Smart Munition/ Advanced Rocket (SMARt) Launcher

Kenneth B. Johnson, NSWC/IHD
Donald E. Davis, U.S. Army AMRDEC

Christopher G. Melkonian, NSWC/IHD
(Presenter)

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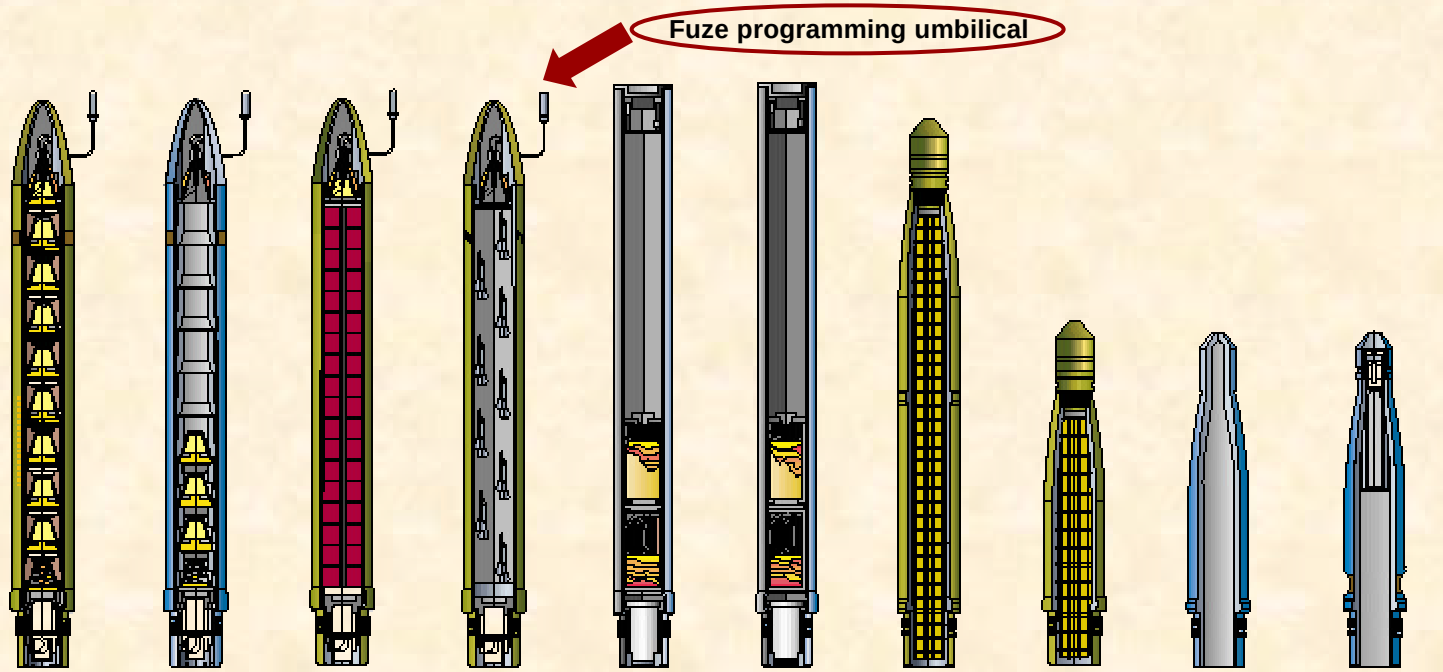
Ken Johnson, (301) 744-4946, DSN 354-4946, JohnsonKB@ih.navy.mil

BRIEFING OUTLINE

- Part I– Current Launchers
  - HYDRA-70 Rocket System overview
  - Characteristics of HYDRA-70 launchers
  - Navy digital launcher
  - Summary
- Part II– SMARt Launcher
  - Guided rockets on the horizon
  - Electrical and structural needs and considerations
  - Summary

A synopsis of each slide is found here.

