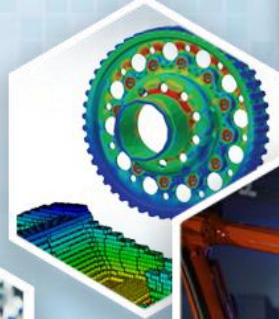


High Rate Aerostructures Fabrication

IACMI Working Group Review

[Brian Rice, UDRI]
June 29, 2022



High Rate Aerostructures Fabrication Working Group Objectives



- Facilitate communications regarding issues and opportunities
- Maintain a technology development roadmap, links to DoD and DoE
- Communicate manufacturing R&D projects for funding opportunities
- Formulate and conduct directed manufacturing R&D
- Support technology transition through conferences and workshops

Meeting Agenda

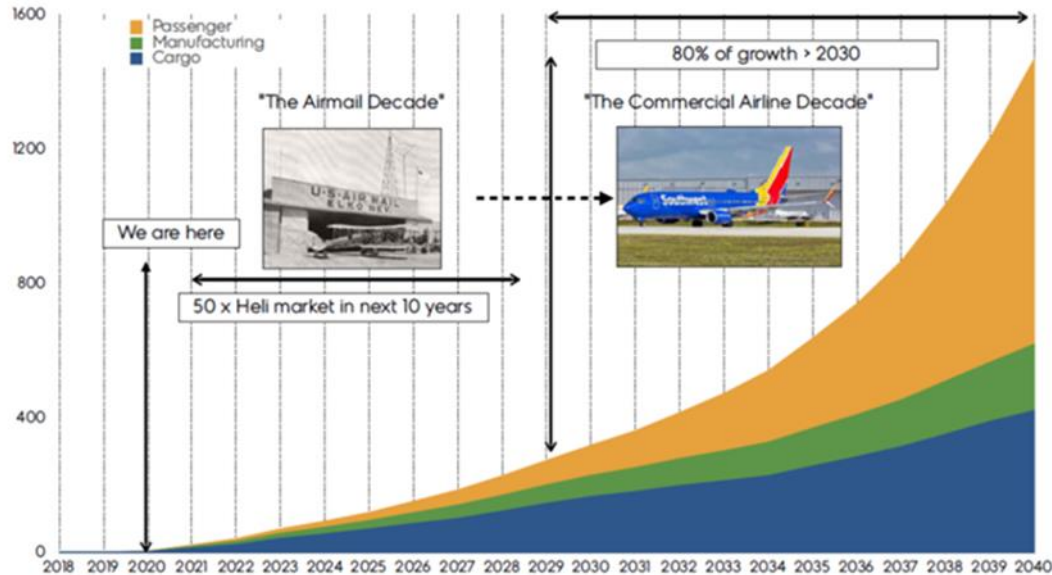


- Aerostructures emerging opportunities overview
- Previous Member's Meeting review
- Technology review
 - Design and Analysis
 - Preforming
 - Tooling
 - Emergent Materials
 - Consolidation and cure
- Opportunities and Challenges – previous poll response
- John Geriguis – Joby “Air Mobility and Economy of Scale”
- **Open the floor to discussion – priorities for IACMI 2.0**

Aerostructures Emerging Opportunities

Advanced Aerial Mobility Market Size by 2040 (\$bn)

