



Aeroderivative Combustion Gas Turbines in CHP Applications

Presented by Jack Kelly, Project Manager
Jacobs Engineering Group Inc.



Lockheed C-5A Galaxy - TF39 Flight Engine



C-5 TURBOFAN ENGINE
The First Main-Branch Turbine Engine

With the C-5 turbofan, a new chapter in engine development was opened. The C-5 is the first engine to feature a high bypass ratio, which allows it to move a large volume of air around the engine core, rather than through it. This design is more efficient and quieter than traditional turbojets, and it is the standard for modern commercial and military aircraft.

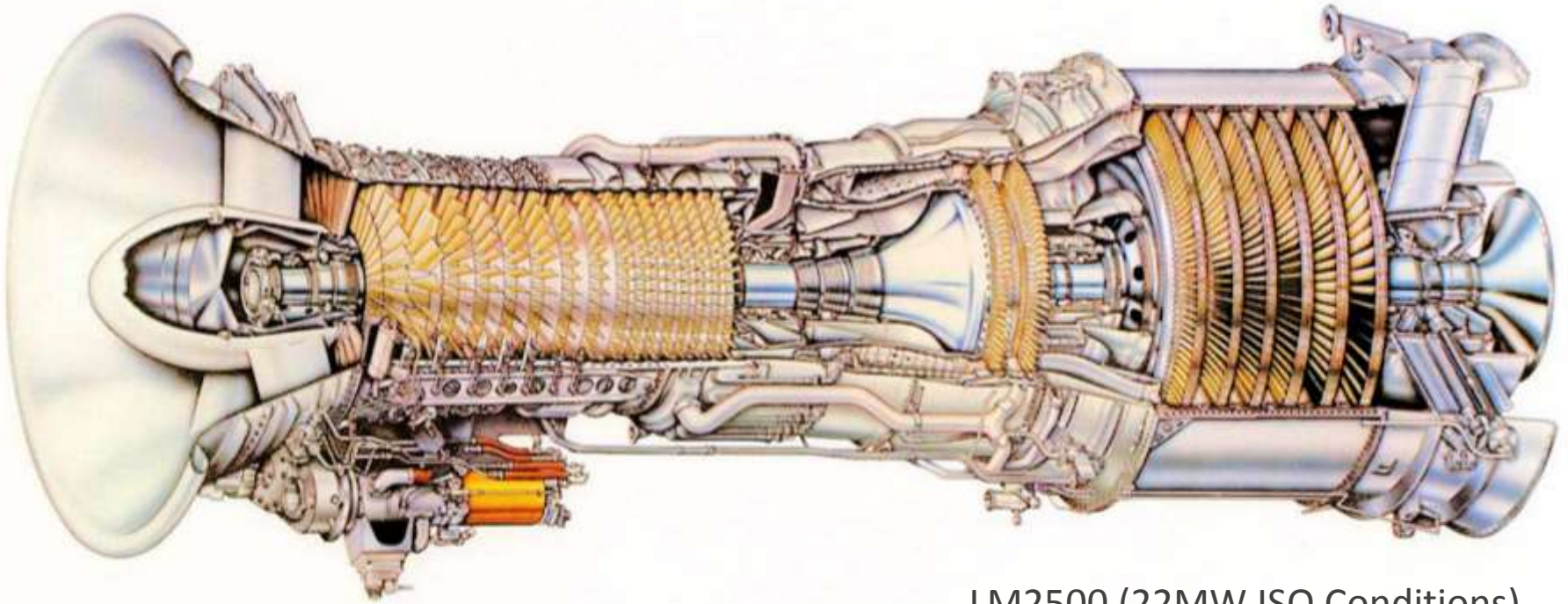
The C-5 is a gas turbine engine, which means it uses a continuous flow of gas to produce power. The gas is compressed by a compressor, then ignited by a spark plug, and the resulting explosion drives the turbine. The turbine is connected to the compressor, so as the turbine spins, the compressor also spins, compressing the gas further.

The C-5 is a complex piece of machinery, with many moving parts and a high level of precision. It is a testament to the ingenuity and skill of the engineers who designed and built it.

