Presented to:

Army Corrosion Summit

Army Aviation Corrosion Engineering Case Studies

AMRDEC
STRENGTH THROUGH TECHNOLOGY

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Date: 10 February 2010

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
10 FEB 2010		**00-00-2010 to 00-00-2010**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Army Aviation Corrosion Engineering Case Studies	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) **U.S. Army Aviation and Missile Research, Development and Engineering Center,Bldg 4488,Redstone Arsenal,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	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**14**	

Overview

- Introduction
- H-47 FRIES Bar Support Rod Corrosion
- H-60 SAS Link SCC Failure

Organization/Who We Are

- AMC
  - RDECOM
    - AMRDEC
      - AED
        - » Structures and Materials Division
          - » Materials Branch
            - » Corrosion and Environmental Team

Introduction/What We Do

- Core Competencies
  - Coatings
  - Corrosion
  - Sealants
  - Adhesives
  - NDI
  - Operational Chemicals and Processes
  - Environmental Issues
- Customer Base
  - Aviation PMOs
  - Corrosion Program Office
  - Environmental Technology Integration Group

H-47 FRIES Bar Support Rod Corrosion

- **Problem**

- **A Category I Quality Deficiency Report (QDR) investigation of the FWD Fast Rope Insertion Extraction (FRIES)/External Recue Hoist support rod (P/N LEX-1583-05), consisting of microscopic, ultrasound, and metallurgic examination revealed severe corrosion of the inside surface of the rod. Subsequent investigation of additional ship sets revealed several support rods within the FWD FRIES/External Rescue Hoist truss assembly exhibiting similar corrosion.**

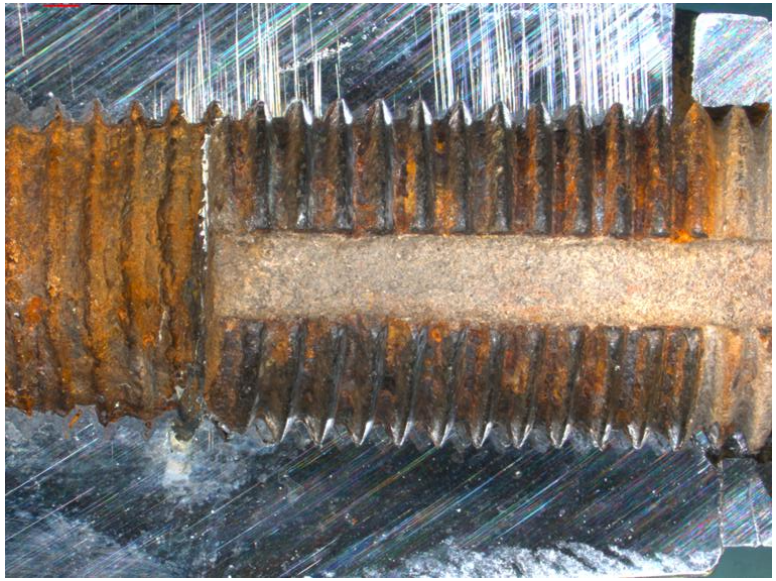
H-47 FRIES Bar Support Rod Corrosion

- **The Investigation**
- Multiple bars were dissected and inspected
- Structural analysis to determine effect of corrosion loss
- Conformance of hardware to the drawings?
- Categorized severity

Interior view of severely corroded Support Rod

H-47 FRIES Bar Support Rod Corrosion

- **Resolution**
- ASAM H-47-09-ASAM-04 is issued
- Requires inspection and grading of the corrosion severity
- Thoroughly dry the rod and treat interior with MIL-C-16173, Grade 3
- Restrict usage of the FRIES station based on corrosion severity



