

UNITED STATES ARMY AVIATION and MISSILE LIFE CYCLE MANAGEMENT COMMAND

The Evolution of Protective Covers for Army Aviation and Missile Systems

Briefed by: Chad Hellums
AMCOM Corrosion Program Office

Steven F. Carr
AMCOM Corrosion Program Manager



Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE FEB 2010		2. REPORT TYPE		3. DATES COVERED 00-00-2010 to 00-00-2010	
4. TITLE AND SUBTITLE The Evolution of Protective Covers for Army Aviation and Missile Systems				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) AMCOM Corrosion Program Office, RDMR-WDP-A, Building 7631, Room 39, Huntsville, AL, 35898				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES 2010 U.S. Army Corrosion Summit, Huntsville, AL, 9-11 Feb					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



AMCOM Corrosion Program Office



*Getting Technology
to
the War Fighter*



Why cover?

- **Protective covers provide protection from:**
 - Environmental effects
 - Particulate intrusion





What are we protecting from?



Environment	Principal Effects	Typical Failure Induced
High Relative Humidity	<ul style="list-style-type: none"> • Corrosion • Electrolysis • Moisture absorption 	<ul style="list-style-type: none"> • Loss of mechanical and electrical strength • Interference with function • Loss of electrical properties • Increased conductivity of insulators
Rain	<ul style="list-style-type: none"> • Water absorption and immersion • Erosion • Corrosion 	<ul style="list-style-type: none"> • Increase in weight; electrical failure • Removes protective coatings • Surface deterioration • Enhances chemical reactions
Wind	<ul style="list-style-type: none"> • Force application • Deposition of materials • Heat loss or gain 	<ul style="list-style-type: none"> • Loss of mechanical strength • Interference with function • Accelerated abrasion and intrusion • Accelerated high/low temperature effects
Sand/Dust	<ul style="list-style-type: none"> • Abrasion • Clogging 	<ul style="list-style-type: none"> • Increased wear • Interference with function • Alteration of electrical properties



The “Old” Way



- Shrink Wrap (Shipping Protection)
- Vinyl Equipment Covers





Shrink Wrap – Total Coverage

- Effective when not compromised and applied under ideal conditions
- Study performed in FY04 found that shrink wrap of current Army aircraft caused more harm than protection
- DA G-4 Issued “Suspension Of Shrink Wrapping Of Army Helicopters” Dec 04 131653Z Message





Vinyl Equipment Covers



- Bulky, heavy and cumbersome to use
- Often not used by soldiers due to difficulty
- Short life due to temperature problems with material
- Provides little to no protection when not used or not used regularly
- Adds burden to the soldier with little benefit





The “New” Way



- **Protective covers**





New cover requirements



- **Covers must now protect**
 - Environmental effects
 - Particulate intrusion
 - &
 - Contaminate intrusion (Chlorides, etc.)
 - UV degradation
 - Temperature damage
 - Condensation formation (Greenhouse Effect)





