Approved Corrosion Prevention Compound for Helicopter Avionics & Tactical Vehicles

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Report Documentation Page

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Overview of Brief

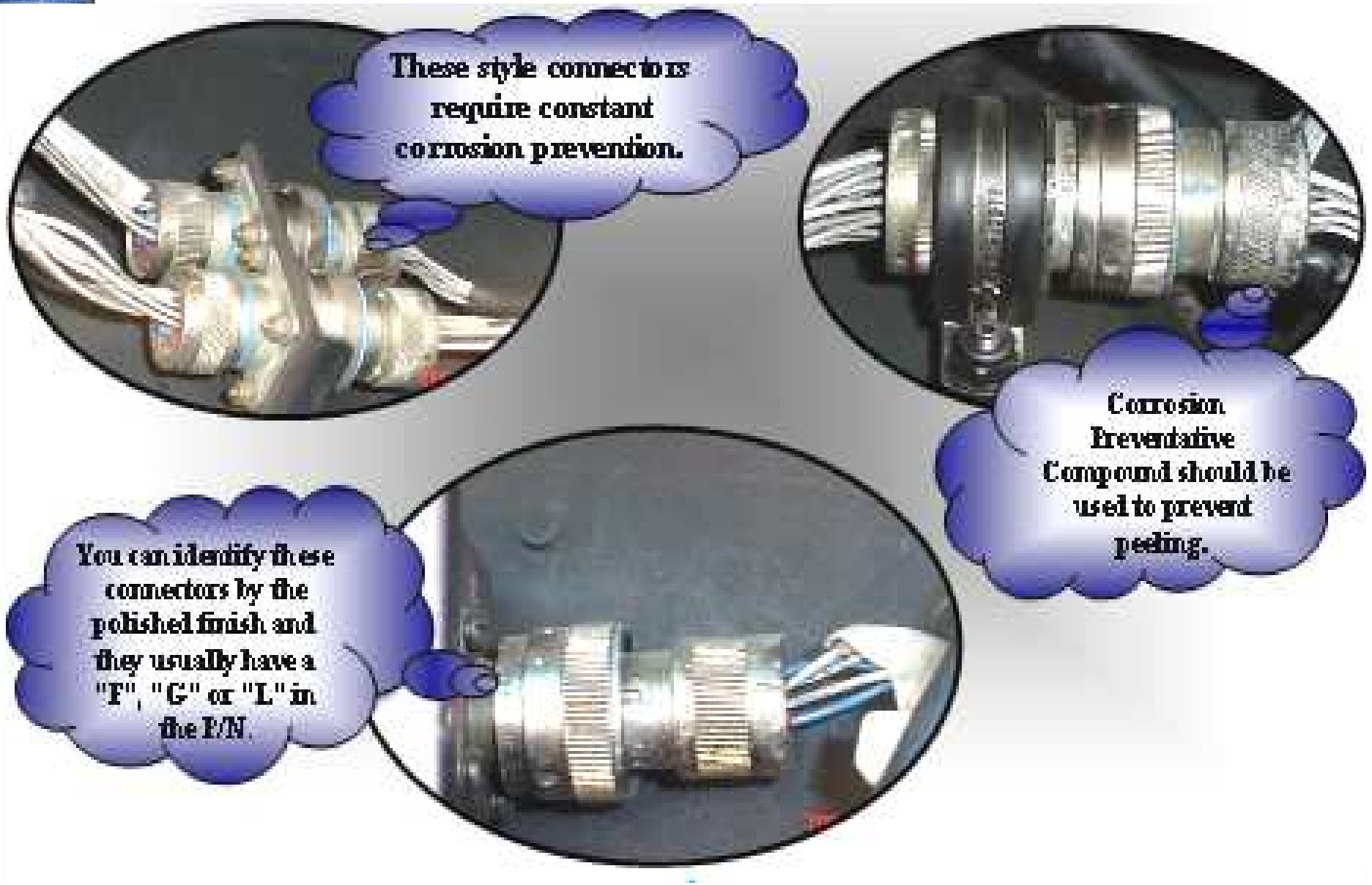
- The Problem Being Addressed Is The Reliability of LRU Electrical Connectors
- Intermittent Effects May Produce Cannot Duplicate (CND's), Retest OK's (RTOK), and Possible Removals Leading To Depot Returns = Exchange Costs
- A Possible Source of These Effects Is The Formation of Thin, Often Invisible Corrosion Films On Contact Surfaces
  - Technical Basis For This Subtle Corrosion Well Established
  - Perception of Problem Difficult Since It usually Cannot Be Seen = Not Reported = "Doesn't Exist"

Corrosion Maintenance H-60

AEROSAFE PRODUCTS, INC.

Corrosion Prone Electroless-Nickel Plated Aluminum Connectors

AEROSAFE PRODUCTS, INC.



Corrosion Prone Electroless-Nickel Plated Aluminum Connectors

AEROSAFE PRODUCTS, INC.

