COLLINS AEROSPACE

ACOUSTIC EXHAUST TECHNOLOGY DEMONSTRATOR

CLEEN III CONSORTIUM PUBLIC INDUSTRY DAY

• November 3, 2021
OUTLINE

• Company Overview
• Elevator Speech
• Program Summary
  • Acoustic Exhaust Technologies
• Project Schedule
  • Overall initial plan
• Summary
COMPANY OVERVIEW
The future of aerospace and defense
Raytheon Technologies is an aerospace and defense company that provides advanced systems and services for commercial, military and government customers worldwide.
COLLINS STRATEGIC BUSINESS UNITS

Formed to meet customer needs and represent the best in innovation, technology and expertise

Aerostructures

Mechanical Systems

Avionics

Mission Systems

Interiors

Power & Controls
OUR SYSTEMS MAKE MODERN FLIGHT POSSIBLE

WE POWER IT
WE START IT
WE VENTILATE IT
WE CONTROL IT
WE MONITOR IT
WE PROTECT IT
WE LAND IT
WE STOP IT

OUR SYSTEMS MAKE MODERN FLIGHT POSSIBLE
BALANCED PORTFOLIO, GLOBAL FOOTPRINT

BROAD AVIATION AND MILITARY PORTFOLIO

- 36% Military
- 64% Commercial
- 40% Aftermarket
- 60% Original equipment manufacturer

GLOBAL PRESENCE

- 68,000+ employees
- 15,000+ engineering workforce
- 300+ sites globally
We design, invent and deliver the MOST ADVANCED AND DIVERSE range of aerospace systems - and solutions - on the market.

**Propulsion**
- Nacelle systems
- EBU
- Engine mounts
- Pylons

**Non-Propulsion**
- Flight-control surfaces
- Tailcones
- Doors
- Radomes
- Naval composites

Based in Chula Vista, California
Collins Aerospace – Aerostructures

Industry-leading independent supplier and integrator of nacelles and pylons, offering complete lifecycle design/build/support for large commercial, regional and business jet customers around the world.
COLLINS CLEEN III ELEVATOR SPEECH

Develop advanced exhaust acoustic systems with applications across nacelles components, enabling lower energy, emissions and noise initiatives, aimed at maximizing efficiency of next-generation propulsion systems.
ACOUSTIC EXHAUST TECHNOLOGIES

<table>
<thead>
<tr>
<th>Technology</th>
<th>Goal Impact</th>
<th>Benefits and Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Acoustic Exhaust</td>
<td>Noise Reduction</td>
<td>0.9 – 1.5 EPNdB</td>
</tr>
</tbody>
</table>

Acoustic Chamber…. combined with novel liners.

- Large Acoustic Cell Liners
  - In Work
  - IP Sensitive

INNOVATIVE
PRODUCIBLE
COST EFFECTIVE

AIAA paper 2006-2681
Advanced Acoustic Exhaust

Benefits:
• Noise Reduction: 0.9-1.5 EPNdB
• Fuel Burn Improvement: Neutral

Risks/Mitigations:
• Novel core producibility with exhaust relevant materials is unknown / Perform fabrication trials
• Close tolerances of bonding skins / Assess build repeatability

Objectives:
• Develop and demonstrate an advanced acoustic exhaust
• Advance manufacturing maturity/producingibility of novel cores

Work Statement:
• Novel core geometries tuned to exhaust tones
• Manufacturing feasibility studies with relevant alloys
• Flat panel mechanical and acoustic property tests
• Demonstrator design, fabrication, and acoustic testing

Progress Update:
• FAA kickoff meetings
• Task plan and risk assessment delivered to FAA

Schedule:
SUMMARY

• Advanced acoustic exhaust technology, noise reduction 0.9 – 1.5 EPNdB
• FAA kickoff meetings and 30-day deliverables completed
• Novel core geometry designs in work
• Fabrication evaluations with relevant materials in planning