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FOD Prevention Products

THE FOD PREVENTION GUIDE

The “Forgotten” Foreign Object Debris

HELLO AND WELCOME!

I'm Torben Biehl Jensen, the founder of TheCanKey. With over 33 years in general aviation, my journey has taken me across Denmark, Norway, and beyond, working on everything from sports planes to small airliners. Holding European EASA PART–66 B1, B2, and C licenses, as well as a USA FAA A&P–I license, I've gained extensive experience in aircraft maintenance, quality auditing, and service shop management.

At TheCanKey, we are committed to the highest industry standards, ensuring reliability for professionals like you. But beyond that, our true mission is education and prevention. Throughout my career as a Line and Base manager, I've seen firsthand the importance of knowledge and attention to detail in avoiding costly mistakes. But FOD prevention is not just about reducing costs – it's about ensuring the safety and performance of aircraft engines. My goal is to share insights and expertise that help professionals stay informed and proactive.

I look forward to this journey of knowledge and prevention together.

Best regard,

Torben Biehl Jensen

FOD (Foreign Object Damage) is an important safety and quality control concept in industries such as Aviation, Aerospace, Manufacturing, Motorsport, Shipping, and the Military, as well as other environments where small debris, loose objects, or wildlife have the potential to cause:

- Damage to manufactured equipment
- Injury to humans
- Production or maintenance delays
- Safety violations

The acronym "FOD" (or F.O.D.) has two interrelated meanings, depending on the context:

- Foreign Object Debris
- Foreign Object Damage

Efforts to prevent Foreign Object Damage are collectively referred to as FOD Prevention Programs or FOE (Foreign Object Elimination).

FOREIGN OBJECT DEBRIS
THE USUAL "SUSPECTS"

Foreign Object Debris refers to any objects, particles, substances, or debris that are out of place and could pose a hazard to aircraft, equipment, cargo, personnel, etc. Examples of foreign object debris include:

- Tools, parts and loose hardware
- Building materials
- Paper, paper clips, pens, coins and badges
- Fragments of broken pavement
- Trash, food wrappers and beverage containers
- Rocks, sand and loose vegetation
- Baggage tags and pieces of luggage
- Hats, rags and gloves
- Birds, wildlife and stray animals
- Volcanic ash

But FOD are also the less visible parts – small yet impacting safety and effectiveness of engine operation.

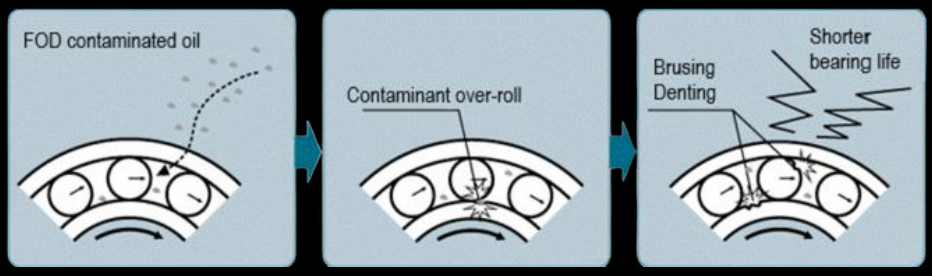
FOD refers to any material that is not part of the engine, such as dust and debris from maintenance work and oil servicing

