



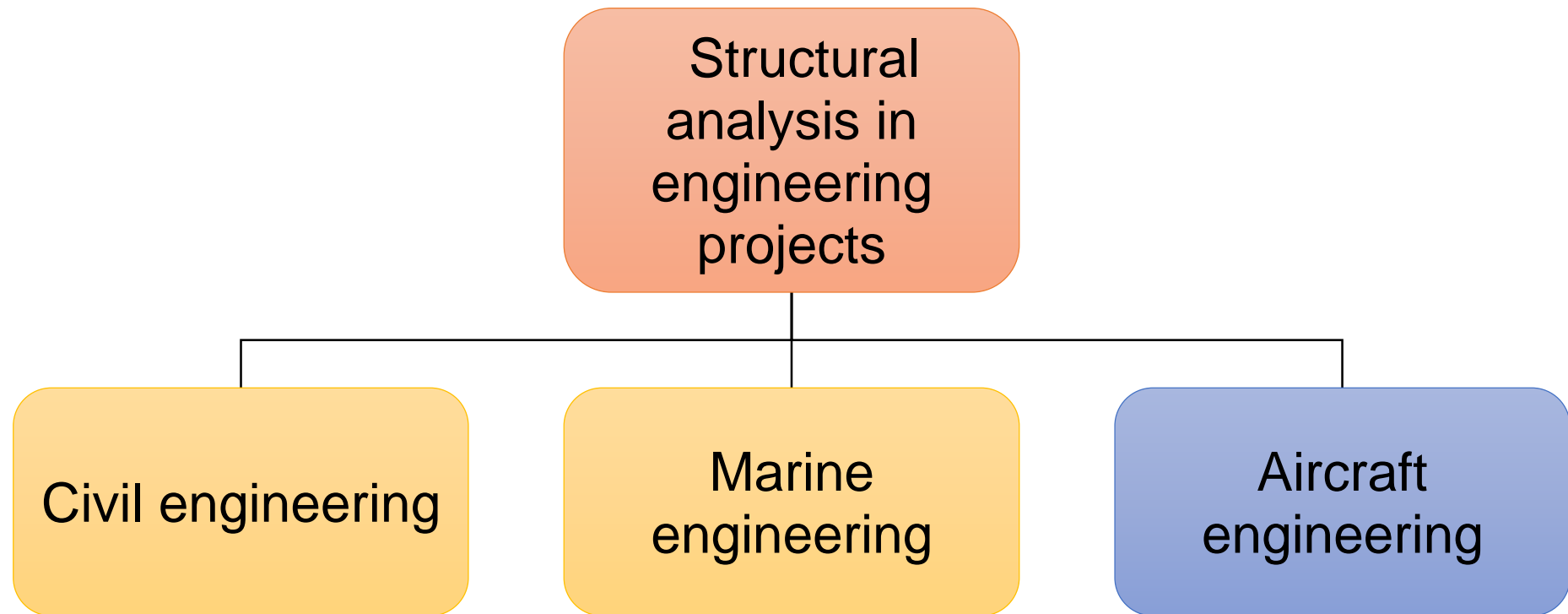
AEE 461 Design of Aircraft Structures

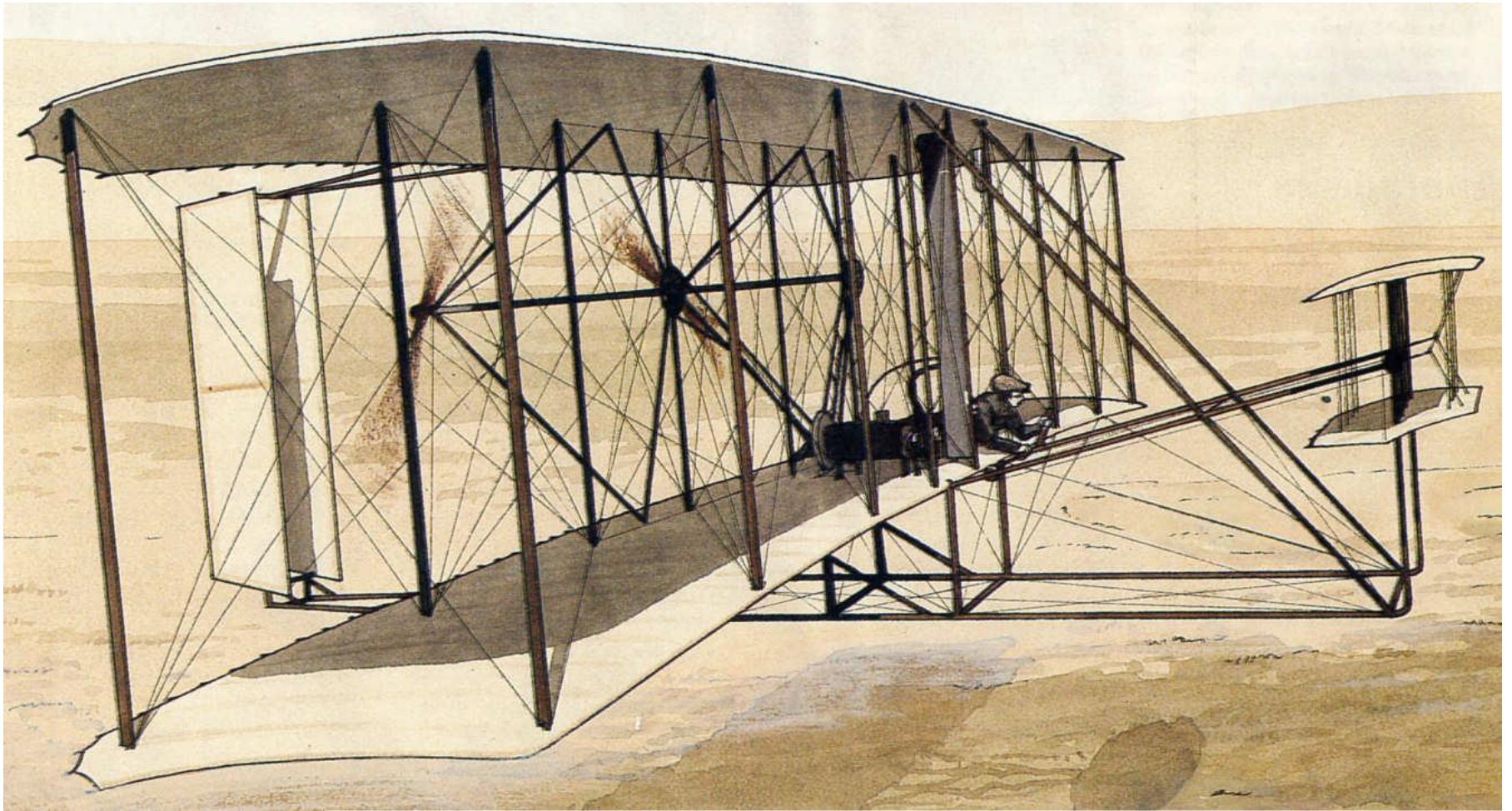
Lecturer: Murat ÇELİK

Lecture #1

Introduction to Structural Analysis

Part 1. The subject. Historical review

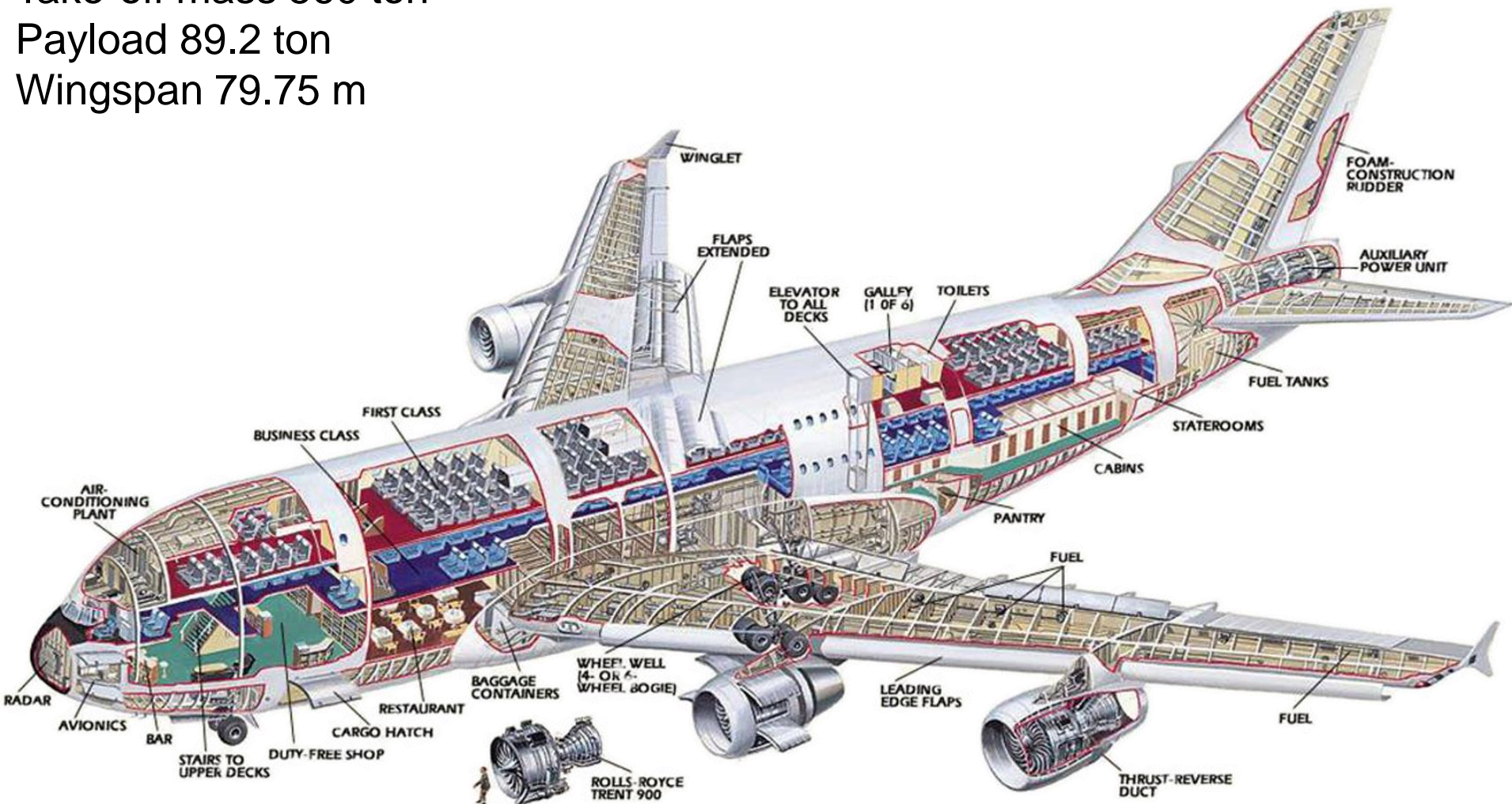




Flyer 1903, Wright brothers, USA
Take-off mass 283 kg, wingspan 12 m

PROGRESS OF AIRCRAFT ENGINEERING (state of the art)

Airbus A380, Europe, 2005
Take-off mass 560 ton
Payload 89.2 ton
Wingspan 79.75 m



