# Automated Flight Information Reporting System (AFIRS)

Presentation to NTSB Forum
October 7, 2014

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# “MH370 / AF447”

- Where is the aircraft?
- What happened?
  - Or more generically,

    “*What is the current state and location of the aircraft?*”

Both questions can be answered with the same technology, which is available and in service today



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# FLYHT Solution

- The system solution consists of two components:

| | |
|---|---|
| AFIRS | *Remotely programmable*, on-board hardware with memory and processing capability |
| UpTime | Web-based secure data conduit, with applications, analytics, and reporting tools |

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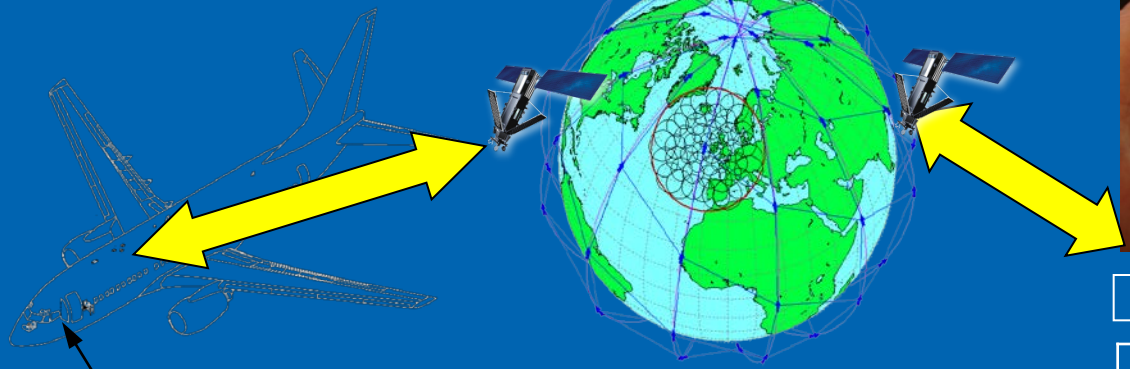
# How it works



"Blue Box"

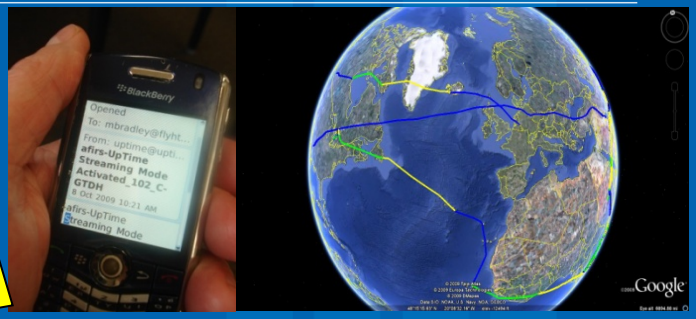
Automated reporting

Voice & data - 2 way.

Connects to FDR and other data sources

Global satellite communications (Iridium) — no gaps or coverage limits

Relays secure information from Blue Box to server and back




| N1XYZ DEPARTED: EGNR AT: 2011-05-16 16:36:26 FOB: 4693 | | | |
|---|---|---|---|
| **G- XYZ Exceedance: N1 Overspeed Left Engine** | | | |
| **LIMIT: 99.5** | | OVER LIM SEC: 25 | PEAK: 100.25 |
| **GMT: 16:36:05** | Location: | LAT: 53.184814 | LONG: -2.9680176 |
| **SAT: 14** | PALT: 160 | MACH: 0.24 | IAS: 159 |

Data transformed into timely messages and usable information- delivered to user IP address in seconds

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# Triggered transmission requirements for irregular operational situations

1. Instant alerting (automatically)

   To dispatch/AOC first;

   Then, if emergency is declared, dispatch expands network of recipients with one action

2. Precise position tracking in real time shifts to high resolution (rate can be escalated by AOC/OCC)

3. Selected aircraft data fed directly to subject matter experts in real time (e.g., maintenance, OEMs; FAA; NTSB); usually based on pre-defined parameters and recipients

# Reporting Tempo—lessons learned

- Never want all the data all the time
- Routine operations data
  - basic position, OOOI, fuel, and a/c status sent real time at selectable intervals (all data recorded on board for later FDM/FOQA)
- Exception-based reporting
  - Event and context data sent in real time (real time FOQA)
  - In irregular operations, a higher rate of position and data reporting is automatically initiated

