GE Aerospace

# Commercial Flight Safety Presentation

Aviation Safety and Aircraft Accident and Incident Investigation Symposium

November 2024

Abu Dhabi, United Arab Emirates

# GE Aerospace… the environment

**52,000** employees

– **62+** Supply Chain locations

– **8** Engineering centers

– **31** countries

– **5,000** suppliers & vendors

– **19** joint ventures (including CFM International and the Engine Alliance)

- **500+** global customers
- **68,000+** installed base of engines (commercial & military)
- **Every 2 seconds** an aircraft with GE engine technology –a) is taking off somewhere in the world
- **900,000+** people in the air right now depending on our engines

(a- Includes joint venture engines built by CFM and EA

# The Aerospace Response Center

## Global Footprint

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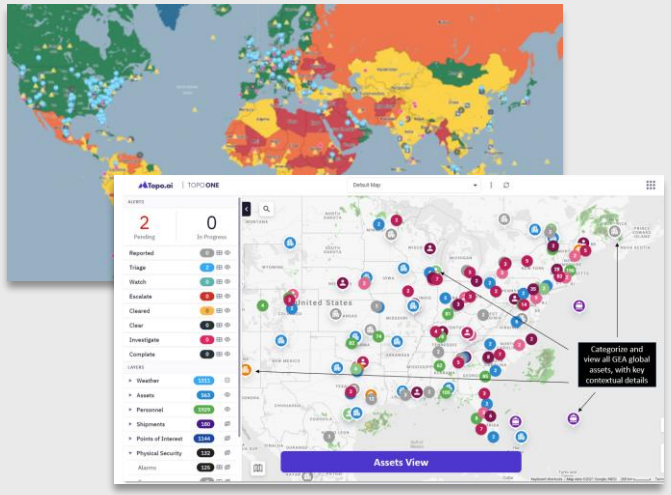
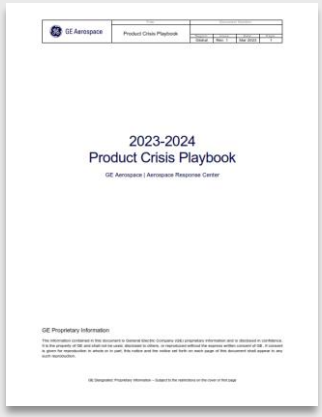
## Monitoring & rapid notification




- 24/7 analyst coverage
- News & social media monitoring
- *Flightradar24* tracking
- WorldCue Mobile app

## Event Triage


**Commercial Product Crisis Board**

| Function | Strategy | Tasks |
|---|---|---|
| **Flight Safety Update**<br>Flight Safety Engineer | Determine technical scope and severity of the event. Support and interface for regulatory authorities throughout investigation | 1) Provide overview of event details<br>2) Update on investigation status<br>3) Communications with regulatory authorities |
| **Engine Information**<br>Product Line Leadership | Coordinate Product Line response by pulling engine history from FDM. Determine the timing for safety analysis to support the fleet | 1) Provide engine information<br>2) Provide aviation systems information relating to aircraft<br>3) Provide engine history<br>4) Determine method of removal / recovery<br>5) Has the SPMT board been notified?<br>6) Is review scheduled?<br>7) Assess imminent risk to fleet |
| **Root Cause Analysis**<br>Product Line Engineering Leadership | Coordinate Product Line technical response and process for root cause identification | 1) Factory Team Status per 901.51<br>2) Report out on known flight data<br>3) Provide update for progress on root cause identification |
| **Fleet Action Plan**<br>C&P90 | Coordinate fleet actions and resources needed to support impacted customers | 1) Provide snapshot data<br>2) Report out on customer inquiries<br>3) Identify regional customer service focal<br>4) Identify available containment activities<br>5) Assess impact of customer actions |
| **Communications – Customer / Media / Employee / IR**<br>External Communications | Develop consistent communications for stakeholders based on assessment of events including media and social media coverage | 1) Provide overview of significant media coverage<br>2) Review Stakeholder Engagement Matrix to align communications<br>3) Develop and update holding statement for all audiences |
| **Legal**<br>Litigation Counsel | Ensure compliance to legal and regulatory requirements, and appropriate internal and external communications; Notify insurance carrier as required | 1) Coordinate with media, program and flight safety teams on communications<br>2) Determine whether insurance carrier notification is required<br>3) Reinforce Annex 13 running rules |
| **ARC**<br>Crisis Management Leadership | Ensure all functions are coordinated and following the established crisis management process | 1) Questions, comments, or input from the group<br>2) Coordinate & schedule follow-on triage call(s)<br>3) Assist in monitoring new developments to event<br>4) Deliver key leader notifications as necessary |

