

Automated Debris Analysis for At-Line Maintainers



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Automated Debris Analysis for At-Line Maintainers



Problem

- Correct and rapid alloy identification of debris from oil wetted components
 - Traditional methods are visual – highly subjective
 - Alternative is lab analysis – logistics tail (cost & delays) – expeditionary considerations
 - Impacts safety
 - Impacts cost – improper diagnosis, high NEOF rates
- Multiservice application



Rotary & Fixed Wing
(Air Force, Army, NAVAIR, Marines)



Ground Vehicles
(Army, Marines)



Marine Vehicles
(Navy, Coast Guard)



(Turbine Engines, Gearboxes, Transmissions, Diesel Engines)

Ex. \$8.7M potentially addressable from Army Aviation Integrated Priority List

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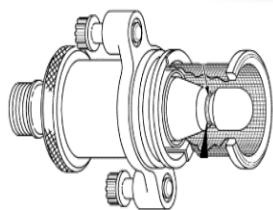
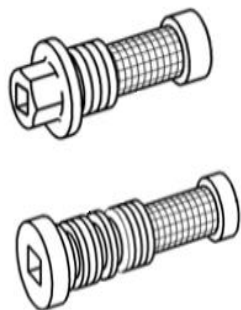
SENSE/CAPTURE

INSPECT

ANALYZE

ACTION

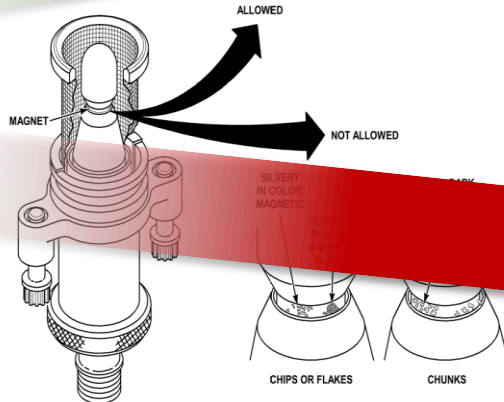
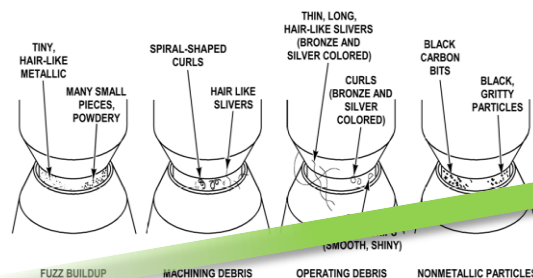
Scavenge
Screens



