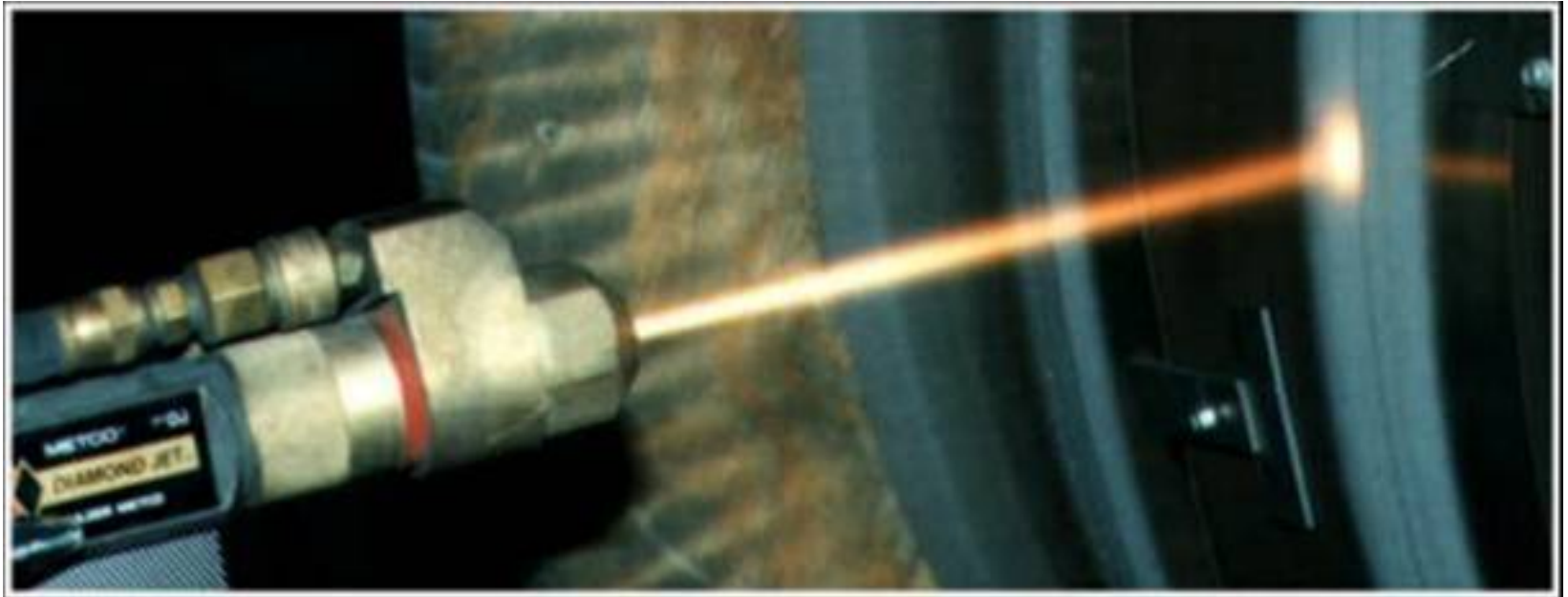


Hard Chrome Alternatives for Hydraulic Components



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Hard Chrome Alternatives for Hydraulic Components

- Program established to assist Oklahoma City Air logistics Center Airborne Accessories Directorate Avionics and Accessories Division (448 ACSG/ENWF, formerly OC-ALC/LGERC) in development and implementation of replacement, repair, and overhaul procedures for hydraulic actuators across multiple weapon systems.



Hard Chrome Alternatives for Hydraulic Components

- Phase 1 – TO and Drawing Review, Database Development, Test Requirement Development
- Phase 2 – Delta-Qualification and Service Testing
- Phase 3 – Data Evaluation
- Phase 4 - Implementation



Hard Chrome Alternatives for Hydraulic Components

- Phase 1 – TO and Drawing Review, Database Development, Test Requirement Development
 - 100% Complete
 - 124 Air Force Technical Orders Reviewed.
 - 729 Engineering Drawings Reviewed.
 - 276 Chrome plated parts and 195 potentially chrome plated parts have been identified



Hard Chrome Alternatives for Hydraulic Components

- Phase 2 – Delta-Qualification and Service Testing
 - Delta-Qualification Testing
 - Flight Control Actuators
 - 87 distinct part numbers
 - 10 estimated to require delta-qualification
 - Utility Actuators
 - 73 distinct part numbers
 - 10 estimated to require delta-qualification
 - Snubbers/Other
 - 12 distinct part numbers
 - 3 estimated to require delta-qualification



Hard Chrome Alternatives for Hydraulic Components

- Rig Testing
 - Completed
 - C-130 rudder actuator
 - C-130 ramp cylinder
 - KC-135 main landing gear actuator
 - KC-135 aileron snubber
 - A-10 aileron actuator
 - B-1 horizontal stab actuator
 - T-38 aileron actuator (testing completed, report in review)
 - In progress
 - F-15 Pitch/Roll Channel Assembly (PRCA)
 - KC-135 Ruddevator (additional seal options)



