NCATT

NATIONAL CENTER FOR AEROSPACE & TRANSPORTATION TECHNOLOGIES

Foreign Object Elimination (FOE)
Elements of Basic Awareness

Standard

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NCATT FOE – Elements of Basic Awareness Standard
Subject, Performance and Task Knowledge Requirements

I. Basic Terms & Definitions (General)

II. Housekeeping

III. Tool Accountability

IV. Hardware Accountability

V. Lost Items

VI. Physical Entry & Personnel Control

VII. Reporting & Investigating

VIII. Material Handling

IX. Parts Protections

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There are twelve basic fundamental *Subject Knowledge, Task Performance and Task Knowledge* activities and functions within the NCATT Standards for Foreign Object Elimination (FOE) – Elements of Basic Awareness. The FOE Standards were identified and defined by aerospace industry Subject-Matter-Experts (SMEs) through an NCATT facilitated, industry recognized, occupational analysis workshop. NCATT workshops focus on the "job" a technician performs in relation to an identified topic or career field.

The NCATT *Standards* can be used by Aerospace Industry education and training entities to develop lesson plans as part of a complete education and training program focused on Foreign Object Elimination.

Individuals can use this document in preparation to challenge the related endorsement exam(s) by using it as a guide to find relevant materials during the study process.

REFERENCES / RESOURCES

- FAA Advisory Circulars 150/5370-2E &150/5380-5B (www.faa.gov)

- Guidelines for The Prevention and Elimination of Foreign Object Damage/Debris (FOD) in the Aviation Maintenance Environment Through Improved Human Performance, by David C. Kraus, Galaxy Scientific Corporation and Jean Watson, FAA Flight Standards Service, Aircraft Maintenance Division (www.hf.faa.gov)

- NAS 412 – Foreign Object Damage / Foreign Object Debris (FOD) Prevention Aerospace Industries Association (www.aia-aerospace.org)

- National Aerospace FOD Prevention Inc. Guidelines (www.nafpi.com)

- National Center for Aircraft Technician Training (www.ncatt.org) PowerPoint FOE Basics and other reference materials on the website

- The FOD Control Cooperation (www.fodcontrol.com), (www.fodnews.com), (www.makeitfodfree.com)

- Wildlife and Bird Strike Organization (www.birdstrike.org)

NCATT Level Definitions

	Scale Value	Definition: The Individual
Task Performance Levels	1	**IS EXTREMELY LIMITED.** (Can do simple parts of the task. Needs to be told or shown how to do most of the task)
	2	**IS PARTIALLY PROFICIENT.** (Can do most parts of the task. Needs only help on hardest parts.)
	3	**IS COMPETENT.** (Can do all parts of the task. Needs only a spot check of completed work.)
	4	**IS HIGHLY PROFICIENT.** (Can do the complete task quickly and accurately. Can tell or show others how to do the task.)
Task Knowledge Levels	a	**KNOWS NOMENCLATURE.** (Can name parts, tools, and simple facts about the task.)
	b	**KNOWS PROCEDURES**. (Can determine step-by-step procedures for doing the task.)
	c	**KNOWS OPERATING PRINCIPLES.** (Can identify why and when the task must be done and why each step is needed.)
	d	**KNOWS ADVANCED THEORY.** (Can predict, isolate, and resolve problems about the task.)
*Subject Knowledge Levels	A	**KNOWS FACTS.** (Can identify basic facts and terms about the subject.)
	B	**KNOWS PRINCIPLE.** (Can identify relationship of basic facts and state general principles about the subject.)
	C	**KNOWS ANALYSIS.** (Can analyze facts and principles and draw conclusions about the subject.)
	D	**KNOWS EVALUATION.** (Can evaluate conditions and make proper decisions about the subject.)

Explanations

A task knowledge scale value may be used alone or with a task performance scale value to define a level of knowledge for a specific task. (Example: b and 1b)

*A subject knowledge scale value is used alone to define a level of knowledge for a subject not directly related to any specific task, or for a subject common to several tasks.

NCATT FOE – Elements of Basic Awareness Standard
Subject, Performance and Task Knowledge Requirements

I. Basic Terms & Definitions
Level A

Identify, define and explain the following *basic* aviation and aerospace industry FOE/FOD terms and definitions.

- *FO (Foreign Object)*—Sometimes referred to as Foreign Object Debris (FOD) – Any alien substance or article that invades any component of the aircraft and which causes or has potential to cause damage to aircraft, persons, equipment, or otherwise diminish safety.

