

Airport Operations Under Intense Dust Storm Conditions In Egypt

User Workshop on Dust Products for Aviation
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Cranfield University
Bedford, UK





Cairo



Giza



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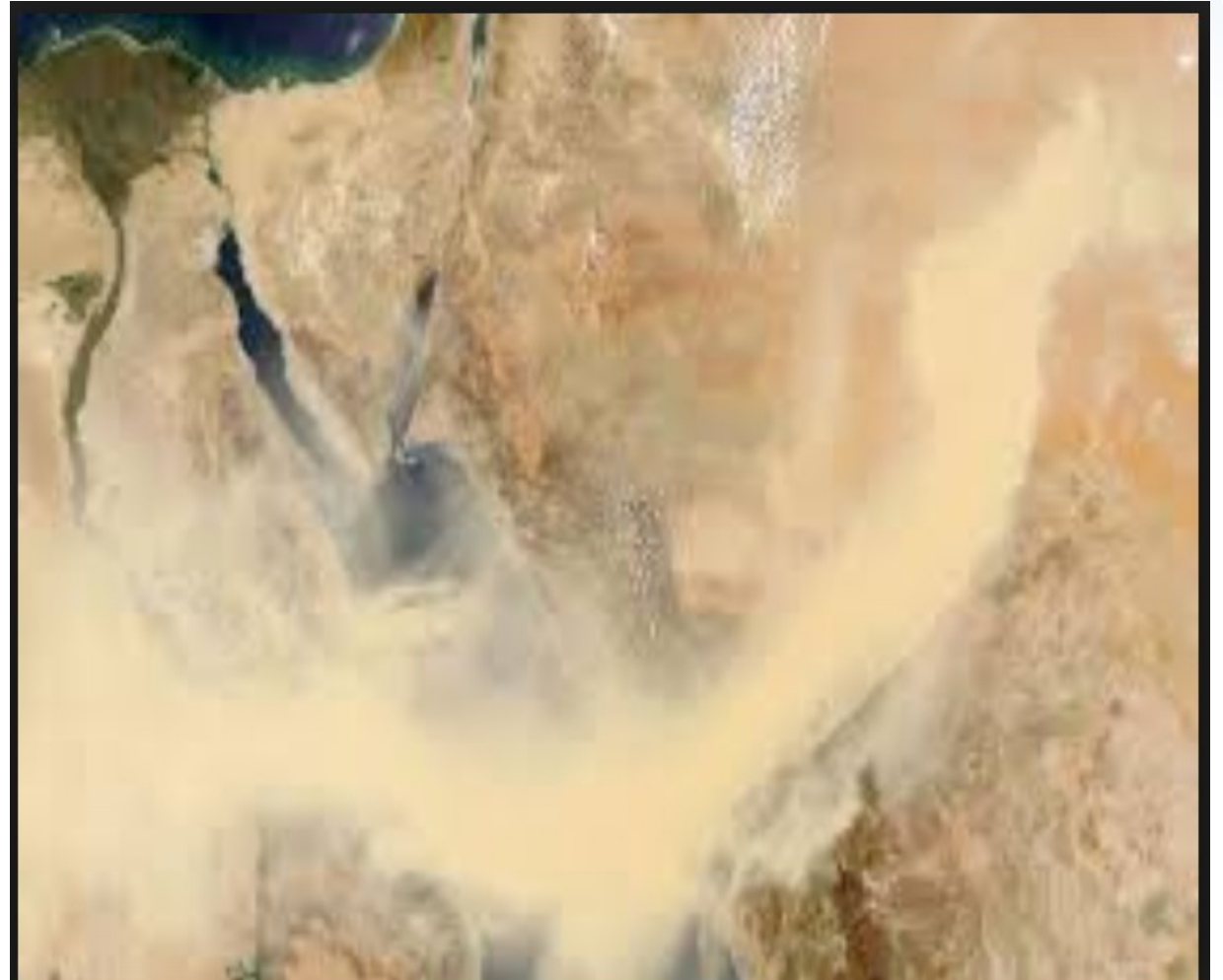
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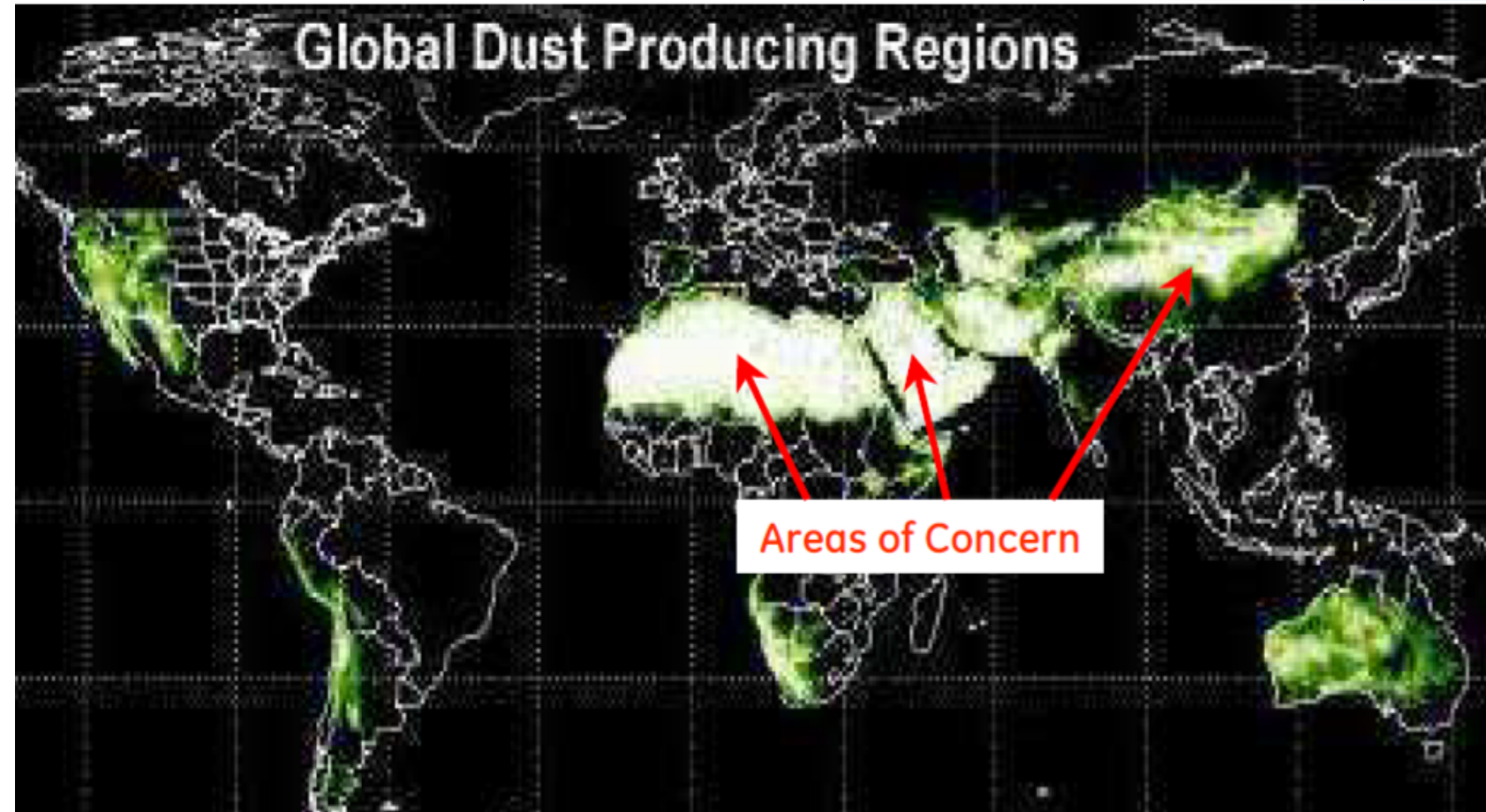
Effect on Aircraft Maintenance.





