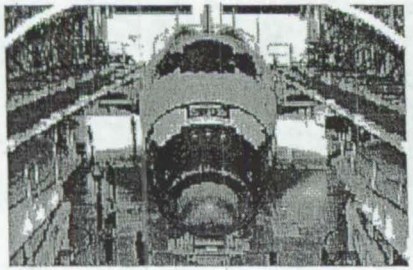
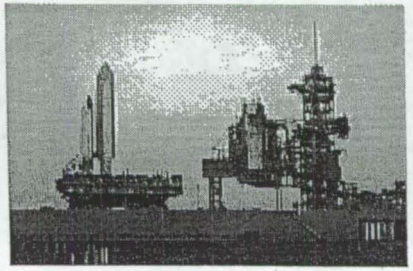
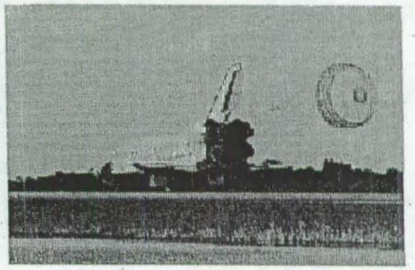
QS210LSK-REV FOD Prevention

Introduction

Housekeeping in the space industry? You may think the idea isn't technical enough for the shuttle program. Yet, eliminating **Foreign Object Debris** or **FOD** is an important goal for USA and NASA.

The justification for this effort is based on data from the aeronautics industry. Experience has shown that if debris is not controlled, it may later cause a variety of in-flight issues. FOD can result in material damage, or make systems and equipment *inoperable, unsafe, or less efficient.*

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United Space Alliance

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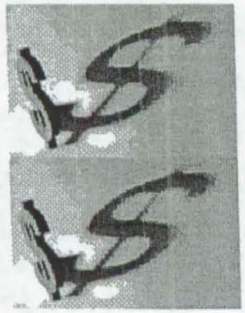
Foreign Object Debris Prevention Program Benefits



National Aerospace FOD Prevention, Inc. estimates the cost of FOD to the global aerospace industry at $4 billion annually.

A Foreign Object Debris Prevention Program reduces costs incurred from lost tools, damaged equipment and impact to the schedule.

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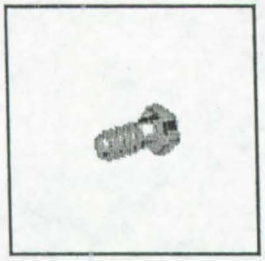
Foreign Object Debris



The term Foreign Object Debris (FOD) is a substance, debris, or article alien to a vehicle or system, which could potentially cause damage.

If you work in flight hardware operational processing areas, you must comply with work area rules, including good housekeeping practices and the "clean as you go" policy.

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"As a Space Shuttle crew member, my life depends on FOD prevention. When it comes to spacecraft, FOD is anything that's out of its proper place. Without the effects of gravity pulling things down, FOD becomes space debris that can be hazardous to systems and crew members."

Kay Hire, Astronaut

Anything that can migrate into flight hardware is a potential candidate for foreign object damage!

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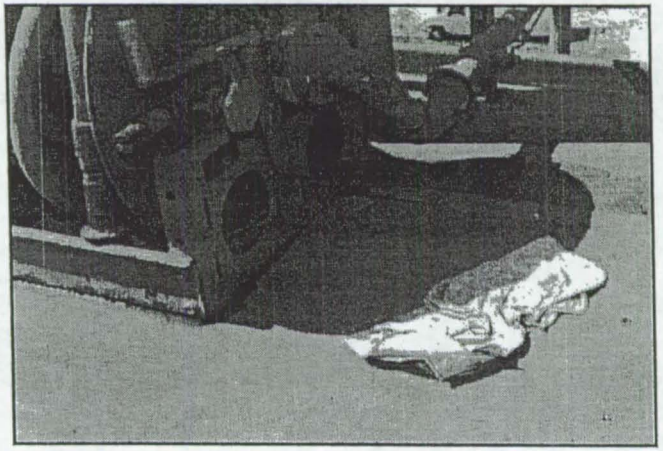
What Causes FOD?

There are two major causes of FOD -- poor housekeeping and poor work habits. In general, a disorganized, dirty work area gives the appearance of sloppy workmanship.



