

Beechcraft®



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TEXTRON AVIATION

# Continued Operational Safety Risk Assessment of Textron Aviation's Commercial Fleet

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July 5, 2018

# Textron Aviation's Commercial Fleet

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- Several Textron Aviation piston and turboprop models are used in scheduled airline service or for hire operations including:
  - Beech 1900
  - Beech King Air
  - Cessna 208
  - Cessna 402B/402C ←
  - Cessna 180/185 ←



# Cessna 402C

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- Popular choice for many small regional airlines
  - Flown on short routes to connect to major airline hubs
  - Sight seeing trips to the Grand Canyon
- Popular choice for small business owners
- Some higher time airplanes used as cargo haulers
- Half of current U.S. fleet is owned by a single airline
- 381 manufactured between 1979-1985



# Cessna 402C Design History

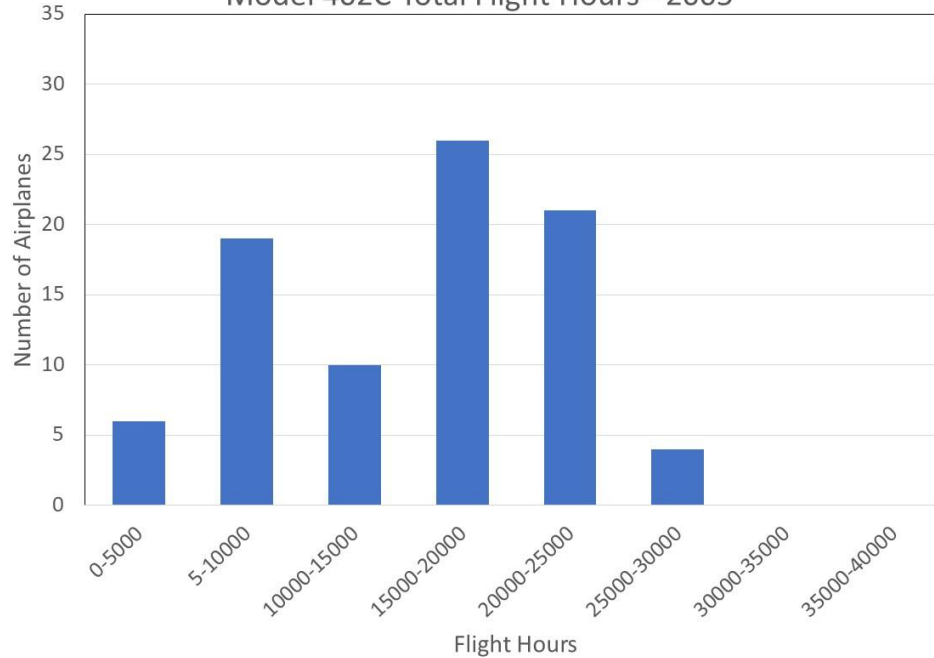
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- Derivative of the Model 402B
- New wing design
- New engine beam structure
- Increased engine horsepower
- Hydraulic landing gear
- Increased vertical stabilizer area
- Increased takeoff weight