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# Infrastructure exists today to support a global fleet

- **Internet-**
  - selected data can be delivered securely to any IP address
- **Satcom-**
  - Global coverage (Iridium). No frequency or capacity limitations

***NO incremental investment required in the enabling infrastructure***

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# Safety/Security

- Automated system with no management or intervention by the crew (physically isolated to prevent tampering);
- No crew discretionary interrupts or “standby” mode (ADS-B)
- Ability to connect to an alternate power input, battery bus or battery pack – easily protected from electrical issues
- In the event of loss/cutoff of aircraft power, AFIRS would transmit its own GPS position data and backlogged data
  - Transport layer encryption
  - Data only goes to pre-designated recipients

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# Implementation Requirements and Timelines

| Requirement | Status | Timeline |
|---|---|---|
| FAA/EASA certified system | Existing | Available today |
| STCs for major aircraft types | Many in hand | Each requires 6-9 mo w/o expediting (can run in parallel) |
| Manufacturing Capacity | In place | Can ramp up to hundreds / mo |
| Installation process | Routine | • New a/c: install as built<br>• Retrofits: C-check cycle<br>• Global fleet could be done in 3 yrs. |
| Communications Infrastructure (SATCOM & Internet) | 100% in place | Available today-no expansion required |
| CONOPS for Emergencies | Baseline exists | Needs to evolve with all parties |

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# Summary of AFIRS Capabilities & Benefits

1) Facilitates continuous situational awareness / operational control (using AC 120-101 as guide)
2) Creates operational and monetary benefits
   - reduce operating costs
   - reduce fuel burn
   - increase dispatch availability
   - avoid unscheduled maintenance
3) Automated alerting & aircraft information for emergencies
   - Automatic alerting
   - High resolution tracking
   - Flight data in real time

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# BACKUP

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# Make one size fit all = fleet commonality

- Same hardware (Dash-8 to B-777)--standard bus interfaces
- Configurable at system level
  - Selection of services (voice, text, OOOIs, trends, AFM exceedances. fuel management, triggered streaming)
  - Report routing (internal and external; situation-dependent)
  - Tailoring of alerts and limits (AFM + operator options)
  - With or without ACARS and/or FANS interfaces
- Fully globally capable when using Iridium (but could work in degraded form with other satcom and broadband (sacrifices global coverage and loss-of-power capabilities))

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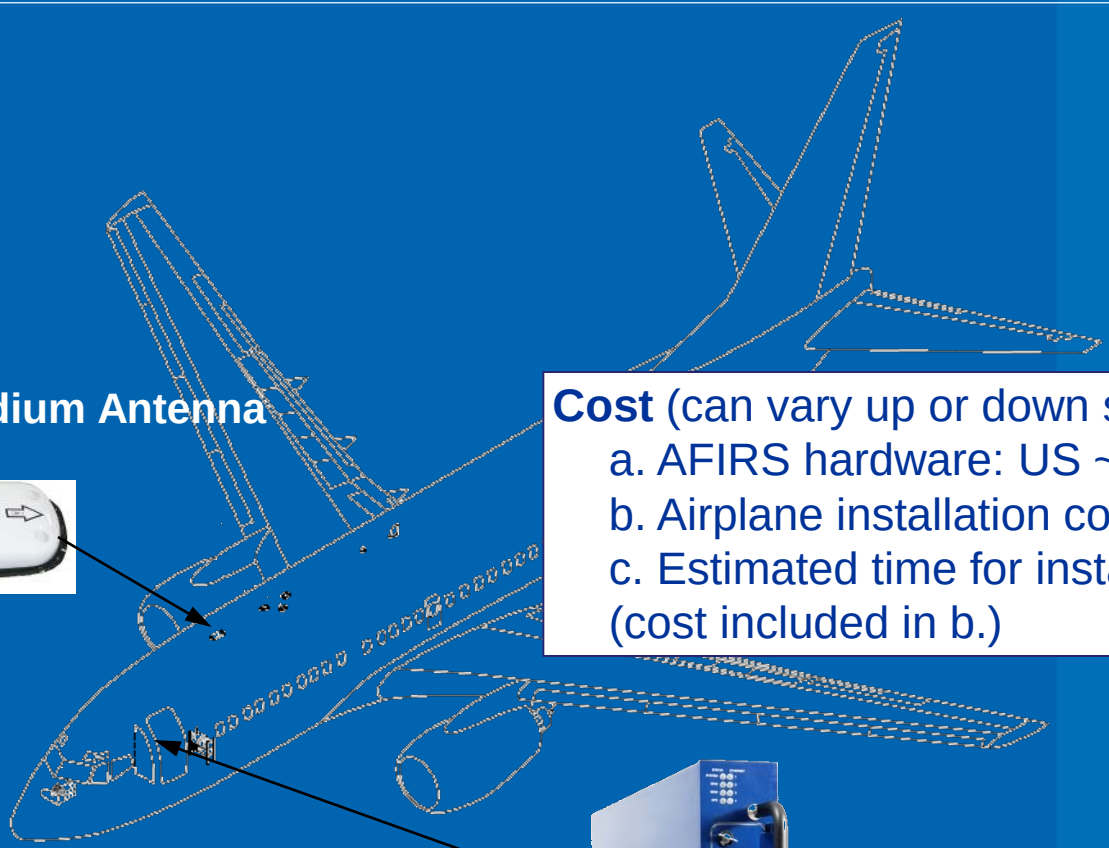
# Typical AFIRS 228 Installation



