

United Airlines 787 Composite Damage and Repair- Operational Experience

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Overview

United Airlines took delivery on their first 787 in 2012. To date, we currently operate 12 787-8, 38 787-9 and 21 787-10 aircraft for a total of 71. There are an additional 4 787-10's on order with pending deliveries. United also has 45 A350 on order with scheduled delivery beginning in 2027.



NDT Requirements

- Damage must be evaluated per the AMM Chapter 5 and SRM
- Ramp damage checker is located at 22 locations worldwide and is the first line of defense per the SRM
- Experience has found that most common damage type is due to lightning
- Lightning damage for the most part has been minor, with some exceptions

Damage and Repair Assessment - NDT

Initially, Boeing 40 hour training class was the requirement for United NDT Technician qualification

Includes:

Part 4 51-00-06 Guided A Scan Damage Detection

Part 4 51-00-07 C Scan Damage Detection

And

Part 4 51-00-08 Guided A Scan Bonded Repair Assessment

Part 4 51-00-09 C Scan Bonded Repair Assessment (Olympus Omniscan)

Damage and Repair Assessment

Later, with the development and release of the Dolphicam 2, we are able to use Boeing NDTM 4 51-00-22 for damage assessment.

The need for repair assessment was much lower than the need for damage assessment.

Newly created 16 hour class for damage assessment (not repairs)
Covering Part 4 51-00-06 and 4 51-00-22 only.

