



# The Future of Commercial Aviation and Its Spectrum Requirements

A look into the Future  
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# The Future of Aviation

- **The future of aviation is being developed today – for automobiles.**
  - **Concept of not driving yourself will gain acceptance.**
    - Your children/grandchildren already accept this.
    - As people age and cannot drive, a driverless car provides freedom.
  - **As people release “control” to a car, they will also be comfortable with not having a pilot in the aircraft.**
- **No Pilot on or in the aircraft.**
  - **How much does this actually change the way people fly and how the air transportation system is managed?**

# The Future of Aviation – Spectrum Requirements

- **What will be the Requirements for an Air Transportation System dominated by unmanned aircraft?**
  - **But first, what do we need to do?**
    - **Keep aircraft and passengers safe – These are the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> ... Priorities!**
    - **Keep traffic moving (safely and efficiently)**
  - **How do we accomplish this?**
    - **Aircraft must be able to continue to perform these essential functions:**
      - **Know and provide its location, direction and speed to others (3 dimensions – Latitude/Longitude/Altitude)**
      - **Sense and Avoid other aircraft (respond safely and effectively) – quickly.**
      - **Receive commands/instructions from “pilot”/air traffic control in case of unexpected issues**
      - **Operate in high density traffic environments both on the ground and in the air**
      - **Operate safely when the “unexpected” occurs**

# The Future of Aviation – Spectrum Requirements

- **What will be the Radio Frequency Spectrum Requirements?**
  - **Spectrum is critical:**
    - **Aircraft must be able to continue to perform their essential functions:**
      - **Know its location: Currently exists. Use same systems/spectrum (GLONASS/GPS, etc.)**
      - **Altitude: Radio Altimeter (4200-4400 MHz)**
      - **Direction/speed: calculated and from measurements**
      - **Sense and Avoid other aircraft – quickly: (960-1164 MHz for ADS-B, TCAS, DME, ACAS; 1250-1390 MHz for ARSR; 8750-8850 Doppler radar, etc.)**
      - **Provide to others location/direction/speed: (1030/1090 MHz for ADS-B)**
      - **Receive commands/instructions from “pilot”/air traffic control: (5030-5091 MHz; FSS)**
      - **Operate in high density traffic environments both on the ground and in the air (autonomy?)**
      - **Operate safely when the “unexpected” occurs (autonomy?)**

# How Do We Get to this Future State?

- **It will not be easy!**
  - It is easier to build a new house, than renovate an old house.
- **What might need to change from the radio frequency spectrum standpoint:**
  - **Systems designed 30+ years ago could be more efficient and more resistant to harmful interference. Do we need all of them?**
- **What additional Communication (Command/Control), Navigation, Surveillance Systems are needed?**
  - **Many interests in the “old” house!**
  - **The landscape is changing around us, we must move faster.**
  - **Remember! -- Safety must still be the #1 priority.**

# Thank You