# GE Aerospace's Capabilities to support Investigation Agencies

## Technical Advisors

- Located in 7 Countries, including India
- 24/7 Support
- Experienced in supporting international investigations
- GE & Safran fully integrated on CFM

## Failure Analysis Lab

- 5 Sites
- Experienced in supporting investigations (Govt, Significant events, Field events etc)
- 1 Lab in Safran to support CFM

## Engine Overhaul Shops

- 12 GE owned Shop
- Support at 3rd Party shops
- 4 On-Wing-Support locations

## Training/Familiarization

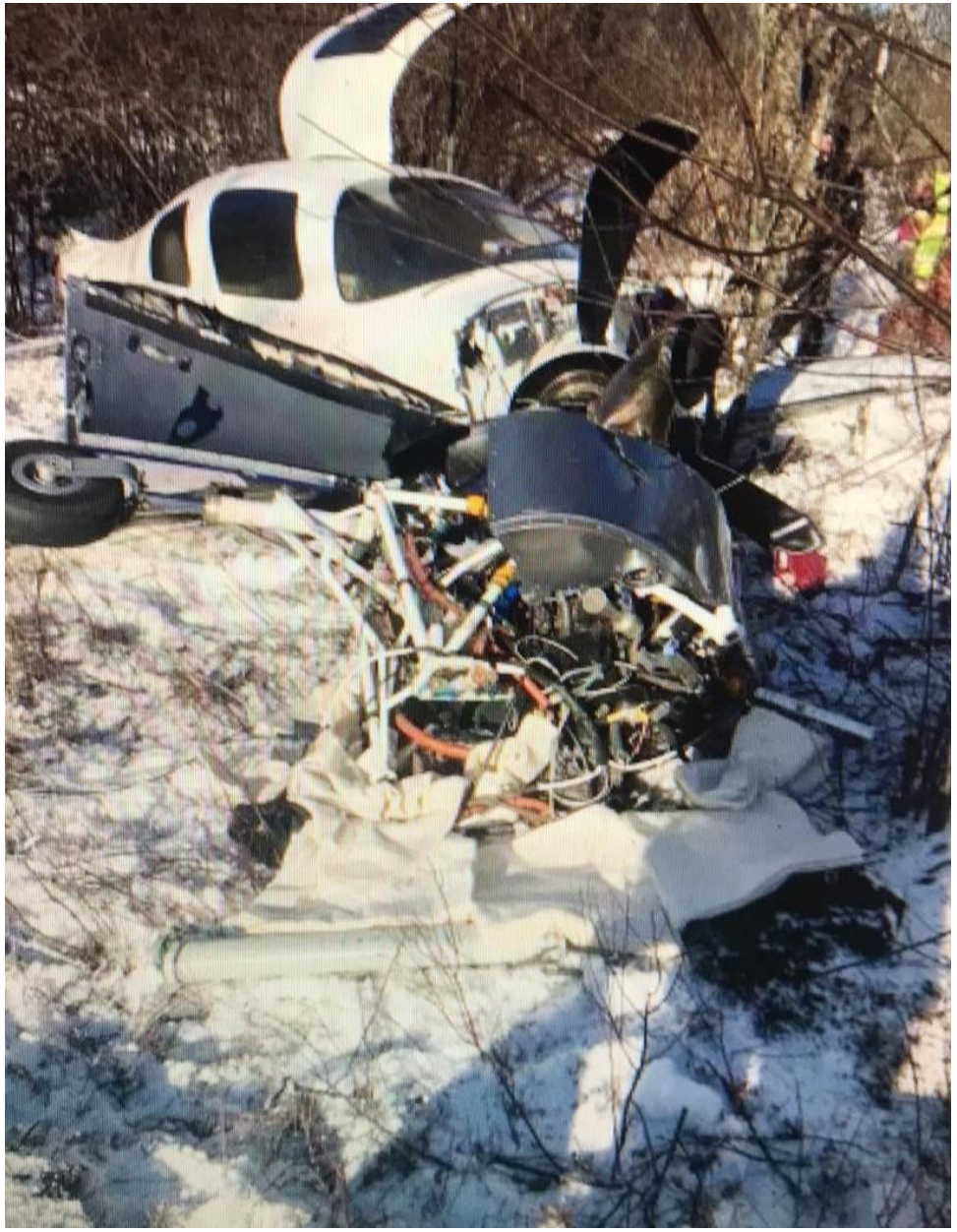
- Engine familiarization & Tear Down
- Certification Overview
- Investigation overview training
- Hosted Regional Regulators (Ex: DGCA, CAAC at GE Aerospace Centers for familiarization activities)

# GE Aerospace Type Certificates

## (State of Design/State of Manufacture)

GE Aerospace (GEA) will always be a party member or a technical advisor to a government agency conduction and  investigation that follows the engine Type Certificate (TC)

