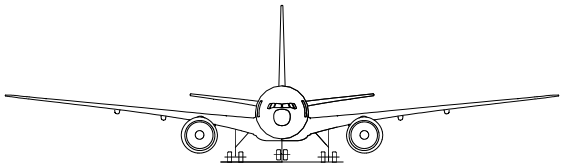
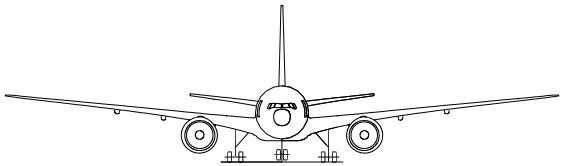


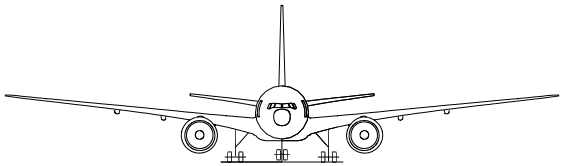
Challenges to Airport Ramp & Runway Debris Control

Airport Technology
Boeing Commercial Airplanes
October 2010



Airport Ramp & Runway Debris Control

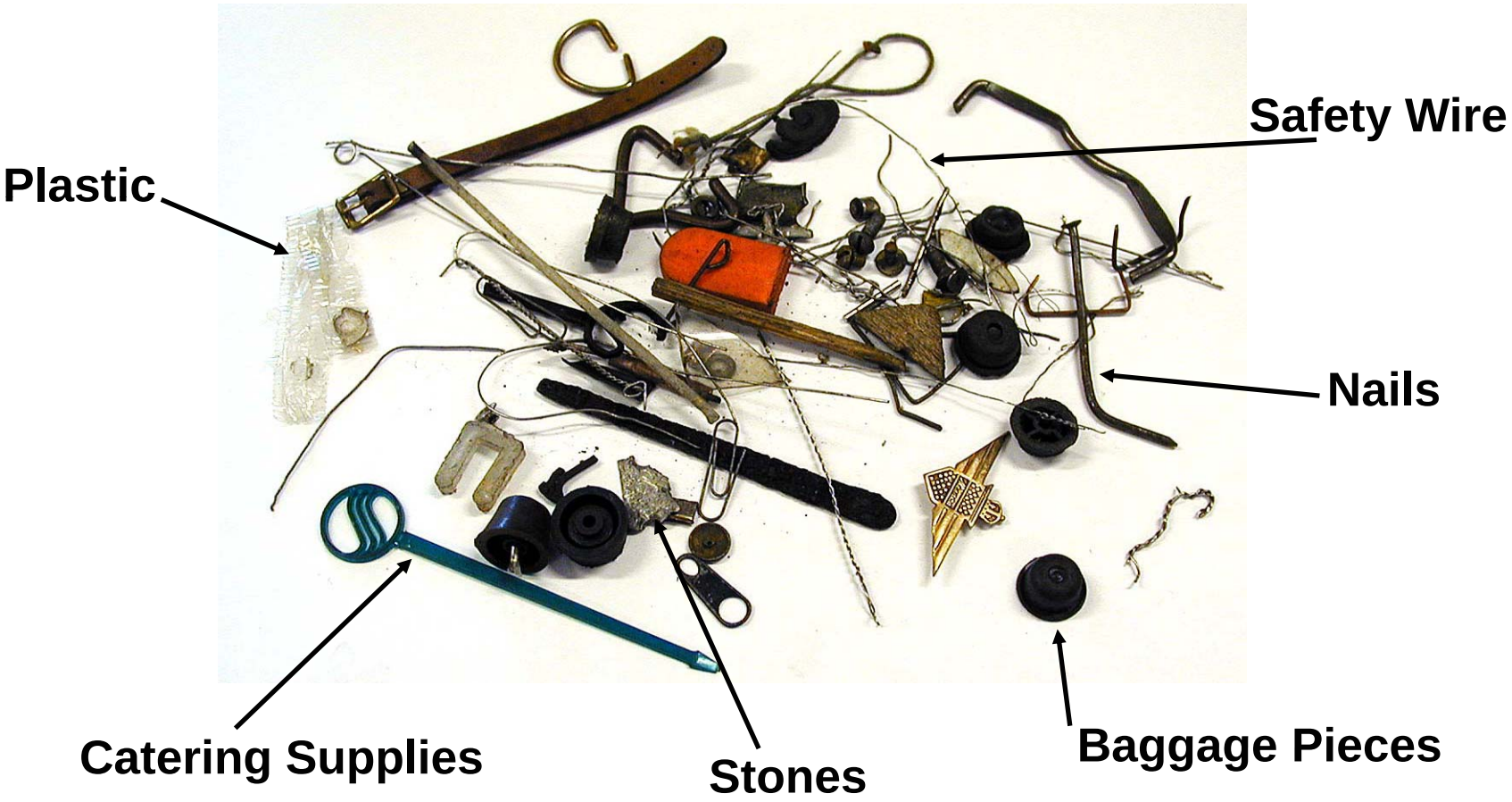
- What is “Airport FOD”
- Definitions
- The Airport Role
- The Airline Role
- How is Airside FOD Generated
- How to Control the FOD Problem
- Conclusions



