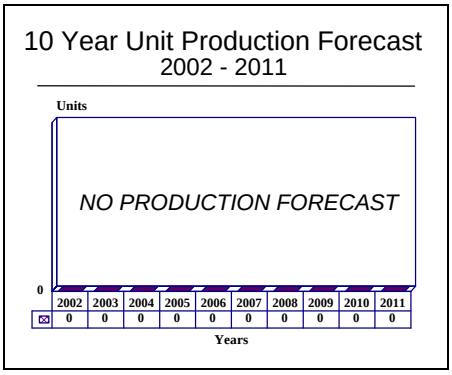
AGM-129 Advanced Cruise Missile - Archived 2/2003

Outlook

- No longer in production. Serial manufacture of this missile never took place
- The US never fielded the AGM-129 Advanced Cruise Missile (ACM)
- This missile could be used as a basis for a new conventional cruise missile
- US Air Force is the only operator of the AGM-129 ACM



Orientation

Description. Advanced second-generation cruise missile.

Sponsor. United States Department of Defense through the US Air Force, Aeronautical Systems Division, Wright-Patterson AFB, Ohio, USA.

Contractors. Developed and produced by General Dynamics Corporation, Convair Division; San Diego, California, USA. Hughes Aircraft Company later purchased the portion of General Dynamics that manufactures the Advanced Cruise Missile.

Second Source. McDonnell Douglas Corporation, Missile Systems (formerly Astronautics) Company; St. Louis, Missouri, USA.

Status. Production completed. Full-scale engineering development completed. Full-scale fabrication was never achieved, since 250 missiles per year would have been needed. Initial deployment on B-52 bombers.

Total Produced. Approximately 478 AGM-129A missiles (including RDT&E units) were completed by the end of 1993 (although this figure does not include the remanufacture of the 30 preproduction missiles General Dynamics built for the US Air Force). As a result of cost overruns, the US Air Force was forced to reduce the number of AGM-129As it would procure from 1,461 to 460. The START (Strategic Arms limitation Talks) treaty and the disintegration of the Soviet Union and Warsaw Pact alliance also contributed to these reductions. Minimum economic production rate is 11 per month. Maximum output for the Advanced Cruise Missile is 36 per month.

Application. An air-launched strategic cruise missile for use as a component of the US strategic triad.

Price Range. Although difficult to estimate due to the advanced technology involved, the Advanced Cruise Missile should cost at least $2.2 million in FY93 dollars. Other estimates place the unit price at $3.8 million.

Technical Data

Design Features. Problems encountered seem to center on the missile's aerodynamic shape and propulsion, rather than the guidance system. The missile has the added problem of a new design with

greater range but little additional room for fuel. Because of the nature of the technology involved with this project, specific technical data concerning the AGM-129 Advanced Cruise Missile is somewhat limited. Available information indicates a range greater than 2,750 kilometers (1,484.89 statute miles) and a high subsonic speed of Mach 0.9. However, some sources have indicated that the Advanced Cruise Missile will have a range capability in excess of four times that of the AGM-86B. The general dimensions should be similar to the AGM-86B's (see separate report). The following information is based on estimates compiled from available documents.

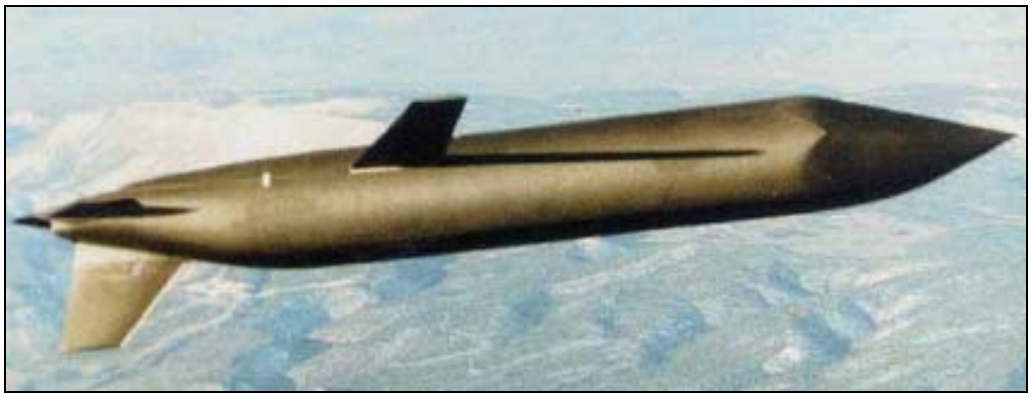
	Metric	**US**
Dimensions		
Length	6.0 m	19.68 ft
Weight	1,250 kg	2,750 lb
Diameter (height)	450 mm	14.76 in
Diameter (width)	860 mm	28.21 in
Wingspan	1.75 m	5.74 ft
Performance		
Speed (Max)	Mach 0.9	Mach 0.9
Range	2,750 km	1,484.63 nm
Accuracy	Less than 40 m	Less than 131.2 ft

