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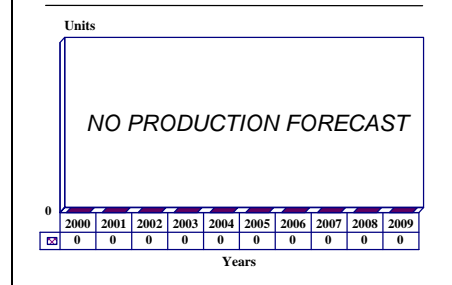
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AGM-45 Shrike - Archived 10/2001

Outlook

- Production concluded. The Shrike program was terminated in favor of the AGM-88 HARM
- Modifications to the existing inventory were undertaken, involving enhancements to the missile's rocket motors and guidance system
- Over 25,000 Shrikes were manufactured; the missile served in the raids on Libya during the 1980s and Operation Desert Storm

10 Year Unit Production Forecast
2000-2009



Orientation

Description. A supersonic, all-weather, air-to-surface guided missile for hostile radar suppression.

Sponsor. US Department of Defense through the US Navy; overall management was through the Naval Air Systems Command, Washington, DC. US Air Force procurement was managed by Warner Robins Air Logistics Center, Macon, GA, USA.

Contractors. Developed by the Naval Weapons Center, China Lake, CA, and jointly manufactured. Texas Instruments, Missile and Ordnance Division; Dallas, TX, was the prime. Motorola Incorporated, Government Electronics Group, Scottsdale, AZ, USA, is presently the primary contractor on the AGM-45 Shrike. Motorola's Tempe, AZ, facility is also involved in the Shrike program.

Major Subcontractors. Aerojet, Motorola and Rocketdyne.

Second Source. Sperry Rand Univac; Blue Bell, PA, USA.

Status. Out of production; production totaled over 25,000 missiles through Fiscal 1980. Production was terminated in favor of the follow-on AGM-88 HARM. (See separate report.) Funding was continued through 1983 to regain the rocket motors in order to extend shelf life, fuse antenna improvement and to maintain inventories.

Total Produced. 25,220 missiles (including RDT&E units) were constructed.

Application. Shrike is used to destroy hostile radar installations, especially those controlling air defense systems.

Price Range. Mod 9 and 10 versions of the AGM-45 cost \$56,000 (Fiscal 1980).

Technical Data

	<u>Metric</u>	<u>US</u>
Dimensions		
Missile Length:	304.8 cm	10 ft
Missile Diameter:	20 cm.	7.92 in
Missile Weight:	177 kg	389.40 lb
Finspan:	91.4 cm	2.99 ft

Performance

	<u>Metric</u>	<u>US</u>
Speed:	Mach 2	Mach 2
Range:	12-16 km	6.47-8.63 nm

Propulsion. Rocketdyne Mk 39 Mod 7 or Aerojet Mk 53 solid-propellant (polybutadiene) motor. Aerojet also produced an improved dual-thrust polyurethane motor for later Shrike variants; this motor was the Mk 78.

Control & Guidance. Texas Instruments or Sperry Univac guidance/control systems are employed. The aerodynamic control surfaces are operated by hot gas actuators.

Launcher Mode. Fired from underwing-mounted racks off all Navy attack aircraft, late F-4 variants, and the USAF's F-105. The primary USAF application is aboard F-4G Wild Weasel aircraft. Israel mounts the AGM-45 on its F-4 and Kfir aircraft.

Warhead. Proximity-fused, high explosive blast/fragmentation type weighing 66 kg (145.2 lb).



AGM-45 Shrike

Source: US Navy

Variants/Upgrades

There is basically one version of the Shrike, although various upgrades were incorporated into this missile over the last several years. For additional information,

please see the pertinent entries under the **Program Review** section.

Program Review

Background. Originally known as the ASM-N-10 ARM (Anti-Radar Missile), Shrike is a supersonic, air-to-surface weapon which homes in on hostile radar emissions. The missile was developed by the Naval Ordnance Test Station (NOTS), now called the Naval Weapons Center, and was partially based on the AIM-7

Sparrow; development began in 1961 and the missile was type classified in 1962. The US Navy began

equipping its attack aircraft with Shrikes in 1964. The early use of the AGM-45 in Vietnam by the Navy and Air Force was disappointing. This led to several modification programs to rectify identified faults or to integrate the modified passive homing head for new hostile frequencies. The USAF initially used this missile on its F-105 Wild Weasel aircraft, but later also equipped its more advanced F-4G Wild Weasel aircraft with Shrikes, the latter application accounting for the majority of the remaining inventories of the missile.

Shrike has been progressively upgraded and improved over the years; 10 versions with 18 sub-types were produced. The last production models were the AGM-45-9 and -10, which differ principally in the frequency coverage of the seeker assembly, and detachable seeker sections. After production termination, the Navy and Air Force continued funding Shrike to support requirements for fleet support, mods, and spares. The USAF began procuring the AGM-45 in 1965 and procured a total of some 14,000 missiles through Fiscal 1981; the Navy procured about 6,200 missiles.

Sequence of Operation. The missile's seeker assembly, which is changed on the ground according to the anticipated threat, is switched on as the aircraft approaches the suspected hostile emitter's position. After the seeker has locked on, the missile is launched. Following motor cut-off, the missile follows a semi-ballistic path as the aerodynamic control surfaces are activated. The guidance system has a monopulse crystal receiver and continually updates the targeting solution by determining the direction of arrival of the hostile radiation.