Weight: 45,000 lb
Length: 50 ft

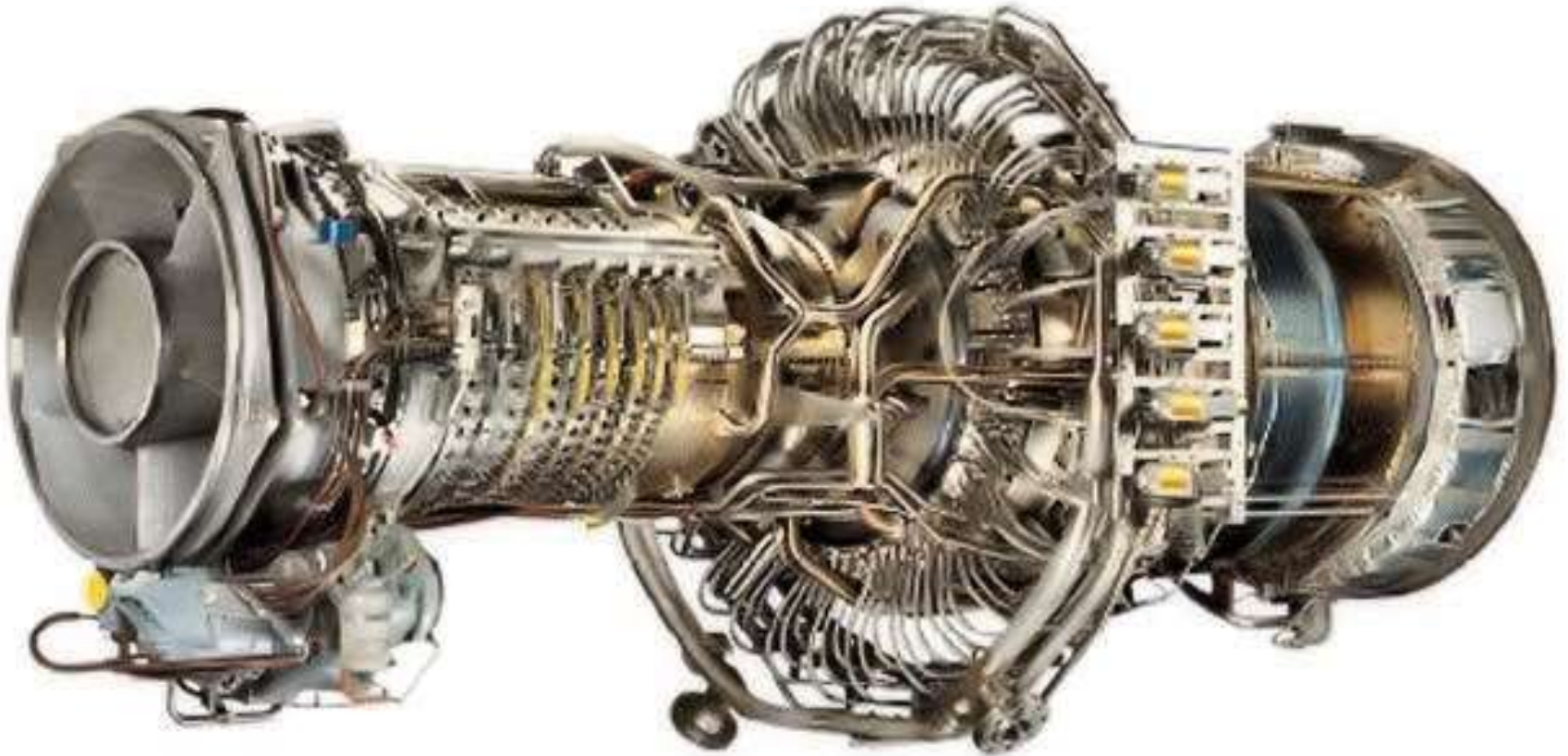
High Bypass Turbofan Aircraft Engine

To A Power Generation Application



LM2500 (22MW ISO Conditions)

2500+G4 DLE: Power and Emissions

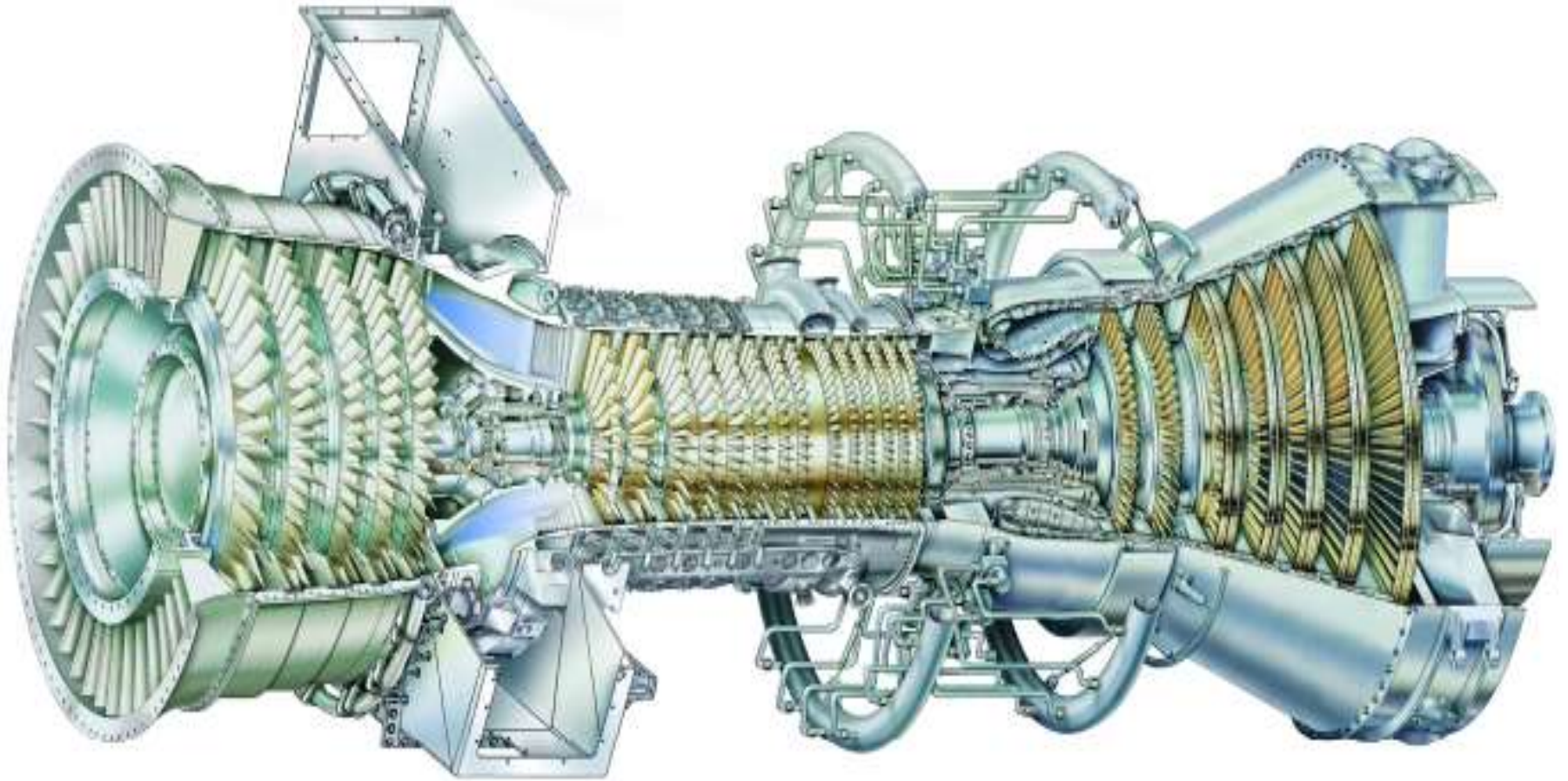


LM2500+ G4 DLE (34MW ISO Conditions)

- UT Austin GT-10
- Texas A&M CHP Upgrade

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Larger Aeroderivative Models



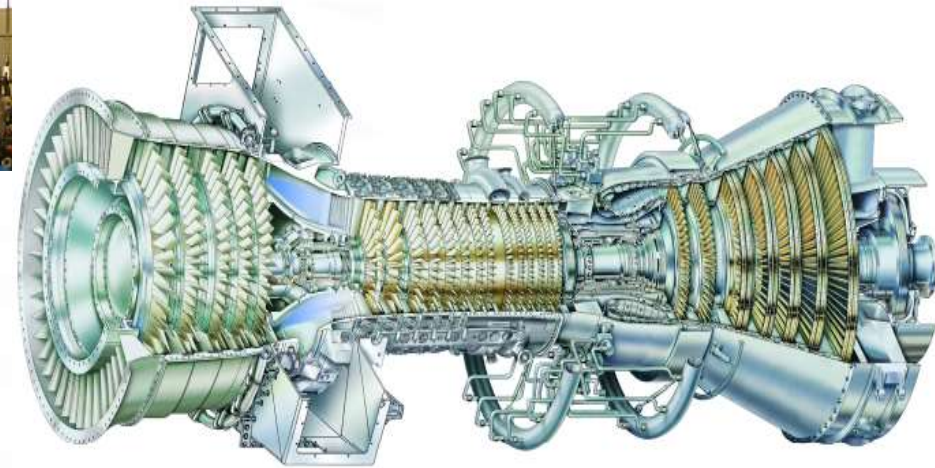
LM6000 (40MW Base Engine @ ISO)