- GE Aerospace is a Type Certificate Holder (TCH) in four nations so will always be working with one of the following agencies:
  - NTSB USA
  - BEA France (CFM)
  - AAII Czech Republic
  - AAIB United Kingdom
- GE Aerospace will support the Investigative Agency via ICAO Annex 13 protocol with the government agency
- GE Aerospace is available to support the on-site, engine disassembly, recorder readouts, and component level investigations



# Collaboration/cooperation on a regional levels

## Safety Symposium/Seminars

- AAIB Overview/Statistics in Regional GE Aerospace Safety Symposium
  (Dedicated 1 full day event on Product Safety where FAA,EASA, DGCA,AAIB, Airlines, Airframers, Engine OEMs, Supply chain share & discuss perspectives on safety topics)


- GE Aerospace participating in AAIB/AP-SAS/MASS/ACP-CAAC.. conferences


"Using Data to Manage Propulsion Safety" & Panelist on Data Sharing between Regulator & Industry

## Regulator Outreach Programs

- NTSB, AAIB-India, GE, PW, Boeing Outreach in India (April 2024)


- CAAC – GE Aerospace Outreach Programs on Product Safety (Sep 2024)

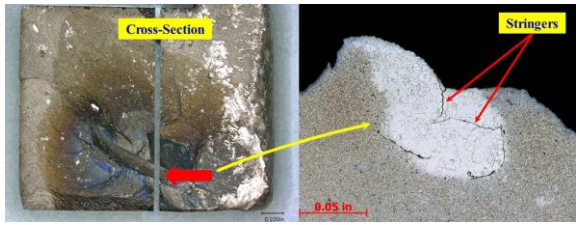
- DOA (Design Organization Approval) SMS Implementation Symposium (June 2024)

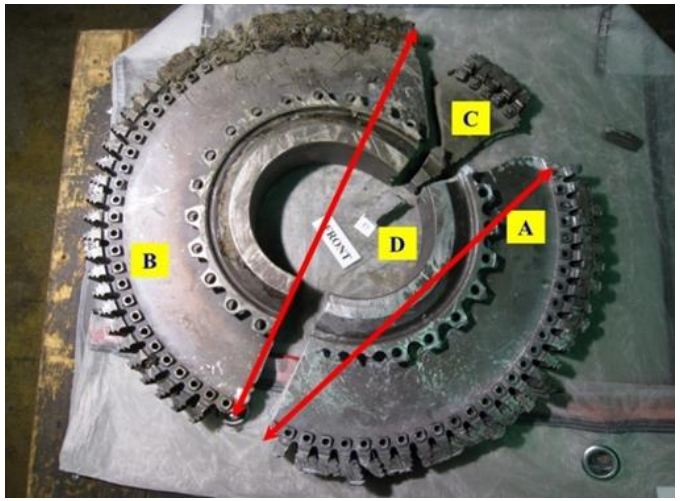
# American Airlines, AA383, 28th Oct 2016, Rotor Disk separation

## Event Description:

- October 28, 2016
- Operator: American Airlines; Flight # AA383
- B767-323, Registration # N345AN
- CF6-80C2B6, Engine Position #2,  ESN 690-373
- Event Location: Chicago O-Hare Airport (ORD); Time: 14:32 CDT
- 161 Passengers & 9 Crew, 21 Injuries (1 Serious Injury)
- The HPT S2 disk (IN718) of the #2 engine separated during the takeoff roll.  A disk fragment penetrated the wing fuel tank leading to a ground fire that damaged the wing & fuselage beyond repair. The separation was due to crack propagation from a Discrete Dirty White Spot introduced in the Inconel disk material melt process.

## Event Photos:




## Investigative Findings:

- Analysis of the material anomaly identified it as a '**discrete white spot**' that is associated with a step in the ingot production process.
- The material anomaly was further classified as a '**discrete dirty white spot**' due to its composition; 'discrete dirty white spots' are associated with clusters of micron-sized oxide, nitride, and/or carbonitride particulates.
- Historical production and testing results on the triple-melt process indicate that the 'discrete dirty white spot' is an **inherent infrequent characteristic of the vacuum arc remelting process.**

## Corrective Actions & Lesson's Learnt:

- **Interim Actions:**
  - Service Bulletins issued for enhanced UTI of CF6-80C2 S1 & S2 HPT disks and CF6-80A S2 HPT disks (common part number) produced prior to the year 2000
  - The FAA issued NPRM 2017-19018 on September 7, 2017, intending to AD these service bulletins
- **Final Actions**:
  - Rotor Integrity Steering Committee and JENQC (Jet Engine Nickel Quality Committee) evaluating appropriate inspection techniques
  - GE Aerospace implementing enhanced disk inspections at new make and in-service

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# Thank You