



# **VERTICAL LIFT IN 2038**

Byron Ward  
VP 525 Program



**EVOLUTIONARY!**





REVOLUTIONARY!



10 years from now **in 2028**



## Fly by Wire will be more commonplace

- **Safety benefits well established**
  - Triple/Quad Redundancy vs Dual for Critical Systems
  - Reduced pilot workload
  - Enhanced Situational Awareness
  - Enhanced Built in Test & Diagnostics
- **Part 29 regulations updated to reflect FBW usage**



**Safety benefits already recognized and adopted in the fixed wing community**

## IVHM / HUMS / BIG DATA

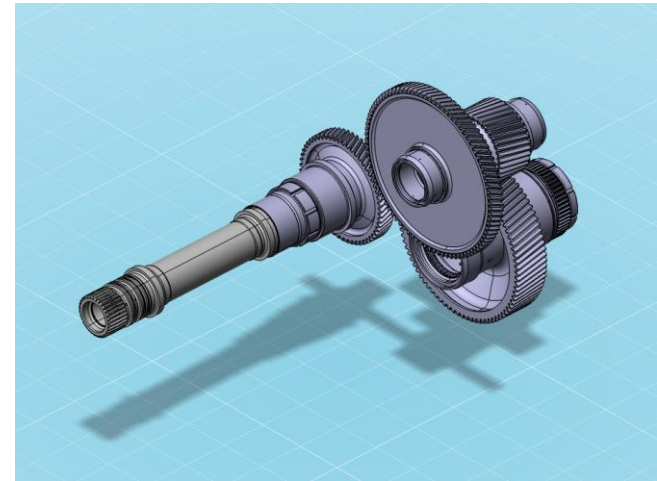
- **Usage of IVHM / HUMS maturing**
- **Memory and Bandwidth much cheaper**
- **Prognostic data more available and shared**
- **Regulatory adoption for usage credit**

**Address the problems before they happen!**  
**Get credit for aircraft flown in more benign environments**

## Increased Drive System Safety

- **Gearbox designs tailored to minimize critical loading and associated heating**
- **Return to simpler is better**
- **Maximize system separation and redundancy**
- **Minimize the potential for loss of lube events**

Simple is Good!



**Drive System Design and Metallurgy Continue to Improve!**

# Crew Error Management

- **Adoption of 25.1302 to Part 29 Rotorcraft**
  - Anticipate errors and enhance design before errors can occur on the aircraft
- **The Manufacturer Must:**
  - Document all cockpit tasks and equipment
  - Show that the cockpit equipment is accessible, intuitive, and provides feedback of pilot action
  - Show that the design allows flight crew to detect and recover from error

**Proactive safety enhancement will be adopted by Part 29**





10 years from now...



Looks like a 525 today!

20 years from now **in 2038**

**Evolutionary**

**REVOLUTIONARY!**

NOW



2028



2038

# Aviators of the Future

## Who are the future aviators?

### Aircraft Avionics



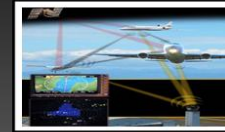
Advanced HUD Imagery



Portable Tech w/flight instrumentation



Touch Screen Avionics Interface



Inflight Data Link (ADS-B)



Advanced Synthetic Vision & Autonomy

### Cultural Technology



Smart Phones



Computers / Laptops



Augmented Reality / VR



Wearable Technology



Computer Interface



Voice Command

### Social Media

- Facebook™
- Instagram™
- Snapchat™

### Technology Consumption

#### Streaming Services

- Netflix™
- Amazon Prime™
- iTunes™

### User Populated Data

- Wikipedia™
- Yelp™
- Waze™

### Sunrise Tech (Observations)

- Autonomy / A.I.
- Intuitive & Minimalistic Design
- Voice Commands
- Hieroglyphical Communication



Future Aviators

### Items Approaching Sunset (Observations)

- Mouse
- Conventional Keypad
- Traditional Telephone Communication
- Handwriting

# Cockpit of the Future – Very Large Display Format

- **Adaptability**

- Screen can adapt to fit the evolving requirements of the crew

- **Survivable**

- Mosaic display stitches together the imagery from multiple screens

- **Intuitive Interface**

- Use of touch gestures in addition to voice commands, iconology and predictive A.I.