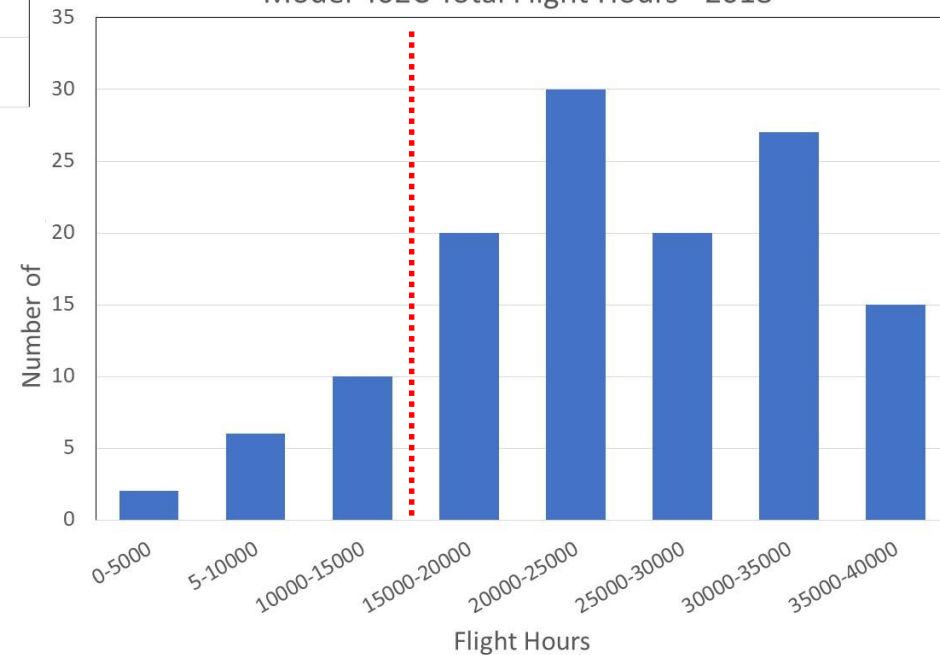


# Model 402C Fleet Flight Hours

Model 402C Total Flight Hours - 2005

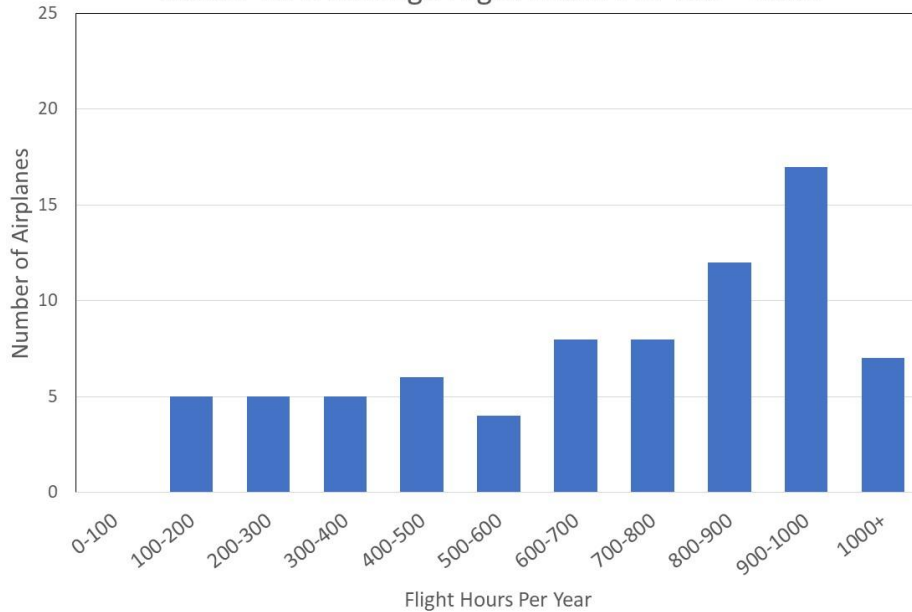


Model 402C Total Flight Hours - 2018

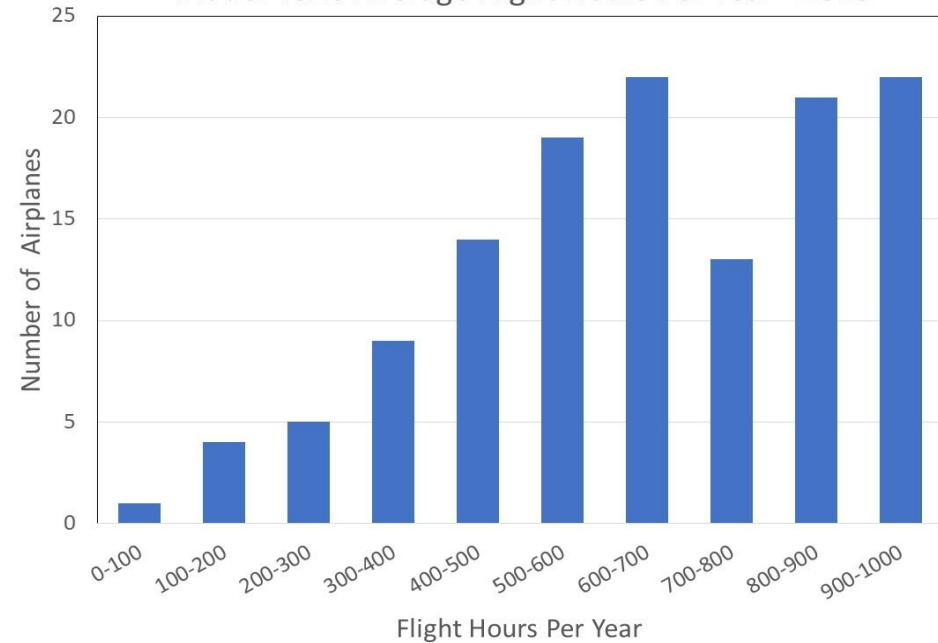


# Model 402C Annual Flight Hours

Model 402C Average Flight Hours Per Year - 2005

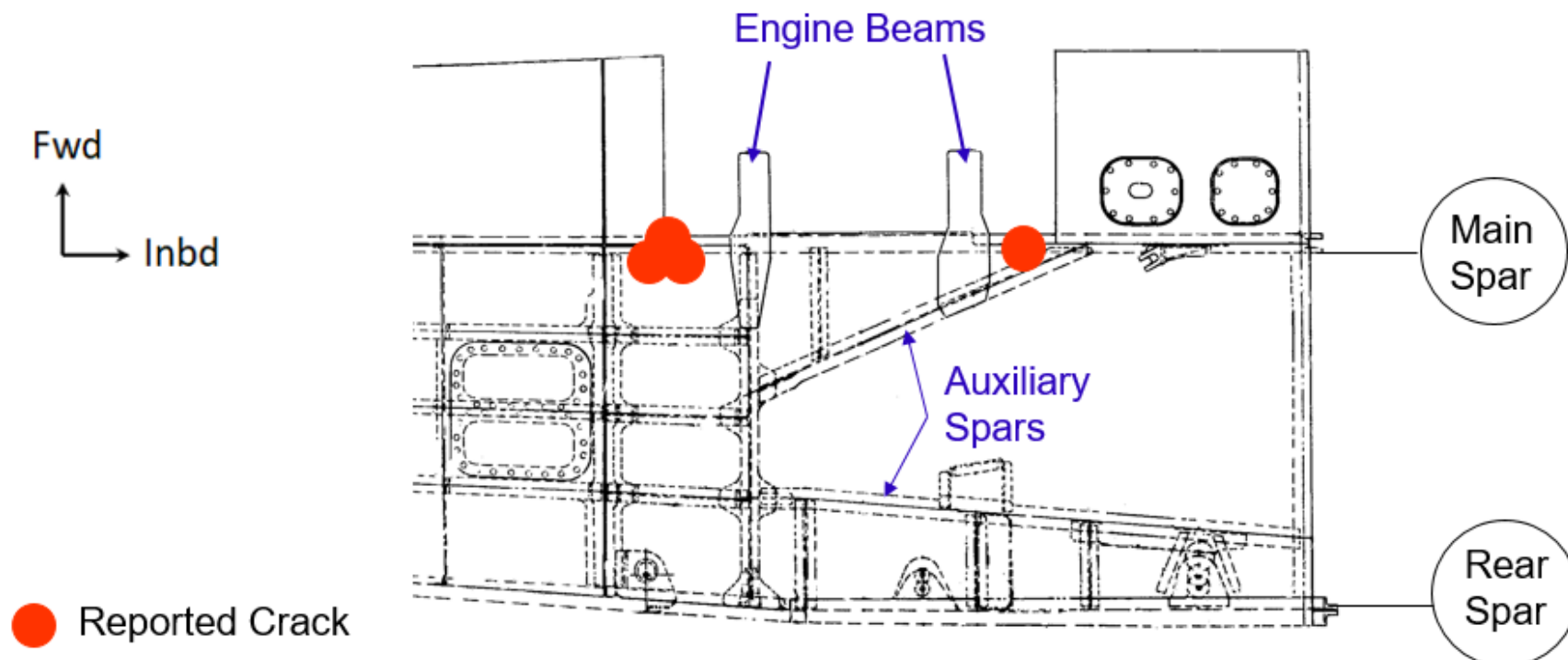


Model 402C Average Flight Hours Per Year - 2018



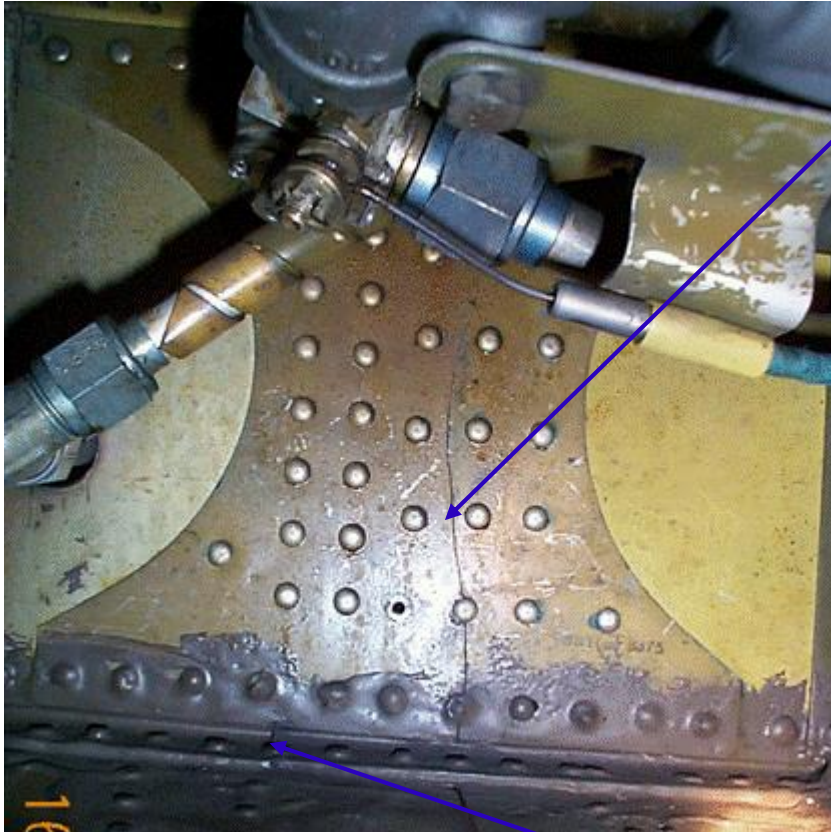
# Model 402C Service History

- Main Spar Cap Cracking
  - April 1999 - wing separation as a result of metal fatigue (20,457 Hrs.)
  - February 2005 - wing spar crack reported on scheduled airliner (20,349 Hrs.)
    - Two more wing spars found cracked the same week (20,510 & 20,349 Hrs.)
  - Airworthiness directive to install wing spar strap at 15,000 Hours

