Enhanced Corrosion Protection for the H-60 Helicopter

R. Guillemette
R. Luchenta
Sikorsky Aircraft
Materials and Process Engineering
4. TITLE AND SUBTITLE
Enhanced Corrosion Protection for the H-60 Helicopter

6. AUTHOR(S)
Sikorsky Aircraft, Materials and Process Engineering

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Sikorsky Aircraft, Materials and Process Engineering, 6900 Main Street, Stratford, CT 06601

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

11. SPONSOR/MONITOR’S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

16. SECURITY CLASSIFICATION OF:
a. REPORT unclassified
b. ABSTRACT unclassified
c. THIS PAGE unclassified

17. LIMITATION OF ABSTRACT
Same as Report (SAR)

18. NUMBER OF PAGES 22

19a. NAME OF RESPONSIBLE PERSON

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.
H-60 Corrosion Performance

• DoD Corrosion Prevention and Control directives emphasize fleet readiness as well as cost and man hour reductions through “designed in” corrosion resistance

• Corrosion improvements incorporated into UH-60M and MH-60S/R
Corrosion Drivers

• Faying surfaces (mostly interior airframe)
  – Primer-only insulation between mating parts
• Hardware and fasteners
  – Dissimilar metals
• Water traps
• Antennae and electrical grounding points
  – Mounting surfaces with low resistivity requirements have minimum finishes
• Wear surfaces
  – Vibration $\rightarrow$ wear $\rightarrow$ corrosion
Design for Corrosion Prevention

- Corrosion inhibitors
- Material selection
- Good access
- Drainage and ventilation
- Sealants
- Water Integrity
- Finishes

Design Features
- Multiple parts vs monolithic structure
- Minimize dissimilar metal
- Avoid crevices and water traps
MIL-DTL-64159 Exterior Topcoat for UH-60M

- Improved Weather Resistance / UV Stability & Resistance (degradation that allows moisture to reach primer and base metal)
- Improved Flexibility (cracks in paint near rivets, faying surfaces allow moisture intrusion)
High Speed Machined Airframe Components

Sheet Metal Components

HSM Components
High Speed Machined Airframe Components

Sheet Metal Components

HSM Components
Corrosion Benefits of High Speed Machined Components

- Replaces multiple sheet metal parts
- Eliminates mating surfaces prone to crevice corrosion
- Eliminates holes prone to corrosion
- Eliminates dissimilar fasteners prone to galvanic corrosion
- Added clear polyurethane at detail level; topcoat of faying surfaces and nut plate locations
- Reduced assembly time and shop waste material
- Environmentally friendlier – reduced solvent from cleaning, reduced chromated sealant, reduced waste
Wet Installation of Interior Fasteners

- Wet installation for low water level regions
- Removable fasteners installed with non-curing sealant
- Permanent fasteners installed with curing sealant
Added Protection for Nutplate Installation

- Rivets wet installed with curing corrosion inhibiting sealant
- Nutplate
- Non-curing corrosion inhibiting sealant applied to bottom
- Drilled holes touched up with conversion coating. Center hole also touched up with primer
- Screw wet installed with non-curing corrosion inhibiting sealant
Rivetless Nutplates

- Easier and faster installation
  - Eliminates 9 installation steps
- Improved corrosion resistance
  - Eliminates dissimilar metals
  - Eliminates two holes
- Improved fatigue life
- Meets NASM25027 torque and push out requirements
- Easier Replacement
  - Can replace threaded nut insert without removing entire nutplate
Rivetless Nutplates
Added Faying Surface Sealing

- Interior faying surfaces traditionally anodized and primed only
- Enhanced protection incorporates sealing mating surfaces with polysulfide sealant
## Improved Sealing Materials

<table>
<thead>
<tr>
<th>AMS 3265 Sealant</th>
<th>Conductive Sealant</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Corrosion inhibiting</td>
<td>• Corrosion inhibiting</td>
</tr>
<tr>
<td>• Non-chromated</td>
<td>• Non-chromated</td>
</tr>
<tr>
<td>• Polysulfide base; compatible with currently used AMS-S-8802 material</td>
<td>• Nickel-fillers provide electrical conductivity</td>
</tr>
<tr>
<td></td>
<td>• Qualification testing underway</td>
</tr>
</tbody>
</table>
Fluid Fog Filming

- Non aerosol, lanolin based corrosion preventative material
- Fluid film sprayed into lower tub and bilge areas of Navy aircraft
- Lanolin material wicks into crevices and displaces water
Dry-to-Touch CPC

- Dry-to-touch, water displacing, corrosion preventative material
- Sprayed onto tail cone interior, lower tub, and bilge regions
Polyurethane Gel Floor Tape

- Corrosion due to lack of “memory” in PTFE floor tape. Permanent set allows water entry when airframe flexes during flight
- Polyurethane gel floor tape, field tested by NAVAIR, has shown a significant improvement in corrosion performance for the H-60 cabin tub
Conductive Polyurethane Gel Antenna Gaskets

- Conductive polyurethane gel gaskets, field tested by NAVAIR, show significant improvement in corrosion performance
- Result is reduced maintenance and extended inspection intervals
NavalHawk Tail Drive Shaft

- Corrosion prevalent at titanium flange and aluminum tube
- Drive shaft faying surface is sealed with AMS-S-8802, but loss of adhesion can occur as the part flexes during flight
- Testing has proven that anodizing the titanium flange and using AMS 3265 corrosion inhibiting sealant will prevent corrosion
HVOF Coatings for Landing Gear Components

- Hard chrome replacement with WC-CoCr coating applied by HVOF process
- New coating provides improved corrosion performance
  - HVOF process produces dense, wear resistant coating
  - Chrome plating is inherently microcracked due to internal tensile stresses, leading to corrosion underneath the coating
- Qualification program complete, ECP in process
**UH-60M Corrosion Prevention Control (CPC) Implementation**

**General:**
- Fittings: Anodize, Prime, Clear Polyurethane at Detail Level
- Wet Installation of Fasteners
- Switch from AMS-S-8802 to Corrosion Inhibiting Sealant
- Polyurethane Antenna Gaskets

- Redesigned 1-Piece ESSS Fittings (no steel strap required)
- Redesigned 1-Piece Transition Steps (no water entrapment)
- Monolithic Structure High Speed Machining
- Spray with Corrosion Preventative Compound
- Replace Floor Sealant with polyurethane gel
- Spray with Corrosion Preventative Compound
MH-60S Corrosion Prevention Control (CPC) Implementation

General:
- Fittings: Anodize, Prime, Clear Polyurethane, at detail level
- Wet Installation of Interior Fasteners
- Fay Sealing of Interior Assemblies
- Switch from AMS-S-8802 to Corrosion Inhibiting Sealant
- Polyurethane Antenna Gaskets

Anodized Tail Drive Shaft Flange

Monolithic Structure High Speed Machining

Spray with Fluid Film

Replace Floor Sealant with polyurethane gel

Spray with Fluid Film