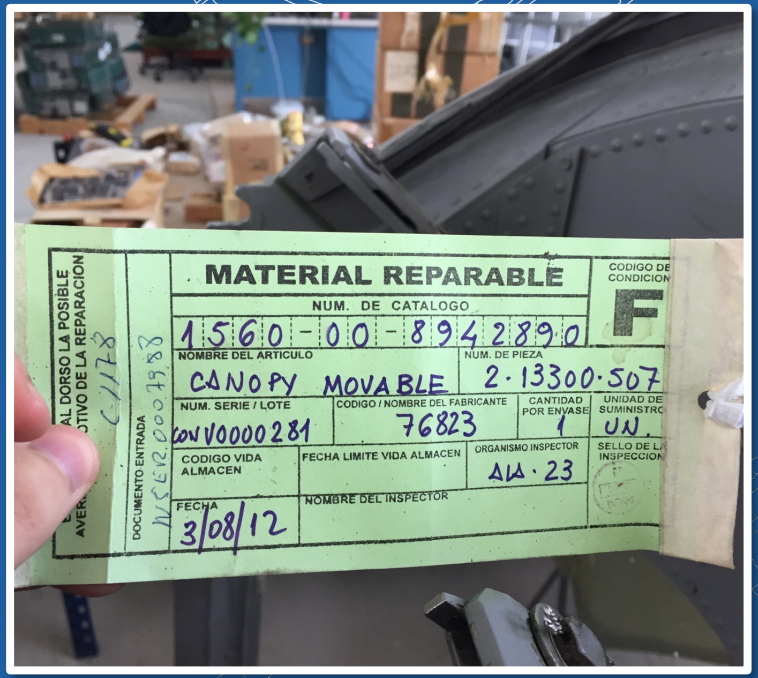
COC's F-5 Canopy

Repair, Restoration & Refurbishment

F-5 Canopies with excessive damage can be repaired, restored, refurbished.



COC Qualified “Work Instruction” are in compliance with AS9100 Rev. D and Technical Orders (T.O.’s)

We provide complete Certificates of Conformance (C of C’s) for every canopy we repair.

COC’s AS9100D Scope

“Supporting of Aging Military Aircraft through Repairs, Refurbishment and Spare Parts.”

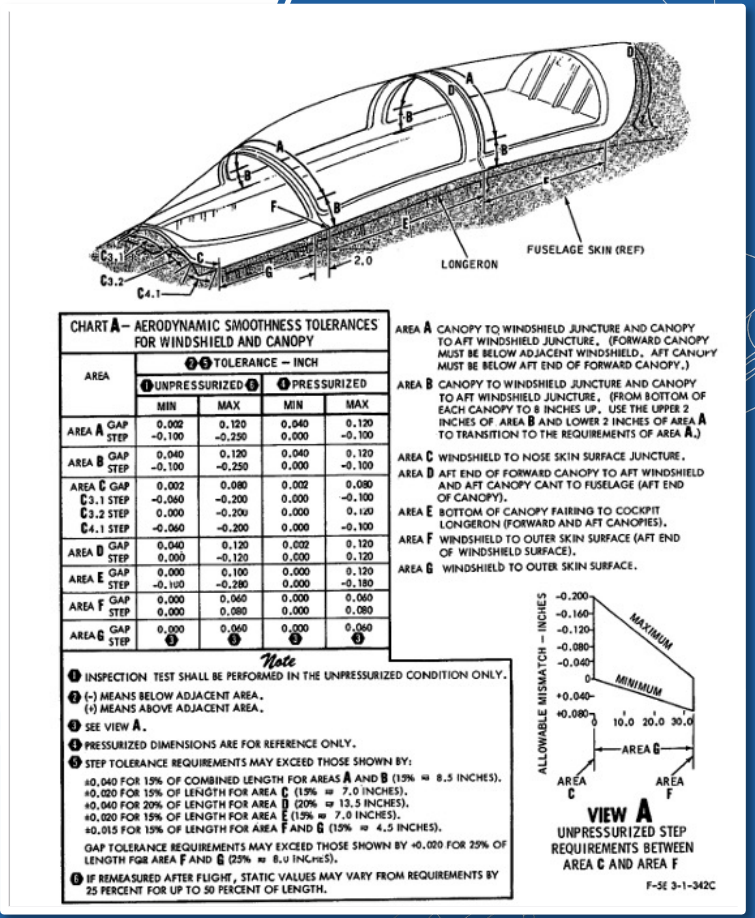


CHART A – AERODYNAMIC SMOOTHNESS TOLERANCES FOR WINDSHIELD AND CANOPY

AREA		❷❺ TOLERANCE – INCH			
		❶ UNPRESSURIZED ❸		❶ PRESSURIZED	
		MIN	MAX	MIN	MAX
AREA A	GAP	0.002	0.120	0.040	0.120
	STEP	-0.100	-0.250	0.000	-0.100
AREA B	GAP	0.040	0.120	0.040	0.120
	STEP	-0.100	-0.250	0.000	-0.100
AREA C	GAP	0.002	0.080	0.002	0.080
	C3.1 STEP	-0.060	-0.200	0.000	-0.100
	C3.2 STEP	0.000	-0.200	0.000	0.120
	C4.1 STEP	-0.060	-0.200	0.000	-0.100
AREA D	GAP	0.040	0.120	0.002	0.120
	STEP	0.000	-0.120	0.000	0.120
AREA E	GAP	0.000	0.100	0.000	0.120
	STEP	-0.100	-0.280	0.000	-0.180
AREA F	GAP	0.000	0.060	0.000	0.060
	STEP	0.000	0.080	0.000	0.080
AREA G	GAP	0.000 ❸	0.060 ❸	0.000 ❸	0.060 ❸
	STEP				

AREA A CANOPY TO WINDSHIELD JUNCTURE AND CANOPY TO AFT WINDSHIELD JUNCTURE. (FORWARD CANOPY MUST BE BELOW ADJACENT WINDSHIELD. AFT CANOPY MUST BE BELOW AFT END OF FORWARD CANOPY.)

AREA B CANOPY TO WINDSHIELD JUNCTURE AND CANOPY TO AFT WINDSHIELD JUNCTURE. (FROM BOTTOM OF EACH CANOPY TO 8 INCHES UP. USE THE UPPER 2 INCHES OF AREA B AND LOWER 2 INCHES OF AREA A TO TRANSITION TO THE REQUIREMENTS OF AREA A.)

AREA C WINDSHIELD TO NOSE SKIN SURFACE JUNCTURE.

AREA D AFT END OF FORWARD CANOPY TO AFT WINDSHIELD AND AFT CANOPY CANT TO FUSELAGE (AFT END OF CANOPY).

AREA E BOTTOM OF CANOPY FAIRING TO COCKPIT LONGERON (FORWARD AND AFT CANOPIES).

AREA F WINDSHIELD TO OUTER SKIN SURFACE (AFT END OF WINDSHIELD SURFACE).

AREA G WINDSHIELD TO OUTER SKIN SURFACE.

Note

❶ INSPECTION TEST SHALL BE PERFORMED IN THE UNPRESSURIZED CONDITION ONLY.

❷ (-) MEANS BELOW ADJACENT AREA.
(+) MEANS ABOVE ADJACENT AREA.

❸ SEE VIEW A.

❹ PRESSURIZED DIMENSIONS ARE FOR REFERENCE ONLY.

❺ STEP TOLERANCE REQUIREMENTS MAY EXCEED THOSE SHOWN BY:
±0.040 FOR 15% OF COMBINED LENGTH FOR AREAS A AND B (15% ≈ 8.5 INCHES).
±0.020 FOR 15% OF LENGTH FOR AREA C (15% ≈ 7.0 INCHES).
±0.040 FOR 20% OF LENGTH FOR AREA D (20% ≈ 13.5 INCHES).
±0.020 FOR 15% OF LENGTH FOR AREA E (15% ≈ 7.0 INCHES).
±0.015 FOR 15% OF LENGTH FOR AREA F AND G (15% ≈ 4.5 INCHES).
GAP TOLERANCE REQUIREMENTS MAY EXCEED THOSE SHOWN BY +0.020 FOR 25% OF LENGTH FOR AREA F AND G (25% ≈ 8.0 INCHES).