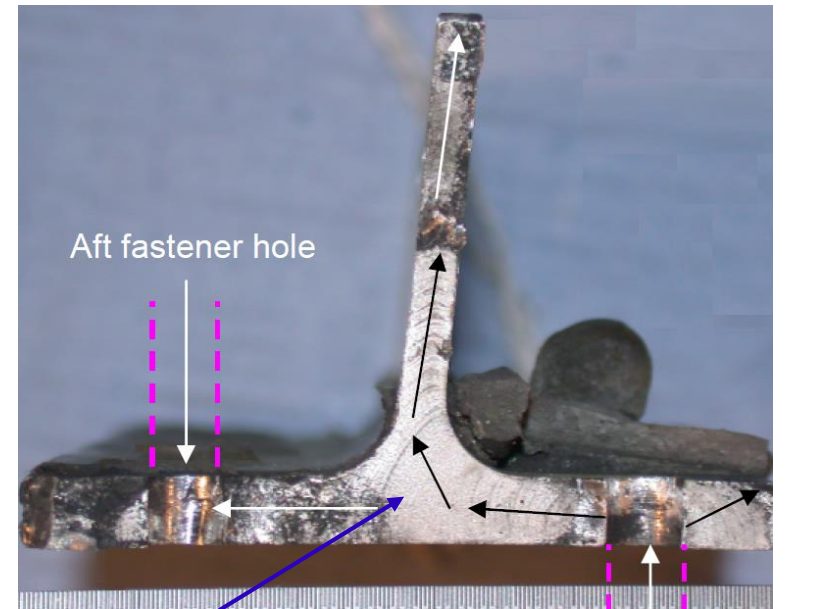




# Model 402C Fleet Wing Spar Cracks



Spar Splice Web Crack



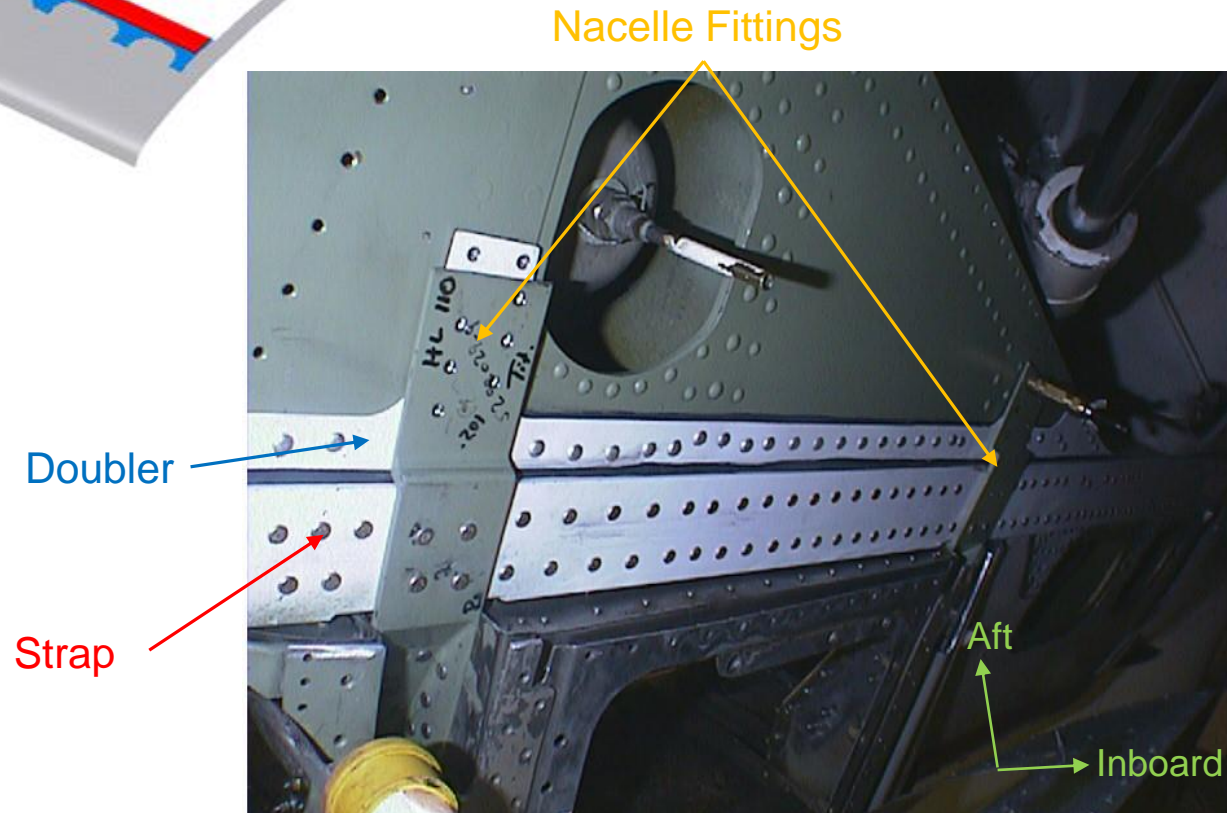
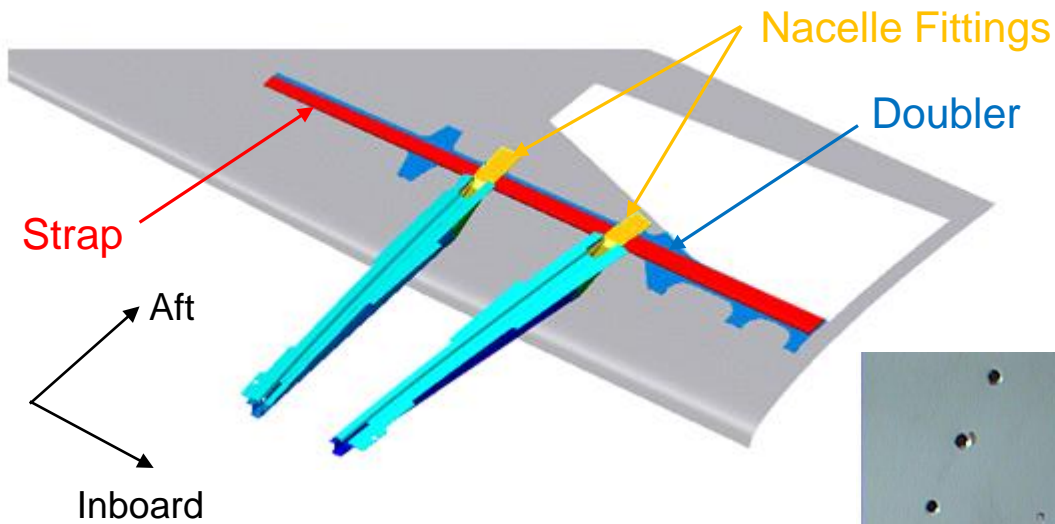
Aft fastener hole

