

AIE (UK) Ltd

Foreign Object Debris (FOD)

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(Document Not Controlled When Printed)
UNRESTRCTED Commercial in Confidence

Objective

- Understand the consequences of FOD
- Provide awareness to the causes of FOD
- Promote active involvement through specific processes & prevention techniques
- Stress good work habits through work disciplines

AS9100 D Standard & FOD



AS9100 Rev D Section 8 requires an organisation to have provisions for the prevention, detection, and removal of foreign objects as mentioned in these sections:

Sec. 8.1- Determining the requirements for the products and services including prevention, detection, and removal of foreign objects

Sec. 8.5.1 Control of Production and Service Provision including the provision for the prevention, detection, and removal of foreign objects;

Sec. 8.5.4 The organisation shall preserve the outputs during production and service provision, to the extent necessary to ensure conformity to requirements including prevention, detection, and removal of foreign objects.

Definition



Foreign Object Debris (FOD)

A substance, debris, or article alien to the component, assembly, system or vehicle that could cause damage

Foreign Object Damage (FOD)

Any damage or incident attributed to a foreign object that can be expressed in physical or economic terms that may or may not degrade the product's required safety and/or performance characteristics

FOD Prevention Areas (FPAs)

The general area where maintenance, manufacturing, modification and production of aircraft / sub-assembly operations are conducted

FPA's



A FOD Prevention Area where manufacturing or modification processes remain open without any potential for FOD entrapment. This includes but is not limited to: Components or assemblies undergoing manufacturing or modification without any closeout activities on the product.

FPA's



A FOD Prevention Area where assembly or modification processes occur. This includes but is not limited to: Components or assemblies undergoing manufacturing or modification in the process of becoming part of a completed aircraft.

FPA's



A FOD Prevention Area where assembly, modification and Flight and Ground Operations require the highest level of preventative measures. The elimination of FOD contamination, entrapment, migration or damage is most critical to safeguard the product.

Examples of FOD

Foreign material comes in many shapes and forms.
It may present itself in the following:

- Broken parts, hand tool, dust, grime, oil, metal shavings, loose nuts, bolts, cotter pins, lock wire remnants, pencil, pen, packing material, rocks, badges, hats, paper clips, rags, trash, paperwork and even wildlife, etc.

Examples of FOD

We should always be aware of and on the look out for FOD or Potential FOD.

Here are some example causes of recognised FOD:

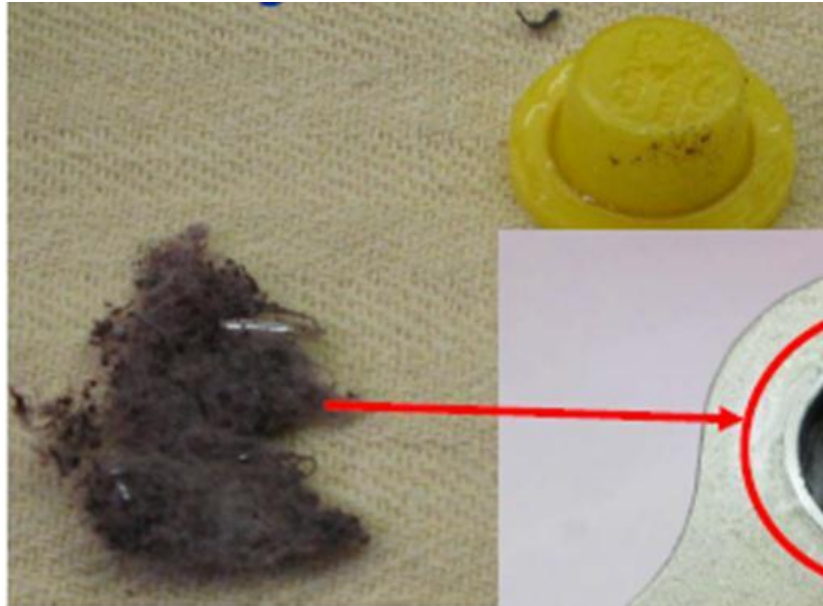
- Unorganized workplace
- Unaccounted for tools or tool details
- Scattered components on the work bench
- Metal chips not cleaned up in the work place
- Food at workspace
- Loose articles carried into the workplace
- Protective covers not installed or improperly installed

