



CLEEN III

HONEYWELL CLEEN PHASE III

Consortium Meeting

November 3, 2021

UNLIMITED RIGHTS

Agreement Number: 693KA9-21-T-00004

Contractor Name: Honeywell International Inc.

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Phoenix, Arizona 85072-2181

HONEYWELL OVERVIEW

NYSE: **HON** | ~919 sites | ~110,000 employees | **Charlotte, N.C.** headquarters | **Fortune 100** | ~\$32.6B (2020 Sales)

Aerospace
\$11.5B



Our products are used on virtually every commercial and defense aircraft platform worldwide and include aircraft propulsion, cockpit systems, satellite communications, and auxiliary power systems.

Building Technologies
\$5.2B



Our products, software, and technologies are in more than 10 million buildings worldwide, helping customers ensure their facilities are safe, energy efficient, sustainable, and productive.

Performance Materials and Technologies
\$9.4B



We develop advanced materials, process technologies, automation solutions, and industrial software that are revolutionizing industries around the world.

Safety and Productivity Solutions
\$6.5B



We improve enterprise performance and worker safety and productivity with automated material handling and voice scanning and mobile computing technology, software solutions, and personal protective equipment and sensing technology.

A Global Diversified Technology Company

HONEYWELL ENGINES AND PLATFORMS

Turbofan Engines

3,000 to 10,000 lb thrust

Commercial business jets
Military trainers



Turboprop Engines

575 to 1,600 shp

Commercial turboprops
Military UAV



Turboshaft Engines

500 to 5,000 shp

Military & commercial helo/rotorcraft
Military surface vehicles/tanks



Over 80,000 Turbine Engines Delivered

NEXT GENERATION TURBOFAN CAN BENEFIT FROM CLEEN III TECHNOLOGIES TO REDUCE FUEL BURN, EMISSIONS AND NOISE



- **State-of-the-art (SOA) performance**
- **Industry leading dispatch reliability**
- **Quantum leap in value: cost and durability**
- **Versatile technology for the Business Aviation Market**
- **Seven aircraft applications to date**
 - > 2500 engines in service
 - > 7 million cumulative flight hours
 - > 4 million cumulative flight cycles