Morgan Stanley

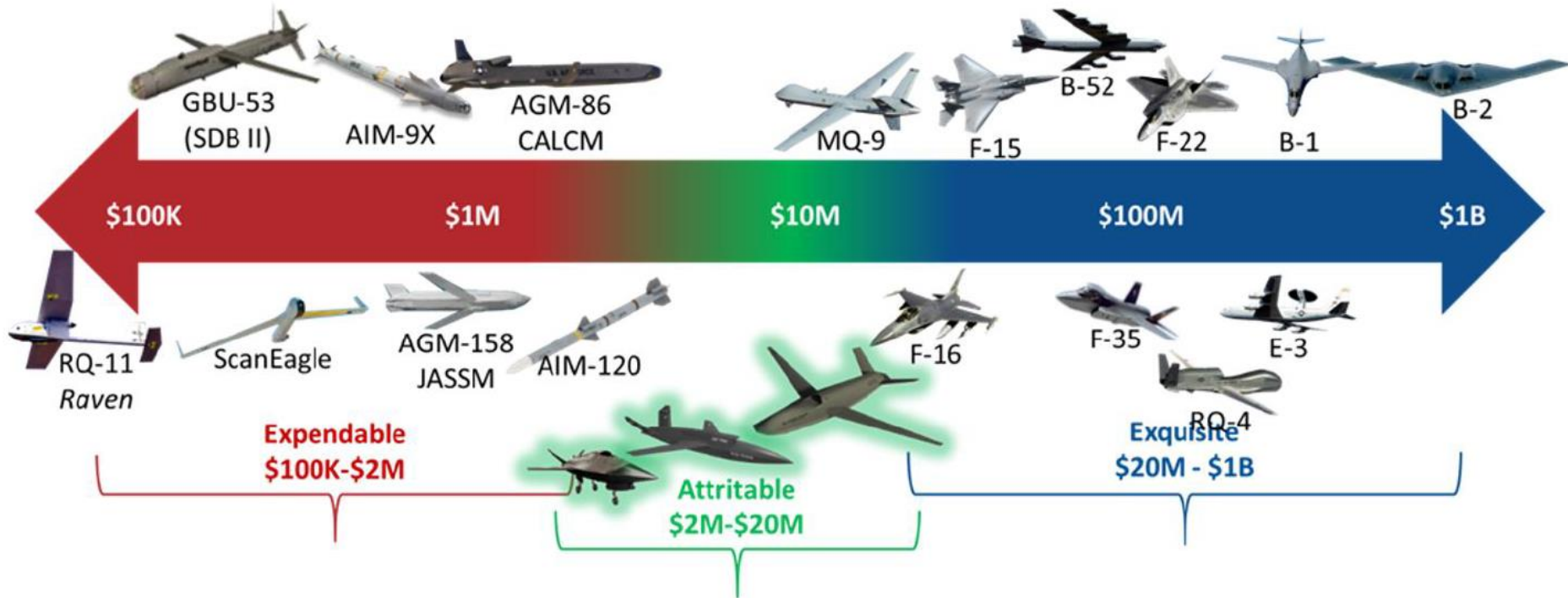


TAM - \$1.5T in 2040



Growing Military Applications

The Attritable Spectrum

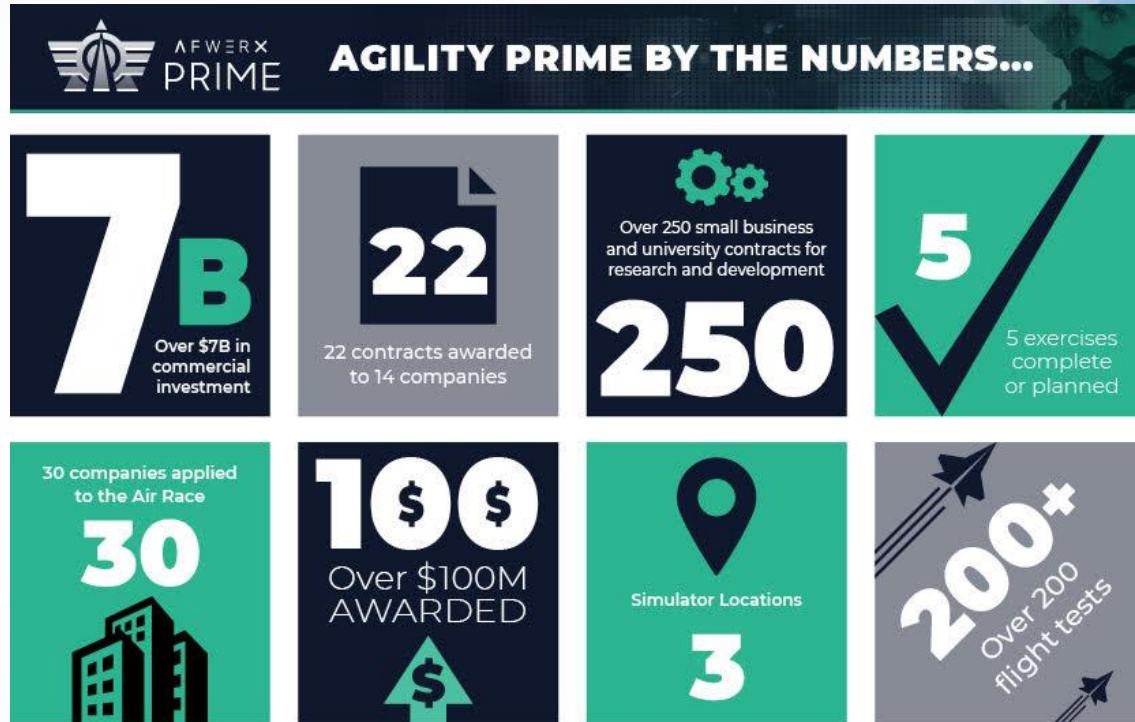


Air Force Agility Prime Program – eVTOL



Operating under the Air Force's AFWERX innovation arm, Agility Prime was launched in 2020 and has awarded 22 contracts to 14 eVTOL aircraft developers

It has awarded more than \$100 million in contracts and a handful of companies have earned military worthiness, including Joby, BETA Technologies and Kittyhawk.



