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VH 3D/60N
ELECTROMAGNETIC PULSE
HARDNESS ASSURANCE,
MAINTENANCE AND SURVEILLANCE
PROGRAM

Naval Air Warfare Center Aircraft Division
E-Cubed Division
Electromagnetic Transient Section

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HARDNESS ASSURANCE, MAINTENANCE AND SURVEILLANCE

DISCUSSION:

- HAMS Background
- HAMS Definition
- Purpose
- System Level Tests
 - Baselines
 - HATs
 - Aircraft MODs
- Field Surveillance Test
 - HM/S Tester
 - Inspections
- VH HAMS Database
- Program Milestones and Responsibilities



BACKGROUND

- HIS-2 Aircraft
 - Modified Version of the H-3
 - Major Avionics Upgrade to Improve Communications, Navigation, and Flight Management Capabilities
 - Hardened to High Altitude Electromagnetic Pulse Environment
 - HIS-2 EMP Test (Kirtland AFB 1985)
 - Implemented Into All VH-3D Aircraft
- VH-60N
 - Basic UH-60A Black Hawk Airframe
 - 1987 Boeing was Tasked to:
 - Identify Mission Essential Equipment
 - Assess Vulnerability of MEE
 - Develop Hardening Approach
 - Provide Detailed Hardening Requirements to Sikorsky



BACKGROUND

- Hardening Methods
 - Windows
 - Copper Screen Between Lamination
 - Transparent Structure
 - Aluminum Mesh in Fiberglass Lay-up
 - Doors
 - Conductive Gasket
 - Control Rods, Cables
 - In-Line Isolation Sections
 - Grounding at Penetrations by Boots or Pulleys



BACKGROUND

- Hardening Methods (Cont.)
 - Fuel, Hydraulic, Pneumatic Lines
 - Peripheral Electrical Bond at Penetration
 - External Wiring
 - Braided Shielded Peripherally Terminated at Penetration and Outboard Equipment
 - TPM for Some Wires (Feed Through Capacitors)
 - Antennas
 - Diodes/Spark Gaps to Protect Receivers
 - TPMs for Non-RF Control Wires



BACKGROUND

- UPSET MARGIN DESIGN GOAL
 - All Flight Critical Equipment
 - All Mission Essential Equipment
 - In All Aircraft Modes



HARDNESS ASSURANCE, MAINTENANCE AND SURVEILLANCE (HAMS)

- Hardness Assurance
 - Procedures Applied During Production of a System to Ensure That the Production is in Compliance With the Hardness Design Specification or Requirements
- Hardness Maintenance
 - Procedures Applied During the Service Life of a System to Ensure That the System's Operation, Logistic Support, and/or Maintenance do not Degrade the System's Designed Hardness
- Hardness Surveillance
 - A Lifetime Cycle of Tests and Inspections Performed to Monitor System Hardness Integrity



HAMS PURPOSE

- To Ensure That Nuclear Hardness Design Integrity is Maintained Throughout the Operational Life of The Aircraft
- To Monitor Aircraft Hardness Status and Report it to Decision Makers



HAMS PROGRAM

- Successful Completion of the VH-60N Baseline Test (1988)
Led to NAVAIR Tasking NAWCAD PAX to Implement
VH-3D/VH-60N HAMS Program (1990)
- Baseline Tests followed by a Series of System Level EMP
Hardness Assessment Tests (HATs)
 - Before & After Special Progressive Aircraft Rework (SPAR)
 - Evaluate Major Aircraft Modifications
- Field Surveillance Tests
- VH HAMS Database



SYSTEM LEVEL EMP TESTS

- Special Progressive Aircraft Rework (SPAR) - A Complete Inspection and Rework Performed at Regular Intervals on Each Aircraft
 - Pre-SPAR HATs
 - Provide Hardness Data on In-Service Aircraft
 - How Well Hardness is Being Maintained at the Fleet
 - Post-SPAR HATs
 - Provide Hardness Data on Aircraft Coming Out of SPAR
 - Determine Whether the Hardening Devices Have Been Correctly Reinstalled
- Aircraft Modifications
 - Verify Contractor Integration Did Not Effect the Overall Hardness of the Aircraft
 - Answer ECP Related Questions
- These HATs Ensure the Hardness Protection Procedures are Sufficient for Maintaining the Overall EMP Hardness of the VH-3D & VH-60N Aircraft and Verify the Safety Margin Design Goal



SYSTEM LEVEL EMP TESTS

FOUR PHASES

- Phase I - Safety Demonstration/Active Systems Test (SD/AST)
- Phase II - Passive System Test (PST)
- Phase III - Low Level Continuous Wave (LLCW)
- Phase IV - Current Injection Direct-Drive (CIDD)



SURVEILLANCE TESTING

- Field Surveillance Tests Conducted at HMX-1 Quantico, VA with the Portable Hardness Maintenance/Surveillance (HM/S) Tester
- Purpose - To Detect and Monitor Changes in Aircraft Hardness at the Fleet Level
- Conducted Once a Year on Each Aircraft on a Not-to-Interfere Basis
 - Test Time- Approximately One Hour
 - All Test Points are Easily Accessible
- The Tester Is A Monitoring Device Only - It Cannot Establish Safety Margins Or Survivability/Vulnerability Characteristics
- Visual Inspections Conducted During Field Test