Introduction:

An aircraft is considered subjected to a hot-and-harsh environment if operated for more than 50 percent of its departures within the Middle East/North Africa (MENA) region. (Embraer Service Newsletter)



Location of Egypt



Introduction (cont.):

Areas of Concern

Algeria, Bahrain, Chad, Egypt, Ethiopia, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Mali, Mauritania, Morocco, Niger, Oman, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates, or Yemen.





Introduction (cont.):



Map of Egypt

Domestic and International Airports





A Sand Storm In Egypt:

“a hazard to flights”





Airside Area Classification:

Airside

The airside is that part of the aerodrome from which unrestricted access is available to the aircraft movement area and from which unauthorised personnel – particularly the public – are excluded for security and safety reasons.

The Manoeuvring Area

This is the part of the aerodrome designed for the take-off and landing of aircraft as well as the surface movement of aircraft but excludes the apron area and any part of the aerodrome designed for maintenance of aircraft. Typically, the manoeuvring area consists of the runways and taxiways.



The Movement Area

This is the part of the aerodrome provided for the surface movement of aircraft, including the apron area, the manoeuvring area and any part of the aerodrome set aside for the maintenance of aircraft.

The Apron Area

This is the part of the aerodrome provided for the parking of aircraft and where most ground handling takes place. This includes cleaning, catering, fuelling, passenger movements, baggage and freight loading and unloading as well as limited aircraft maintenance work.



Effect on Airport Operations:

- Warning:
Visibility Level
Wind Speed
- Blowing dust,
- Strong winds, and
- Limited visibility.





Effect on Airport Operations (cont.):

Ground operations at airport terminals:

- **Personnel:**

Outside workers may be hampered or even prevented from doing their jobs. May also pose health hazards to ground personnel and pilots if it is breathed in.

- **Runways:**

Strong storms can leave dust on runways, and must be cleaned up before normal operations can be resumed.





Effect on Airport Operations (cont.):

Tuesday 13 Feb 2018:

“Dust storm shuts down air traffic at Upper Egypt's Aswan airport”





Effect on Airline Operations:

Airlines often need to delay or even cancel departures on short notice due to:

- Unforeseen maintenance needs caused by sand and dust.
- Operational safety issues related to flight crew members (Crew time exceedance; Fatigue risk; Change crew).
- Disturbance of flight schedule