Much easier to train more techs with reduced class length

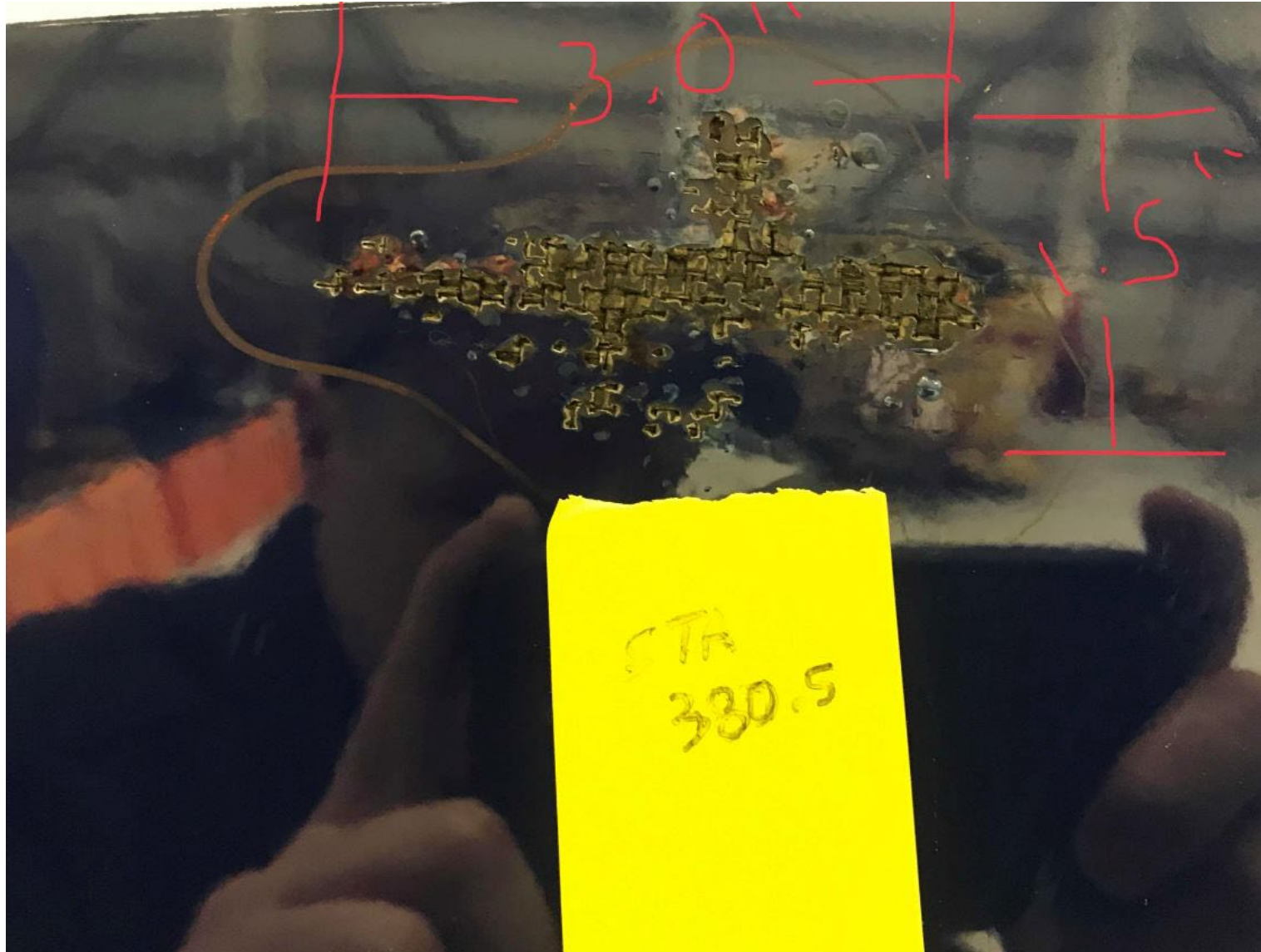
Dolphicam 2

This has made the Dolphicam 2 a real game changer

With 7 units, we can support the system with a fairly rapid deployment plan as needed if the ramp damage checker is not able to help in the decision process

In addition, we have more training in place for guided A scan without the need for the 40 hour qual.