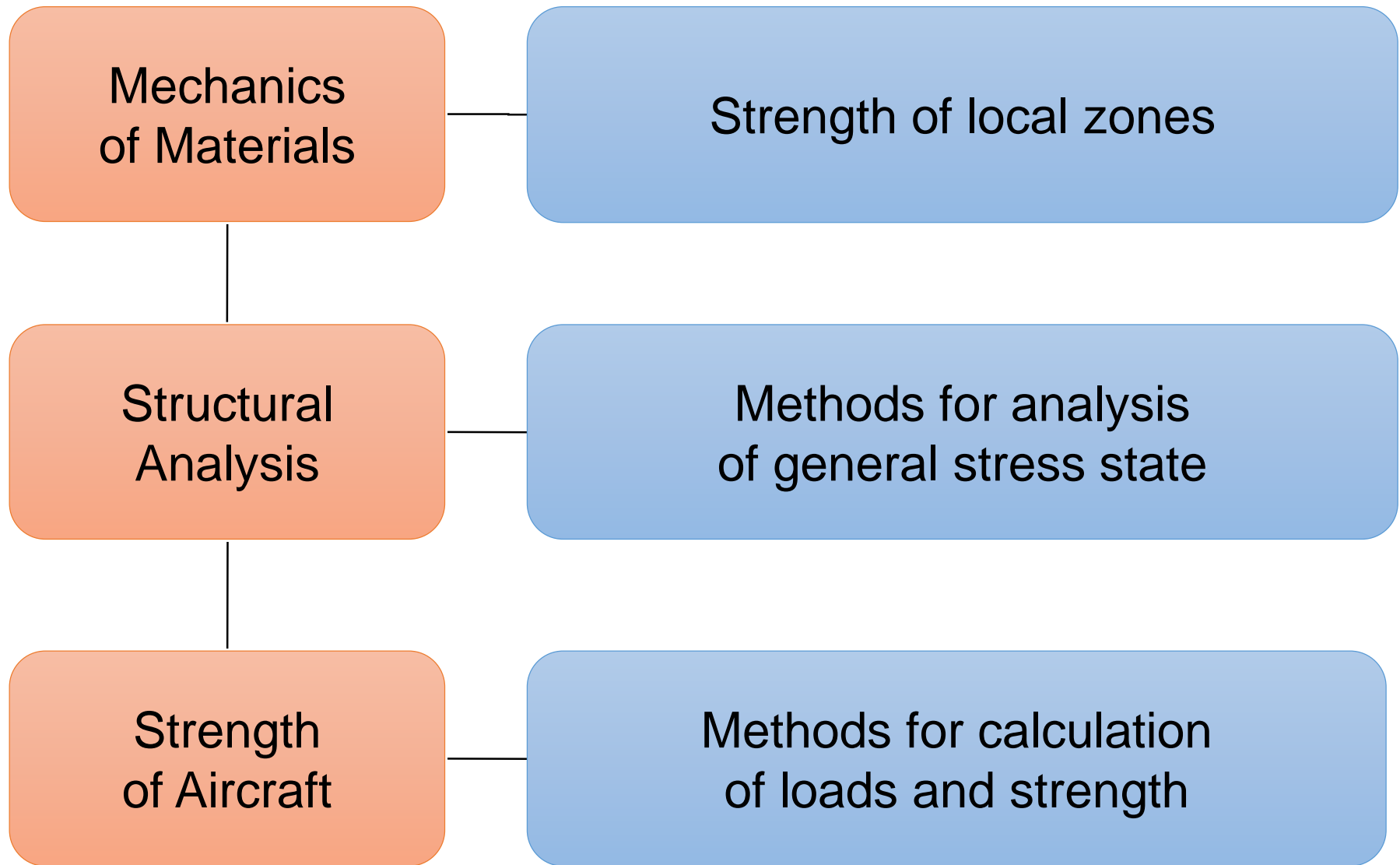
Antonov An-225. Soviet Union, 1988

Take-off mass 640 ton

Payload 250 ton

Wingspan 88.4 m



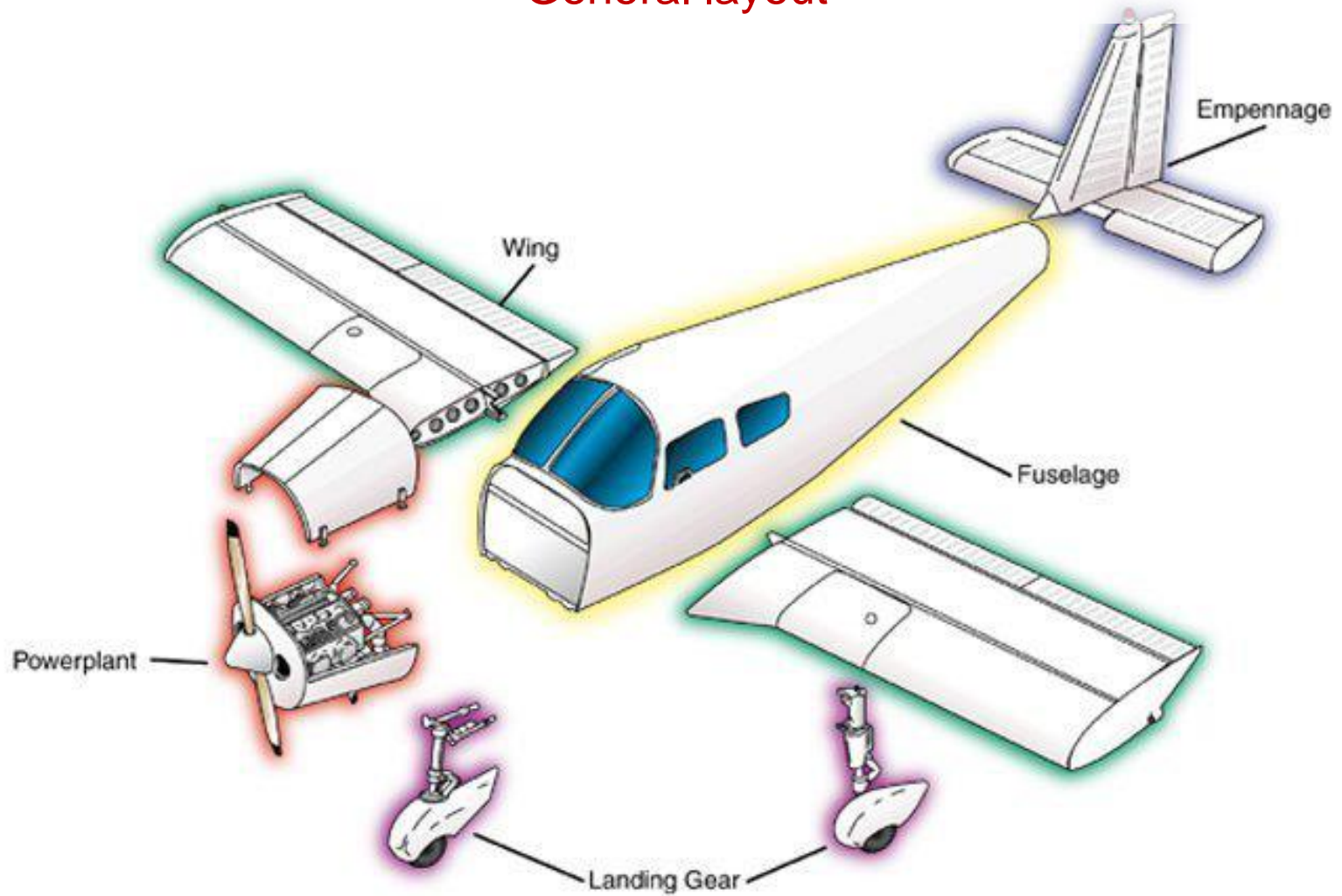


Structural analysis is the determination of the effects of loads on physical structures and their components.

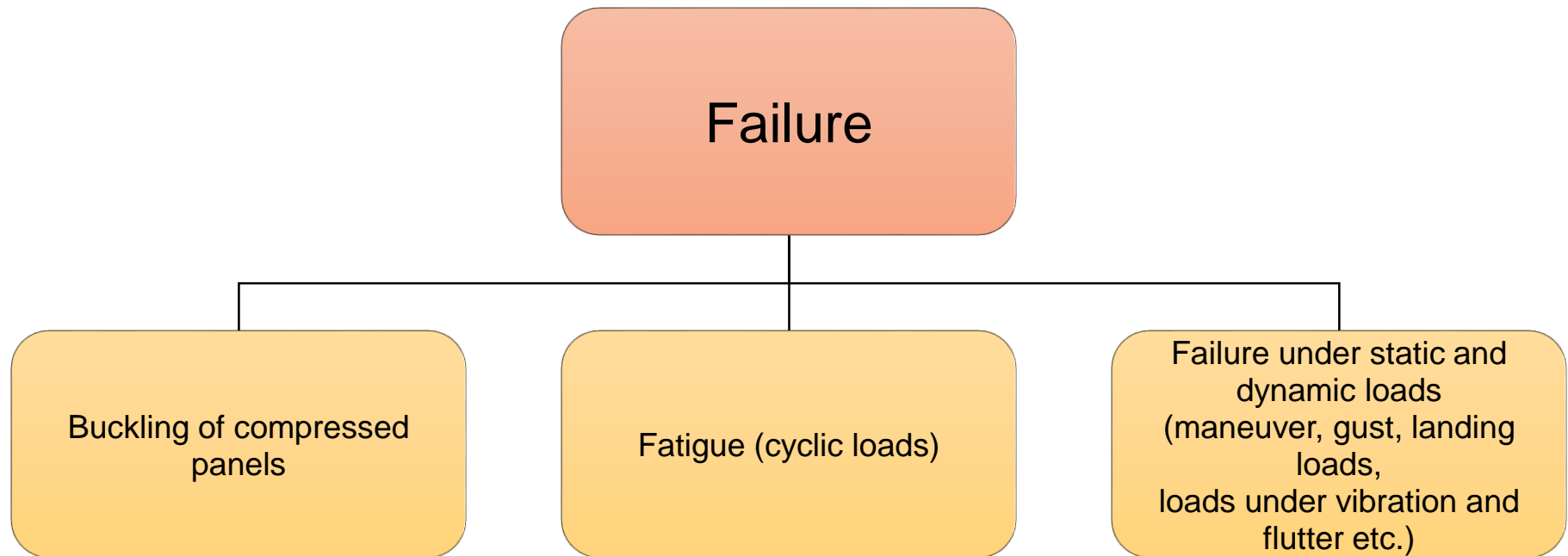
As a science, structural analysis covers principles and methods of strength, rigidity and stability calculations.