- *FOD (Foreign Object Damage)*—Any damage or incident attributed to a foreign object that can be expressed in physical or economic terms which may or may not degrade the product's required safety and/or performance characteristics.

- *FOE (Foreign Object Elimination)*—A program or process used to assure a FOD-free product/system.

- *Potential FOD* – The condition where foreign object debris may cause damage, and/or failure should the product be put into use.

- *FOD Designated Area*— (*Also referred to as FOD Critical (NAS 412) or FOD Sensitive*)—Any area where flight hardware is in place and exposure to foreign objects would potentially cause a system or product failure due to deterioration, malfunction or damage.

- *FOD Barriers*—Devices such as edge protectors, caps, plugs, and protective covers used for hoses, cables, ducts, electronic components and other hardware exposed to potential damage.

- *FOD Walk / Sweep*—Physical inspection and removal of FO in an assigned area or a zone.

- *Critical FO*— Any material that is inadvertently left inside an assembly after close out or test and any foreign objects in areas from which migration is possible, (e.g., through tooling holes, bend relief cutouts, drain holes, intakes, etc.) which are probable to cause system or component malfunction or deterioration should the product be put into use.

- *Clean As You Go*—An ongoing process of removing work debris and keeping the work area clean while performing a task on a product.

NCATT FOE – Elements of Basic Awareness Standard
Subject, Performance and Task Knowledge Requirements

- *Consumables / MSP (Miscellaneous Small Parts) and PLS (Production Line Stock)*—Supplies provided to workers that are expendable. Examples are:
  - Issued apparel (e.g. gloves, hair nets, snoods, booties etc.)
  - Safety glasses and shop coats
  - Glue, paint, sealant
  - Rags, gauze pads, swabs
  - Sandpaper, brushes, applicators, paper, pens, plastic covers
  - Stock items (e.g. rivets, washers, fasteners and other hardware)
  - Perishable Tools (e.g. drills, reamers, apex tips)

- *Housekeeping*—Is the responsibility of employees to maintain a clean and orderly work area with necessary tools, materials, and equipment in their places of orderly arrangement.

- *Focal Point*— A FOD Focal Point should develop and implement plans and programs to prevent damage to aerospace products during associated design, manufacturing, assembly, test, acceptance, packaging, handling, storage, transporting, maintenance, flight line, and launch operations. The Focal Point assures that FOD incidents are thoroughly investigated and that incident reports are completed as applicable. The Focal Point(s) should be appointed by upper level management (e.g. the chief operating official) and have sufficient authority and organizational freedom to identify and implement FOD preventive measures whenever and wherever required. The Focal Point is described in detail in NAS 412.

- *FOD Point of Contact (FOD POC) / Local FOD Coordinator*—The FOD Point of Contact is in charge of and in direct control of FOD Designated Areas, including personnel entry, tool control logs, FOD audits, posting alerts and completing FOD Incident Reports. The Focal Point and the FOD Point of Contact work as a team. Students should understand that position titles and responsibilities tend to change from organization to organization. FOD Focal Point(s) and FOD POC tends to fall into organizational specific structure and titling differences. Typically organizations that do not identify a Focal Point and a FOD Point of Contact as separate and unique positions will blend the responsibilities of the Focal Point and the FOD Point of Contact. In at least one large aerospace manufacturing organization the FOD Point of Contact position is known as the Local FOD Coordinator. Regardless of titles and levels of responsibility the work of a FOD Focal Point / FOD Point of Contact / Local FOD Coordinator is significant. The FOD POC is not defined or addressed (as a unique position) in NAS 412 but FOD POC does appear in other FOE / FOD materials including FAA advisory circulars and FAA guidelines.

II. Housekeeping
NCATT Level B

Identify the relationship of basic facts and state general principles relevant to the aviation and aerospace industry methodology (terms, tools and processes) on housekeeping.

- *Clean As You Go Programs* utilize practices to prevent FOD from migrating into aviation products. *Clean As You Go Programs* provide an ongoing process of removing work debris as it accumulates and keeps the work area clean while tasks are performed on products, vehicles, or assemblies in a FOD designated area.

    Paperwork is often a tool that technicians use to complete task or to track and account for loose parts. The technician must remember that items (paper, pens, pencils, staples, paperclips, and other office supplies) used with paperwork can sometimes become Foreign Objects themselves. Controlling loose office supplies is an important component of *Clean As You Go Programs.* It is important to always be conscious of personal actions around a FOD sensitive product, vehicle or assembly.