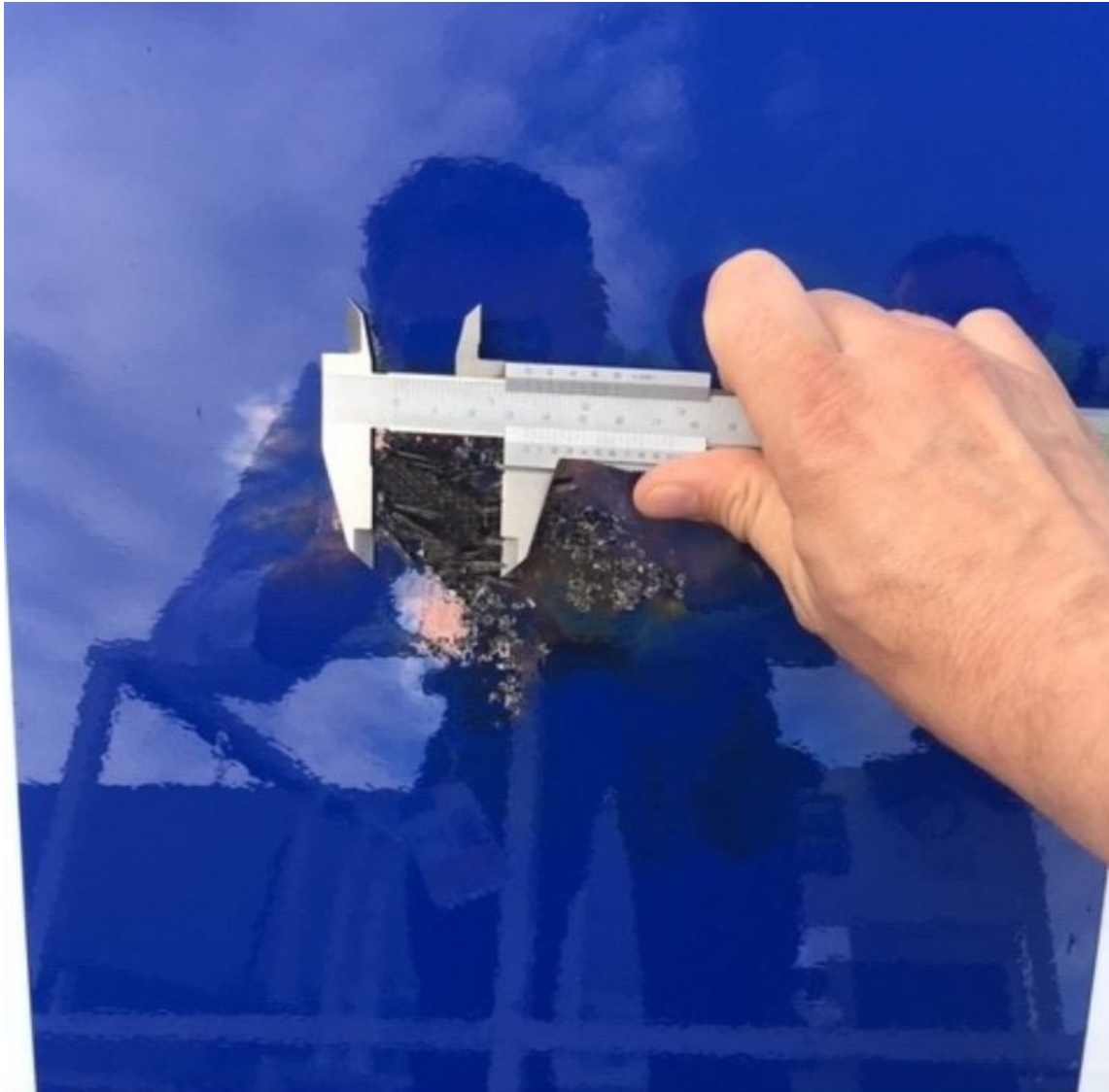
Lightning strike



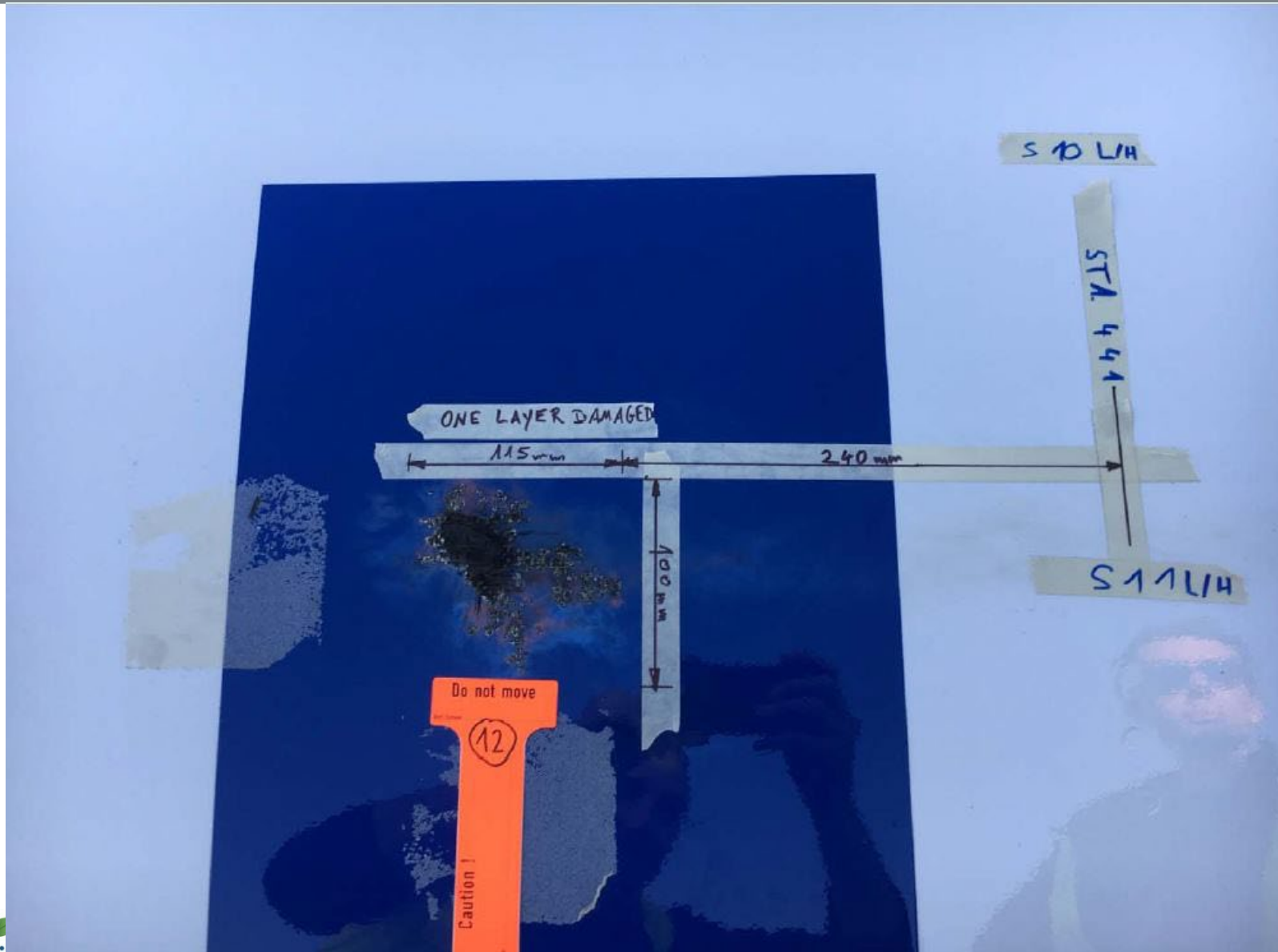
Lightning strike



Lightning strike



Lightning strike



Lightning strike- AC 981

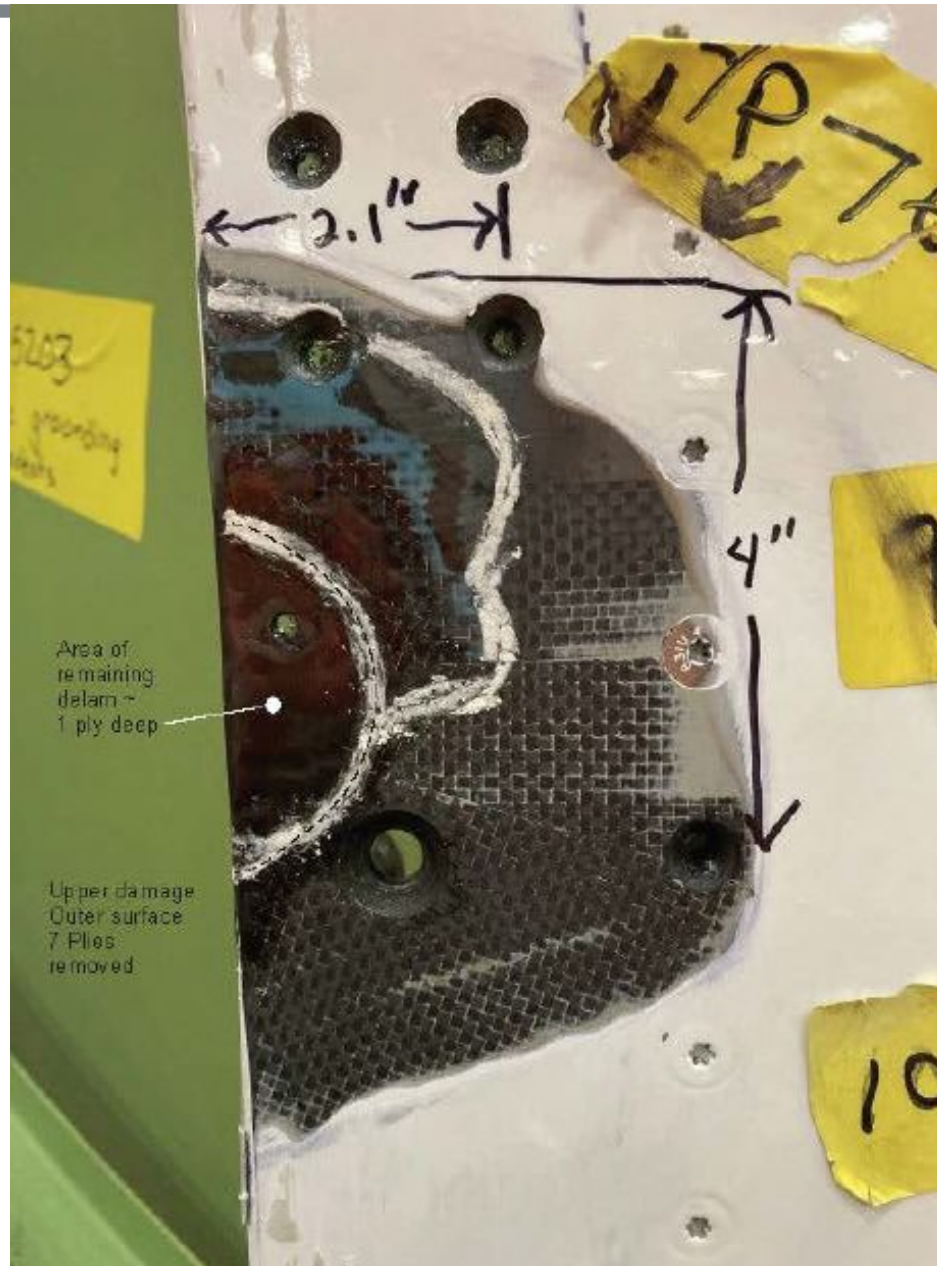


**Our Christmas gift 2021-
Found on arrival 12/25
with over 50 areas of
damage**

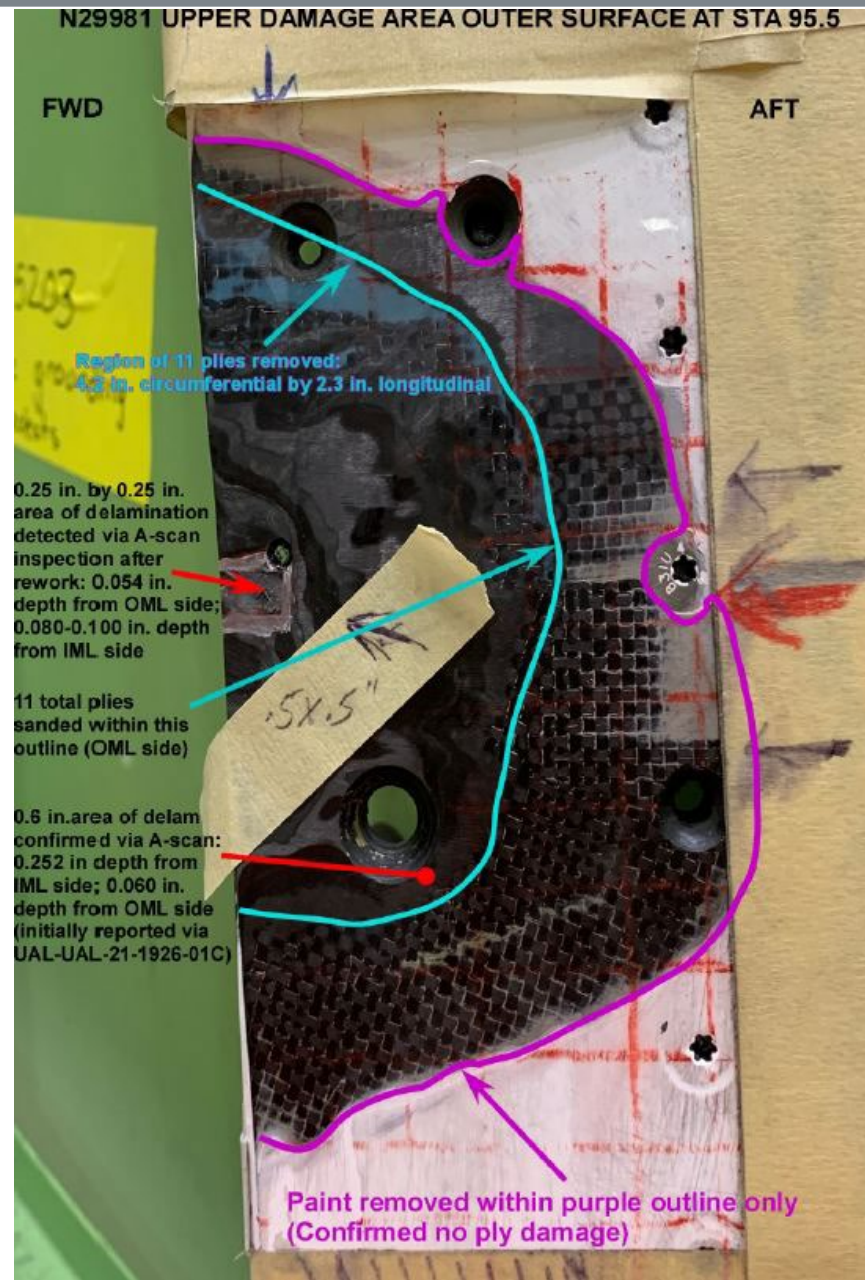
Lightning strike- AC 981



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Additional damage site
indicated per Pulse echo NDT
per NTM Part 1 51-01-03.
D = .6"
Remaining thickness per UT
from inner surface - .234"
Adjacent undamaged
thickness - .311"

Lightning strike- AC 981



Lightning strike- AC 981



Lightning strike- AC 981



Ground Damage

B. Description of High Energy Impact Events

- (1) A high energy impact is when the type, force, or cause is significant with or without the result of damage you can visually see.