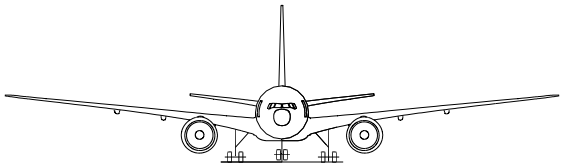
What is "Airport FOD ?"

It Can Be a Bolt, a Concrete Chip, a Piece of Paper, a Paint Can, a Hat, a Passenger, Tire Tread....

FOD at the Gate



This is unusual in that all of the material shown on this slide was collected at a single aircraft stand.

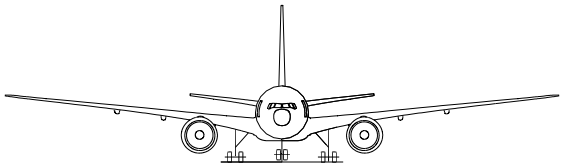


Definitions

1. Foreign Object Debris:
A substance, debris, or article alien to a vehicle or system which would potentially cause damage

2. Foreign Object Damage:
Any damage attributed to a foreign object that can be expressed in physical or economic terms which may or may not degrade the products safety and/or performance characteristics

Definition Source: National Aerospace FOD Prevention Inc.

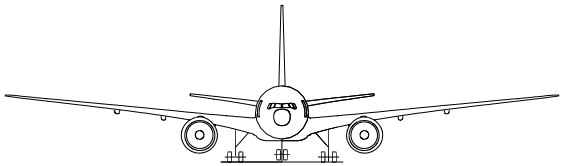


Impacts of Airport FOD:

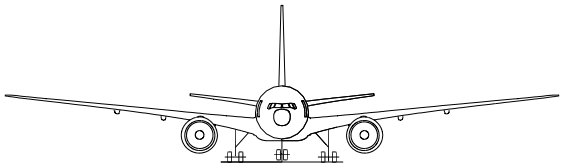
- ✈ **Engine Ingestion on the Aircraft**
- ✈ **Aircraft damage**
- ✈ **Velocity Impact of Debris Launched by Jet Blast Into Other Aircraft, Personnel (Ramp/Passengers), and Buildings**

BOTTOM LINE: FOD = $$$$$$$

This is a re-treaded tire that delaminated and left debris behind.



Tire debris impacted bottom of the wing causing this damage.

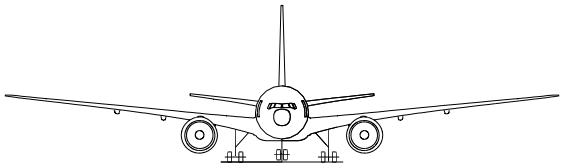


The Airport Role

The Responsibility for Cleanliness by Airports Serving Scheduled Airlines is as Follows:

- **International Civil Aviation Organization - Annex 14**
  - **Standard**

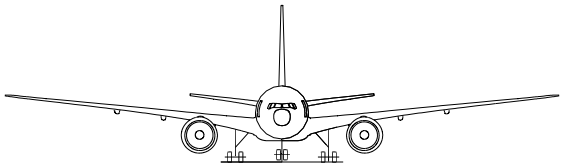
- **Federal Aviation Administration - Part 139**
  - **Requirement**



ICAO Annex 14, Chapter 10, Para 2.8, Pavements:

The surface of a paved runway shall be maintained in a condition so as to provide good friction characteristics and low rolling resistance. Snow, slush, ice, standing water, mud, dust, sand, oil, rubber deposits and other contaminants shall be removed as rapidly and completely as possible to minimize accumulation.

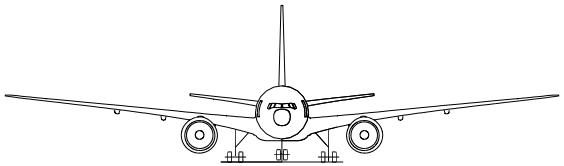
Refer also to ICAO Airport Services Manual, Part 8: Airport Operational Services



FAA Part 139.305(a)(4) Paved Areas:

Except as provided in paragraph (b) of this section; mud, dirt, sand, loose aggregate, foreign objects, rubber deposits and other contaminates must be removed promptly and as completely as practicable