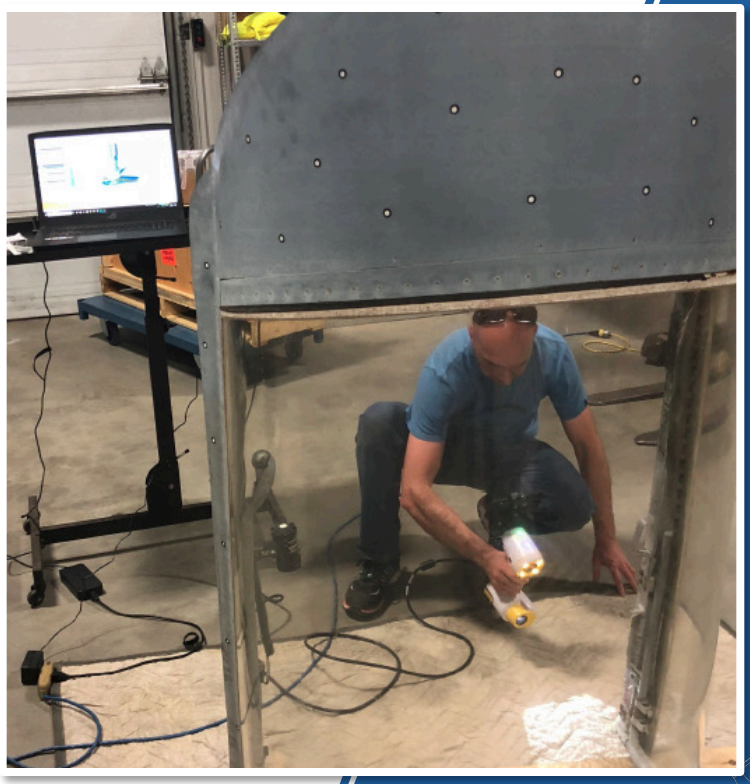
❻ IF REMEASURED AFTER FLIGHT, STATIC VALUES MAY VARY FROM REQUIREMENTS BY 25 PERCENT FOR UP TO 50 PERCENT OF LENGTH.

VIEW A
UNPRESSURIZED STEP REQUIREMENTS BETWEEN AREA C AND AREA F

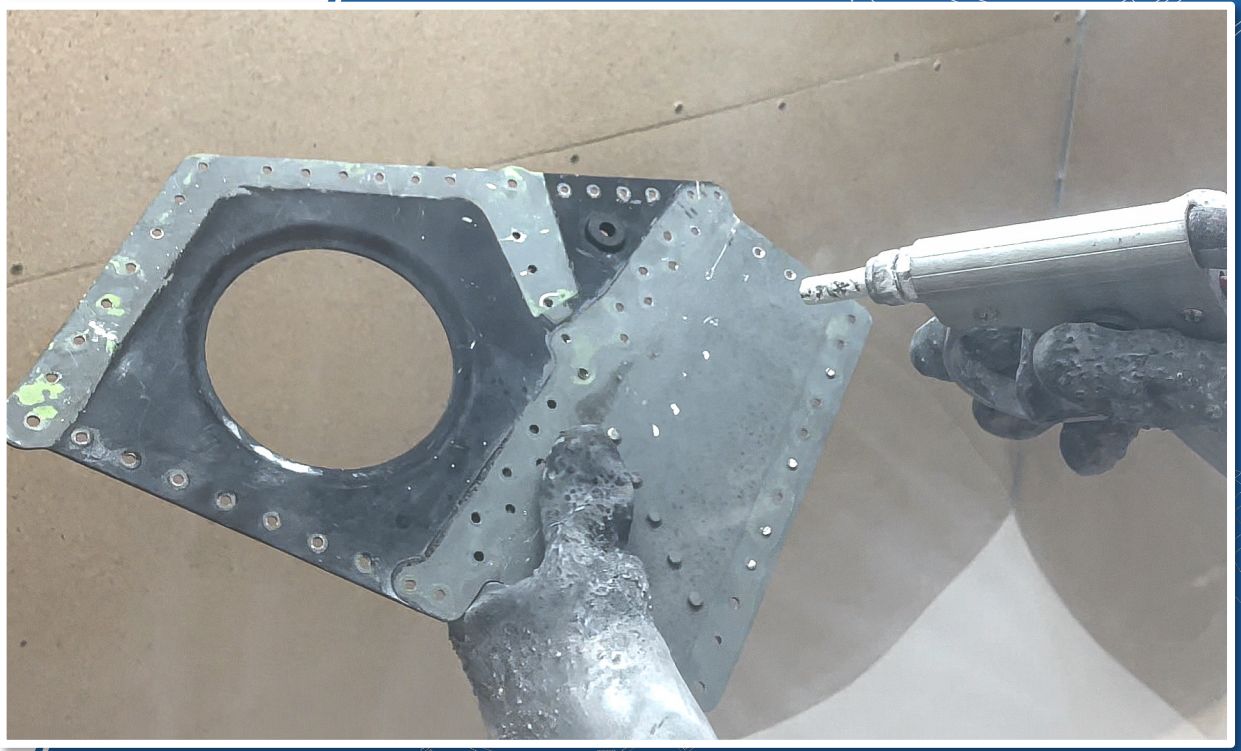
F-5E 3-1-342C

Step 1: 3D Scan

COC techs 3D Scan the damaged canopy. For smaller aircraft assemblies, we use a hand-held photogrammetry scanner.