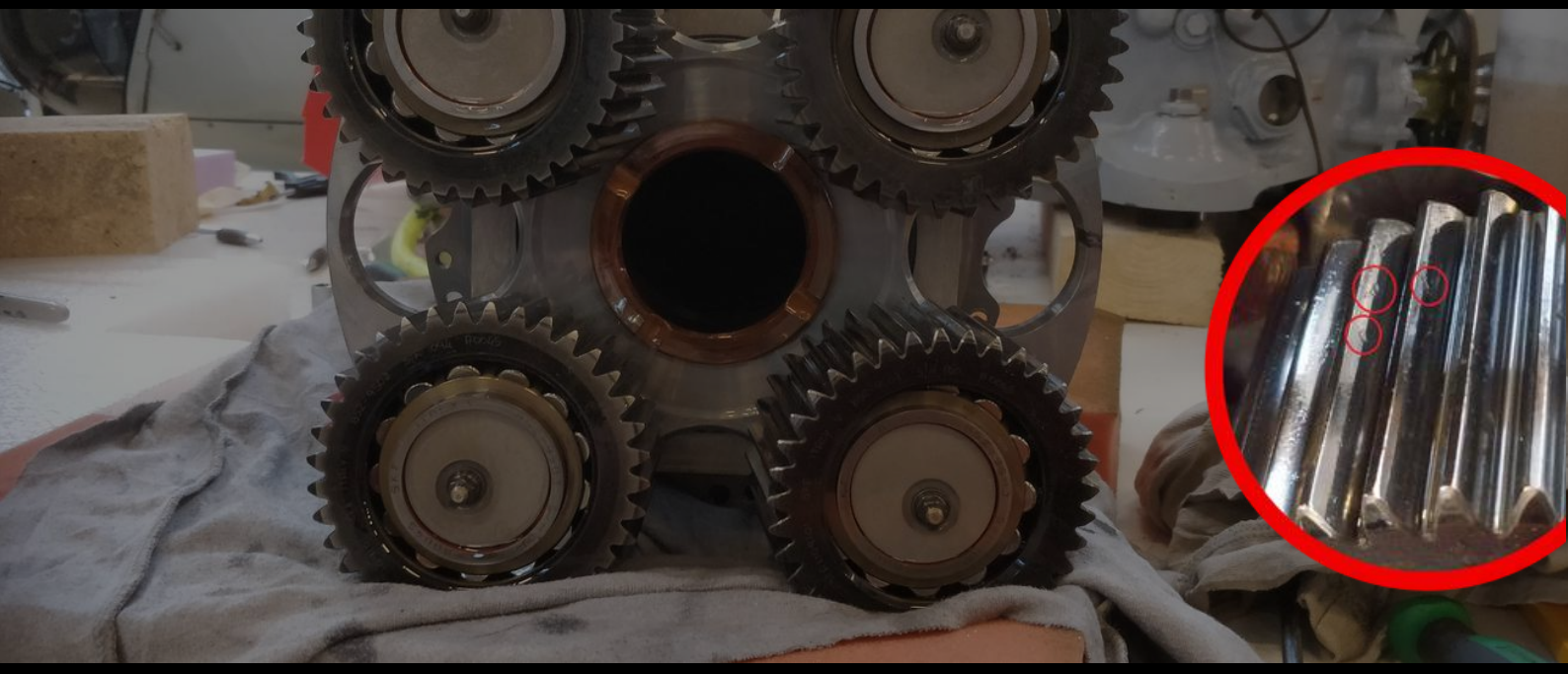
Engine oil contamination with Foreign Object Debris from improper oil can opening and oil handling are critical aspects of FOD risk

“Using the wrong tools to open turbine oil cans can introduce metal debris into the oil system, leading to engine damage. To show how much contamination occurs, we ran a simple test—punching 16 holes in an oil can with a screwdriver. The amount of debris? Shocking! Let’s take a look.

WHY FOD PREVENTION IN OIL IS SO CRITICAL

- The turbine engine is susceptible to Foreign Object Debris (FOD) in the oil system.
- FOD in oil systems can create:
  - Premature wear
  - Over-roll damage to gears and bearings
  - False chip warnings, and eventually real chip warnings and biased oil samples
- In the worst case, engine failure.
- The presence of solid particles (FOD) in oil reduces its lubricating properties and leads to wear.
- Contamination by particles as small as 5 µm can affect the reliability and safety of the lubrication system. Particles larger than that are even more damaging.
- Bearings and gear failure often begin with the over-roll of a solid metal particle, which can lead to gearbox failure if undetected or ignored.





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BEARING DAMAGE PROGRESSION

IMPROPER OIL CAN OPENING

Traditional tools like screwdrivers and pliers create metal shavings or debris.

DEBRIS FALLS INTO THE OIL CAN

Cast-off metal particles from the can lid drop directly into the oil.