LAUNCHER'S VIEW OF THE HYDRA-70 ROCKET SYSTEM



M261	M267	M264	M255A1	M257	M278	M229	M151	WTU-1/B	M274
MPSM HE	MPSM Practice	Smoke (RP)	Flechette	Illum. Flare	IR Flare	17 lb HE	10 lb HE	Practice	Practice Smoke

M439 Programmable Time Fuze

M442 Airburst Fuze

M423 Impact Fuze

M433 Program-mable Impact Fuze

M423 Fuze

Mk 66 Rocket Motor

The multi-purpose HYDRA-70 Rocket System has interfaces for rocket motor ignition and analog fuze programming.

COMPARISON OF CURRENT HYDRA-70 ROCKET LAUNCHERS

Service \ Characteristic	7-Tube Launcher Nomenclature and Weight	19-Tube Launcher Nomenclature and Weight	Structure	Aircraft Qualification	Thermal Protection	Programmable Fuzing Capability	Firing Circuits
Army	M260 35 pounds	M261 85 pounds	Bulkhead and thin-walled tube structure	Rotary-wing only	None	Cockpit-settable	Rocket Mgt. Sys. in aircraft; safety switch on launcher
Navy / MC	LAU-68 D/A 84 pounds	LAU-61 C/A 145 pounds	Banded thick-walled tube structure	Fixed- and rotary-wing	Intumescent paint coating; thermal barriers for launcher ends	None	Fire switch in aircraft; intervalometer in launcher, ripple/single fire and safety switches on launcher
Air Force	LAU-131 67 pounds	LAU-130 120 pounds			None		

The characteristics and capabilities of the HYDRA-70 rocket launchers vary significantly by Service.

ORIGIN OF THE NAVY DIGITAL LAUNCHER PROGRAM

Limitations of Current Launchers

- Currently-fielded Navy and Air Force rocket launchers can't use HYDRA-70 warheads with programmable fuzes.
- These launchers also lack cockpit-selectable single or ripple fire.
- No launcher can fire rockets in a completely arbitrary order.
- Army aircraft always carry rocket control electronics (and their weight) regardless of whether they carry a launcher.

Cause

- Non-extensible and non-standard interfaces (such as the RMS and intervalometer) between legacy launchers and fire control systems

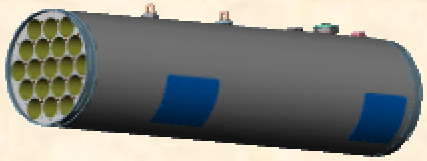
Solution

- Integrate launcher/rocket control electronics into the launcher and provide direct communication between the aircraft and the launcher through a MIL-STD-1760 interface.

DIGITAL LAUNCHER PROGRAM HISTORY AND FUTURE DIRECTION

1999-2002: Engineer and test prototype Smart Electronics Package and launcher structure

2003: Develop three airworthy launchers



2004: Perform pre-flight qualification testing

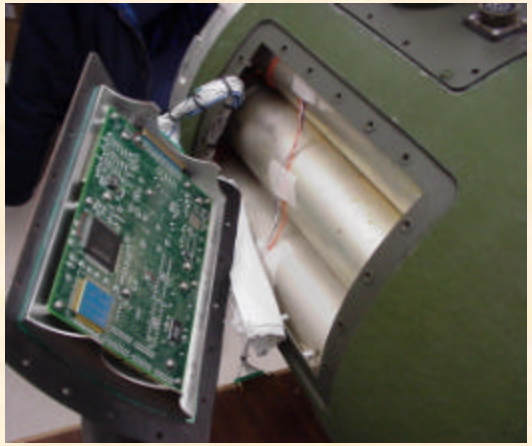
Conduct AH-1Z flight testing

The Navy's Digital Launcher Program is making significant progress toward aircraft integration and flight testing.