The goal of structural analysis is to get the efficient structure and verify its fitness for use.

General layout



The aircraft structure should be strong under complex loading and conditions occurring in service, during the certain service life. Aerospace structures always have very strict weight limitations, that's why calculation methods should be extremely accurate and reliable.



Loads for conventional structures are usually specified in regulatory documents.

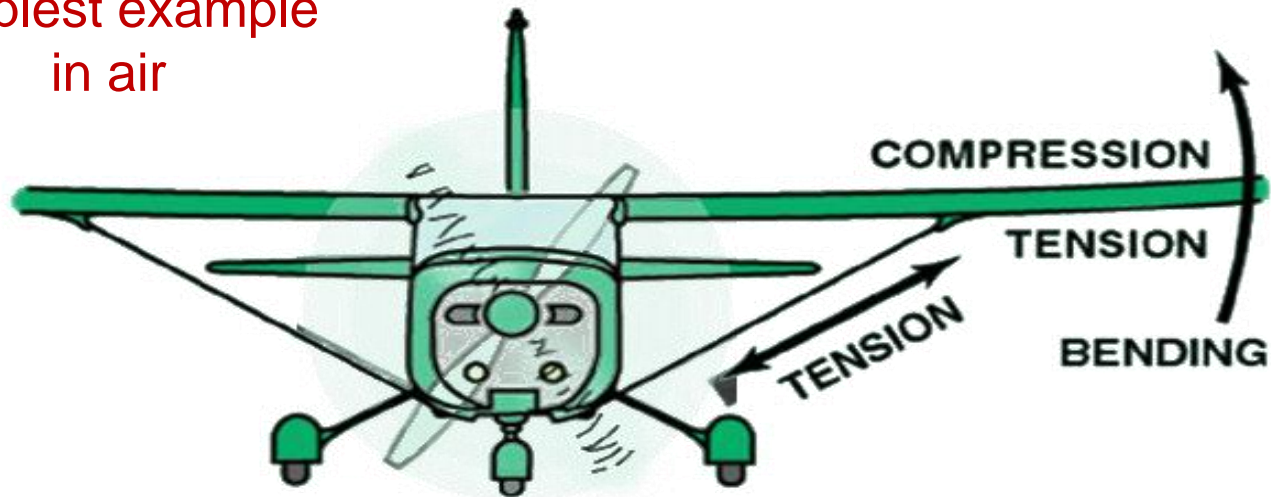
For civil engineering, methods for load calculations are specified in Structural Codes and cover dead, live, impact, wind, snow and earthquake loads, hydrostatic and soil pressures, thermal effects etc.

In aircraft engineering, methods for load calculations are specified in:

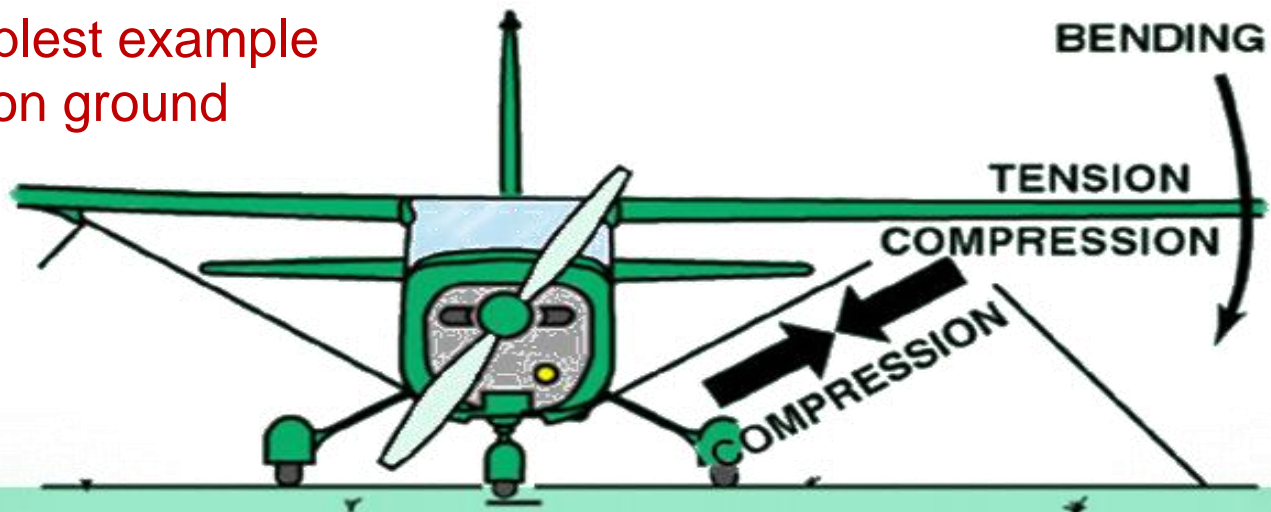
- Federal Aviation Regulations (FAR) for USA;
- Certification Specifications (CS) for Europe;
- Aviation Rules («Авиационные правила», АП in Russian) for post-USSR countries.

They are highly harmonized with one another.

