



FASTER FLIGHT FOR EVERYONE

Strong EE-Aero team developing electric air technologies

Electric



Boeing makes history with flights of Fuel Cell Demonstrator Airplane

In the News

A transportation team at Boeing Research & Technology Europe in Manly, Spain, has demonstrated the first time the team can fly the airplane powered by fuel cells. The flight was a key milestone in the development of a new generation of aircraft.

During these flights in February and March, it allowed more global customer to Boeing, and showcased the capabilities of the aircraft. The flight was a key milestone in the development of a new generation of aircraft.

Boeing's first fuel cell-powered aircraft, the Fuel Cell Demonstrator Airplane (FCDA), is a small-scale prototype for a future fuel cell-powered aircraft. The flight was a key milestone in the development of a new generation of aircraft.

Company leaders and the history-making team in Manly, Spain, are proud to have taken this step in the development of a new generation of aircraft.

"This is a great step in the development of a new generation of aircraft," said Alan Day, Boeing senior vice president of Engineering, Research & Technology and chief technology officer for the Fuel Cell Demonstrator Airplane program. "The flight was a key milestone in the development of a new generation of aircraft."

The Fuel Cell Demonstrator Airplane program has been a key milestone in the development of a new generation of aircraft.

A team of Boeing engineers, led by Thomas August, led the development of the aircraft. The flight was a key milestone in the development of a new generation of aircraft.

The flight was a key milestone in the development of a new generation of aircraft.

Boeing's first fuel cell-powered aircraft, the Fuel Cell Demonstrator Airplane (FCDA), is a small-scale prototype for a future fuel cell-powered aircraft. The flight was a key milestone in the development of a new generation of aircraft.

Company leaders and the history-making team in Manly, Spain, are proud to have taken this step in the development of a new generation of aircraft.

"This is a great step in the development of a new generation of aircraft," said Alan Day, Boeing senior vice president of Engineering, Research & Technology and chief technology officer for the Fuel Cell Demonstrator Airplane program. "The flight was a key milestone in the development of a new generation of aircraft."

The Fuel Cell Demonstrator Airplane program has been a key milestone in the development of a new generation of aircraft.

A team of Boeing engineers, led by Thomas August, led the development of the aircraft. The flight was a key milestone in the development of a new generation of aircraft.

The flight was a key milestone in the development of a new generation of aircraft.



Once-in-a-generation upgrade of aircraft propulsion

Where old rules will no longer apply

Third great age of aviation

- Vast impact, as significant as the jet age
- 15-20 year transformation of aviation