Forward fastener hole

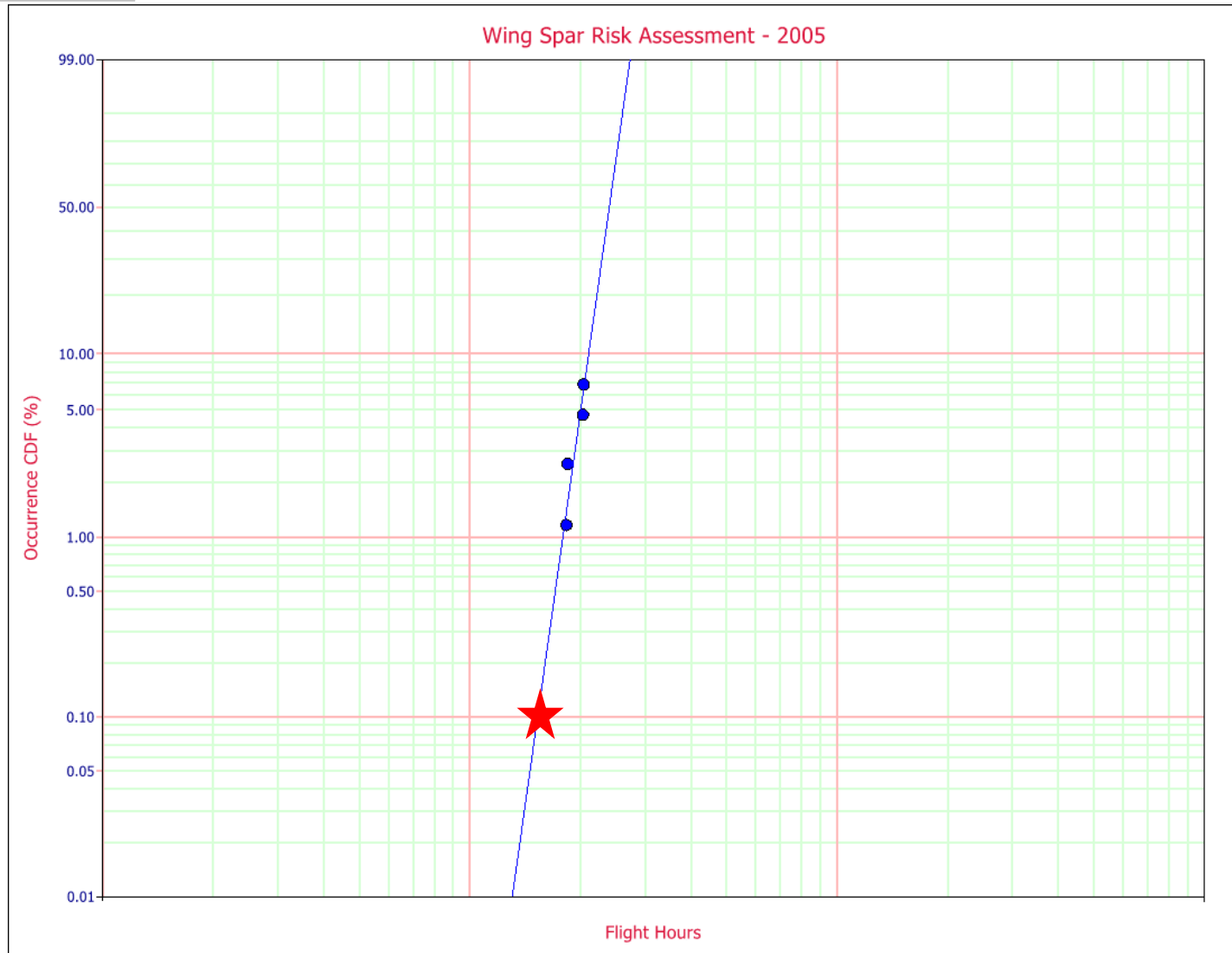
Wing Front Spar Crack



# Wing Spar Modification



# Wing Spar Risk Assessment

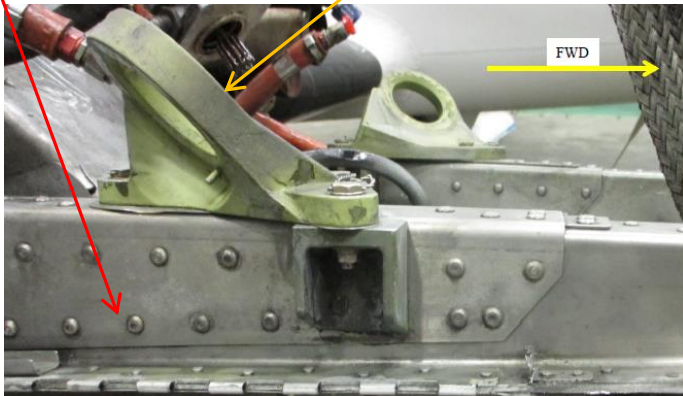


# Model 402C Service History

- Engine Beam Cracking
  - New doublers (1981) and new aft engine mounts (1986) were added
    - Short cracks were stop drilled before adding doublers
  - February 2015 cracks were found growing from underneath the doublers (29,000+ Hrs.)
    - Eight more were found cracked in the next month (27,000 -38,000 Hours)
  - Airworthiness directive for 200 hour x-ray inspection
  - Life limit established for engine beams at 20,000 Hours

Added Doubler

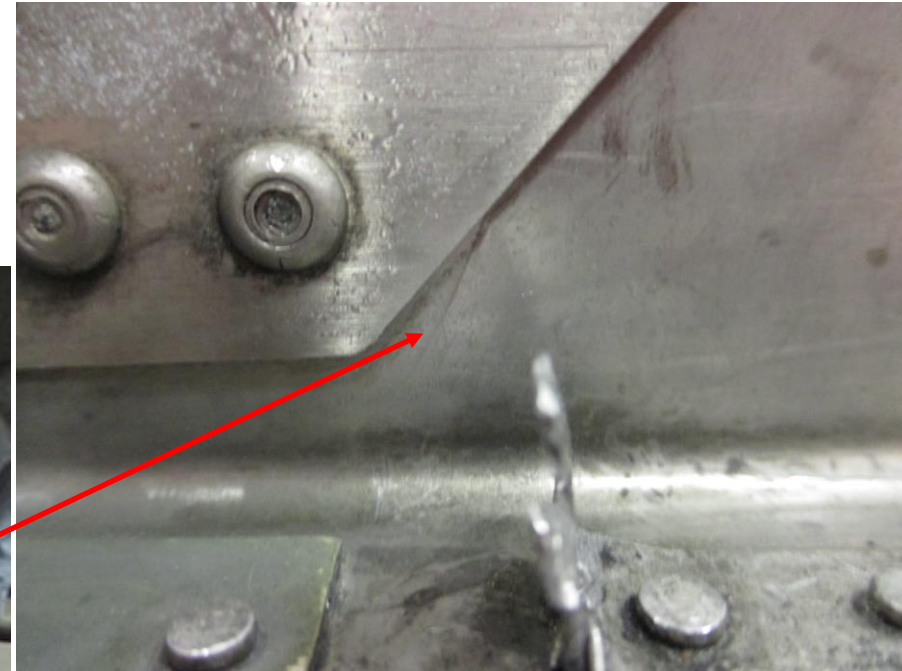
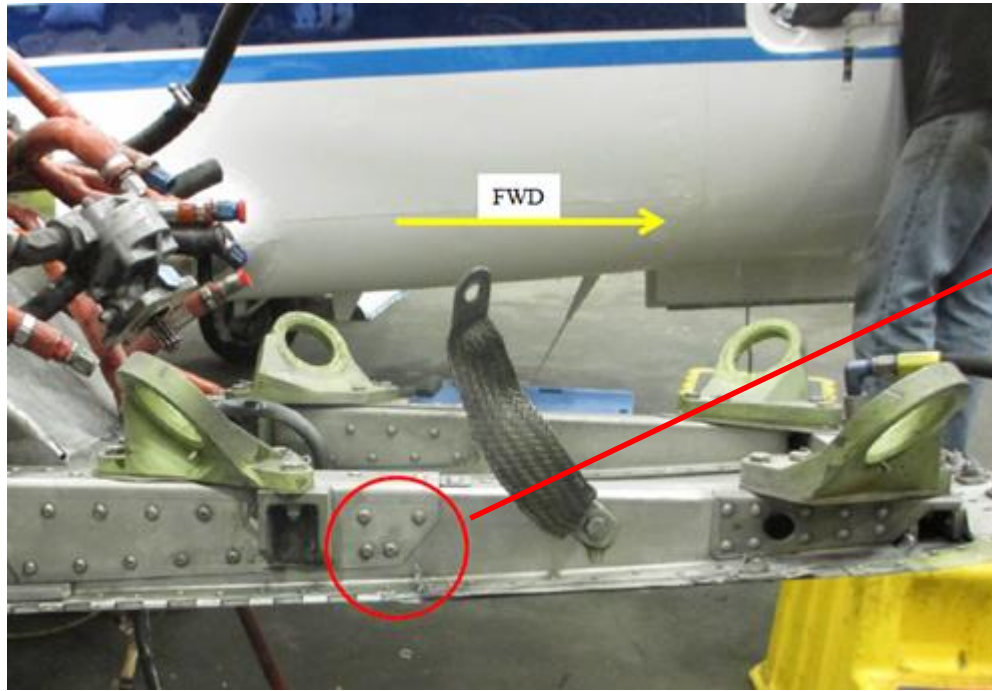
New Aft Mount