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Clean As You Go

Most work-related debris is removed from processing areas as part of "clean as you go" practices. "Clean as you go" includes these steps:

- Clean the immediate work area when work cannot continue.
- Clean the immediate area when work debris has the potential to migrate to an out-of-sight or inaccessible location.
- Clean the immediate area after work is completed and prior to inspection.
- Clean at the end of a shift.
- If you drop something or hear something drop, pick it up!

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FOD Prevention Program

As an added safeguard, USA's Foreign Object Debris Prevention Program has been established to identify the debris missed during standard housekeeping.

The primary goals of the program are to provide a standardized approach, maintain awareness, prevention, and compliance, and to ensure operational processing areas are safe, clean, and free of foreign object debris.

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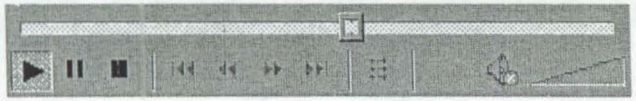
FOD Walkdowns

First line managers select Site FOD Monitors from their work groups. As part of the USA program, monitors must walkdown a designated area each day and inspect for FOD, both inside and outside flight hardware.

First line managers must also perform a daily walkdown of one area/zone (minimum) within their assigned area.



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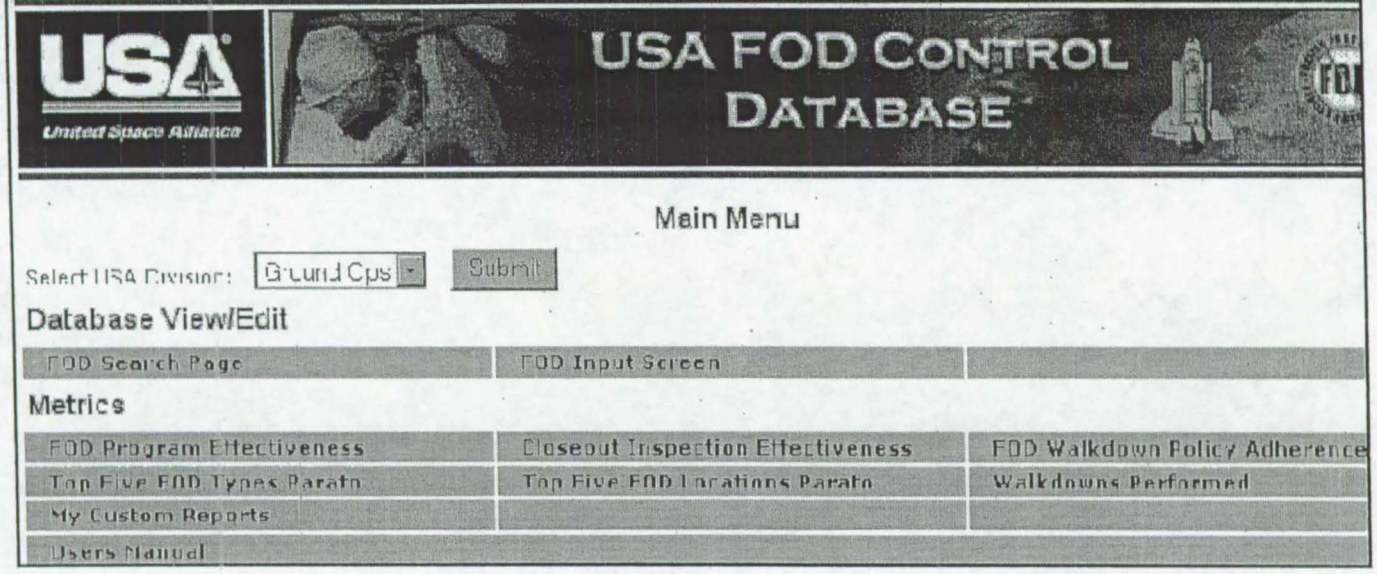

FOD walkdown results are entered into the Integrated Quality Support Database (IQSD) at the end of shift each day. First line managers must report their findings separately in the IQSD.