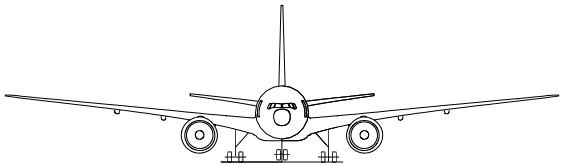
Refer also to FAA Advisory Circular 150/5210-24, Airport Foreign Object Debris (FOD) Management



The Airline Role

- Airlines Generate Much of the FOD Found on the Airside Through Their Operations and Those of their Support Functions

- User Agreements Typically Identify the Agency Responsible for Cleaning Various Areas



How is it Generated

- **Infrastructure**
  - **Physical Degradation of the Airport Surfaces and Facilities**
  - **Airside Maintenance/Construction Activities**

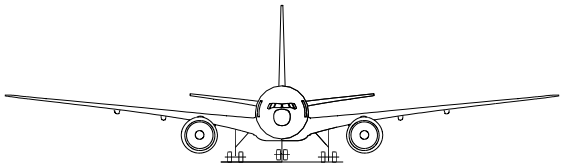
- **Operational Activities**
  - **Servicing & Maintenance of Aircraft**
  - **Windborne Debris from Adjacent Areas**
  - **Operation of Aircraft (Jet Blast)**

- **Personnel**

- **Weather Phenomena**

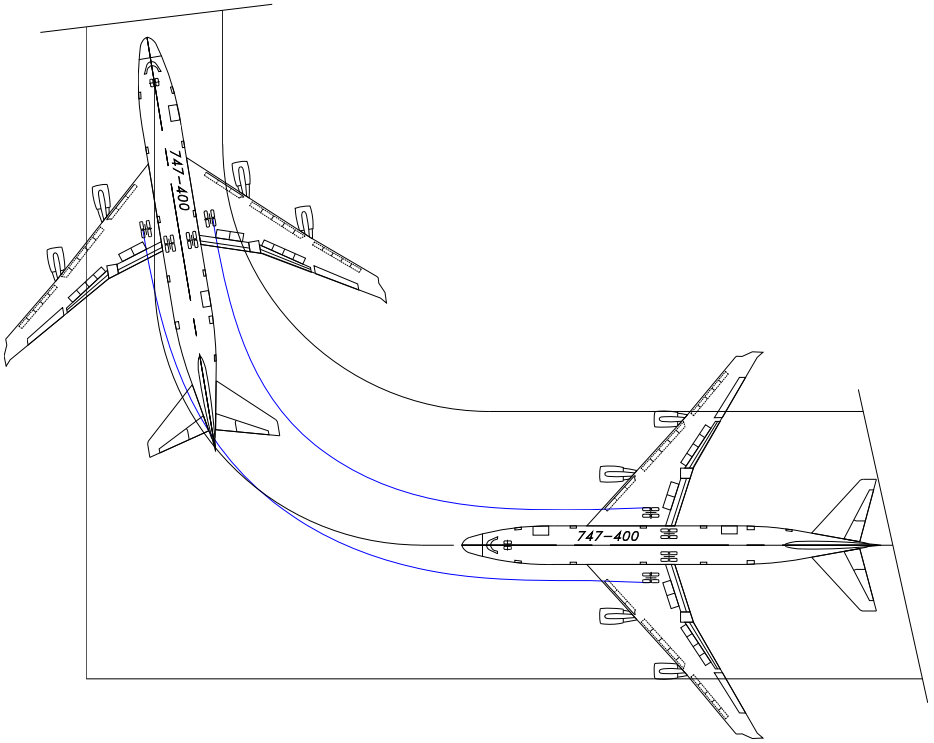
Infrastructure FOD Sources

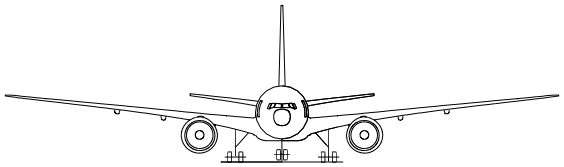
- **Broken Pieces of Pavement Collect at Edge of Gate Area, Then Are Carried Out Via Vehicle Tires**
- **Loose Pieces of Construction Material Can be Blown From the Gate Area Onto the Maneuvering Areas**



Operational FOD Sources

- On a 150 FT (45m) Wide Runway, The #1 and #4 Engines Can Blow FOD from Shoulder Area Back Onto The Runway
- Jet Blast From Aircraft Turning At RW/TW Intersections Can Blow FOD Onto Runway