**GPS/ Dual Iridium Antenna**

**Cost** (can vary up or down somewhat):

a. AFIRS hardware: US ~$50k

b. Airplane installation costs: US ~ $20k

c. Estimated time for installation:~200 hrs. (cost included in b.)

**AFIRS 228 Unit**

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# Triggers

- **Aircraft-related**
  - "Routine" maintenance alerts
    - (AFM limit exceedances; system discrepancies)-short duration message with data
  - Emergency situations
    - Major airworthiness issues (depressurization, loss of engine(s), low fuel, fire, etc.) would trigger a higher rate of position reports and FDR data dump
- **Irregular operation-related**
  - Extreme attitude changes
  - Significant unauthorized deviation from flight path
  - Crew request

# AFIRS Airworthiness Approvals

| FLYHT Airworthiness Approvals | | | | | |
|---|---|---|---|---|---|
| Aircraft Type/Series | TCCA (Canada) | FAA | EASA | CAAC (China) | ECAA (Egypt) |
| Airbus A319-A320-A321 [ACJ319- ACJ320-ACJ321] | 220(A), 228(A) | 220(A) | 220(A) | 220(A), 228(IP) | 220(A) |
| Airbus A330-200/300 | 220(P) | | | | |
| ATR 42 / 72 | 228(A) | | 228(A) | | |
| Bombardier CRJ-100/200/440 [CRJ-100SE] | 220(A) | 220(A) | 220(A) | | |
| Bombardier CRJ-700/900 [Challenger 870/890] | 228(A) | | | 228(A) | |
| Boeing 737-200/300/400/500 | 220(A), 228(IP) | 220(A) | 220(A) | 220(A) | |
| Boeing 737-700/800 [BBJ1/BBJ2] | 220(A), 228(A) | 220(A), 228(IP) | 220(A) | 220(A), 228(IP) | |
| Boeing 747-200 | 228(A) | | | | |
| Boeing 757-200 | 220(A) | 220(A) | 220(A) | 220(A) | |
| Boeing 767-200/300 | 220(A), 228(A) | 220(A), 228(IP) | 220(A) | 220(A) | |
| Boeing 777-200/300 | 228(A) | 228(A) | | | |
| DeHavilland DHC-7 | 220(A) | | | | |
| DeHavilland DHC-8-100/200/300 | 220(A) | 220(A) | 220(A) | | |
| DeHavilland DHC-8-400 | 220(A) | | | | |
| Embraer EMB 135/145 [Legacy 600] | | 220(A) | | | |
| Fokker F.28 Mk0100 | 220(A) | | | | |
| Hawker 750/800XP/850XP/900XP | 220(A), 228(A) | 220(A), 228(IA) | 220(A), 228(A) | | |
| McDonnell Douglas DC-10-10/30/30F | 220(A) | 220(A) | | | |
| McDonnell Douglas MD-83 | 228(P) | | | | |

220(A) = Active AFIRS 220  220(P) = Provisioned AFIRS 220 with Activation Approval Pending

228(A) = Active AFIRS 228  228(P) = Provisioned AFIRS 228 with Activation Approval Pending