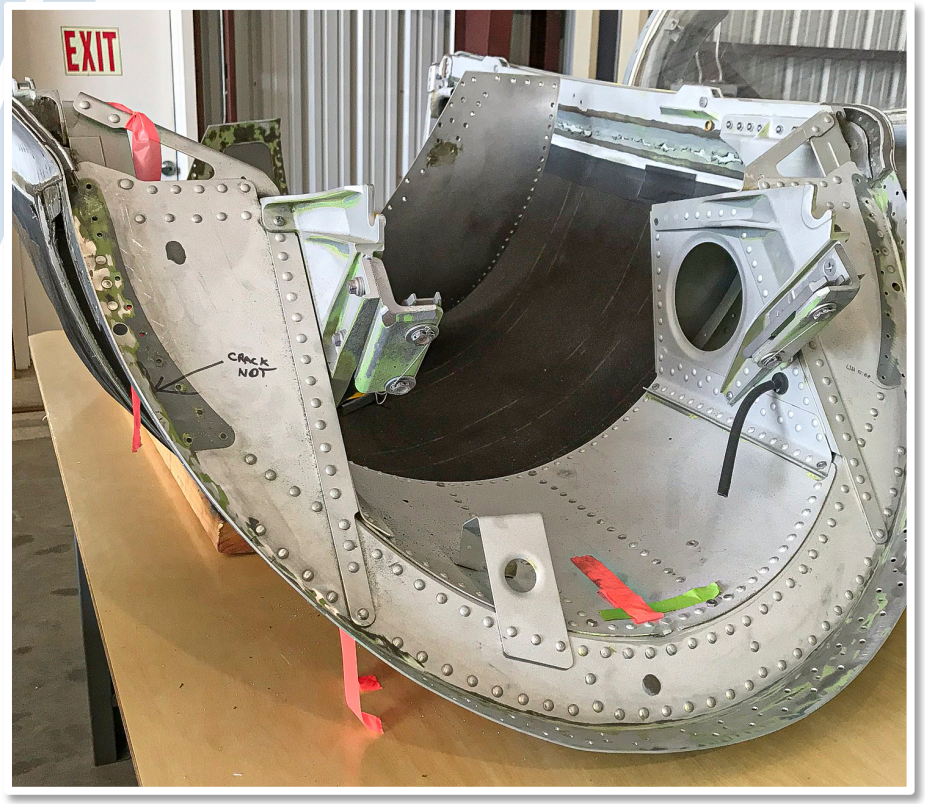


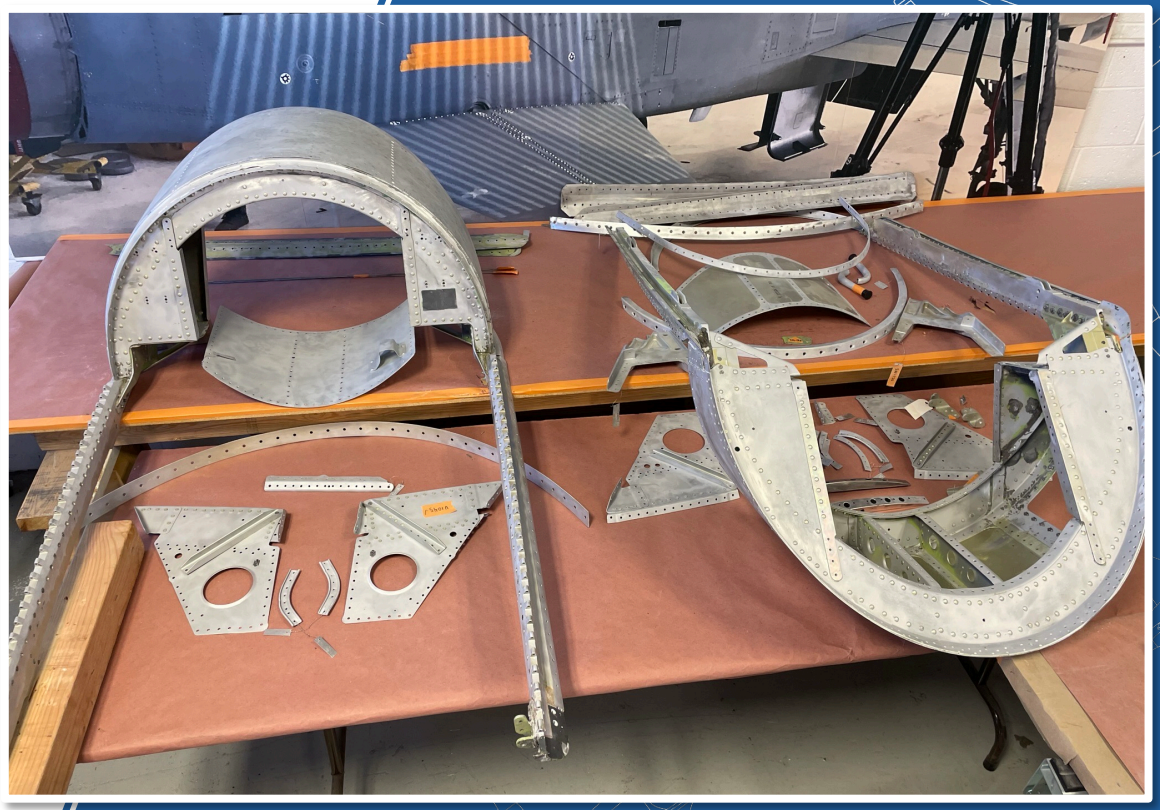
Step 2A: Plastic Media Blast to Aerospace Approved MIL-P-85891A



Step 2B: Media Blasting

Media blasting renders the canopy free of any paint, sealant and primers enabling COC technicians to perform first initial visual inspection.



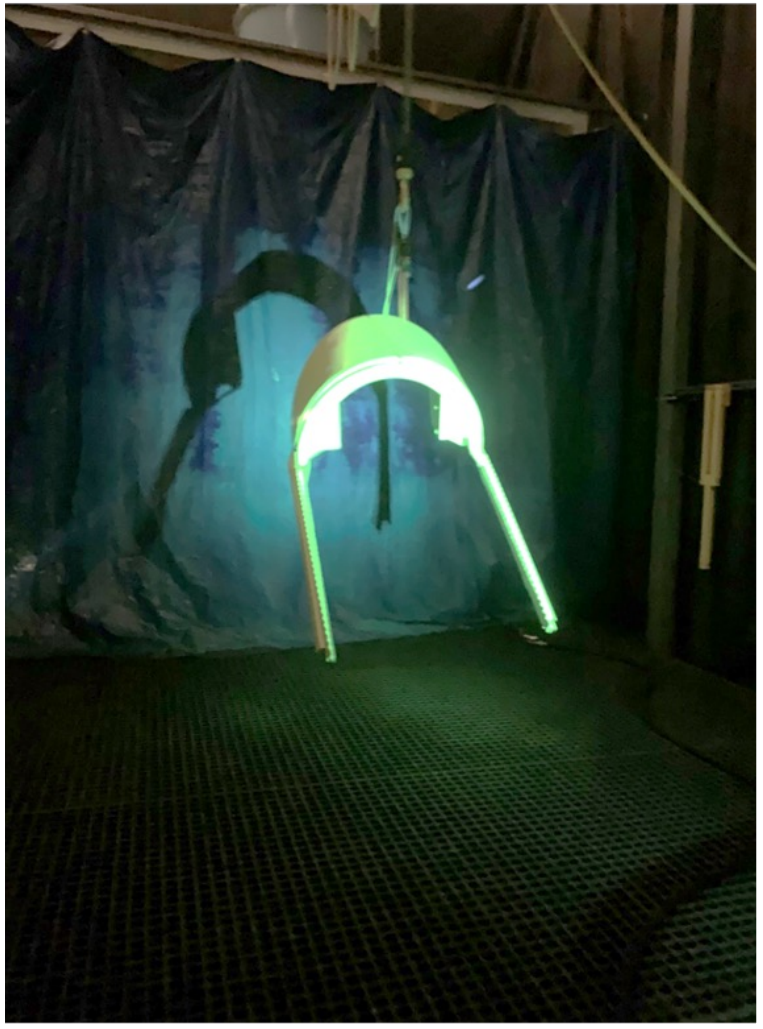


Step 3: Identify major areas of damage and corrosion

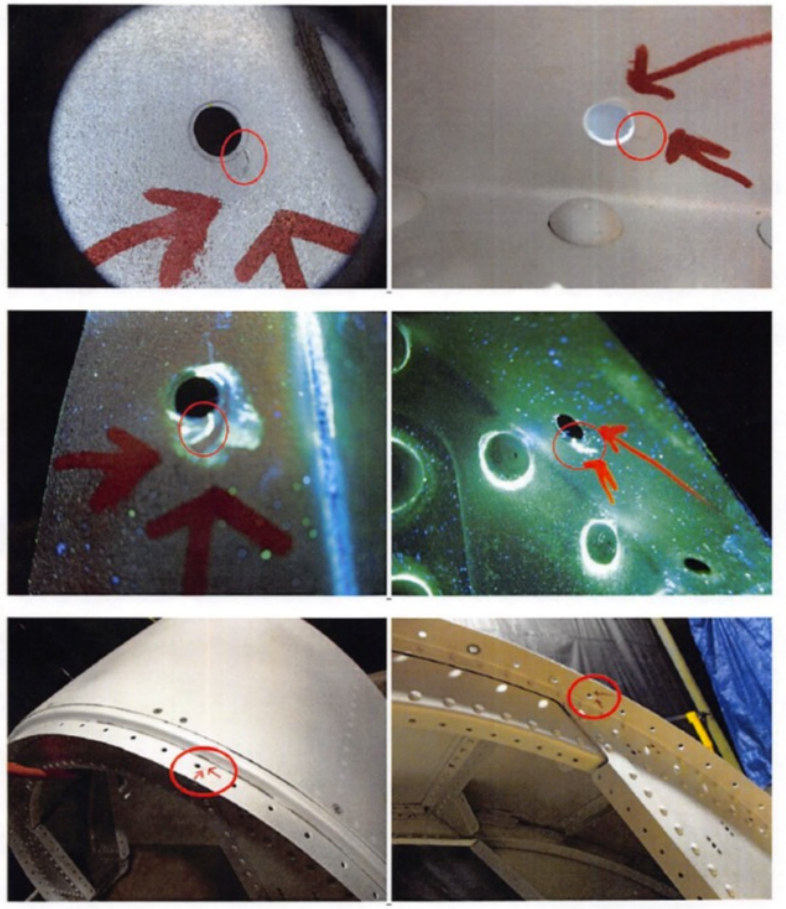
- Establish the Repair Plan – what parts need to be repaired, replaced.