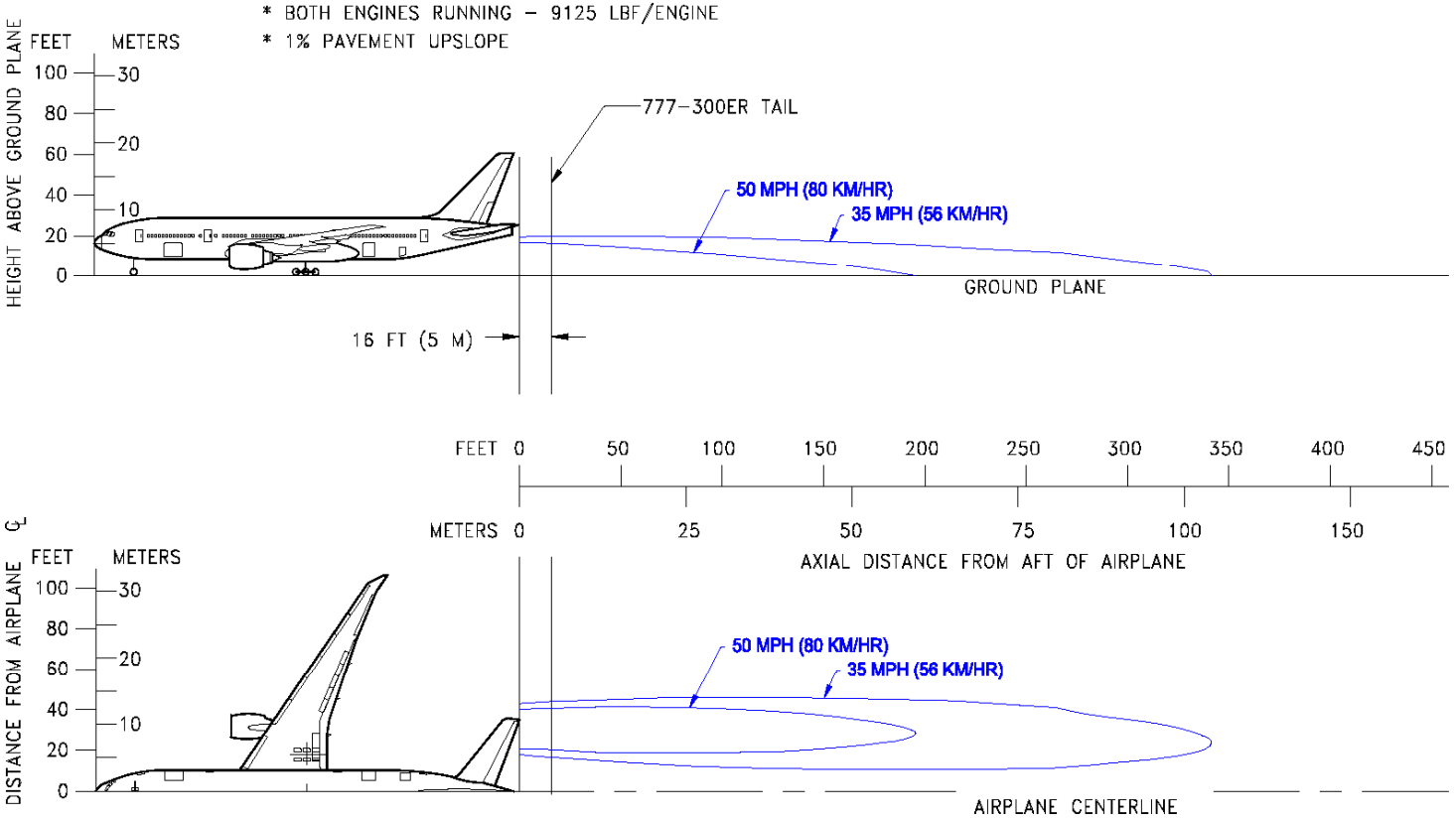


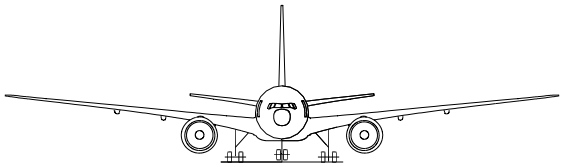


777-200ER Jet Blast - Breakaway Thrust

NOTES:

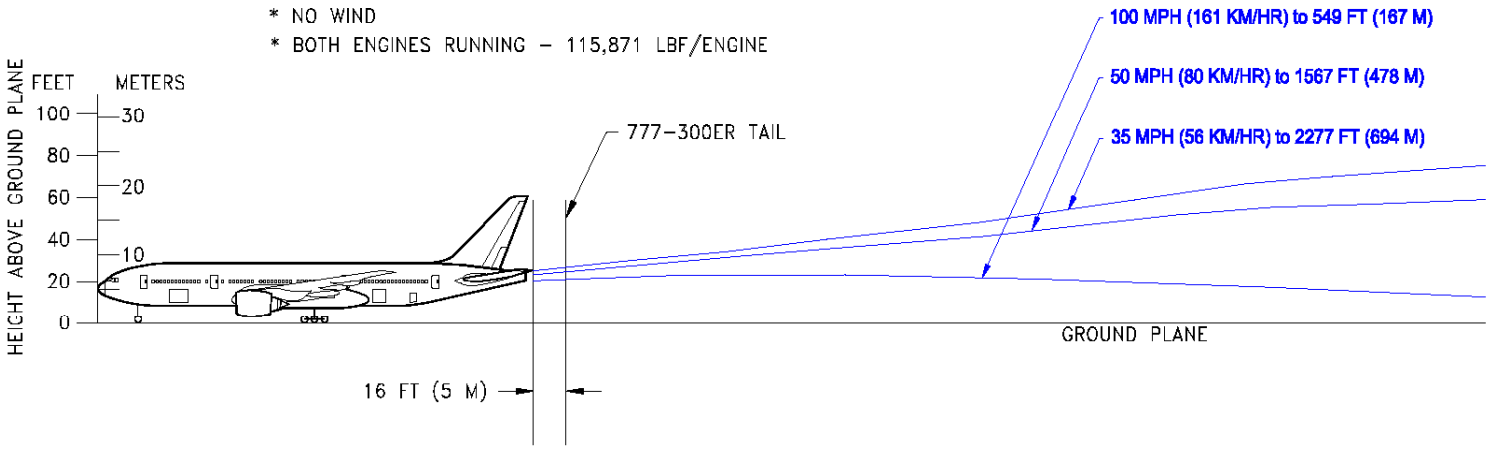
* ENGINE THRUST AT BREAKAWAY SETTING
* CONTOURS CALCULATED FROM COMPUTER DATA
* STANDARD DAY * STATIC AIRPLANE AT MAXIMUM TAXI WT (777,000 LBS / 352,442 KGS)
* NO WIND * SEA LEVEL
* BOTH ENGINES RUNNING – 9125 LBF/ENGINE
* 1% PAVEMENT UPSLOPE

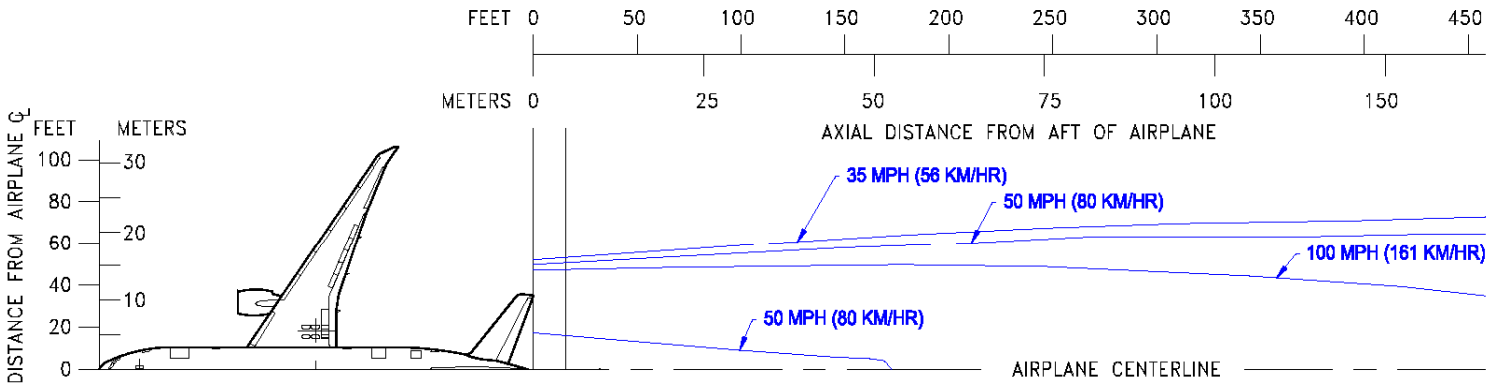




777-200ER Jet Blast - Takeoff Thrust

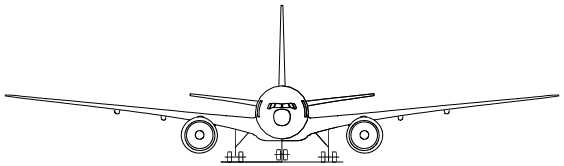
NOTES:
* CONTOURS CALCULATED FROM COMPUTER DATA
* STANDARD DAY
* SEA LEVEL
* NO WIND
* BOTH ENGINES RUNNING – 115,871 LBF/ENGINE





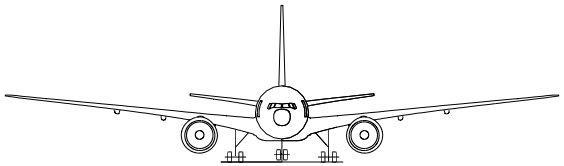
This is not an optional cargo storage area!

