Principles of Mechanical Engineering

- Every science has a *unique* vocabulary *associated with* it, and mechanical engineering is no exception. *Precise* definition of basic concepts forms a *sound foundation* for the *development* of a science and *prevents* possible misunderstandings.

- In this lecture, one of the main *branches* of mechanical engineering science, namely ***thermal-fluid sciences*** are reviewed.

What is engineering and what does engineer?

- Engineering is to design useful and economical systems for people by use of resources already existing in nature.

- engineer is educated in the mathematical and natural sciences,
- the engineer *applies* the knowledge to design and develop *usable devices*, *structures* and *processes*.

What is mechanical engineering and what does a mechanical engineer?

- It is *concerned with machinery*, *power*, *manufacturing* or *production*, *heat* and *mass transfer processes* such as *evaporation*, *condensation*, *conduction*, *convection*, *radiation*, *absorption*, *humidification* and *drying*.

  Design and manufacture,
- machine *tools*,
- *turbines*,
- *compressors*,
- printing presses,
- food processors,
- *air-conditioning* and *refrigeration* systems,
- engines for cars and aircrafts,
- diesel locomotives,
- trucks and public *transportation vehicles*,
- helicopters,
- hovercrafts,
- tractors etc.

Mechanical Engineering **Mechanical Engineer**

Mechanical Engineering:

Concerning with

*Machinery *Power *Manufacturing and Production

*Heat and Mass Transfer *Mechanics *Robotics

Sample subjects

*Design and manufacture machine tools *Engines *Turbines

*Compressors *Food processors *Air-conditioning

*Public Transportations *Helicopters *Aerodynamics

…….etc.

Mechanical Engineers do the machines and these machines ;

Move and lift loads, transport people and goods, produce energy and convert it to other form.

Chemical Energy ======> Mechanical Energy (Engines)

Mechanical energy ======> Electric Energy (Generators)

Engine

Generator

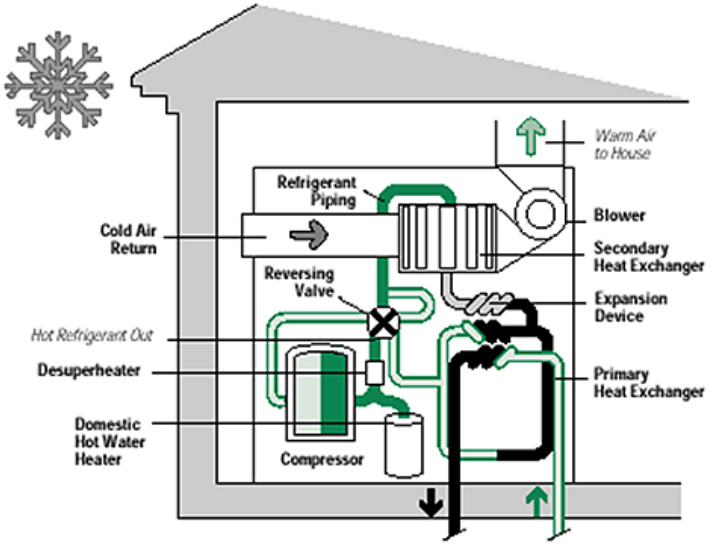
Mechanical Engineering Disciplines

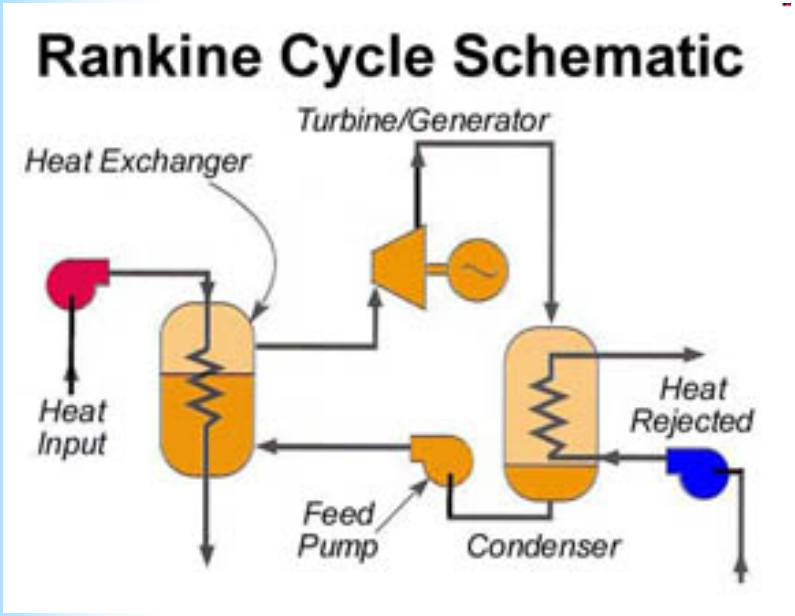
In our Department, we have 6 main Disciplines ;

