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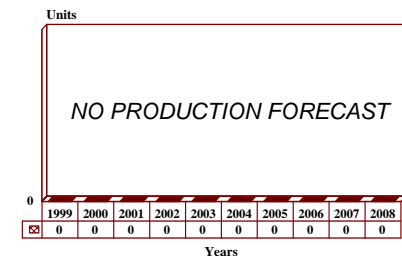
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HAVE SLICK - Archived 3/2000

Outlook

- Initial HAVE SLICK development effort complete. No specific HAVE SLICK missile is intended to be developed
- Follow-on programs dealing with similar technology are being examined
- Technology from HAVE SLICK program is being used as part of the McDonnell Douglas (now Boeing) bid for Joint Air-to-Surface Stand-off Missile (JASSM) contract

10 Year Unit Production Forecast
1999-2008



Orientation

Description. Next-generation conformal air-to-surface missile system.

Sponsor. US Air Force through the US Air Force Development Test Center, Eglin AFB, FL, USA; and Wright Laboratory's Armament Directorate, Eglin AFB, FL.

Contractors. McDonnell Douglas Corporation (formerly McDonnell Douglas Missile Systems Company), St. Louis, MO, USA; and LTV (now Loral Vought Systems), Dallas, TX, USA.

Status. HAVE SLICK was an advanced development effort, also known as a laboratory technology push effort. This program was not one that had as its aim the development of a specific weapon system. The initial development effort has been completed. The HAVE SLICK demonstrations were completed in the summer of 1990 after a series of flight tests. The follow-on program is being devised. This program could be integrated with the new Precision Strike Initiative. No additional funding had been specifically allocated for the HAVE SLICK program in FY92 or FY93 defense budgets. No specific requirement exists for a HAVE

SLICK-type system, and industry sources have stated that the US Air Force has no intention of transforming it into a full program. Certain aspects of the HAVE SLICK program are being applied to other weapon systems development efforts. McDonnell Douglas is using technology from HAVE SLICK as part of its Joint Air-to-Surface Stand-off Missile (JASSM) bid.

Total Produced. Full-scale production has not commenced. A total of three air vehicles were constructed by LTV and McDonnell Douglas. The first airframe was delivered to Eglin AFB, Florida in January 1991. The three vehicles were used in six successful launches at subsonic and supersonic speeds, using an F-111 fitted with a Rockwell-developed conformal ejection rack.

Application. A conformal air-to-surface system intended for use on next-generation stealth fighter/bomber aircraft. If successful, this system could be used on current-generation fighter and fighter/bomber aircraft.

Price Range. The US Air Force has no estimates on the cost of a HAVE SLICK-type system.

Technical Data

Design Features. Specific technical data on the HAVE SLICK do not exist, since the program was only a concept definition. What is known is that the system is an asymmetrically shaped, composite structure intended for conformal carriage without use of pylons on future low observable aircraft. HAVE SLICK test vehicles rely on the missile's flat under-surfaces and three or four tail fins for lift and control. The missile's control fins would unfold from the dispenser immediately following ejection from the launching aircraft. When this airframe was combined with advanced seekers, jet propulsion and armament, the missile would be capable of delivering a 908 kilogram (2,000 pound) payload at either subsonic or supersonic speeds. The missile's aerodynamic design would enable it to fly farther on less fuel, exhibit unprecedented low drag, and feature an extremely high payload-to-weight ratio compared with current or envisioned systems. The

airframe is said to resemble a cruise missile but would be capable of maneuvering like an airplane. The program is described as visionary and would change the way aircraft carry and discharge their ordnance, providing increased flexibility to air forces.

Propulsion. Various propulsion systems could be used with a HAVE SLICK-type system.

Control & Guidance. Various guidance system options are likely to be open to the system that would incorporate HAVE SLICK technology.

Launcher Mode. The HAVE SLICK would be carried conformably on next-generation fighter aircraft.

Warhead. The missile would likely offer various warhead options, including a submunition dispensing capability.

Variants/Upgrades

No specific variants or upgrades can be presented. Various advanced technologies were researched under HAVE SLICK, including aircraft shaping designs,

low-cost composite materials, advanced manufacturing processes, improved submunition dispensing techniques and state-of-the-art guidance and control schemes.

Program Review

Background. The US Air Force is still experimenting with the design of advanced conformal air-to-surface weapon systems for use on aircraft one generation beyond the F-22. However, an option for incorporating a limited strike capability into the F-22, and a desire to provide a ground-attack version of this aircraft at some later date, could result in certain aspects of this program moving ahead far more quickly than previously anticipated. The HAVE SLICK could provide future flexibility for airborne assets that could not possibly be accommodated by an internal carriage system.

The initial goal of the HAVE SLICK program was to provide information on the ability of aircraft to carry weapon systems conformably, without the need of pylons and other harnessing equipment. A series of six flight tests were conducted: three captive carry-offs on an F-111, and three actual drops. Of these tests, three were supersonic and three subsonic. Each air vehicle was used in two flight tests and recovered via a parachute recovery system. The flights were to

demonstrate the maneuverability of the system and that its composite airframe would not degrade performance. These HAVE SLICK demonstrations were completed in the summer of 1990.