CONTAMINATED OIL IS POURED INTO THE ENGINE

FOD-laden oil is transferred into the turbine system.

FOD ENTERS THE BEARING SYSTEM

Debris circulates within the engine oil, reaching gear and bearing surfaces.

BEARING DAMAGE PROGRESSION

Dents Form
Debris causes tiny surface indentations.

Stress Concentration Increases
Rolling elements repeatedly pass over dents, worsening stress.

Micro Cracks Develop
The stressed metal starts forming micro-cracks.

Spalling Occurs
Surface layers break off, leading to full bearing failure.

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“Oil mishandling is the most common factor leading to contamination in turbine oils.

- Dirty funnels, dirty top-up containers, dirty fill nozzles in bulk storage, dirty lube storage places, galvanized top-up containers and other non-dedicated equipment used for oil storage.
- Dirty oil storage places like a line station van or aircraft baggage compartment are also a source of contamination.
- Galvanized or chromed top-up containers if the coating is flaking off into the oil.
- Non-dedicated equipment can easily be a source of contamination.

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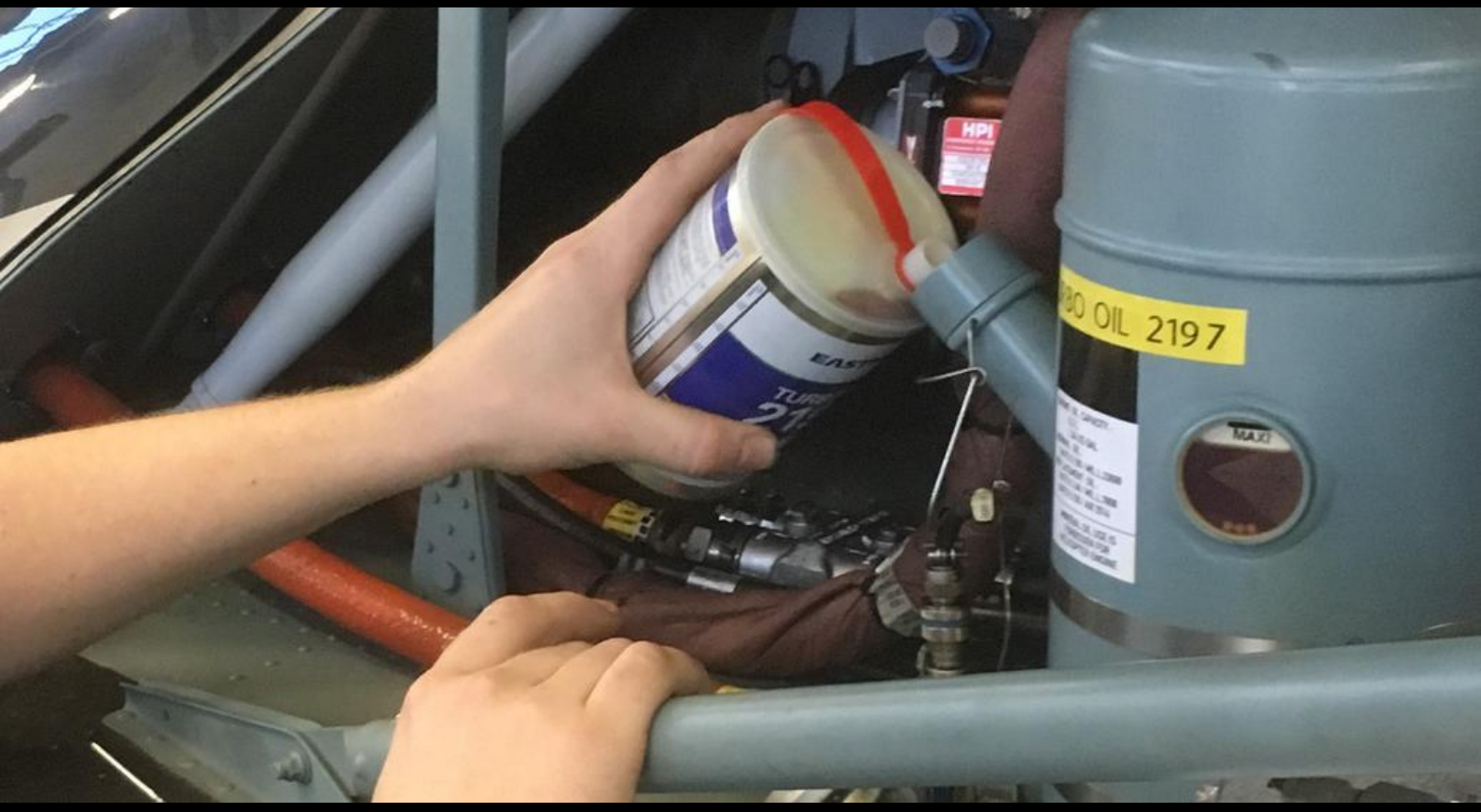
OIL SPILLING CAN LEAD TO EXPENSIVE CONFUSIONS