IP = In Progress – Design 80% (min.) Complete or Submitted to Foreign Authority for Validation

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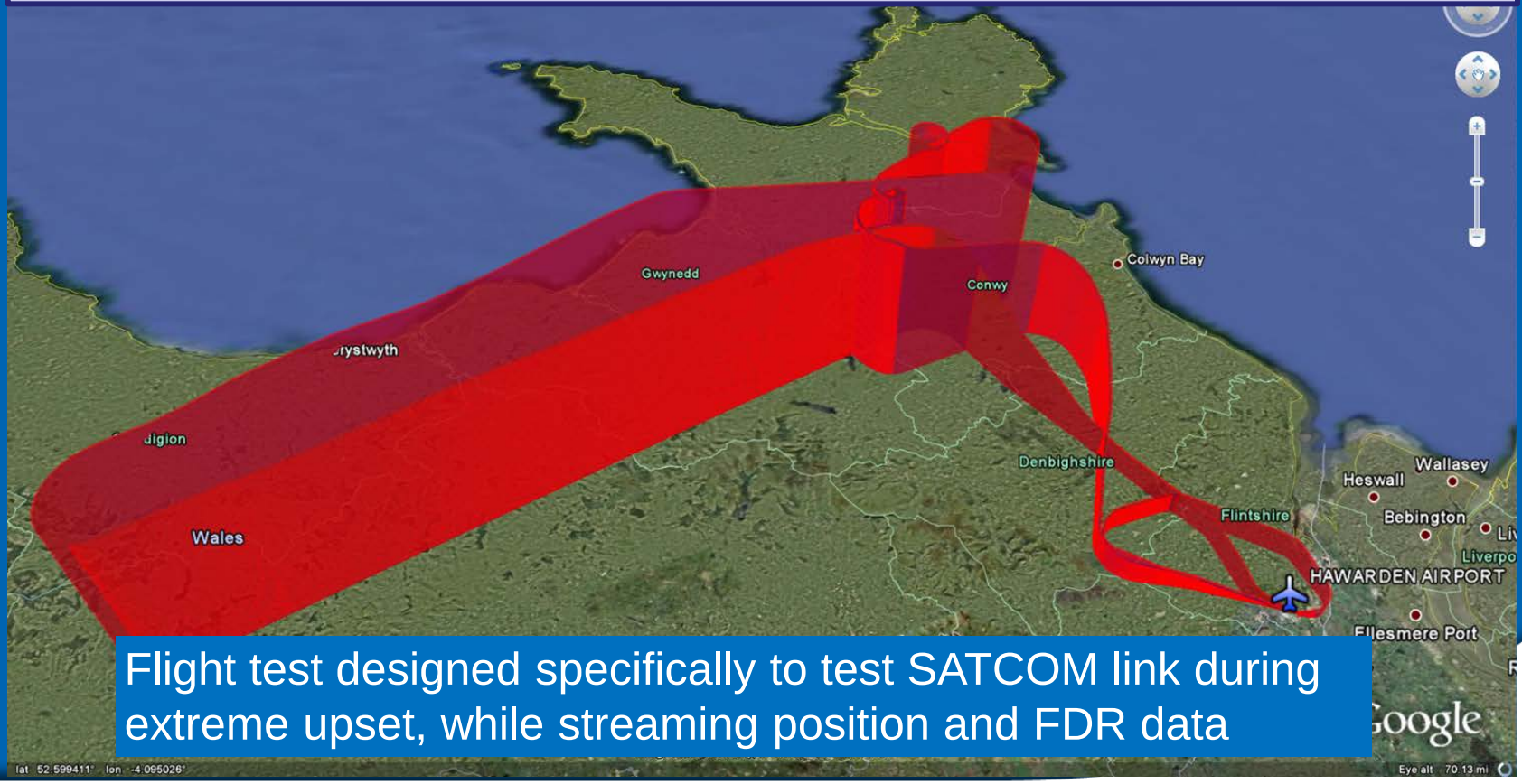
# Maintaining connectivity in extreme attitudes

**Issue**: If aircraft experiences extreme attitude changes, can a SATCOM-based (Iridium) triggered position and data transmission system maintain its link?