Step 4: 3D Scan

- Canopy undergoes penetrant inspections and Eddy Current fastener inspections

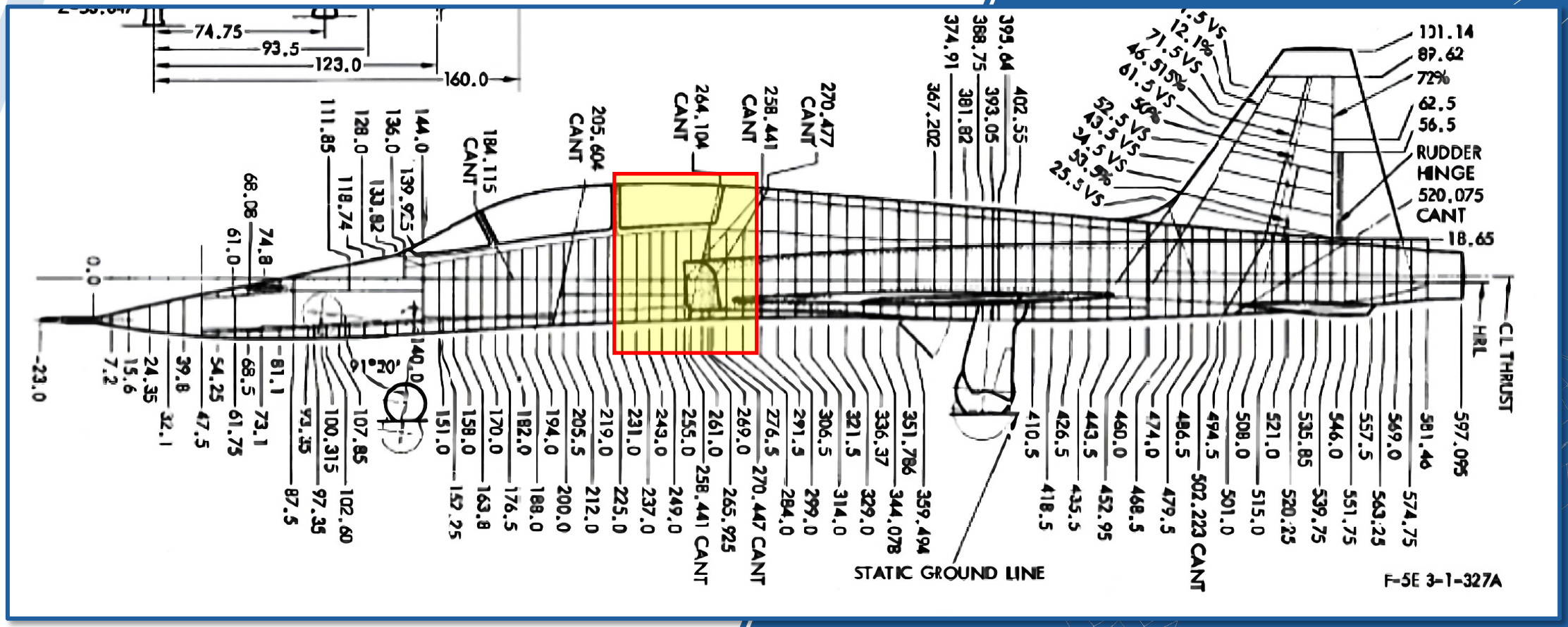


Document No: EMF-301F	**Issue Date:** 10/11/11	Approved by: Brandon Mensinger, Level 3	Elite metal finishing, llc
Revision: C	**Rev. Date:** 11/12/2014	Quality Manager: Joel Clemons	



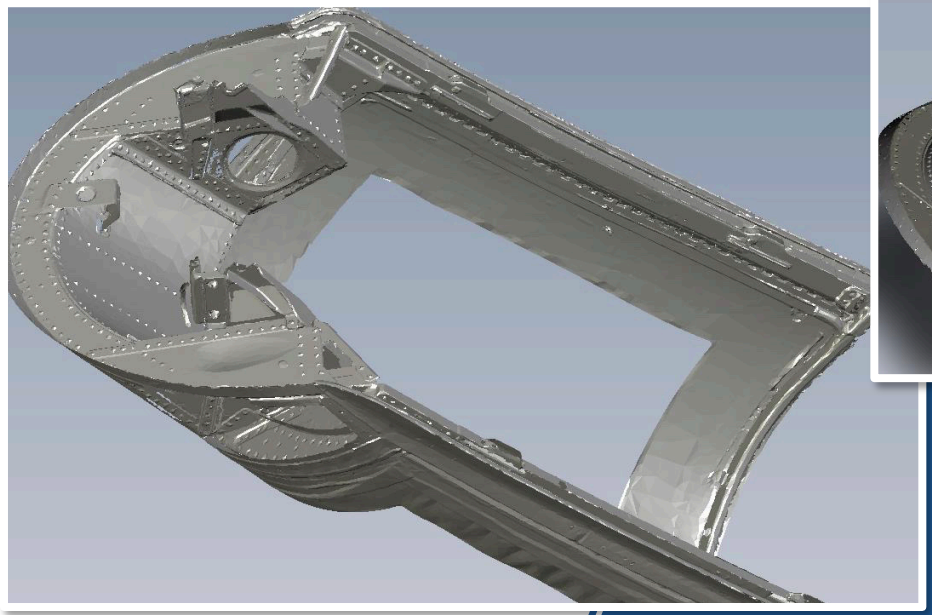
Step 5A: Pre-Measurement

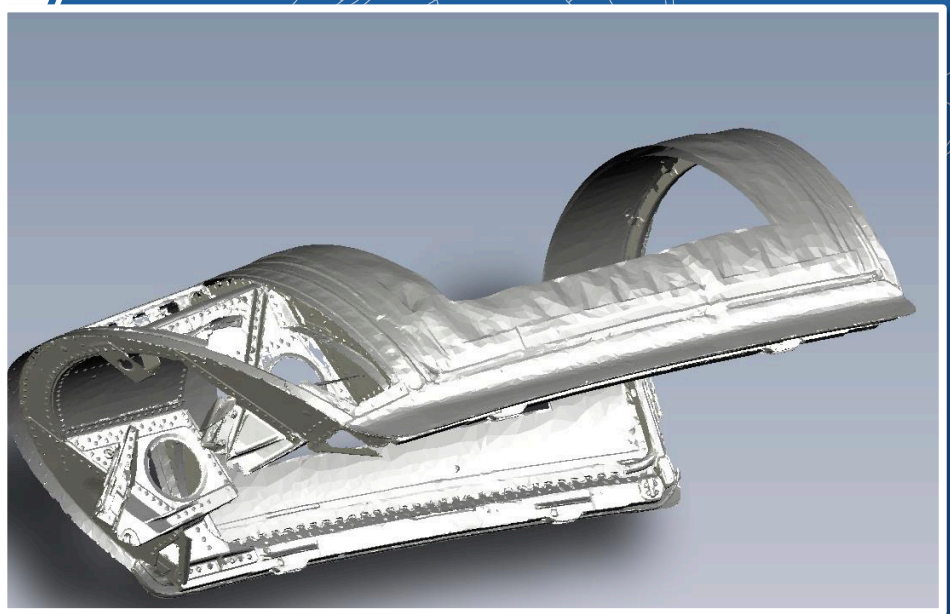
Using the F-5 Basic Dimensions, COC incorporates the Fuselage Station (FS) measurements where the canopy fits to the airframe.