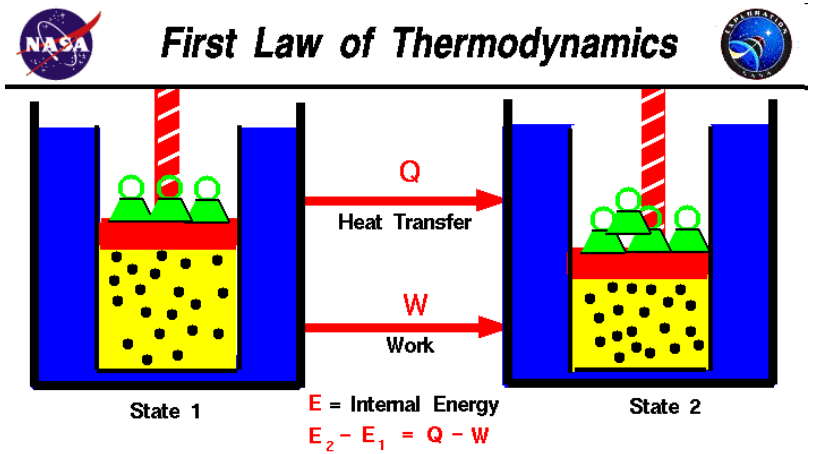
1. THERMODYNAMICS
2. ENERGY
3. AUTOMOTIVE
4. MECHANICS
5. CONSTRUCTION AND MANUFACTURING
6. THEORY OF MACHINES

THERMODYNAMICS DISCIPLINE
Research Interests

- Properties of matter
- Energy
- Heat
- Air-conditioning
- Cycles



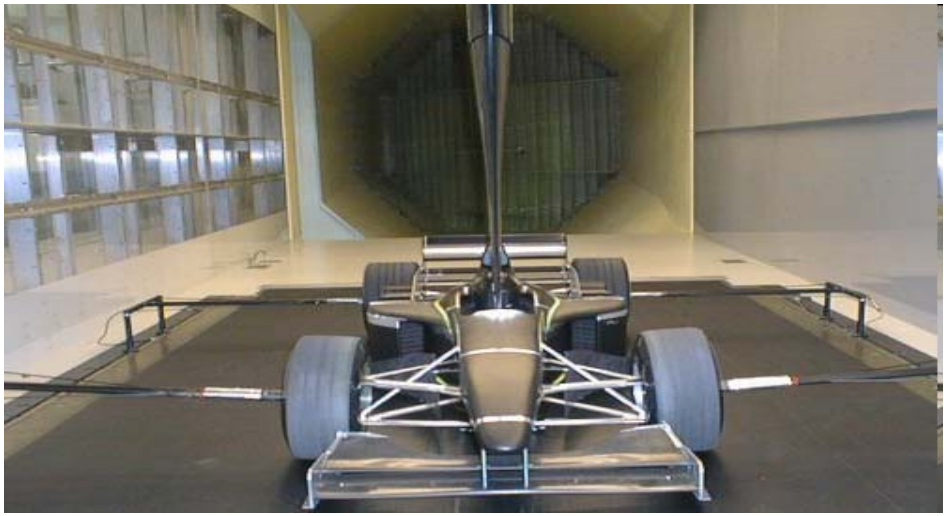


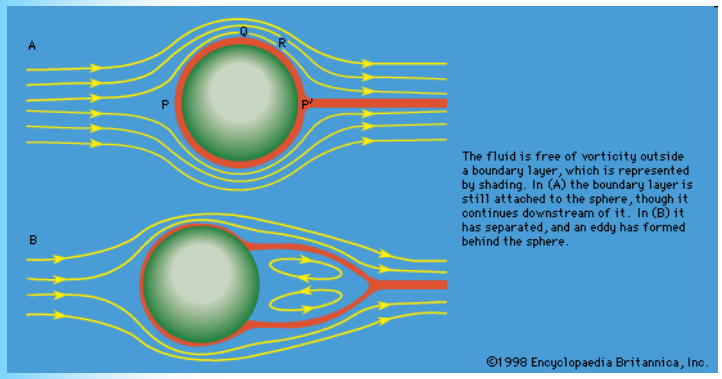


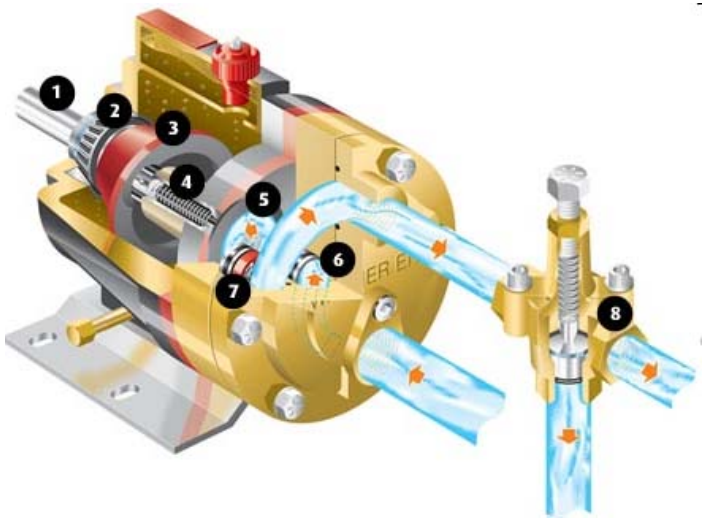
Any thermodynamic system in an equilibrium state possesses a state variable called the internal energy (E). Between any two equilibrium states, the change in internal energy is equal to the difference of the heat transfer into the system and work done by the system.

