



JAL Perspective on Application & Field Experiences for Composite Structure

3rd FAA/EASA Industry Composite Damage
Tolerance and maintenance Workshop

Jun Yamanaka
Japan Airlines
Engineering Department
June 4th, 2009



- **Outline**
- Field experience and thought against the events
- Activities for PDA Prevention
- Summary - What we expect...

JAL Group Fleet (279 Airplanes)

Dream Skyward. JAL

www.jal.co.jp

JAL
JAPAN AIRLINES

747 Series: 51 Airplanes



www.jal.co.jp

JAL
JAPAN AIRLINES



777 Series: 43 Airplanes

www.jal.co.jp

JAL
JAPAN AIRLINES

767 Series: 50 Airplanes



www.jal.co.jp

JAL
JAPAN AIRLINES

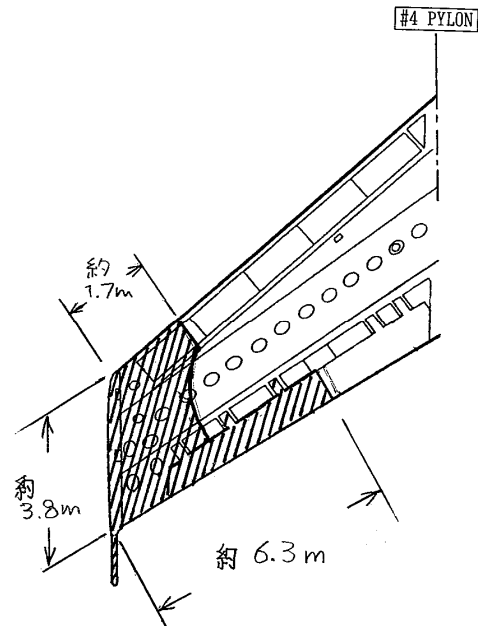


A300-600: 22 Airplanes

And more....

- Outline
- **Field experience and thought against the events**
- Activities for PDA Prevention
- Summary - What we expect...

Damage on Wing – Collision with Light Pole



Wing tip was hit with light pole.

The wing main box, wing tip structure, leading edge flap and aileron got severe damage.

Damage on Wing – Collision with Light Pole

■ The repair took almost 3.5 months

One week survey/inspection after the incident.

Inspection was done by visual. Only a very little local NDI was required.

Two months to wait for the repair parts.

One month for the repair.

Cut and splice the wing skins, spars and stringers. All repair were “Bolted” repair.

All the repair was done with OEM AOG team.

No post repair inspection (Damage tolerance inspection) was required.

Damage on Wing – Collision with Light Pole

■ What we expect when same thing happens on composite wing...

Inspection for damage survey to be done by visual and no significant NDI to be required.

Repair parts become available in shorter time, utilizing production parts convert to the repair parts.

Repair concept/scheme is not different from what we see on the aluminum airplane.

No post repair inspection (Damage tolerance inspection) will be required.

Lightning Hit Damage



Lightning hit damage occurred on the engine cowling. Heat damage with disbond was found.

The cowling was replaced.

