



HyTEC

Hybrid Thermally Efficient Core

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NASA Sustainable Flight National Partnership Panel

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www.nasa.gov

Hybrid Thermally Efficient Core



Goal:

- The Hybrid Thermally Efficient Core (HyTEC) Project will accelerate the development of the next generation small-core turbofan engine technologies with improvements in efficiency, durability, performance, hybridization, and sustainability in order to meet the next Entry into Service (EIS) single aisle aircraft expected in the 2030's.

Objectives:

- Achieve **5-10% fuel burn reduction** versus 2020 best in class
- Achieve **up to 20% power extraction** (4 times current state of the art) at altitude to optimize propulsion system performance and enable hybridization
- Demonstrate the effective and efficient operability of high blend (**>80%**) **Sustainable Aviation Fuels (SAFs)** in 2030s EIS combustors.

HyTEC Metrics

- Small core technologies aligned with future single-aisle propulsion products
- Target engine thrust of 25,000 – 35,000 lb_f

Key Performance Parameter (KPP)	Full Success Single Aisle ~2035 EIS
Engine Bypass Ratio	> 15
Engine Overall Pressure Ratio	> 50
HPC Exit Corrected Flow	< 3 lbm/s

Partner with industry to mature and demonstrate promising technologies.

Propulsion Efficiency through High Power Density Core

Small core:

- Low mass flow rate
- Keeping axial configuration of the High Pressure Compressor (HPC)
- Enables higher bypass ratio

Enabling technologies:

- High Pressure Turbine (HPT):
 - Aerodynamic improvements
 - Advanced materials to increase temp capability and reduce cooling requirements
- HPC aerodynamic and operability improvement
- Compact combustor optimization with SAF compatibility
- Electric hybridization

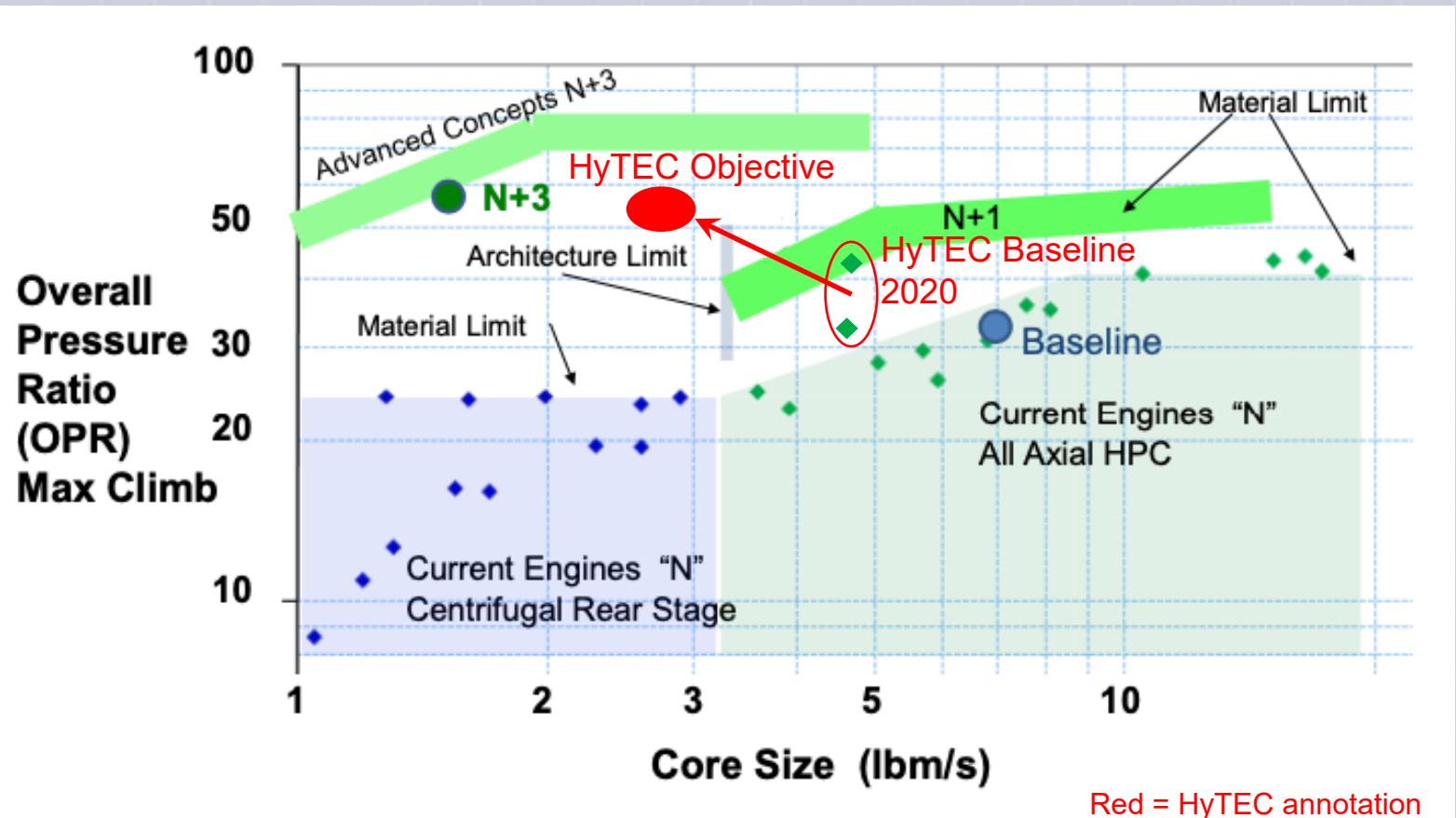
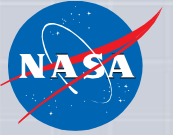