FROM FLIGHT ENGINE CONFIGURATION TO AERODERIVATIVE COMBUSTION TURBINE



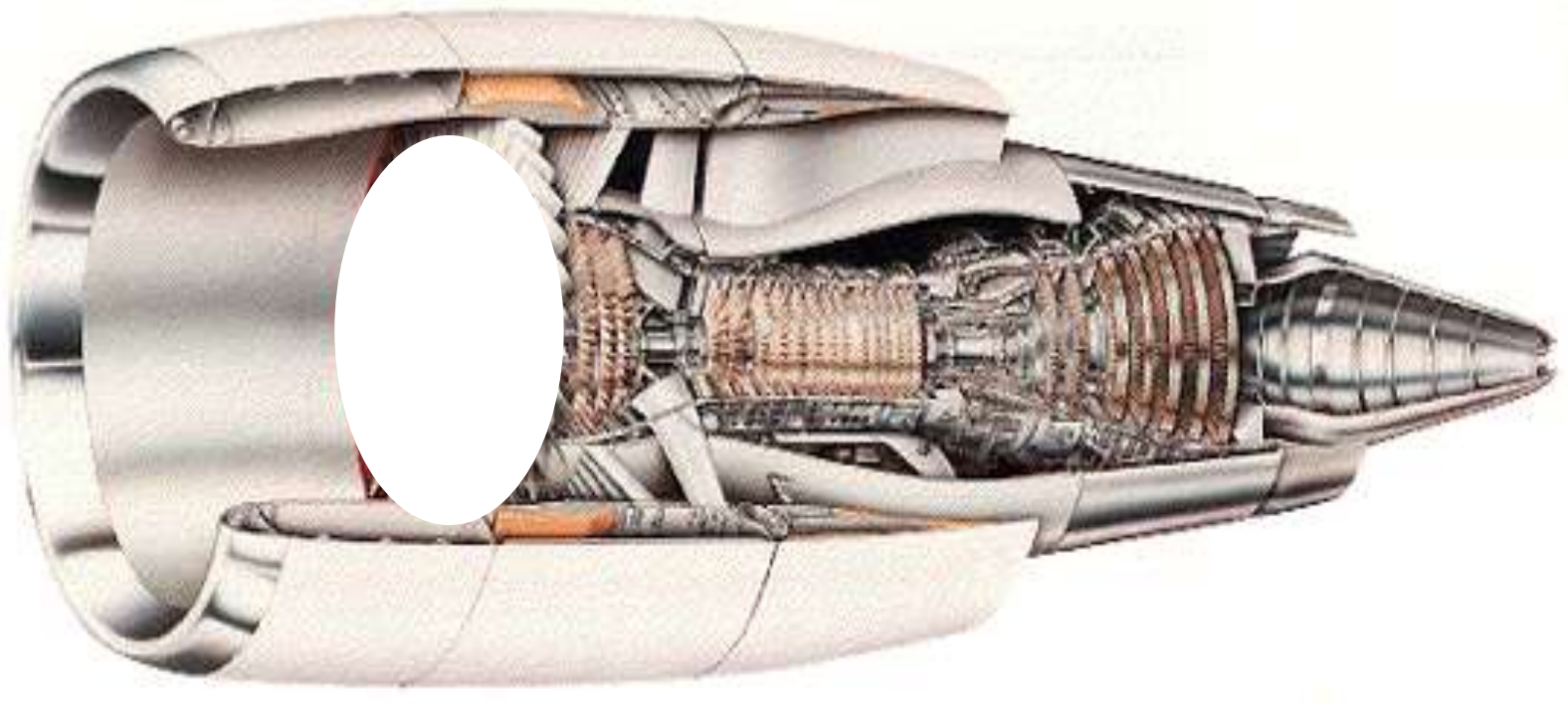
LM6000

CF6-80C2



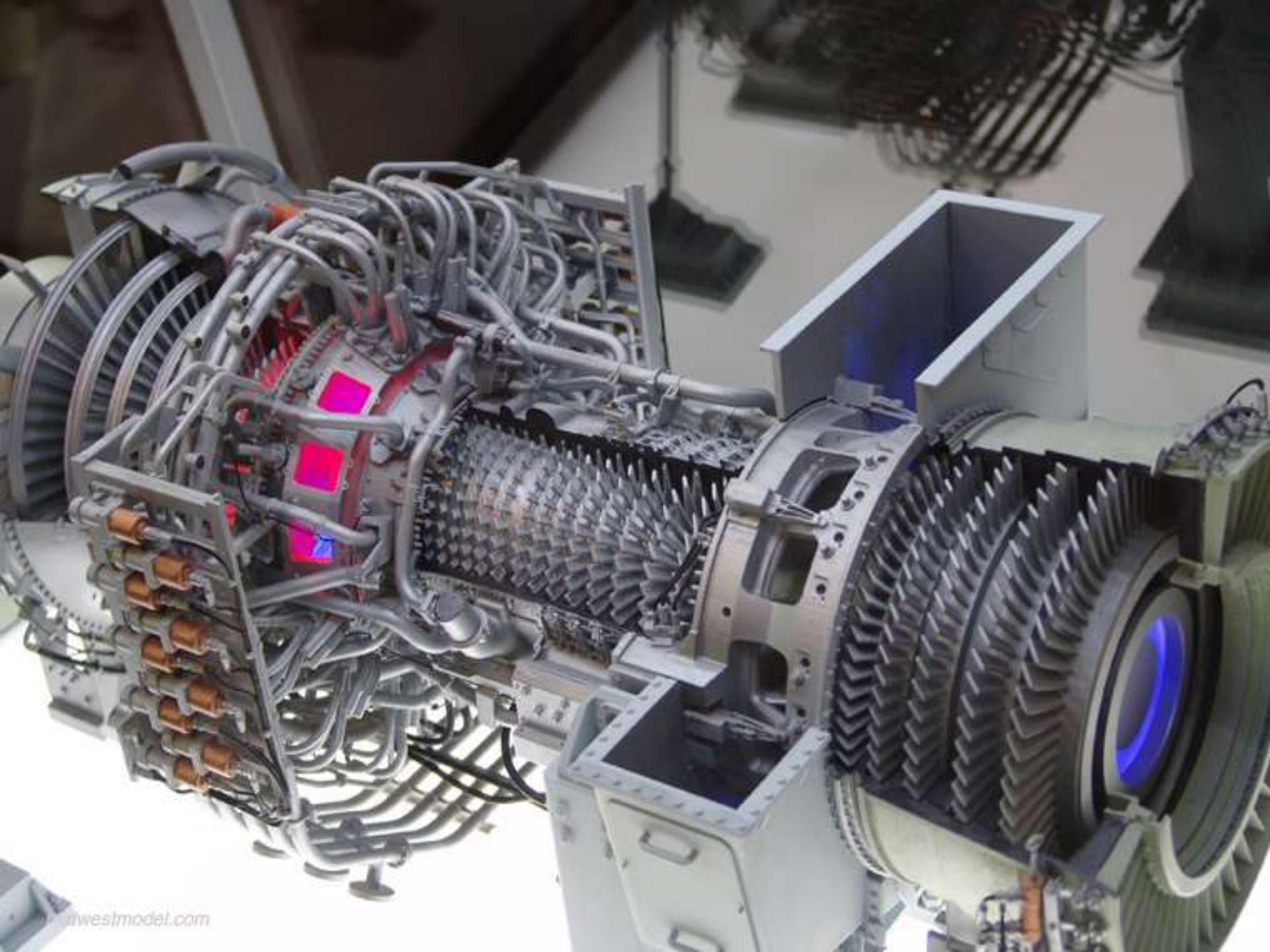
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Flight Engine Cut-Away