ENERGY DISCIPLINE
Research Interests

- Fluid Mechanics
- Aerodynamics
- Flow control
- Wind energy
- Fluid dynamics
- Two phase flows







AUTOMOTIVE DISCIPLINE
Research Interests

Internal Combustion Engines

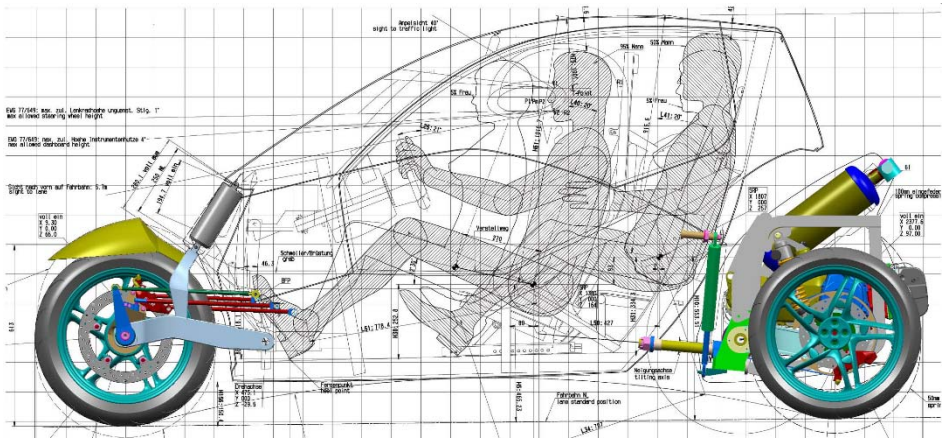
Vehicle Technology

Vehicle Systems

Alternative Fuels

Hydrogen Based Vehicles

Vehicle Dynamics



Low pressure steam turbine wheel.
(Courtesy of Carolina Power and Light Company)

Overview of a steam turbine and main generator for a nuclear steam power station.
(Courtesy of Carolina Power and Light Company)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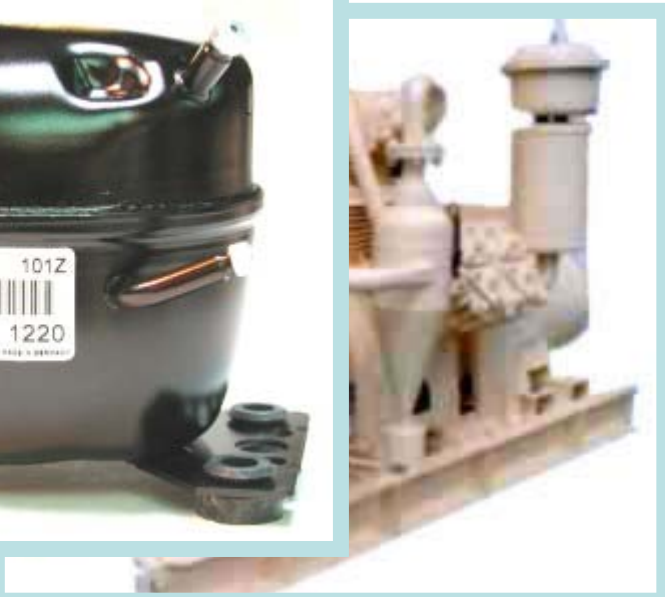

