



13 NOV 19

For Public Release

AQUIFER

Aqueous, Quick-charging battery integration for electric flight research

Overcoming Barriers to Electric Aircraft Propulsion

Nov. 13th, 2019

Kurt Papathakis – Principal Investigator (AFRC)
Pat Loyselle – Co-principal Investigator (GRC)
Robert McSwain – Co-principal Investigator (LaRC)



Envisioned Electric Propulsion Future

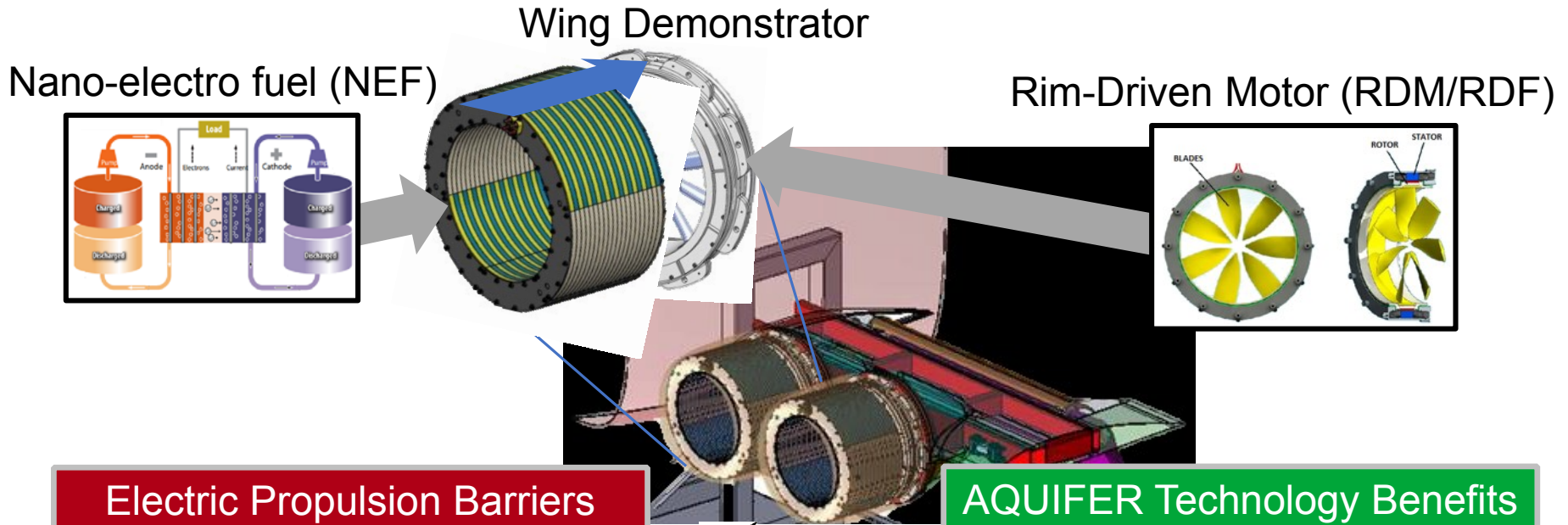


Electric Propulsion Barriers

- ✘ Fire / Explosion Hazards
- ✘ Recharging Time
- ✘ Radiated EMI
- ✘ Coupled Power & Energy
- ✘ Range Limitations
- ✘ Noise Concerns



AQUIFER Concept



Electric Propulsion Barriers

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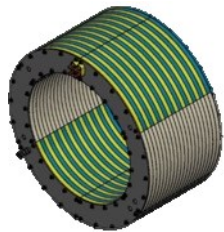
AQUIFER Technology Benefits

- ✓ Aqueous fuel
- ✓ Charging time equal to fuel pumping
- ✓ Co-locating power & energy, no long cables
- ✓ Need more power – more stack area
- ✓ Need more range – more fuel
- ✓ No hub or blade-tip interference noise