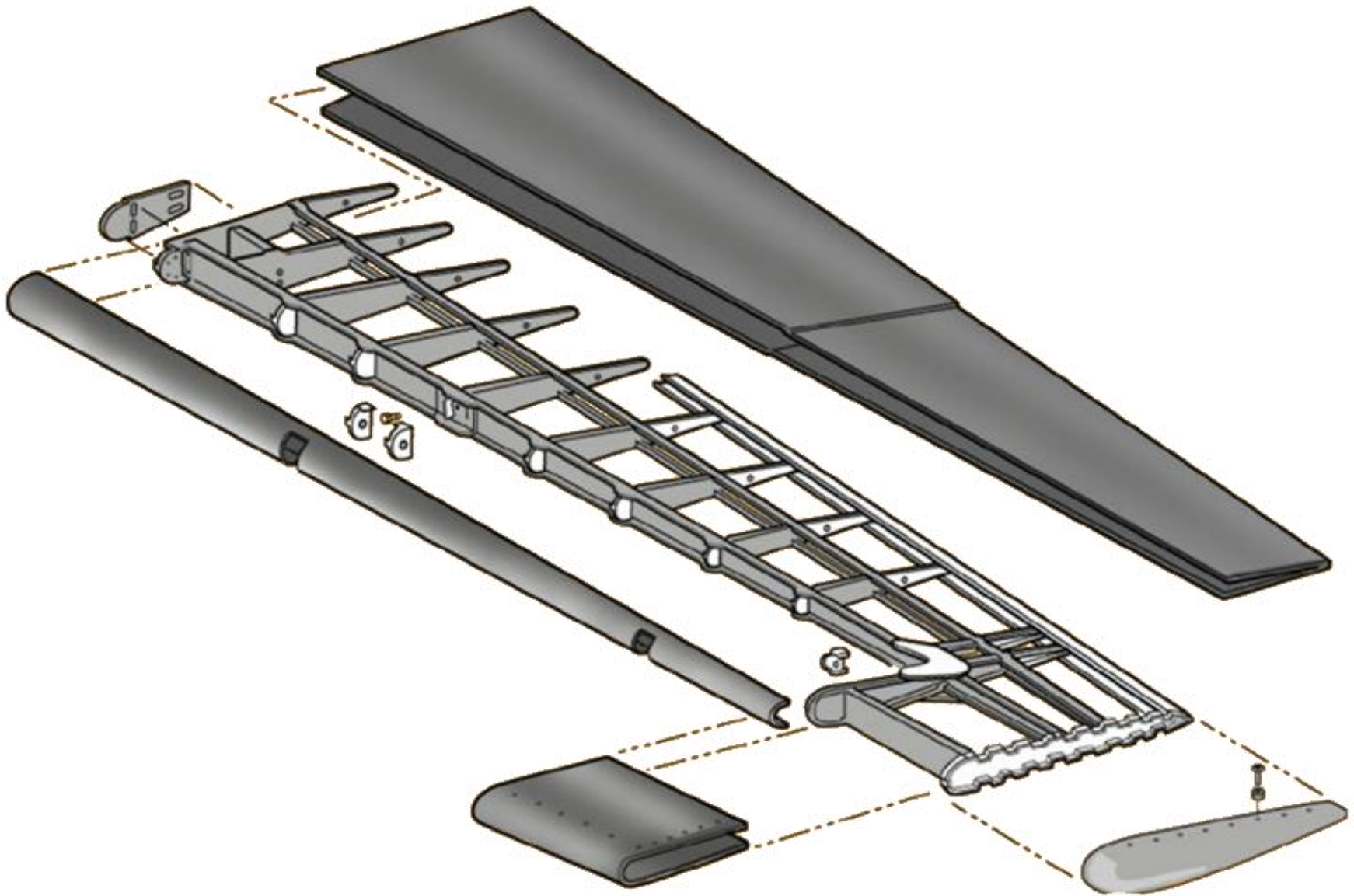
Simplest example
in air



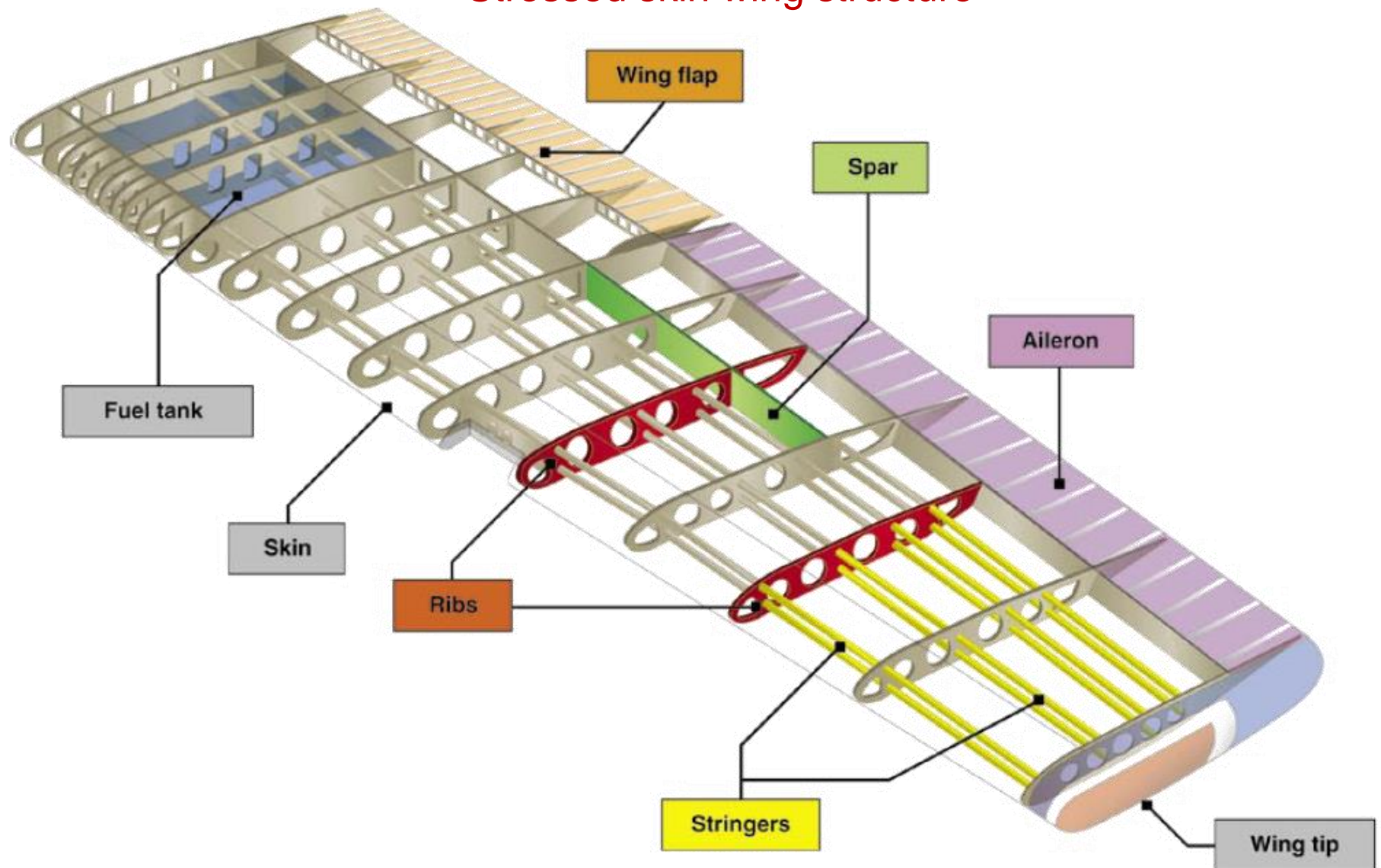
Simplest example
on ground