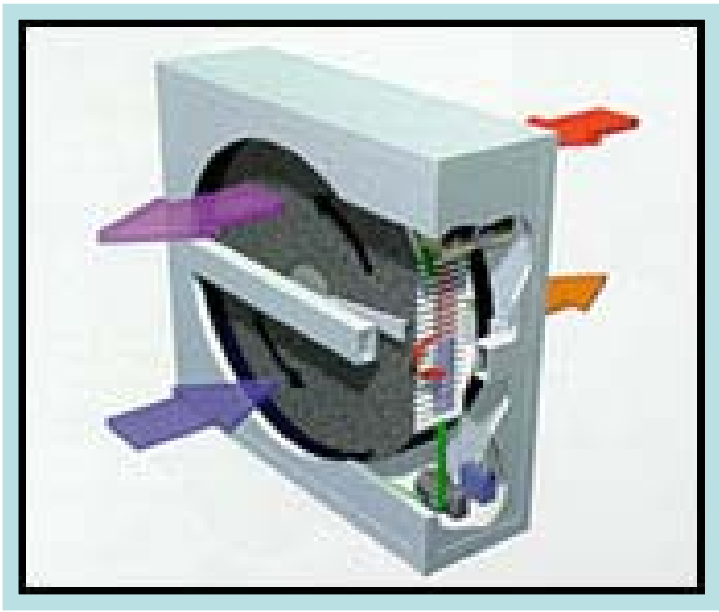

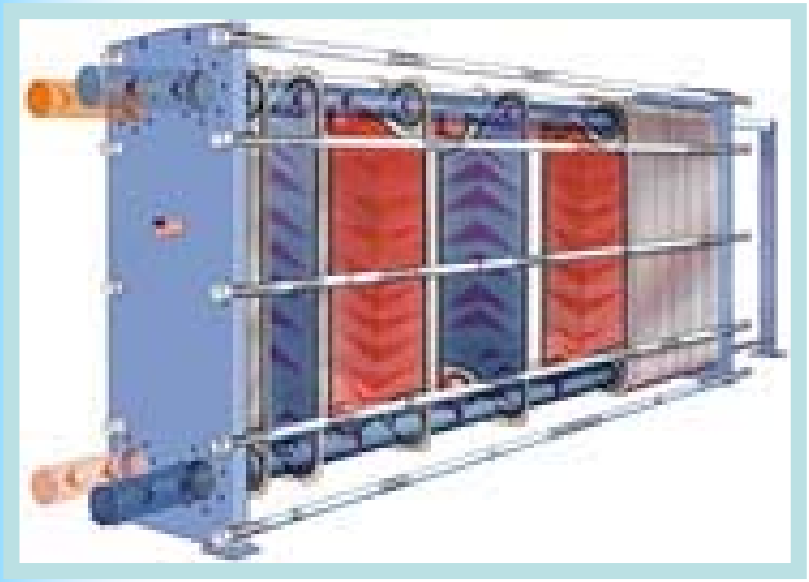


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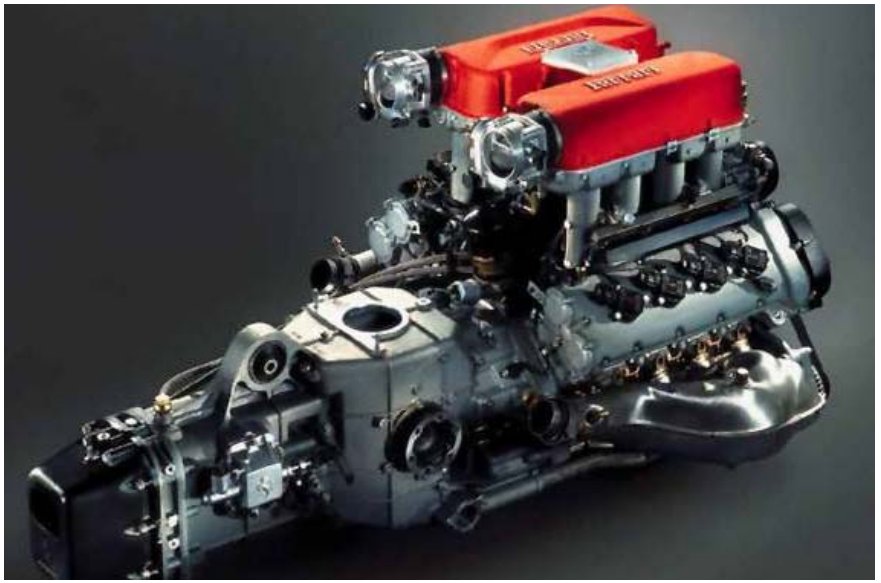