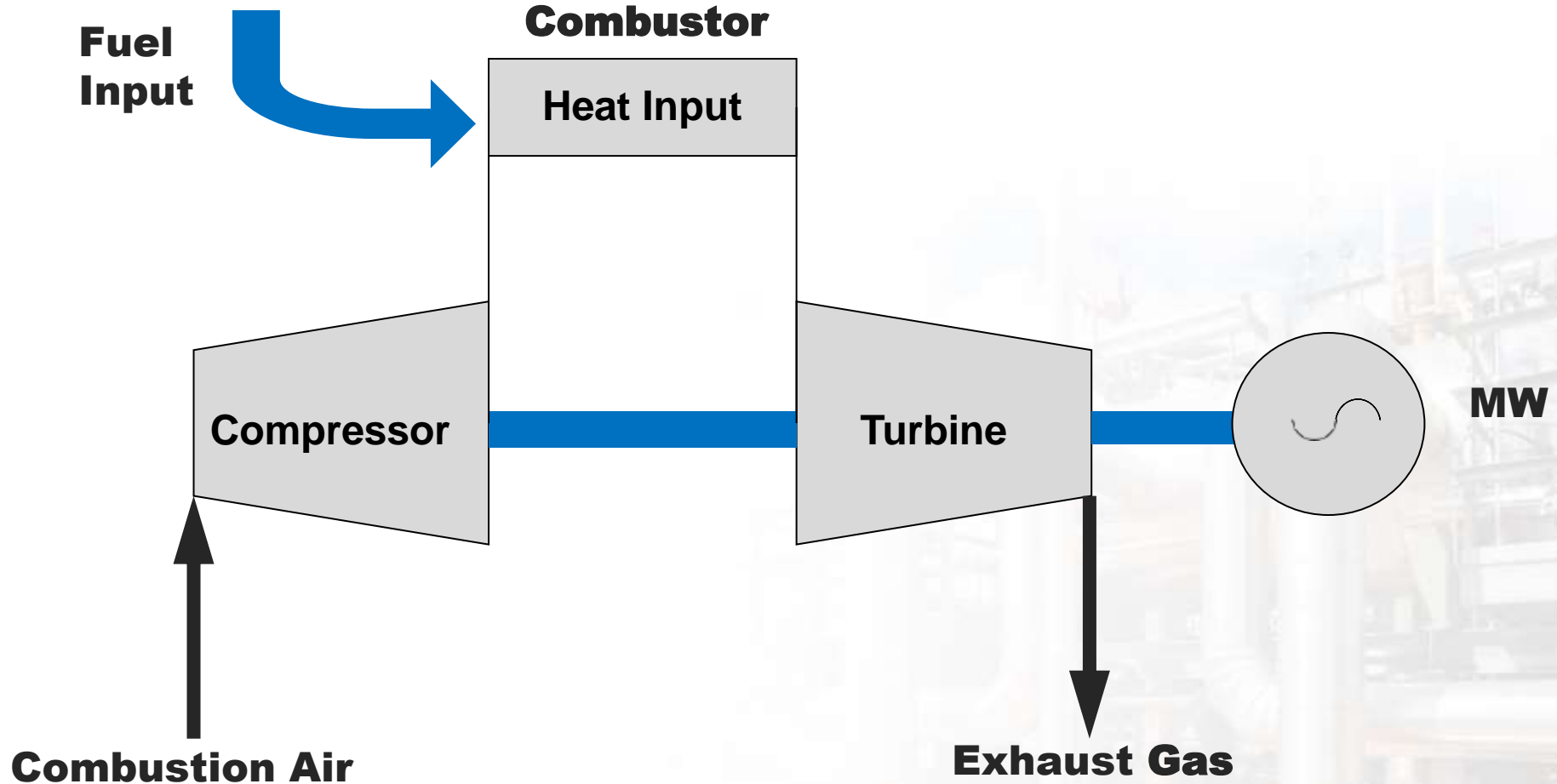


CF6 Turbofan Aircraft Engine

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Open Cycle: Working Fluid



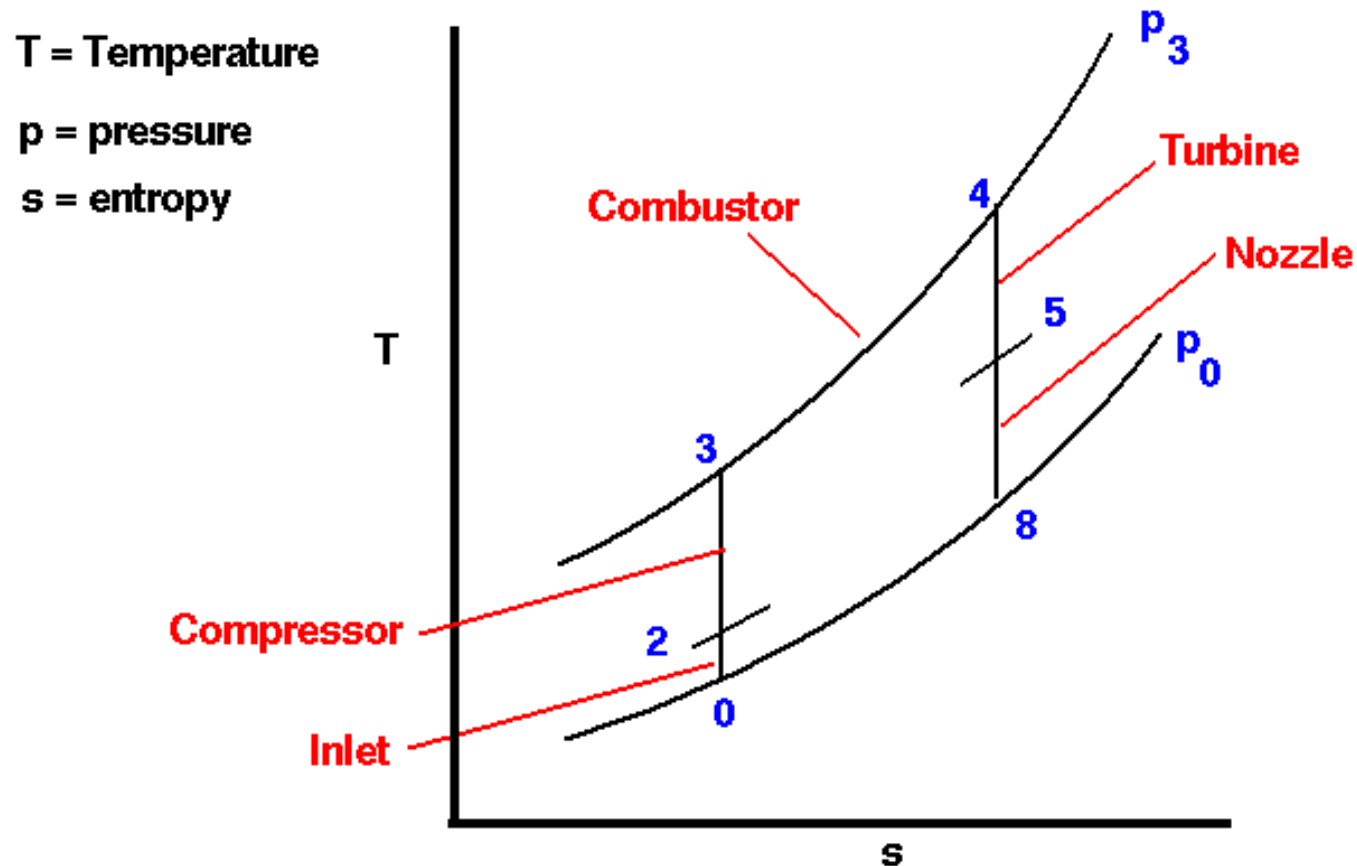
- Heat supplied internally
- Working fluid passes through only once