**Bombardier
CL300**



2004

**Gulfstream
G280**



2012

**Bombardier
CL350**



2014

**Embraer
Legacy 450/500**



2014 - 2015

**Cessna
Longitude**



2018

**Embraer
Praetor 500/600**



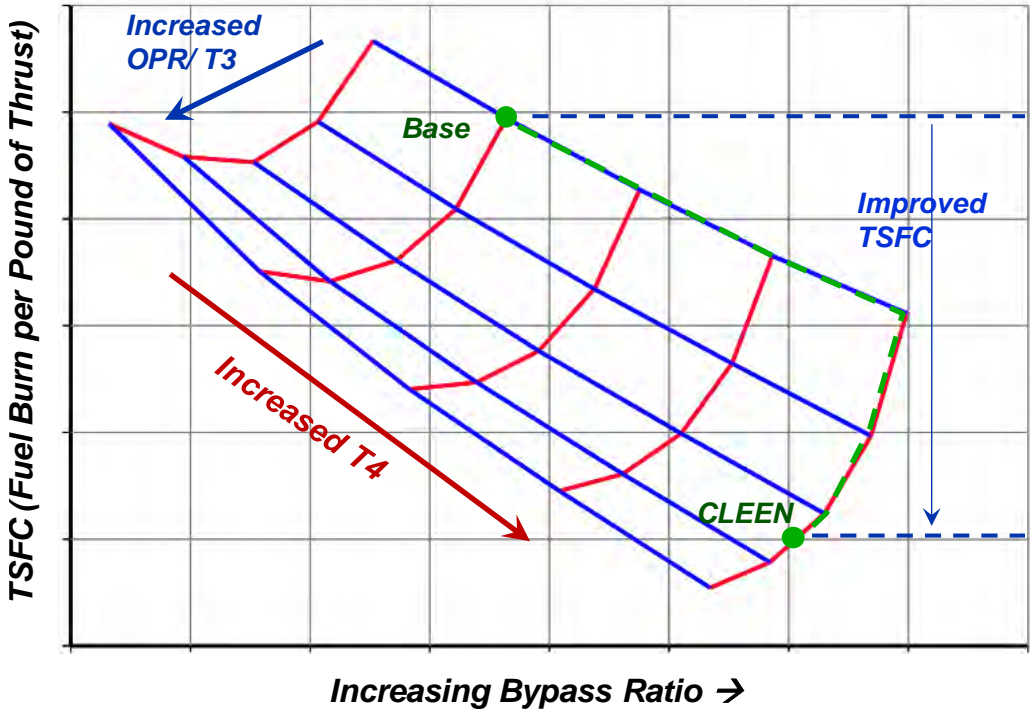
2019

CLEEN III Technologies Enhance Future Product Capabilities

CLEEN III ENGINE SYSTEM OPTIMIZATION

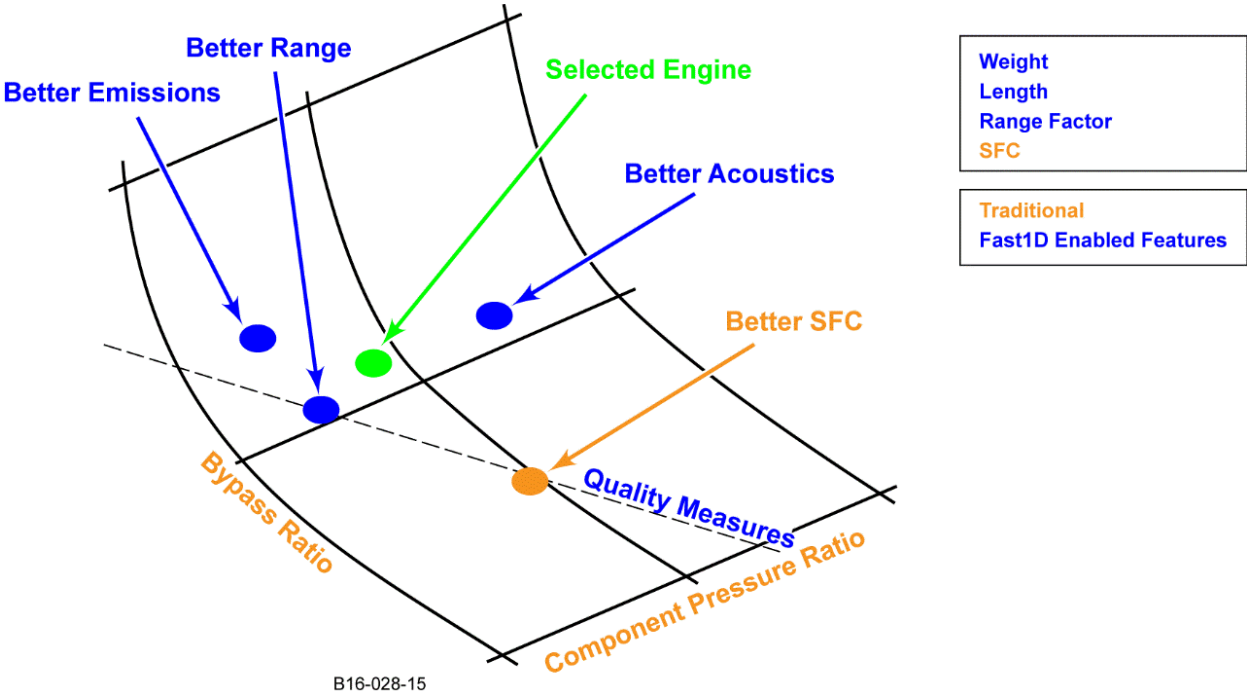
System integration study focused on infusing technologies to reduce mission fuel burn

Technologies focus on engine core, increasing Compressor and Turbine temperature capability (T3 and T4) to enable reductions in aircraft mission fuel burn



The CLEEN III cycle selection is a balance of Range, TSFC and Acoustics for optimal engine performance

System optimization provides a holistic, simultaneous look at basic engine performance + mission range and fuel, acoustic, emissions, engine geometry, length, weight and quality measures (loadings, stress, etc.)



Big Benefit Comes from a System Solution Optimization

MISSION/FLEET BENEFIT ASSESSED FOR TSFC, EMISSIONS, & NOISE

Generate cycle-based benefit predictions for CLEEN engine

- Predictions to be completed for CLEEN cycle with & without TSFC tech applied

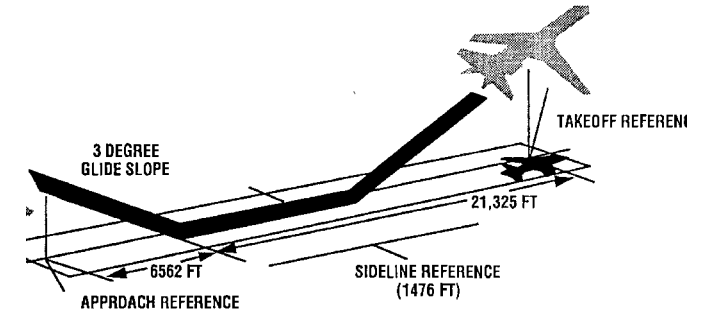
Provide input to Georgia Tech for fleet wide technology benefit assessment