Figure 5 OPR versus Core Size for Generation N, N+1 , N+3

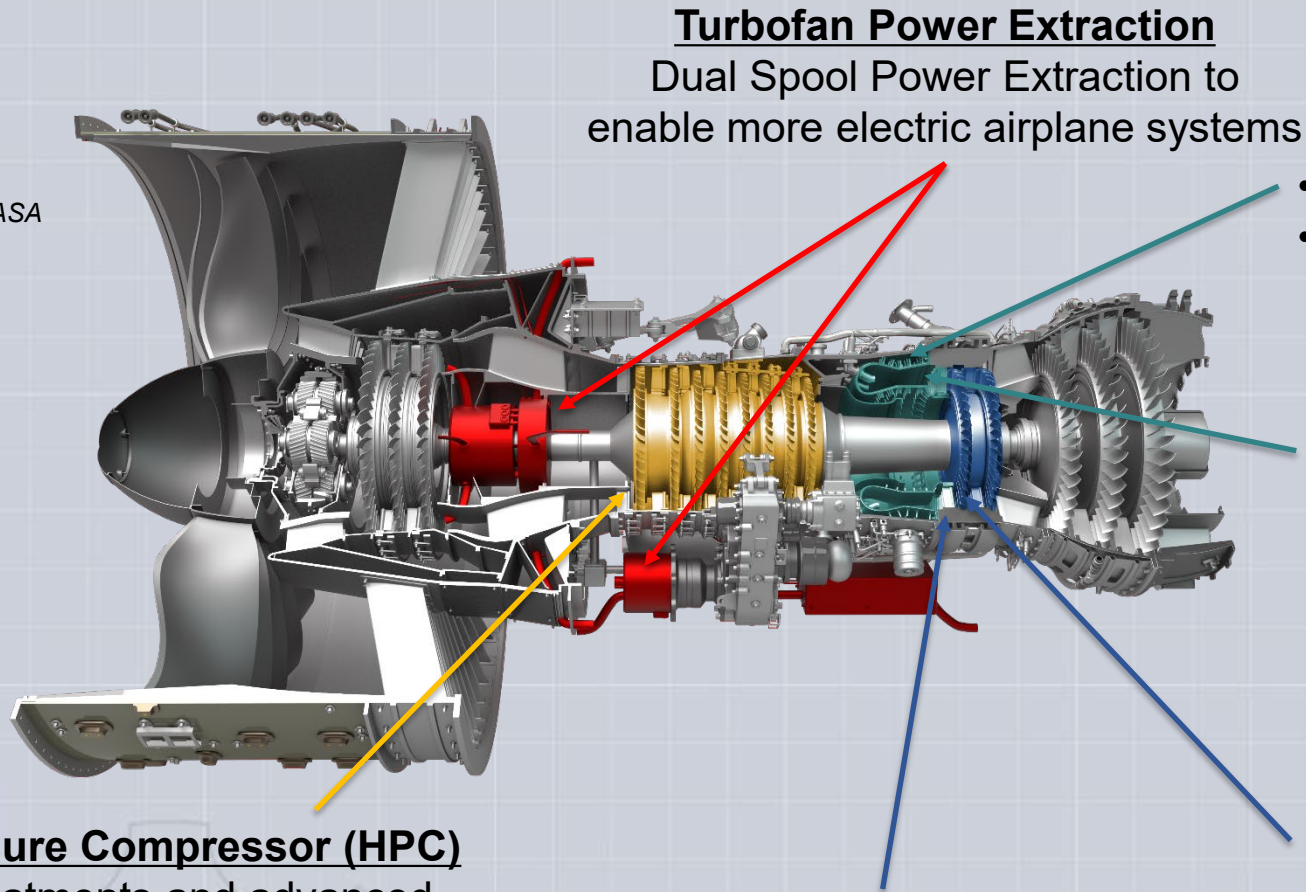
Ref. Lord, W.K. et al.: "Engine Architecture for High Efficiency at Small Core Size,"
AIAA 2015-00071. <https://arc.aiaa.org/doi/10.2514/6.2015-0071>