Are you chasing an engine oil leak or has someone just spilled the oil?

Often engine leaks are suspected while it is “only” oil spilling when topping up
It is time and money spent unnecessarily on removing cowlings, cleaning the engine, and running it to look for leaks – just to find, there are no leaks
Most of the time improper tools and fillers are used resulting in oil spills both outside the cowling and inside the engine compartment. Often oil is even spilled over the engine itself. One flight later the oil is everywhere



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ARE FREQUENT CHIP WARNINGS LEADING YOU TO ZAPPING AND IGNORING THEM ?

- In helicopters, the most critical component is the Main Gearbox (MGB). The MGB has its own lubrication system that includes chip detectors to detect and early warn of the wear and tear of internal components. However, they collect any magnetic debris, also oil can cast off material.
- Chips detectors are connected to cockpit warning lights and may have a burn-off capability. Pilots will be able to zap and clear the warning during flight.
- Oil filling is done directly into the MGB. Some oil filler necks might have a coarse filter, but nothing that prevents small FOD contamination. The oil introduced to the MGB is out of the can and thus perceived to be clean.
- When mechanics use improper tools, e.g. screwdrivers, and pliers, to open turbine oil cans metal debris cast-off is created and falls into the oil.
- Pilots can get lulled to sleep by “non-wear”/ false chip warnings created by oil can material cast-off. When a “real wear” chip light warning comes on, it is ignored or zapped – But it might be the only warning you get before disaster.

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FOD PREVENTION IS KEY!

Damage caused by FOD in the oil system leads to repairs, that can involve total disassembly of an engine and inspecting components for signs of damage This can be a time-consuming and very costly process due to the highly specialized nature of turbine engine repair works

Debris enters the oil system

FOD circulates within the engine

Damage occurs

Chip warning triggers

Flight delay, safety risks, & costly repairs

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Prevention can be easy and highly effective!

Pay extra attention to the job. FOD in turbine oil usually goes unnoticed by the handler.

Make sure to use the correct oil type and brand. Mixing of turbine oils is not allowed.

Keep the oil cans and funnels clean and dry, away from sources of dust and debris.

Keep the oil cans covered when not in use. This can be done by using TheCanKey DustCaps or FunnelCaps on the oil cans. Always keep FunnelCaps installed and sealed, even on empty cans.

Clean and inspect the oil cans and funnels before use. This includes wiping down the cans and funnels with a clean, dry cloth to remove any dust or debris

Keep the oil cans and funnels organized and properly labelled. This can include keeping the cans and funnels in designated areas and labelling them with their contents and expiration dates.

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Show location and operation of oil filler points on engines and gearboxes.

Use proper handling techniques. This includes using protective gloves and glasses, and clean tools when handling oil cans and funnel.

Always open the oil can with the right tools like the certified FOD-free TheCanKey oil can opener.

Use only approved and proper oil fillers.

Educate mechanics and pilots.

"The FOD Bag frees your hands to work!

Large FOD logo as a reminder for awareness.

Adjustable clip-on belt for hands-free convenience.

Two compartments for FOD collection.

