Opportunities and Challenges to IoT Expansion on Aircraft

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Rockwell Collins: The Most Trusted Source of High Integrity Solutions
IoT Successes in Aviation

- Engine predictive maintenance
- Engine efficiency
- System malfunctions relayed to the ground
- ...

But: Is this Really “Internet of Things???”.
Challenges to IoT Expansion in Aviation

- Safety
- Security
- Value
- .....And Culture!

Tech Community

- Innovate fast
- Value will come out of innovation
- Apply IoT solutions to many applications

Aviation Community

- Safety above all
- Incremental Change
- IoT needs to “buy its way on the aircraft
- Highly Regulated
Continuous Improvement and Rigorous Processes Result in One Mishap per 10,000,000 Flights

Systems need proof to $10^{-9}$ failures

ARP 4754A
Aviation Security

Convergence of communications and network-centric information processing
- Passenger Networks
- Maintenance Data Collection
- Wireless Sensors
- Electronic Software Distribution
- Navigation Data Processing
- Air Traffic Control Decentralization

**GAO**: Expanding connectivity and converging data networks across avionics is a growing risk

**GAO Report** → **ARINC 811**

Security Vulnerabilities Lead to Safety Hazards

Image Source: Volpe Research Center, DOT
IoT Connectivity is a challenge!

• **Wiring in modern aircraft is a highly complex, critical system**
  – Total wire count: ~100,000
  – Total wire length: 470 km
  – Weight of wires: 5,700 kg
  – (plus 30% for support)

• **Wireless is only used for Level E functions!**
  – WiFi to passengers and crew

• Initiative underway for 4.0 GHz wireless for certain safety functions
  – Standards being developed
  – Focus is to reduce current wire weight
External Aircraft Connectivity: Limited but Growing

Aircraft Comm & Nav Spectrum
Not Growing

Aircraft Satcom Spectrum
Growing

![Diagram showing spectrum bands and connectivity options for aircraft communications and navigation.](chart.png)
Value to the Stakeholders

- Airline ROI on new investments is ~ 18 months
- New Systems/Products and Services need to “buy their way” on an aircraft

Opportunities
- Improved Weather status and prediction/Advisories
- Autonomous Flight Rules (UTM/ATM)
UTM/Autonomous Flight Regulations

**UTM:** Automated Traffic Management for UAVs under 400 feet

**ATR:** Autonomous Flight Rules for self separation and efficient routes without FAA intervention
Conclusion

- IoT could provide significant benefits to Aviation
- Until now, IoT use is limited mostly to electromechanical systems’ maintenance functions
- Limitation is due to concerns over aviation safety, security and value
- Improved connectivity and high integrity IoT will provide significant benefits to aviation and the national aerospace system