Step 5B: Photogrammetry CAD Model

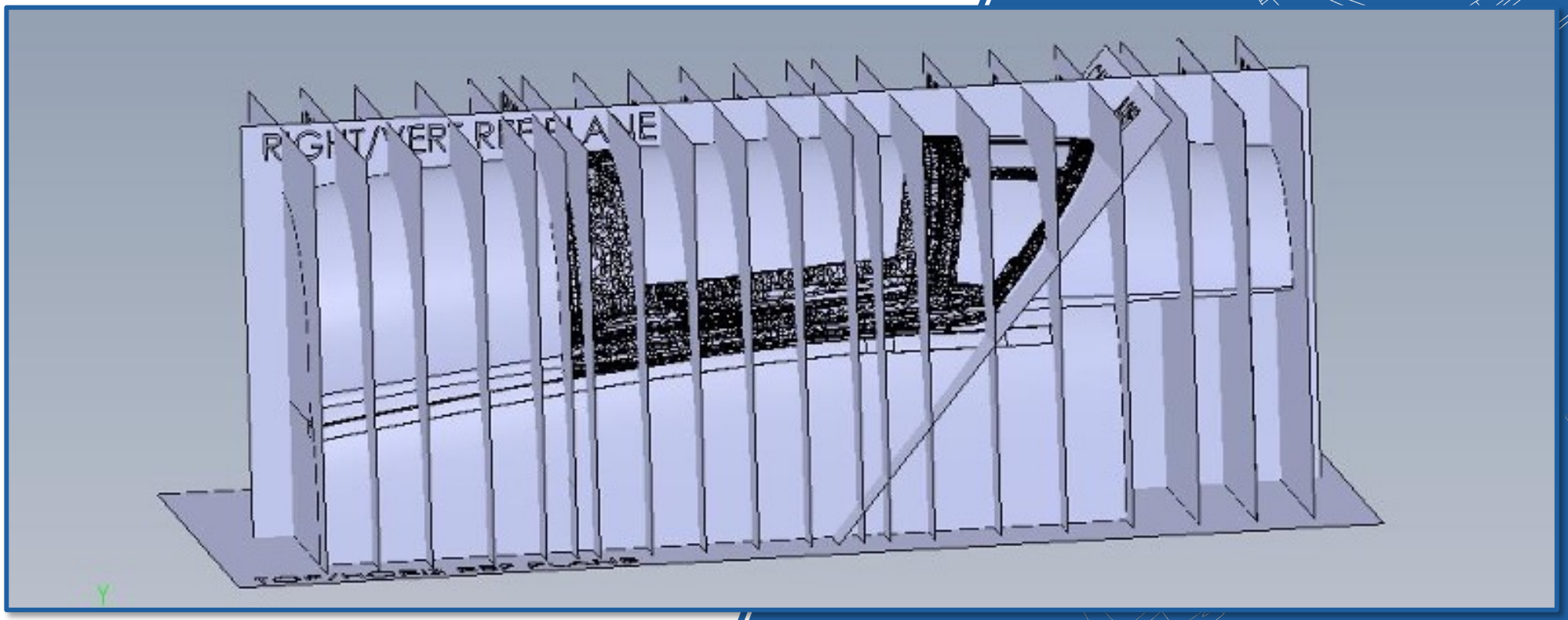
- Scan of damaged canopy is converted to CAD Models.
- Using the Photogrammetry equipment, we have both the exact dimensions and a photographic representation.





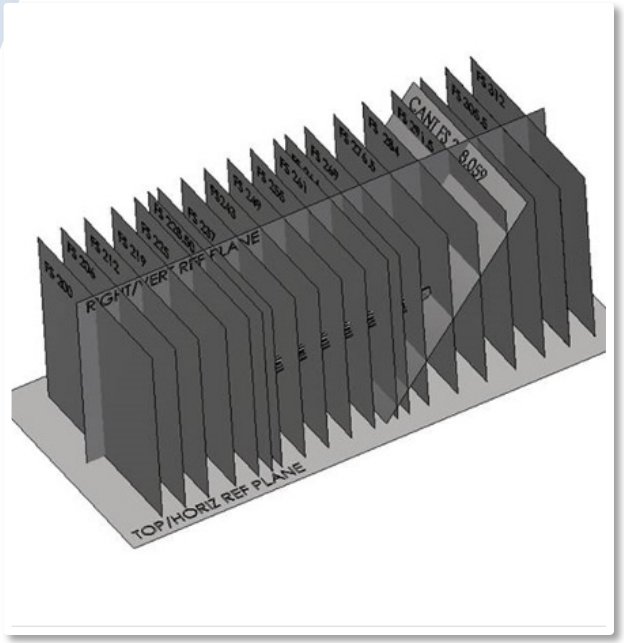
Step 6A: Canopy CAD Model into Fuselage CAD

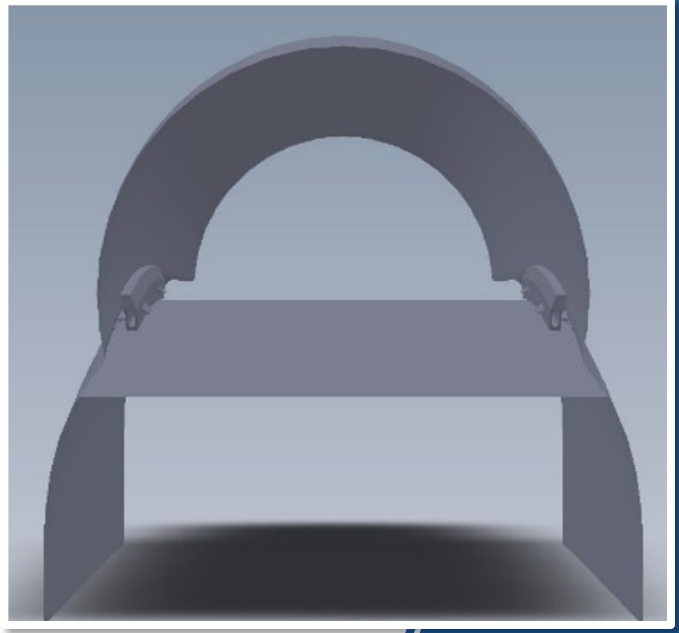
We take the CAD model of the damaged canopy and ‘insert’ it into fuselage Basic Dimension Data CAD model. Now we can measure what we need to fix.

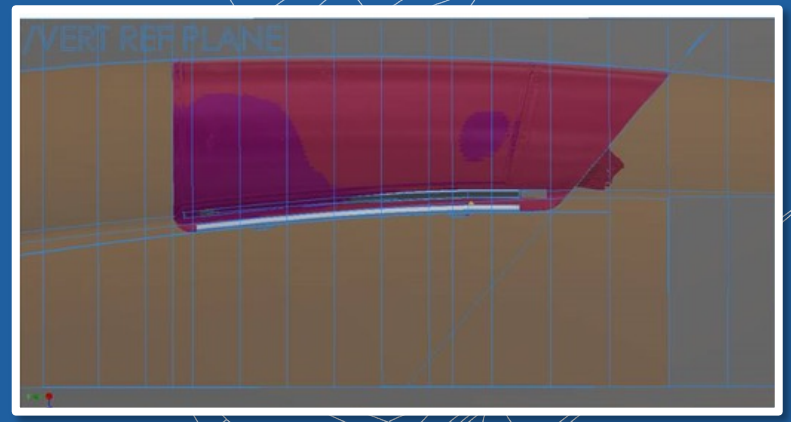


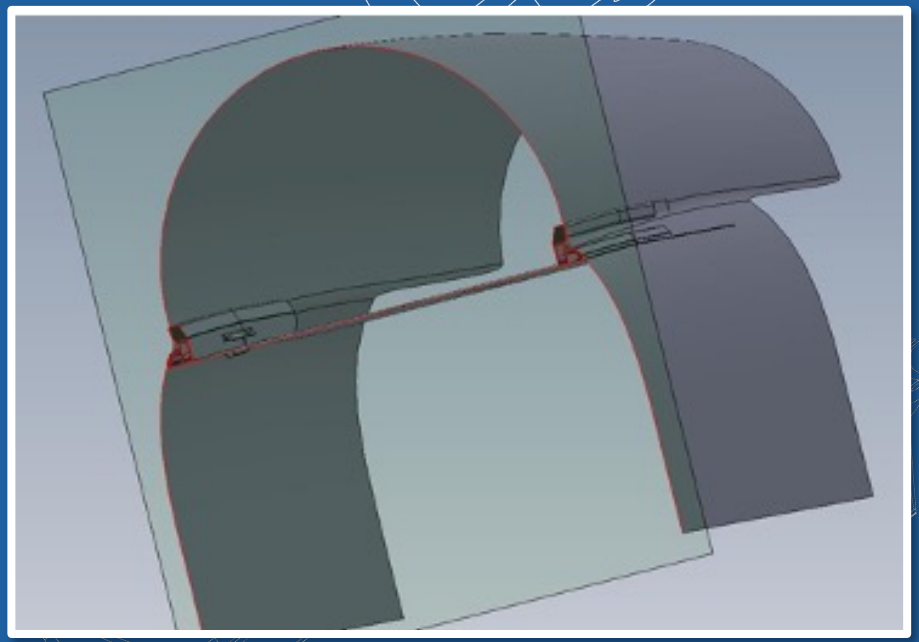
Step 6B: Overlay the Basic Dimension Data for fuselage and canopy.