Develop technologies to overcome scaling barriers for compact core.

HyTEC Phase 1 Technical Content



Credits: NASA



High Pressure Compressor (HPC)

Casing treatments and advanced designs to enable operability with optimized efficiency and performance.

Turbopan Power Extraction

Dual Spool Power Extraction to enable more electric airplane systems

Combustion Technologies

- Sustainable aviation fuel compatibility
- Compact design for small core engines

Enhanced Combustor Materials

Ceramic matrix composite (CMC) liners for combustors to increase performance and durability.

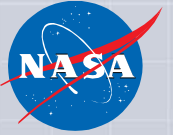
High Pressure Turbine (HPT) Materials

- CMCs/Environmental Barrier Coatings (EBCs) for turbine components to increase temperatures and efficiency.

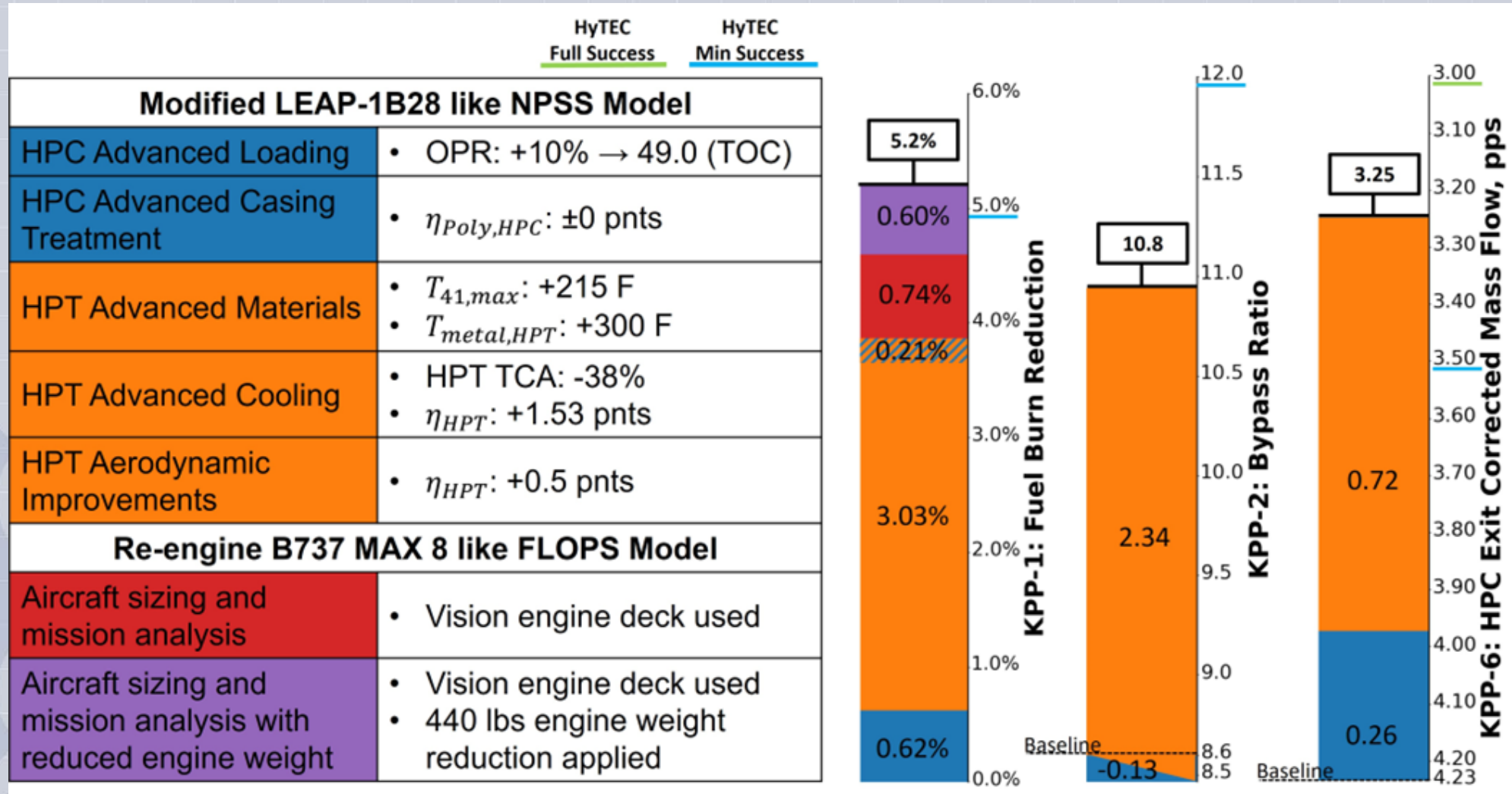
Advanced HPT Aerodynamics