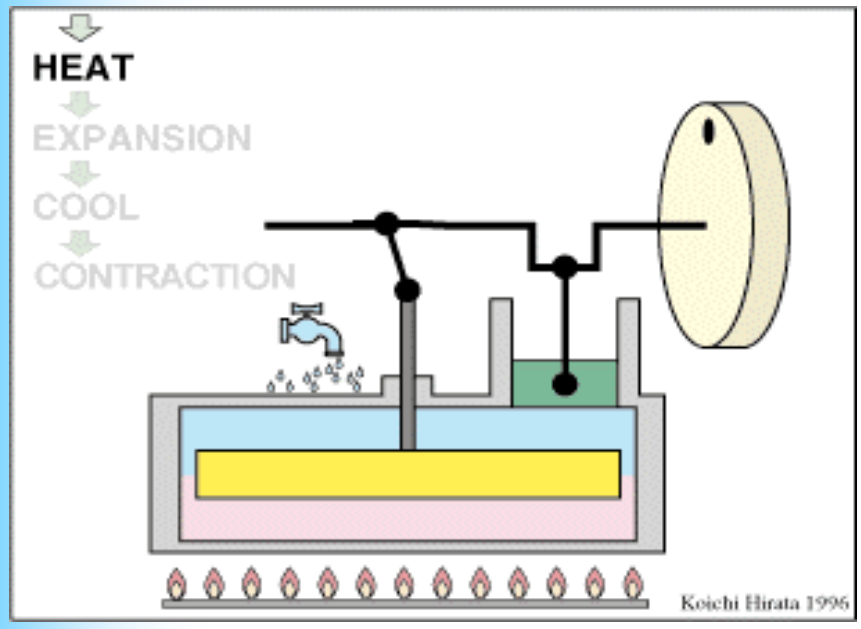
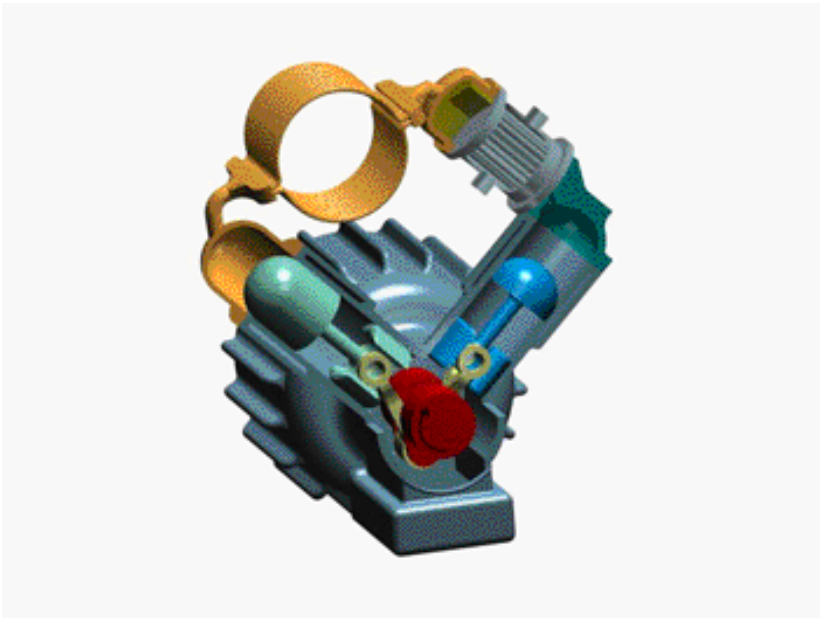
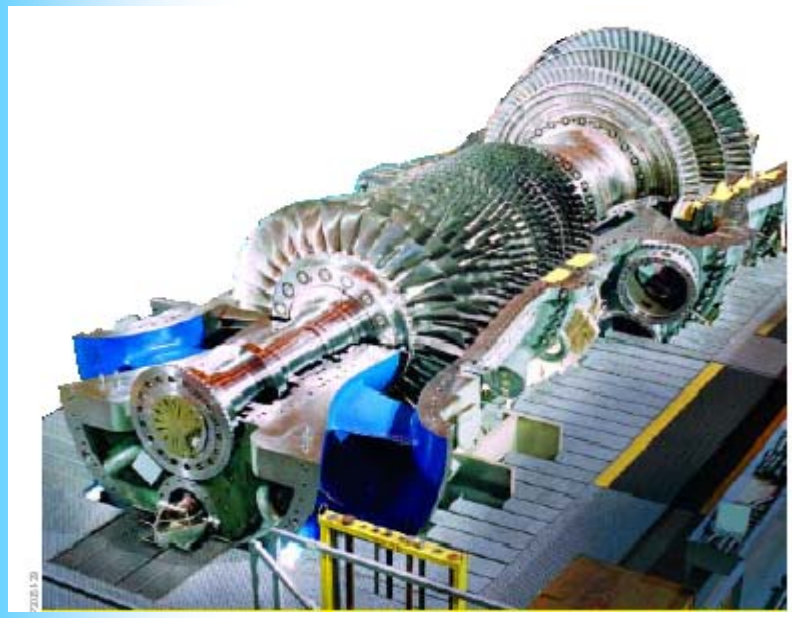
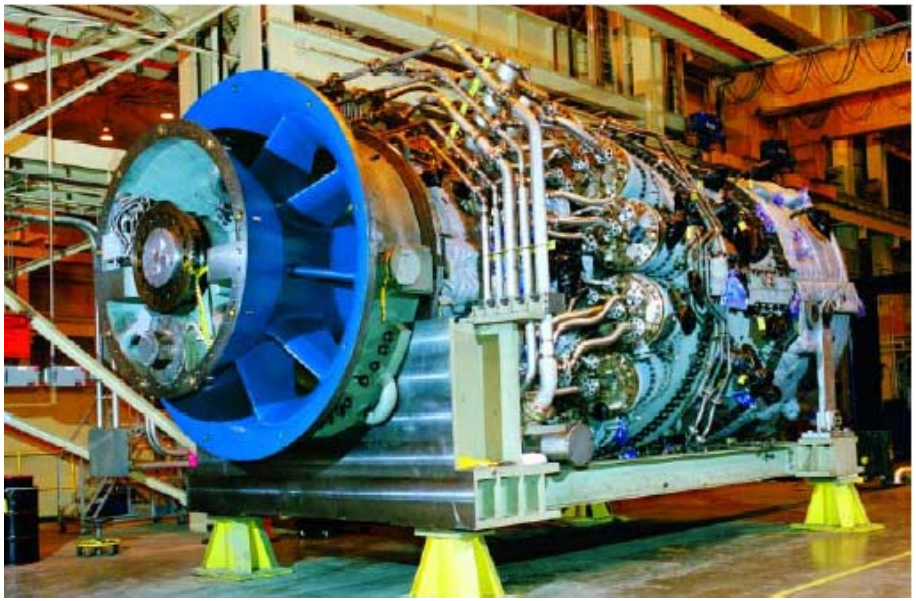
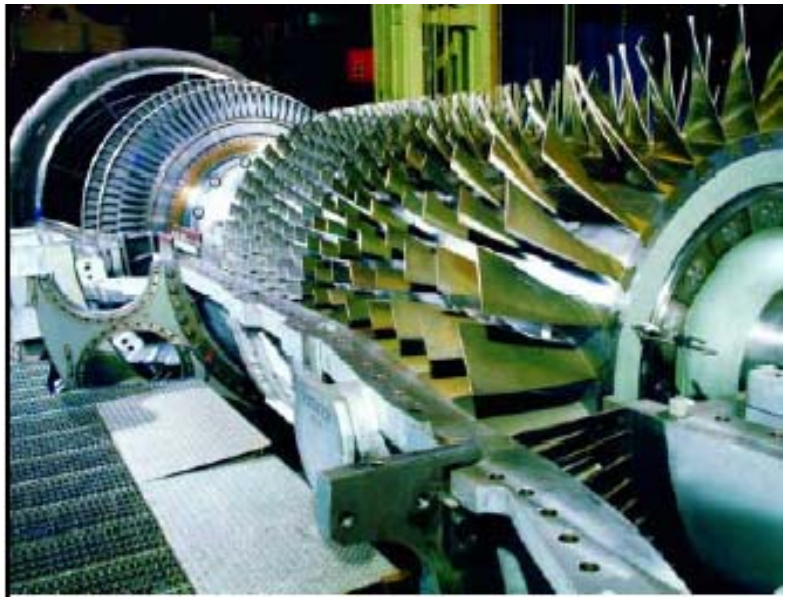