- Comparing with ‘Scanned’ damaged canopy to determine what to repair.



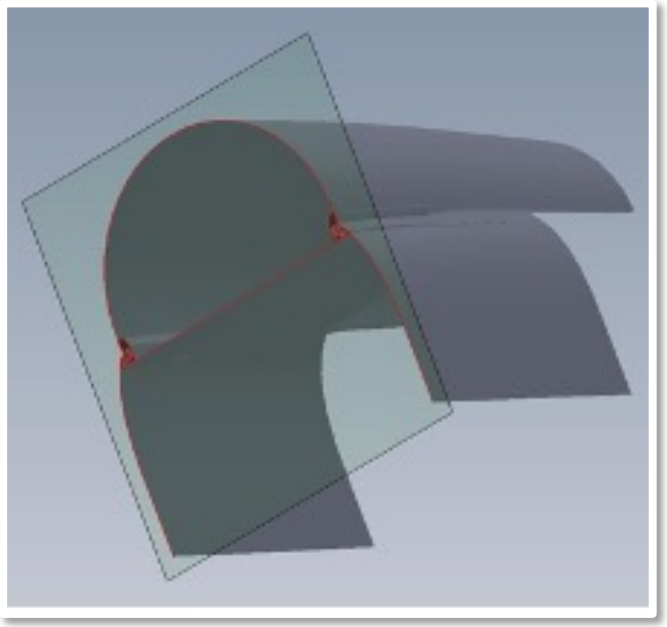


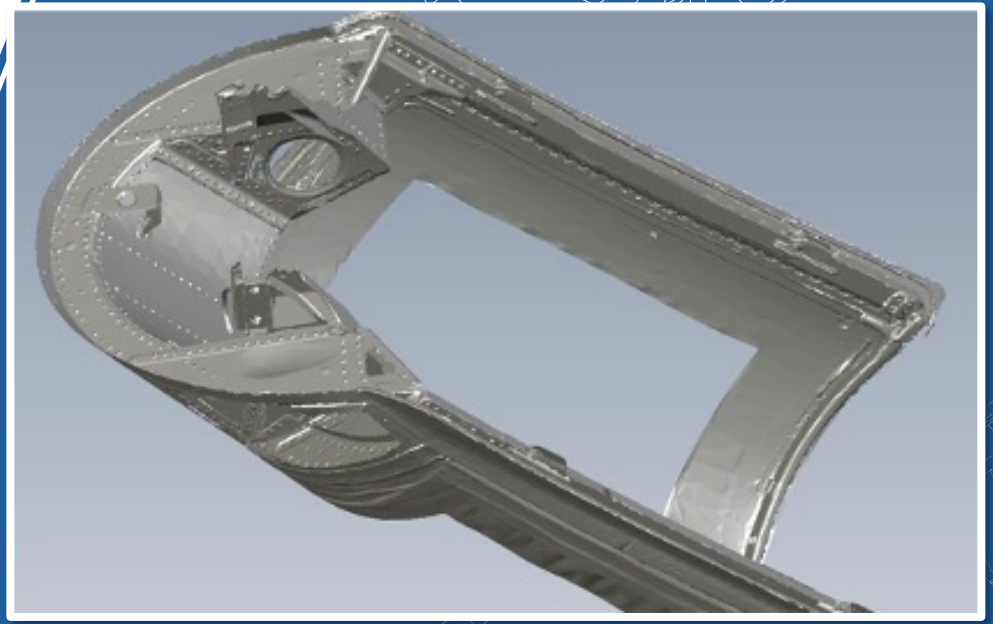




Step 6C: Compare Dimensions to Data

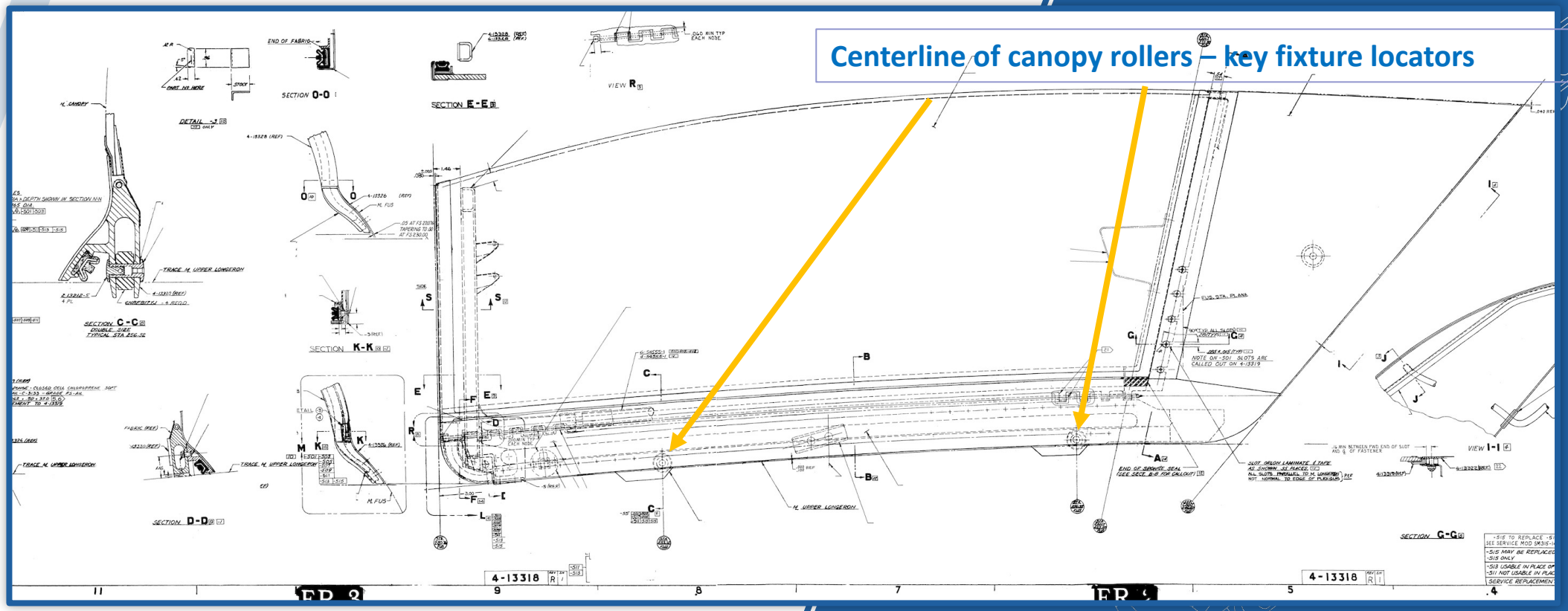
- Compare damaged canopy dimensions to the Nominal Data for the reassembly process.





Step 7A: Design & Repair Canopy Security Fixture

Design Fixture to secure canopy while repairing it using original engineering dimensions and measurements.



