaparral air defense system. Although the US has retired the system from service, many foreign militaries continue to operate the Chaparral and have shown an interest in these now-surplus US units.

Chaparral's continued viability is due to many operators not having the necessary resources to initiate wholesale replacement programs. Furthermore, the threat level for these countries has not exceeded the MIM-72's combat capabilities. This could mean that Chaparral exports – although production may cease – may continue into the first decade of the 21st century.

For now, Egypt, Morocco and Taiwan seem to be the most likely near-term candidates for Chaparral buys. Other potential customers include Tunisia, and perhaps Portugal and Thailand. So far, these orders are still pending, but they represent significant potential for the Chaparral. Part of this demand, if not most of it, will likely be filled with Chaparral fire units and missiles taken from the US inventory. Many of these missiles will likely have to undergo some degrade of remanufacture prior to shipment overseas, helping to generate a fair level of contractor activity, perhaps throughout the forecast period, that does not necessarily involve fabrication of additional missiles.

Due to the uncertain nature inherent in dependence on export contracts for future production awards, the following forecast should be viewed with considerable caution. The reader should also be cautioned that some sales will likely be fill with existing weaponry that may not involve much, if any, contractor participation. If production does continue, annual totals are likely to fluctuate.

NOTE: Our forecast includes all MIM-72 production versions, new and modification missiles, and those equipped with the Rosette Scan Seeker. This forecast is also being maintained to reflect continued market activity involving the Chaparral.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

			High Confidence Level			Good Confidence Level				Speculative			
Missile	**(Engine)**	**thru 98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**Total 99-08**
LOCKHEED MARTIN CORPORATION													
MIM-72(a)	MK.50/M121	23109	100	83	0	0	0	0	0	0	0	0	183
Total Production		23109	100	83	0	0	0	0	0	0	0	0	183

(a)Thru years include RDT&E missiles. Forecast line includes all MIM-72 versions.