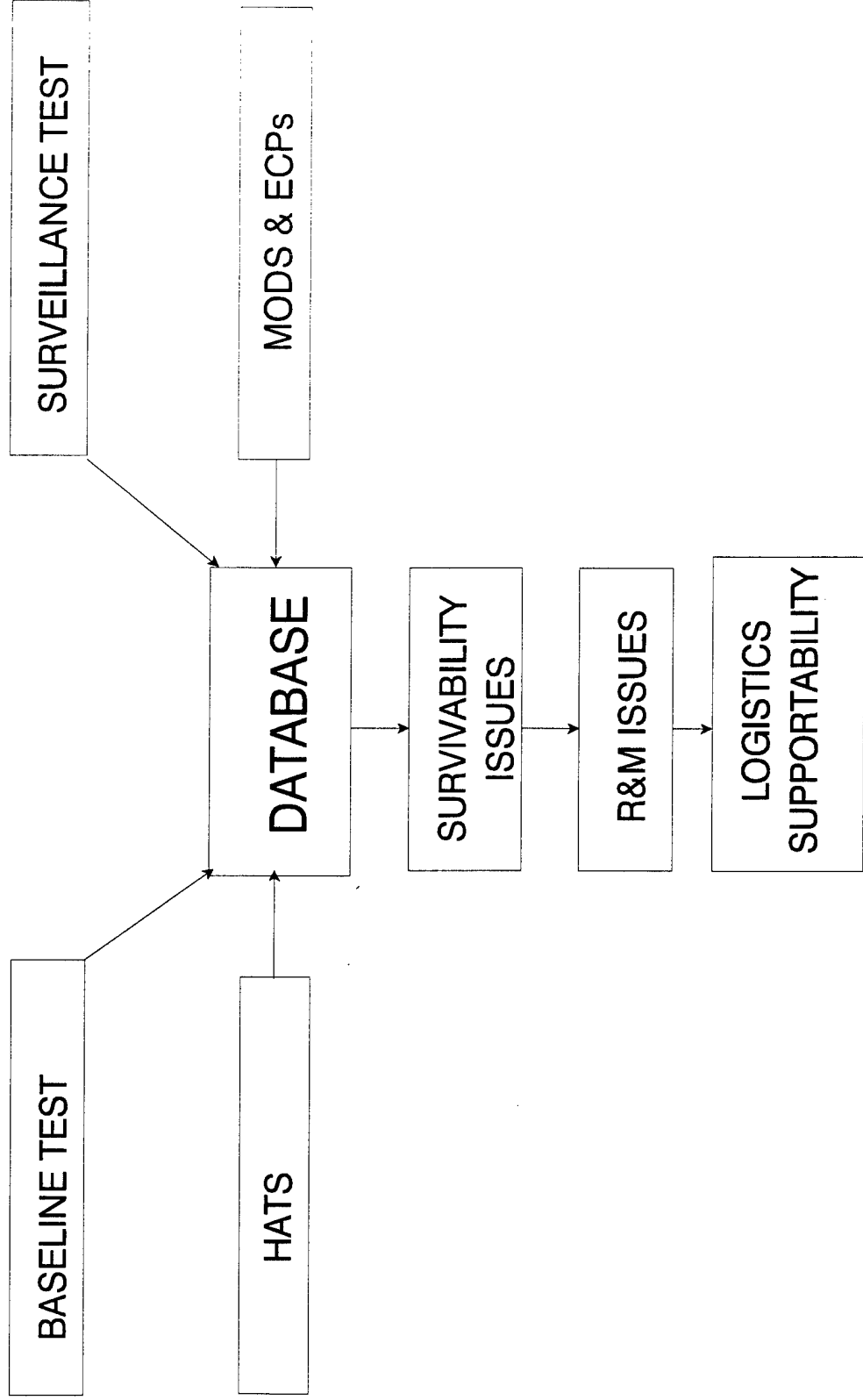


HAMS TESTER

- The Tester Consists of a Synthesized Dual Frequency Transmitter, a Receiver, and Special Adapted Sensors
- Radiates a Continuous Damp Sine Wave at 1 Watt
- Entire Aircraft Illuminated Externally at 75.200 MHz
- E-Field & Current Measurements Made at Selected Test Points to Assess Overall Hardness of Aircraft
- Baseline Values are Recorded and Stored in Memory
- Is Also Used as a Sniffer to Evaluate Aircraft Apertures and EMP Points-of-Entry
- Does Not Replace System Level Test at NAWCAD



HAMS DATABASE





TEST TEAM RESPONSIBILITIES

- Coordinate and Participate in HAMS Working Group Meetings
- Provide On-Site Engineer/Technical Support to the Fleet
 - Portable HM/S Tester
 - EMP Technical Expertise
- Track Hardness Degradation of Each Aircraft
- Maintain the VH HAMS Database



MILESTONES

- System Level Tests - One Aircraft Each Year
- Major Communication/Navigation System Upgrade (CNSU) Being Incorporated Into Both VH-3D & VH-60N Aircraft
 - VH-60N CNSU EMP Baseline Test Scheduled For April 1996
 - VH-3D CNSU EMP Baseline Test Scheduled For May 1996
- Field Testing Using the HM/S Tester
 - Currently Evaluating Hardness Design for an EMP Sliding Glass Window to Replace the Fixed Window in the VH-3D Aircraft
 - Conducted at the Squadron on A Not-To-Interfere Basis



SUMMARY

EMP SURVIVABILITY OF THE VH AIRCRAFT WILL BE ENSURED THROUGHOUT ITS LIFE-CYCLE BY:

- Maintaining Hardness Integrity Of Design
- Stringent Configuration Control
- Surveillance Testing
 - Field Activities
 - System Level At NAWCAD, Patuxent River