Combat Employment. It is not known if the Shrike was used by the United States during its involvement in the war to liberate Kuwait (1990-1991). However, anti-radiation missiles were used extensively and in great quantities by the allied air forces in their attacks on Iraqi air defense units. The apparent lack of an Iraqi air defense response to the numerous and sustained air attacks could mean that these systems were fairly effective in their suppression missions.

In 1986, the AGM-45 was employed by US Naval forces in the joint US Navy/US Air Force strikes against Libya. The success rate of the AGM-45 was considered more than acceptable. During the 1982 Falklands War, the United Kingdom used the Shrike missile to suppress Argentinian coastal radar installation, although with limited success.

Modification. Motorola Incorporated, Government Electronics Group, Tempe, AZ, is currently the only manufacturer with the facilities to modify/manufacture

AGM-45 Shrike missiles. The company is currently performing on an upgrade contract from the US Air Force to increase the accuracy and flight envelope of the Shrike. The modifications which the company is performing deal with the guidance system only.

Potential Modifications. Shrike was the first Western anti-radiation missile to enter service, but contained various limitations. For example, if the hostile emitting radar shut down after the Shrike had been launched, the round would lose guidance signals and (as one author said) would "go ballistic." The Shrike also places tactical limitations on the launch aircraft. The missile also had a relatively short range – approximately eight kilometers (five miles) – and minimal off-boresight attack capability. In order to launch a Shrike successfully, the launch aircraft must fly directly towards the target; the missile cannot be fired from a turn.

However, Shrike remains in front-line service with a small number of armed services worldwide, including the US Air Force and Navy. US Air Force F-4G Wild Weasel crews now regard the Shrike solely as a defense-suppression weapon, rather than a kill weapon. The Shrike's relatively light warhead and limited flight performance are better suited to the task of forcing the enemy to keep his radar shut down for as long as possible, rather than that of actually causing massive damage.

These noted limitations could be corrected through a modification program for the system. Potential modifications to the AGM-45 could include the addition of a new seeker, possibly the Texas Instruments Block IV and/or the Ford Aerospace HARM Low Cost Seeker (see AGM-88 report), or other improved system. It could also include the upgrade/replacement of the existing rocket motor to provide increased range and better performance and the replacement of the existing hot gas actuation system with a more modern one, such as pneumatic.

Although each of these modifications appears to be quite viable, the likelihood of the US Armed Forces initiating an extensive Shrike capability modification program seems doubtful. This belief is due to the relatively small number of Shrikes involved (between 6,000 and 7,000 missiles), and the potential cost. A more likely anti-radiation modification program could involve the AIM-9 Sidewinder, which has already been the basis for the AGM-122 SIDEARM I (see separate report).

It should be noted, however, that during the US raid on Libya in 1986, the Air Force and Navy aircraft fired over 50 anti-radiation missiles, approximately 1.5 per participating aircraft.

Funding

The US Air Force's Fiscal 1989 budget contained funding (\$14.9 million) for the modification of a small number of Shrike anti-radiation missiles. No additional funding has appeared within recent US defense budgets.

Recent Contracts

In June 1989, Motorola Incorporated received an \$8.4 million contract for guidance section modification kits, control section modification kits, data for engineering change proposals and configuration changes for the AGM-45. The contract was awarded by the Warner Robins Air Logistics Center, Robins Air Force Base, Georgia.

Timetable

<u>Year</u>	<u>Major Development</u>
1961	Program began
1962	Redesignated AGM-45
1964	Initial deliveries made to US Navy
1966	Air Force procurement began
1974	HARM (Shrike follow-on) development contract awarded
1975	Shrike scheduled to end production
1976	HARM technical slippage occurred
1977	Production contracts for Shrike increased
1978	HARM entered FSED
1979	Iran canceled Shrike purchase; USAF withdrew FY80 buy
1981	Shrike production for USN/USAF terminated
1989-90	Shrike modification program continued

Worldwide Distribution

User Country(s). The only countries which are known to operate Shrike are the **United States, United Kingdom, Iran** and **Israel**. Iran canceled its purchase in 1979; only a few missiles had been delivered.

Forecast Rationale

The AGM-45 Shrike remains in service with the US Armed Forces, but may have been designated a reserve system. The main anti-radiation missile used by the US military is the AGM-88 HARM. Should demand for anti-radar missiles rise higher than the supply of HARMs, the Shrike would then be used.

There is no mention of any AGM-45 Shrikes being fired against Serbian units during Operation Allied Force. If true, this is the first time that the US has not used Shrike during a major operation. The missile was used against Libya in 1986 and extensively on Iraqi air defenses during Operation Desert Storm (1990-1991). Whether this is significant remains to be seen.

The AGM-45 Shrike is expected to remain in active duty with the US military until its numbers are

exhausted or the system is overtaken by obsolescence, making Shrike's maintenance costs too high to justify the missile's continued use. No further production of the AGM-45 is anticipated, having been concluded in 1981. However, the US could continue the low-level modification of the system as part of its routine maintenance cycle in order to maintain its combat viability.

The US is studying various options for meeting its future anti-radiation missile requirements. In the meantime, the US military will continue to depend on existing systems like the AGM-45 Shrike and AGM-88 HARM.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Missile	(Engine)	thru 99	High Confidence Level				Good Confidence Level			Speculative			Total 00-09
			00	01	02	03	04	05	06	07	08	09	
TEXAS INSTRUMENTS INCORPORATED													
AGM-45 (a)	MK.37/53/78	25220	0	0	0	0	0	0	0	0	0	0	0
Total Production		25220	0	0	0	0	0	0	0	0	0	0	0

(a) Forecast line includes RDT&E units.