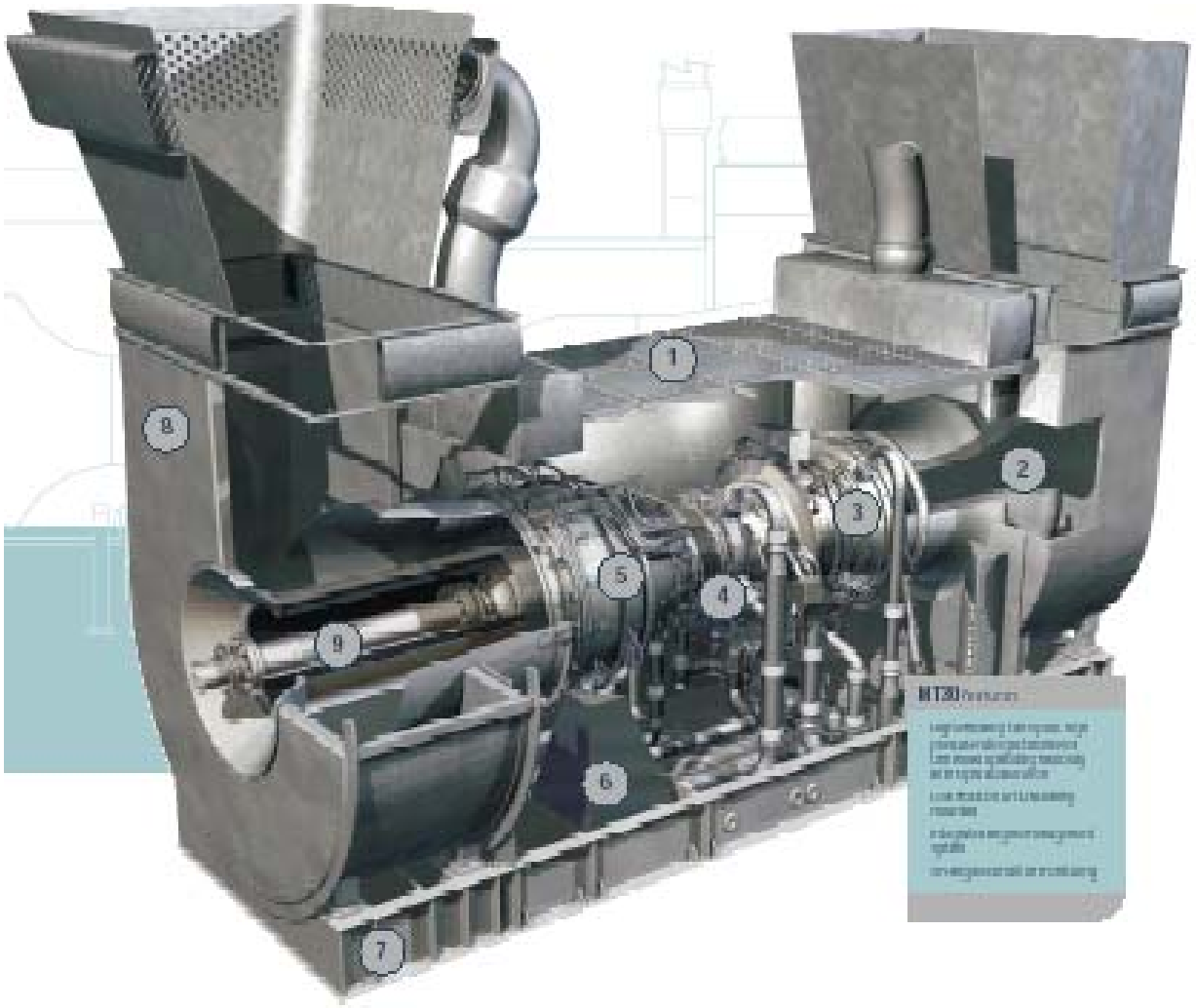

HEAT
EXPANSION
COOL
CONTRACTION
Koichi Hirata 1996







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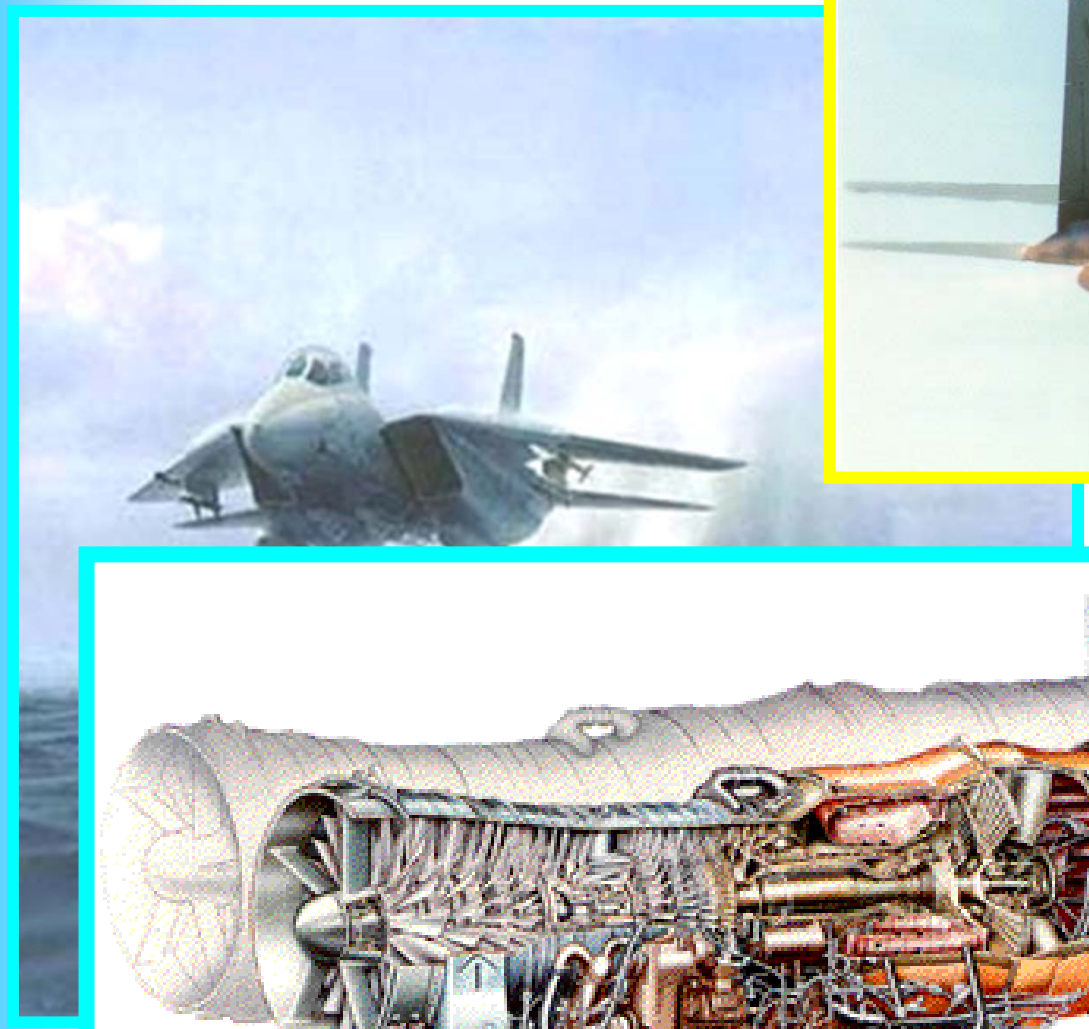