Chip
Detector



Visual



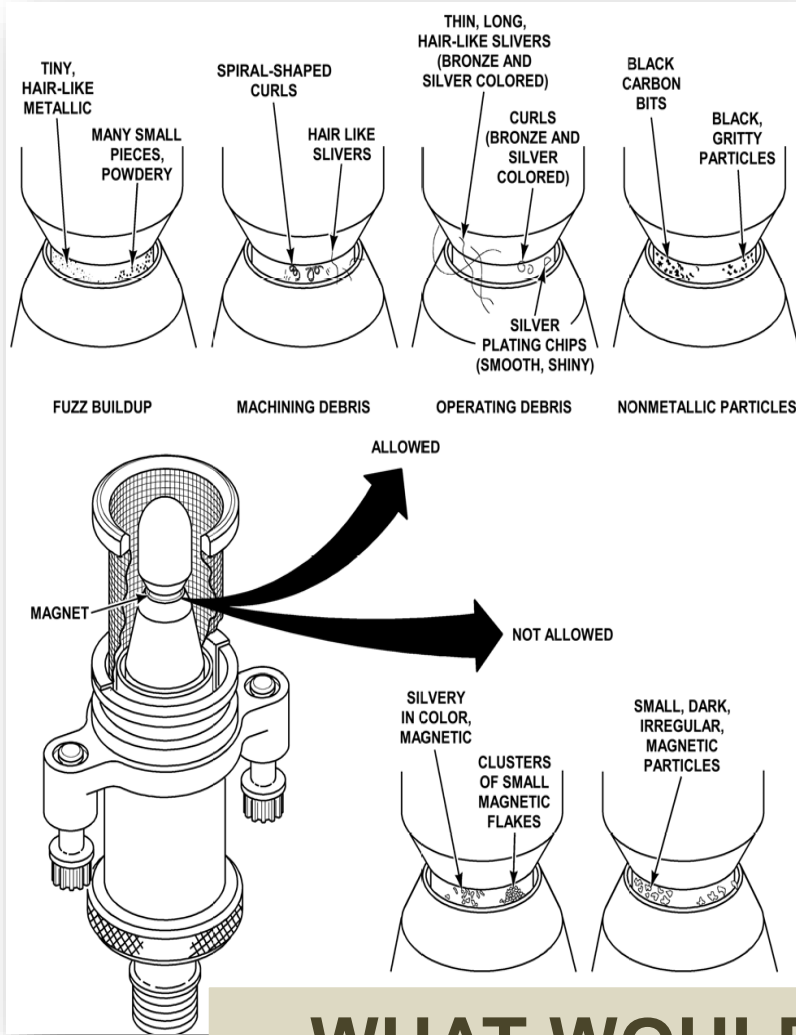
Release for
Service



Remove/Repair
Component

**SUBJECTIVE VISUAL
ANALYSIS**

Automated Debris Analysis for At-Line Maintainers



**WHAT WOULD YOU DECIDE?
GO OR NO GO?**

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Solution

- Deployable, rugged, self-contained instrument for automated analysis of chip detector debris
- Immediate GO/NO-GO equipment assessment and maintenance decisions by At-Line Maintainers
- Automatic analysis of each individual particle determines alloy type & particle size
- Innovative application of laser spectroscopy
- Simple to operate
- Reliable - two level maintenance



CHIP ANALYSIS **ChipCHECK**

Sample ID: 201502c-FACB123456-03262015

FACB	F100-PW-220	F-16	SN 123456
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Results:

MATERIAL	# IDENTIFIED	TOTAL AREA (µm)	ALARM
M50	4	3,465,878	ALARM
M50 NiL	2	2,582,789	ALARM
Ti-6Al-4V	3	1,345,014	
Not in Library	2	975,987	
TOTALS	11	8,360,668	---

Condition Status:

ALARM

Status: Analysis Complete - Awaiting Input -(UNIT ON)- -(UNIT READY)- -(ANALYZING)-

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Benefits

IMPROVE SAFETY

Eliminate risk of launching a damaged asset based on subjective debris analysis

Confirm damage debris to drive appropriate maintenance decisions

DRAMATICALLY REDUCE O&M COSTS

Eliminate NEOF Removals/Overhauls driven by non-critical 'normal' debris

Reliably identify damage events in progress & reduce likelihood of secondary damage

MAXIMIZE AVAILABILITY OF CRITICAL ASSETS

Consistent, analysis-based decisions by at-line maintainers within minutes

Eliminate aircraft status decision based on subjective debris review

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Challenges & Risks

- Changing the status quo
 - Proven technology applied to field environment
 - Move of lab class analyses to at-line
- DoD Community Awareness/Exposure
 - Requires shift in current process
 - Multiple stakeholders
 - Identification of appropriate decision makers
- Risk
 - Resistance to change



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Innovation Status

- TRL/MRL 7 Demonstrated capability with trial activities in an operational environment:
 - USAF: Trials at Shaw AFB & Carswell Field. Demonstrated correlation with SEM-EDX
 - RCAF: Initial units fielded and processing damage debris from CH149 Cormorant. Demonstrated correlation with SEM-EDX
 - US Army: Collaboration with AOAP to address 701D NEOF rates
 - Commercial rotorcraft: Initial unit fielded processing debris from S-92 (engines & gearboxes)
- Probable Applications:

Pratt & Whitney F100



GE T-701 Engine



Cummins VTA-525 /
903 cubic inches



Honeywell AGT 1500c



GE LM2500 Gas Turbine



V16 Alco Diesel Engine



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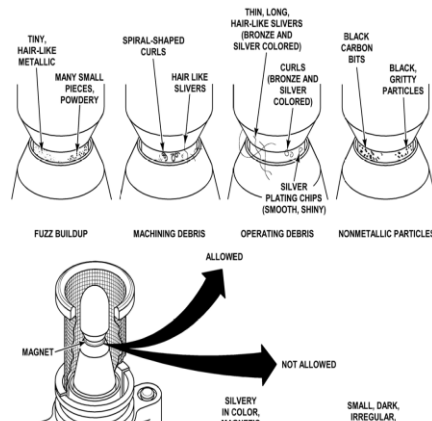
- Obstacles & Competing alternate solutions: Laboratory class equipment (SEM-XRF) / Traditional lab analysis. Resistance to change in process.

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Vision / Final Thoughts

- Integration into DoD maintenance processes
 - Initially supplement current subjective processes
 - Establish GO/NO-GO limits for high value components
 - Document process and limits in appropriate TMs/TOs
- Thoughts to leave with you



**Equip and empower at-line maintainers
to make informed decisions**

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Questions