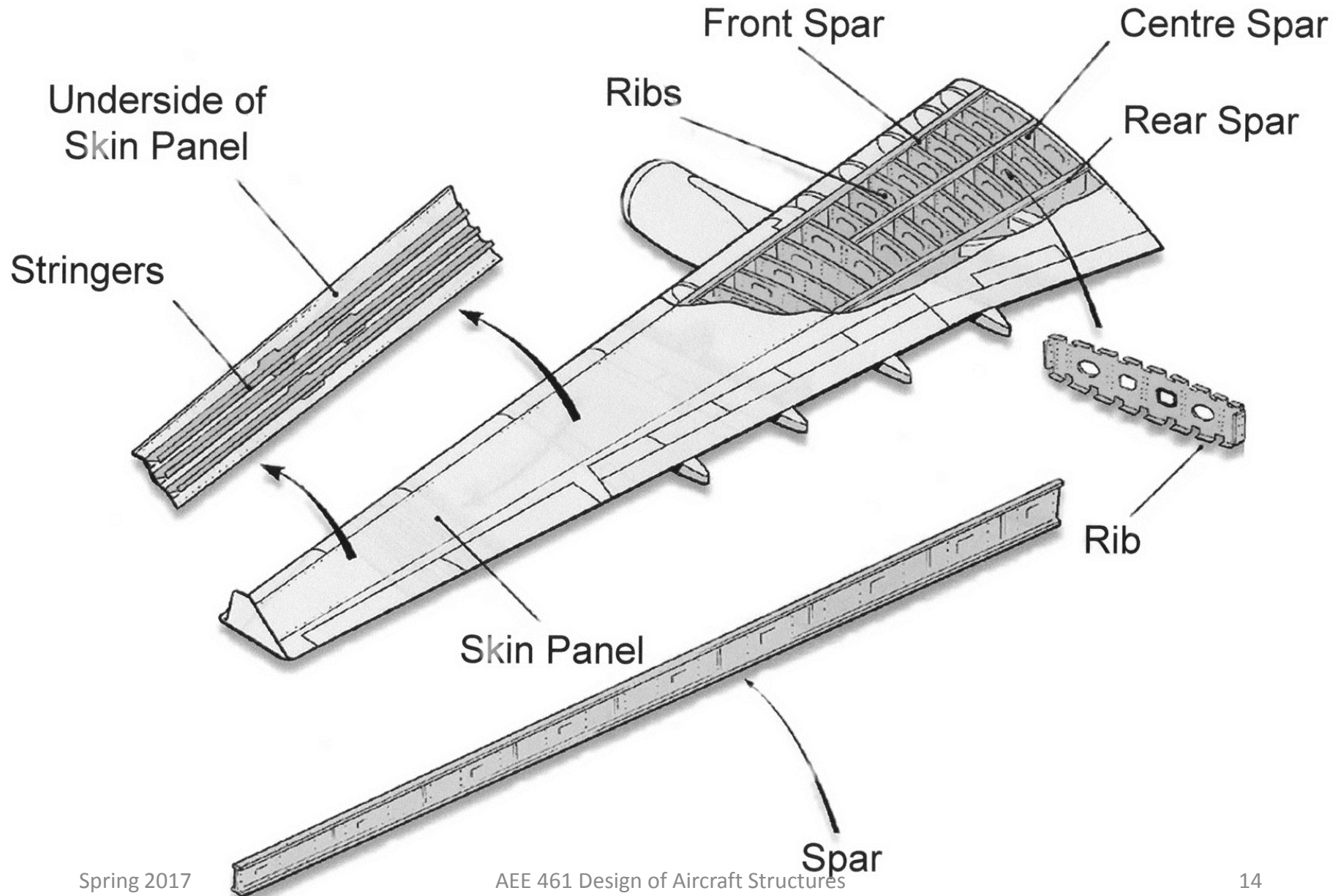
Stressed skin wing structure



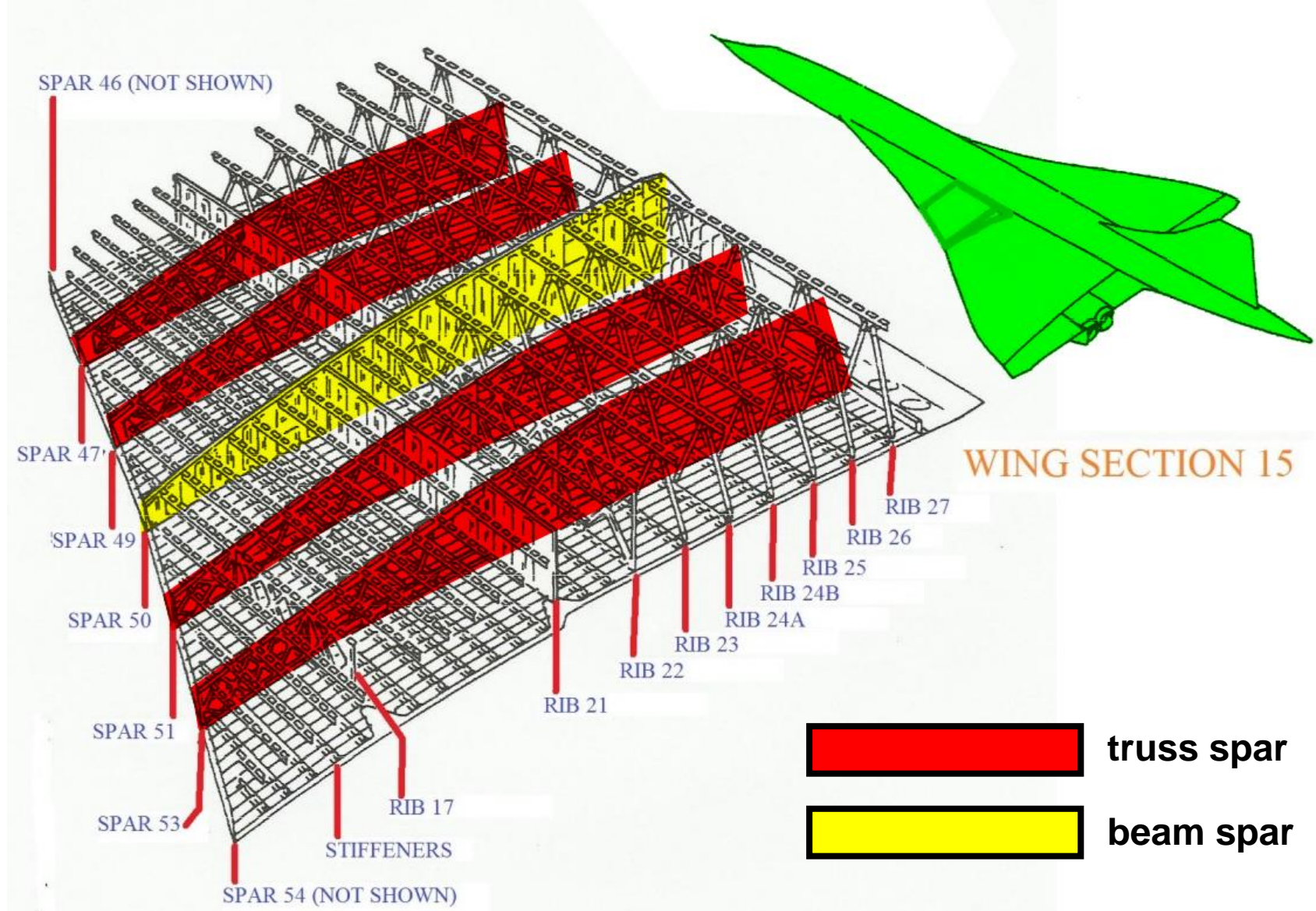
Stressed skin wing structure



