



United Technologies Research Center

UTRC Overview

Presented by

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Senior Research Engineer

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Be Curious 

Making
 **modern life**
possible



Providing high technology systems and services
to the aerospace and building industries.



Our business units

“UTRC is where
you bring your
toughest problems.”



UTC Aerospace Systems



**United
Technologies**

Climate | Controls | Security



Pratt & Whitney

A United Technologies Company



Otis

A United Technologies Company

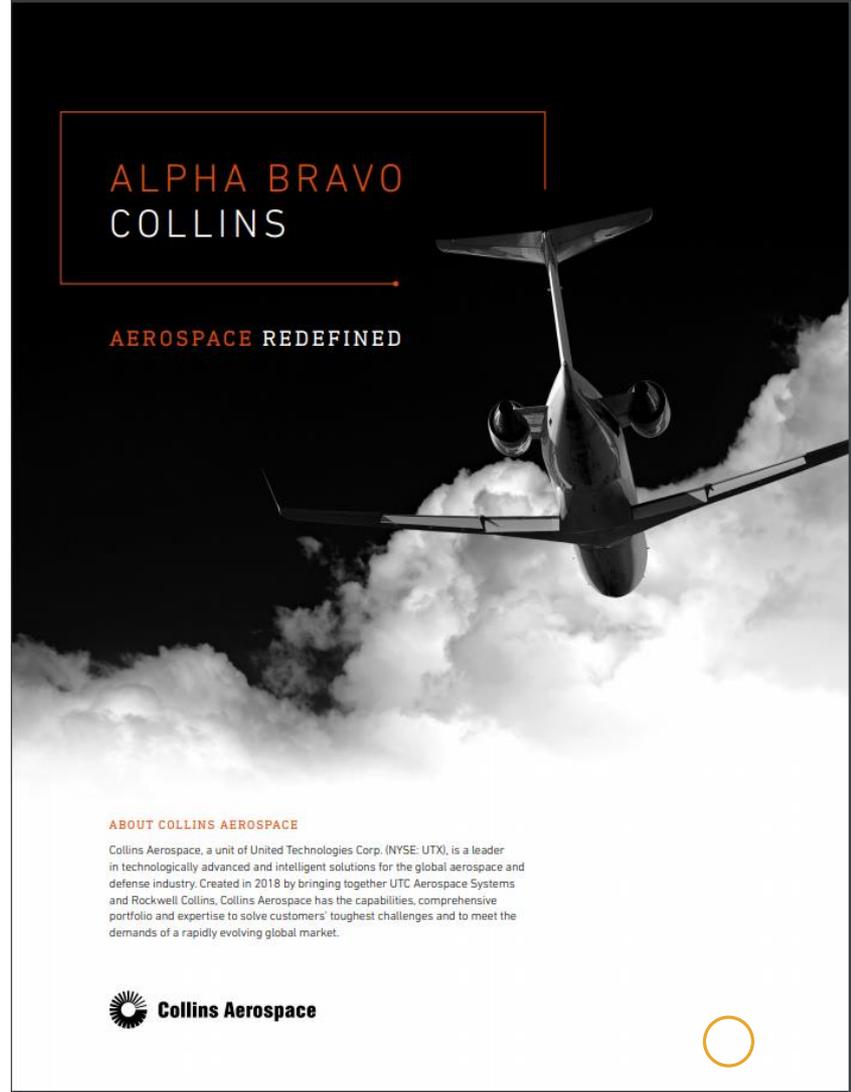


**United
Technologies**

Collins Aerospace

Completion of Rockwell Collins acquisition creates an industry-leading aerospace systems supplier, Collins Aerospace Systems

Collins Aerospace builds on the legacy of industry-leading innovation at UTC Aerospace Systems and Rockwell Collins



ALPHA BRAVO
COLLINS

AEROSPACE REDEFINED

ABOUT COLLINS AEROSPACE

Collins Aerospace, a unit of United Technologies Corp. (NYSE: UTC), is a leader in technologically advanced and intelligent solutions for the global aerospace and defense industry. Created in 2018 by bringing together UTC Aerospace Systems and Rockwell Collins, Collins Aerospace has the capabilities, comprehensive portfolio and expertise to solve customers' toughest challenges and to meet the demands of a rapidly evolving global market.