Enable more efficient turbine operation by developing advanced blade and cooling designs and aerodynamic features.

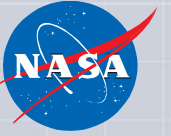
HyTEC Systems Analysis



Phase 1 Technology impact on 2020 CFM LEAP baseline.

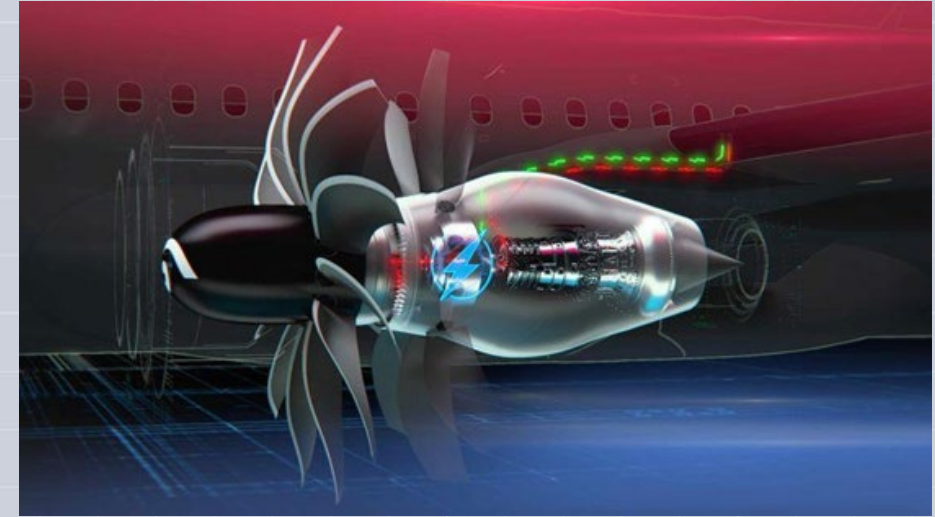


HyTEC Phase 2 Contract Award



Phase 2 Engine Core Demonstration Contract

- NASA selected GE Aerospace of Cincinnati for HyTEC's Phase 2 Integrated Core Technology Demonstration.
- Cost-share contract with a maximum government value of approximately \$68.1 million and a 50% minimum GE Aerospace cost share.
- Five-year performance period that began Feb. 15, 2024.



RISE Engine Concept

To meet the goal of HyTEC Phase 2, GE Aerospace will integrate Phase 1 technologies into an engine core to perform a compact, high-power density core ground demonstration by the end of 2028.

