Risks of Space Weather: A Commercial Aviation Perspective

2016 AMS Washington Forum
Leveraging Environmental Intelligence to Enhance Risk Management
12 April 2016, Space Weather Session
American Association for the Advancement of Science
1200 New York Ave., Washington, D.C.

Panelist
Tom Fahey, Mgr. Meteorology, Delta Air Lines
Tom.Fahey@Delta.com

Solar Events & Aviation
NOAA’s solar activity categories:
1. Radio Blackouts (R)
2. Solar Radiation (S) Storm
3. Geomagnetic (G) Storm

Aviation Impacts:
• Radio Communications
• Health Affects

Flight Routes: Asia ↔ U.S.
Polar Routes

Delta Weather Hazard Avoidance Procedures
• Apply to All Weather Hazards for both:
  – Preflight Planning
  – En Route Adjustments
• Color Coded for both Pilot & Flight Dispatch Use:
  – ADVISORY: YELLOW
    No Action required Preflight or en route.
  – ALERT: ORANGE
    Adjust route preflight & en route provided no other operational limitations
  – AVOID: RED
    Adjust route preflight & en route

Delta’s Space Weather Procedures
Each flight must maintain constant communication with ATC & with the company.

Delta’s Primary Comms Method: ACARS (using VHF or SATCOM)
Delta’s 2nd Comms Method: Voice Communications (using HF or SATCOM)

Communications
Inmarsat SATCOM is not available North of 82N.

No Ops on all Polar Routes During Strong Solar Radiation (S) Storms
Due to possible health affects

No Ops North of 82N During Strong (G) Geomagnetic Storms
Due to possible loss of HF

Flight Routes: Asia ↔ U.S.
Polar Routes

Delta Weather Hazard Products
Types & Intensity

TP Message Products
- Forecast Activity
  Used for Preflight Planning
- Current Activity
  Used En Route

AVOID
Sev Icing
Volcanic Ash
Strong Mtn Wave
> Moderate Turbulence

OUTLOOK/SUMMARY
Products
- Used by Dispatcher as initial info for Pre-Flight Planning.
- Compliments TP Products.

ALERT
Moderate Icing
Moderate Turbulence
Moderate Mtn Wave, Tstrms, Ozone
Space Weather (S & G level 3 or >)

ADVISORY
Frontal Shear
Light-Moderate Turbulence
Space Weather (R level 3 or greater)

DELTA
Weather Hazard Avoidance Procedures

• Apply to All Weather Hazards for both:
  – Preflight Planning
  – En Route Adjustments
• Color Coded for both Pilot & Flight Dispatch Use:
  – ADVISORY: YELLOW
    No Action required Preflight or en route.
  – ALERT: ORANGE
    Adjust route preflight & en route provided no other operational limitations
  – AVOID: RED
    Adjust route preflight & en route

Delta’s Space Weather Procedures
Each flight must maintain constant communication with ATC & with the company.

Delta’s Primary Comms Method: ACARS (using VHF or SATCOM)
Delta’s 2nd Comms Method: Voice Communications (using HF or SATCOM)

Communications
Inmarsat SATCOM is not available North of 82N.

No Ops on all Polar Routes During Strong Solar Radiation (S) Storms
Due to possible health affects

No Ops North of 82N During Strong (G) Geomagnetic Storms
Due to possible loss of HF
Delta Weather Hazard Products
Space Weather Summary/Outlook

• Used as Pre-flight Planning Tool

Green = Good

Delta Meteorology Space Weather Activity and Forecast

Issue Time: 0030Z Sunday, May 19, 2013
Next Update: 1100Z Monday, May 20, 2013

*Valid Times See Below

Previous 24 hour Activity

Valid: 0600Z 5/18/2013 to 0600Z 5/19/2013

Event 1

Event 2 (if needed)

Event 3 (if needed)

Scale

Valid Time

Scale

Valid Time

Scale

Valid Time

Geomagnetic Storms:

G1
18/0252z - 18/0900z

NONE

NONE

Solar Radiation Storms:

S1
18/0252z - 18/0900z

NONE

NONE

Radio Blackouts:

NONE

N/A

NONE

Current Activity

Geomagnetic Storms:

NONE

G3, G4, G5

Solar Radiation Storms:

NONE

S3, S4, S5

Radio Blackouts:

NONE

See latest TPs issued for:

24 hour Forecast Activity

Valid thru: 0000Z 5/20/2013

Delta Air Lines
Space Weather Info
Storm Scales & Delta TP Product

G or S Storm: Scale > or = 3, requires Delta TP Alert

No TP Issued

No TP Issued

No TP Issued

No TP Issued

No TP Issued

No TP Issued

Delta Actions

Type of Storm

Storm Scale

Abbr.

1

2

3

4

5

Radio Blackout

R Storm

None

None

Awareness: HF problem on sun lit side

Solar Radiation

S Storm

None

Aware

Adjust Route: 3 to 7

Geomagnetic

G Storm

None

Aware

Adjust Route: 10 to 12

Solar Events & Actions

Type of Storm

Sun ⇒ Earth

Duration

Maximum Affects

Travel Time

Average

Aviation

Earth

Time

Radio Blackout

R Storm

3 minutes

A few Hours

HF Radio

Near Equator

Daylight

Solar Radiation

S Storm

Approx. < 1 hour

< 1 day

HF Radio & Health

Near Poles

Any

Geomagnetic

G Storm

Approx. 18-24hrs

1-2 days

HF Radio

Near Poles

Any

Delta’s Ops Concerns:

• HF Radio Communication disruption

• Improved Space Wx Fcsting for both Airline safety & efficiency

Space Wx Info Needs

• As simple as psbl for Aviation Ops Decision Makers

• “H” (Health) Scale. Implement after details addressed.

Performance Values for Space Weather Forecasting

• A goal not a mandate

• Re-routes are the responsibility of Operator

• Fcsting should not over reach accuracy capability

Slide 45 – Fall 2014
Int’l Recurrent Corrected & Clarified NO TP for G1,G2, S1 & S2

No TP Issued

No TP Issued

No TP Issued

No TP Issued

No TP Issued

No TP Issued

Edited version of Slide 44 – from Fall 2014 Int’l Recurrent

Delta’s Conclusions

Conclusions

Delta’s Ops Concerns:

• HF Radio Communication disruption

• Improved Space Wx Fcsting for both Airline safety & efficiency

Space Wx Info Needs

• As simple as psbl for Aviation Ops Decision Makers

• “H” (Health) Scale. Implement after details addressed.

Performance Values for Space Weather Forecasting

• A goal not a mandate

• Re-routes are the responsibility of Operator

• Fcsting should not over reach accuracy capability