Propulsion. The missile uses the enhanced F112 turbofan, which has significantly better fuel consumption than the AGM-86B. This engine was produced by Williams International. The new missile has no supersonic performance in the terminal phase of flight. The propulsion system has also cut down on infrared emissions. The F112 turbofan engine, formerly the 14A6, was funded under the US Air Force Advanced Technology Cruise Missile Program, PE#63319F. Teledyne CAE, second source on the F107 Tomahawk engine, wants the Air Force to proceed on second-sourcing of the F112 engine. The Air Force has been considering a second-source production line for the F112 engine.

Control & Guidance. An advanced TERCOM Assisted Inertial Navigation System type guidance is employed, using a laser radar developed by General Motors Corporation; Hughes Aircraft Company. Accuracy improvements are said to enable the AGM-129 to strike within ten feet of a target, a significant improvement over current-generation cruise missiles. Terminal guidance is aided by in-flight course updates from satellites. The new missile features enhanced maneuverability to avoid defenses, as well as signature-reduction technology, including a composite/polymer airframe. The AGM-129A is equipped with fold-out wings and vertical stabilizers. Allied Signal Aerospace Company, Allied Actuation Systems Division, provided the elevon and rudder flight-control actuators.

Launcher Mode. The AGM-129A Advanced Cruise Missile is to be deployed initially on the B-52G and later on the B-1B and B-2 bombers. The AGM-129 will be carried internally and externally by these aircraft. The B-52H will be able to carry eight internally and 12 externally. The B-1B has six external pylons capable of attaching between 12 and 14 missiles, as well as its Boeing Common Strategic Rotary Launcher, which is capable of carrying eight internally. The Boeing CSRL is to be installed on all three of these aircraft. Only the B-2 will not carry the AGM-129 externally.

Warhead. The AGM-129 carries a 150 to 200 kiloton nuclear warhead. There are presently no plans for the missiles to carry a conventional warhead.



AGM-129A

Source: General Dynamics

Variants/Upgrades

The United States Air Force had wanted to develop a conventional version of the nuclear-armed AGM-129A missile system. This system was known as the AGM-129B. However, this program was eventually terminated. For additional information, please see the pertinent entries under the **Program Review** section.

Program Review

Background. Even in the early 1980s, as the AGM-86B was first being deployed, it was known that this particular Air-Launched Cruise Missile (ALCM) would be only an interim step in cruise missile technology. The Soviet Union's development of a viable look-down/shoot-down fire-control radar for aircraft, an advanced air-to-air missile, and other advances in Soviet air defenses led to questions of the AGM-86's survivability. The rapidity of development of the Soviet defenses and the associated projected technical obsolescence of the AGM-86, were unforeseen. The speed with which the US would develop the various forms of signature reduction stealth technology was also unexpected. These events led the Air Force to believe that an advanced cruise missile with a performance and survivability greatly improved over the AGM-86 could be fielded sooner than thought. The Advanced Cruise Missile program is a third-generation cruise missile which will eventually replace the present AGM-86B.

DARPA Program. The US Air Force's Advanced Cruise Missile program may owe its existence in part to the Defense Advanced Research Projects Agency's (DARPA) Advanced Cruise Missile Technology program. The technology being pursued by this effort was to provide new basing and employment options for future cruise missile forces. Increased range and/or payload options were being pursued through investigation of advanced propulsion systems, stressing new polymer and composite materials, advanced engine cycles and high-energy fuels. DARPA's objective was to obtain intercontinental ranges for the cruise missile, eliminating the need for launching aircraft to penetrate hostile airspace. DARPA hoped that by the late 1980s or early 1990s it would have developed the technology for air-launched cruise missiles to fly 11,272 kilometers (7,000 miles) or more to their targets.

On January 17, 1983, LTV Aerospace/Vought, Dallas, Texas received $12.1 million from the Air Force for extended long-range technology evaluation for intercontinental cruise missiles. DARPA selected Vought's proposal over another submitted by a second firm. This program was also probably the basis for the Long-Range Conventional Stand-off Weapon System (LRCSW - see Advanced Technology Cruise Missile report).

Competition. In August 1982, the US President approved development and deployment of the Advanced Cruise Missile. In September 1982, the Air Force issued a request for industry proposals. Boeing, Lockheed and General Dynamics all responded to the Air Force's requests for development of a new cruise missile. While there was obviously no fly-off competition, the Air Force evaluated the three proposals on the following points: 1) mission effectiveness, 2) operational utility, 3) technological risk, 4) logistical support, 5) manufacturing quality assurance, 6) tests and evaluations, and 7) program management.