TECHNOLOGIES

Hybrid Electric Technology

Power extraction and insertion
enable hybridization

High-Pressure Compressor

Casing treatments and advanced designs
optimize efficiency and performance

Combustion Technologies

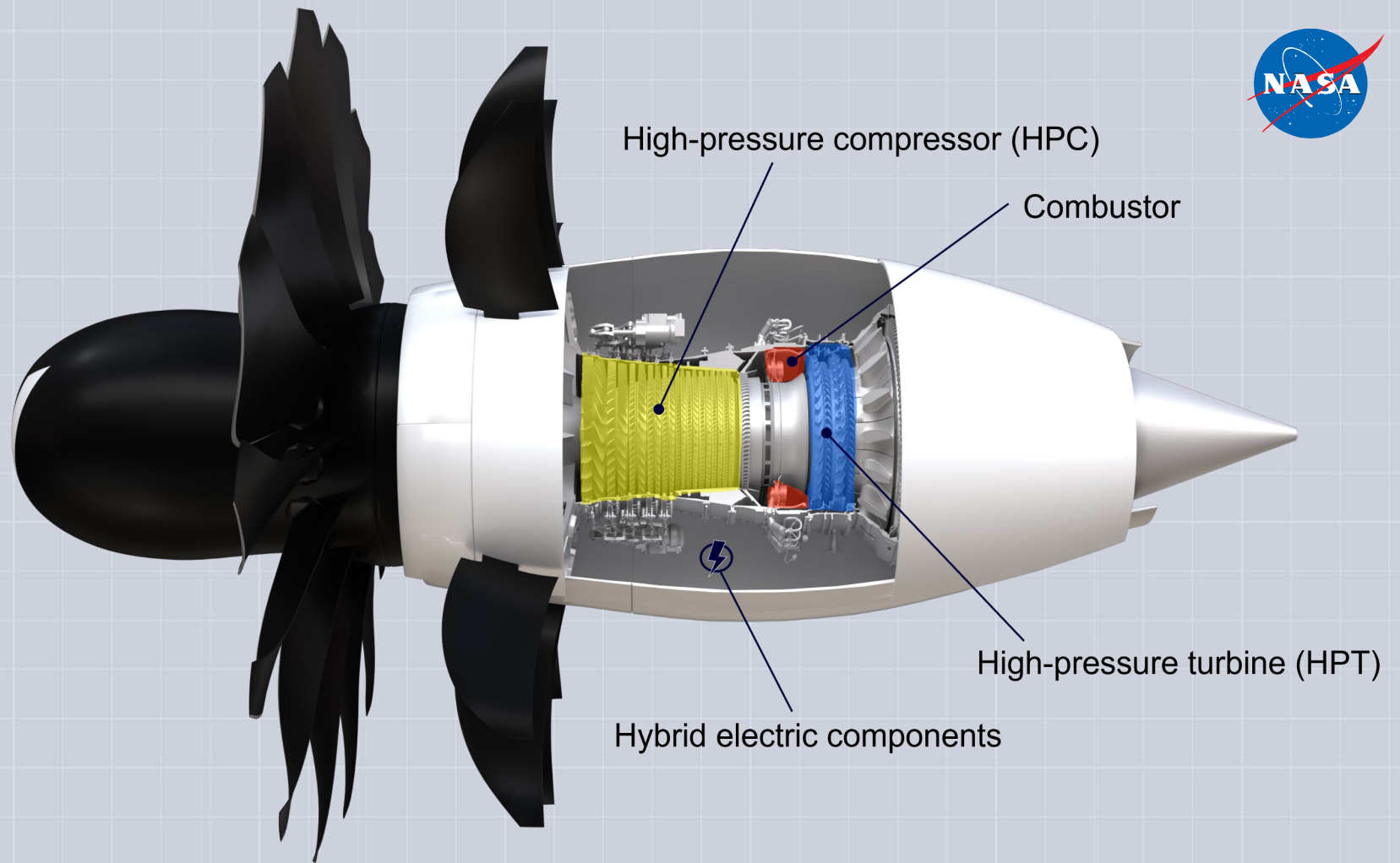
Provide sustainable aviation fuel
compatibility and compact design for
small core engines

Enhanced Combustor Materials

Ceramic matrix composite (CMC) and
environmental barrier coating (EBC)
liners for combustors are used to increase
performance and durability

Advanced High-Pressure Turbine Aerodynamics

Enable more efficient turbine operation by
developing advanced blade and cooling
designs and aerodynamic features



Artist's representation only; components not to scale or true to actual designs.
(Image Credit: GE Aerospace)

HyTEC Phase 2 Technologies