This was an Actual Event Caused by Jet Blast– Airline Name Removed



How to Control The Problem

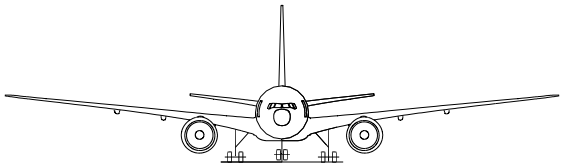
- Training
- Inspection by Airline and Airport Personnel
- Maintenance Activities
- Communication/Coordination
- New Technology Opportunities



Training

- **Both Airline and Airport Personnel Need Training to:**
  - **Identify FOD**
  - **Know the Potential Results of Ignoring FOD**
  - **Know How to Eliminate FOD**
  - **Recurrent Training**

- **Key to This Effort Is the *ACTIVE* Participation of All Personnel, Especially Airline Station Management and Flight Crews**

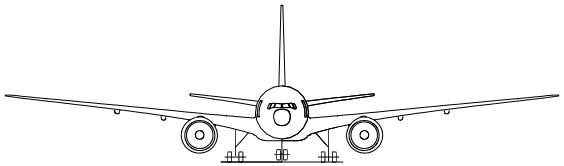


Inspection

- **Airline Personnel Should Participate, When Able, With the Airport Staff During the Daily Airside Inspections (This Will Ensure That the Local Airline Staff Know What Is Happening on the Airfield)**

- **FOD Inspections Must Be Carried Out at Regular Intervals**

- **Airlines Should Designate Individuals to Ensure That the Gate Areas Are Acceptable Prior to the Aircraft Operating There**



Maintenance Activities

- **Sweeping Operations Should Be Scheduled And Available On An "As Needed" Basis. Airlines Need To Provide Access To Gate Areas**

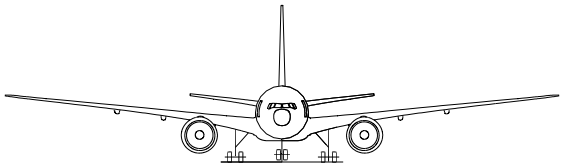
- **Capability Must Exist to Respond to Repair Problem Areas (Hole in Taxiway, Etc.) So As To Minimize the FOD Potential**

- **Funding Must Exist to Maintain Paved Surfaces In Good Condition**

- **Procedures Must Be In Place (Airport & Airline) For Weather/Disaster Recovery, To Include FOD Removal**

FOD Reduction Methods

- Rumble (Shaker) Strips Can be Used to Dislodge FOD From Vehicle Undercarriage Prior to Operating on the AOA
- These are Locally Manufactured and Can be Transportable

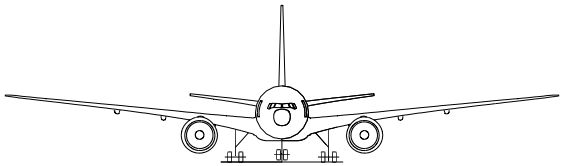


Communication/Coordination

- **Notification of Airside Construction Activities and Scheduled Maintenance Must Be Disseminated to the Airport Users**

- **Airport Pre-Construction Planning Must Include the Methodology to Control and Contain FOD Generated by the Construction Activity**

- **Airlines Need an Active Airport Users Committee to Coordinate Their FOD Control Efforts With the Airport and Other Tenants**