Stop Drilled Cracks

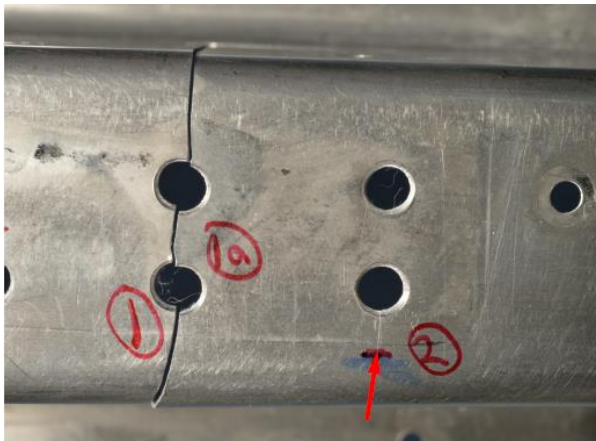


# Model 402C Engine Beam Cracks

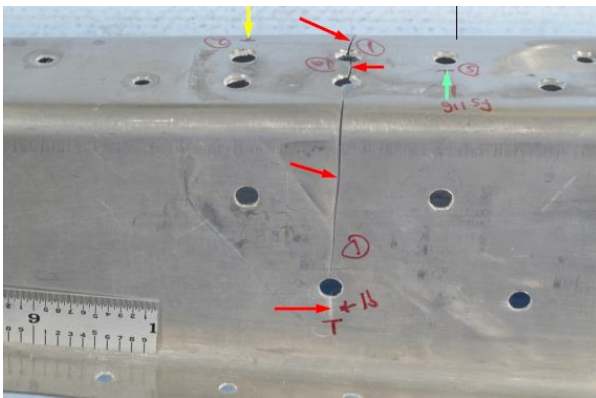


→ FWD

# Model 402C Engine Beam Cracks

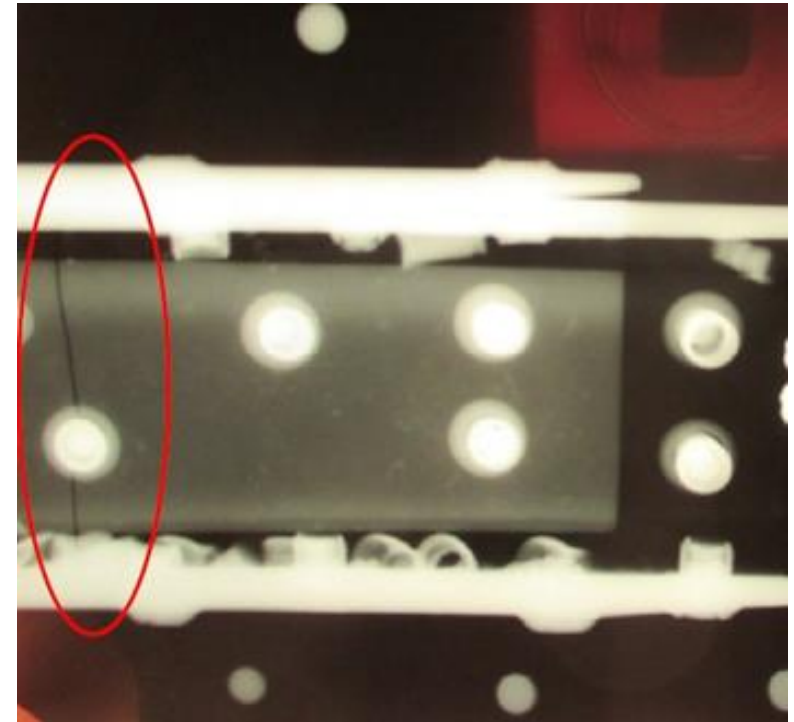


Top View



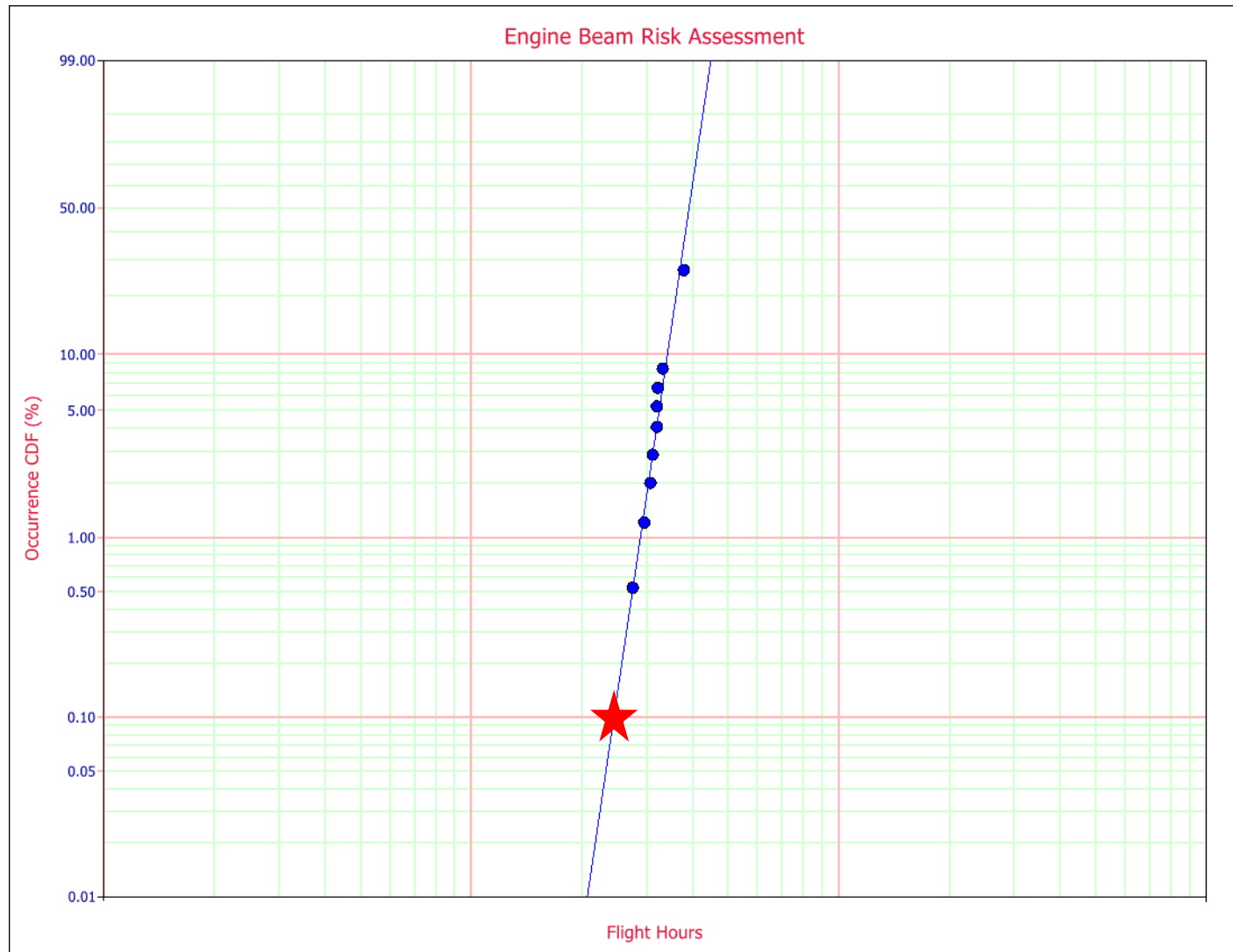
Side View

LH Outboard Beam  
 Fwd of Aft Engine Mt  
 29,000+ TTIS



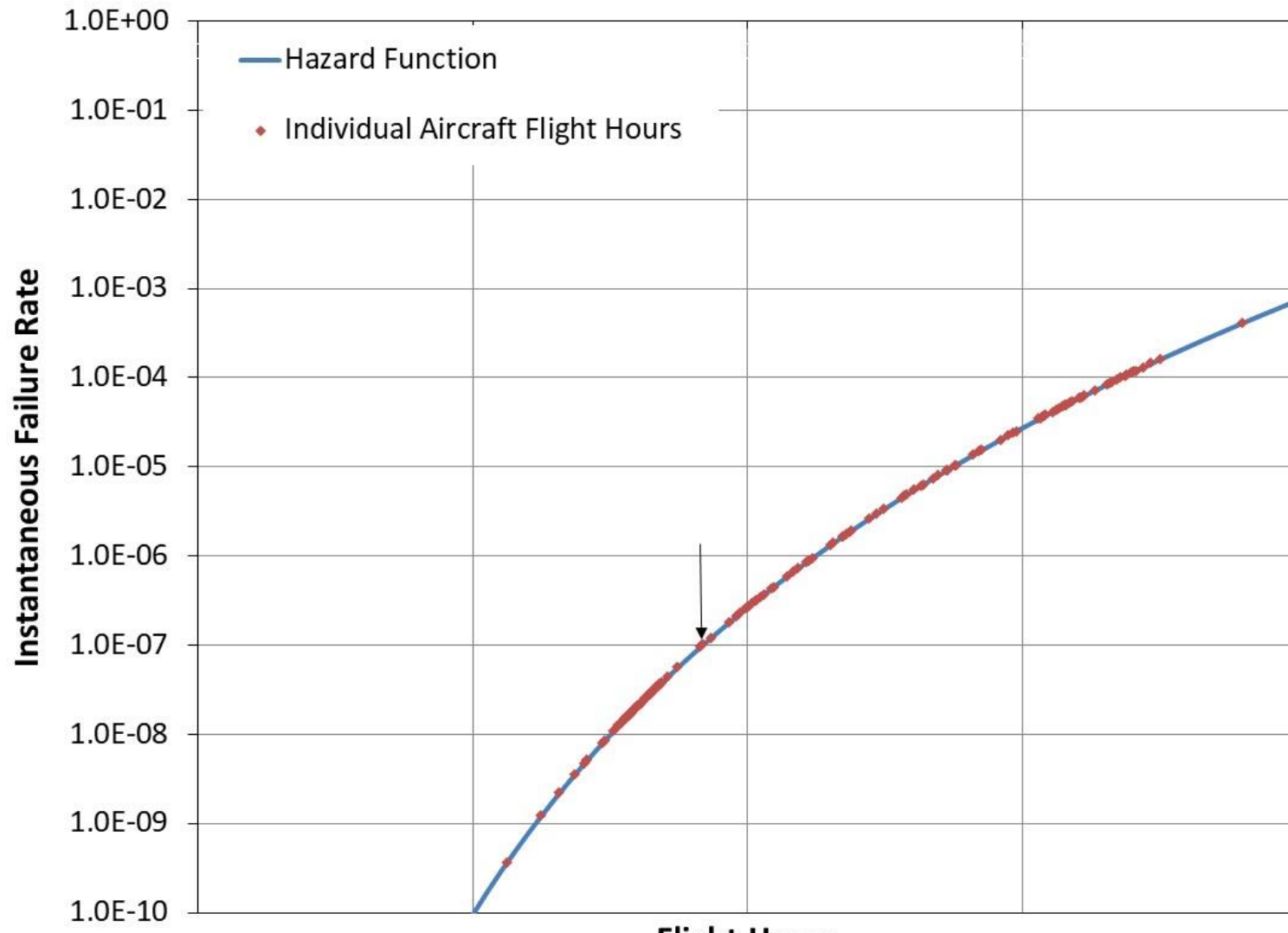
X-ray Image  
 LH Inboard Beam  
 Fwd of Aft Engine Mt  
 32,000+ TTIS