 - (a) In all conditions, personnel working around the airplane must know the risk of damage to airplane structure if it is hit with high energy.
 - 1) High energy impacts must be reported and addressed.
- (2) Examples of low velocity, high energy blunt impacts include:
 - (a) An airport jetway that hits the fuselage at more than normal operational speeds or angles.
 - (b) Ground Support Equipment that hits the structure at more than 2 mph (3 km/h) or violently shakes the airplane.
 - (c) Impact by a blunt, high mass object at low speed that is different from normal contact with the airplane made during servicing and maintenance of the airplane.

C. Examine the Airplane Structure

- (1) Examine the structure in the area that you think or know that the impact incident occurred and at the adjacent support structure.

NOTE: Adjacent support structure is the fastener locations in the skin panel which attach to the internal structure. They give support to the skin.

- (a) Use visual and instrumented NDI procedures to examine the external area of high energy impact and an additional 1 ft (30 cm) around the area.

- 1) Refer to 787 NDT Manual Part 1, 51-01-02 to find the applicable inspection procedure.

NOTE: The larger inspection area given above is the recommended minimum. The inspection area is a result of the energy of the impact.

- (b) Visually examine and instrumented NDI the external surfaces of the airplane in the general area of the impact which includes the nearest support structure.

- 1) Refer to 787 NDT Manual Part 1, 51-01-02 to find the applicable inspection procedure.

- (c) If you find signs of damage in the skin at the adjacent support structure or in skin below a stiffener, do an internal visual and instrumented NDI procedures.