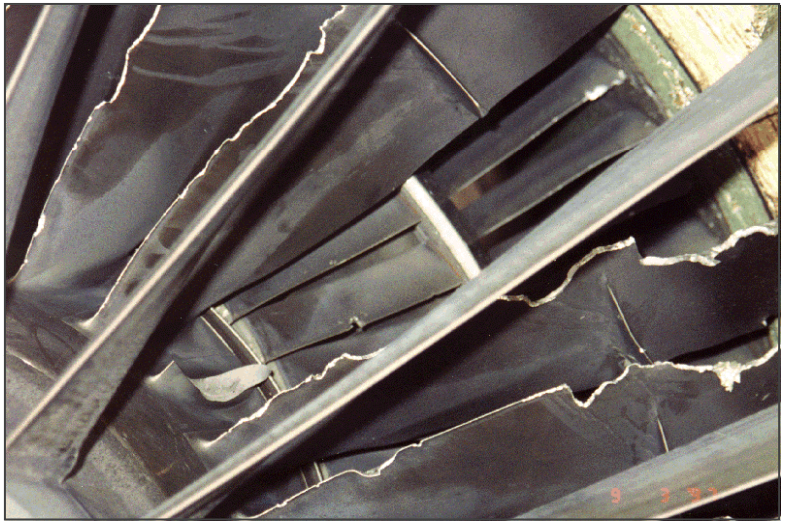
New Technology Opportunities

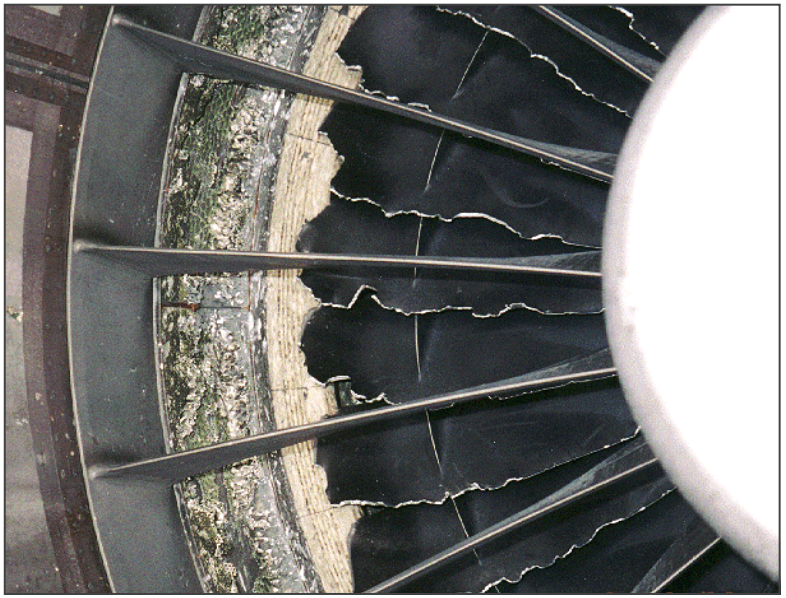
✈ AC 150/5220-24, Airport Foreign Object Debris (FOD) Detection Equipment describes:

- **Stationary Radar**. A radar detection system, able to detect a metallic cylindrical target measuring 1.2 in. (3.0 cm) high and 1.5 in. (3.8 cm) in diameter at ranges of up to 0.6 mile (1 km). Sensors are located 165 ft (50.0 m) or more from the runway center line.
- **Stationary Electro-Optical**. An electro-optical detection system, able to detect a 0.80 in. (2.0 cm) object target at ranges of up to 985 ft (300. m) using only ambient lighting. Sensors are located 490 ft (150 m) or more from the runway center line.
- **Stationary Hybrid**. Uses both an electro-optical and radar sensor in a unit collocated with the runway edge lights. The system is able to detect a 0.8 in. (2 cm) target on the runway.
- **Mobile Radar**. A radar detection system mounted on top of a vehicle that scans the surface in front of the vehicle when moving. The radar scans an area 600. ft by 600. ft (183 m by 183 m) to detect FOD items measuring 1.2 in (3.0 cm) high and 1.5 in (3.8 cm) in diameter. The system can operate at speeds of up to 30 mph (50 km/h), supplementing human/visual inspections.

BOEING

Remember!!!!!






FOD CAN BITE
YOU IF YOU'RE
NOT
CAREFUL!!!

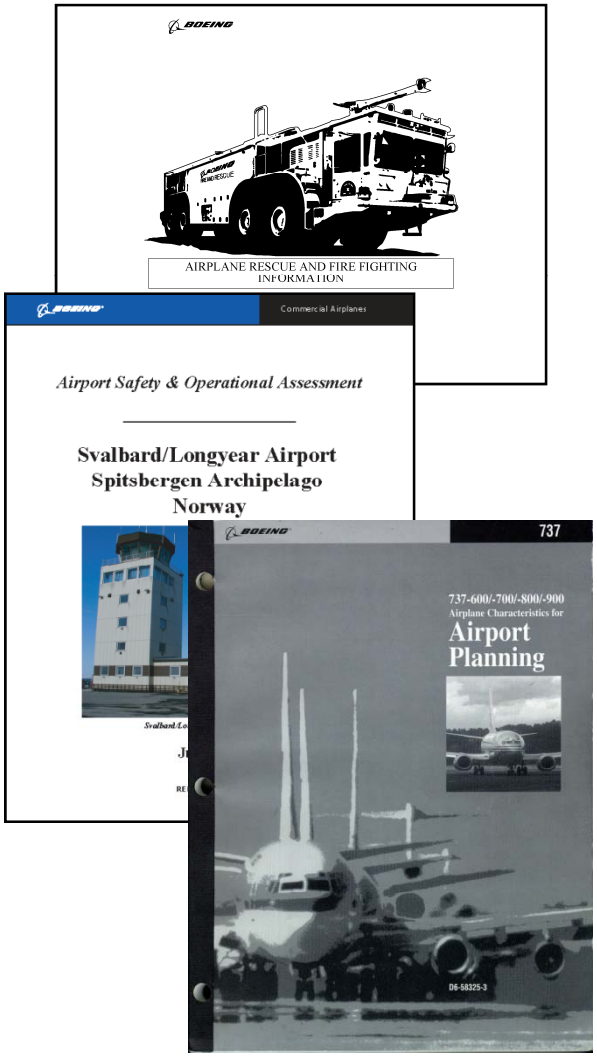
Conclusions

- Control FOD Through a Combination of the Following:
  - Training
  - Inspection
  - Maintenance
  - Communication/Coordination
  - New Technology Opportunities