Stressed skin wing structure



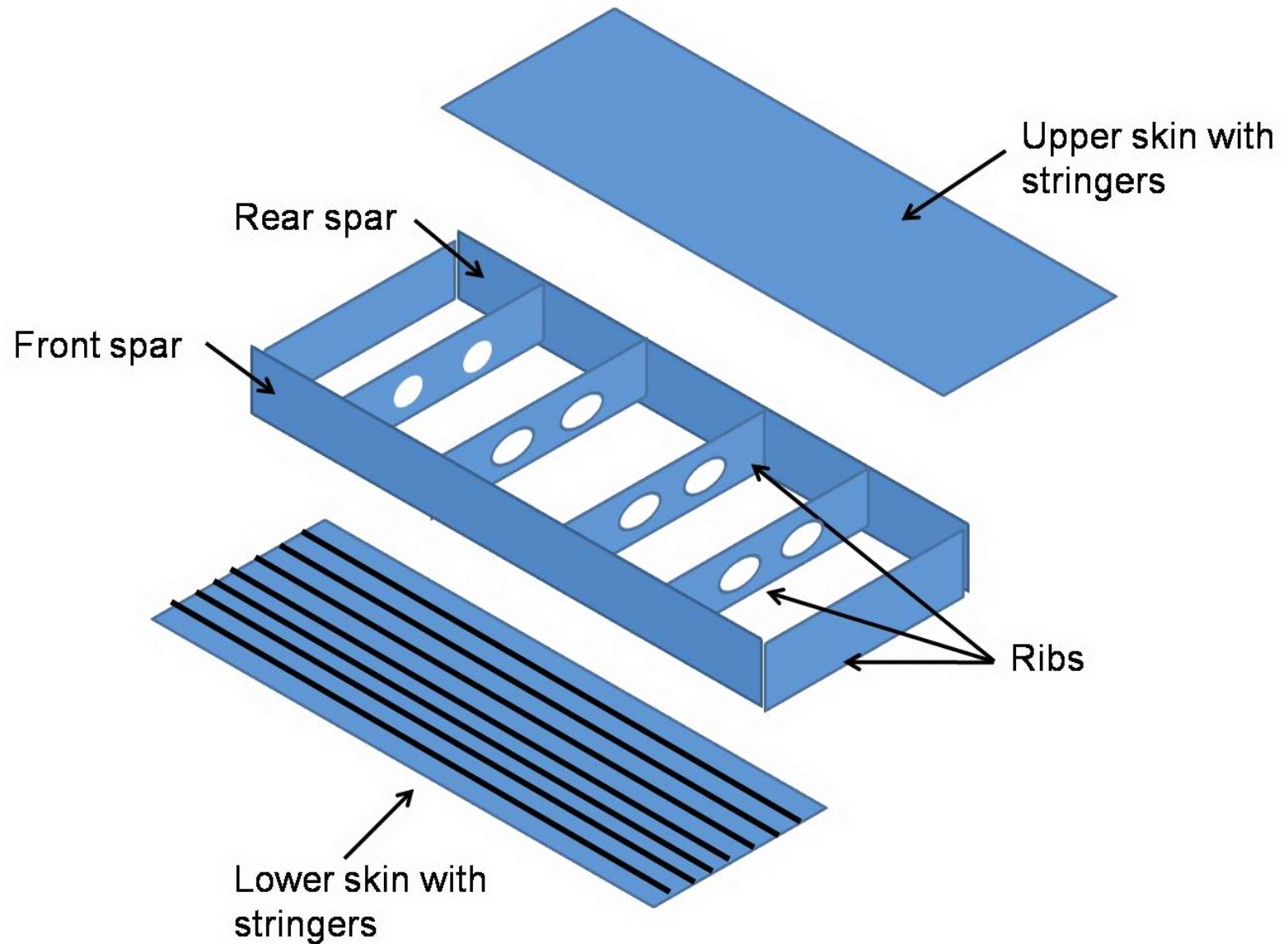
Wing Structure of Concorde (Europe, 1969)



Skin reinforced by stringers (Airbus A350)