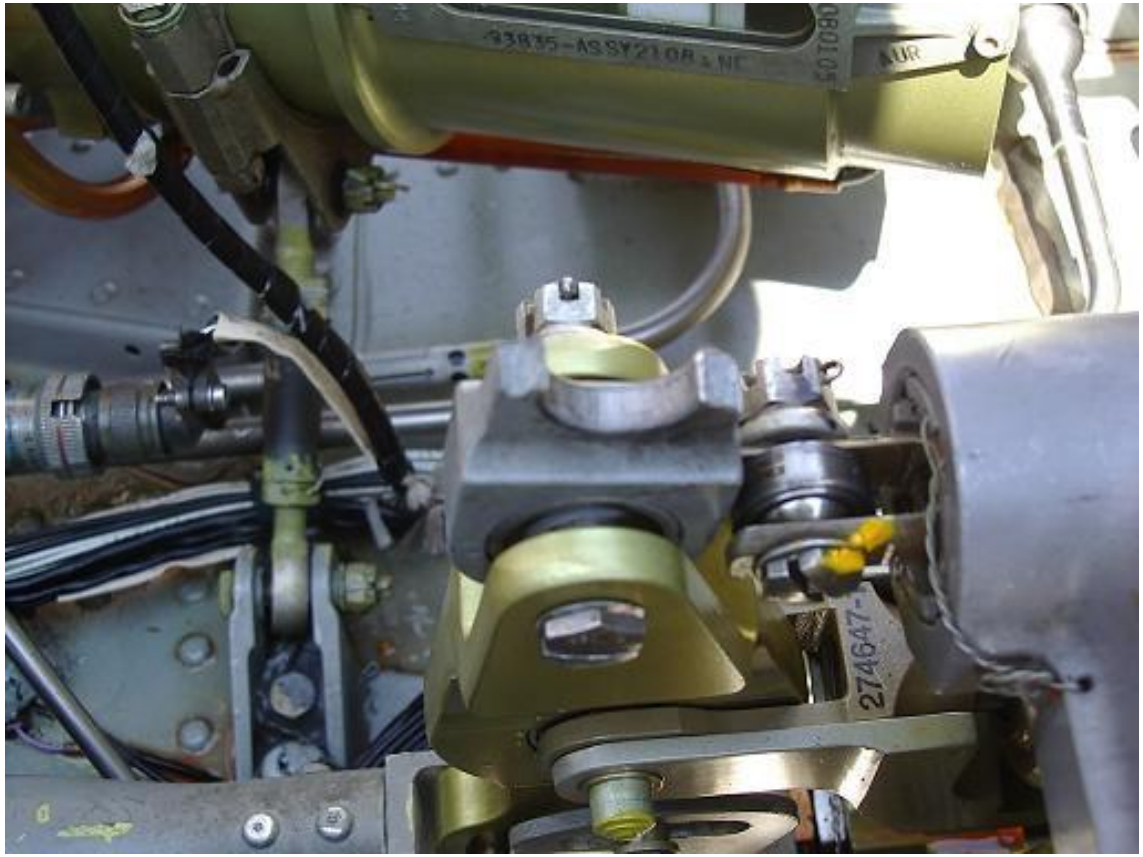
Example of rod end threads of a seized in place rod end. Notice the extent of the corrosion and pitting

H-47 FRIES Bar Support Rod Corrosion

- Result – The rest of the story
- Aircraft were restricted until support rods were replaced
- All support rods have been replaced
- The old rods have been scrapped

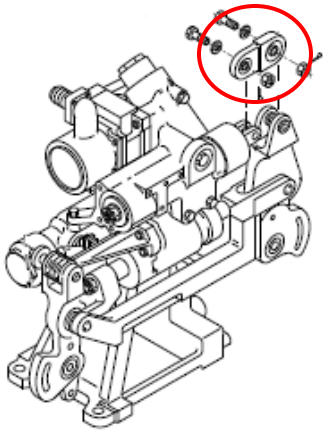
H-60 SAS Link SCC Failure

- **The Problem**
- During ground taxi of a Navy aircraft, it would not turn right despite full right pedal input. Inspection of the aircraft revealed the Stability Augmentation System (SAS) Link, PN 70410-02334-044, on the Yaw Boost Servo was fractured. Analysis determined that the Link failed due to Stress Corrosion Cracking (SCC), and indicated the material to be 7075-T6 Temper.

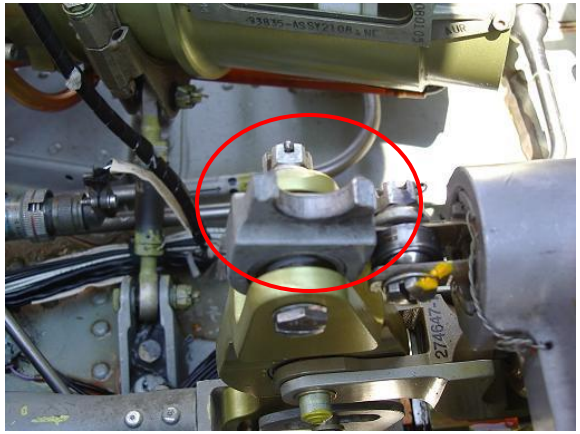


H-60 SAS Link

Problem: **HS-11 reported that during preflight flight control checks, pilot noticed a thump. Pilot continued with preflight checks and noted that all flight controls felt normal and that the anomaly did not return. During ground taxi aircraft would not turn right despite full right pedal input. The aircraft was shutdown at which time the SAS Link, P/N 70410-02334-044, on Yaw Boost Servo, P/N 70410-22910-045, was found fractured.**