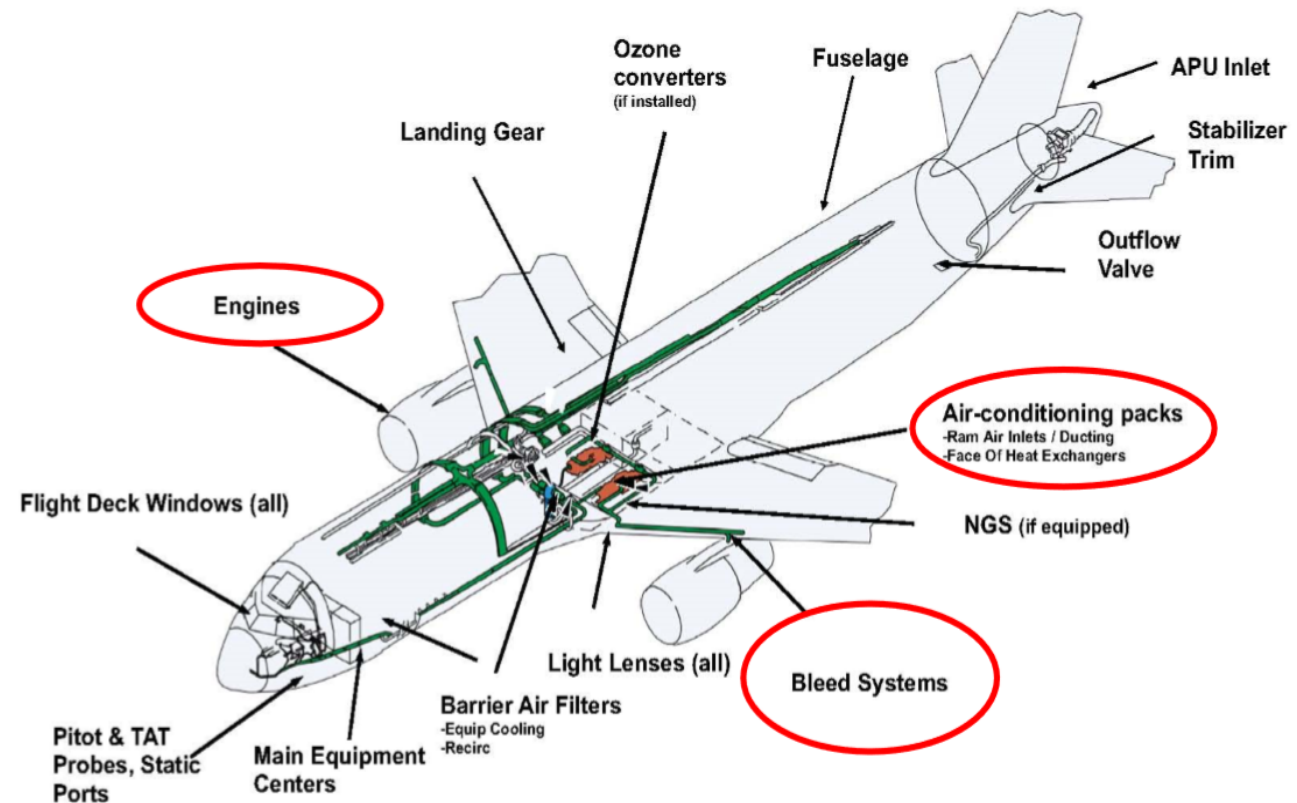


Effect on Aircraft:

Dust particles make their way into an engine will decrease engine performance.

Blowing dust effect:

- Damage the external surface of the aircraft.
- Clogging of filters
- Failure of valves
- Dust in cabin
- Computers/modules overheating



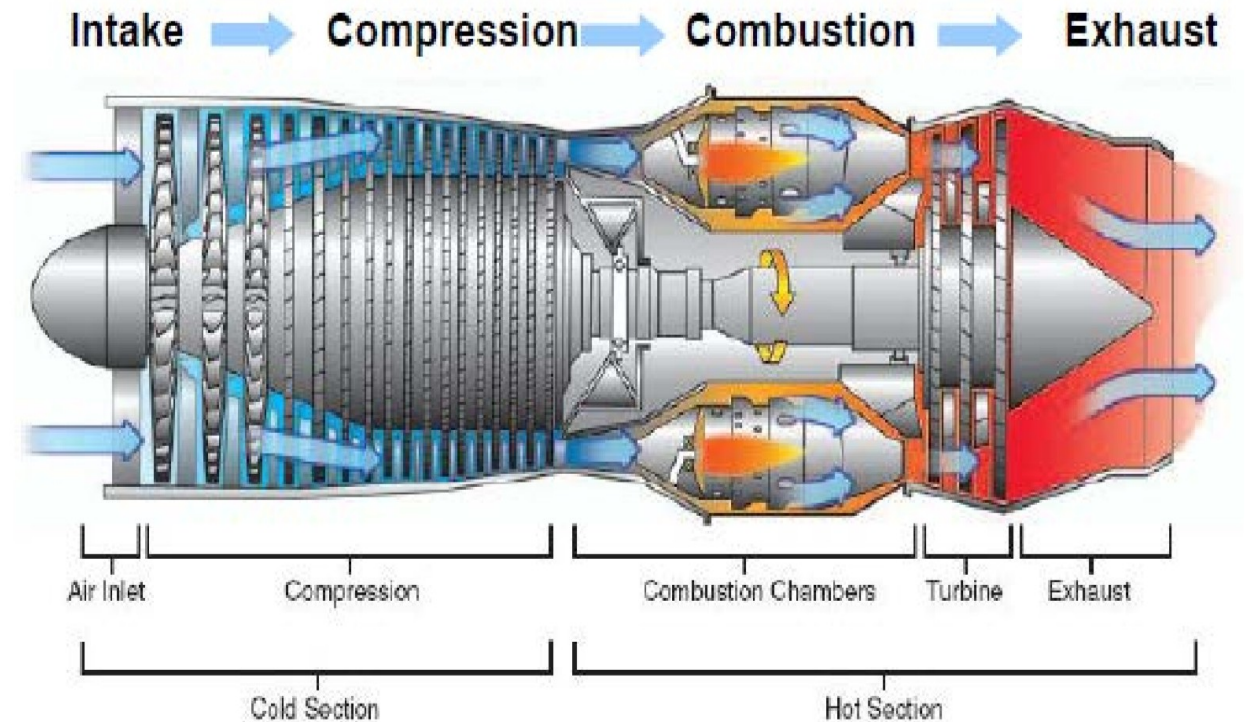


Effect on Aircraft Maintenance:

Engines:

Sand build-up in turbine cooling holes, melting in hot cavities, exposing the protective coatings in the hot section, specifically deterioration of:

- High Pressure Nozzle Guide Vanes.
- High Pressure Turbine Blades.
- Combustion Chamber Liners.