# Engine Beam Risk Assessment





# Engine Beam Risk Assessment



# Model 402C Service History

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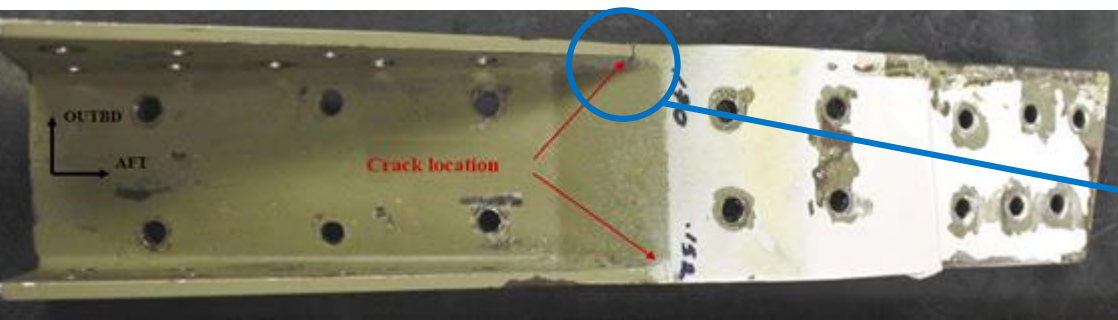
- Nacelle Fitting Cracking
  - Nacelle fittings - added by the wing spar strap modification
  - December 2016 - cracks were found in two nacelle fittings (14,000+ Hrs.)
    - An additional 25 fittings were found cracked
  - Two modes of cracking
  - Airworthiness directive to visually inspect for cracks via boroscope every 25-200 hours depending on time in service
  - Life limit established for fielded fittings



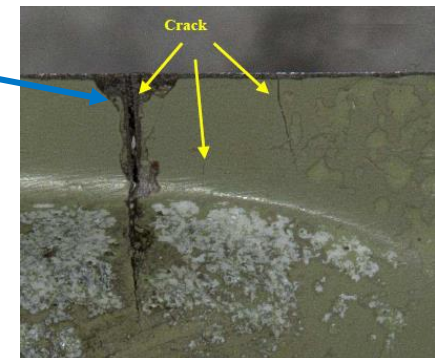
# M402C Nacelle Fitting Cracking



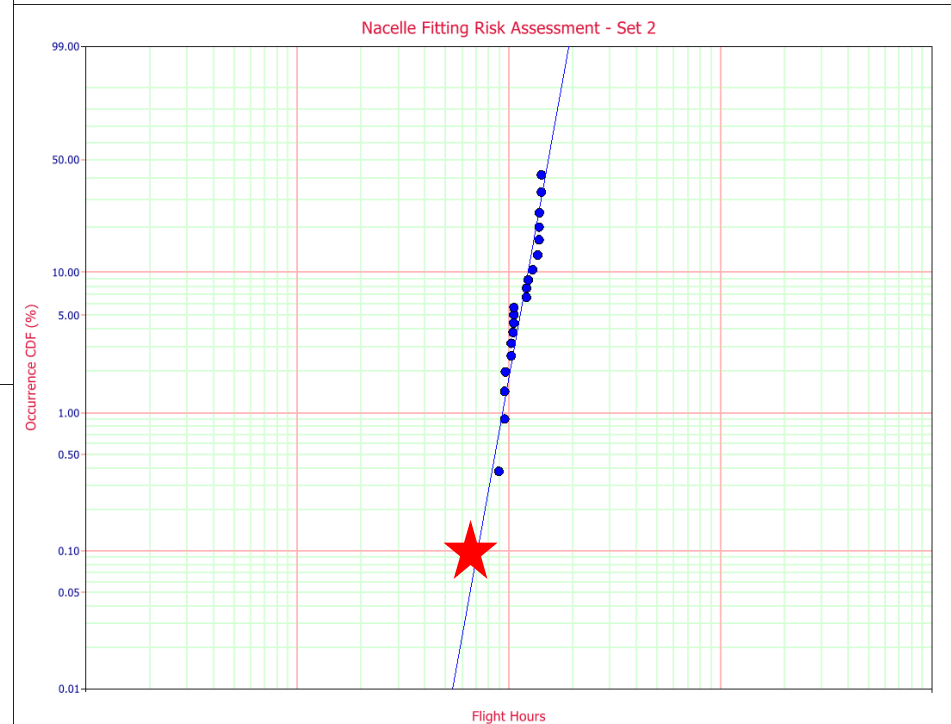
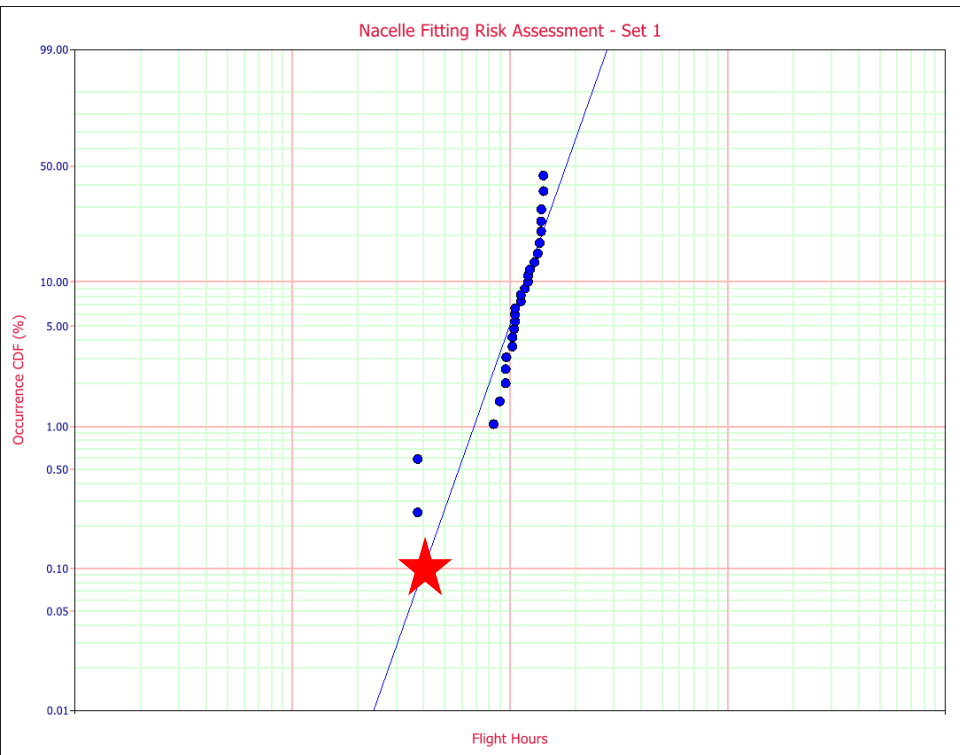
View looking down on upper surface