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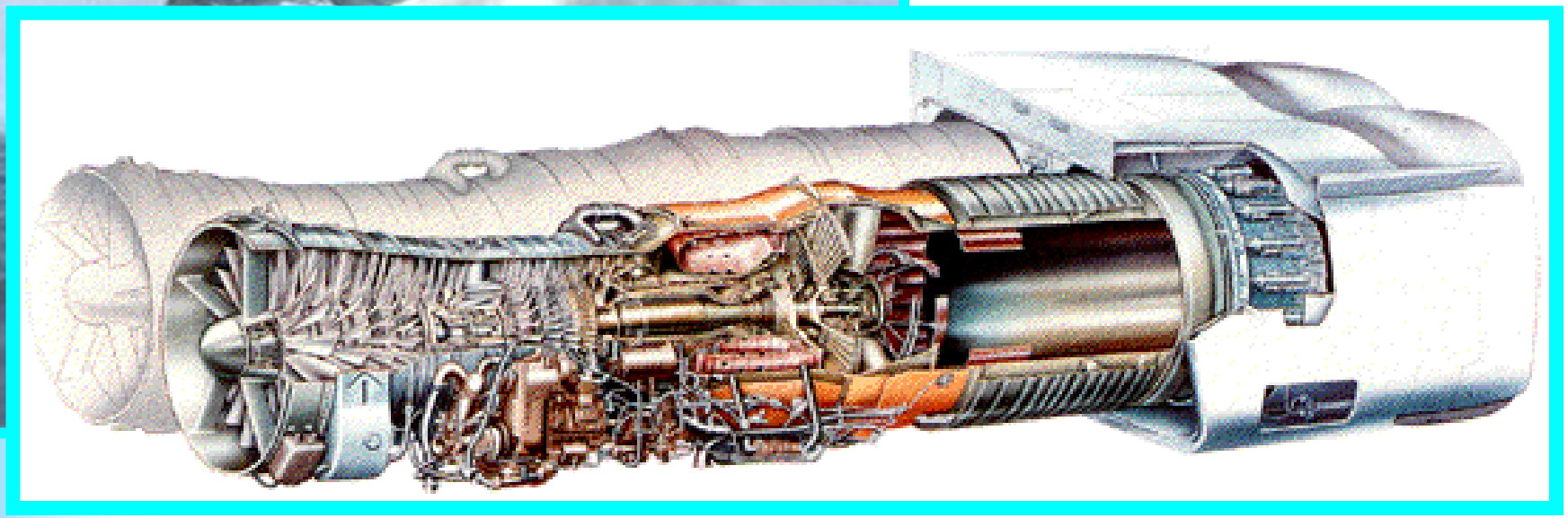
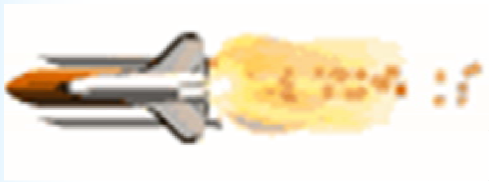
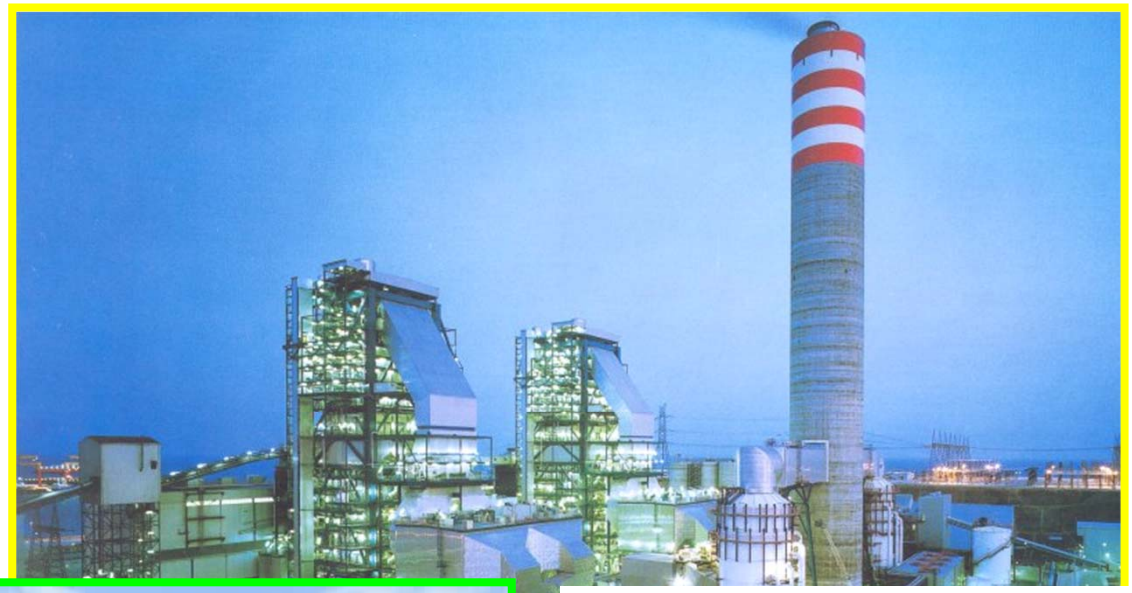