Potential consequences



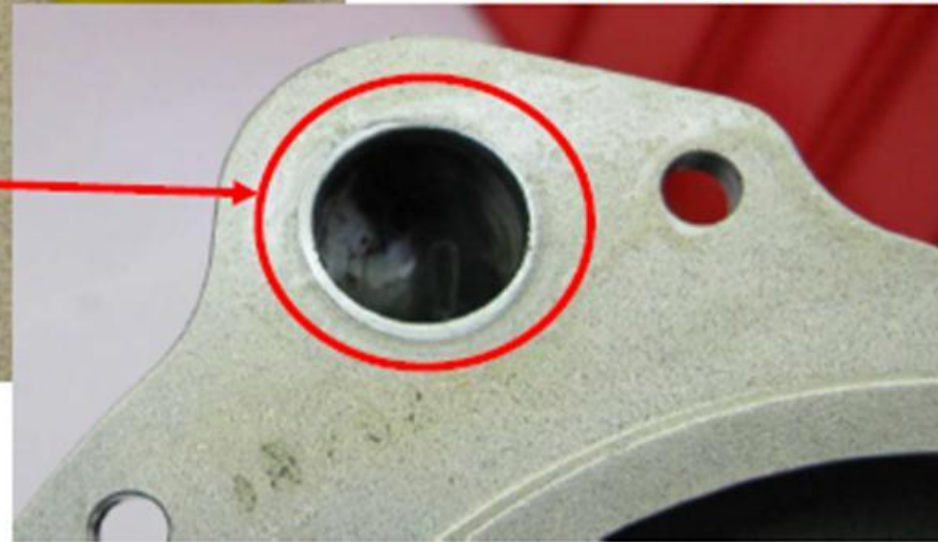
- FOD may cause many failures and damage, but worst of all –it might cause injuries and even loss of human life!
- FOD can also cause damage to the company's finance and reputation.
- It is a fact that foreign objects and/or debris have contributed to jammed flight controls, engine damage, electrical shorts, fluid contamination, control valve failures, fires and other major failure incidents that have resulted in costly material damage, loss of vehicle and of life.

Mfg. Process Debris



Scotch bright

This pump was returned by a customer because of a foreign object.



Assy. Process Debris

- Fabric found in Sealed Assembly
- Product leaked during acceptance testing
- Leak was caused by a nylon fibre contaminant preventing seal integrity at a manifold interface
- The nylon fibre came from clothing or a lab coat



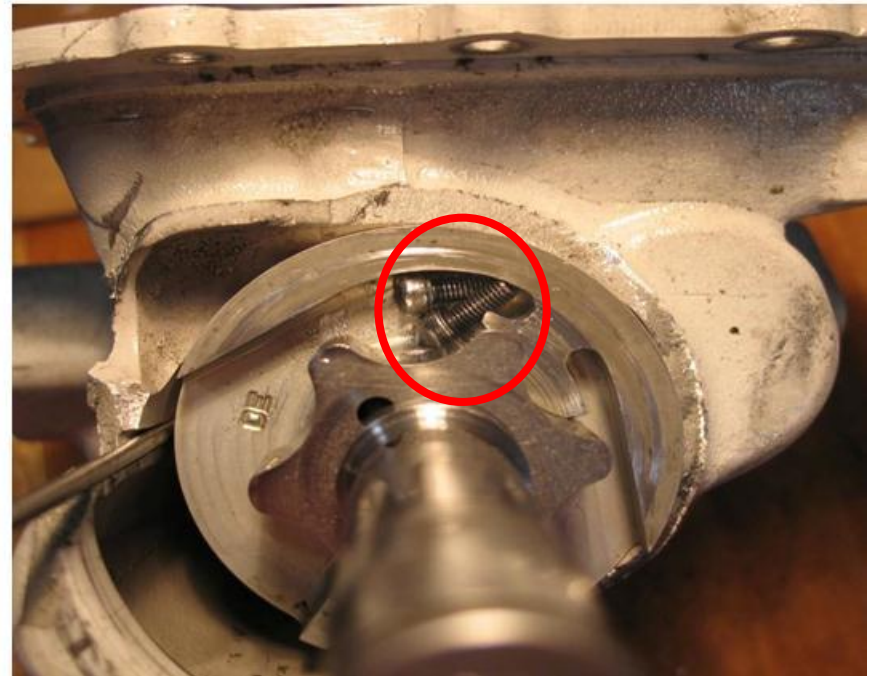
Assy. Process Debris

Fasteners found in Pump



Small FOD can cause big problems.

This pump blew after ingesting several screws.