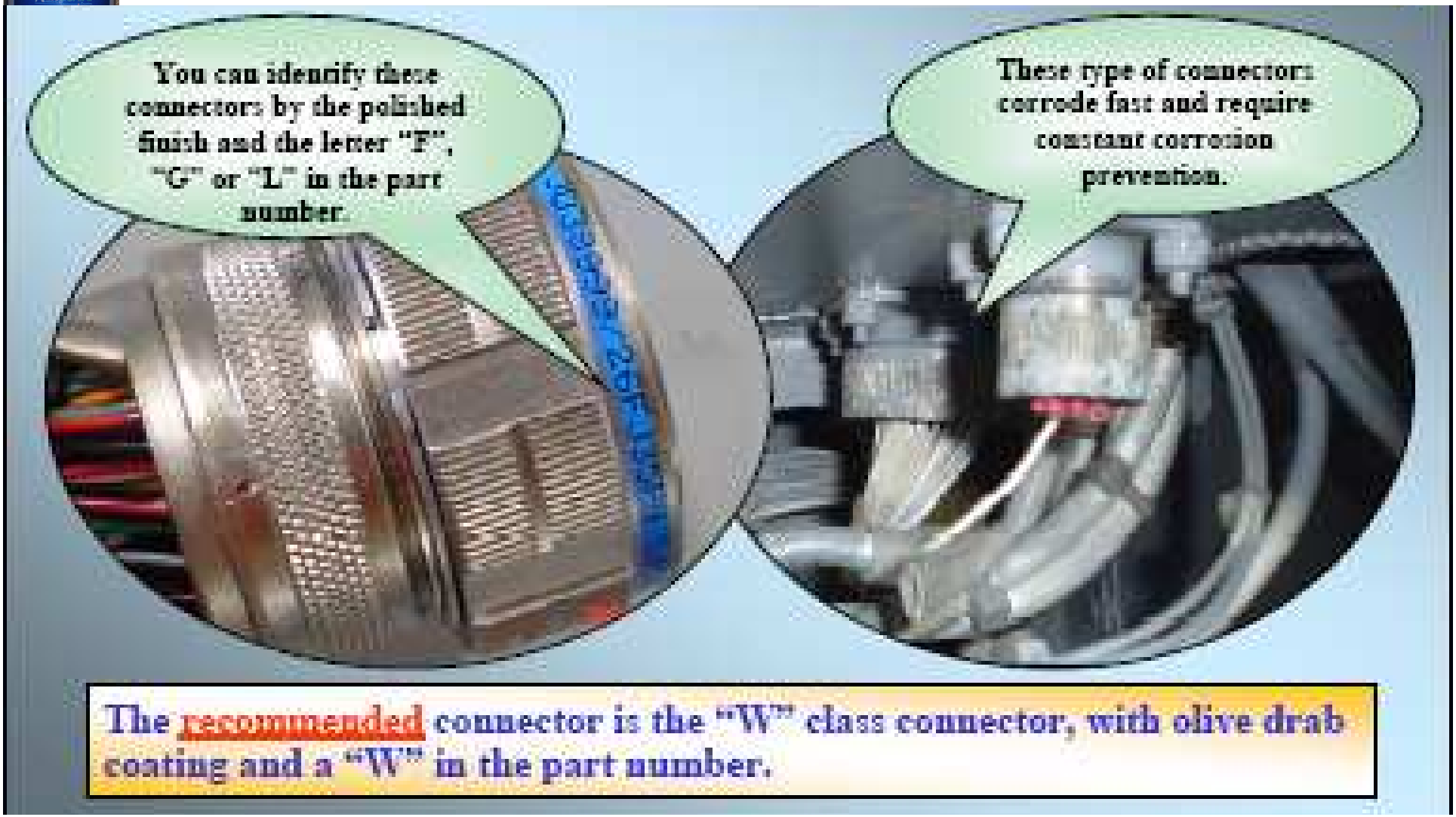
These type connectors corrode fast and require constant corrosion prevention.

You can usually identify these connectors by their polished finish and they usually have a "F", "G" or "L" in the P/N.

The *recommended* connector is the "W" class connector, with olive drab coating and a "W" in the part number.

Corrosion Prone Electroless-Nickel Plated Aluminum Connectors

AEROSAFE PRODUCTS, INC.



CPC Usage

T.O. 1C-5A-23, Table 12-9, Modifications

- **C-5 Aircraft Usage Approved through Program Letter from Clay Elliott in Sept 2007**
- **F-16 Aircraft Usage Approved for use since 1988**
- **Naval Air Depot Usage since 2003 All Naval Aircraft**

Item	Finish Material	Specification	National Supply Class	Quantity or Size	Vendor Source Code	Commercial Designation or Source	Application (Use)
1	Compound, Corrosion Prevention	MIL-PRF-16173, Grade 2	8030	Aerosol Can Bulk	1KQX9	Cor-Ban 22	Corrosion preventive wax-film coating. Excellent protection over steel surfaces.
55	Compound, Corrosion Prevention	MIL-DTL-85054	8030	Aerosol Can Bulk	1KQX9	Cor-Ban 35 Undyed	Corrosion preventive hard-film coating. Excellent protection over deteriorated paint.
56	Compound, Corrosion Prevention	MIL-PRF-81309, Type II	8030	Aerosol Can Bulk	66724	LPS-2	Corrosion preventive thin oil film coating. Excellent faying surface protection on bilge structure.
58	**Compound, Corrosion Prevention**	**MIL-PRF-81309, Type III or MIL-L-87177, Grade B**	**6850**	**Aerosol Can Bulk**	**0FT11**	**Super Corr-A**	**Corrosion preventive very thin oil film coating (Avionics Grade)**
59	Compound, Corrosion Prevention	Commercial (BMS 3-38)	8030	5 oz. Tube Case of 6 oz cans	1KQX9	Cor-Ban 27L Paste	Corrosion preventive paste film. Excellent coating as an anti-seize and corrosion preventive product on fasteners.

Typical CPC Products

AEROSAFE PRODUCTS, INC.