DIGITAL LAUNCHER TECHNICAL OVERVIEW

Design Innovation

- Develop a Smart programmable launcher Electronics Package (SEP)
- Implement MIL- STD- 1760 interface between aircraft and SEP
  - standard connector and signal set
  - standard serial digital data interface for control, monitor, and release of stores



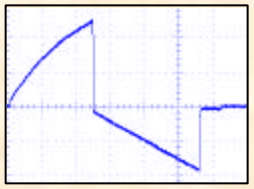
Capabilities

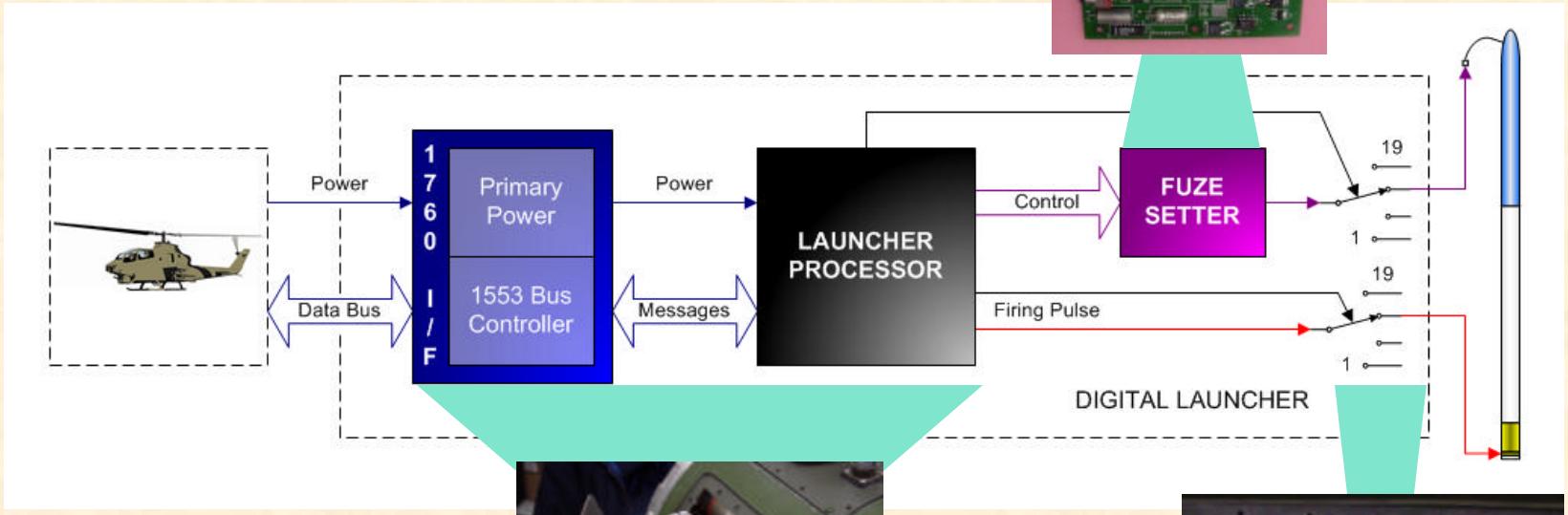
- Supports all HYDRA-70 warheads
- Arbitrary firing order
- Cockpit-selectable ripple or single fire
- Rocket inventory data can be uploaded into the launcher when rockets are replenished or removed
- Rocket presence detection
- Launcher service-life recording
- Launcher built-in test (BIT)
- Backward compatibility with 5-pin mode aircraft

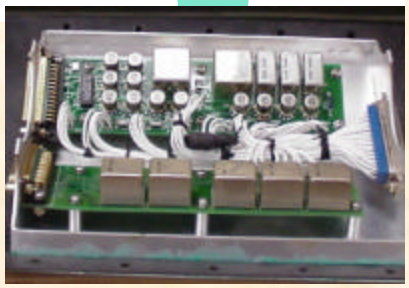
The digital launcher eliminates the limitations, and surpasses the capabilities of currently-fielded launchers.