Thermodynamic Principles of Operation



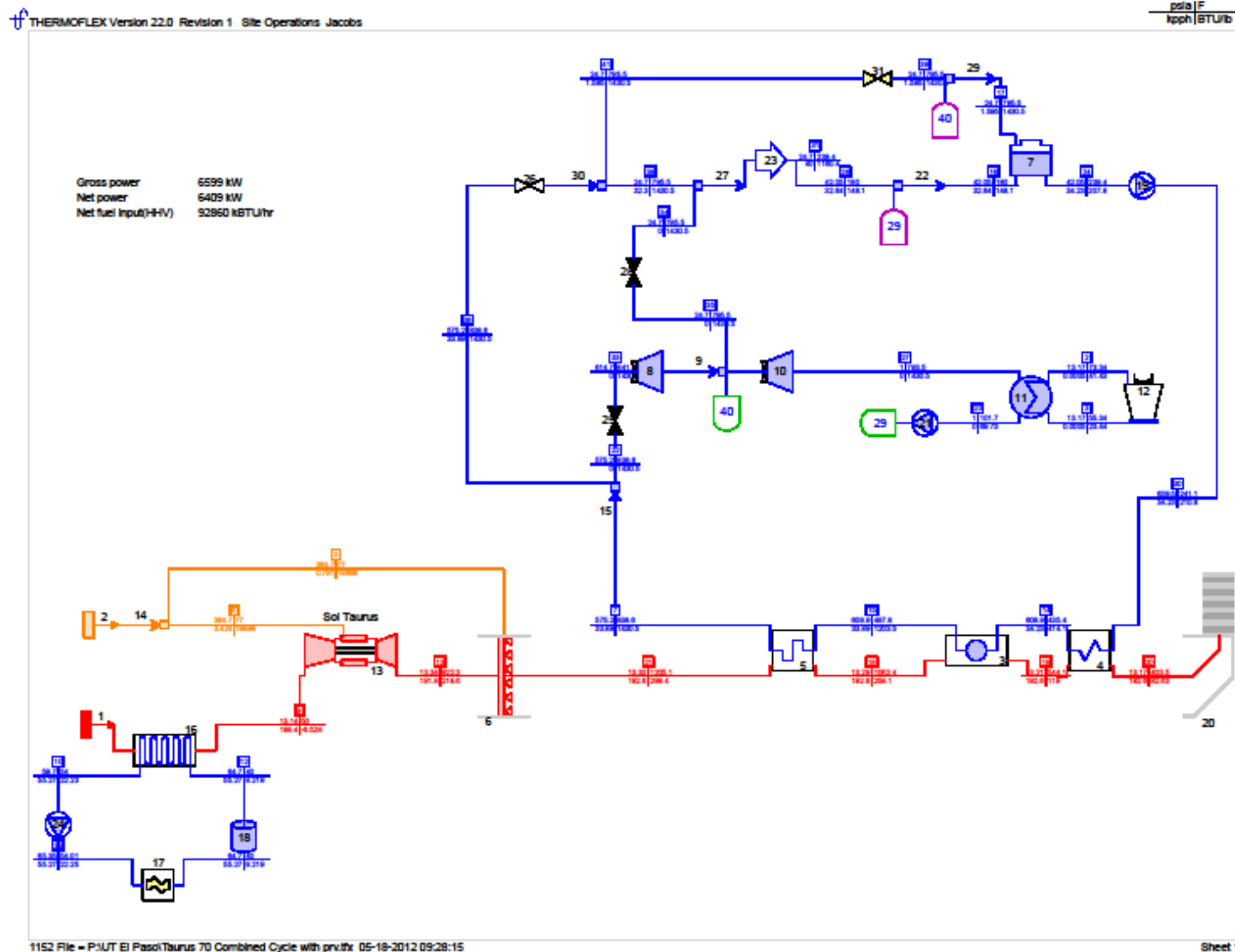
Ideal Brayton Cycle ***T-s diagram***

**Glenn
Research
Center**



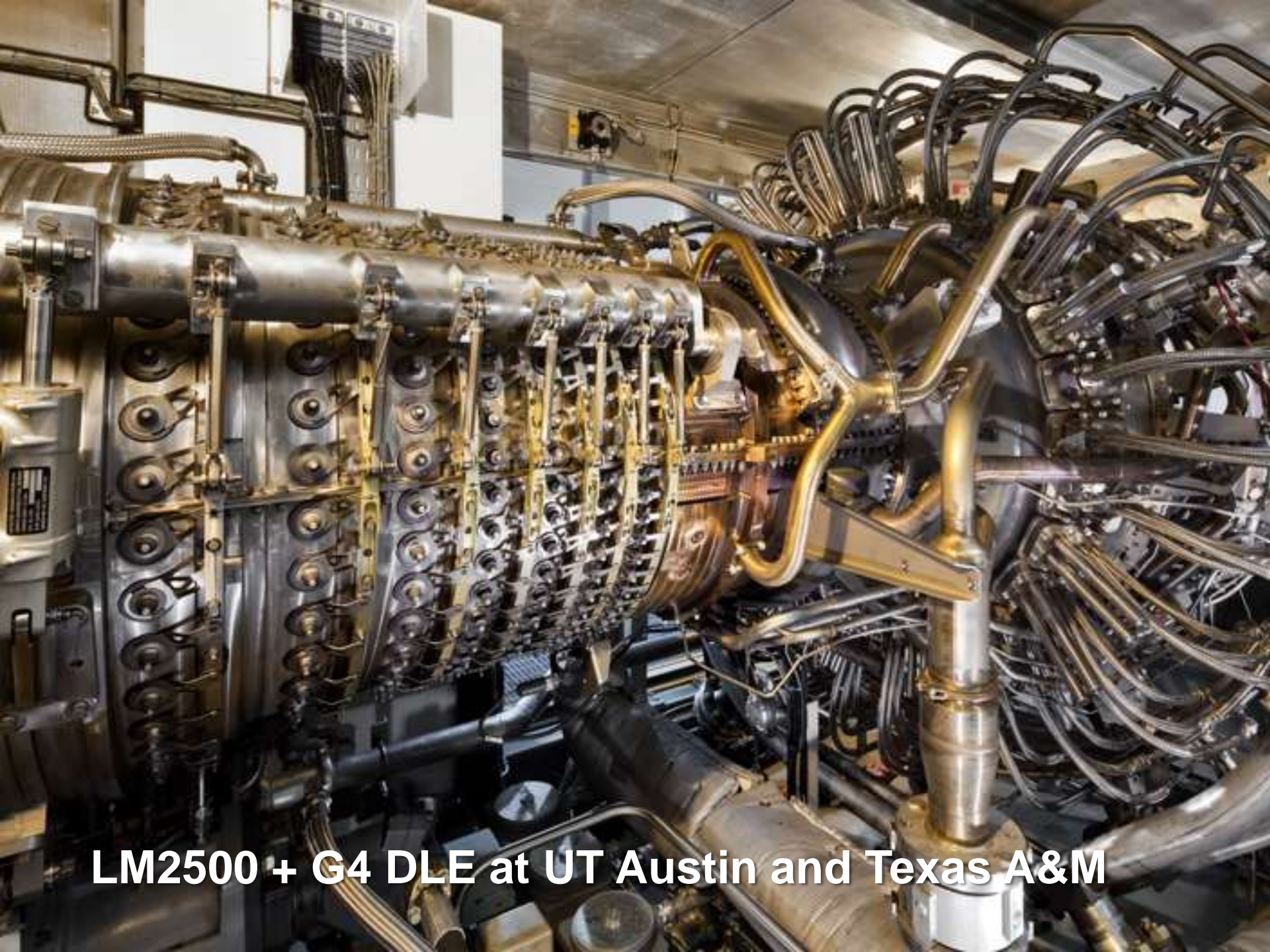
JACOBS®

Thermoflex Heat Balance Modeling Software



Why use an aircraft-based gas turbine?

- **Predicated** on an established and successful product
- **High** simple cycle efficiency (44%+)
- **High-power-low-weight ratio**, smaller and lighter than industrial frame combustion turbines