Product Name	Vendor Part #	Container Size	Unit of Issue	National Stock Number (NSN)	CPC Type
Cor-Ban 35 Undyed	006710	12 oz. Aerosol Can	Case (12 per case)	8030-01-516-6254	Hard Film
	006708	5 Gallon	Can	8030-01-531-7364	
Super Corr-A	**12-351**	**12oz. Aerosol Can**	**Case (12 per case)**	**6850-01-528-0653**	**Ultra Thin Film – Avionics/Mechanical**
LPS-2	00216	11 oz. Aerosol Can	Case (12 per case)	8030-01-382-1301	Oil Film - Structure
Cor-Ban 27L	009404	Pint	Case (12 per case)	6850-01-469-7645	Paste Film
	010082	6 oz. PowerCan	Case (12 per case)	8030-01-531-7355	
	009402	5 oz. Tube	Case (12 per case)	8030-01-531-7357	
Cor-Ban 22	007047	12 oz. Aerosol Can	Case (12 per case)	8030-01-523-4290	Wax Film
Formit-18-360	006227	18 inch long 360 fan spray	12 per Package	6850-01-492-2942	Extension Nozzles
Formit-48-360	009132	48 inch long 360 fan spray	12 per Package	Custom Length for C-5 Gear Bogie	

Implementation

AEROSAFE PRODUCTS, INC.

- **Earlier Studies (Ground and Flight) have Demonstrated**
  - **Some CPC's Are Very Effective At Reducing or Eliminating Connector "Corrosion" and Intermittent Electrical Connection Effects**
  - **No Known Risks**
  - **Low Cost; C.O.T.S. Materials**
  - **Only 2-3 CPC's on QPL Identified Per Earlier Studies As Meeting These "Requirements" For Flight Tests**
  - **Easy To Implement In Field**
- **Use Has Long Been Permitted Per T.O. 1-1-689**
- **Implementation Has Been Very Slow Due to Lack of Incentive because it is not in Depots Interests during Potential BRAC Closures**

OUTSTANDING IMPACT ON FLEET READINESS

AEROSAFE PRODUCTS, INC.

- **Reduced Sailor/Soldier/Airman Corrosion Workload**
  - **Easier to apply**
  - **Time between applications is longer (28 days versus daily).**
- **Less Environmental Waste is stocked and issued.**
  - **Fewer empty aerosol containers are processed as Hazardous Waste .**
- **Chemical Costs**
  - **Less lubricant is procured**
  - **Fewer empty aerosol containers are generated**
- **Asset Availability – Significant Improvement in A_o**
- **Corrosion protection is Significantly improved.**
- **Reduced Corrosion Manhours can be Redirected to Mission Priority Operational Tasks.**

Referenced in all Tech Orders and Tech Manuals

AEROSAFE PRODUCTS, INC.

- Super Corr A Approved for All Air Force Aircraft
- Super Corr A Approved by NAVAIR for NADEP Jax, North Island & Cherry Point Aircraft
  - F-18, C-130, P-3C, EA-6B, H-60, H-53, H-46, C-40, T-45, GSE, ALRE Equipment, All Avionics,
- Totally Suitable For Flight/Avionics (Tri-Service Manual)
- “Avionics Cleaning and Corrosion Prevention/ Control”
  - NAVAIR 16-1-540 (Navy)
  - TO 1-1-689 (AF)
  - TM-1-1500-343-23 (Army)
- Total Corrosion Inhibition
- No Known Engineering Risk