    All employees should ensure the work area is clean:

    o prior to starting an operation
    o as an operation progresses and work debris accumulates
    o when an operation cannot continue
    o after an operation is completed and prior to inspection
    o at the end of each shift

- *FOD Cans and Containers*—Foreign Object Debris cans and containers are strategically placed in FOD designated areas. FOD cans and containers are very useful tools in preventing foreign objects from migrating into aerospace products. It is everyone's responsibility to utilize FOD cans and containers for any trash or foreign material in a FOD designated area.

- *FOD Bags (typically worn by individuals)* —A method of placing and securing any personal belongings such as change, contents of one's pockets, jewelry (chains, necklaces, earrings, rings, watches), sun glasses, badges or any item that has the potential to become a Foreign Object. These bags are worn while visiting or working in a FOD designated area. Some FOD programs restrict the use of these bags to personal items only while other programs allow FOD bags to be used for collection of debris. FOD bags are not used for tool storage or transport (see "*Tool Pouches / Tool Pockets / Tool Bags"* in the Tool Accountability Standard #3).

Note: Typically work residue (e.g. scrap wire cuttings, string ties) generated during the shift may be temporarily stored in a FOD Bag or other designated FOD Container until they can be discarded properly.

- *5S*—Sort, Straighten, Shine, Standardize, and Sustain, is a method that describes a Japanese concept for housekeeping and organization of the workplace. The 5S philosophy is appropriate and is used in many FOD program because good housekeeping processes and habits have a significant positive impact on FOD prevention. Some companies use 6S which includes Safety. In order to launch a 5S or 6S event all employees in the area participate to *organize* the area using the Sort, Straighten, Shine, Standardize, and Sustain process. *Organization methods* that include taping off areas, color coding and *organizing* tool cabinets are utilized. A map of the area is created displaying each assigned location.

- *Permanent Tooling*—At completion of any major or minor permanent tool maintenance or upgrade (may include facilities) FOD designated areas must be completely swept for all foreign objects, ensuring that all foreign objects are removed prior to area activation.

III. Tool Accountability
NCATT Level B

Identify the relationship of basic facts and state general principles about the following terms, definitions, methods, devices and process used to provide *Tool Accountability Methods.*

- *Tool Control* – Any formal system designed to assure that each tool that goes onboard an aircraft is removed and accounted for.

- *Shadow Box / Board*— A toolbox or storage board with specifically, marked locations (e.g. foam cutouts) for each tool in the tool box or storage board so that a missing tool is readily noticeable. A tool box or storage board can be inventoried in 60 seconds or less. Shadow boxing with foam cutouts is very popular and is often used in conjunction with other methods.

- *Tether*—A lanyard of sufficient length and strength (wire, rope, cable, etc.) that is secured to the technician (user), structural workstand or other suitable location at one end (as appropriate) and the tool or equipment at the other end. The tether should be minimum length to preclude damage from tethered tool "free swing." Tethering prevents dropping tools or equipment into or onto aircraft or other aerospace products. The tether itself can become FOD if it (including tether related hardware) is not regularly examined for damage and wear.

- *Chit System*— A chit is an assigned identification tag issued to a technician displaying a control number. Technicians replace any tool that they remove from a tool box with their assigned tag (chit). If another technician or area supervisor inventories the tool box, the chit system accounts for the missing tool and identifies the technician that is in possession of the tool. For this method of tool accountability to be effective tool boxes must be shadow boxed with specifically marked locations for each tool and technician must follows the one-for-one policy of removing a tool and replacing the tool with their assigned tag. If not controlled chits can become FOD themselves. It is the responsibility of every technician to control his or her chits, especially in the FOD designated areas. Chits can also be used to designate that a tool has been removed from the tool box for repair or calibration.

- *Tool Inventory Sheets / Logs*—Written Tool Inventory Sheets / Logs are a listing of tools and materials that must be checked in and out when entering or departing a FOD designated area. Completed Tool Inventory Sheets / Logs are required prior to the FOD designated area closeout.

- *Tool Pouches / Tool Pockets / Tool Bags* — A tool control pouch that contains an identified (inventoried) set of tools. The tool pouch is subject to logging in and out, or chitting.