- **Modest** foundation and building requirements or outdoor installation
- **Direct-drive capability** for either 50 or 60 Hz power generation
- **Ease and speed** of maintenance



LM2500 + G4 DLE at UT Austin and Texas A&M



UT Austin GT-10 Power Plant Annex Building



UT Austin GT-10 HRSG and Stack



LM2500 + G4 DLE at Texas A&M

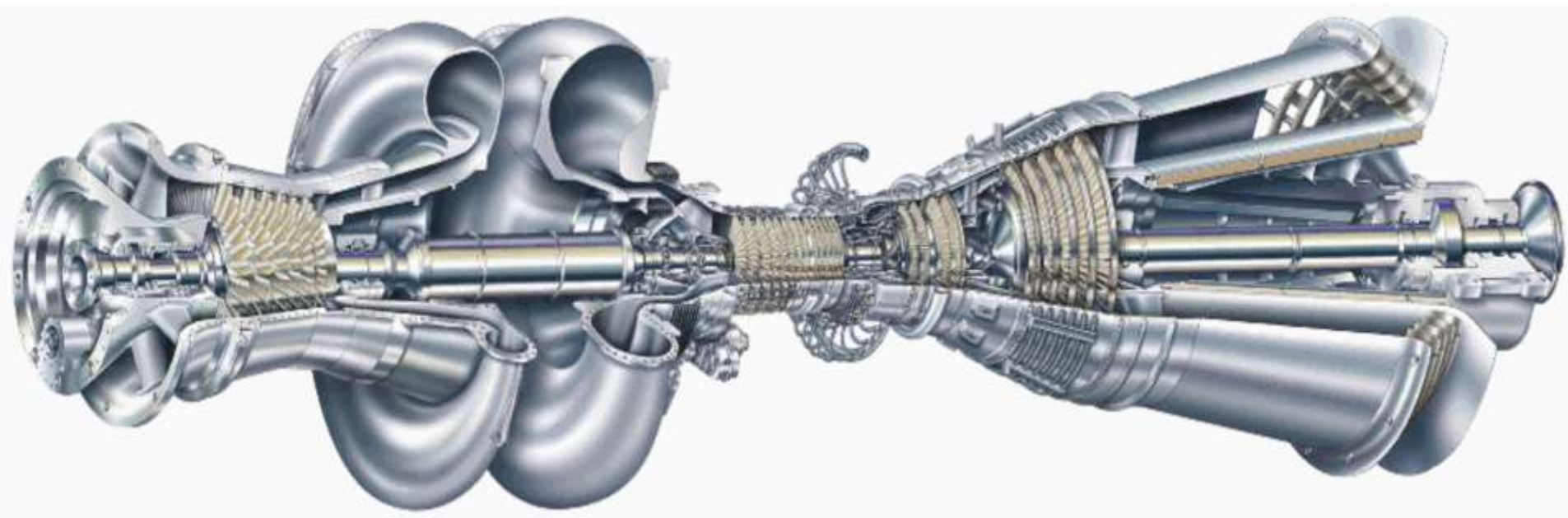


New Control Room at Texas A&M



USS Ticonderoga CG 47 (4xLM2500 Turbines)