Effect on Aircraft Maintenance (cont.):

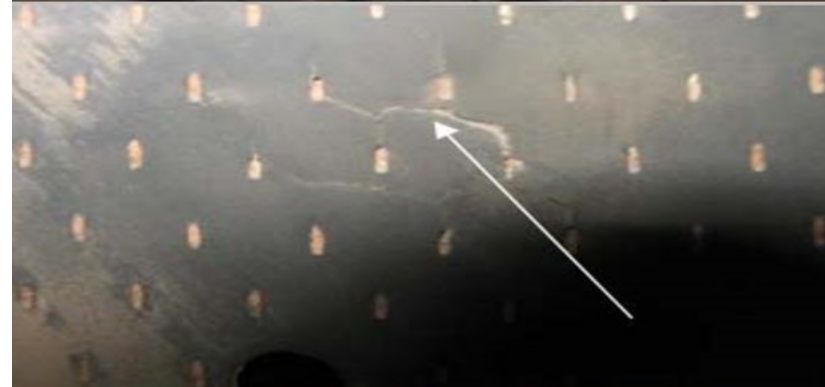
Average rate of removals for some major components:

- B777 Engines:
Removals at 9000 FHR (60000)

- B777 APU:
Removals at 4000 FHR (22000)

- B777 Heat Exchanger:
Removals at 5000 FHR (18000)

Note: To build an opinion, Hour/ Cycle Ratio, flight hours and altitude should be defined