SMART ELECTRONICS PACKAGE FUNCTIONAL ARCHITECTURE

Fuze power and time delay programming signal

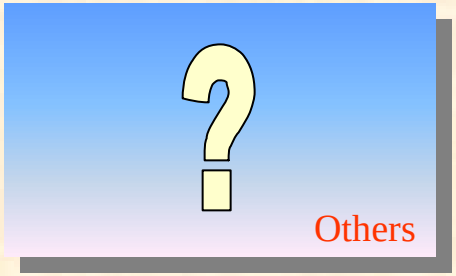




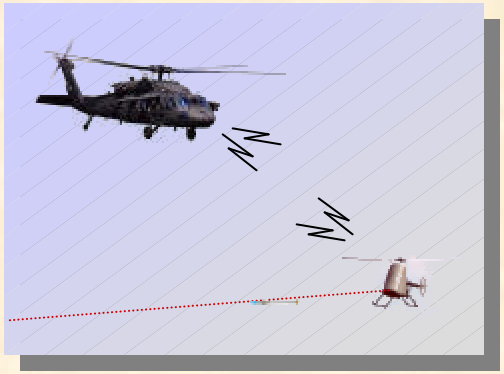


The Smart Electronics Package is comprised of three circumferential access panels, each containing a circuit board.

UAV APPLICATIONS OF THE SMART ELECTRONICS PACKAGE



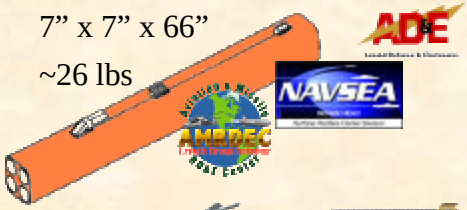
NSWCIHD developing 9” x 3.75” 4-tube SEP and Vigilante stores/sensor management system in support of LCPK flight test



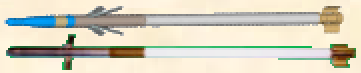
The SEP is used in the Army’s 4-tube Hydra Universal Rail Launcher (HURL), which has an improved rocket detent assembly, compared to current launchers.

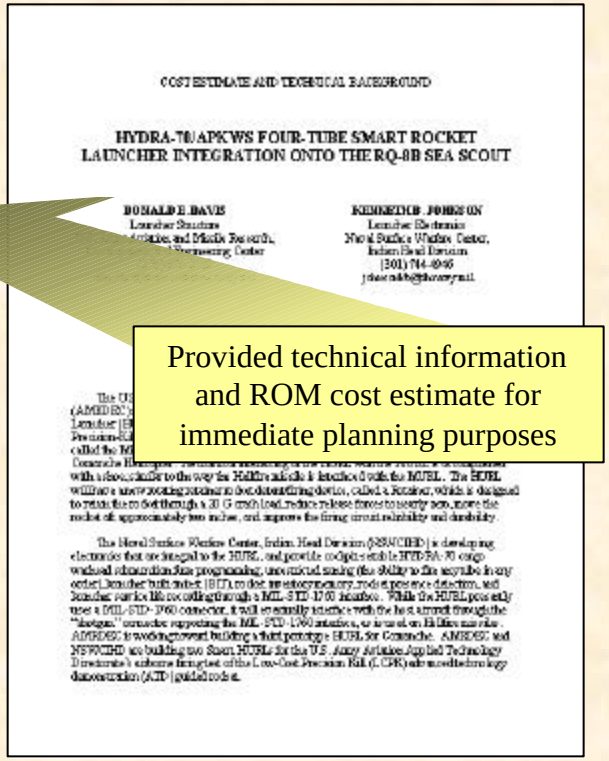
7” x 7” x 66”

~26 lbs



~30 lbs ea.





COST ESTIMATE AND TECHNICAL BACKGROUND

HYDRA-70/APKWS FOUR-TUBE SMART ROCKET LAUNCHER INTEGRATION ONTO THE RQ-8B SEA SCOUT

DONALD E. DAVIS
Launcher Structures

KENNETH JOHNSON
Launcher Electronics
Naval Surface Warfare Center, Indian Head Division
(301) 744-4946

Provided technical information and ROM cost estimate for immediate planning purposes

NSWC/IHD is actively involved in, and pursuing other Smart Electronics Package insertion opportunities.