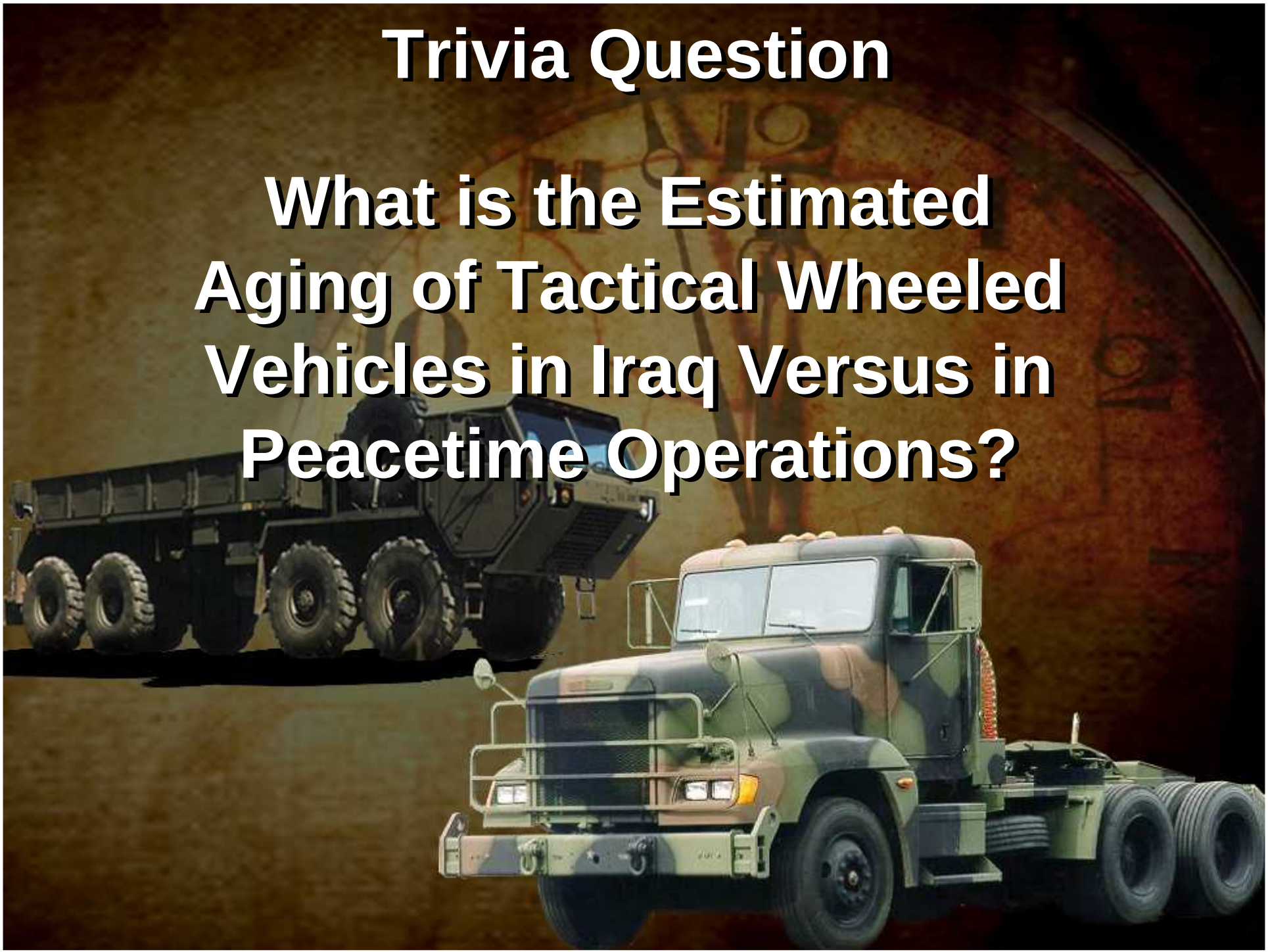

US Army Tactical Vehicles
Corrosion Perspective


Trivia Question
How Many Tactical Wheeled Platforms Does the Army Currently Manage?

Trivia Answer

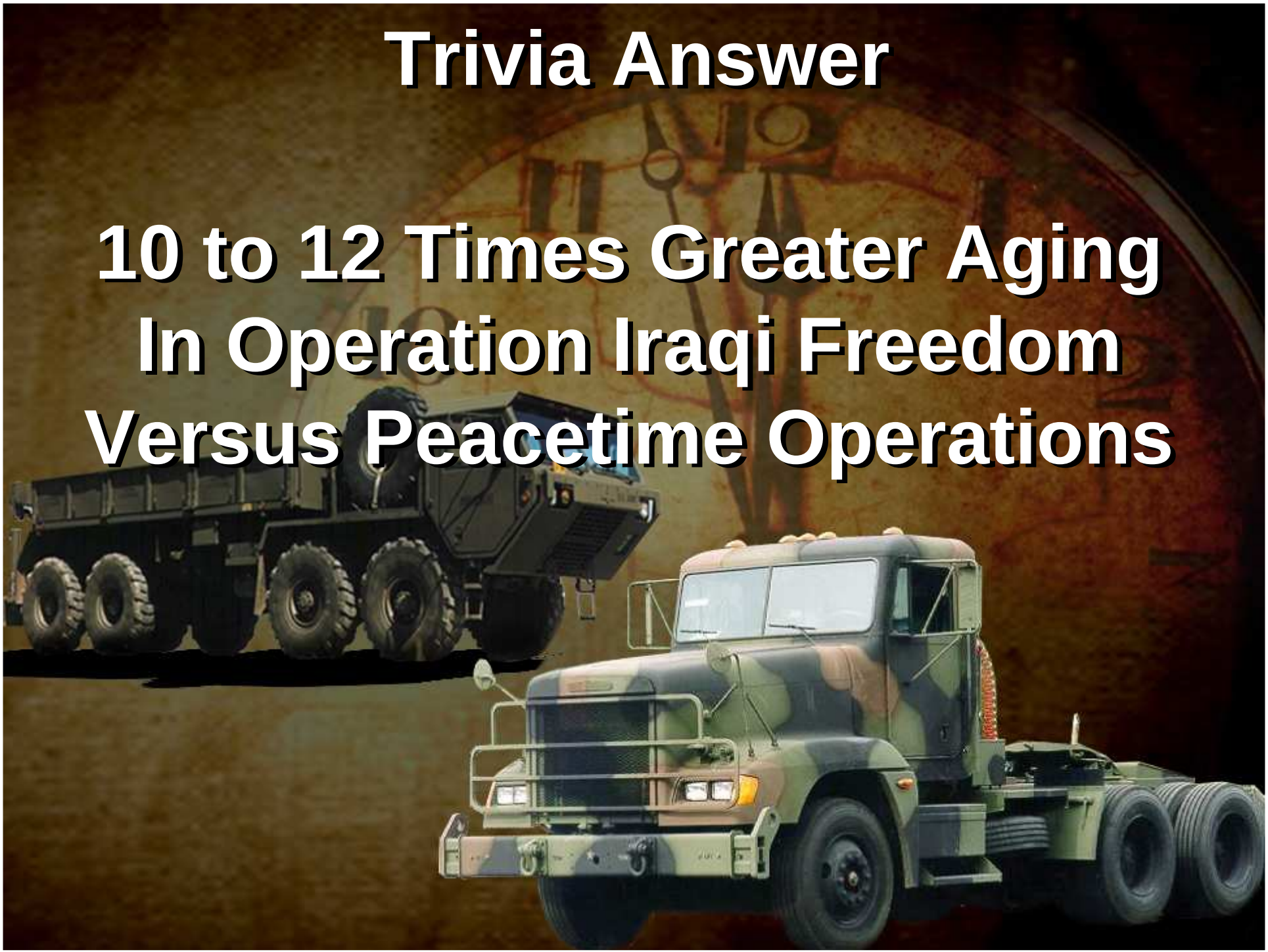
Trivia Question

What is the Estimated Aging of Tactical Wheeled Vehicles in Iraq Versus in Peacetime Operations?