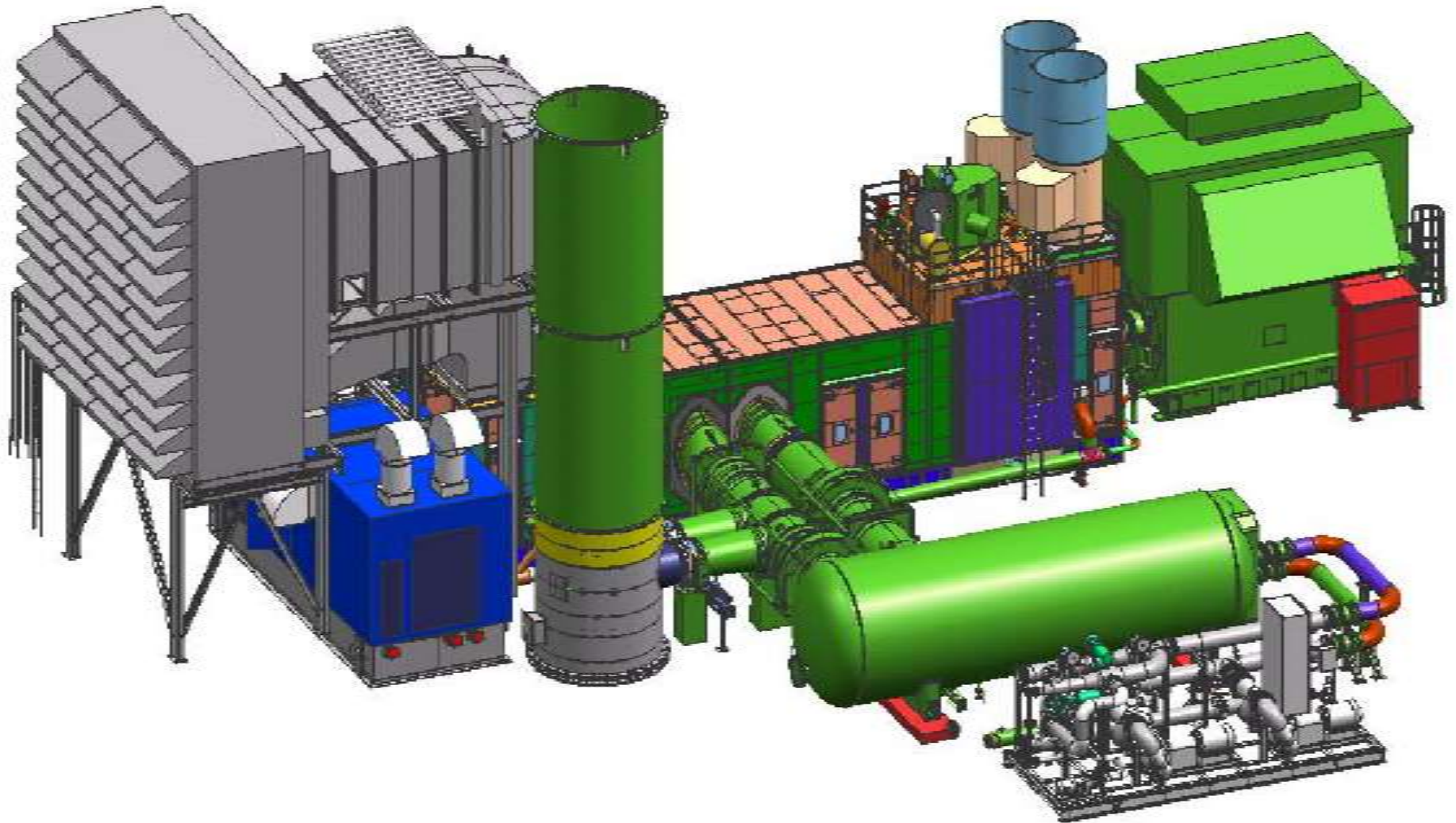
General Electric LMS100



Simple Cycle Configuration:
100 MW in 10 minutes

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General Electric LMS100

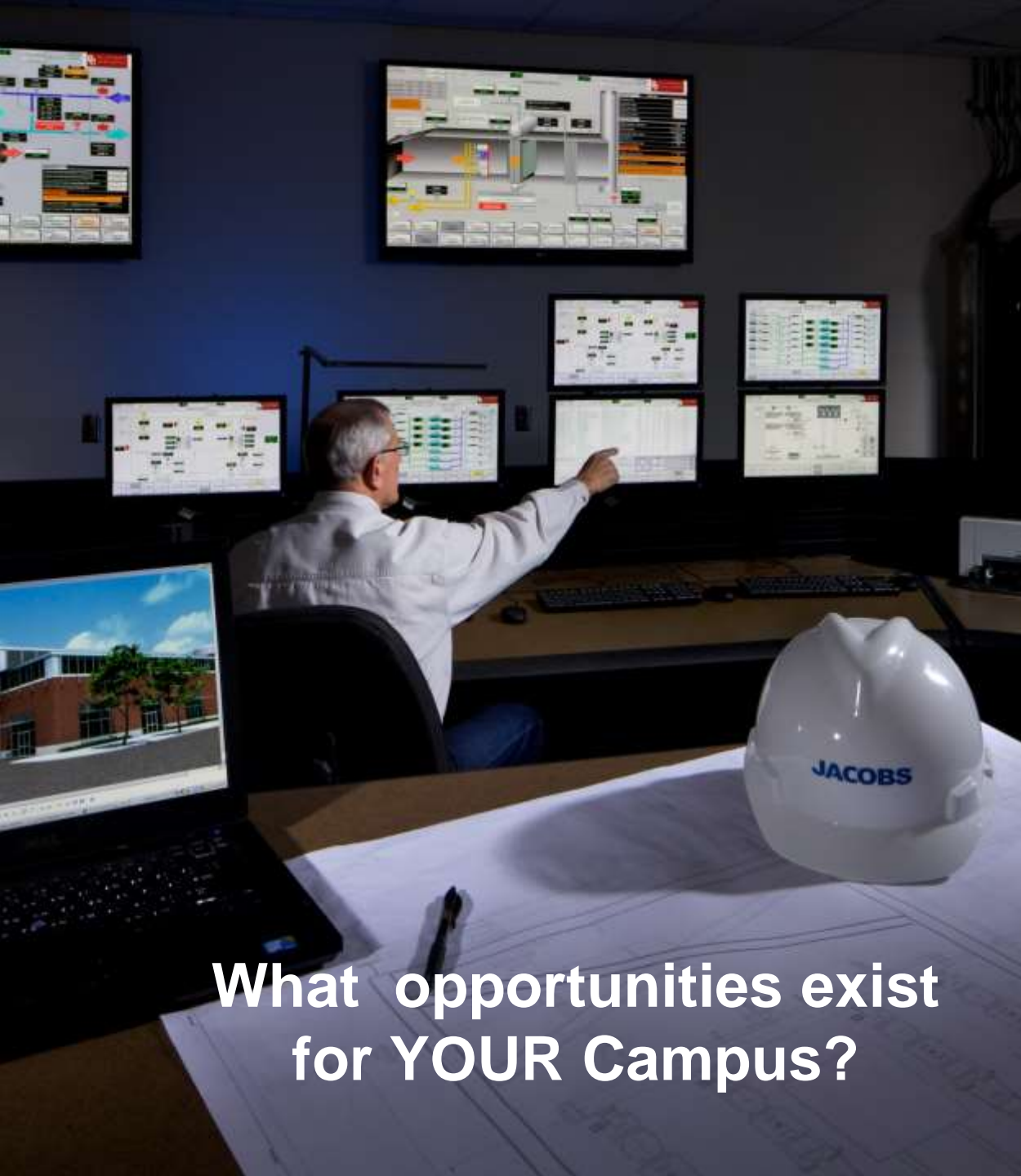


Aging Infrastructure and Utilities



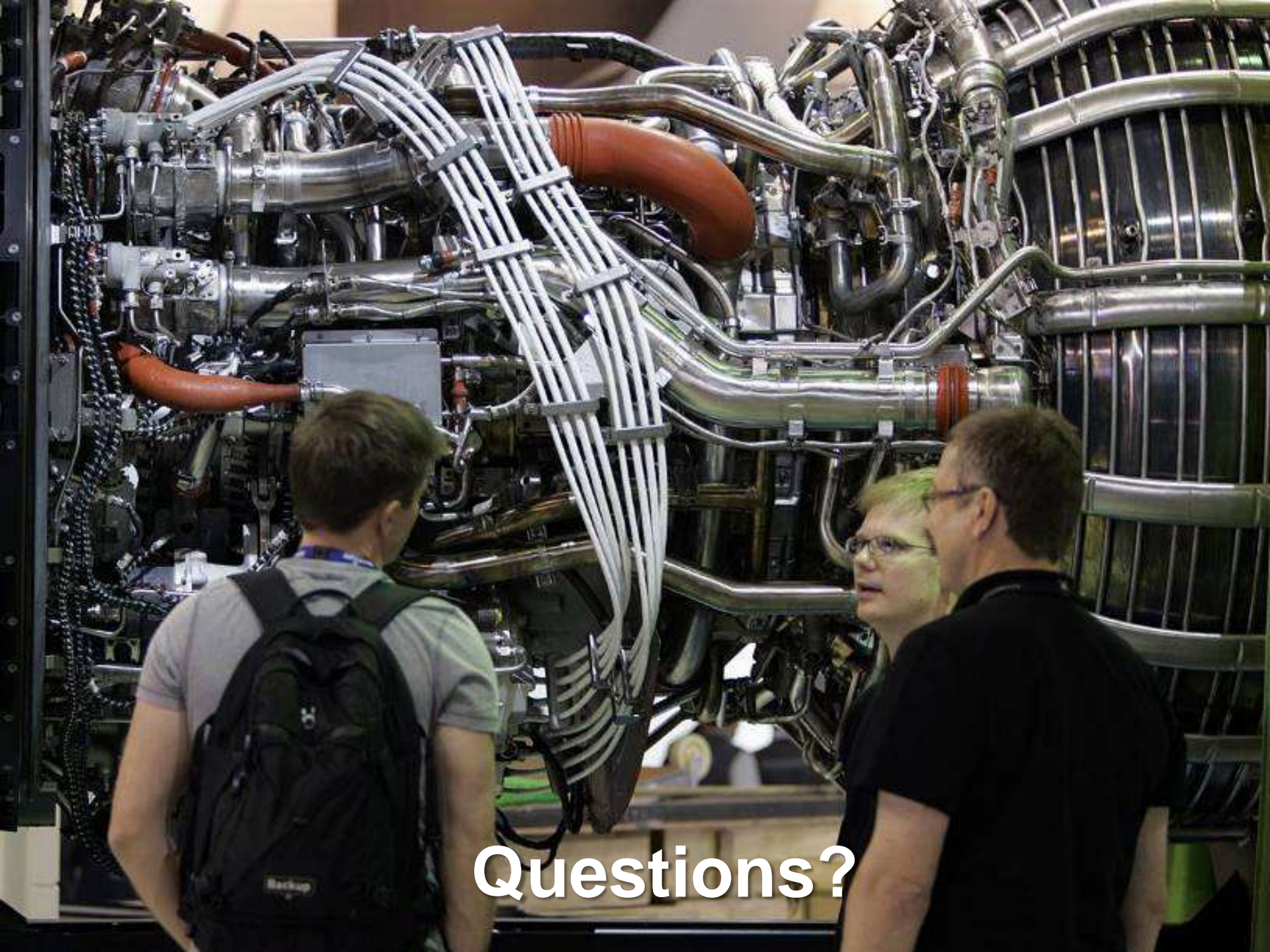
Making a Difference at Your Campus

- **Reduce Your Carbon Footprint**
- **NOx Reductions to 2.5 ppmv**
- **High Thermal Efficiencies +44%**
- **Rapid Start & Ramp Up**
- **Clean Burning Natural Gas Fuel**
- **Dual Fuel Options for Flexibility and Backup**



**What opportunities exist
for YOUR Campus?**





Questions?