Additional Protection



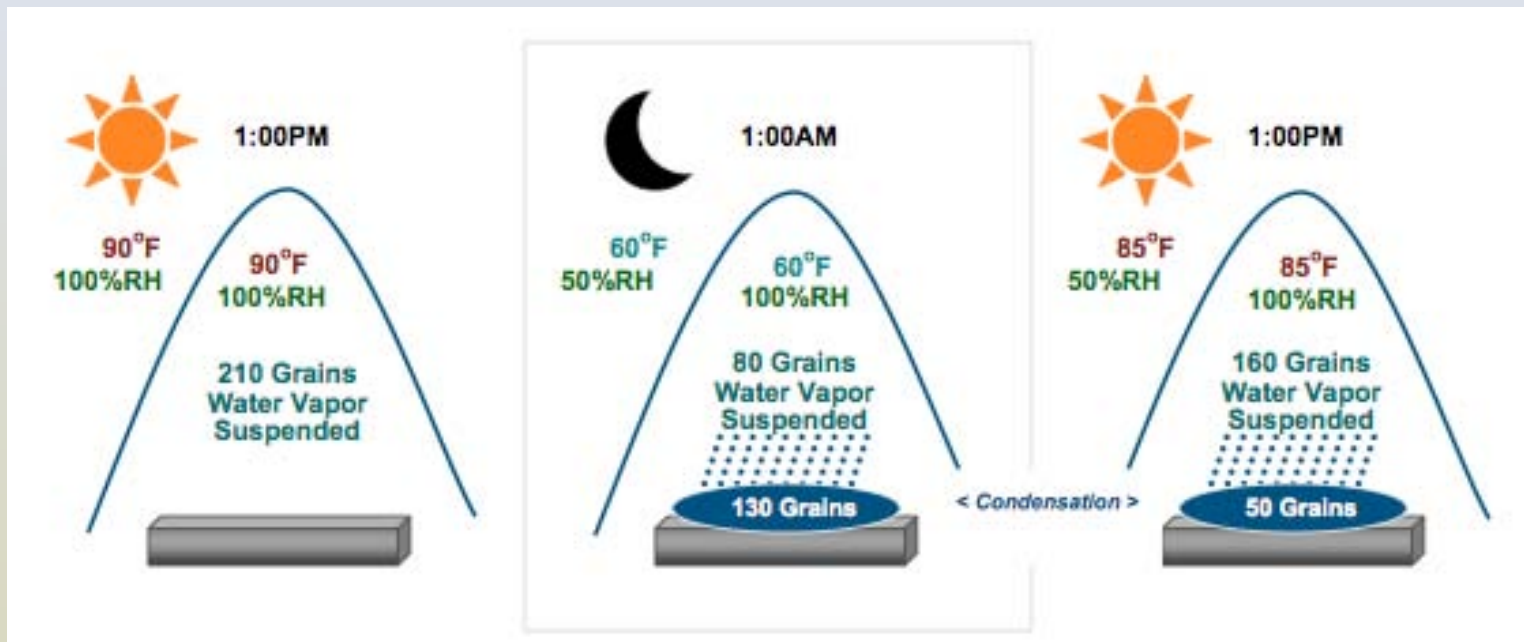
Environment	Principal Effects	Typical Failure Induced
High Temperature	<ul style="list-style-type: none"> • Thermal aging: oxidation, structural change, chemical reaction • Softening, melting and sublimation • Viscosity reduction and evaporation • Physical expansion • Decreased MTBF 	<ul style="list-style-type: none"> • Thermal aging: oxidation, structural change, chemical reaction • Softening, melting and sublimation • Viscosity reduction and evaporation • Physical expansion • Decreased MTBF
Chemical Intrusion	<ul style="list-style-type: none"> • Corrosion, electrolysis 	<ul style="list-style-type: none"> • Surface deterioration and structural weakening • Alteration of electrical properties • Interference with function • Increased conductivity
UV Radiation	<ul style="list-style-type: none"> • Embrittlement • Physiochemical reactions 	<ul style="list-style-type: none"> • Surface deterioration • Alteration of electrical properties • Discoloration of materials



The “Greenhouse” Effect



- Trapped air within an enclosed space allows condensation to form





Paired Factors



Paired Environment	Principal Effects
Humidity + High Temperature	<ul style="list-style-type: none"> •High temperature tends to increase the rate of moisture penetration.; the general deterioration effects of humidity are increased by high temperatures
Humidity + UV Radiation	<ul style="list-style-type: none"> •Humidity intensifies the deteriorating effects of solar radiation on organic materials
Humidity + Chemicals	<ul style="list-style-type: none"> •High humidity may dilute concentrations and could affect the corrosive action by increasing coverage and thereby increasing conductivity and the rate of corrosion.
Humidity + Particulates	<ul style="list-style-type: none"> •Particulates have a natural affinity for moisture and this combination increases deterioration
High Temperature + Chemicals	<ul style="list-style-type: none"> •High temperature increases the rate of corrosion influenced by chemicals (salts and sulfurs)
High Temperature + UV Radiation	<ul style="list-style-type: none"> •High temperature can increase the breakdown of organic materials by UV radiation
High Temperature + Particulates	<ul style="list-style-type: none"> •The erosion rate of particulates may be accelerated by high temperature
UV Radiation + Particulates	<ul style="list-style-type: none"> •Suspected to result in temperature elevation
Chemicals + Particulates	<ul style="list-style-type: none"> •Particulates and chemicals influence the rate of corrosion and enhance deterioration



Cover technology



- **A “breathable” cover**
 - Allows vapor transfer out while preventing water, contaminants and particulates from intruding
- **A “soft” cover**
 - Will not damage or abrade the surface of the asset
- **A “lightweight and packable” cover**
 - Lightweight and compressible enough to be user friendly
- **A “tough” cover**
 - Can withstand the daily use of a soldier while still performing all other duties listed
 - Resists damage from UV radiation



Aviation Cover applications





Missile Cover Applications





Contacts

Steven F. Carr

AMCOM Corrosion Program Manager

steven.f.carr@us.army.mil

256-876-7472

Robert A. Herron

Deputy Corrosion Program Manager

robert.a.herron@us.army.mil

256-876-5061

Chad A. Hellums

AMCOM Corrosion Program Office

chad.hellums@us.army.mil

256-842-6745