1 Aircraft Design Fundamentals

1 Introduction to Design

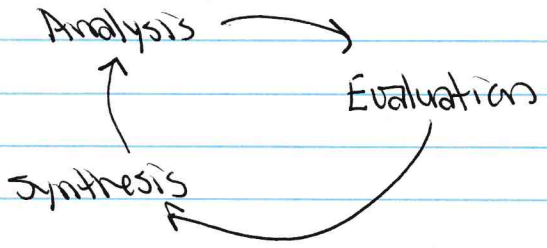
In general design has 3 major operations:

1) Analysis,
2) Synthesis, and
3) Evaluation.

Analysis: Process of predicting the performance of or behavior of a design candidate

Evaluation: Process of performance calculation and comparing the predicted performance of each design candidate to determine deficiencies

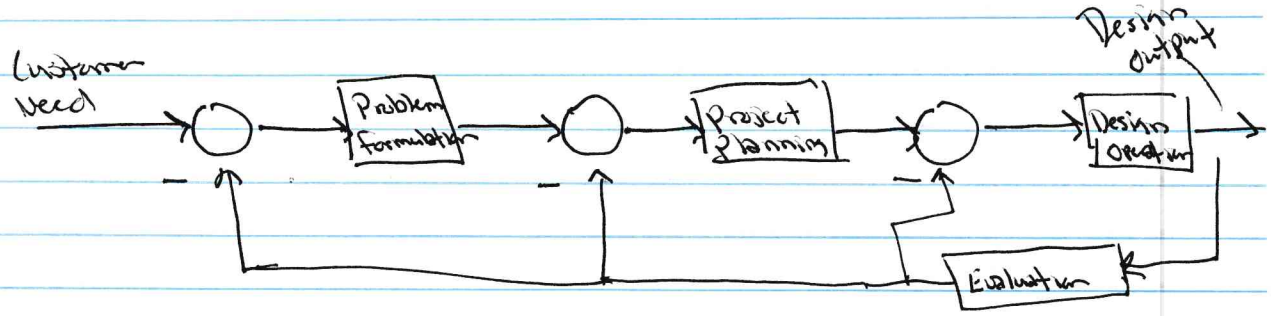
Syntheis: The creative process of putting known things together into new and more useful combinations.



In general, Aircraft design incorporates 6 disciplines

1) Flight Dynamics
2) Aerodynamics
3) Propulsion
4) Aero-Structure
5) Management Skills
6) Engineering Design

II Engineering Design



Basic engineering design block diagram.

First, a need must be identified. Once the need is clearly identified then the attention may be turned to how to meet the given need. Once all of this has been done, a problem statement may be derived. A good problem statement has a goal, objectives, and constraints.

Goal: A brief, general, and ideal response to the need statement. The need expresses the current undesired situation while the goal describes the ideal future.

Objectives: Quantifiable expectations of performance which identify those performance characteristics of a design that are of most interest to the customer. At this point we are specifying <u>what</u> needs to be done, not <u>how</u> it should be done!

Constraints: We are not able to design without bound. There are restrictions to the decisions we may make. These include price, reliability, aesthetics, etc.

At this point the customer's needs have been translated into design requirements through goals and objectives. Design requirements may include customer and engineering requirements.

As the design processes, changes to the design become more difficult. Thus, it is important to get as much as one can right the first time.

III Design Project Planning

A method of monitoring progress is important. A common method of project management control is via a Gantt Chart.

IV Decision Making

Confirmations should be selected based on evidence and reasoning. The hard part is that confirmations are often a compromise between objectives.

A method of making a decision among alternatives is

1) Specify the alternatives
2) Establish the grading criteria to determine different forms of "merit".
3) Refine the metric. How do we rate these criteria?
4) How to we convert different metric units to a universal one?
5) Select the one with the highest value

V Feasibility Analysis

While coming up with ideas to solve the problem statement, multiple viable solutions may be given. Feasibility analysis must be done on each one to help in deciding which to go with.

Feasibility determines whether the design solution meets the goal and criteria (and to what degree), and determines if the solution is something that can actually be created.