Bright red colour for visibility.

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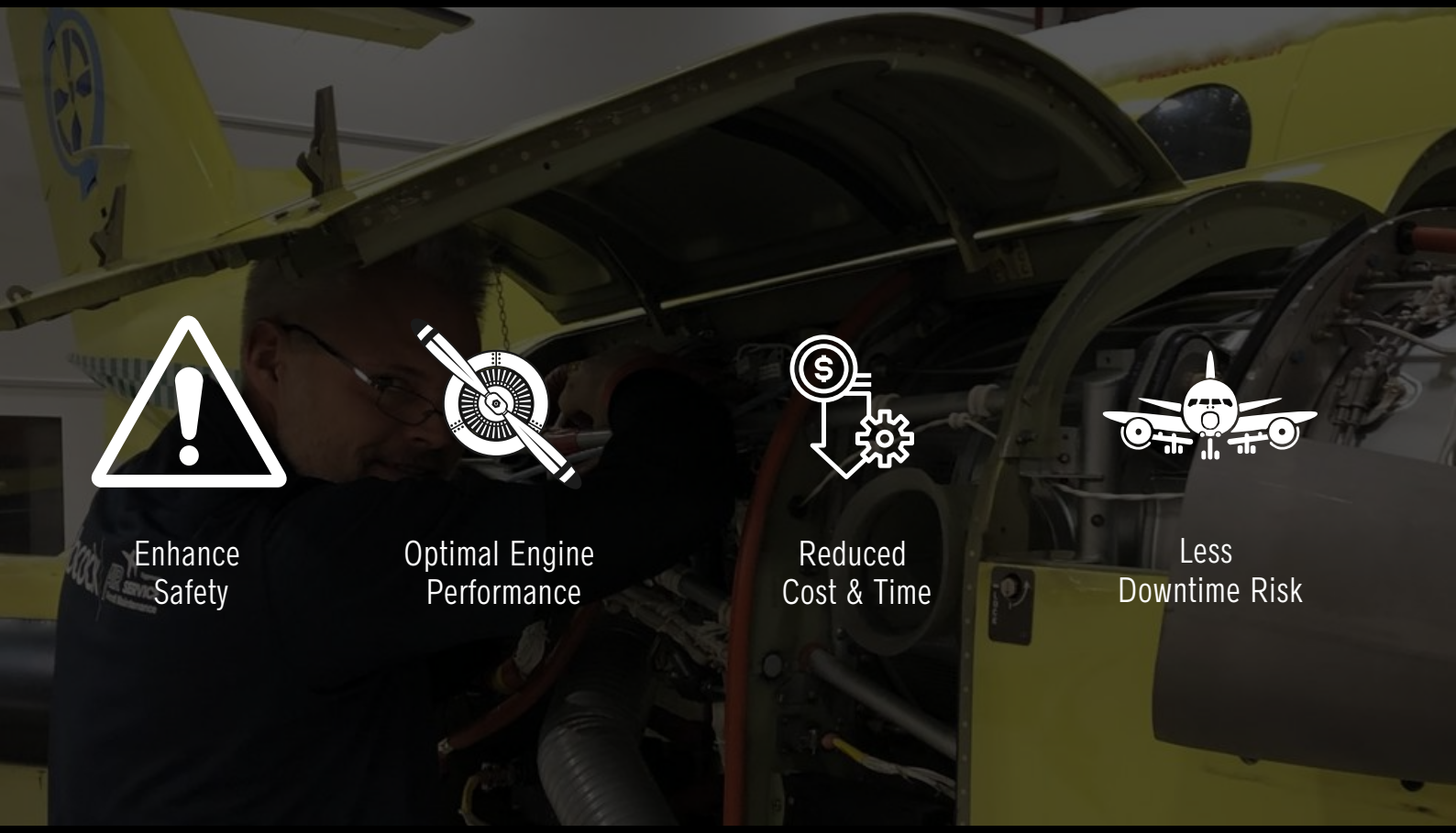
FOD PREVENTION PAYS OFF