SUMMARY– PART I

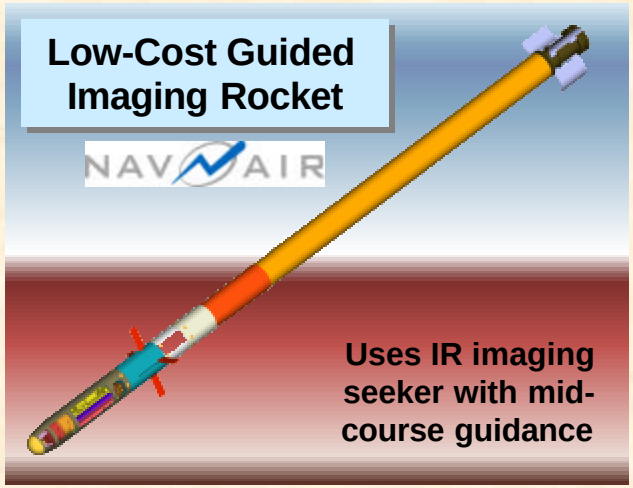
- Currently-fielded HYDRA-70 launchers “get the job done,” but have varying levels of operational capability.
- The Navy is developing a digital launcher that eliminates the limitations, and surpasses the capabilities of current launchers.
- The digital launcher architecture provides an extensible model for advanced and multi-Service launchers.

PART II– SMART MUNITION/ ADVANCED ROCKET LAUNCHER

Advanced Precision-Kill Weapon System

Block I uses semi-active laser guidance

Guided rockets like APKWS and LOGIR create new launcher challenges and opportunities!



The Army and the Navy are developing guided rockets with capabilities beyond those of the HYDRA-70 Rocket System.

POTENTIAL ELECTRICAL NEEDS OF GUIDED ROCKETS

- Pre-launch electrical power that can provide
  - Guidance electronics “wake-up”
  - Lock-on before launch (LOBL)
- Launcher communication network that can provide
  - Laser code setting for the laser seeker
  - Fixed target image templates and mobile target parameters for the imaging seeker
  - Initial conditions such as range to target and transfer alignment
  - Data receipt confirmation
  - Guidance built-in test (BIT) status

Guided rockets need more capable electrical interfaces than do existing unguided rockets.

WIRED OR WIRELESS POWER AND DATA?

- Bluetooth™ RF network and inductive communications have been suggested as wireless approaches. The general feasibility of the inductive approach has been demonstrated by the Army.*
- Whereas power and data can be simultaneously transferred over inductively-coupled launcher tube and rocket coils, Bluetooth™ will require some type of physical connection for power transfer.
- A completely wired power and data connector should mate automatically, be reliable under harsh conditions, and be volumetrically efficient.

*Sambuco, A., HDL-TR-1705, "Analytical Investigation of Inductive Loop Coupling for Remote Set Fuzing," June, 1975.

Launcher-rocket power and data coupling options run the gamut from physical connectors to fully wireless approaches.