Scheme of wingbox structure



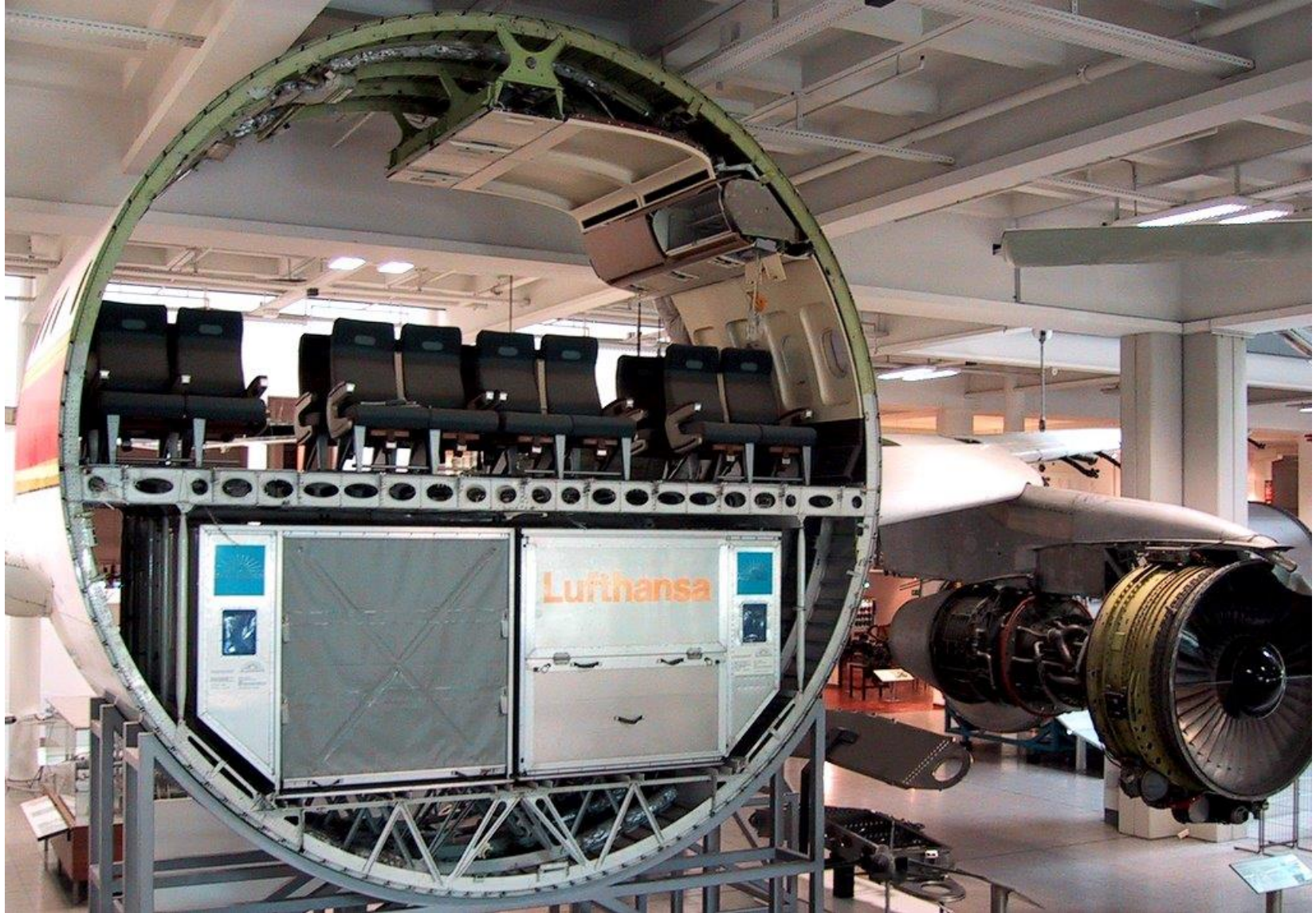
Wingbox structure of Airbus A380



Fuselage structure



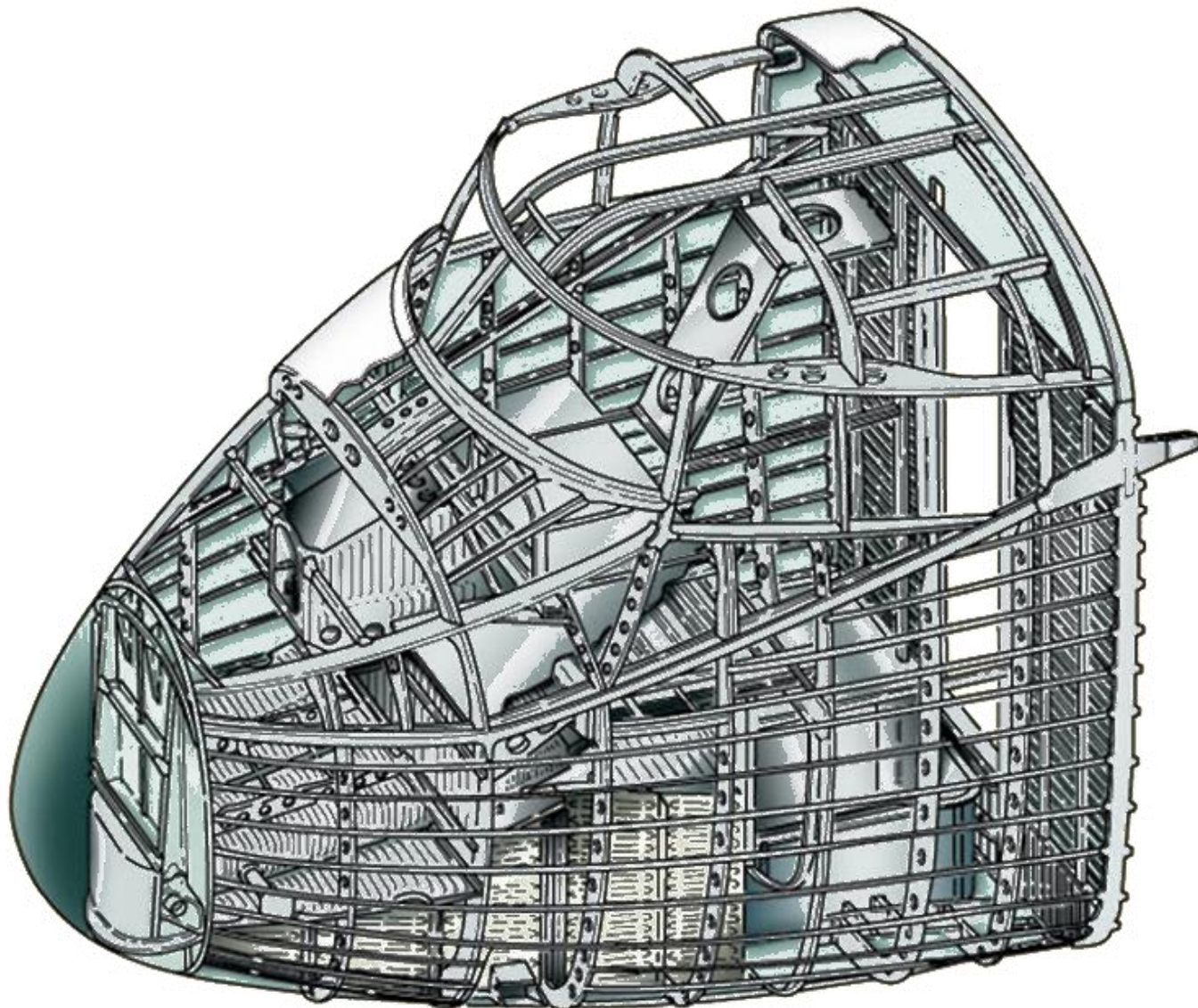