- *Tool Identification*—Tools are marked for issue, return and accountability. Every tool that is assigned to a specific area or tool box is marked with one or more of the following methods:

  o Tags
  o Sensors
  o Bar Codes
  o Laser Etching/Engraving
  o Color Code

- *Consolidated Tool Kits*—Also known as "CTK" are specific tool boxes with all tools inside assigned to the specific tool box. This tool box is inventoried by tool crib personnel or area supervision. The tool box has foam cutouts or magnetic storage containers, and is shadow boxed for easy inventory. Consolidated Tool Kits have replaced technician's "personally provided" tools and tool boxes in most aerospace industry operations.

- *Tool Condition*—Assuring that a tool's condition is clean, undamaged and free of Foreign Objects prior to use is a professional FOD prevention method. *It is very important to visually inspect tools for all the conditions described herein.* <u>Tool condition inspections should be accomplished prior to and immediately after job completion.</u>

  o Broken or Worn Tools—Visually inspect tools for broken or worn areas that can become FOD.
  o Damaged—Any damaged tools should be repaired or replaced to prevent the damaged tool from becoming FOD.
  o Dirty—Ensure the tools are clean and ready for use prior to each use.
  o Flaking— (Chrome flaking) Flaking is a hidden foreign object and can become a serious problem if undetected.

- *Sponge Count*—A formal procedure utilizing a written record of all items entering and leaving a work area. The medical industry uses this procedure to ensure that all surgical materials that are taken into a surgical operation area are properly accounted for at the end of the surgical procedure. Thereby preventing FOD (a sponge, surgical tool, etc.) from accidentally being introduced or left inside a patient. Applying the "sponge count" methodology in aerospace industry settings ensures that foreign objects (Critical FO) are not left inside aerospace products, assemblies or vehicles.

- *Electronic Tool Accountability System*—Tools can be tracked to a user by a unique identifier such as a badge. The electronic tool accountability system utilizes electronic sensors and/or bar codes that identify each individual tool (see "Tool Identification" in this section).

IV. **Hardware Accountability**
NCATT Level B

Identify the relationship of basic facts and state general principles about *Hardware Accountability* and describe the methods for controlling hardware.

- *Hardware* – A general term for all of the small components, such as nuts, bolts, screws, and washers used to assemble aerospace components, products and vehicles.

- *Kitted Hardware*—A kit that contains the *exact amount* of hardware assigned to perform a specific task. For example, to build a harness the exact amount of hardware, wire, plastic ties, and wrapping to complete the task is supplied to the technician. Use of kitted hardware ensures the technician has no spare hardware, and must use all of the hardware that is provided in the kit to successfully complete the task. If hardware becomes lost it is readily noticeable because the task will be incomplete by the amount of lost hardware. Early recognition that the hardware has been lost brings about early reporting of the lost hardware and immediate follow-up.

- *Hardware Removal, Control and Replacement*—If hardware is removed during maintenance, alteration or other task the removed hardware must be controlled and accounted for. Procedures used to control and account for removed hardware may differ from one organization to another, but established procedures must be followed. Failure to follow established procedures is often a major contributor in the creation of foreign objects.

- *Hardware Storage*— During the manufacturer, maintenance, repair or alteration of an aerospace product, assembly or vehicle it is critical to have hardware contained in a manner that does not promote migration to the product as FOD. As hardware storage moves closer to FOD designated areas, greater preventive and control features should be implemented.

- *Tote Trays and Containers*—A Tote Tray is a covered device for storing, carrying, or transporting hardware in a secure manner to prevent inadvertent droppings. Tote Trays and Containers are closed devices utilizing spring loaded lids (compared to open containers or loosely held hardware). Tote Trays and Containers are effective hardware control devices that help control and prevent accidental spillage of hardware. Hardware spillage prevention is an important element in FOD control and is extremely important when working over (above) an aerospace product, vehicle, or assembly. Dropped hardware from above tends to find its way into the most inaccessible and critical location.

V. Lost Items
NCATT Level B

Identify the relationship of basic facts and state general principles of reporting lost or found items.

- *Report Missing, Lost and Found Items*—This is an integral part of having a successful FOD Program and all technicians are encouraged and responsible to report missing, lost or found items. Typically there is a documented process of steps that are to be followed, and is designed to ensure employees will report lost items before they cause damage. At most facilities there are NO repercussions for reporting a lost or missing tool or item even if the technician is at fault. Although established as a positive self reporting method, repeat offenders may face disciplinary action.