Lightning Hit Damage



Damage Status – Lower Surface



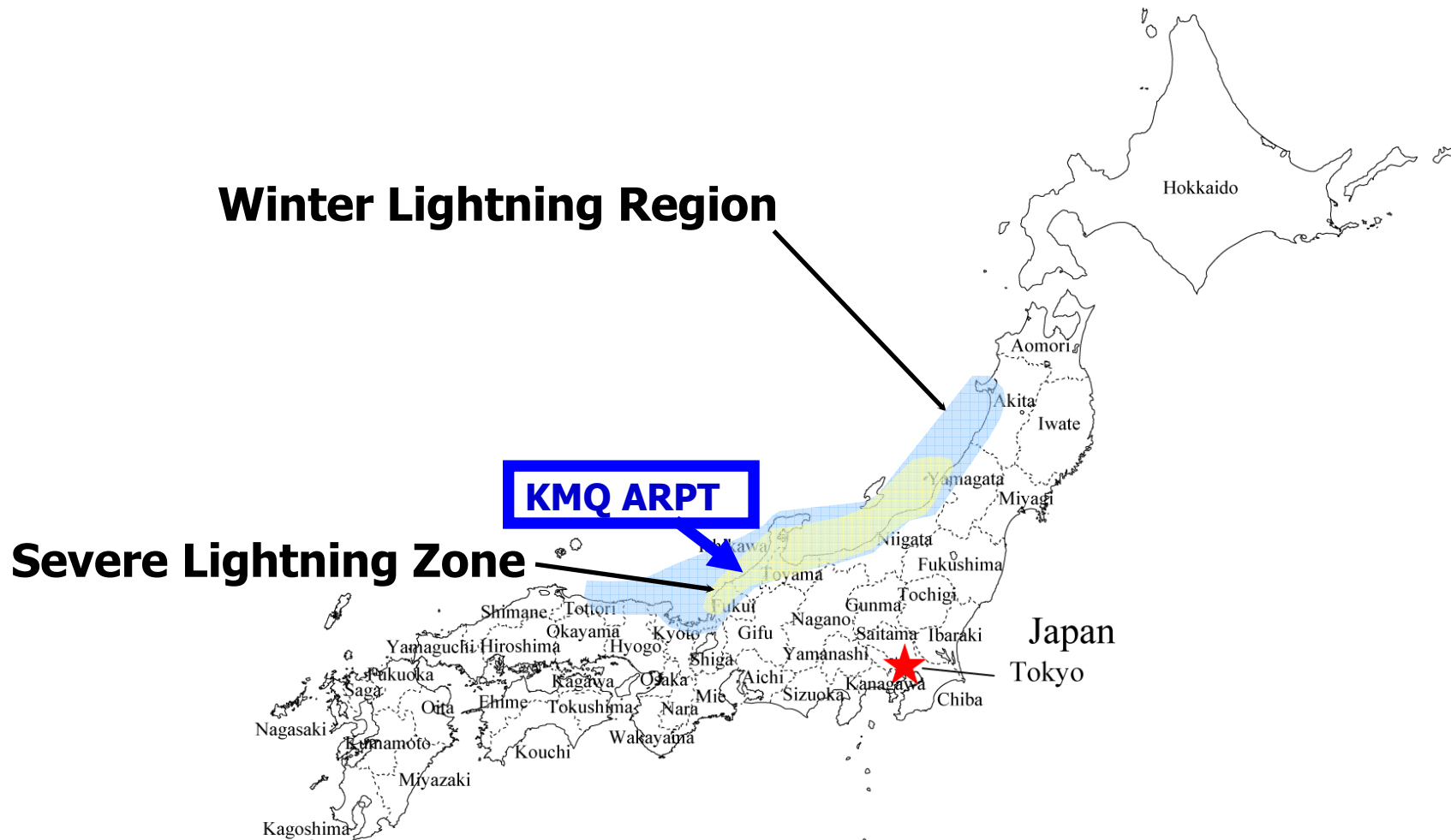
Heavy Damage with Crack, Delamination & Resin Burn-Off – Skin Plies (12" x 40")
Missing – Discharger, Discharger Base & Insert



Lightning hit damage occurred on the outboard aileron.
Heat damage with large disbond was found.

The aileron was replaced.