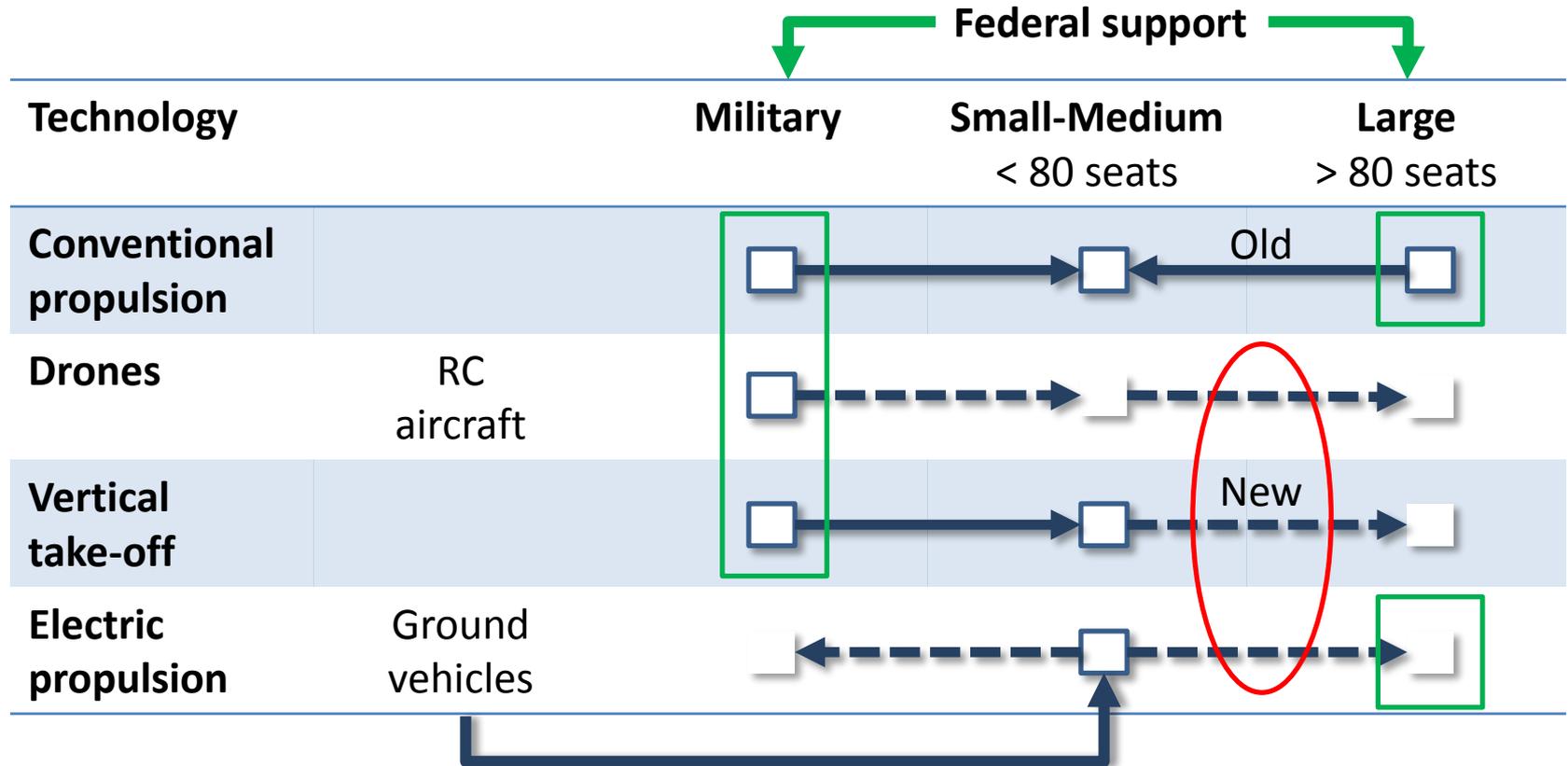
Led by smaller manufacturers
“staircase” to airliners

- Staged scale-up to long-haul airliners
 - Recreational and trainers
 - VTOL and ODM
 - Rotorcraft and Commuters