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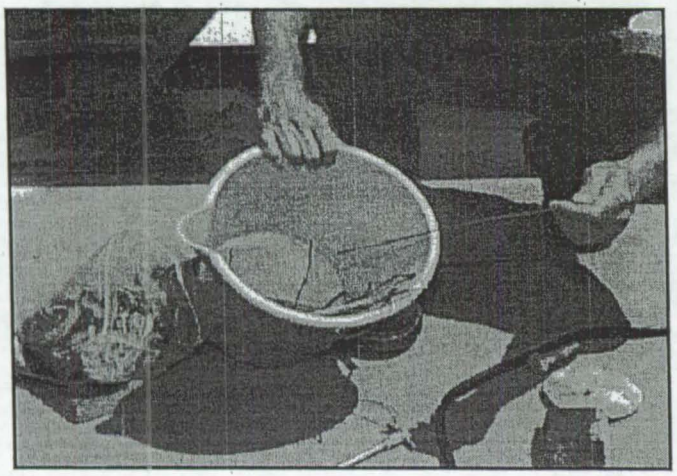
What do monitors look for on a walkdown?



Items most commonly found are tape, safety wire, and tie-wraps. Other examples of debris include staples, paper clips, paper, particles generated from operations such as sanding, drilling, and welding, liquids and chemicals, food, clothing, hair, insects, screws, nuts and washers, tools, jewelry, eyeglasses, plastic and rubber, and string.

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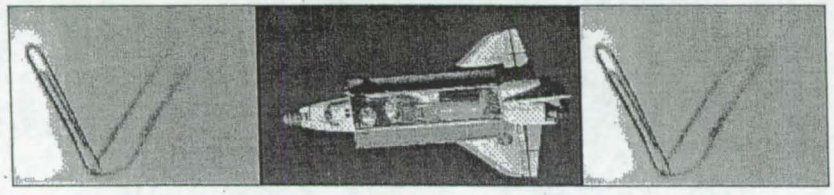
Foreign Object Debris (FOD)



The term foreign object debris can be somewhat ambiguous. A paper clip on a desk is not FOD, because it is in an office setting. It *is* FOD if found in a flight element or processing area, because a paper clip does not belong in an aerospace environment.

This simple item could later prove catastrophic to a vehicle and crew.

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Other FOD Examples

When Space Shuttle Endeavour arrived in California for inspection and maintenance in 1996, workers found a mummified tree frog under a panel in the shuttle's payload bay. Because California has no tree frogs, technicians assumed the frog jumped onboard sometime after Endeavour landed at Kennedy Space Center and before it was ferried to Palmdale.

Other foreign object debris has been discovered during scheduled orbiter maintenance. For example, coins, ink pens, a socket and a contact lens were once found behind bulkhead panels and within the recesses of one shuttle.

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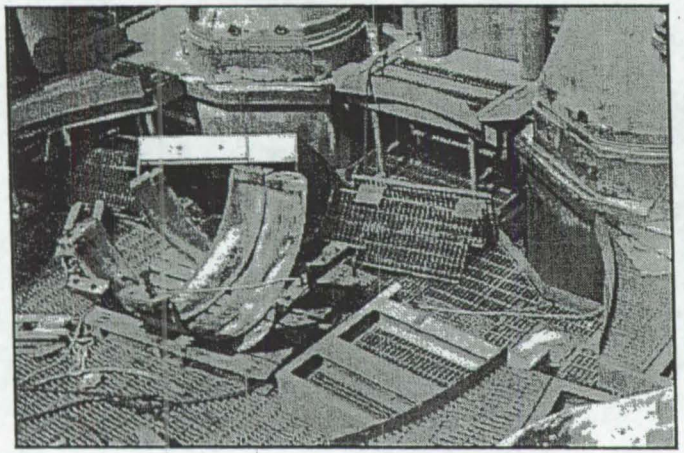
Other FOD Examples



In addition to work-related debris, FOD Monitors must look for unattended tools, uncontained parts, and assembly hardware. If hardware or containers are not associated with the work in progress, then these items should be removed for disposal or storage.

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Inspections

Before entering a controlled area, technicians must verify they have performed a close inspection of hoses, cables, ducts, and equipment to ensure that parts or pieces cannot detach and become foreign object debris in flight hardware.