Cause: **Lab analysis determined that the link failed due to stress corrosion cracking (SCC) through its cross section. Subsequent to this failure, the link further fractured due to overload. Hardness and conductivity testing indicate a –T6 temper condition which has poor resistance to SCC. Newer SAS Links (-045) are manufactured in the –T73 temper condition which is less susceptible to SCC. However, drawing for older SAS Links (-044) allows manufacture in the T-6 temper condition. SAS Link is used on Yaw and Collective Boost Servo Assemblies (P/N 70410-22910-045) and Pitch and Roll Trim Assemblies (P/Ns 70410-22760-050/-051/-053).**



Risk Assessment: **HRI = 12. Medium Safety Risk**

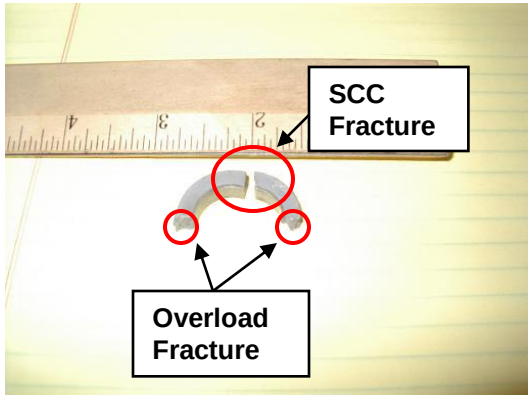
- **Severity: Catastrophic (1).**
- **Frequency: Improbable (E).**

Required Action: **Bulletin for one-time inspection:**

- **Inspect for and remove all -044 SAS Links .**
- **Inspection to be conducted either visually if link p/n is legible or via eddy current conductivity testing if p/n is not legible.**

Compliance time: **NLT next 56 Day Special**

Application: **All Naval H-60 aircraft**



Supply Data:

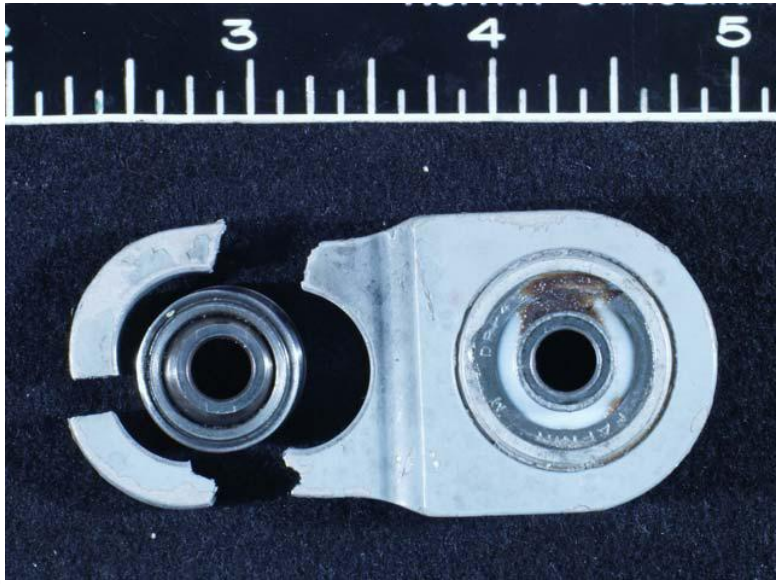
- **Bulletin is logistically supportable.**
- **157 SAS Link Assemblies, P/N 70410-02334-045, on hand.**