- Choosing TheCanKey FOD free turbine oil can opener has proven to be a major scoop for the Norwegian Air-Ambulance operator Avincis Aviation Norway AS.
- Operating 10 Air-Ambulance equipped Textron Aviation Beechcraft King Air 250 since July 2019, the once factory-new King Airs have now accumulated a total of 75.000 engine hours.
- Avincis maintenance team, on 7 line stations and 1 base maintenance facility, has consistently used TheCanKey FOD free turbine oil can opener.
- During those many engine hours, the operation has been FOD-free, except for only two chip warning events. The two chip warning events both turned out to be hair-like metal debris consistent with shavings from the use of a metal can opener. Most likely used by a third-party maintainer during peak periods.



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“FOD prevention an important part in the sustainability agenda.

Use TheCanKey FunnelCaps to avoid:

- Spilling oil.
- Getting oil on your hands or clothes.
- Throwing away leftover oil.
- FOD in open oil cans.
- Mixing oils.
- Environmental fines.

Seaplanes in the water are slippery and in constantly motion by wind and waves. It is crucial that the oil filler equipment enables to perform the oil filling task without spilling oil into environment, while not worrying also about your own safety

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MANAGEMENT PLAYS CRITICAL ROLE IN FOD PREVENTION

Why do old habits die so hard? We are creatures of habit, and changing our routine takes an open mind. Management plays a critical role in ensuring that turbine engine oil servicing is performed in a way that prevents FOD and promotes personal safety. But there are simple steps that can be taken by management to ensure that oil servicing is performed in a FOD free, safe and effective way.

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SIMPLE STEPS TO IMPLEMENT CHANGE

IN YOUR OWN AND YOUR TEAM´S WORK ROUTINE

1.

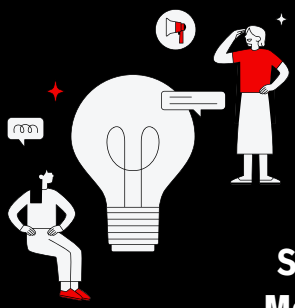
Create an Action Plan:

Encourage regular training for all employees involved in oil servicing, including training on proper procedures for servicing and maintaining turbine engines, and on FOD prevention and identification.

2.

Build Knowledge on FOD Risks:

Promote a culture of safety and cleanliness throughout the organization, with a particular focus on preventing FOD. This should include regular cleaning and maintenance of oil servicing equipment and regular reminders to employees of the importance of FOD prevention and safety during oil servicing.



3.

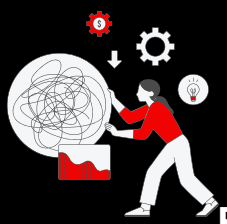
Set Procedures & Monitor Progress:

Establish clear policies and procedures for oil servicing that are in line with industry standards and regulations. These policies and procedures should include guidelines for proper cleaning, inspection and handling of oil servicing equipment.

4.

Simplify Tool Access:

Provide the necessary resources such as proper oil servicing equipment. Ensure new tools are easy to find and use—near aircraft, in toolboxes, etc.



5.

Keep FOD Prevention Current:

Keep the conversation going – make FOD prevention a routine topic. Monitor and improve oil servicing procedures and keep up to date with the latest technologies and best practices in oil servicing. Use TheCanKey FOD-free oil servicing tools to prevent FOD during oil service and enhance personal safety.

6.

Give it Time:

New habits take weeks to form. Be persistent and celebrate small wins.

THECANKEY STORY

Challenging Old Habits Creates Innovation

THE CHALLENGE OF OLD HABITS

For years, aircraft mechanics followed traditional methods, like using screwdrivers to open oil cans–without questioning the potential consequences.

THE DISCOVERY OF THE PROBLEM

Metal debris in the engine was traced back to the oil cans being opened with sharp tools, leading to Foreign Object Damage (FOD).

THE VISION FOR CHANGE

Instead of following the old ways, a new solution was needed. Could a better method of opening oil cans prevent metal debris and engine damage?

THE INVENTION OF THECANKEY

TheCanKey was born: a simple, durable, easy-to-use FOD-free oil can opener designed to eliminate metal debris during oil can opening.