Lightning Hit Damage



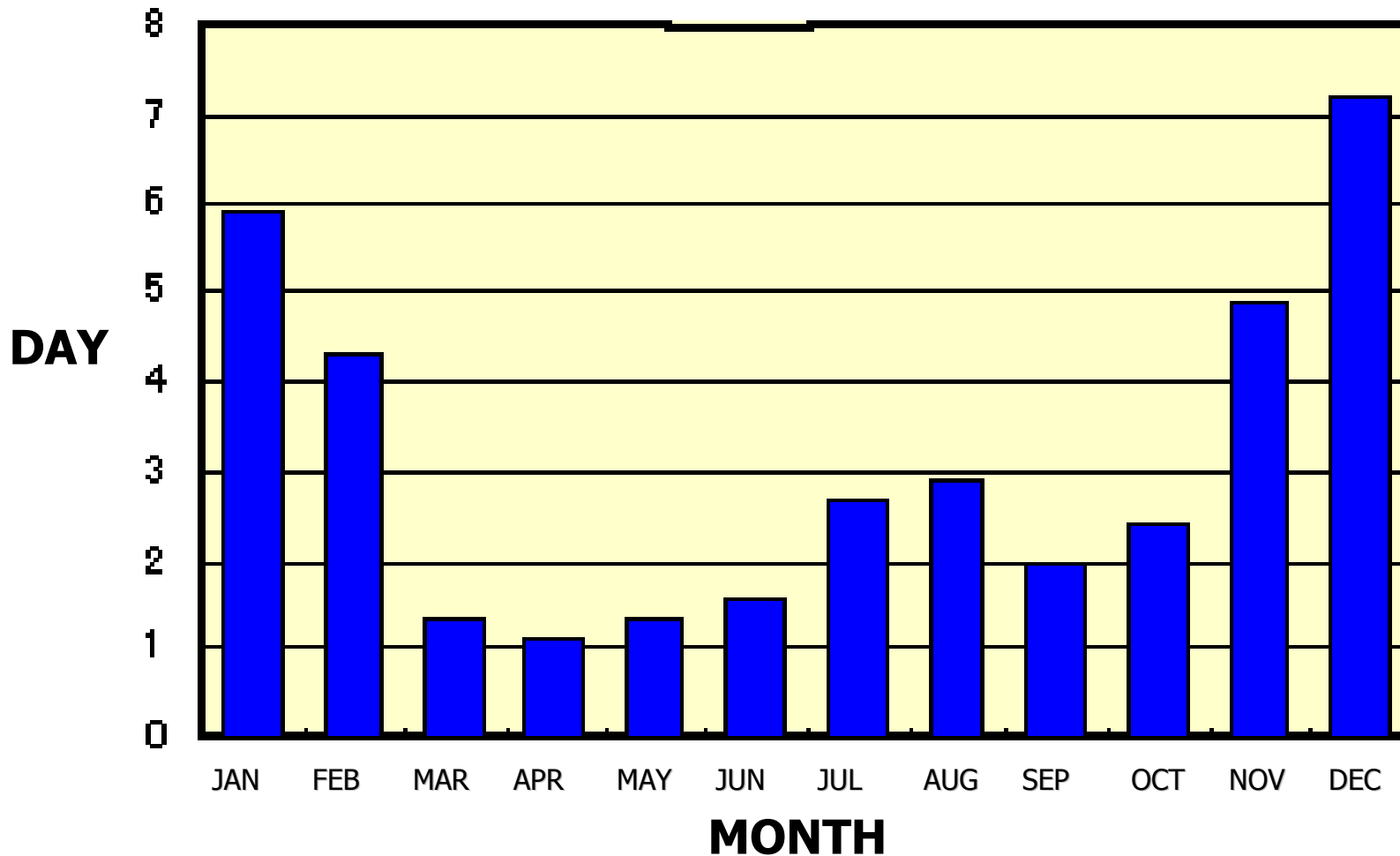
Winter Lightning Region

KMQ ARPT

Severe Lightning Zone

Significant concentration of “High-Energy” lightning discharge along Japan Sea coastal region in winter season.

Lightning Hit Damage



Monthly Thunderstorm Condition Status at KMQ ARPT Area

Lightning Hit Damage

	Charge	Current
Summer	5C or less	20KA or less
Winter	Over 300C	200KA

Comparison of the Lightning Discharge in Summer and Winter.

■ What we expect when designing a new airplane with regard to the lightning protection...

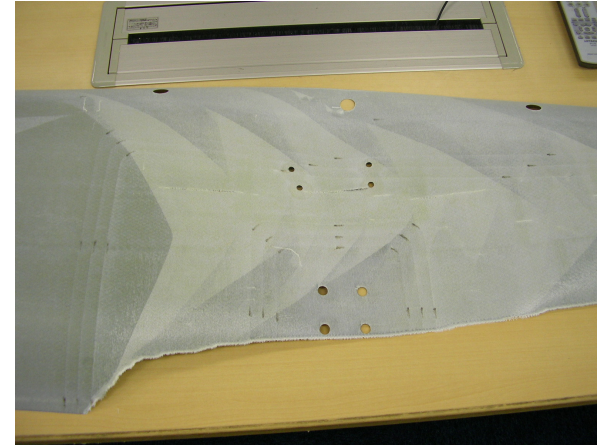
The structure is robust enough and no significant damage occurs after the “winter lightning hit”.

No immediate lightning hit inspection which requires to access all over the aircraft surface.

Inspection can be waived off till main base return or till next convenient maintenance opportunity.

Repair concept/scheme to relief the airplane back to revenue service is easy and no time consuming.

Large peel off skin of glass fiber honeycomb



During the turn around, the pylon aft fairing glass fiber honeycomb skin was found peeled off. The most outer glass fiber ply disbonded and departed from the airplane.

No other damage was found in the honeycomb.

The same defect was found on other airplane.

One airplane flew only 7 months from delivery.

Large peel off skin of glass fiber honeycomb

■ What we think about this event...

The root cause of the disbond was considered to be a poor edge protection design of the skin.

The skin edge erosion lead the airflow to peel off skin ply.

We understand that this panel passed the required NDI testing during production. However, fairly large disbonding is occurred during operation.

I hope same discrepancy does not occur on the primary composite structure.

- Outline
- Field experience and thought against the events
- **Activities for PDA Prevention**
- Summary - What we expect...

■ What is PDA??

=> **P**art **D**eparting from **A**irplane

Any part falling off or missing from the airplane is what we call PDA.

