Oil Analysis of Army Aviation Systems

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Purpose of Briefing

- Provide results of AMRDEC Aviation Engineering Directorate (AED) airworthiness-based review of existing Army Oil Analysis Program (AOAP) - directed component teardown data.
- Identify current and potential benefits of oil analysis.
- Recommend a Path Forward reflecting coordinated position between AMCOM, AED, LOGSA AOAP Program Manager, and Program Executive Office - Aviation.
AOAP for Airworthiness:

- Based on a review by AED of the limited data available, oil analysis techniques used by AOAP has limited use as an airworthiness condition monitoring tool.
  - Primarily caused by a lack of correlation of AOAP oil analysis criteria to actual component condition as determined through component teardowns.
  - Data reviewed was based on limited teardown analysis from 7+ years ago. Components removed as a result of oil analysis recommendations have not been evaluated since that time.
  - Criteria currently used may result in unnecessary removal of components and unwarranted maintenance efforts.
- The available data is insufficient to conclude that no airworthiness (safety) issue will exist if oil analysis is terminated.
  - Requires a comprehensive review of all failure modes and effects for all components currently being monitored by AOAP.
AOAP for operational readiness and economy:

- Current oil analysis techniques used by AOAP are effective at determining lubricant physical properties and cleanliness.
  - Provides the basis for “on condition” oil changes when warranted and extends the life of components.
  - AMSAA verified UAH study conclusions that showed positive payback of ~$5M/yr when oil was sampled and moved to “on condition” from regular change intervals for Aviation Systems.
- Use of available oil analysis equipment and techniques in industry may provide a benefit to AOAP.
- Maintenance personnel from 160th SOAR participating in AOAP working group argued in support of continuing AOAP citing increased user confidence in safe operations and improved maintenance planning.
1. **DETERMINE IF OIL ANALYSIS IS REQUIRED TO MAINTAIN AIRWORTHINESS OF AIRCRAFT SYSTEMS**

   1) AED to determine if oil analysis provides an airworthiness benefit.
   - Review failure modes and effects for all Aviation System oil-wetted components, hydraulic systems, and grease-lubricated components.
   - Based upon results of above, determine if oil analysis is required to identify an impending failure of one of the above components.
   - Revise oil analysis criteria used by AOAP to insure removals are warranted from an airworthiness perspective.
   - Estimate one-year effort to address all Army Aviation Systems.

   2) Immediately stop issuing recommendations for component removals without AED concurrence.
   - All AOAP lab recommendations directing removal of components shall require review and coordination from AED prior to transmittal to field units.
   - Allows AED to apply available analysis results and lessons learned to recommendation development process.
   - Provides an immediate reduction in premature/false removals and will provide data needed support the failure modes and effects review effort.
2. **REVISE AOAP CRITERIA AND GUIDELINES TO MAXIMIZE THE BENEFIT TO OPERATIONAL READINESS AND ECONOMY OF OPERATION FOR AIRCRAFT SYSTEMS**

Establish a Collaborative Alliance between AMCOM; Aviation Engineering Directorate; PEO Aviation; the Program Manager, AOAP; and the Field user.

- Conduct studies to quantify benefits of oil analysis in terms of operational readiness and economy of operation.
- Survey other services and FMS users on their oil analysis practices and experience.
- Survey industry on advances in chip detection, particle counting technology and debris monitoring.
- Provide communication channels to identify issues and to coordinate efforts.
- Determine optimal sampling intervals.
- Revise oil analysis criteria used by AOAP to insure removals are warranted from an operational readiness, safety and economy of operation perspective.
- Jointly execute the overhaul/restructure of AOAP and revise AOAP/JOAP Regulations and Doctrine applicable to the Aviation Community.
- Modeled after successful AOAP/TACOM Collaborative Alliance.
Time Line

1\textsuperscript{st} Qtr:
• AED commence review of failure modes and effects for all applicable components.
• Establish Collaborative Alliance With AMCOM, AED PEO AVN and LOGSA.
• AOAP direct Field Labs to coordinate recommendations with AED.
• Conduct Joint Oil Analysis Program CG/EG meeting with other services.

2\textsuperscript{nd} – 3\textsuperscript{rd} Qtr:
• AED continue review of failure modes and effects for all applicable components.
• Host aeronautical world-wide conference with members of the Collaborative alliance, the Army Safety Center and MACOMS aeronautical reps.

4\textsuperscript{th} Qtr:
• Finalize system enrollments and/or removals, sampling interval determinations, and AOAP lab analysis criteria.
• Update all applicable aeronautical regulations.