EXPANSION OF SOLUTIONS

Over time, the product line expanded with FunnelCaps for easy oil filling and DustCaps to protect cans from debris, further enhancing maintenance safety.

IMPACT AND BENEFITS

By challenging old habits, mechanics save time, reduce engine failures, and avoid expensive repairs–making maintenance smarter, safer, and more efficient.

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OTHERS TRUST TheCanKey

★★★★★

Stephen Gosling
Sales & Marketing Director at Adams Aviation Supply Co Ltd.

"TheCanKey has proven an ideal way to get the message out that we at Adams Aviation are the Europe-wide source for Exxon Aviation lubricants. We're delighted with TheCanKey's impact and with the reception from customers."

★★★★★

Debi Crouson
Kenmore Crew Leasing,
Inc dba Shepherd Aero

"Great news! TheCanKey is a hit with our jet training and global ferry clients! We would like to place another order with the same logo as before. Thank you so much. We appreciate you!"

and many more...

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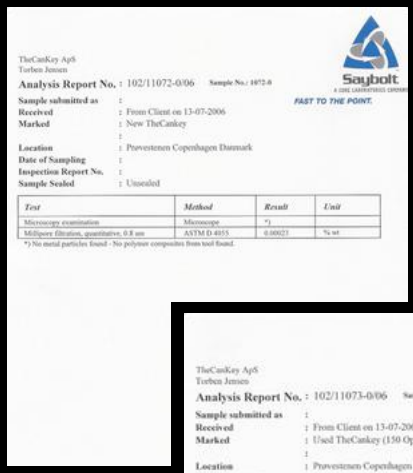
Quality of TheCanKey has been put to the test on deposits in the oil

- New and used TheCanKey have been tested at Saybolt oil labs in Denmark. The tests have confirmed the high quality of TheCanKey.
- The reports show that there is only 0.00023% weight deposited in the oil when opening a can of turbine oil with a new TheCanKey and 0.00032% weight from the used TheCanKey.
- This means that if you measure in grams it is 0.00023 grams or if you use oz. it is 0.00023 oz.
- Finally, a microscopy examination of the deposits shows that there were no metal particles from the turbine oil can itself, or polymer composites from the TheCanKey found in the oil.
- The microscopic amount of weight deposited in the oil comes simply from handling TheCanKey and the turbine oil can.



TheCanKey ApS
Torben Jensen

Saybolt
FAST TO THE POINT.

Analysis Report No. : 102/11072-0/06 Sample No.: 1072-0

Sample submitted as	:
Received	: From Client on 13-07-2006
Marked	: New TheCankey
	:
Location	: Provestenen Copenhagen Danmark
Date of Sampling	:
Inspection Report No.	:
Sample Sealed	: Unsealed

Test	Method	Result	Unit
Microscopy examination	Microscope	*)	
Millipore filtration, quantitative, 0.8 um	ASTM D 4055	0.00023	% wt

*) No metal particles found - No polymer composites from tool found.

TheCanKey ApS
Torben Jensen

Saybolt
FAST TO THE POINT.

Analysis Report No. : 102/11073-0/06 Sample No.: 1073-0

Sample submitted as	:
Received	: From Client on 13-07-2006
Marked	: Used TheCankey (150 Openings)
	:
Location	: Provestenen Copenhagen Danmark
Date of Sampling	:
Inspection Report No.	:
Sample Sealed	: Unsealed

Test	Method	Result	Unit
Microscopy examination	Microscope	*)	
Millipore filtration, quantitative, 0.8 um	ASTM D 4055	0.00032	% wt

*) No metal particles found - No polymer composites from tool found.

Saybolt Danmark A/S 20-07-06

Jan Achmann

APPROVED SIGNATORY

Precision parameters apply in the evaluation of the test specified above. Please also refer to ASTM D3244 (except for analysis of RFG), IP 367 and appendix E of IP standard methods for analysis testing with respect to the utilization of test data to determine conformance specifications.

SAYBOLT DANMARK A/S

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