- If an item is lost during an assembly, manufacturing, or maintenance task, cease activity in the affected area and initiate a search for the item. Continue this search until the item is found or adequate assurances are made that the item is not contained in the aircraft, aerospace vehicle or assembly. Searching for such items may require de-paneling or nondestructive inspections, including flashlight and mirror, borescope and x-ray. If an item cannot be located after a search has been completed, annotate the applicable forms with a description of the item and the search procedure that was followed.

VI. Physical Entry & Personnel Control
NCATT Level B

Identify the relationship of basic facts and state general principles about physical entry into both flight hardware and FOD designated areas.

- *General Entry*—When physical entry is required into flight hardware (e.g., crew compartment, engine intake, exhaust, fuel tank areas, etc.) personnel should remove all loose objects, badges, jewelry, etc., from clothing. Pocketless or closed zippered pocket coveralls should be worn to preclude foreign objects dropping from pockets.

- *Designated Areas*—A FOD designated area is any area where flight hardware is in place and exposure to foreign objects would potentially cause a system or product failure due to deterioration, malfunction or damage.

  o Most manufacturing companies identify FOD designated areas based on a risk assessment of the potential for FO to migrate into the final product. Requirements for entry into and working within these areas increase as the final product progresses through the factory to customer delivery.

o FOD designated areas whether found in manufacturing operations, repair station or general repair facilities, are selected and defined by the individual aerospace operator in accordance with their particular operational requirements. FOD designated areas are typically identified as: FOD Awareness, FOD Sensitive, FOD Critical, FOD Restricted and FOD Controlled. Entry into these areas is limited in accordance with the organization's established FOD/FOE Program Procedures. The procedures may include training and/or certification(s) coupled to appropriate authorization.

VII.   Reporting & Investigating
NCATT Level A

Identify basic facts and terms about reporting Foreign Object Damage incidents and investigation requirements.

- All Foreign Object Damage should be reported immediately and investigated as soon as possible. When a FOD incident occurs, operations should immediately cease and an investigation should be initiated to determine the cause. Cause and corrective action should be attained in a timely manner to preclude similar occurrences in the future - "lessons learned." Cause may be determined by visual observation, forensic analysis or by location of the object.

- Follow established procedures for formally reporting FOD incidents as they may vary from company to company.

- All FOD incidents reports should be forward to the FOD Focal Point (see definitions) for investigation, cause and corrective action.

VIII.   Material Handling
       NCATT Level B

Identify the relationship of basic facts and state general principles related to material handling.

- A well-established plan for material handling and parts protection can eliminate many potential FOD hazards

- *Control Techniques*
  - Materials and accessories used in the packaging, handling, shipping and storage that have intimate contact with the part or assembly should be clean and free of contamination.
  - Parts and assemblies should be packaged in a manner that will preclude any chance of one item making contact with another during normal handling operations.
  - Protective and packaging materials should be chosen based on their ability to adequately resist penetration by tearing, parting or piercing from forces either external or internal during normal handling operations.
  - Specific instructions for packaging, unpackaging, handling should be followed when provided.
  - Protective devices/FOD Barriers (edge protectors, caps, plugs, covers, filters, rub strips) should be cleaned and secured to prevent accidental damage.
    Refer to NCATT Standard #9 for additional information.
  - <u>Once installed, unauthorized removal of the protective devices is prohibited and should be controlled through assembly or maintenance paperwork.</u>

- Consideration should be given to the visibility / detection of material used for protection so that the material itself doesn't become FOD.

- *Material Characteristics*
  - Materials should be compatible with the environmental and physical stresses expected to be encountered during product service.
  - Electro-Static sensitive devices should be properly protected to avoid damage. Materials that are used to protect electro-explosive devices and sensitive electronic components should be kept clean, covered, and stored away from ordinary non-static safe materials.

- *Condition*—Visually inspect all packaging, handling, shipping and storage containers for the following:
  - Nicks, dents, holes, abrasions, scratches, bums, etc., which may be detrimental to the function and integrity of the part or assembly.
  - Grease, preservatives, corrosion products, weld slag, shop dirt, and other materials foreign to the item.

- *Packaging / Containers*—Packaging methods, materials and processes, including storage and shipping containers can be a source of FOD and could result in damage. In some cases there may be design considerations for FOD sensitive products, vehicles or assemblies that require the use of specific packaging and / or containers. In other applications the design considerations may forbid the use of a specific packaging or container. In all cases the proper packaging and/or containers must be used.