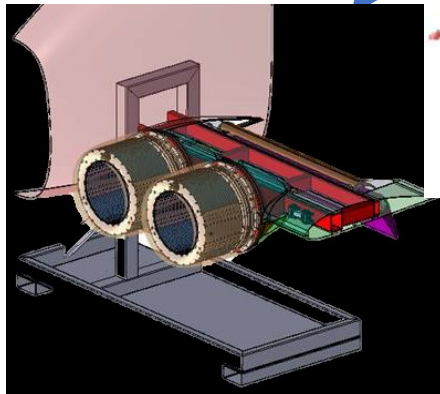
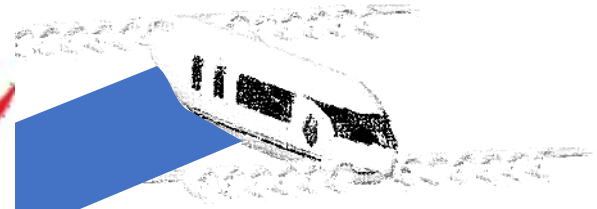


The AQUIFER Team

Influit Energy, Chicago, IL



Boeing BR&T and BCA

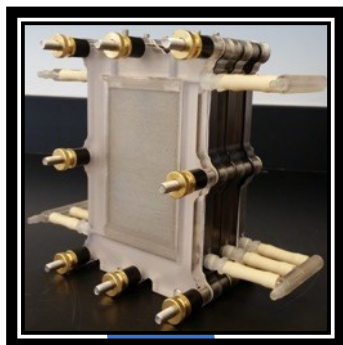


ESAero, San Luis Obispo, CA

Engineering Precision,
Costa Mesa, CA



The AQUIFER Team

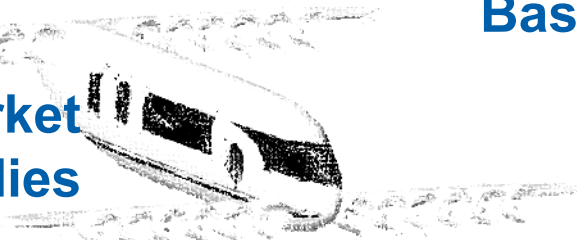


**NEF
Baseline**



**RDM
Baseline**

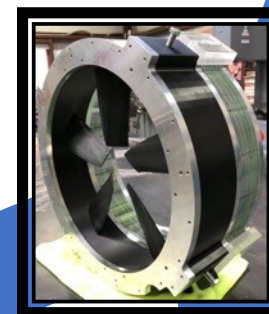
**Aircraft Market
Studies**



**NEF
Annular
Design**

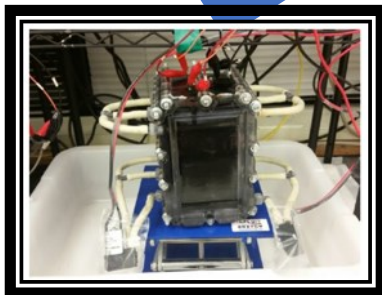


**RDM
Design**

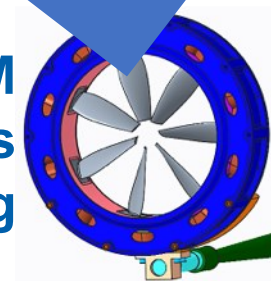


**NEF + RDM
Integrated Wing Demo**

**NEF
Bench
Testing**



**RDM
Acoustics
Testing**



Year One Recap

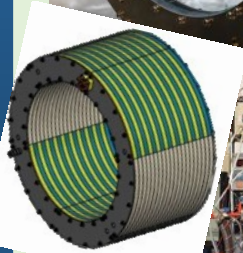
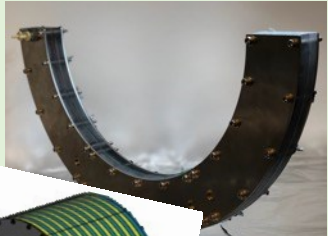
Successes

RDM Development



Wing Demo
with AQUIFER "GEN 1"

with AQUIFER LN vision system



NEF Development

Diverse & Agile Team

Challenges

Wing Demo Development

NEF Development

RDM Development

Now Decision Point



Future Considerations

- **NEF Generation 2 (GEN 2) Development**
 - Maintain non-explosivity / non-flammability of GEN 1
 - 1-year Target: 75 Wh/kg
 - 3-year Target: 500+ Wh/kg
- **Air-bearing development**
 - Improved motor acoustics
 - Improved motor thrust
 - Minimal complexity increase