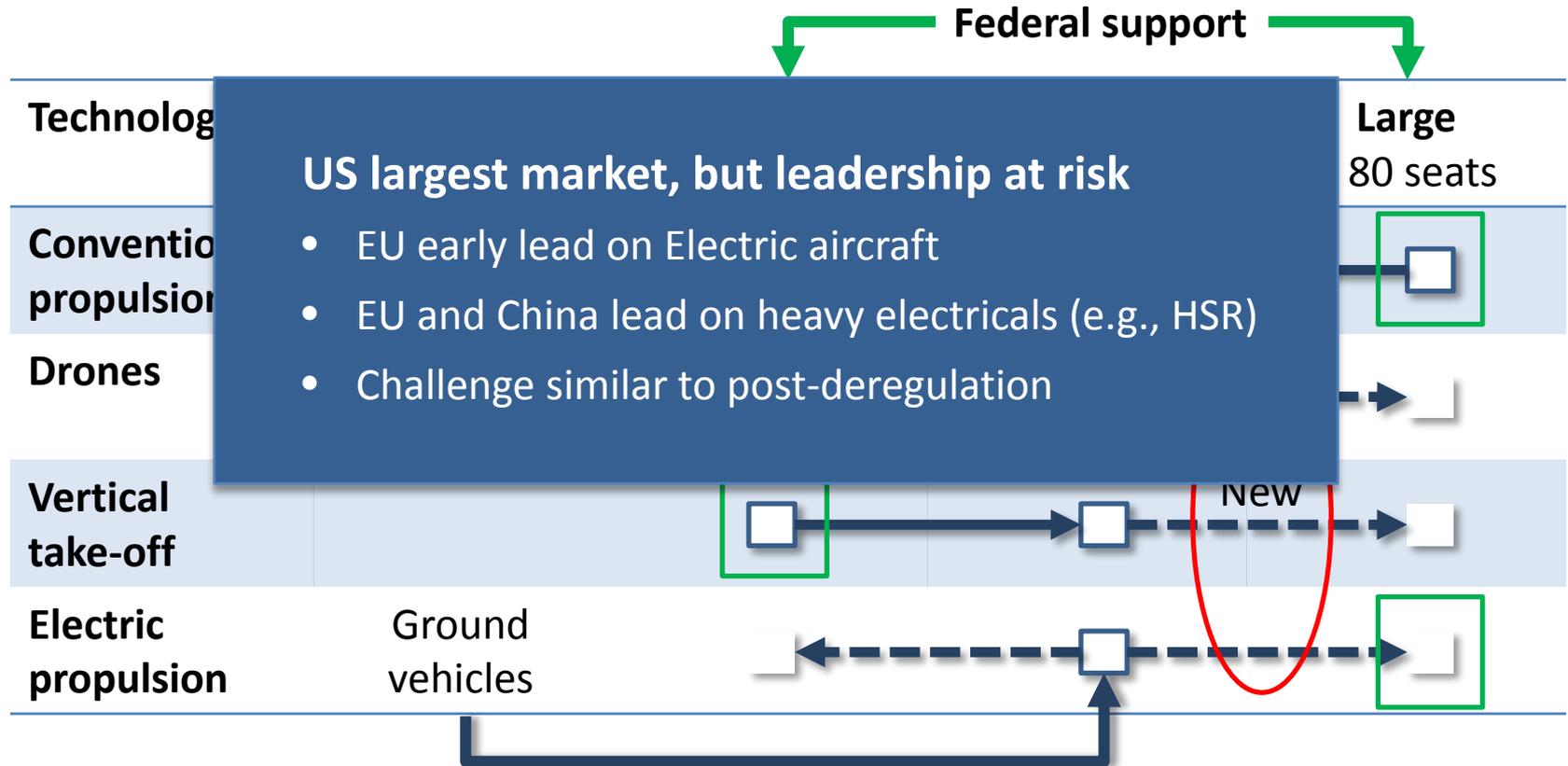
Transformation starts now
scale-out in 2020s

- Key technologies largely in place
- 15-20 years ahead of airliners

Reversed flow of technology leaves US vulnerable



Reversed flow of technology leaves US vulnerable



Action needed in four areas to accelerate US progress

Focus on innovation staircase

- Over emphasis on majors and N+3 needs
- Shift roadmap to focus on progressive flight platforms 2020-2040 leading to airliners

Balance government support

- \$B in Federal and State support to EV closed to aviation
- Extend support from ground to all vehicles (DOE, DOT)
- Balance innovative platforms vs airliners (e.g., CLEEN)

Clear certification pathways

- Conclude Part 23 re-write; develop EV standards
- Fund research e.g. aviation battery safety, paschen limits

Establish infrastructure roadmap

- No clear path to define and develop airport infrastructure for electric aircraft, e.g., swap, recharge
- Define process and accountabilities for infrastructure

Path to Certification: ASTM working groups



- FAA regulations to industry consensus standard basis per Congressional mandate
- Standards developed by working groups of industry, FAA, and EASA
- Final standards become regulations when “accepted” by FAA and EASA

Part 23 re-write nearly complete

- ASTM F44 Working group
- Unifies FAA part 23, and EASA CS-23
- First release of “new part 23” in 2016
- Part 23 covers installation
- Very little new content for electric
- Once accepted, adding electric propulsion content much easier

EV standards in progress

- ASTM F39.05 launch September 2014
- Responsible for all electric propulsion* and related systems, incl. hybrid
- Global: Good FAA support, limited EASA
- Progress determined by participation
- Tzunum coordinating work to establish a battery safety standard

Developing standards for aviation battery packs

Requirements

- Covers all aspects of battery installation, operation, recharge, swap
- Provide level of safety to equivalent to current systems
- Accommodate aircraft 1 to 19 passengers
- Be “technology agnostic”
- Minimize specific guidance

Approach

- Build on existing standards
 - SAE and ISO ground EV
 - DO-311a from RTCA
 - LSA and EASA CS-22 special conditions
- Engage SMEs on BMS, battery testing
- Define tests and metrics which reward safer technologies
- Complete draft for Spring working session; finalize in 2017

Leadership of the age of electric aviation at play



Oops, believe that's my flight ... time to close the deal !!