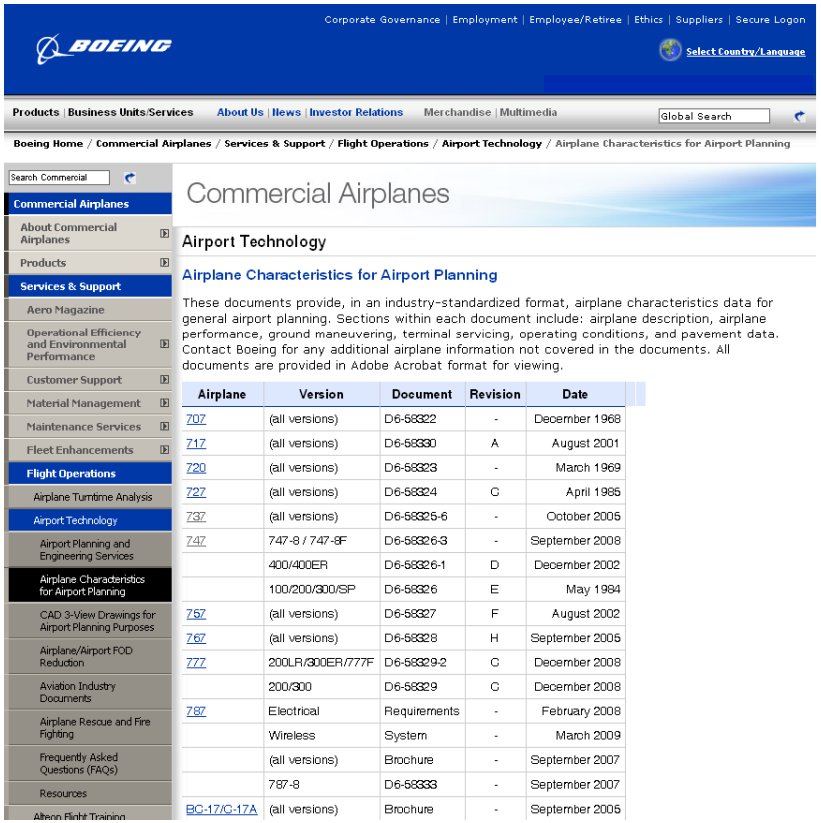
- Airlines Need an Active Airport Users Committee To Coordinate Their FOD Control Efforts With the Airport And Other Tenants

- FOD Is ***Everyone's*** Responsibility and by Teamwork It ***Can*** Be Controlled!

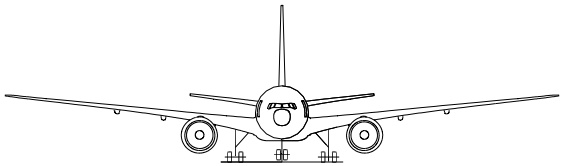
Airport/Airplane Compatibility Data & Documentation



Available on www.boeing.com/airports



Airplane	Version	Document	Revision	Date
707	(all versions)	D6-58322	-	December 1968
717	(all versions)	D6-58330	A	August 2001
720	(all versions)	D6-58323	-	March 1969
727	(all versions)	D6-58324	C	April 1985
737	(all versions)	D6-58325-6	-	October 2005
747	747-8 / 747-8F	D6-58326-3	-	September 2008
	400/400ER	D6-58326-1	D	December 2002
	100/200/300/SP	D6-58326	E	May 1984
757	(all versions)	D6-58327	F	August 2002
767	(all versions)	D6-58328	H	September 2005
777	200LR/300ER/777F	D6-58329-2	C	December 2008
	200/300	D6-58329	C	December 2008
787	Electrical	Requirements	-	February 2008
	Wireless	System	-	March 2009
	(all versions)	Brochure	-	September 2007
	787-8	D6-58333	-	September 2007
BC-17/C-17A	(all versions)	Brochure	-	September 2005



Additional FOD Resources

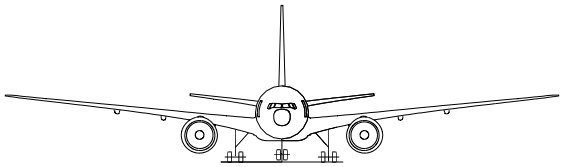
http://www.fodcontrol.com/

Make It FOD Free: FOD Prevention Program Manual

FOD*BOSS Rapid Response Airfield Sweeper

Additional FOD Resources:
FOD Prevention Program Manual:

*Additional FOD Resources: FOD*Boss*



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Website - <http://www.nafpi.com>