Fuselage cross section of Airbus A300



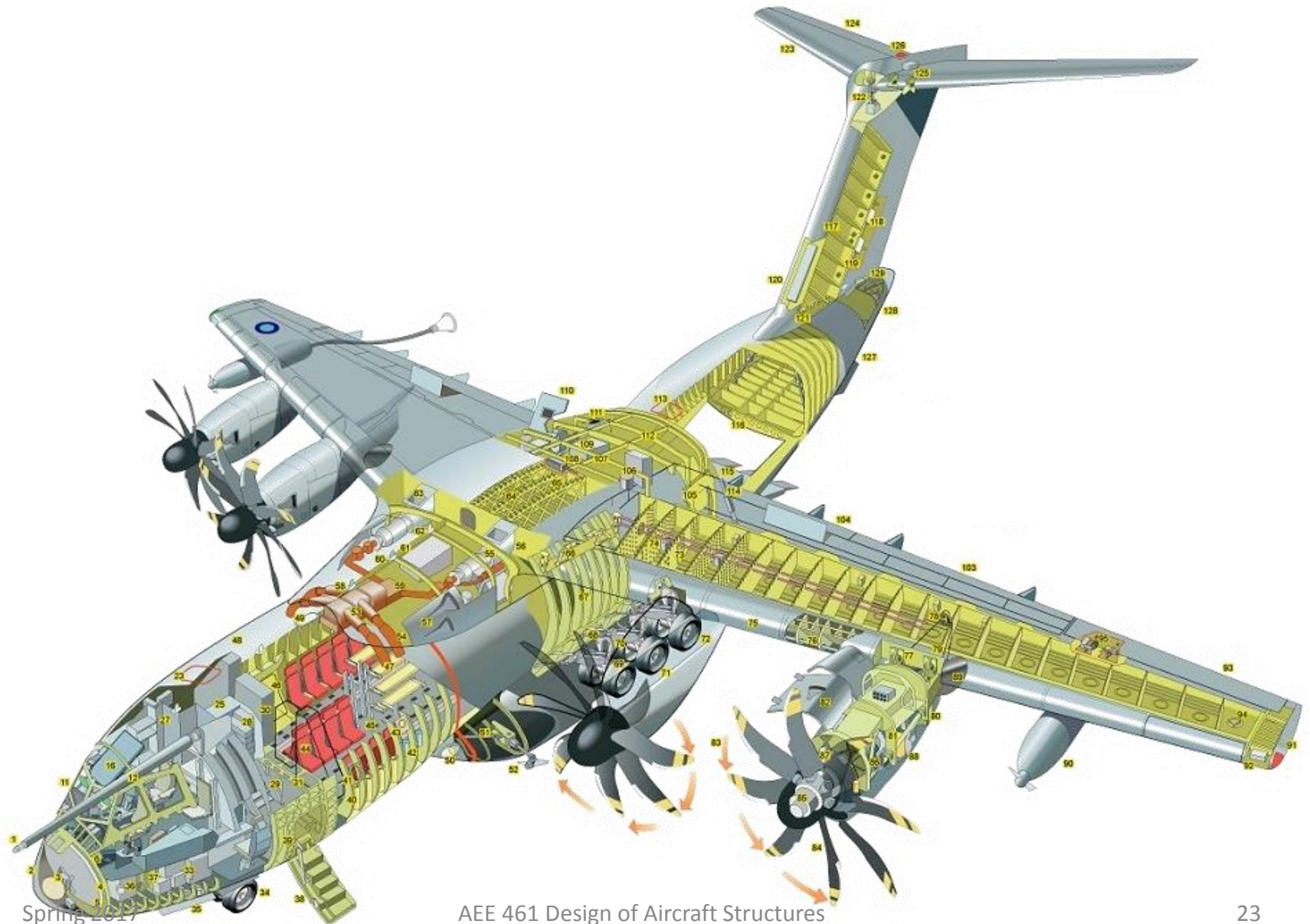
Fuselage structure of Airbus A380



Stressed skin nose fuselage structure



Airbus A400M structure



B2 Spirit structure