Trivia Answer

10 to 12 Times Greater Aging In Operation Iraqi Freedom Versus Peacetime Operations



We Are At War !

M870A3 Trailer

Family of Medium Tactical Vehicles

Heavy Equipment Transport (HET) Battle Damaged

Heavy Expanded Mobility Tactical Truck (HEMTT), Battle Damaged

Palletized Load System (PLS) Truck and PLS Trailer (PLS-T)

M915A3 Line Haul Tractor

HMMVW Battle Damaged

M939A2 5 Ton Truck

The War on Terror Will Not Be Short

- Continuously Rejuvenate Today's Fleet
- Replace Parts With More Reliable Parts
- Leverage Commercial Innovation
- Use Block Improvements for Vehicle Architectures Upgrades

Crew Survivability is a Permanent Requirement

Challenges

- Increased Fuel Efficiency
- Increased Reliability
- Reduced Maintenance

Tactical Vehicles Corrosion

Readiness of Army Weapons Systems

AEROSAFE PRODUCTS, INC.

Readiness Status of Major Weapon Systems (Percentage)		
Weapons Systems	Availability Goal	Actual Availability
FMTV	90	96
HMMWV	90	94
M198	90	93
MLRS	90	93
M3 Bradley	90	93
Avenger	90	93
M1A2 Abrams Tank	90	92
M2 Bradley	90	92
PLS-Truck	90	91
5-Ton Truck	90	91
OH-58D Helicopter	90	90
M109	90	89
HEMTT	90	88
UH-60 Helicopter	75	82
M1A1 Abrams Tank	75	82
AH-64 Helicopter	75	80
CH-47D Helicopter	75	66

Source: U.S. Army Status of Resources and Training System (SORTS) Database (Sep 2002)

TARDEC 2008 View of US Army's Aging Tactical Vehicle Fleet

AEROSAFE PRODUCTS, INC.

2008	Total Vehicles	Average Age	Replacement Age	O&S Costs $/Mile (Including Fuel & Parts)
HMMWV	105,255	18.2	15	$1.74
M-1A2 Abrams	8,800	30	20-30	$8.50
M-2/M-3 Bradley	6,724	27	20-30	$6.50
FMTV LMTV 2.5T MTV 5 Ton	10,294/ 8,782	10.4/9.0	20/22	$1.67/$1.84
M809	10,124	34.6	20	$3.24
M939	30,533	20.4	20	$3.23
M35	23,716	36.1	20	$1.85
HEMTT	12,626	18.6	20	$5.43
PLS	3,499	12.7	20	$3.80
HETS	2,263	11.4	20	$4.98
M915	5,791	18.9	20	$1.61
LT Trailers	27,300	18.1	20-30	Not Avail
MD Trailers	31,800	37.3	20-30	Not Avail
MV Trailers	26,500	24.5	20-30	Not Avail

Source: Tactical Wheeled & Tracked Vehicle Modernization Strategy Industry Update PEO CS & CSS