View looking up at lower surface

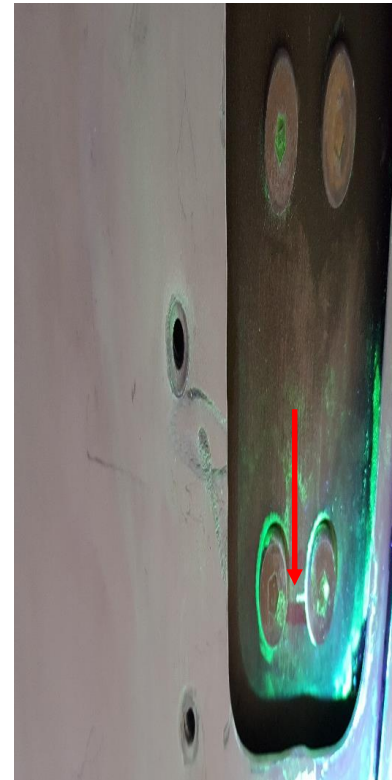
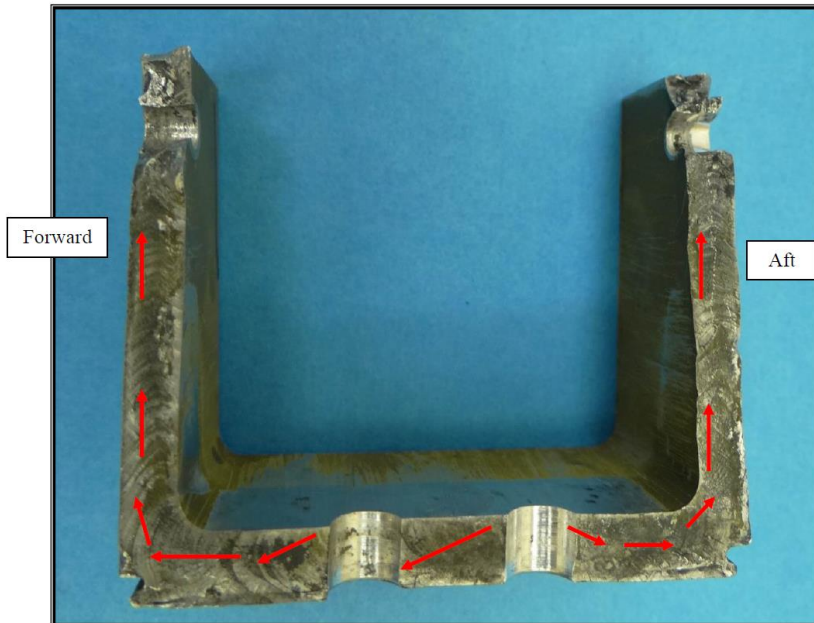


# M402C Nacelle Fitting Risk Assessment



# Model 402C Service History

- Carry-thru Forward Lower Spar Cracking
  - Spar is common to all 300/400 series twins
  - April 2017 - Carry-thru spar found severed (35,000+ Hours)
    - Two additional spars found with small cracks at 15,000+ hours
  - Airworthiness directive to visually inspect spar caps every 50 hours
  - Automated bolt hole eddy current inspections
    - Model 425 will be life limited





# Cessna 180/185

- Model 180 is a 4-6 seat, single engine aircraft
  - Strut braced – Aluminum construction
  - 230 hp. engine
  - 6,193 airplanes were built between 1953 and 1981
- Model 185 is a 6 seat, single engine aircraft
  - Basically a Cessna 180 with a strengthened fuselage
  - 300 hp. engine
  - 4,448 airplanes were built between 1961 and 1985
- Often fitted with floats or skis
- Called a “*bush pilot’s dream*”
  - Sightseeing tours to Mt. Denali (Alaska)
  - African safaris
- ~50% fleet based in Canada or Alaska