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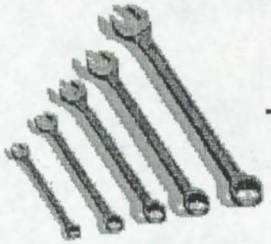

Tool Control

Tool Control is standard procedure in KSC controlled work areas where flight hardware is processed. Tools with cracks, chips, or evidence of corrrosion are not permitted in the processing areas. Tools must be stored in approved containers, such as a tote tray or soft tool bag. Cardboard is not permitted under any circumstances.

Users are responsible and accountable for tools carried into designated processing areas and flight hardware. Tools cannot be transferred or loaned from one area or individual to another without proper documentation. And, if a tool is lost inside flight hardware, a lost-and-found Problem Report (PR) must be initiated immediately.

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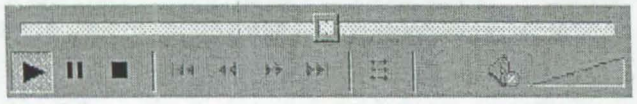
Tethering

How can you drop something, but catch it before it hits the floor, or another object? Tether it!

Tethering has long been recognized as an effective method for protecting against foreign object damage and lost objects. Tethering inside or above flight elements prevents dropping items, which may be difficult to retrieve, or may be overlooked.



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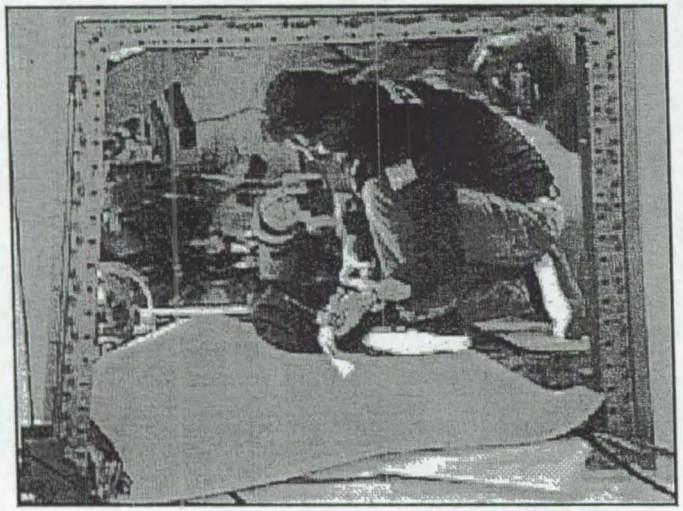
Other Methods to Control FOD



Drop cloths, "elephant hide", or other suitable, approved material may be used to restrain items. It is important to place equipment, tools, and containers in safe areas where they cannot cause damage to flight hardware or injury to personnel.

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Preventing FOD

Work practices, which support FOD prevention to flight elements, include:

- Removing jewelry that is not permanently attached.
- Taping permanently attached jewelry and watches to prevent them from becoming FOD.
- Tethering eyeglasses.
- Removing items from pockets, before entering flight elements.
- Removing badges before entering a flight element.
- Not wearing visible amounts of cosmetics or medication inside the crew module or payload bay.
- Tethering tools prior to removal from their container.

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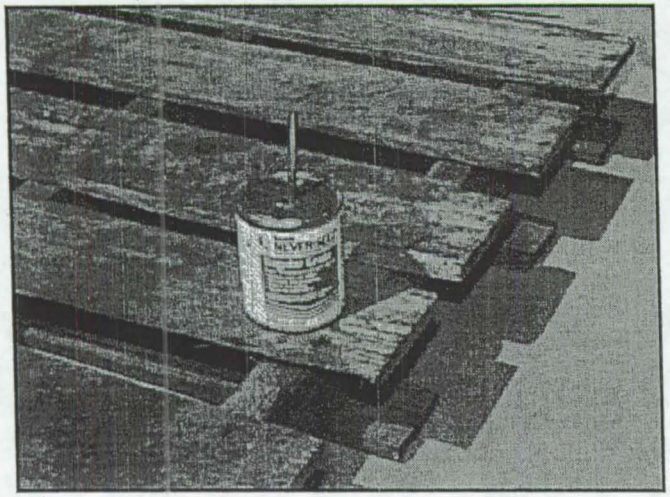
Chemicals



FOD Monitors must report unattended and/or unlabeled chemical containers. Spills may damage many protective materials used on flight hardware, like orbiter tiles, and can degrade the insulation on wiring used in electrical systems.