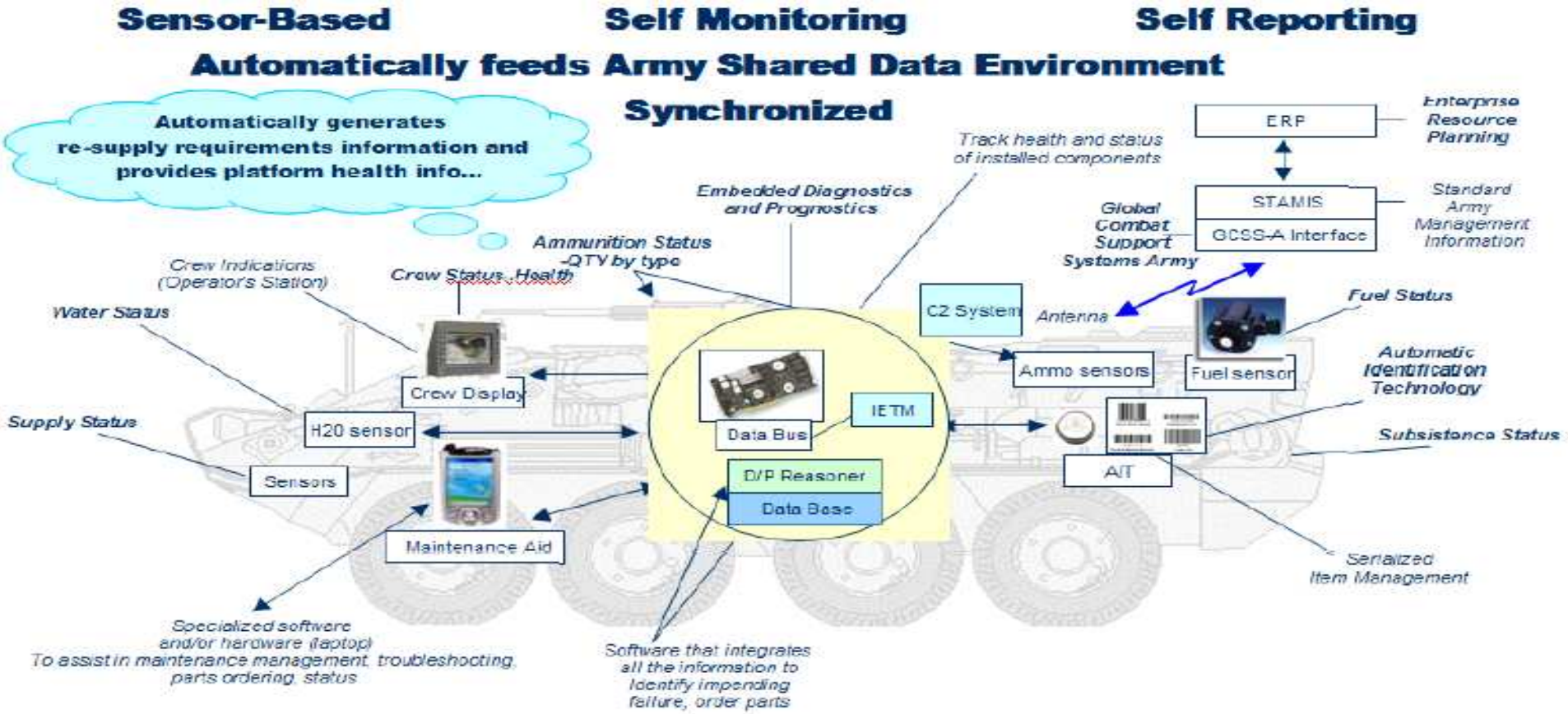
Army Future Maintenance Concept

AEROSAFE PRODUCTS, INC.

Condition Based Maintenance

- **TARDEC's Top 3 Efforts:**
- **Diagnostics / Prognostics**
- **Sensor Integration**
- **Data Warehousing**

- **What's Missing?**
- **No Electronics Systems Corrosion Protection with a Hydrophobic CPC like Super Corr A.**
- **Mil-C-81309 Hydrophilic CPC**

