



Engineering, Test & Technology
Boeing Research & Technology

A Vision for Flexible Hybrid Electronics (FHE)

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What is Boeing?



1925: Boeing Air Transport enables cargo transport in the emerging Air industry

2017: Boeing is World's Largest Aerospace Company



Boeing's Interest in FHE

Lighter Weight

- 1% weight reductions can equate to *billions* in operating cost savings to carriers.

Less Complexity, Improved Maintenance, Higher Reliability

Added Capability



Printed electronics is an enabler

OEM Timeline for Implementation of SHM



Near Term

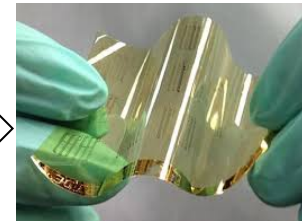
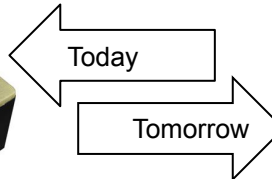
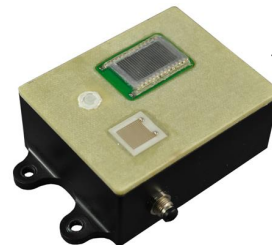
- Replace inspection tasks with SHM to reduce maintenance burden
- Enable flexible maintenance intervals via operational monitoring using existing aircraft & ground capabilities
- Assess conditional events

Mid Term

- Integrated airplane-level solutions and conditional maintenance based on SHM information
- Enable SHM based optimized design and weight savings
- Certification of maintenance credit

Long Term

- Optimize design rules for integrated F&DT and maintenance philosophy based on SHM monitored structures
- Longer economical airframe utilization



Reduced Life Cycle Cost

Improved Mission Reliability

Improved Availability

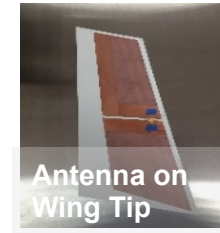
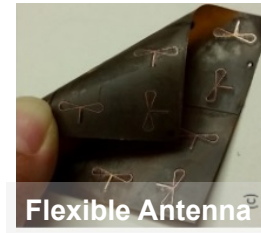
Improved Operational Plans

Efficient Supply Chain

Enhanced Design

Build Something Better

Antenna Technologies



Simpler to Make, Install Anywhere, Flexible and Conformal, Improve Performance

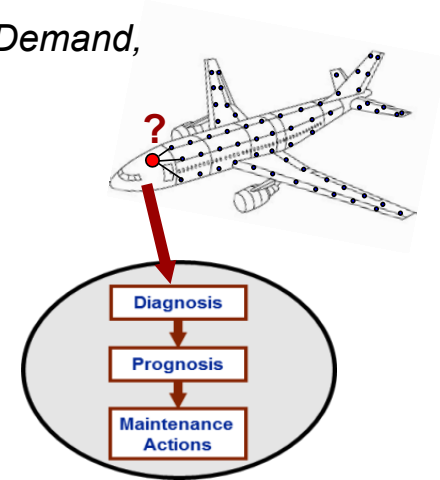
Asset Monitoring



Multiple Operations, Lots of Infrastructure



More data on Demand, IoT through Life Cycle



Boeing Technology/Material Needs

Some of the Things Boeing is Seeking to Enhance with FHE:

- Knowledge of Corrosion Status in Materials
- High Conductivity Materials
- Fabrication of Large FHE Arrays/Systems
- Robust Interconnects
- Substrate Materials
- Component Integration



Boeing FHE Example

747-8 Damage Detection Sensor
Uses a form of FHE



FAA Certified; Currently flying on all 747-8's