Cessna 180



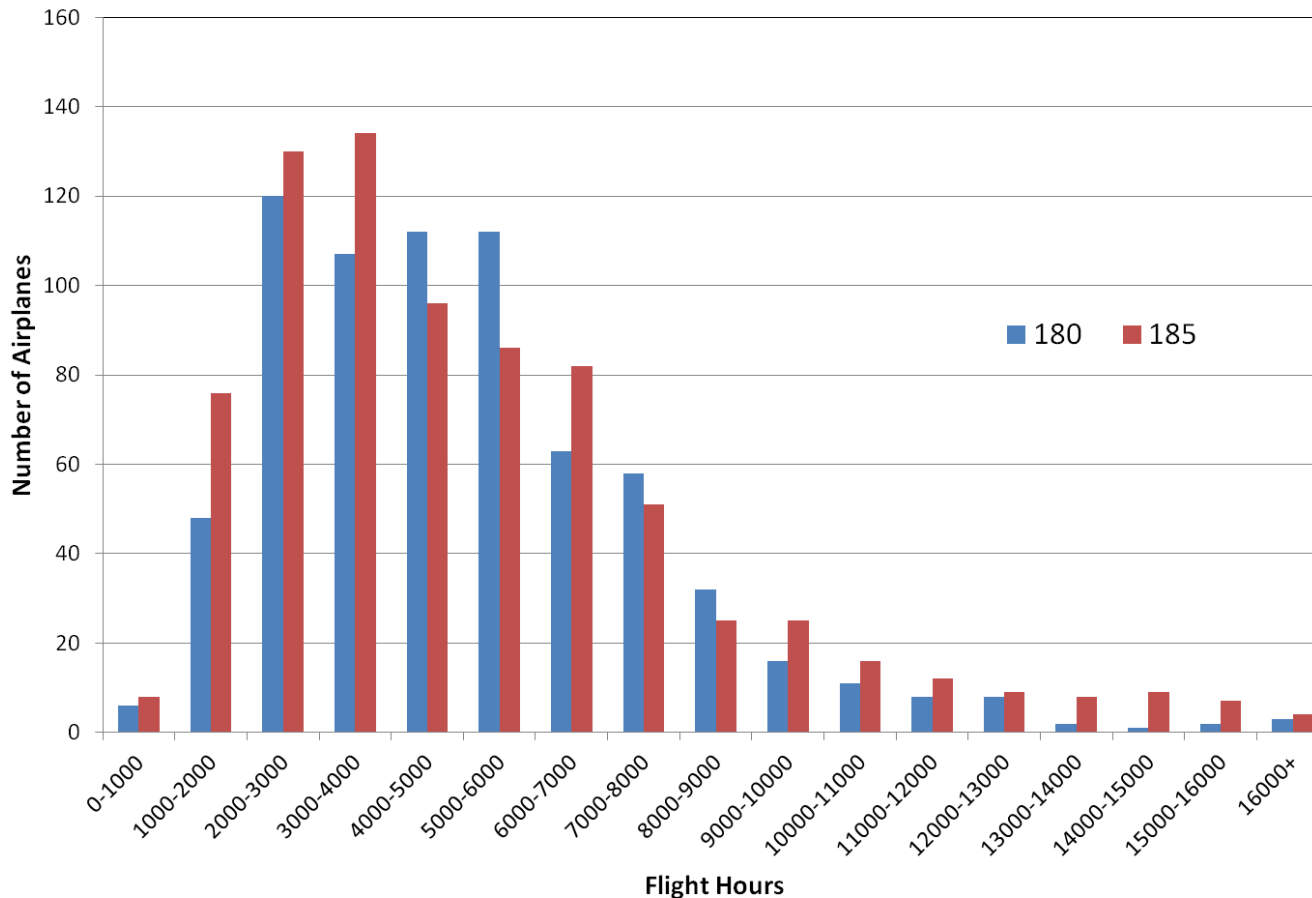
Cessna 185



# Cessna 180/185 Flight Hours

<u>Model</u>	<u>Number Made</u>
180	6193
185	1149
A185	<u>3299</u>
	10,641

Model 180/185 Flight Hours

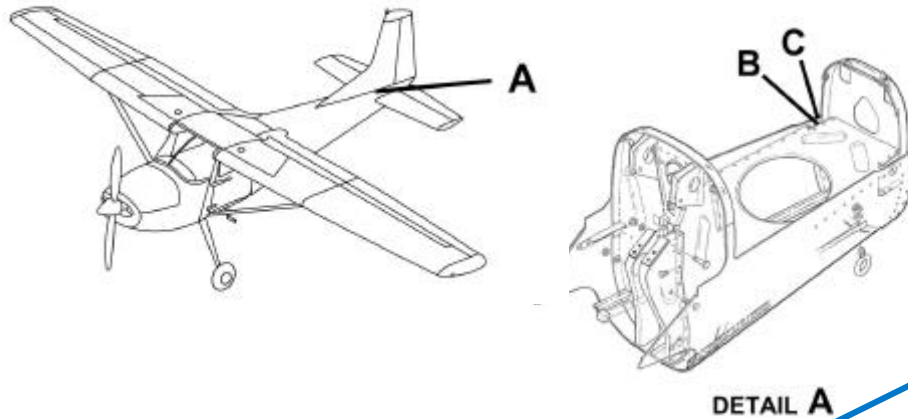


# Cessna 180/185 Horizontal Stabilizer Structure

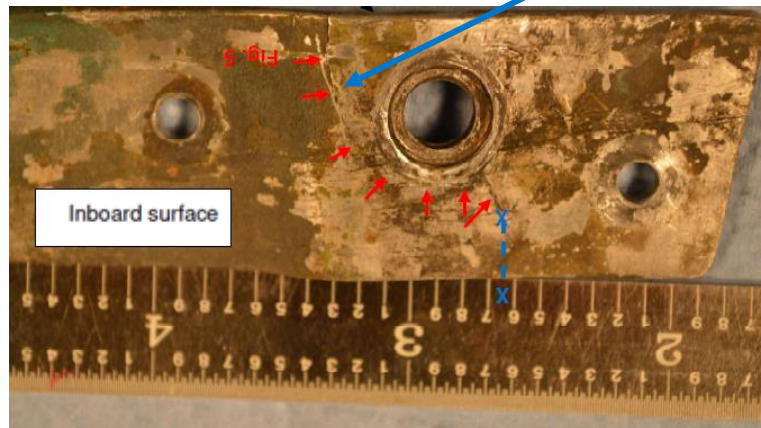
- Horizontal Stabilizer Structure Cracking
  - Tailcone reinforcement angle found cracked at horizontal stabilizer attachment
    - 27 cracks found (2,700 -14,000+ Hrs.)
    - Stabilizer attachment bolt passes thru reinforcement angle
  - Cracks also noted in:
    - Horizontal stabilizer hinge bracket
    - Stabilizer hinge reinforcement channel
    - Stabilizer hinge assembly
    - Aft spar and aft spar reinforcement
  - Airworthiness directive is being considered for 500 hour visual inspection



# Cessna 180/185 Stabilizer Attachment



Detail C



Stabilizer Hinge  
 Bracket  
 Reinforcement  
 Angle

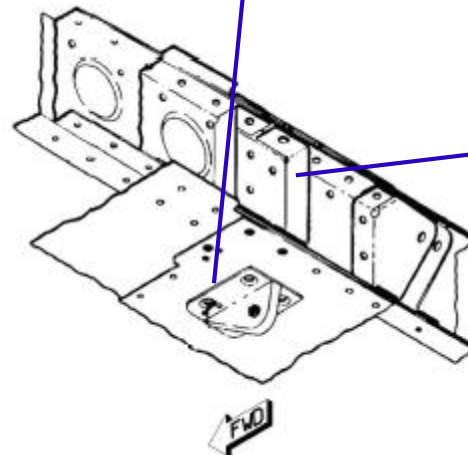


Detail B

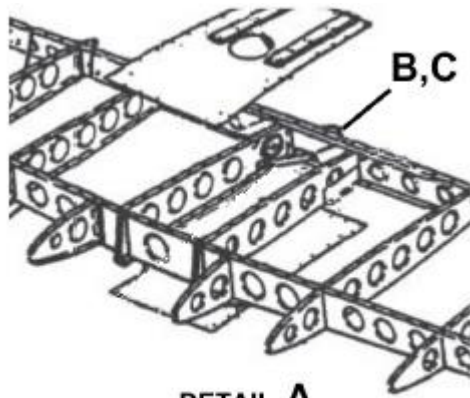
# Cessna 180/185 Stabilizer Hinge



Stabilizer Hinge Assembly

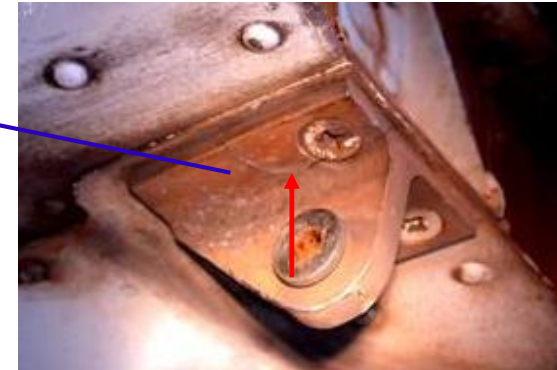


Detail B



**DETAIL A**

Looking Aft Skin Has Been  
Removed For Clarity



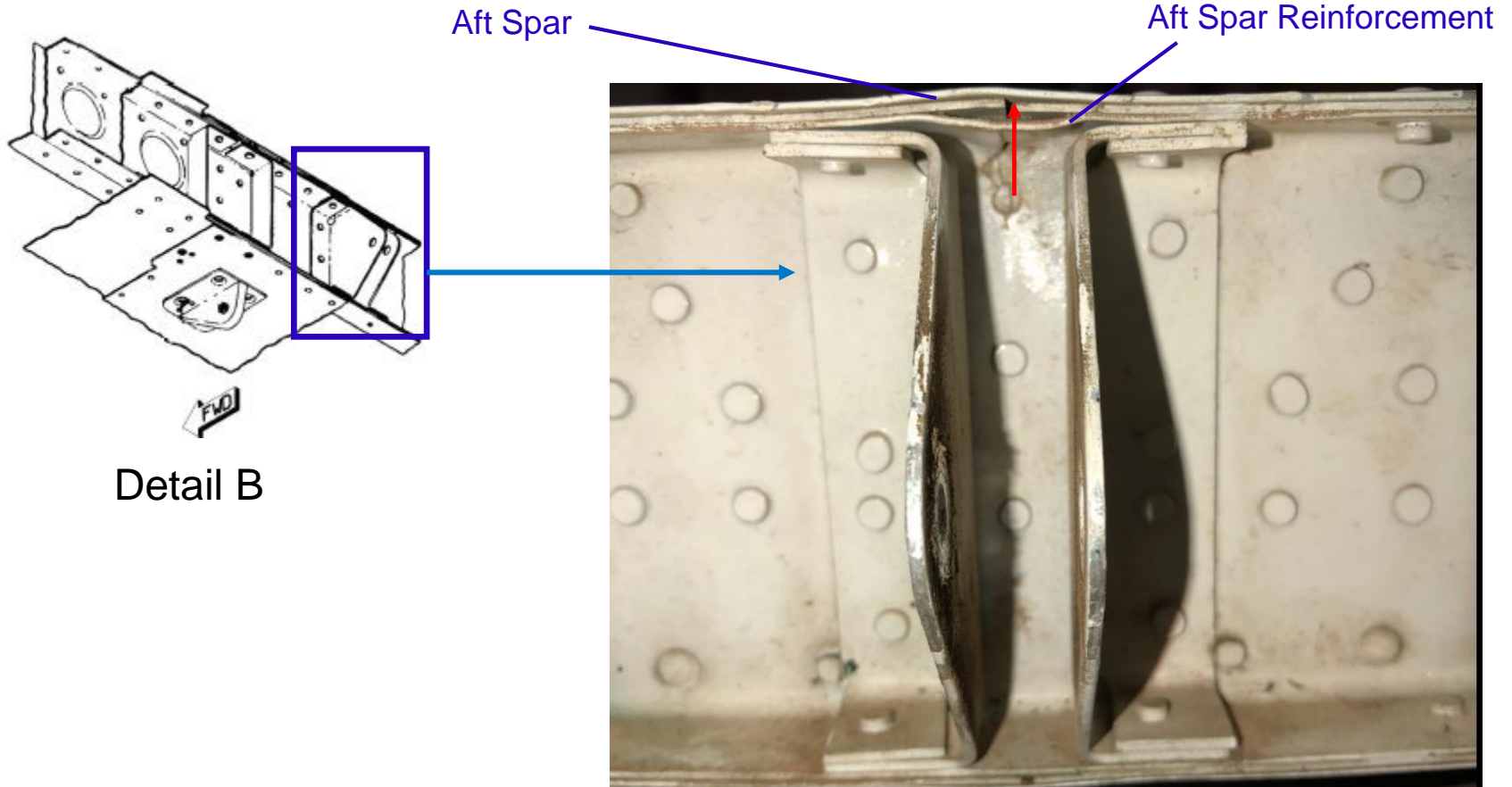
Stabilizer Hinge Reinforcement Channel



Detail C



# Cessna 180/185 Aft Spar & Spar Reinforcement



# Cessna 180/185 Tailcone Angle Risk Assessment

