

ORGANIZED WIRING SYSTEMS

440372

16p

Thomas Meiner
Naval Air Warfare Center
Indianapolis, Indiana

SUMMARY

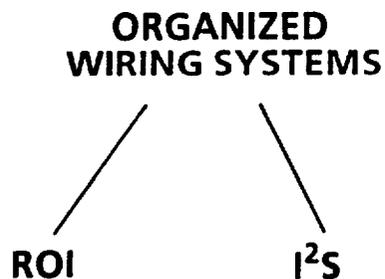
- THE WIRING SYSTEM IS THE LINK FOR ALL SYSTEMS, AND MUST BE INCLUDED IN THE QUALITY ASSURANCE PROGRAM.
- WITHOUT QUALIFICATION AND STANDARDIZATION, WIRING MAINTENANCE COSTS WOULD BE EXORBITANT.

- NAVY STUDIES SHOW THAT WIRING (TAKEN COLLECTIVELY) IS CONSISTENTLY ONE OF THE TOP FIVE "BAD ACTOR" SYSTEMS OF EVERY AIRCRAFT TYPE FOR:
 - NON-MISSION CAPABLE (NMC)
 - PARTIAL MISSION CAPABLE (PMC)
 - MAINTENANCE MAN HOURS (M/MHRS)

TRADITIONAL HARNESSING PITFALLS

- EXPENSIVE AND DIFFICULT TO MANUFACTURE,
- NORMALLY INSTALLED PARTIALLY ASSEMBLED,
- DIFFICULT TO MAINTAIN AND MODIFY,
- REQUIRES TWISTED AND SHIELDED COMPONENTS TO CONTROL EMI,
- SIZE AND WEIGHT REDUCTION LIMITED BY MECHANICAL AND ELECTRICAL FACTORS,
- REQUIRES HIGH-COST TRAINING AND PIECE-PARTS LOGISTICS THAT IS OFTEN INEFFECTIVE, AND
- ALL MAINTENANCE IS "O" OR "D"

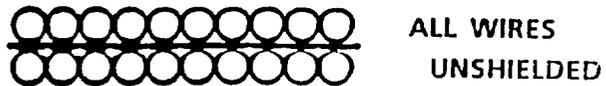
ORGANIZED WIRING: "WIRING WITH FIXED RELATIVE POSITIONING OF CIRCUITS. THIS IS TYPICALLY A RECTANGULAR BUNDLE."



TYPICAL HARNESS CROSS SECTIONS



ROI HARNESS



OWS IS APPLICABLE TO:

- NEW DESIGN,
- REWORK,
- ECP'S, AND
- ALSO APPLIES TO MISSILES, STORES, PODS, SUSPENSION EQUIPMENT, AND AVIONIC'S SUITES

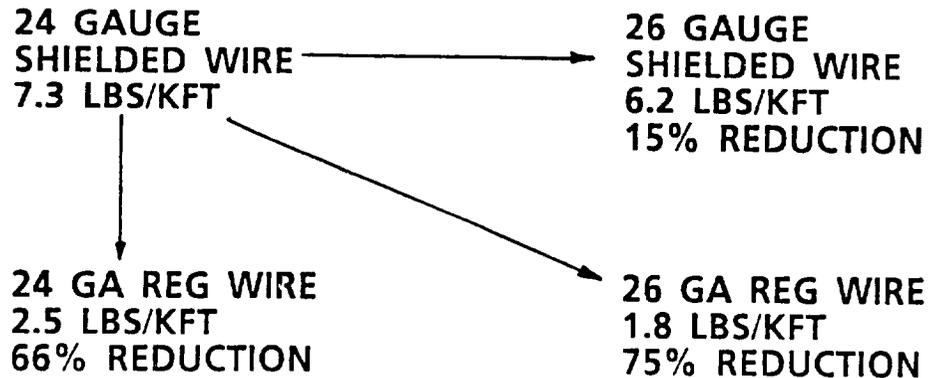
ADVANTAGES

- **WEIGHT SAVINGS**
- **IMPROVED RELIABILITY**
- **PREDICTABLE EMI PERFORMANCE**
- **IMPROVED MAINTAINABILITY**
- **LIFE CYCLE COST SAVINGS**
- **ACTIVE WIRING FEATURES**

RIBBON HARNESSES REDUCE WEIGHT BY:

- **ELIMINATION OF INDIVIDUAL SHIELDS AND JACKETS,**
- **LESS OUTER BRAID PER UNIT HARNESS LENGTH,**
- **ELIMINATION OF SHIELD - TERMINATORS AND EMI BACKSHELLS,**
- **DOWN-GUAGING OF WIRES DUE TO IMPROVED MECHANICAL AND ELECTRICAL CHARACTERISTICS OR RIBBONS, AND**
- **REPLACING HEAVY COAX WITH STANDARD WIRE IN CERTAIN APPLICATIONS**