- **Enhanced Visual Acuity**

- Ultra-wide aspect ratio screen with synthetic vision or enhanced imagery serves as a large artificial horizon in DVE situations



20 years from now in 2038

## Cockpit of the Future – Heads Out Technology



## Future Flight Controls

- **Fly by wire and advanced control laws are enablers for future aircraft control**
- **Regulatory acceptance for higher levels of automation will be tested first in Part 23/27 airspace**

Bell FCX-001



# Hybrid Propulsion

- **Propulsion System Flexibility**
  - Turbine
  - Fuel Cell
  - Battery
- **Distributed Propulsion**
  - Adds needed P29 redundancy
  - Advent of 1MW/1340hp+ Level A motor
  - Large heavy critical transmissions go away

Courtesy of Uber



**Propulsion Systems could change radically in 20 years  
The necessary investment is happening now!**

## On Demand Mobility Benefits

- **ODM will drive following improvements into Part 29 Class aircraft**
  - **Obstacle avoidance**
  - **Synthesized vision**
  - **Ultra high levels of automation and redundancy**
  - **Propulsion Alternatives**
  - **Coordination of manned / unmanned airspace**

Courtesy of Uber



**Part 27 ODM will drive confidence in automation**

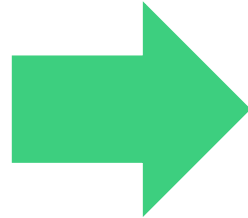


# On Demand Logistics



Commercial  
Freight

Commercial  
Logistics



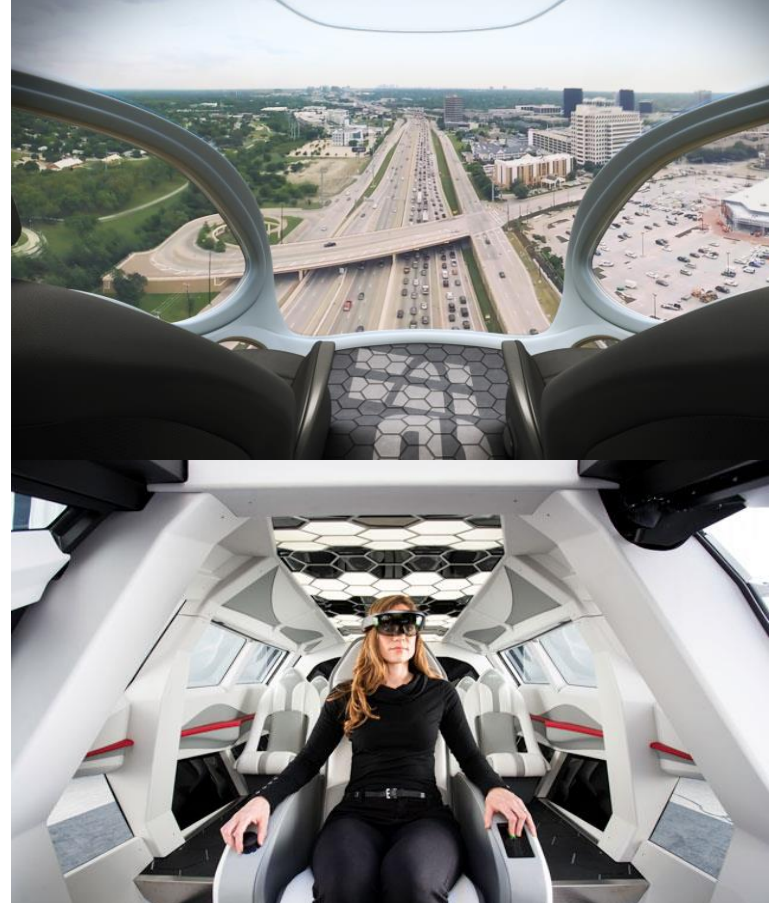
# Conclusions for 2038

**The Technology Genie is Out of the Bottle**

**Autonomy and A.I. will Take Over Mundane Tasks**

**Situational Awareness Increases Dramatically**

**Future Aviator Task is Cognitive Thinking**





**QUESTIONS?**