A problem encountered with the system was that the asymmetrical design of the missile tended to push it up toward the aircraft after release (a so-called pitching movement). The ejector rack corrected this problem and the flight demonstrations proved successful. These tests also demonstrated the all-composite air vehicles' superior extended-range capabilities.

Because of limited funding and lengthening development periods, a HAVE SLICK-type system would likely be first available around the year 2010. The next generation of air-to-surface weapons will likely be carried externally since this provides a greater degree of flexibility to the aircraft platform. Air-to-air weapons can be internally mounted since this is a limited engagement field and revolves around a small number

of systems. The external carriage of air-to-surface weapons would enable the next generation of attack aircraft to remain small, while internal storage would require large fighters to accommodate larger weapons bays.

New Effort. The most recent effort in the area of advanced weapons carriage is under way at Boeing Military Airplane, Boeing Defense and Space Group, the effects of which could be felt throughout the US fighter fleet. Boeing was selected in early 1993 to explore a new approach for carrying weapons on existing and future tactical aircraft. The program centers on an advanced weapons carriage unit with a design involving a common stores and release system, basically the holding mechanisms, to support such current and future tactical combat aircraft as the F-15 and F-16 and F-22. A common, potentially modular, attaching mechanism could be provided that would be capable of functioning with a variety of systems regardless of size. Boeing says that the same system will support all tactical weapons and will meet the quick change, multifunction and low drag, low observable USAF requirements, while cutting down on support costs.

Work was done over a 20-month period under a \$1.7 million contract. Boeing will work with the US Air Force Wright Laboratories at Eglin Air Force Base, Florida, to determine a final design and build a working model. McDonnell Douglas was working with Boeing as a subcontractor. There is no specific time-frame for such a system to become available, although the time

between contract award and production would be relatively short. Eventually, the new weapon carriage method could be used on existing (F-15, F-16 and F-111) and future fighter and attack aircraft (F-22 and the next-generation Multi-Role Fighter).

The United States' new attack aircraft, being developed under the Joint Advanced Strike Technology (JAST) program, will carry much of its weapon systems internally. All air-to-air weaponry will be carried in internal bays. However, for a medium-level stealth capability, the internal weapons might be supplemented with externally hung conformal armaments.

USAF Request. The US Air Force's Wright Laboratory (Armament Division) released a request for proposals (SOL F08630-95-R-0009) on April 11, 1995, for companies interested in a new research effort. This effort is to be a Weapon Integration and Design Technology (WIDT) program, which is intended to increase the effective payloads of advanced combat aircraft by developing compressed variants of current air-to-surface weapons. Any modifications must be inexpensive, simple, lightweight and have minimal impact on aircraft performance in terms of drag, stability and control, and radar cross-section.

The estimated period of performance is 35.5 months, which includes 100 days for writing and reviewing the final report. The WIDT effort is planned to involve a 10-month concept definition phase, followed by a 22-month fabrication and testing segment. A contract was awarded in late 1995 to McDonnell Douglas.

Funding

Funding for the HAVE SLICK research effort was contained under Project 2718 (Air-to-Surface Technology Integration) within Program Element 0603363F (Armament Technology Integration Development), as well as Program Element 0603601F Conventional Weapons Technology.

Recent Contracts

A contract for HAVE SLICK Phase II, including the design, fabrication and flight test of a representative composite dispenser airframe and weapon-release system, was issued in June 1987.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1980s	Contract awarded to McDonnell Douglas/LTV for this program
	1990-91 ^(a)	Research continued
	1992	Program redefined
	1995	Follow-on program launched
	1996	McDonnell Douglas includes HAVE SLICK technology in its JASSM

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	2000s ^(a)	bid Research into HAVE SLICK-type technology proceeding

^(a) estimate

Worldwide Distribution

For the immediate future, no exports of any HAVE SLICK-type systems or technology are anticipated. If the United States produces a new weapon system incorporating some HAVE SLICK technology, its export will likely be restricted to close allies.

User Country(s). If this program continues into production, the **United States Armed Forces** are expected to be the initial operators of the HAVE SLICK.

Forecast Rationale

The development of advanced combat aircraft, with their greater stealth characteristics, required weapon systems designers to produce products that did not degrade the performance of these platforms. The HAVE SLICK program explored the development of such next-generation systems to meet part of this need, but never had the aim of producing an operational system. Currently known efforts appear to focus on inexpensive modifications to existing weaponry.

The need for more aerodynamic, conformal, HAVE SLICK-type systems will likely grow as the new

century approaches. The tendency among aircraft designers to incorporate greater stealth features, thereby lowering radar cross-sections, demands the development of such conformal weapons carriage systems or the elimination of external armaments carriage altogether. Since on existing aircraft the latter is not possible and will be extremely difficult on next-generation fighters, HAVE SLICK-type technology could become a common part of future air-to-surface weapon system development efforts. However, it would not in itself transition to an actual weapon system development program.

Ten-Year Outlook

No forecast has been provided.

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