COLLINS AEROSPACE

ACOUSTIC EXHAUST TECHNOLOGY DEMONSTRATOR

CLEEN III CONSORTIUM PUBLIC INDUSTRY DAY

- November 3, 2021

This document contains no technical data subject to the EAR or the ITAR
ECCN: NSR CLS15693753

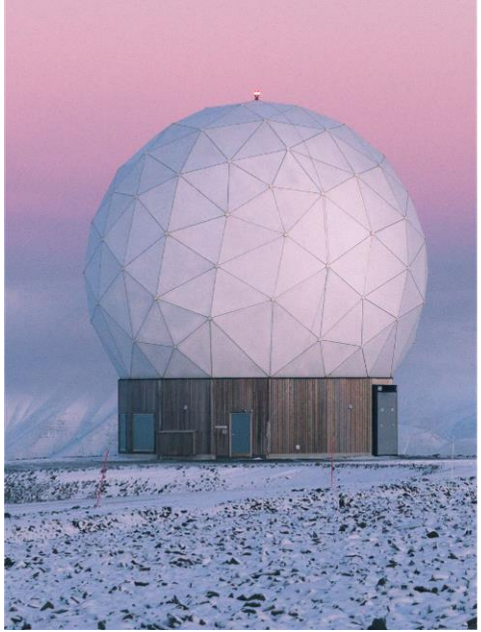
Collins Aerospace

OUTLINE

- Company Overview
- Elevator Speech
- Program Summary
  - Acoustic Exhaust Technologies
- Project Schedule
  - Overall initial plan
- Summary

COMPANY OVERVIEW





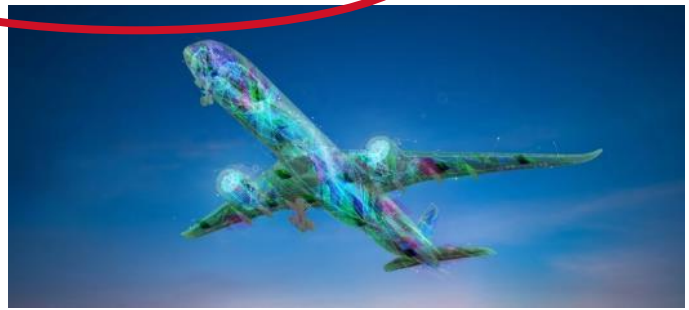

Raytheon Technologies

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.

Raytheon Technologies

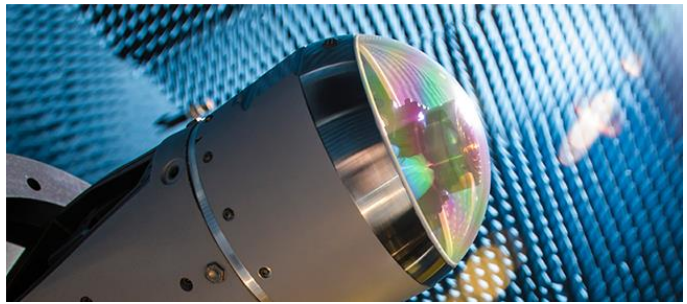
Collins Aerospace



Pratt & Whitney

Raytheon Intelligence & Space

Raytheon Missiles & Defense



COLLINS STRATEGIC BUSINESS UNITS

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

Aerostructures

Avionics

Interiors

Mechanical Systems

Mission Systems

Power & Controls

Collins Aerospace

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

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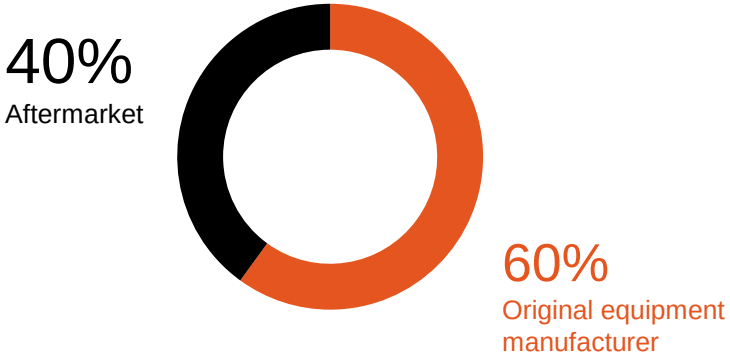
BALANCED PORTFOLIO, GLOBAL FOOTPRINT

BROAD AVIATION AND MILITARY PORTFOLIO



GLOBAL PRESENCE

68,000+
employees

15,000+
engineering workforce

300+
sites globally

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COLLINS AEROSPACE – AEROSTRUCTURES

Based in Chula Vista, California

We design, invent and deliver the
MOST ADVANCED
AND DIVERSE
range of aerospace systems
- and solutions -
on the market

Propulsion

- Nacelle systems
- EBUs
- Engine mounts
- Pylons

Non-Propulsion

- Flight-control surfaces
- Tailcones
- Doors
- Radomes
- Naval composites

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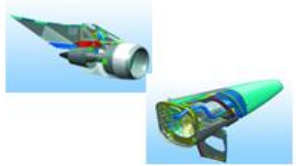
COLLINS AEROSPACE – AEROSTRUCTURES

Key Products and Systems

Nacelle systems

Pylons and fairings

Flight control surfaces



Key Platforms

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

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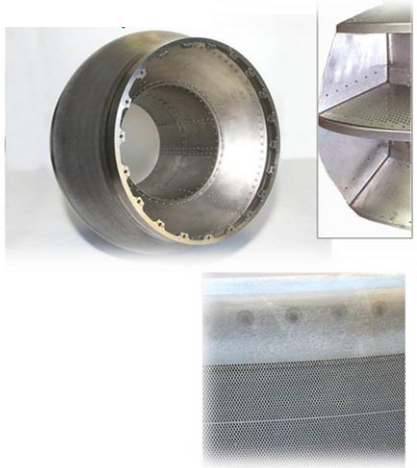
COLLINS CLEEN III ELEVATOR SPEECH

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

Technology	Goal Impact	Benefits and Application
Advanced Acoustic Exhaust	Noise Reduction	0.9 – 1.5 EPNdB

Acoustic Chamber….



AIAA paper 2006-2681

….combined with novel liners.

Large Acoustic Cell Liners In Work
IP Sensitive

INNOVATIVE
PRODUCIBLE ✓ COST EFFECTIVE

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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/producibility of novel cores

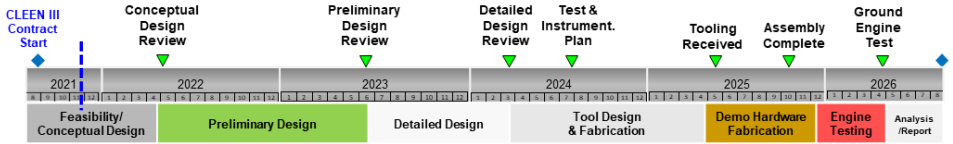
Work Statement:

- 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:



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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