- *Opening and Closing Containers*—Caution must be taken when opening and closing containers. Nailing, strapping or installing screws can cause damage to hardware or provide additional internal FOD in the container.

- *Storage*—Follow the established storage procedures to prevent damage. Improper storage procedures can be a cause of Foreign Object Damage.

- *Transportation*—Follow transportation procedures to prevent damage. Transporting FOD sensitive products can be a cause of Foreign Object Damage. This consideration includes the responsibility of transportation vehicles to be free of loose debris while transporting FOD sensitive products.

IX.   Parts Protections
NCATT Level B

Identify the relationship of basic facts and state general principles related to parts protection.

- *FOD Barrier*—A device used to protect electronic components and other hardware that are exposed to potential damage. It is a measure that prevents migration and entrapment of Foreign Object Debris in a FOD sensitive product. Devices such as edge protectors, caps, plugs, and protective covers that are used to seal-off and provide protection for hoses, cables and ducts are FOD Barriers. FOD Barriers can be a cause of Foreign Object Damage if not controlled or accounted for properly.

- *FOD Barrier (Interior) Removal*—Barriers placed inside lines to prevent FOD must be removed prior to closeout. Flags should be placed outside the line to remind personnel to remove interior barriers. Failure to remove FOD Barriers

from fuel, hydraulic and vent lines has been, and continues to be, the cause of serious aviation incidents and accidents.

- *Electrostatic Discharge (ESD)*—ESD can be considered a source of Foreign Object Damage. Electrostatic discharge is the instantaneous discharge of static electricity that has built up on one surface or point and is discharged to another surface or point. It is commonly seen and felt when a person walks across a carpet or slides across a car seat and then reaches for the door handle. The zap that occurs is electrostatic discharge. Prior to coming into contact with an ESD sensitive product technicians must ensure that all potential static charge has been dissipated from their person through a grounding procedure. A recent example of ESD FOD occurred when an ungrounded maintenance technician came into contact with the open electrical terminal connection to a Full Authority Digital Engine Control (FADEC). The FADEC was destroyed. Replacement cost of the FADEC exceeded $300,000 dollars. ESD is a complex subject with the potential for very expensive and dangerous consequences. Technician should seek additional and updated ESD training prior to handling ESD sensitive products.

X.   Hazardous Materials
NCATT Level A

Identify the basic facts and terms related to the handling, control and disposal of hazardous material.

- Management of hazardous materials is important in the prevention of minor and major injuries to personnel and aerospace products. Mismanagement of hazardous materials can lead to the inadvertent introduction of the material into or onto aerospace assemblies, components and vehicles resulting in Foreign Object Damage.

- Use and handling of hazardous materials must be performed in accordance with the specific materials Material Safety Data Sheet (MSDS).

- Disposition of hazardous materials is dependent upon the commodity that is being discarded. Disposal must be in accordance with federal, state and local hazardous material disposal procedures.

XI. Wildlife/Environment
NCATT Level A

Identify the basic facts and terms related to wildlife and environment issues that are major causes of Foreign Object Damage.

- *Wildlife*—Can be a very dangerous source of Foreign Object Damage. For example a small animal can get into an aircraft and chew through wires causing unknown damage. Unpredictable bird strikes continue to be a major part of Foreign Object Damage to aircraft and are very difficult to manage. Another wildlife factor to consider is the potential for Foreign Object Damage from rodent droppings that introduce foreign objects into aviation and aerospace products that may or may not cause damage, but will result in an investigation that can waste time and money.

- *Environment*—Elements of weather are considered foreign objects. Snow, rain, hail, wind, and ice are foreign to the aircraft, product, or assembly and can cause damage.

XII. FOD Effects
NCATT Level B

Identify the relationship of basic facts and state general principles related to FOD effects.

- *Costs*—The aviation and aerospace industry is losing approximately 4 billion dollars annually to FOD. Insurance expenses (cost) to companies that have incidents are increasing. In the manufacturing sector manufacturers may increase contract cost, which may lead to the loss of current or future contracts. In other aerospace operations (air carrier, repair organization or general aviation) the cost can easily cause the failure of the business.

- *Life*—Foreign Object Damage can have a direct impact on human lives. The famous Concord Crash in Paris, France had a devastating impact that killed 113 people due to a foreign object. It is very important that the technician understands the effects of Foreign Object Damage.