Housekeeping

Trash found in part container



Worn tools with loose parts



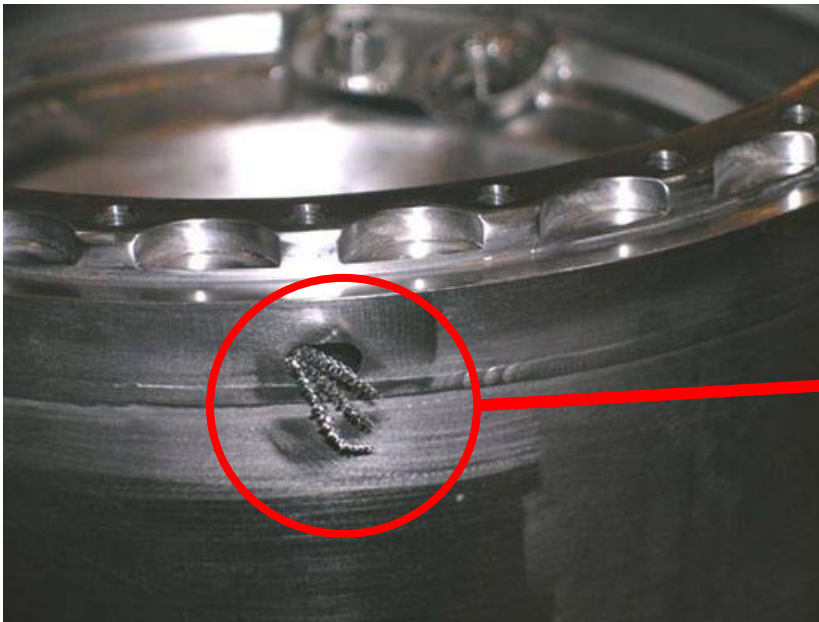
Hand tools must be monitored for loose parts, breakage or required maintenance.



After repeated use, the screw backs out of the flex socket

Mfg. Process Debris

Machine chippings become FOD
if machined parts are inappropriately cleaned



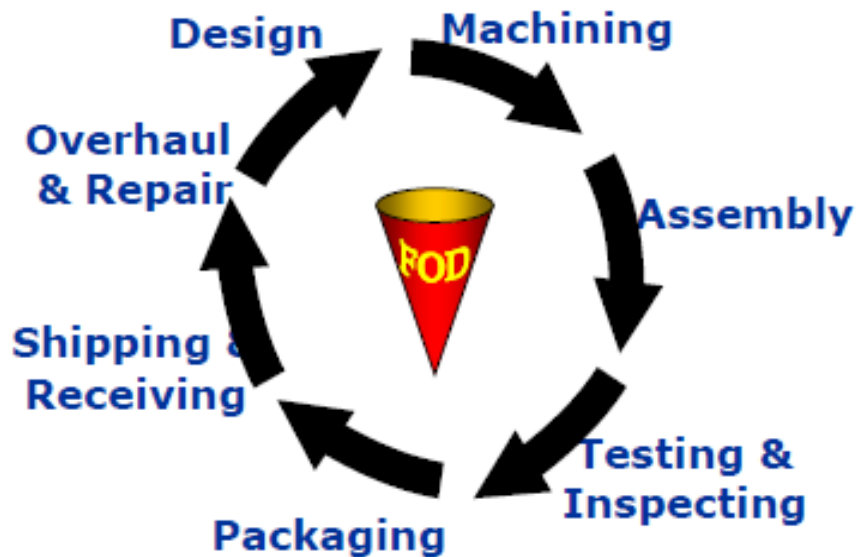
Who should be aware

PEOPLE IN THE PROCESS

FOD elimination should be a focus at ALL steps

From initial design to shipment, there are many opportunities for foreign objects to invade the product.

Preventing FOD at only one step is not sufficient.



Preventing FOD at only one step is not sufficient.

Who should be aware



FOD Awareness and Training

Promote participation in FOD elimination and provide frequent training

Material and Part Handling

Move and store all parts and production tooling in a way that prevents damage and corrosion

General Housekeeping and 5S

Implement good cleaning practices as well as organisation of parts, tools, and supplies

Who should be aware



Processes

Use prevention, detection, and cleaning to eliminate process media and debris

Tool Accountability

Know where your tools are and the condition they are in

Communication and Feedback

Put up Posters or FOD Alerts in common areas so that all personnel are aware of FOD Risks

Prevention Considerations



Consumable Control

Keep Consumables out of FOD critical area and use on a “take as needed” basis

Hardware Accountability

Know what you have used and how much you should have left

Personnel Control

Identify FOD Control Areas, allowing only the required personnel and tools access

Prevention Considerations



FOD Management

Assign a person to be the FOD focal point

FOD Reporting

Know who to contact and what to do in an actual, or suspected FOD event

Measuring Performance / Metrics

Track FOD incidents and findings. Use Root Cause and Corrective Actions to make improvements

Clean as You Go



“Clean As You Go” is the on-going/in-progress practice of removing debris during manufacturing, fabrication, modification, operations, or maintenance on/in the aircraft, part, component assembly, sub-assembly, or engine to ensure the product is FOD free.