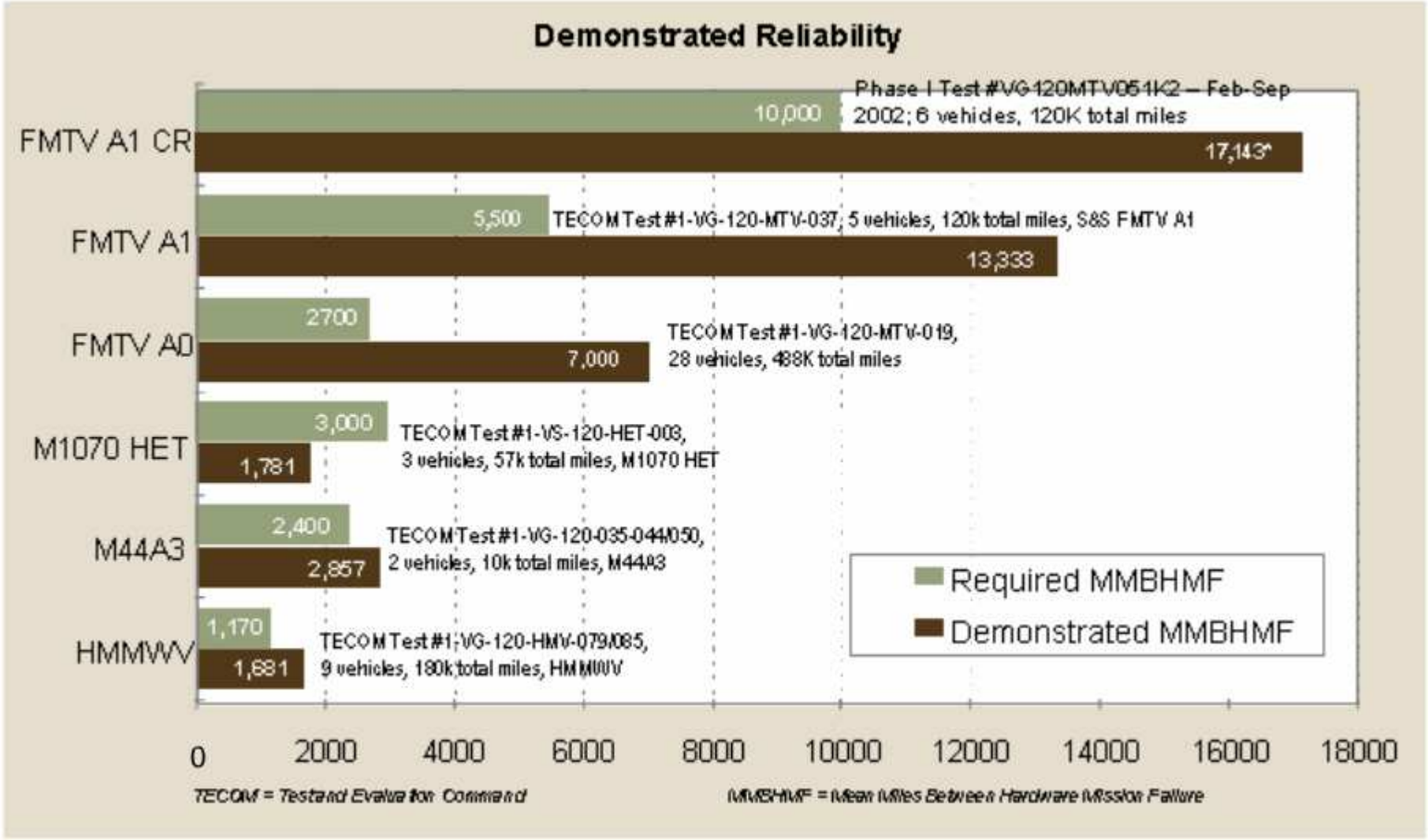


Effect of OIF/OEF Environment and Increased Mileage on Vehicle Life

Category	OP Tempo Weighted Average	Total OIF/OEF Vehicles	Accelerated Aging Factor	2008 Equivalent Age + 6 Yrs of War
Excavator	213%	264	2.08	8
UUH	342%	120	2.69	9
ASV	286%	36	3.00	9
LHS & Bridge Transporter	280%	504	3.36	9
M-1A2 Abrams Tank	477%	580	3.75	10
M2/M3 Bradley IFV	507%	846	4.56	10.5
M88 Tank Retriever	579%	326	4.37	10.5
HEMETT Cargo	289%	606	2.56	8.5
HEMETT Wrecker	372%	344	1.83	8
HMMWV	329%	12,345	2.81	9

Example of FMTV TACOM Past Test Criteria & What Industry Delivered

AEROSAFE PRODUCTS, INC.



* Fleet average of test vehicles including all failures attributed to CR changes and A1 baseline.

HMMWV Test Criteria Did Not Reflect Corrosion Requirement

AEROSAFE PRODUCTS, INC.

- Test Criteria Did Not Stress Corrosion anywhere in the Vehicle Specification
- Result Trucks Rusted out shortly after 1st Gulf War during 1994 timeframe and made History on ABC News 20/20
- Corrosion Problems included Real Protection of Vehicle Internal Uni-body Construction
- Vehicles Reordered in 1998 with Corrosion Requirement Prior to Contract Signature by SAE Dr. Andy Viilu (Ret) , OSD Land Warfare
- Problem: Product used to fix Army Corrosion was procured due to Senior Officer Retirement/Rehire and not due to Best Practices

AEROSAFE PRODUCTS, INC.

SUPPORTING RESET

TACOM COMMUNITY RESET MISSION

"Sustain and RESET combat-ready forces to meet all aspects of Army mission requirements"

Support level of effort to meet

the Army requirement to return the force to fully ready status. RESET includes all units and/or organizations that were directly involved in OIF/OEF. RESET also includes future deployment missions."

AEROSAFE

RESET CONCEPT

All deployed equipment will be repaired to a prescribed equipment condition with emphasis on mitigating damage caused by environmental conditions (delayed desert damage). Maintenance tasks are required to return equipment to pre-hostility condition.

- RESET - Sustainment Level

  Equipment that was deployed that has been identified as requiring repair beyond 10/20 standard.

- RESET - Retail Level

  Deployed equipment that units will bring to TM10/20 standard with Delayed Desert Damage at home station with support from TACOM community.

What is missing from TACOM Reset Program for Tactical Vehicles ?

- **Corrosion Protection For Electronic/Electrical Systems**
  - **Age Of Equipment**
  - **Op Tempo**
  - **Desert Salt Environments Require A True Hydrophobic CPC & Lubricant For Electrical/Electronic Systems.**
- **CPC Also Requires Lubricant To Prevent Corrosion Of Threads By Environmental Salt Elements**
- **CPC Requires Non Flammable Component For Safety**
- **CPC Prevents Corrosion Of Electronic Components**
- **CPC Eliminates Intermittent Electrical/Electronic Faults Due To Corrosion On Dissimilar Material Non Compatible Connector Pins From Different Manufacturers.**

Navy Success Stories

AEROSAFE PRODUCTS, INC.

P-3C Corrosion Reduction
Flap Jack Screws & Flap Tracks

AEROSAFE PRODUCTS, INC.

- **Initial Yearly Labor Avoidance 30,000 man hours for P-3 fleet of 240 aircraft.**
- **Material Savings of approximately $22,000/year**
- **Flap Tracks, Actuators and Jack Screws of the 240 aircraft in the P-3 fleet are lubed once every 28 days versus daily**
- **Resultant Avoidance more than 46,000 man hours per year**
- **Increased Fleet Safety**

False Alarm Problems Caused by Corrosion on Electronics & Connectors Solved by Super Corr A

AEROSAFE PRODUCTS, INC.

False Alarms account for 60 % of LRU Failures in Fleet

- A system-indicated malfunction that can't be validated because no request for corrective maintenance follows.
- A Cannot Duplicate Alarm (CND) differs from a false alarm in that it signifies a malfunction that can't be confirmed

Cannot Duplicate Alarms (CND) Accounts for 60 % of Tested Items

- A situation that results in an operationally observed or recorded malfunction for a system or subsystem that equipment maintenance personnel can't duplicate or confirm.

Factory/Depot Retest OK

- A maintenance event involving a part or subsystem malfunction at the on-equipment maintenance level that personnel can't duplicate at the off-equipment maintenance level.
- Result of this event, personnel may return the item to service without taking corrective action.