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FOD Disposal

Any time FOD is found, it is everyone's responsibility to pick it up and dispose of it in an approved receptacle.

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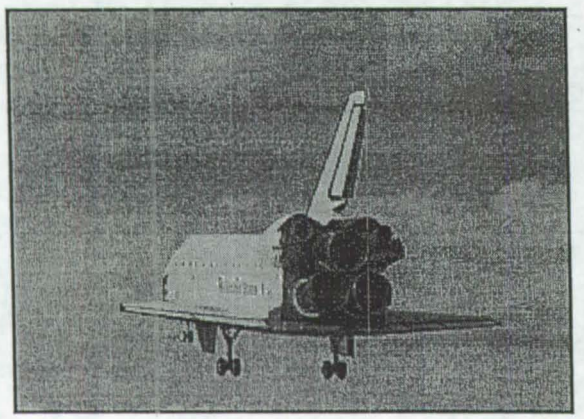
FOD at the Shuttle Landing Facility



When the orbiter returns after a mission, foreign object debris again becomes an issue. Any material that does not belong on or over the surface of the shuttle runway is considered FOD. In fact, the runway is checked for FOD up to about 15 minutes prior to landing.

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FOD Prevention Techniques

At KSC, birds are a special concern, because most of the Center is a national wildlife refuge, providing a home to more than 330 species. Unfortunately, birds can damage the thermal protection system on the orbiter.

Shuttle Landing Facility employees use special pyrotechnic and noise-making devices, as well as selective grass cutting techniques, to discourage birds around the runway.

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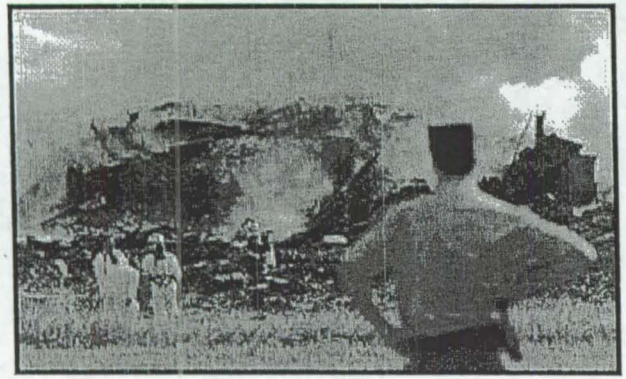
The Results of FOD



On July 25, 2000, a Concorde jetliner crashed soon after takeoff, killing everyone on board. According to investigators, a strip of metal lying on the runway had punctured one of the Concorde's tires, setting off a chain of events that brought the jet down in flames.

The crash was a freak accident, but it was a sobering reminder of a problem that all aerospace companies face:

Foreign Object Damage can result from Foreign Object Debris.

(from "New Horizons" Feb. 2001, Lockheed Martin Space Systems Company)

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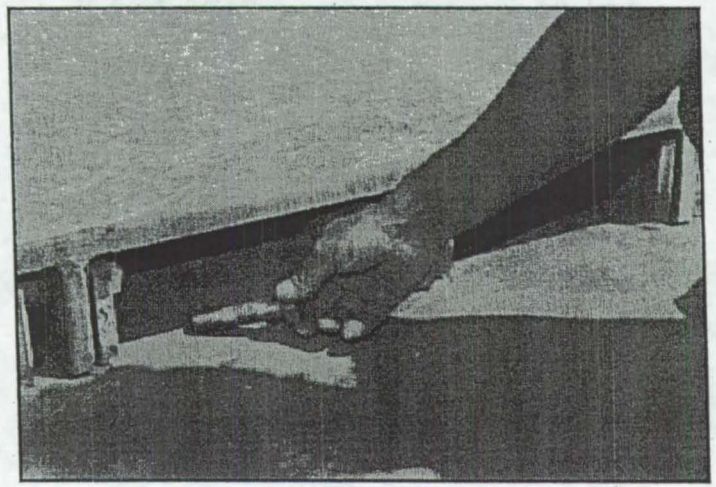
FOD Is Everyone's Responsibility



If you see something that doesn't belong in a flight processing area, pick it up! If you drop something or hear something drop, pick it up! In the long run, this simple action contributes to the safety of space vehicles and astronaut crews.