**WIRING SYSTEM WEIGHT REDUCTION TECHNIQUES
DOWNGAUGING VS. SHIELD ELIMINATION
(WEIGHTS USED ARE TYPICAL)**



ORGANIZATION METHODOLOGY

- **CIRCUITS ARE GROUPED BY AMPERAGE ONTO POWER RIBBONS AND SIGNAL RIBBONS**
- **CIRCUITS ARE POSITIONED ON RIBBONS TO ELIMINATE DETRIMENTAL CROSSTALK; FOR EXAMPLE,**
 - **LOW IMPEDANCE GROUPING**
 - **HIGH IMPEDANCE GROUPING**
 - **SPIKE CIRCUITS POSITIONING**
- **HIGH AMPERAGE CIRCUITS MAY BE SEPARATED TO ENHANCE HEAT DISSIPATION; FOR EXAMPLE,**
 - **"ON/OFF" CIRCUIT SEQUENCING**
- **RESULTS IN RELIABLE, PREDICTABLE E³ PERFORMANCE**

**WIRING INTEGRATION UNITS
PERFORM MANY FUNCTIONS:**

- **CIRCUIT COLLECTION AND REDISTRIBUTION POINTS,**
- **RIBBONS HARNESS CIRCUIT ORGANIZATION POINTS,**
- **WIRE GAUGE CHANGE POINTS,**
- **RIBBON HARNESS/ENDPOINT HARNESS INTERFACE**

WIU'S CAN INCORPORATE:

- **ACTIVE CIRCUITRY (RELAYS, IC'S, FUEL QUANTITY SYSTEM SIMULATORS, ETC.),**
- **DISCRETE FILTERS,**
- **DATA BUS COUPLERS/FIBER OPTIC DECODERS,**
- **BUILT-IN-TEST (BIT) SYSTEMS,**
- **SYSTEM MONITORING CIRCUITRY, AND**
- **SELF-HEALING CAPABILITIES**

- **MODULARITY PROVIDES:**
 - **SYSTEM GROWTH POTENTIAL AND SIMPLIFIES MODIFICATION**
 - **ENHANCED REPAIR CAPABILITIES BOTH ON AND OFF AIRCRAFT**
 - **THE CAPABILITY TO REPLACE DAMAGED/REPAIRED HARNESSSES AND WIUs TO BRING WIRING SYSTEM BACK TO "LIKE NEW" CONDITION DURING THE ENTIRE SERVICE LIFE OF THE AIRCRAFT**
 - **FOR THE FULL APPLICATION OF THE LOGISTICS SUPPORT ANALYSIS (LSA) PROCESS TO WIRING SYSTEMS**
 - **LIFE CYCLE COST SAVINGS**

END POINT HARNESSSES:

- **ARE SHORT AND SIMPLE**
- **R&R AT "O" AND REPAIR AT "I"**
- **EASILY UPGRADED OR REPLACED FOR SYSTEM UPGRADES, AND**
- **CAN INCORPORATE CERTAIN RIBBON HARNESS FEATURES**

NAVAIR DIRECTIVE

13200
Ser AIR-546D4

JUN 26 1991

MEMORANDUM

From: AIR-546
To: AIR-911A
Via: AIR-516

Subj: CHANGE TO SD-24

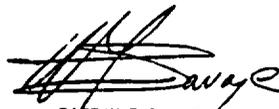
1. During a meeting among AIR-546, AIR-516, and AIR-411 it was decided to revise paragraph 3.16.5 of SD-24 as follows:

a. 3.16.5 WIRING - The signal and power distribution wiring shall be an organized wiring system such that all circuits are maintained in the same relative position to one another throughout their entire length. The design of the organized wiring system and the selection of its electrical components shall be proposed by the contractor and approved by NAVAIR. Conventional electrical wiring...

2. We all concur with this approach. I am preparing a separate package that will be routed for AIR-05 and AIR-04 endorsement of this change.

3. If there are any questions my point of contact is Mr. David Pielteter, 692-7125, AIR-546D4

Copy to:
AIR-411
AIR-546D4
AIR-516


CAPT W. F. SAVAGE
AIR-546
Division Director

BENEFITS OF ROI

- WEIGHT SAVINGS THROUGH ORGANIZATION AND ELIMINATION OF INDIVIDUAL SHIELDS AND ASSOCIATED HARDWARE
- LIFE CYCLE COST SAVINGS
- RELIABLE, PREDICTABLE E³ PERFORMANCE
- UTILIZES EXISTING TOOLS, LITTLE ADDITIONAL TRAINING
- DESIGN FLEXIBILITY TO MEET SYSTEM REQUIREMENTS
- INTERFACES WITH EXISTING AVIONICS

ADVANTAGES OF WOVEN RIBBON ELEMENTS:

ROI RIBBONS:

- **ARE NOT RESTRICTED TO "STANDARD" RIBBON WIDTHS,**
- **CAN INCORPORATE ANY GAUGE SIZE WIRES,**
- **MAY BE DESIGNED WITH A MIXTURE OF GAUGE SIZES,**
- **ARE EASILY FABRICATED, AND**
- **ARE COMPATIBLE WITH EXISTING FLEET MAINTENANCE EQUIPMENT**

ROI HARNESS TERMINATION FLEXIBILITY

ROI HARNESSES:

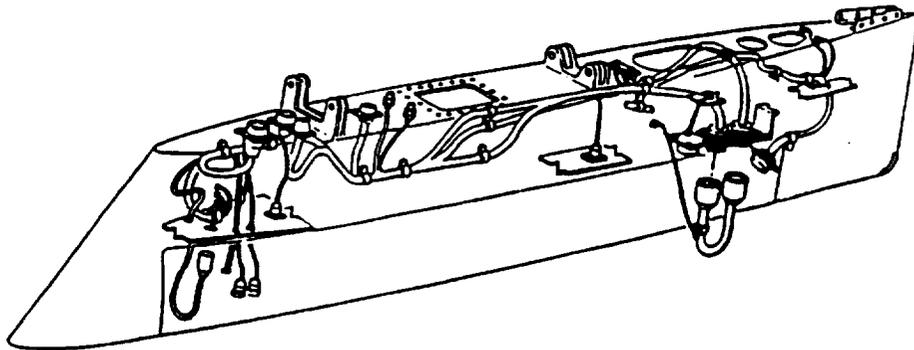
- **ARE NOT DESIGN RESTRICTED TO ANY SPECIFIC CONNECTOR TYPE,**
- **MAY BE TERMINATED USING EITHER RECTANGULAR OR CIRCULAR CONNECTORS,**
- **ARE COMPATIBLE WITH MOST MILSPEC CONNECTORS,**
- **MAY BE CRIMPED OR SOLDERED, AND**
- **THE WIRES TERMINATE DIRECTLY INTO ALL CONNECTORS WITHOUT THE USE OF ANY TRANSITIONAL ELEMENT**

ROI HARNESSSES REDUCE BATTLE DAMAGE EFFECTS

- ROI HARNESSSES SUSTAIN MINIMAL DAMAGE FROM PROJECTILE PENETRATION AS COMPARED TO CONVENTIONAL WIRING BUNDLES,
- ROI DESIGN EXPEDITES BATTLE DAMAGE ASSESSMENT AND REPAIRS,
- DAMAGED RIBBONS ARE "ZIPPED" BACK TOGETHER WITH STANDARD CRIMP SPLICES WITHOUT THE NEED FOR I.D. MARKING,
- REPLACING SEVERLY DAMAGED ROI HARNESSSES IS PLAUSIBLE AND GREATLY SIMPLIFIED COMPARED TO REPLACING CONVENTIONAL SPIDER HARNESSSES.

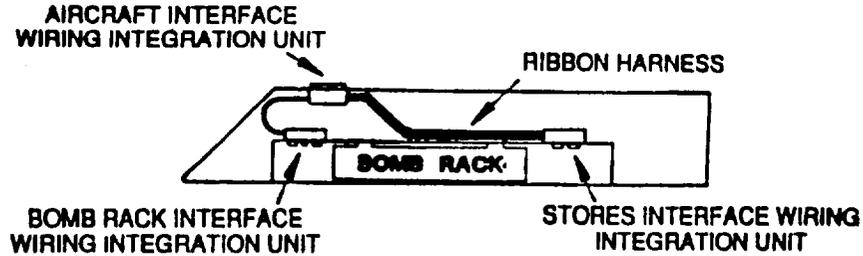
A-6E RELIABILITY & MAINTAINABILITY (R&M) PYLON

ORIGINAL WEAPONS CONTROL SYSTEM IMPROVEMENT (WCSI) PYLON DESIGN



A-6E R&M PYLON

PYLON ROI LAYOUT



V-22 WIRING IMPROVEMENT STUDY WEIGHT SUMMARY 24 JAN 1991

	BASELINE	ROI
MIDWING HARNESS	239 LBS	132 LBS
REDUCTION	-----	45%
FULL AIRCRAFT ESTIMATE *	1546 LBS	1185 LBS
REDUCTION	-----	23.4%

* EXTRAPOLATED FROM MIDWING RESULTS USING BELL BOEING GROUND RULES.

**V-22 WIRING IMPROVEMENT STUDY
COST SUMMARY 24 JAN 1991
(MIDWING AREA ONLY)**

	BASELINE	ROI
R&D (NRE)	\$ 1,216,600	\$ 1,473,300
INVESTMENT (PRODUCTION)	\$152,921,900	\$110,656,121
O&S (SPARES)	<u>\$ 6,108,800</u>	<u>\$ 3,571,700</u>
	\$160,247,300	\$115,701,121
 % REDUCTION	 -----	 28%

1) BASED ON 913 A/C PRODUCTION RUN.

- OWS PROVIDES BENEFITS IN COST, WEIGHT, R&M, E³ PERFORMANCE, AND GROWTH POTENTIAL
- MODULARITY OF HARNESSSES AND WIUs SIGNIFICANTLY IMPROVES WIRING SYSTEM LOGISTICS SUPPORT
- COMPLETE ROI WIRING SYSTEM CURRENTLY BEING DEVELOPED FOR THE V-22
- ORGANIZED WIRING TO BE APPLIED IN FUTURE AIRCRAFT PLATFORMS AND REWIRE PROGRAMS



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