Step 7B: Design & Repair Canopy Security Fixture

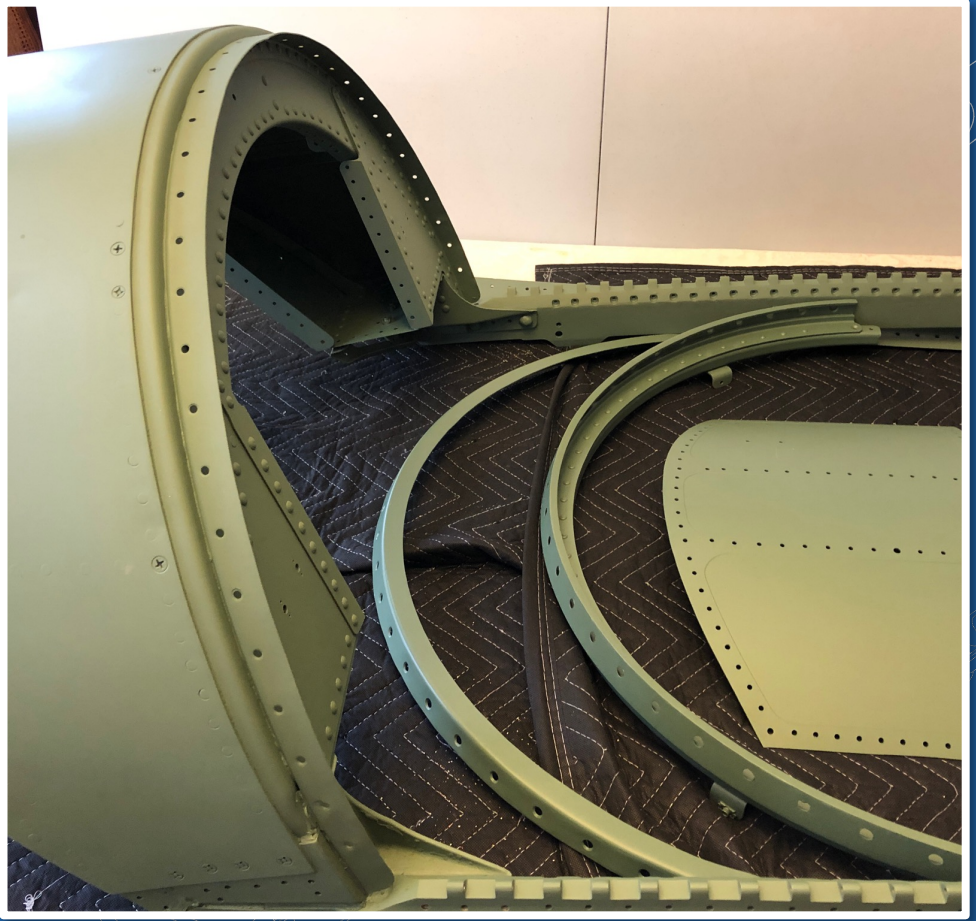
- The Fixture to secure canopy is a very simple design We do not need a ‘traditional’ type fixture because we have all the dimensions in our CAD files.

Step 8: Determine all the key measurements for the important dimensions.

1. Circumference of canopy hoops, FWD & AFT
2. Centerline of canopy lockdowns 4 places, 2 RH & 2 LH – lockdown roller pins
3. Length and width, FWD hoop to aft hoop (beams)
4. Height from canopy base to top of hoops
5. Do not measure canopy glass (panel) surface as this will be replaced with new glass
6. Rear canopy assembly aft of rear hoop; aft canopy glass.
    1. Sheetmetal fabrication, include rivet locations, with attach brackets.
    2. Locations of brackets/supports, alignment of brackets/supports for reinstallation, to ensure alignment with fuselage mating supports.
7. Rear skin at join line; rear fuselage with rivet locations (FS264.104 - FS 270.477)

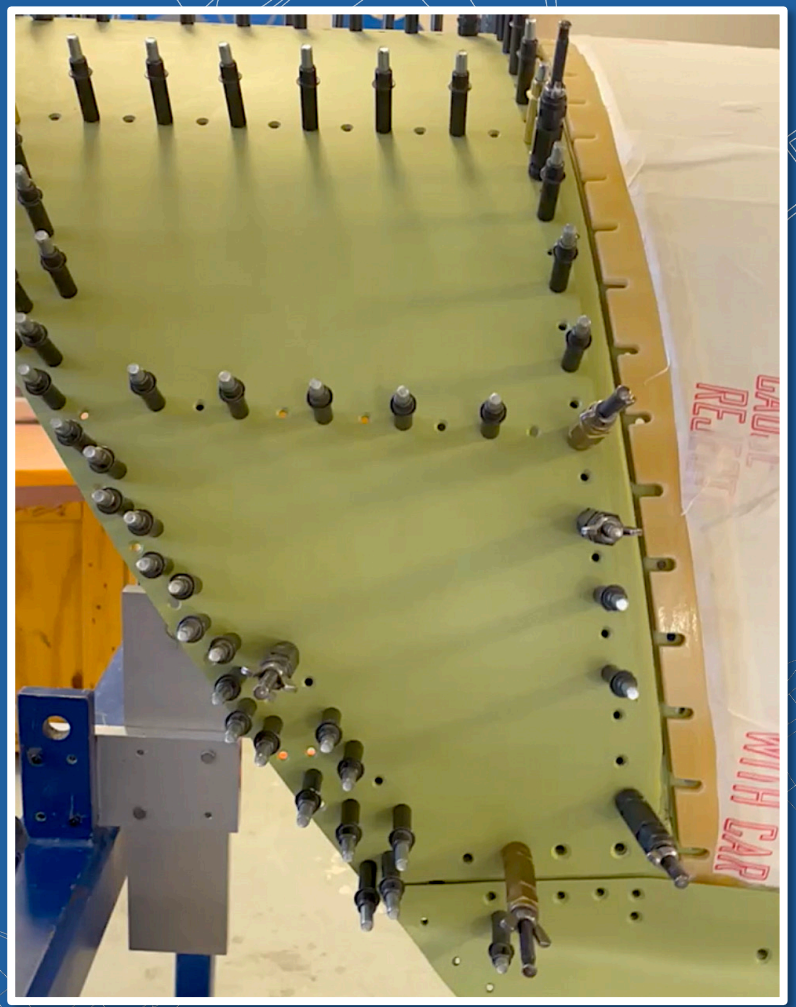
Step 9: Anodize and Prime Parts

- The parts that pass inspections are reprocessed with new anodize and prime and ready to be reassembled.