NOTE: Examples of operations debris include application of adhesives, grease, or sealant in excess or in areas outside of product requirements; machining chips, drill shavings, safety wire remnants, solder balls, coatings, tie wraps, grit blast, shot peen, tumbling media, and hardware remnants, etc.

“Clean As You Go” shall be enforced in all environments

Work Place Organisation

1. SORT

Determine what is required and what is not, in the amount needed and only when needed

2. STRAIGHTEN

Arrange items that are needed so that they are easy to use, labelled and anyone can find them and put them away correctly

3. SWEEP

Clean and sweep on a regular and frequent basis, so that when you need something, it's there and it works

4. STANDARDISE

Revisit the first 3 of the 5s on a regular and frequent basis and consolidate with standard procedures

5. SELF-DISCIPLINE

To sustain and improve 5s activities through clear policy and systems

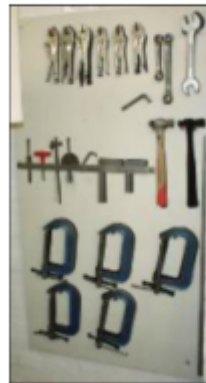


**Before & After
a 5S
workshop**



Organised hand tools

Workplace – Shadow board



- Something is missing
 - It may be being used in the workplace – I know where to look to find it
 - It may be lost – I can order another one
 - If I'm using it, I know where to return it to ... but it doesn't *enforce* me to return it to its shadow – my behaviour is optional

**Agree
Standard**



Work Place Organisation

- Help to reduce footprint of the parts around the work stations
- Improve labour productivity through kitting and easy handling
- Protect the parts throughout their cycle and avoid packaging material on the shop floor
- Easily move parts whilst assembly is in progress when the location is changed.



Gas turbine parts



**Aircraft equipments,
Kitting and protection**




**Part can rotate
in the container**





**Small parts, fast
and visual kitting**

FOD Communication

**Foreign Object Damage
CAN KILL**

This  FOD on runway

Lead to **THIS** 

And THIS  - 106 persons dead
- Loss of reputation that resulted in grounding of all Concorde

YOU can help prevent accidents like this

- **Never** leave anything that could become FOD behind
- **Always** pick up anything that could become FOD

**THEY KEEP
US SAFE!**

**WE KEEP
THEM SAFE!**



Simple Prevention Rules



- Establish processes to prevent, detect, and clean debris at defined intervals
- House keeping (Clean as you go) Keep your work area clean and organized.
- Maintain tool awareness, organize tools so they are easily accounted for, do so before and after your work assignment.
- Secure loose tools with appropriate equipment or methods (chain / wirelock etc).

Simple Prevention Rules



- Account for all material and equipment used in the process, (e.g. shadow boxes, cut-outs, and designated storage locations for tooling and equipment).
- Verify that your clothing and accessories (e.g. pens, jewellery) do not contaminate or provide an avenue for contamination.
- Handle and store parts, assemblies, fixtures, and equipment in a manner that prevents damage, deterioration, or contamination.
- Food and drink allowed only in designated areas

Simple Prevention Rules



- Ensure that all assembly layouts are free from foreign objects prior to layout inspection
- Ensure that each component or pre-assembly is thoroughly clean
- Ensure workbenches are faced with a hard wearing approved material
- Provide exact Quantity of loose small parts (fasteners, seals, wire etc) in a kit for assembly operations

Simple Prevention Rules



- Ensure that components are protected from FOD during storage and between manufacturing operations
- Use protective caps and material as specified
- Identify and display FOD requirements within each controlled area
- Inform your FOD Point of Contact or Team Leader of any condition that may lead to a potential FOD induced failure or incident
- Visitors to FOD Control and FOD Critical areas must be escorted at all times

FOD Summary



- FOD can cause delays in manufacturing and assembly
- FOD can cause product failure
- FOD can cause loss of business
- FOD can cause injury and death
- FOD comes in all shapes & sizes

Everyone's Responsibility



It is **EVERYONE'S** responsibility to recognise and prevent FOD

Don't rely on the person who looked before you...

...or the person who will look after you

FOD Prevention requires TEAM EFFORT!

References



- National Aerospace Standard NAS 412 "Foreign Object Damage/Foreign Object Debris (FOD) Prevention"
- AS9146 "Foreign Object Damage Prevention Program"