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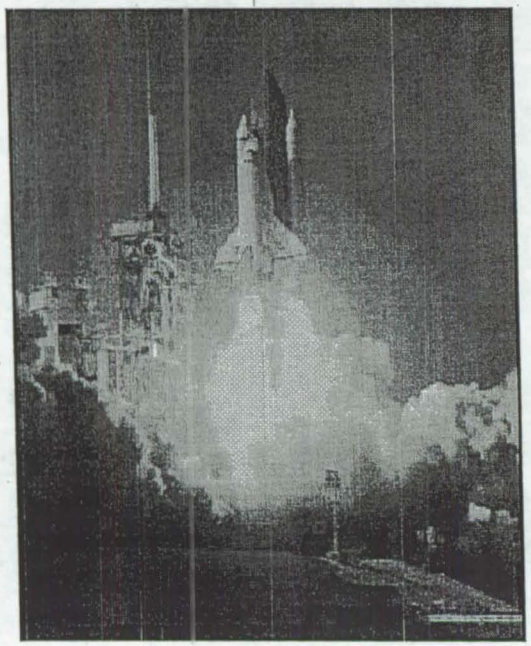
Eliminate FOD at Kennedy Space Center



The mandate for accountability of tools, hardware, and processing items is critical to flight safety and the total elimination of all FOD at the Kennedy Space Center.

At KSC, flight safety is everybody's responsibility, and it starts with you.

Always remember:
FOD is a small word, but to all the workers at KSC, and especially our astronauts, it is a big priority.

Curator Sherry Randolph
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REVIEW QUESTION

1. Foreign Object Debris (FOD) is a substance, debris, or article alien to a vehicle or system, which could potentially cause damage.

☐ A. True

☐ B. False

Submit

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REVIEW QUESTION

1. Foreign Object Debris (FOD) is a substance, debris, or article alien to a vehicle or system, which could potentially cause damage.

- ☐ **A. True**
- ☐ **B. False**

Submit

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REVIEW QUESTION

2. What is one major cause of FOD?

- ☐ A. Not enough time to clean up
- ☐ B. Poor housekeeping
- ☑ C. Unclear work documents
- ☐ D. FOD walkdowns

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REVIEW QUESTION

3. A paperclip is NOT FOD in an aerospace environment.

- ☐ A. True
- ☑ B. False

Submit

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REVIEW QUESTION

4. What is the proper procedure for loaning tools to an individual?

- ☐ A. Clear it with your management first.
- ☑ B. Complete the correct documentation.
- ☐ C. Notify the OIC.
- ☐ D. No special procedures are required.

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REVIEW QUESTION

5. Unattended tools are considered FOD.

- ☑ A. True
- ☐ B. False

Submit

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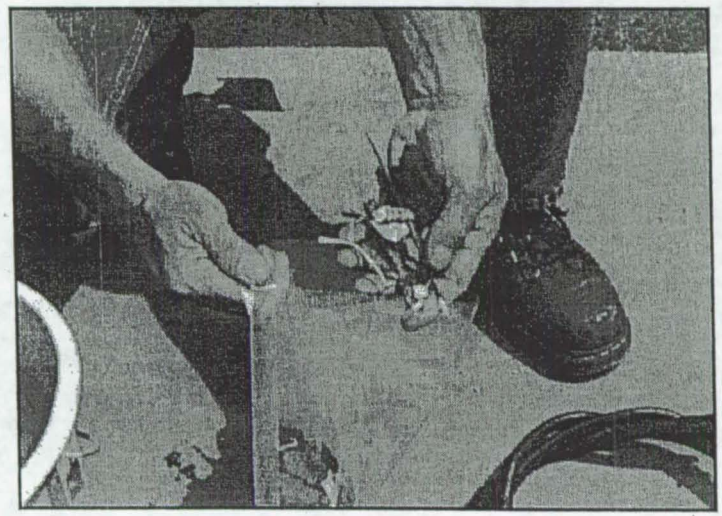
You have successfully completed the FOD Prevention course. Please submit a Course Attendance Roster to your Training Office.



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