Air Force Agility Prime



“The challenge for the advanced air mobility market is that we’re aiming to eventually **reach volumes more familiar to the automotive industry** while retaining the extremely **high standards required by aerospace regulations**,” says Oliver Walker-Jones, head of marketing and communications at **Joby Aviation Inc.**, a developer of eVTOL aircraft.

“You need an automated tooling and material system, which is not in place right now,” says Bihlman. **“Instead of taking six to eight hours for autoclave curing we need to cure parts in minutes.”**

“Thermosets are not going to go away. It’s not a question of moving from one to the other. It’s about incorporating thermoplastics on a bigger scale,” says Jensen. **“If you want to achieve high rates, then you need to move to thermoplastics. And there aren’t many qualified thermoplastic materials out there.”**

Air Force Agility Prime



One company striving to find that right combination is Joby Aviation, which has set an ambitious goal of launching an air taxi service in 2024. Its pre-production prototype began flight testing in 2019 and logged more than 5,300 miles last year. A second prototype received FAA Special Airworthiness Certification for experimental research and development in late 2021. It also earned U.S. Air Force airworthiness approval, allowing the company to fly its aircraft as an Agility Prime contractor.

In 2019, **Toyota** invested \$394 million in Joby Aviation and began sharing **expertise on high-volume production**



Opportunities and Challenges – Poll Response



Poll Topic: Opportunities and Challenges (Select top 3) (Oct2021)

Structure and process certification and material qualification

Developing the value chain

Meeting growth projections

Develop agile, low cost, manufacturing methods

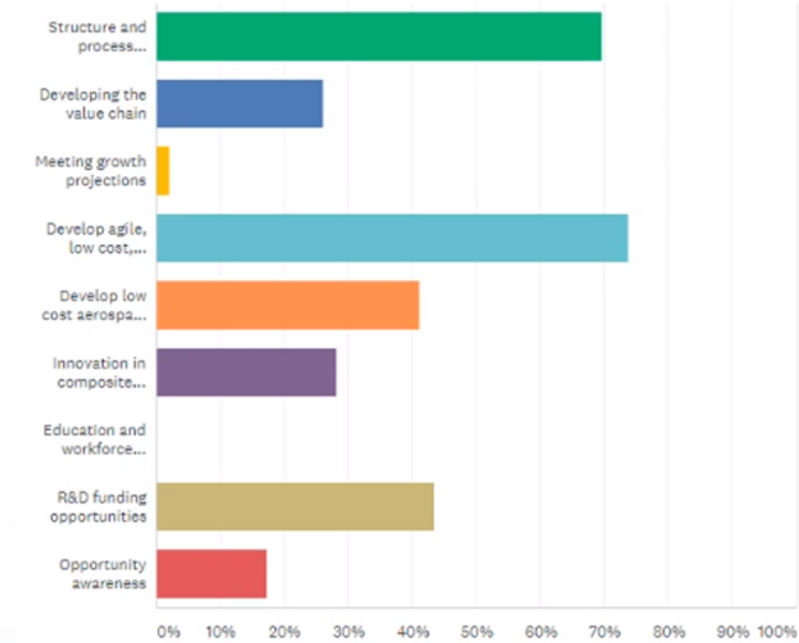
Develop low cost aerospace grade materials

Innovation in composite design and FEA

Education and workforce development

R&D funding opportunities

Opportunity awareness



DOE Clean Energy Goals for MUSA Institutes



- Describe the innovation for technical work including any new focus areas with quantitative techno-economic targets showing **advancements in manufacturing processes, novel materials, enabling technologies, supply chain integration**, or other relevant aspects of advanced manufacturing that have not already been commercialized, marketed, distributed, or sold by another entity.
- Description should demonstrate how the Institute will contribute to progress in achieving the U.S. climate and energy goals to **attain net-zero U.S. industrial and economy-wide greenhouse gas emissions by 2050 and/or help achieve a net-zero power sector by 2035.**