From its inception, the Advanced Cruise Missile program was given little publicity, as opposed to the

previous fly-off competition for the AGM-86 Air Launched Cruise Missile contract. In April 1983, the Air Force selected General Dynamics' Convair Division as its Advanced Cruise Missile prime contractor; the new missile type was classified the AGM-129 in mid-1987. A firm fixed-price incentive contract will provide for the ACM's full-scale development and includes not-to-exceed cost options for the first two production lots.

AGM-129A Description. The AGM-129 uses a radical new design. Although similar in overall size to the current-generation Boeing AGM-86B, the Advanced Cruise Missile is very different in shape. No control wings are visible when the missile is in its launch station. According to sources, this indicates that the AGM-129 relies on body lift. The inlet of the Williams F112 engine is located beneath the missile and is of a flush design. The exhaust is not visible, but it could be a two-dimensional slot beneath the missile's upswept tail. Three aerodynamic control surfaces are visible: two downward-folding elevators and a third, much larger surface that appears to be a ventral rudder which is offset to one side of the exhaust. A conformal antenna for the guidance system is mounted under the nose.

According to a recent report, the missile's stealth design features are concentrated on the forward-and-above aspect, from which a cruise missile is most likely to be detected. The upper surface of the nose is a half-cone, and features such as the inlet, exhaust and rudder are shielded by the afterbody. According to some sources, the radar cross section from exactly 90 degrees to the side of the missile is probably quite high. However, the only systems that could pick the missile out against ground clutter are pulse-Doppler radars. A target moving at 90 degrees to the axis of the radar has no range change relative to the ground, so Doppler would not detect it.

Second-Source Contract. Problems with the AGM-129 prompted a search for a second source. McDonnell Douglas Missile Systems (formerly Astronautics) Company was eventually selected to fulfill this requirement and was awarded a $1.2 million technology transfer contract. Under the contract, General Dynamics, the ACM developer, would provide McDonnell Douglas with the technical data to become a second source. This move was not only to address delays and quality control problems in the ACM program, but it was also seen as an attempt to use competition to drive down the cost of the missile.

In May 1988, the company received a $16.8 million contract from the Air Force to act as a second source for the AGM-129 program. This contract, a follow-on to the $1.2 million award of November 1987, was the next step leading to the company's qualification as a second source for the Advanced Cruise Missile. After qualification, contracts were to be awarded on a competitive bidding system. McDonnell Douglas Missile Systems Company would assemble the missiles at its Titusville (Florida) facility.

Production orders for the AGM-129 were to have been split between the two contractors. Approximately 30 percent of the procurement totals were to be provided to each contractor with the remaining 40 percent to go to the winner of the previously expected competition. Competition between the two companies was expected to begin by FY90. However, the prime and second source were not able to compete for the AGM-129A as planned. The US Air Force was in the process of restructuring the program to accommodate design changes, flight-test delays, and other problems. Therefore, qualification of McDonnell Douglas as second source was delayed until December 1990. Head-to-head competition was planned to commence in 1993, at which time a single contractor might have been selected. However, following the Bush administration's announcement that no additional missiles would be procured after FY92, no head-to-head competitions have taken place.

AGM-129B: Conventional. The US Air Force was working on a classified program to develop a conventional warhead version of the AGM-129A. Known as the AGM-129B, its development was awarded to General Dynamics in a sole source contract. The US Congress eventually canceled this program. No additional work is reported to be under way pertaining to the AGM-129B, although the idea may be kept alive as a potential alternative to the development of an all-new long-range strike missile. The US Air Force had wanted to procure 125 AGM-129B missiles.

Clone Program. The Defense Nuclear Agency is pursuing a Clone (Composites and Low Observables Nuclear Effects) program with the goal of integrating nuclear hardness assurance into design practices for composite/low observable aircraft systems, including strategic bombers, cruise missiles, and radar absorbing materials and structures.

Funding

The overall ACM procurement total was reduced from 640 to 460. This reduction was necessary to close out the program and pay for a $121.2 million cost growth that surfaced while missile deliveries were suspended due to quality problems. Some $344 million in FY92 ACM procurement funding was rescinded, although an additional allocation was made in FY93 to support completion of the missiles the US Congressional Conference Committee had already ordered. Without these additional allocations, the service might have had to reduce the total number of nuclear armed missiles to 270. Total program cost has been estimated at $4.82 billion, a reduction of $132.6 million.

A service life extension program will be launched for the ACM in FY2001. The service life of the ACMs are due to expire between 2003 and 2008. This is new start program that will enable the AGM-129 to remain in service through 2030. This program will identify those components that cannot be sustained beyond the normal service life.