Flight test designed specifically to test SATCOM link during extreme upset, while streaming position and FDR data

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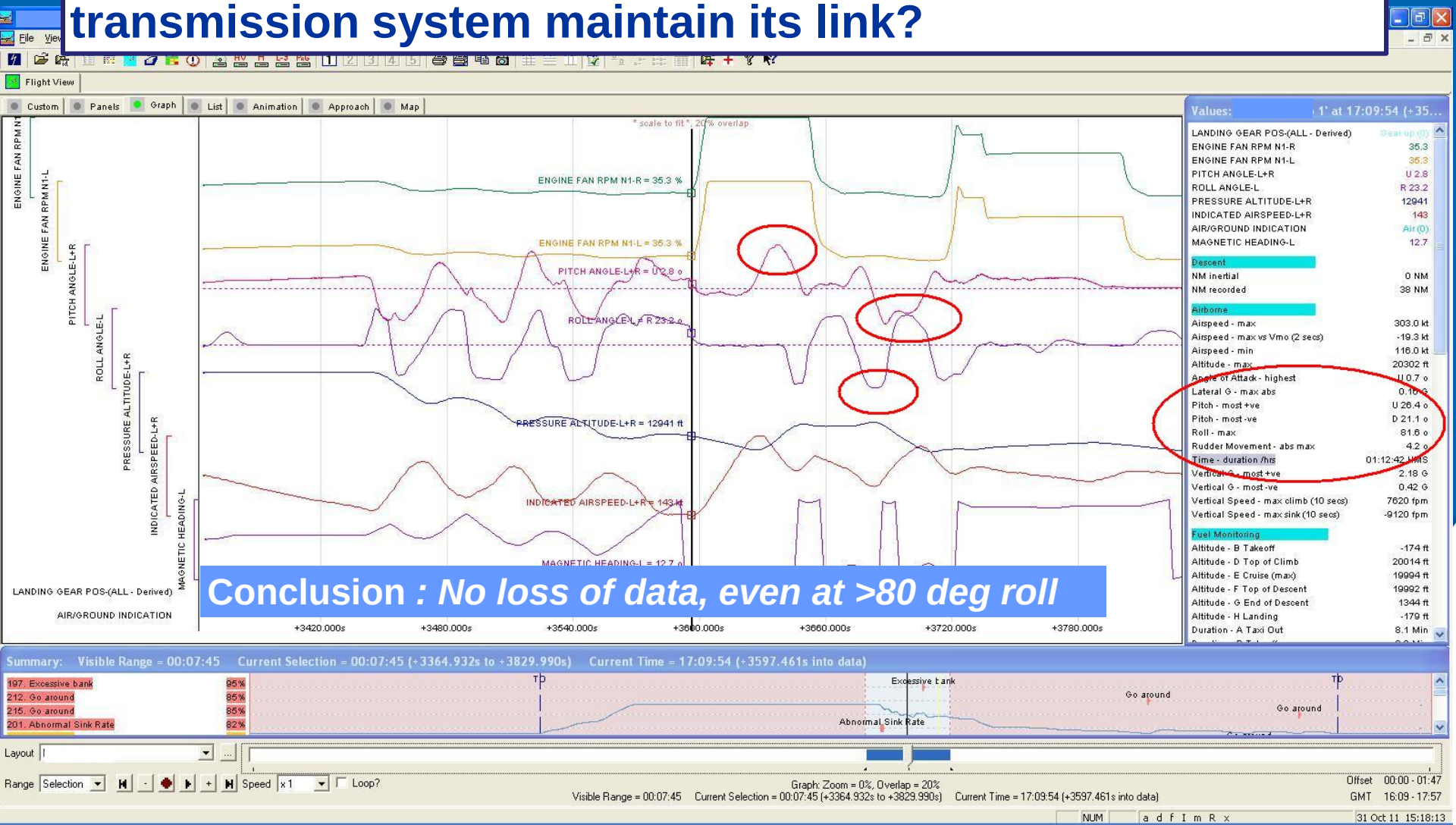


**Conclusion *: No loss of data, even at >80 deg roll***

# Data Transmission & Costs

Path: Iridium ⇨ UpTime web server ⇨ user(s)

- Flight following at intervals as short as 5 seconds (real-time); normal 5-15 minutes at operator discretion
- Monitored on the airline's ASD at the AOC/OCC; position report usually contains other info about aircraft status

Cost:

- <$0.05 per position report (typical user requests 4-12 per hr.)
- Other services are menu priced
- Triggered streaming event would cost ~$5-10/minute (max)

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