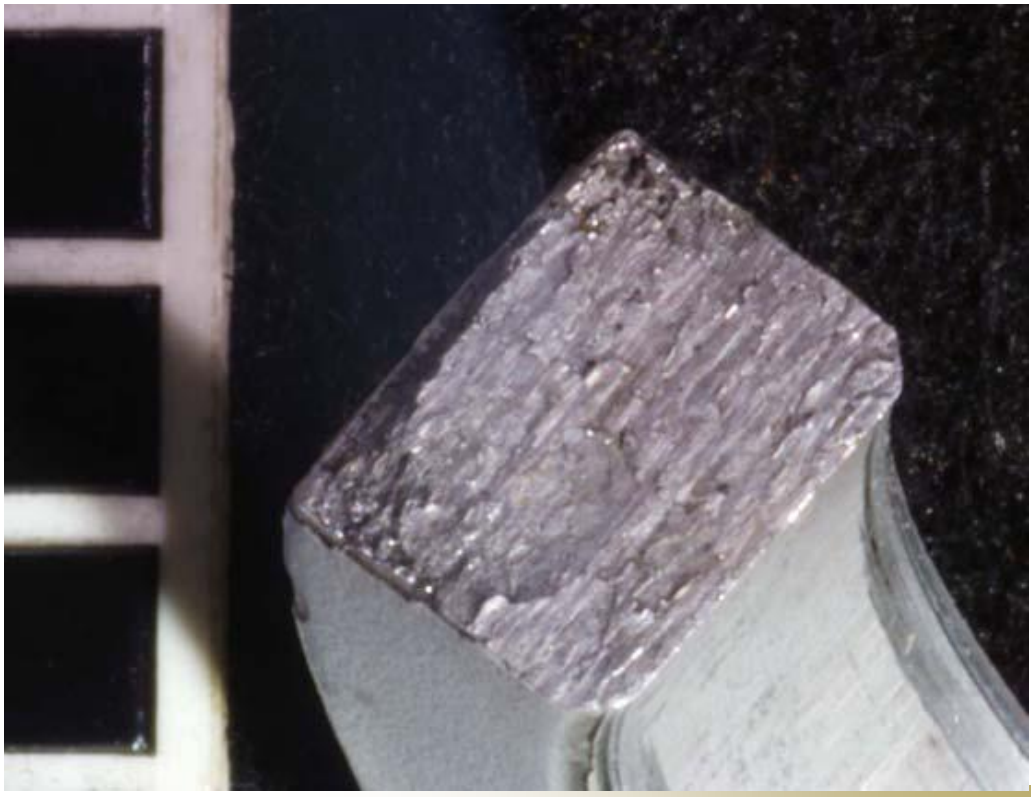
Follow-On Action:

- **Ensure all SAS Link Assemblies, P/N 70410-02334-044, are purged from supply system.**
- **Ensure references to SAS Link Assembly, P/N 70410-02334-044, are removed from applicable manuals.**

H-60 SAS Link SCC Failure

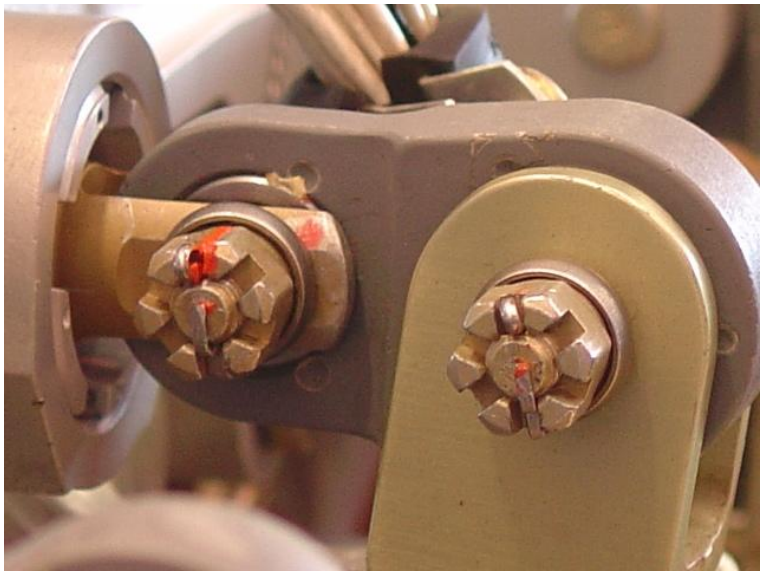
- **The Investigation**
- Drawing review – the link was not to print
  - 7075-T651 versus 7075-T73
  - Press fit versus adhesive and staked
- Structural Analysis
- Failure Analysis
- Risk Analysis





H-60 SAS Link SCC Failure

- **The Resolution**
- Issue a message H060-10-ASAM-04
- Inspect all subject links for evidence of corrosion
- Conductivity check to determine alloy
- Touch up and apply CPC MIL-C-81309 Type II
- Ongoing inspections of T6 links



H-60 SAS Link SCC Failure

- The Outcome
- As of 13 Jan, 1052 aircraft, 3165 links inspected
- 999 links failed (T6)
- 362 Aircraft with new links

Conclusion

- Introduction
- H-47 FRIES Bar Support Rod Corrosion
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