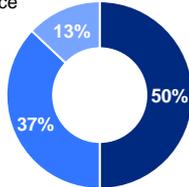


\$60B
2017 UTC Sales

\$3.9B
invested in R&D

END MARKETS

Military Aerospace
& Space

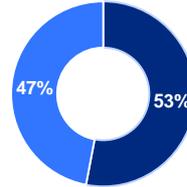


Commercial
Aerospace

Commercial
& Industrial

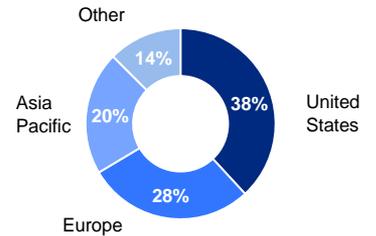
SALES BY TYPE

Aftermarket



Original
Equipment
Manufacturing

SALES BY GEOGRAPHY



United
States

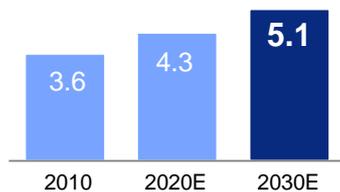
Operating at the intersection of



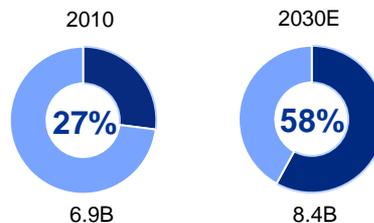
powerful
megatrends



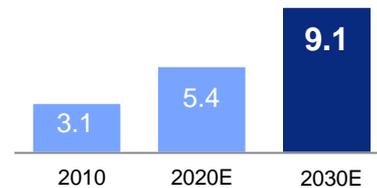
Growing urban population
(billions)



Expanding global middle class
(share of population)



Increasing demand for air travel
(revenue passenger miles in trillions)



UTRC is UTC's
 **innovation
engine**

Defining what's next:

Define
new
frontiers

Co-develop
new
technologies

Solve
tough
problems

Serve
as hub for
technical
interchange

Leverage
global network
of innovation

A **global**
presence



Berkeley, CA

Established in 2009, focuses on cyber physical systems and embedded intelligence



East Hartford, CT

Founded in 1929, focuses on a broad range of system engineering, thermal, fluid, material, and informational sciences



Cork, Ireland

Established in 2010, focuses on energy, security and aerospace systems



Rome, Italy

Joined UTC in 2012, focuses on model-based design and embedded systems engineering



Shanghai, China

Established in 1997, focuses on integrated buildings, fluid and mechanical systems



