Airplane Sizing NEW
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Description
This course provides an overview of the fixed-wing airplane sizing process. It is applicable to jet transport, turboprop commuter transport, military (trainers, fighter bomber, UAV) and general aviation aircraft. The design process covers sizing (weight, wing area, thrust/power), drag, high lift device sizing, weight and balance, stability and control and geometry. Numerous examples are shown, and lessons learned and “what to watch out for” are discussed.

Highlights
- Introduction to airplane design: flowchart of the design process
- Review of drag polar breakdown for subsonic and supersonic airplanes, rapid method for drag polar prediction, check of drag polar realism
- Two airplanes: same mission, different design: comparison of the Boeing B-47 with the B2 Vulcan
- Preliminary sizing of airplane take-off weight, empty weight and fuel weight for a given mission specification: applications; sensitivity of take-off weight to changes in payload, empty weight, range, endurance, lift-to-drift ratio and specific fuel consumption; role of sensitivity analyses in directing program-oriented research and development: applications
- Performance constraint analyses: relation between wing loading and thrust-to-weight ratio (or wing loading and weight-to-power ratio) for the following cases: stall speed, take-off field length and landing field length, statistical method for estimating preliminary drag polars, review and effect of airworthiness regulations; relation between wing loading and thrust-to-weight ratio (or wing loading and weight-to-power ratio) for the following cases: climb and climb rate (AEO and OEI), cruise speed and maneuvering; the matching of all performance constraints and preliminary selection of wing area and thrust required: applications
- Preliminary configuration selection; what drives unique (advanced) configurations? Discussion of conventional, canard and three-surface configurations; fundamentals of configuration design
- Preliminary Design Sequence:
  - Fuselage/cockpit
  - Type of propulsion
  - Wing planform
  - Type, size and disposition of high-lift devices
  - Layout of empennage (horizontal tail, canard, V-tail, vertical tail sizing)
  - Type of landing gear
  - Preliminary drawing (CAD), including loading diagram
  - Class I weight and balance
  - Class I stability and control
  - Class I moment of inertia estimate
- Example airplane sizing exercise using Advanced Aircraft Analysis (AAA)

Who should attend?
Aeronautical engineers, mechanical engineers, electrical engineers needing to learn more about design. Pilots with some engineering background, government research laboratory personnel, engineering managers and educators.