Hard Chrome Alternatives for Hydraulic Components

- Service Testing
 - In preparation / progress
 - C/KC-135
 - C-130
 - Test plan approved through AMC, SPOs
 - Single test plan for both platforms
 - Two year plan, with mid term option to terminate
 - In planning / negotiation with SPOs, using commands
 - A-10
 - T-38



Hard Chrome Alternatives for Hydraulic Components

- Service Testing (cont)
 - C/KC-135 Service Test to include
 - Snubbers (2 units)
 - Main Landing Gear Actuator (2 units)
 - Main Landing Gear Door Actuator (2 units)
 - Ruddevator Actuator (2 units)
 - Installation planned for Feb 06 at Grand Forks and MacDill AFBs



Hard Chrome Alternatives for Hydraulic Components

- C/KC-135 Aileron Snubber

- Endurance Testing Results

- Actuator C, with O-ring and back-ups, completed 21,200 cycles with zero leakage
 - Actuator D, with VL Seal (S), completed 21,200 cycles with 8 total drops of fluid.
 - This piston rod had small circumferential scratch at test completion.



Hard Chrome Alternatives for Hydraulic Components

- **C/KC-135 Main Landing Gear Actuator**
 - Used to extend and retract the C/KC-135 MLG
 - Rig test included 20,000 cycles, high and low temp



Hard Chrome Alternatives for Hydraulic Components

- C/KC-135 Main Landing Gear Door Actuator
 - Used to open and close the C/KC-135 MLG Door
 - Similarity arguments in lieu of rig testing



Hard Chrome Alternatives for Hydraulic Components

- Service Testing (cont)
 - C-130 Service Test to include:
 - Rudder Actuator (1 unit)
 - Aileron Actuator (1 unit)
 - Elevator Actuator (2 units)
 - Ramp Actuator (2 units)
 - Aft Cargo Door Actuator (2 units)
 - Components of these actuators are being coating and finished.
 - Assembly into actuators planned for Feb/Mar 06
 - Installation planned for Mar 06 at Little Rock AFB and Delaware ANG.



Hard Chrome Alternatives for Hydraulic Components

- C-130 Rudder Cylinder in Cold Test
 - Early leakage determined to be due to gland OD seals
 - Similarity arguments applied to aileron and elevator actuators in lieu of rig testing



Hard Chrome Alternatives for Hydraulic Components

- C-130 Ramp Actuator
 - Used to operate the C-130 Ramp Door
 - Rig test included 20,000 cycles, high and low temp
 - Similarity argument applied to aft cargo door in lieu of rig testing



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Hard Chrome Alternatives for Hydraulic Components

- B-1 Horizontal Stabilizer
 - Drives horizontal stab surfaces for pitch and roll control
 - USAF contract to Boeing



Hard Chrome Alternatives for Hydraulic Components

- B-1 Horizontal Stabilizer
 - Coating
 - Forward Piston coated by Southwest United Industries
 - Aft Piston coated by PTI



Hard Chrome Alternatives for Hydraulic Components

- B-1 Horizontal Stabilizer
 - Rig Testing
 - Performed by Boeing
 - Endurance – 750,000 (approx 1/2 aircraft life)
 - No unacceptable leakage observed
 - Service Tests - None
 - Similarity Arguments
 - Other B-1 flight control actuators
 - Drawing updates completed
 - TO and stocklist updates in progress



Hard Chrome Alternatives for Hydraulic Components

- B-1 Pitch/Roll SCAS
 - Provides pitch and roll input to mixers and on to horizontal stab surfaces for added stability and for autoflight
- USAF contract to Boeing
- Simplified endurance scan to qualify
- Test in progress



Hard Chrome Alternatives for Hydraulic Components

- Phase 4 – Implementation
 - B-1 horizontal stab drawings updated, TOs under review by 448 ACSG/ENWF (formerly OC-ALC/LGERC) to prepare for implementation at overhaul
 - Component repair drawings in preparation for other projects (ARINC and 448 ACSG/ENWF)
 - Implementation strategy under discussion with AF internal Technical Review Boards (TRBs), OEMs, SPOs (e.g., configuration issues, part numbers, etc.)



Hard Chrome Alternatives for Hydraulic Components

- Summary
 - 1 Actuator (B-1 Horizontal Stab) has completed qualification testing and is ready for implementation.
 - 6 Actuators (C/KC-135 Aileron Snubber, A-10 Aileron, C/KC-135 MLG, C-130 Rudder Booster, T-38 Aileron and C-130 Ramp Cylinder) have successfully completed rig testing.
 - 4 C/KC-135 Actuators (MLG, MLG Door, Aileron Snubber, Ruddevator) are ready for installation on the C/KC-135 for service testing.
 - 5 C-130 Actuators (Ramp Cylinder, Aft Cargo Door Cylinder, Elevator Booster, Aileron Booster, and Rudder Booster) being prepared for installation on the C-130 for service testing.
 - 2 Actuators (KC-135 Ruddevator, F-15 PRCA) are on contract for rig testing
 - Numerous additional actuators will be considered for similarity pending successful completion of rig and service testing described above.



Hard Chrome Alternatives for Hydraulic Components

- Questions?