US FUNDING

	FY99		FY2000		FY2001		FY2002 (Req)	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
USAF								
Proc								
Adv. Cruise Missile	-	1.4	-	1.0	-	2.0	-	-
RDT&E								
Proj - 1	-	-	-	-	-	4.1	-	2.5

All $ are in millions.

Proj - 1 PE#0101120F Advanced Cruise Missile.

Recent Contracts

In October 1999, Boeing was awarded a $450 million indefinite delivery/indefinite quantity contract to provide for depot level repair of inertial navigation systems on various aircraft: the Advanced Cruise Missile, the Navy Dual Miniature Navigation System, the Minuteman and Peacekeeper missile systems, and other electronic systems. Work will be completed by September 2004. Contract Number F42610-99-D-0006

In November 1996, Hughes Missile Systems Company, Tucson, Arizona, was awarded a $45 million time-and-materials contract to provide for engineering services for the AGM-129A Advanced Cruise Missile through September 2001. Contract Number F34601-96-C-0775

In October 1995, Hughes Missile Systems Company, Tucson, Arizona, was awarded a $9 million time-and-materials contract for FY96 engineering services to support the AGM-129 ACM. Contract Number F34601-95-C-0902

In May 1995, Sechan Electronics, Lititz, Pennsylvania, was awarded a $13.9 million contract for 47 Operational Test Launch Payloads in support of Operational Test and Evaluation of the Advanced Cruise Missile. Work will be completed by September 1999. Contract Number F33657-94-C-0017

General Dynamics was contracted to manufacture some 420 ACMs, while McDonnell Douglas delivered 100 units. As of March 1992, General Dynamics had delivered 149 ACMs. McDonnell Douglas had delivered one. The US Air Force said that it had only 29 operational ACMs in its arsenal. In May 1992, General Dynamics Convair Division received a $332.3 million face-value increase to a fixed-price incentive contract for FY90 (25 units) and FY91 (35 units) production of the AGM-129A Advanced Cruise Missile. Contract Number F33657-89-C-0082. McDonnell Douglas received a $389.7 million face-value increase to a fixed-price incentive contract for FY90 and FY91 AGM-129A production. McDonnell Douglas produced 50 missiles with FY90 and FY91 funding. Contract completion was in March 1993. Contract Number F33657-89-C-0083

Timetable

Month	Year	Major Development
	FY77	Development initiated
	FY80	Development accelerated
Jul	1982	US Air Force study issues requirement for next-generation cruise missile
Aug	1982	President approves development and deployment of ACM
Sep	1982	Air Force issues RFP for ACM
Apr	1983	Contract awarded to General Dynamics
	1986	Initial low-rate production commences
	1987	Production decision
Mid	1987	Type classified as AGM-129
	1990	Funding awarded for General Dynamics and McDonnell Douglas each to produce 50 missiles (actual production delayed)
	1991	100 AGM-129s to be manufactured; production to be split eventually between the prime and second source (again actual production delayed)
	1991-92	Initial Operating Capability expected
	1992	Bush administration announces ACM procurement to end in FY93
	1992	US Congress partially rescinds ACM procurement funding
	1992	US DoD cuts ACM procurement to 460
	1993	Final ACM deliveries made
	2001	ACM service life extension program launched

Worldwide Distribution

The AGM-129A Advanced Cruise Missile is not expected to be exported. The missiles Boeing completed were delivered to the US Air Force. No further new production of this system is anticipated.

User Country(s). The **United States Air Force** is the only anticipated user of the AGM-129 missile.

Forecast Rationale

The United States is expected to keep the AGM-129 Advanced Cruise Missile (ACM) in service longer than once anticipated. This long-troubled program has seen more than its fair share of ups and downs over the years including development problems and funding irregularities.

Now, the United States plans to extend the service life of the ACM through 2030. Retirement of the ACM was to commence in 2003 and be completed by 2008. A study will help to identify those components that cannot be sustained beyond the normal service life. The decision to extend the ACM's service life appears to have brought an end to talk of outfitting part of the ACM inventory with conventional warheads. Instead, the US is focusing on other options that do not involve the AGM-129.

The US Air Force completed purchases of the ACM long ago, although orders fell far short of its once-stated procurement goal of 1,461 missiles. No further new unit purchases are anticipated. Some contracting activity will continue in order to support the existing inventory and maintain the missile's effectiveness in the 21st century.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

			High Confidence Level				Good Confidence Level				Speculative			
Missile	(Engine)	thru 01	02	03	04	05	06	07	08	09	10	11	Total 02-11
GENERAL DYNAMICS CORPORATION													
AGM-129A	F112-WR-100	478	0	0	0	0	0	0	0	0	0	0	0
Total Production		478	0	0	0	0	0	0	0	0	0	0	0