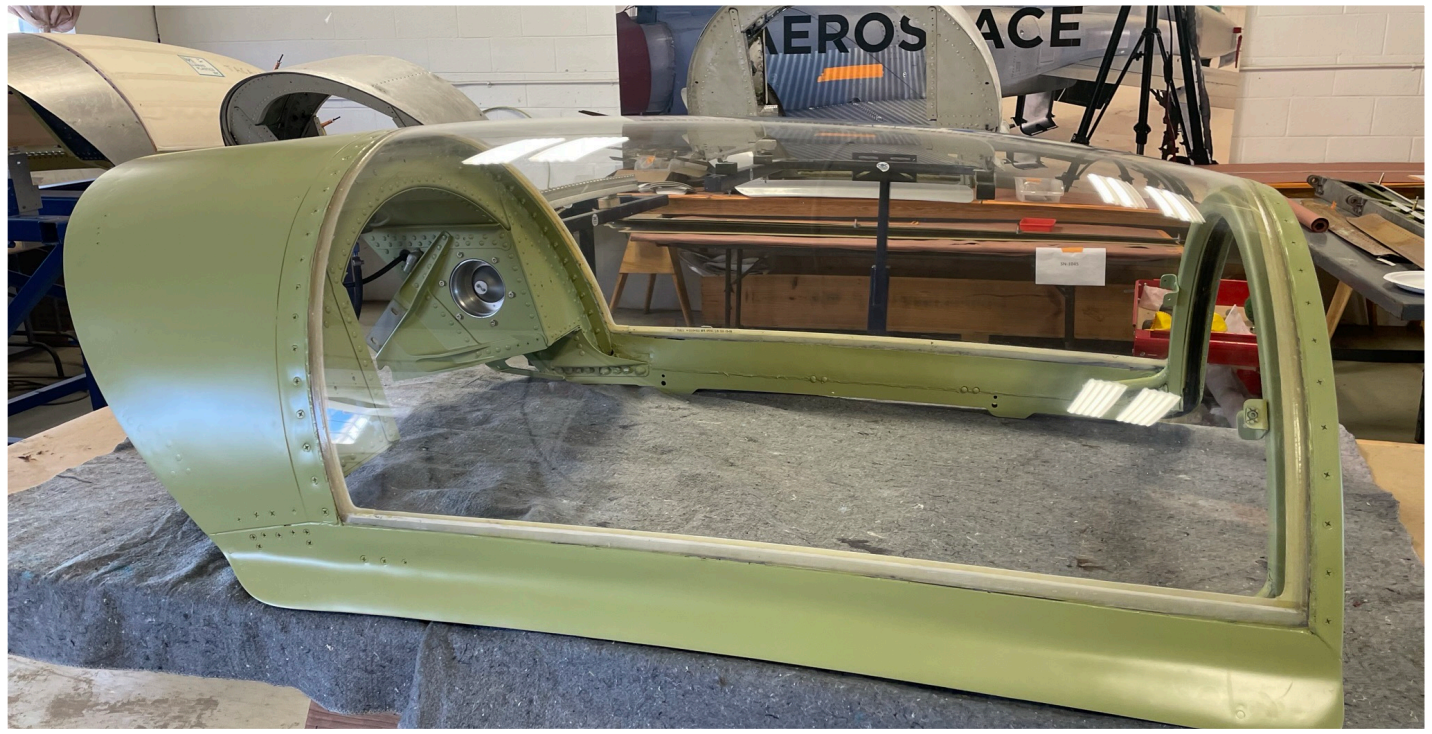
Step 10: Canopy Reassembly

- Canopy is reassembled with all new fasteners. Technicians check dimensions with the 3D Scanners to maintain alignment.



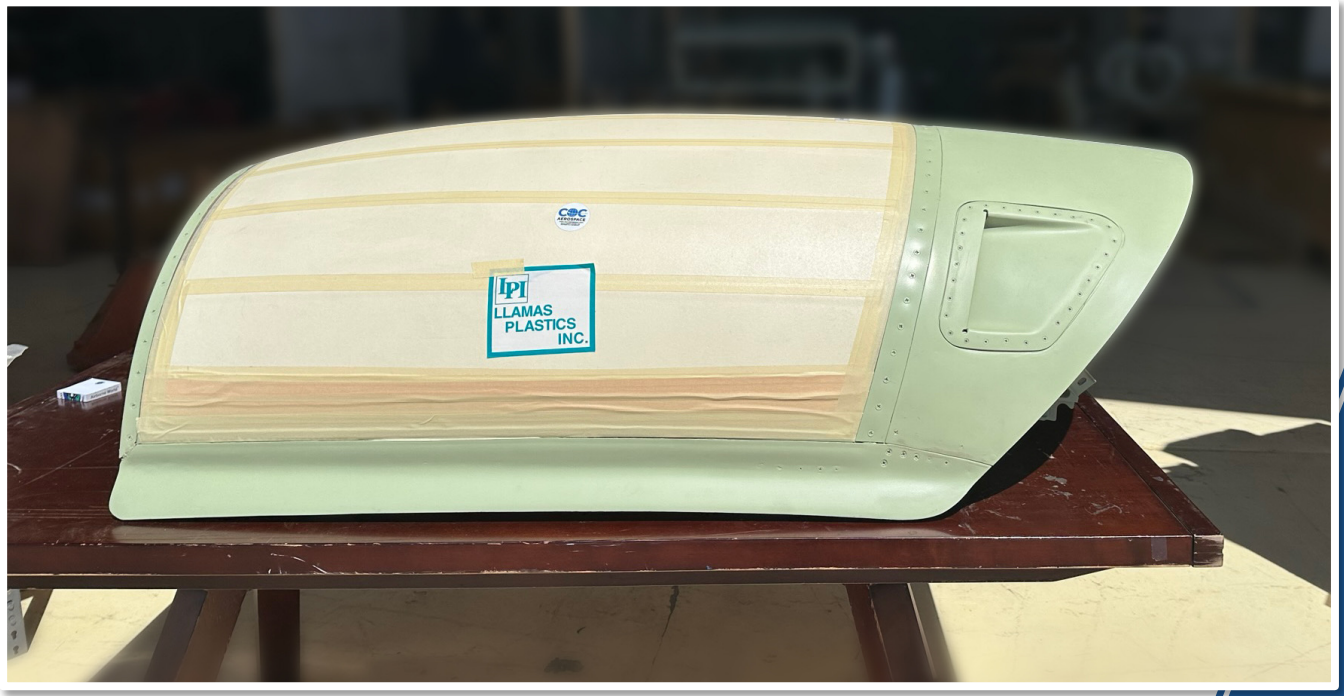
Step 11: Final Finishes

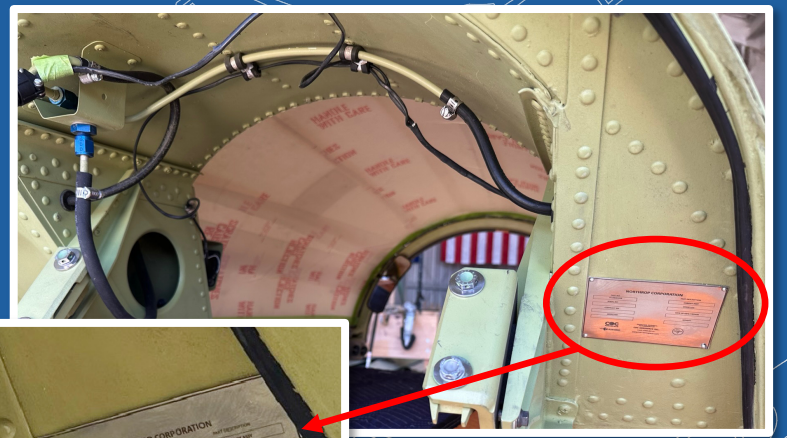
- Canopy is complete, upgraded from -513 to -515.
- Apply final paint, crate and ship back to customer.



Step 11: Final Finishes

Canopy is complete, upgraded from -513 to -515.
Apply final paint, crate and ship back to customer.





Step 11: Final Finishes

Canopy is complete, upgraded from -513 to -515.
Apply final paint, crate and ship back to customer.

COC Supports all F-5 Dual Seat Canopy Part Numbers

F-5 & T-38 2 Seat – Forward

- 2-13201-507 NSN: 1560-00-854-5748
- 2-13201-511 NSN: 1560-00-237-9347
- 2-13201-515 NSN: 1560-01-034-9047

F-5 & T-38 2 Seat – Aft

- 2-13300-507 NSN: 1560-00-894-2890
- 2-13300-511 NSN: 1560-21-845-7794
- 2-13300-515 NSN: 1560-01-013-0544
- 2-13300-517 NSN: 1560-01-082-5120
- 2-13300-519 NSN: 1560-01-040-2952

COC Supports all F-5 Single Seat Canopy Part Numbers

F-5 Single Seat

- 4-13318-505 NSN: 1560-00-949-0009
- 4-13318-507 NSN: 1560-21-845-7796
- 4-13318-511 NSN: 1560-00-175-3869
- 4-13318-513 NSN: 1560-00-427-8935
- 4-13318-515 NSN: 1560-01-038-8377

COC's Canopy Refurbishment & Restoration

- Significant savings over cost of newly manufactured canopy
- Return to Flight is four (4) times faster
- For F-5 aircraft, new replacement canopies are extremely expensive and time consuming to attempt manufacture.

The COC F-5 Team - www.coc-aerospace.com

EXPERIENCE - OVER 5 DECADES YEARS SUPPORTING LEGACY AIRCRAFT

CUSTOMER SERVICE - OVER 50 YEARSSUPPORTING THE SAME CUSTOMERS

TRUST - ABOVE ALL, WE ALWAYS DO THE RIGHT THING

COC AEROSPACE

AS9100D