☐☐☐ Access Panels, Aerodynamic seals, and etc...

Activities for PDA Prevention

■ Why PDA is a concern??

Activities for PDA Prevention

■ Typical Airport in Japan

Fukuoka Airport



Airport

Itami (Osaka) Airport



- Some of Japanese airports are located in residential area.

PDA events attract a great deal of attention in Japan.

Activities for PDA Prevention

- **PDA is a concern;**
 - For person's safety on ground,**
 - For damage to property on ground,**
 - For dispatch of airplane itself,**
 - For runway debris,**

Activities for PDA Prevention

■ PDA event is giving concerns to public

Once it reported by the media, people considers the subject airline as “Unsafe”.

Passengers may avoid choosing such an airline for their future travel.

Activities for PDA Prevention

Media Report Sensationally

Parts departed from JAL Airplane!

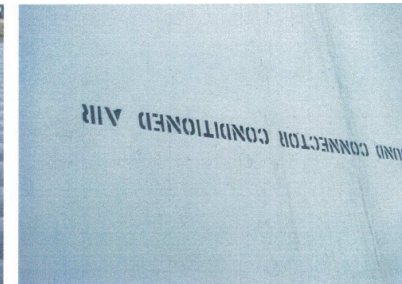
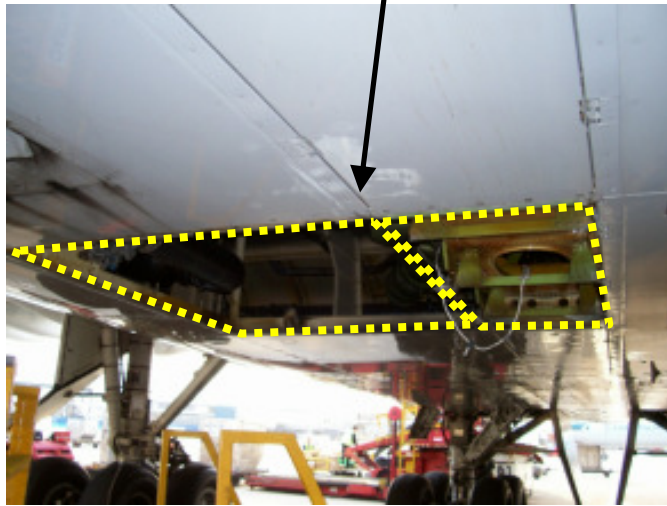
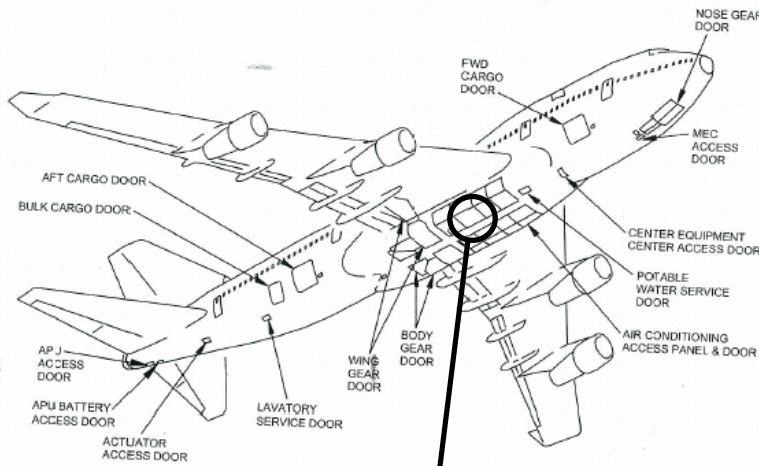
Hot Metal Piece from the Sky!



Activities for PDA Prevention

Air-con Bay ACC Panel Missing

- The Panel fell down in a farmer's field near houses.



Activities for PDA Prevention

- **What we expect OEM to design new airplane with regard to the PDA prevention...**

PDA usually occurs on the smaller piece of airplane structure. Therefore, it may not be a significant airplane integrity concern.

However, it is always the concern from other aspects as presented in the previous slides...

Therefore/////

Regardless of composite parts or aluminum parts, make the every piece of structure to be robust enough against PDA.

- Outline
- Field experience and thought against the events
- Activities for PDA Prevention
- **Summary - What we expect...**

Summary - What we expect...

- **Composite becomes major structure material for the airplane. The technology became mature.**
 - **It is highly durable with regard to the fatigue.**
 - **It is highly durable with regard to the corrosion concern.**
 - **It is highly contributing to the light weight.**
- **Today, I did share some field experience and my though against those events.**
- **With adding little more essence from those field experience to the existing design, we can rely on composite more ...**

Thank you !