Work with airframer to quantify benefit for aircraft mission

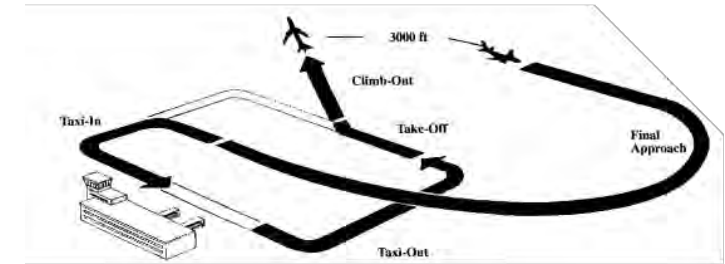
Engine TSFC/Emissions/Noise Prediction + Measured Technology Benefits



Fleet Benefits Assessments



ICAO Landing/Takeoff (LTO) Emissions Cycle



Aircraft Mission Benefit Assessment

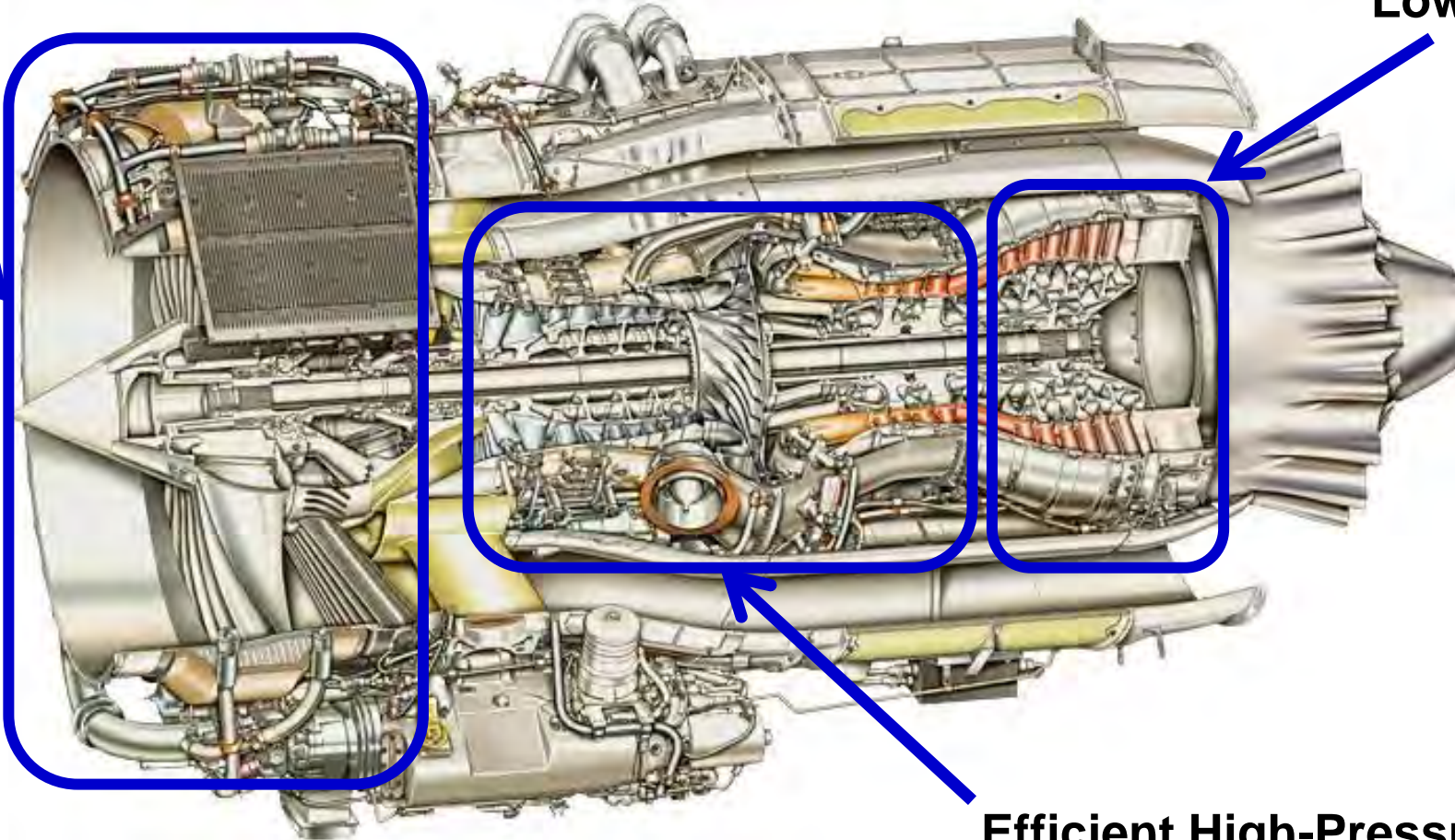


Global Benefit of CLEEN III Technology will be Quantified

HONEYWELL CLEEN III TECHNOLOGIES




Highly Efficient Fan Module

**High Work / High Lift
Low Pressure Turbine**



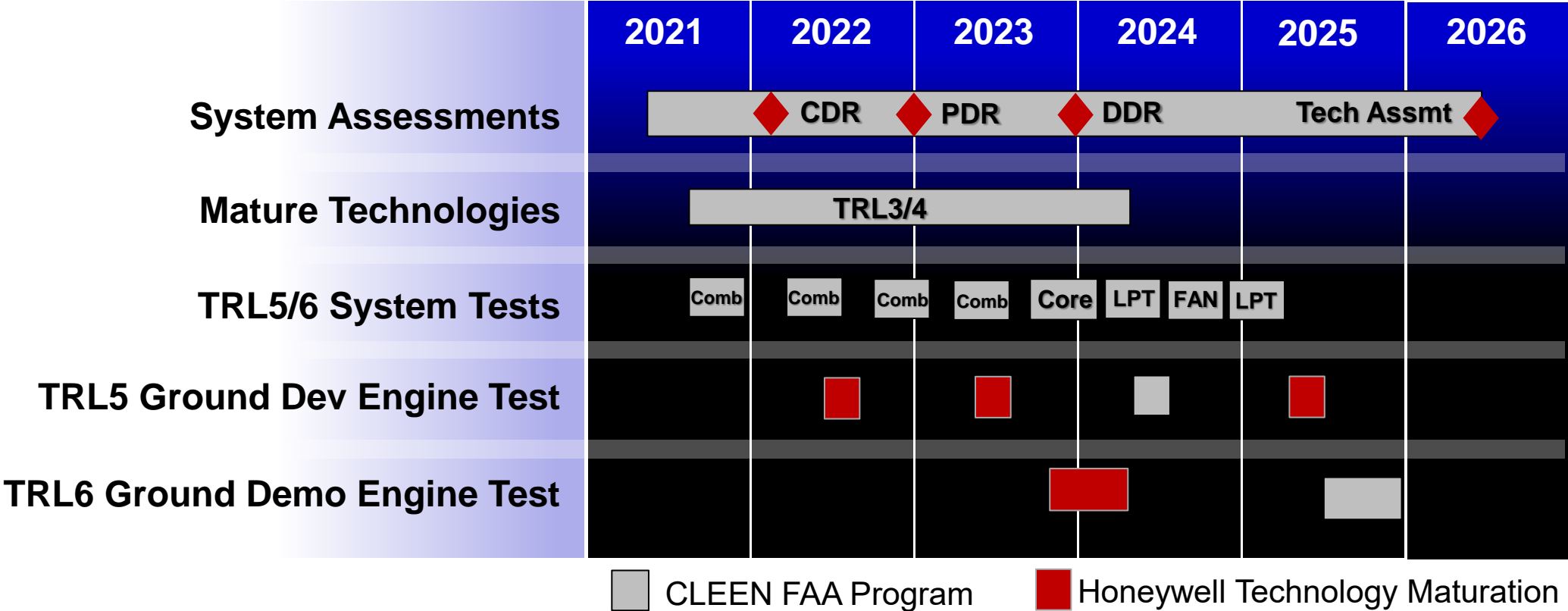
**Efficient High-Pressure
Green Core**

HONEYWELL CLEEN III TECHNOLOGIES

CLEEN III Technology	Technology Description	Benefits and Applications
Highly Efficient Fan Module 	<p>Honeywell is developing over-the-rotor acoustic treatment, a high efficiency booster, and optimizing the fan exit guide vanes and booster stators for combined noise and efficiency benefits.</p>	<ul style="list-style-type: none"> • Noise: 1.5 EPNdB • Fuel: 1.5% fuel burn reduction • Application: Super mid-sized business jet • Entry into service (EIS): 2031
Efficient Green High-Pressure Core 	<p>Honeywell is developing advanced high-pressure compressors, low emission combustors, and efficient high pressure turbine technologies.</p>	<ul style="list-style-type: none"> • Noise: 3 EPNdB reduction • Fuel: 8.3% fuel burn reduction • Emissions: 70% margin to CAEP/8 NOx; reduction in nvPM • Application: Super mid-sized business jet • Entry into service (EIS): 2031
High Work High Lift Low Pressure Turbine (LPT) 	<p>Honeywell is developing technologies for a reduced weight, more efficient and quieter low-pressure turbine.</p>	<ul style="list-style-type: none"> • Noise: 0.5 EPNdB • Fuel: 2.5% fuel burn reduction • Application: Super mid-sized business jet • Entry into service (EIS): 2031

CLEEN III Technologies to Reduce Fuel Burn, Emissions and Noise

CLEEN III PROGRAM SCHEDULE



THANK YOU!