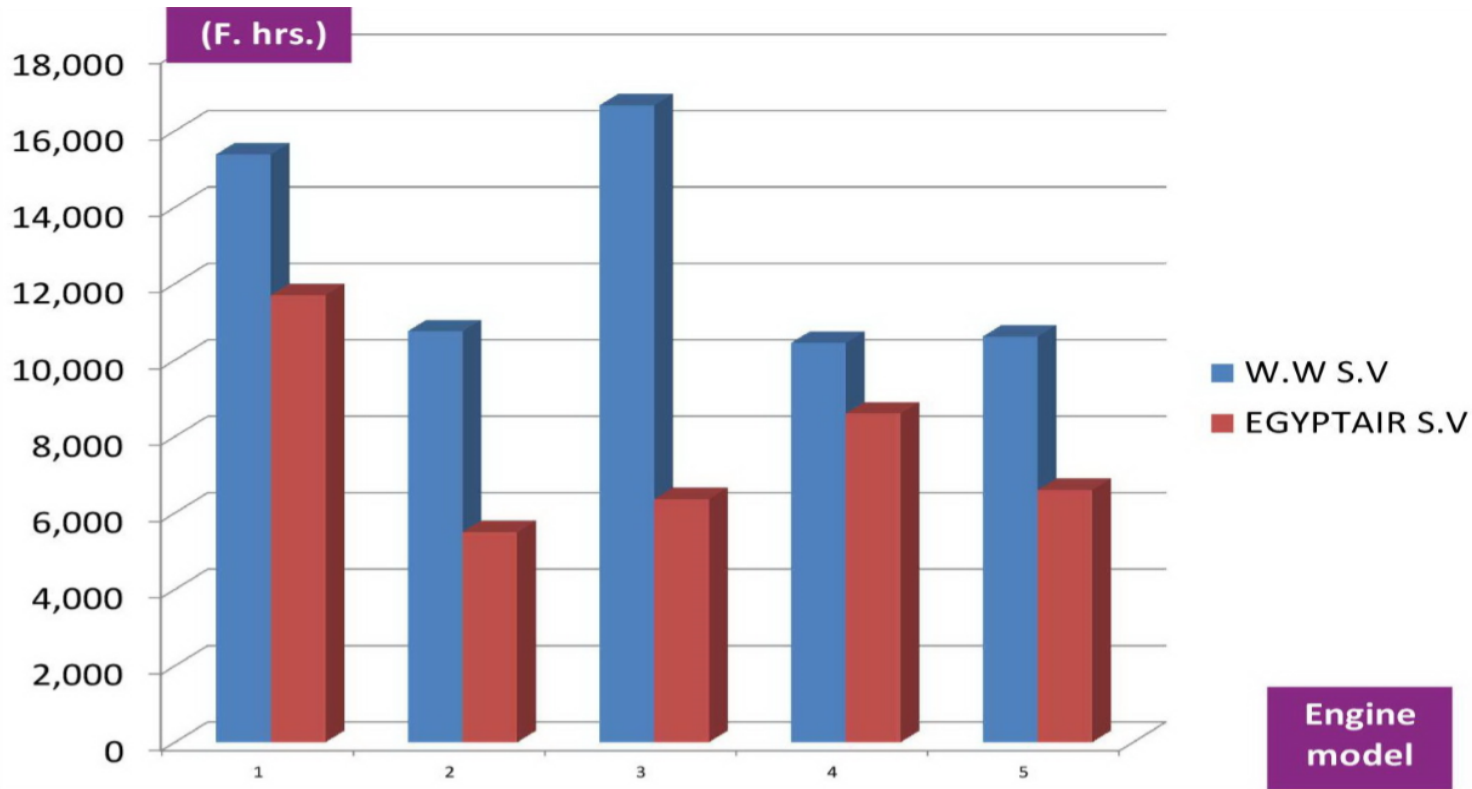
Combustion Chamber Distress



HPT Blade Erosion



Effect on Aircraft Maintenance (cont.):



Engines:
Average shop visit times for EagyptAir engines compared to worldwide fleets (E170 is 60%)



Figure 60 - 2nd Stage Vanes

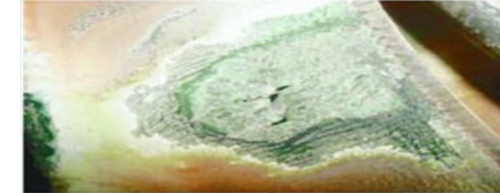
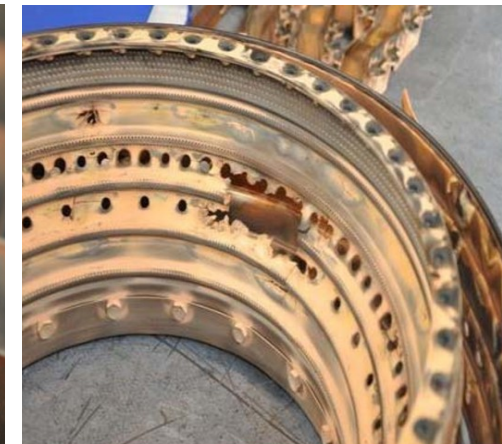


Figure 61 - 2nd Stage Vanes

HPT Stage 2- distress



HPC Blades- Dirt& Dust



Combustion Chamber



Effect on Aircraft Maintenance (cont.):

LRUs



Air-conditioning packs



Heat Exchanger Contamination



IFE Compartment



Cockpit air distribution duct





Effect on Aircraft Maintenance (cont.):

Additional Cost of Maintenance

For a fleet of 109 aircraft:

58% of the standard "A" Check Package are
Additional Tasks to the MPD.

~ 90 Million USD Over Regular MPD Manpower
Cost.

~ 240 Million USD Over MPD for Components and
Consumables.

On Average, $\frac{1}{4}$ Component On-Wing Life due to Accelerated
Deterioration.

~ 40 Million USD Over Industry cost of APU Repair/Overhaul.

~ 120 Million USD Over Industry cost of Engine Repair/Overhaul





Conclusion:

- Access to services related to sandstorms and duststorms prediction and warning advisories
- The abrasive quality of these aerosols on wind screens and paintwork and the potential impact on the correct functioning of mechanical and electronic components of aircraft continue to pose questions and deserve further investigation by the engineering departments of manufacturers and operators.
- In the absence of clear guidance on the relative importance of the granularity, size spectra and chemical /mechanical properties of the aerosols forming the sand and dust, a definitive proposal on thresholds and criteria for defining the intensity of sandstorms and duststorms is difficult to make.
- Continued involvement of and coordination with the engineering side will be required to arrive at a more definite solutions.

Thank You



Eng. Hisham Nasser
CEO Technical Consultant
CIAF Leasing