People with knowledge & perspective



Advanced Degrees



Doctorate



Masters





Defining the

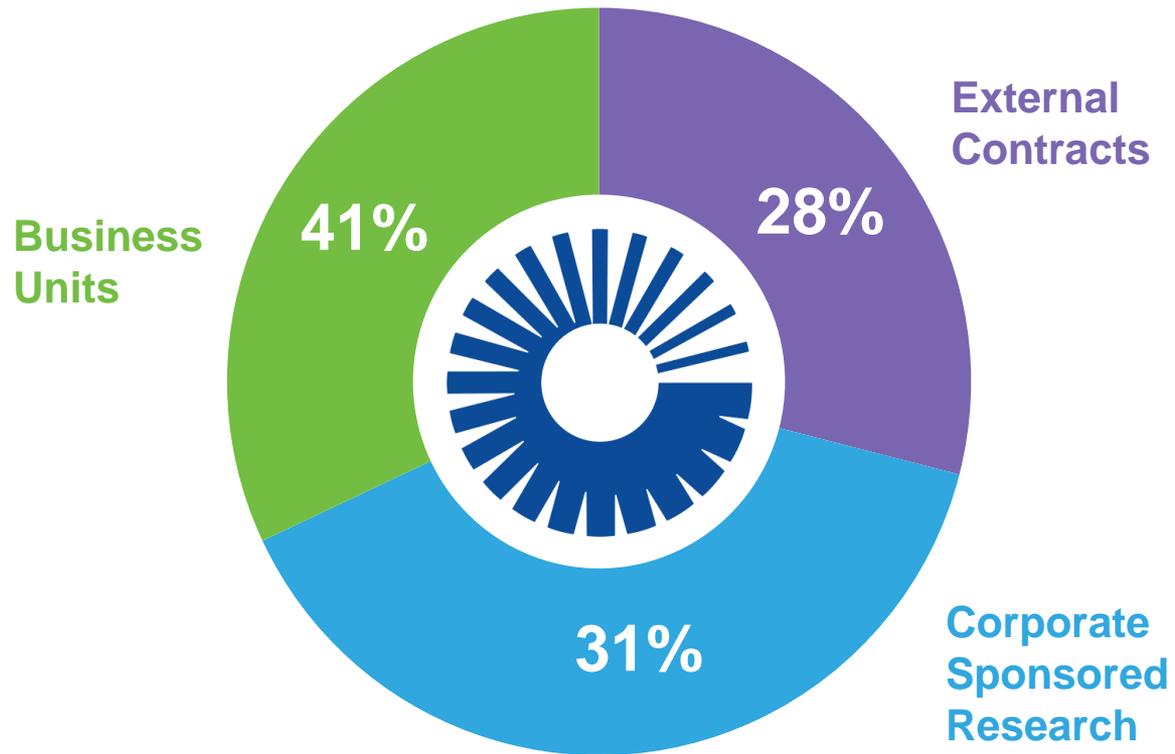
cutting edge

Advanced Manufacturing
Aerodynamics & Acoustics
Applied Mechanics
Autonomy & Controls
Combustion
Cyber Physical Security
Data Science
Embedded Intelligence
Materials
Networks & Communications
Power Electronics
Thermal Management



**United Technologies
Research Center**

How we're \$ funded



Focused on



performance



Physical Sciences

- Advanced Materials
- Applied Physics
- Environmental Science
- Materials Chemistry
- Measurement Science
- Solid Mechanics
- Surface Mechanics

Systems

- Advanced Laboratory for Embedded Systems
- Control Systems
- Cyber-Physical Systems
- Decision Support & Machine Intelligence
- Electromagnetics & Networks
- Power Electronics
- Software Systems
- System Dynamics & Optimization

Thermal & Fluid Sciences

- Acoustics
- Aerodynamics
- Aero-Thermal Testing
- Combustion Science
- Propulsion Technology
- Thermo-Fluid Dynamics
- Thermal Management

Focused on performance



Physical Sciences

Applied Physics

- Optical/chemical sensing
- Printed electronics
- Microfabrication

Solid Mechanics

- Structural analysis
- Material damage modeling

Surface Mechanics

- Process modeling
- Tribology
- Advanced manufacturing

Environmental Science

- Process development and scale-up
- Green and sustainable manufacturing
- Membranes and sensing

Measurement Science

- Material characterization
- Mechanical property testing
- Component forensic analysis
- Inspection technique development

Advanced Materials

- Materials for structures
- Coatings
- Additive manufacturing

Materials Chemistry

- Green surface protection technologies
- Electromechanical systems and sensors
- Material design and synthesis



Focused on performance

Systems

Advanced Laboratory for Embedded Systems

- Simulation of embedded systems and networks
- Synthesis and verification
- Formal methods
- Software technologies
- Analysis, control, and optimization

Control Systems

- Multi-variable controls
- Robust controls
- Optimization-based controls
- Adaptive controls
- State estimation and navigation

Cyber-Physical Systems

- Intelligent systems and robotics
- Model-based development
- Validation and verification of complex systems

Decision Support & Machine Intelligence

- Machine learning, data mining
- Diagnostics, prognostics, PHM
- Sensor fusion
- Video analytics
- Human machine interaction

Electromagnetics & Networks

- Electromagnetics
- Communications, wireless
- Sensor networks
- Embedded processors

Power Electronics

- High density converters
- High temperature-high frequency devices
- Converter topologies
- High speed machines

Software Systems

- Software engineering and architectures
- Formal methods
- Cyber-physical systems security

System Dynamics & Optimization

- Uncertainty quantification
- Multi-scale system modeling
- Mathematics on graphs, computational mathematics
- Optimization



Focused on performance



Thermal & Fluid Sciences

Acoustics

- Aeroacoustics
- Structural Acoustics/Dynamics
- Noise and vibration diagnostics, modeling, and control

Aerodynamics

- Flow physics
- CFD Modeling
- Experimental aerodynamics
- Turbomachinery

Aero-Thermal Testing

- Component performance and operability
- Experimental model validation

Combustion Science

- Multi-phase reacting flows
- Material flammability
- Laser diagnostics

Propulsion Technology

- Experimental Combustion
- Combustor systems
- High speed propulsion systems

Thermo-Fluid Dynamics

- Thermodynamics
- Multi-phase Flow Heat Transfer
- Experimental Heat Transfer
- Thermal Dynamic Modeling

Thermal Management

- Heat transfer
- Multi-scale modeling
- Thermal system optimization



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