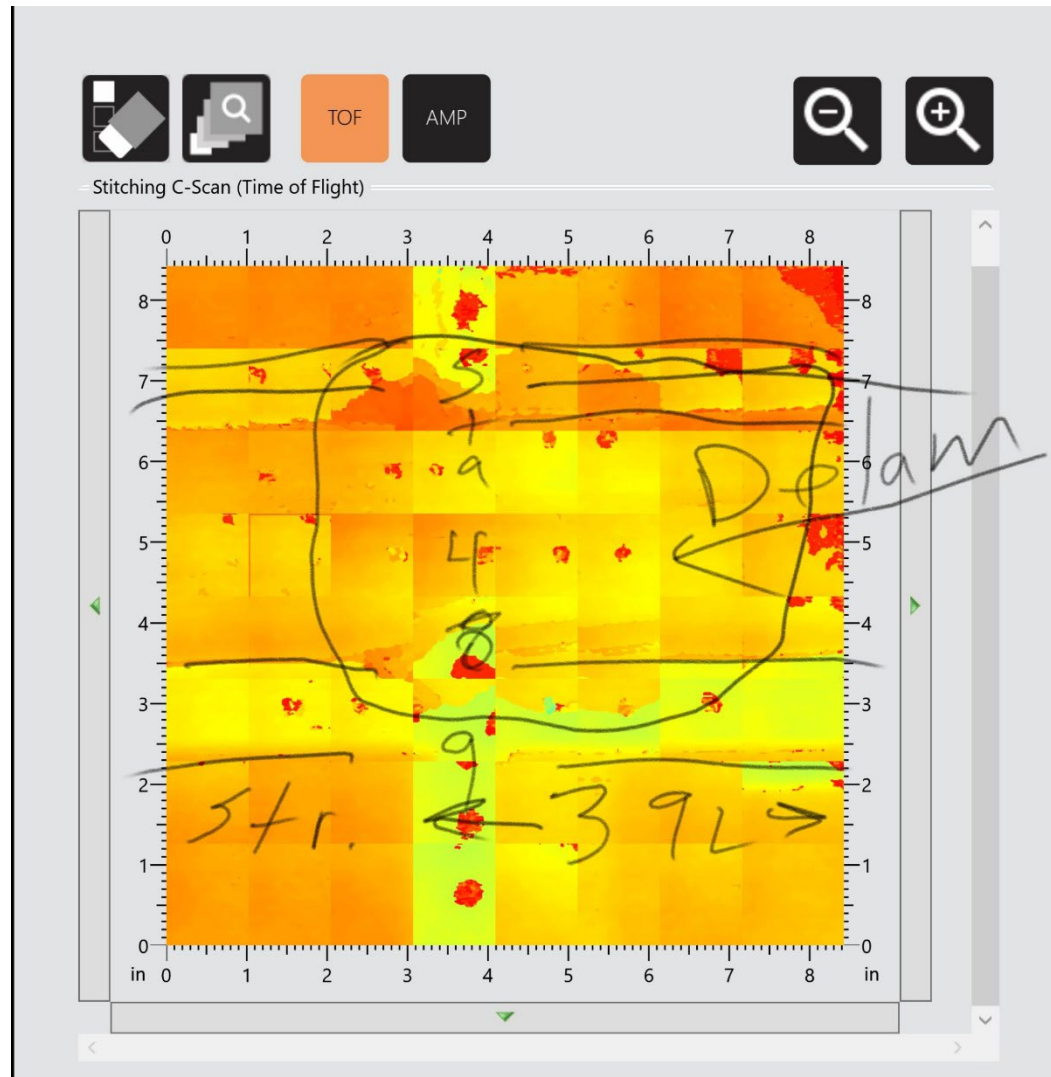
- 1) Disassemble the structure if necessary.
 - 2) Refer to 787 NDT Manual Part 1, 51-01-02 to find the applicable inspection procedure.

- (d) Refer to Boeing if more clarification is necessary about the area for the inspection, the location of the underlying support structure or repairs necessary for the damage found.