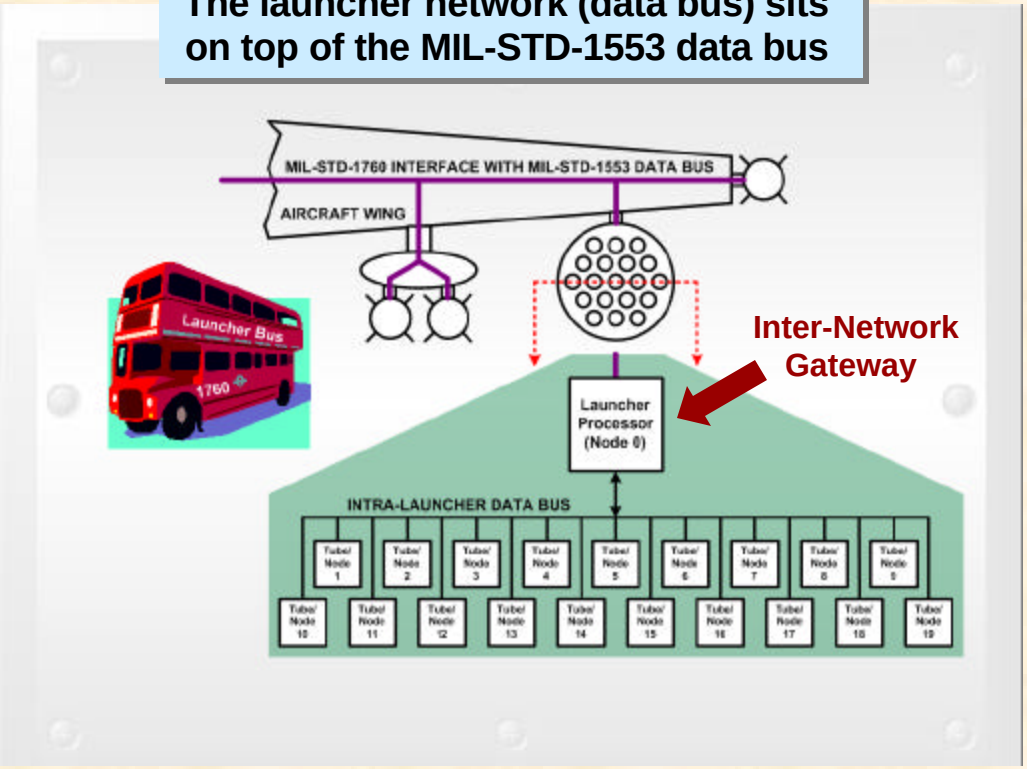
INTRA-LAUNCHER COMMUNICATION NETWORK

Communication of specific targeting data to individual guided rockets will always be needed.

Communication to all guided rockets at once may be needed for transfer alignment optimization and operational tempo support.

Both needs can be met through a launcher communication network that provides an architecture for future capabilities extensibility.

The launcher network (data bus) sits on top of the MIL-STD-1553 data bus



Guided rockets provide maximal design and operational flexibility through a launcher communication network.

POTENTIAL STRUCTURAL NEEDS OF GUIDED ROCKETS

- Roll-lock rockets in launcher
  - Guided rockets having an inertial measurement unit (IMU) need a constant roll orientation relative to the launch platform, which can vary from rocket to rocket, to perform transfer alignment of coordinate systems
- Provide seeker dome protection from rocket blast and foreign object debris
  - Consider a launcher fairing and sapphire or breakable glass seeker domes
- Optimize launcher structure for electrical power transfer and communications
  - Consider advanced connectors, composite materials, and launcher shapes

The launcher structure needs to support the specialized components of guided rockets.

OTHER BENEFICIAL STRUCTURAL ENHANCEMENTS

- Reduce launcher weight
- Increase launcher strength and service life
- Simplify and enhance rocket retention through use of the Army's rotating retainer, or "rotainer"
  - Locks the rocket into the launcher through insertion force only; eliminates blast paddle closure pinch hazard
  - After the locking mechanism is disengaged upon rocket firing, the rotainer provides negligible hold-back force
  - The locking mechanism should retain rockets through rotary- and fixed-wing aircraft crash loads (presently tested to 20 g's)
  - Reduces parts count and increases reliability
  - Reduces size and frees up two inches of tube length
  - Reduces loading time and ground crew required

Overall launcher structural characteristics can also be enhanced in the development of a guided rocket launcher.

SUMMARY

- The various currently-fielded HYDRA-70 launchers are not as capable as they could be.
- The digital launcher fills capability voids, and provides an extensible model for advanced and multi-Service launchers.
- Advanced guided rockets like future APKWS blocks and LOGIR require more capable launchers with advanced electrical and structural features that can be provided by the SMARt launcher.
- Launcher requirements need to be developed for each guided rocket system.