Super Corr A is a Simple Solution that Works

- Corrosion Preventive Compounds (CPC) Inhibit Corrosion To A Degree Which Makes Their Use Worthwhile
- Previous OSD Funded Independent Battelle Labs & Navy Submarine Studies Demonstrated that Connector Corrosion can be Prevented with CPC Lubricants
  - Inexpensive
  - No Risk
  - No Impact On Normal Ops
- Potential Cost Savings Throughout DOD Is Large Due To Exchange Cost Avoidance

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OGDEN AIR LOGISTICS CENTER (AFMC)
HILL AIR FORCE BASE, UTAH

20 MAR 2007

MEMORANDUM FOR Defense Supply Center Richmond
ATTN: FAJA/Mr. Clifford Myers
8000 Jefferson Davis Hwy
Richmond, VA 23297-5809

FROM: 501 ACSS/GFLB
6080 Gum Lane, Bldg 1212
Hill AFB UT 84056-5825

SUBJECT: Lektro-Tech Super Corr A and Super Corr B

Based on performance studies performed by Battelle (Dr. William H. Abbott, 501 King Ave., Columbus, Ohio 43201) under Air Force Contract F42620-00-D-0030-0012, Lektro-Tech Super Corr A is considered "two way interchangeable" with Super Corr B; therefore, Super Corr A is an acceptable replacement or substitute for Super Corr B.

Tim Sorensen
F-16 Engineering Branch Chief
501 ACSS/GFLB

AEROSAFE PRODUCTS, INC.

US Air Force 20 March 2007 Letter Substituting Super Corr A for Super Corr B Notice to DLA

NADEP Test Findings

- Efforts have been Well Received
- Duplication of Efforts Significantly Reduced
- Approvals of New Technologies Continue at an Increasing Rate
- Need Continues for Feedback from Fleet
  - Clear Understanding of Issues
  - How to make the Biggest Impact
  - Lack of MT's Hinders ability to Gather Feedback
- Pollution Prevention Award for Reduction of Waste Stream for Hazardous Materials

FIGURE 2: A second round of tests determined that the lubricating and corrosion protection properties of Super Corr were superior to the product being used by the P-3 squadron at NADEP Jacksonville.

Note: Super Corr A Mil-L-87177A vs Mil-C-81309 CPC

Military Organizations & OEM/Airline Approvals

AEROSAFE PRODUCTS, INC.

US Military & NATO

- Office of Secretary of Defense - Corrosion Defense Success Stories
- US Air Force – C-5B, F-16, F-15, C-130, C-17, H-60, All Landing Gear, etc…
- US Navy All Depots All Aircraft
- US Navy Trident & Attack Submarines (Sub Safe Approval)
- **US Army Mil 81309 Only Hydrophilic Type CPC's**
- NATO Aircraft and Ships/Submarines
  - **Royal Navy, Royal Air Force, Deutsche Marine (German Navy), Luftwaffe German Air Force, Royal Netherlands Navy etc..**
- US DHS – Customs & ICE Aircraft
- US Coast Guard All Aircraft

OEM's

- Boeing Commercial/Military Aircraft
  - Including McDonnell-Douglas
- Sikorsky All Commercial/Military Aircraft
- Raytheon/Beech
- Cessna
- Embraier
- Northrop-Grumman
- Lockheed-Martin
- Airbus (All Aircraft)
- Euro-Copter (EC Series)
- Bombardier (All Aircraft)

Airlines

- Domestic Airlines Southwest, AA, US Airways, Delta, United, Air Tran, Jet Blue, Alaska Air, etc….
- International Airlines British Airways, Lufthansa, Air France, El Al, JAL, Qantas, Island Air, Avianca Air, etc....

Conclusions

AEROSAFE PRODUCTS, INC.

- 19 years of OSD/USAF Funded Corrosion Studies Continue To Confirm All Earlier Successful Conclusions that Super Corr A :
  - Significant Mission Capability Benefits
  - No Known Risks
  - No Downside
  - Large Potential Cost Avoidance Due To Reduced Removals And Exchange Cost Reduction
- Potential Savings Difficult To Calculate Due to Unknown Fraction Of Removals Actually Returned To Depot
  - Results Apply To Electrical/Electronic Systems Across Platforms; Air, Land, and Sea
- These Results Are Unique To The Specific CPC Used In This Study because this product is the only Medical Grade Hydrophobic, Non Flammable CPC Lubricant for electronics & avionics systems/components along with Lubricant for Mechanical Systems.
  - Super Corr A meets Mil-L-87177A for Ultra Thin Film for Avionics & Mechanical Systems Lubricant and Exceeds Mil-L- 81309 General Purpose CPC coatings.
- Ultra Thin CPC Film has NO Thermal Load for Environmental Control System Components and Cooling/Heating Coils

AeroSafe® Products Inc.
Master Distributor of Super Corr A Corrosion Prevention Compound (CPC) Ordering & Address Information

Master Distributor

- AeroSafe® Products Inc.
- P.O. Box 4755
- Marietta, GA. 30061 USA

- Email: jim@aerosafe.com or sales@aerosafe.com

- Website: www.aerosafe.com

- Telephone:
  (Voice) 888-666-7855
  alt (727) 584-2936
  (Fax) 770-429-0461

- SUPER CORR A
- 16oz. (12oz. fluid) Aerosol Can
- NSN: 6850-01-529-0653 --- $58.00

- SUPER CORR A
- 12 Aerosol 12 oz by Volume Cans per Case
  - One -10 cases - $696.00/cs - 11+ cases $684.00/cs
- SUPER CORR - A (BULK)
  - Type II , Grade B Commercially available in Bulk
  - 10 Pound - One Gallon Can
  - 46 Pound – 5 Gallon Pail - (Call for pricing)
  - 520 Pounds – 55 Gallon Drum
- SUPER CORR - G (BULK) Industrial Grade (ENSOLV Solvent)
  - Type II , Grade B Commercially available in Bulk
  - 10 Pound - One Gallon Can -
  - 46 Pound – 5 Gallon Pail - (Call for pricing)
  - 520 Pounds – 55 Gallon Drum