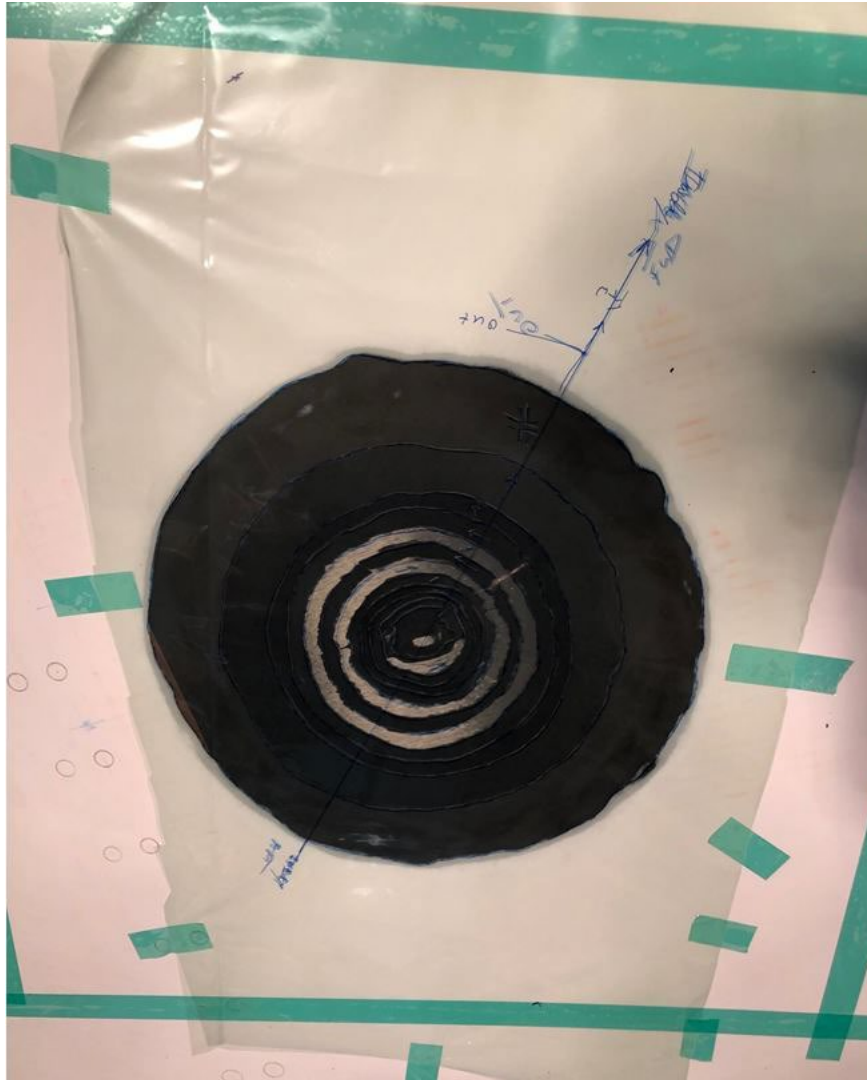
Major Repairs

- United has experienced very few major repairs, and even fewer bonded repairs

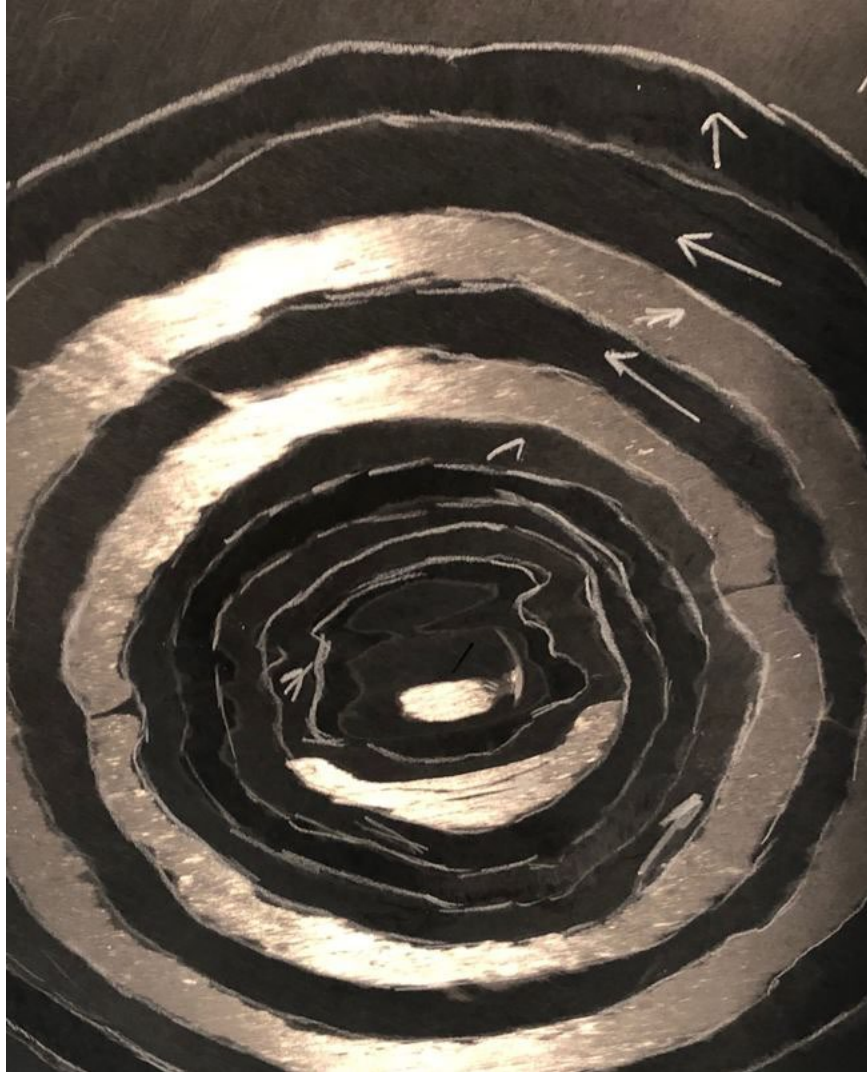
- Examples



On walkaround, damage was found on the bottom of the right wing



Taper sand, ready for DVDB, 15 ply repair



Bagged for survey



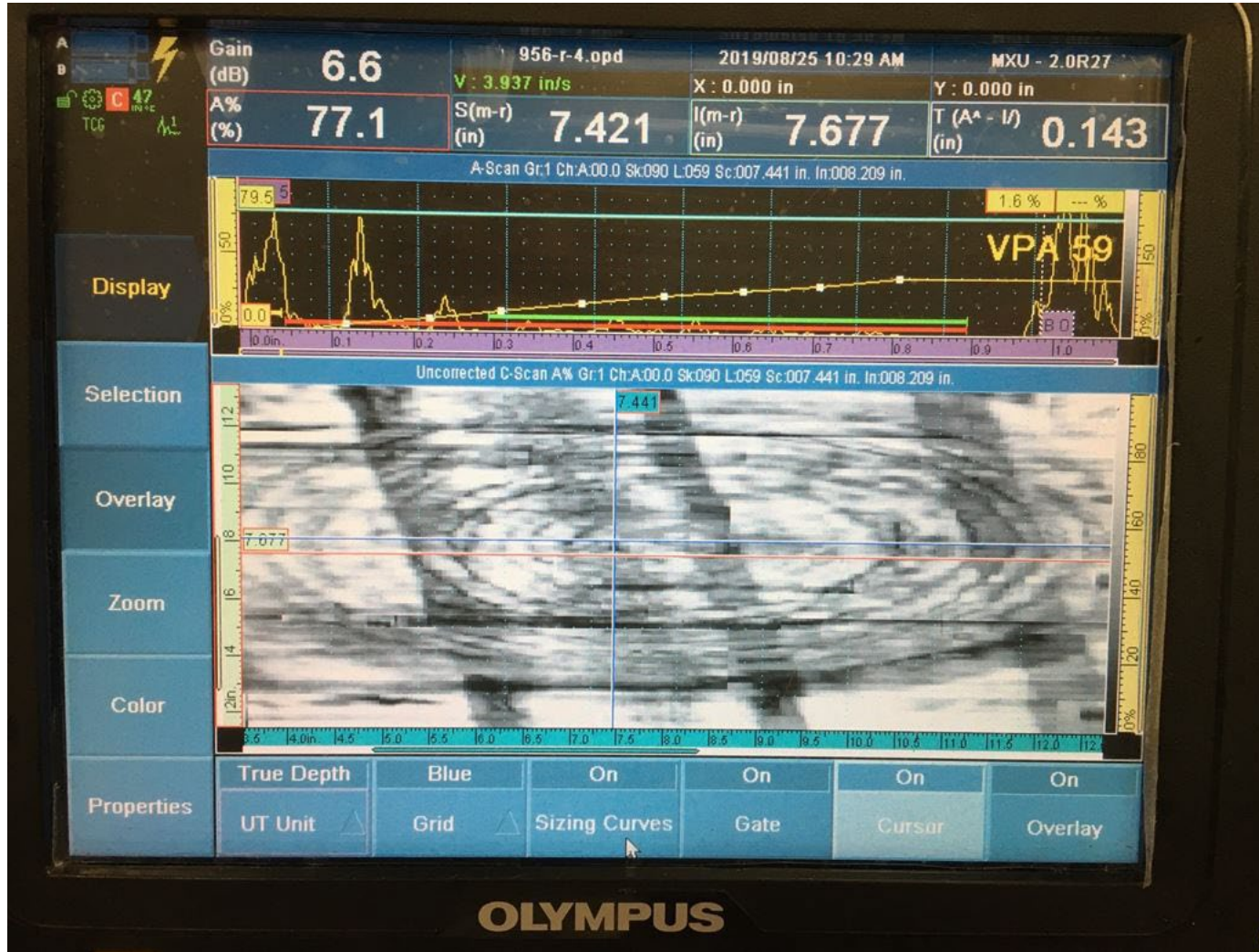
Practice on the left wing



After the cure



Final Scan- repair completed



Results

Skin below the area of contact was scanned with Dolphicam 2. No delam was found. Damage was found to the lower chord



Wingtip Replacement



Wingtip Replacement



Conclusions

- Overall service experience has been good
- Dolphicam2 has helped speed up RTS
- Lightning strikes for the most part are minor, but have potential to be the most difficult to repair.

Questions?