NASA Dryden Flight Research Center Photo Collection
http://www.dfrc.nasa.gov/Gallery/Photo/index.html
NASA Photo: EC04–0092–28 Date: March 27, 2004 Photo By: Jim Ross

A modified Pegasus rocket drops steadily away after release from NASA's B–52B, before accelerating the X–43A over the Pacific Ocean on March 27, 2004.

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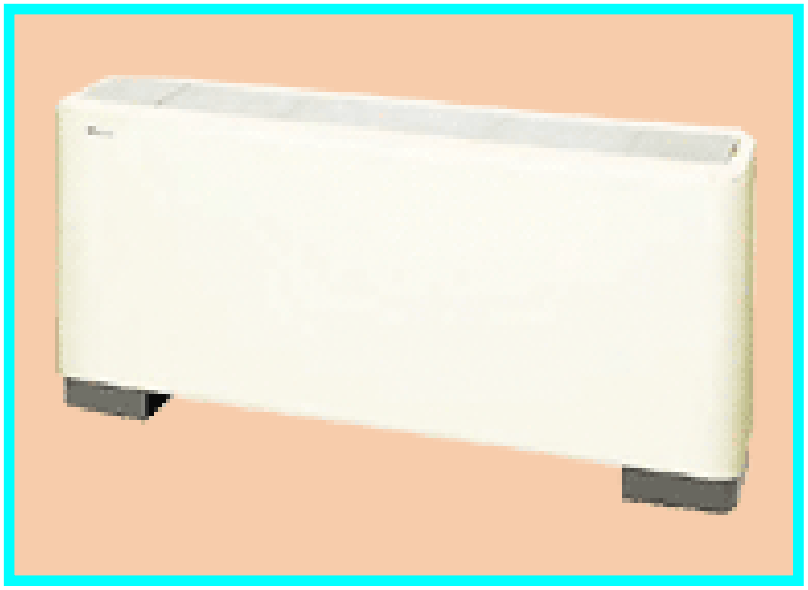

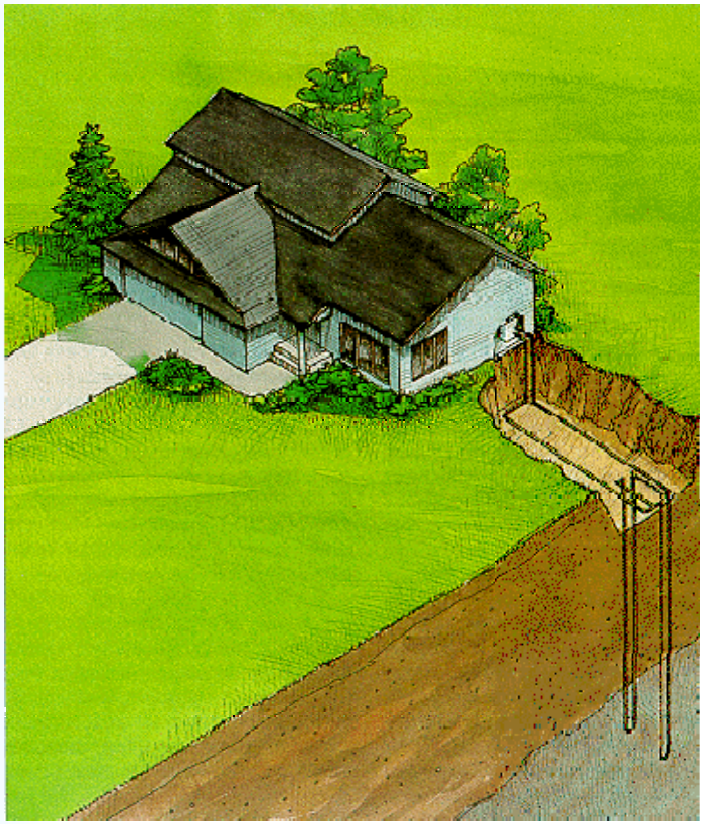

Thermodynamics

- Thermodynamics can be defined as the science of energy.
- From Greek words **therme (heat) and dynamis (power),**
- **to convert heat into power.**

- ***Intensive* Properties : (independent of the size)**
- *pressure P*
- temperature T
- density

- **Extensive properties (depend on the size).**
- Mass m
- volume V