Project Planning – where to start?

Engineering Design may be defined as the process by which an engineer goes from a state of ignorance to a state of knowledge. For example, to fully define (design) a single structural part, the engineer must first know what the loading condition will be, what the environment it must function in, the manufacturing options, etc. The engineer also needs to know what materials are available. Then he or she can bring this knowledge together with their expertise to make good engineering decisions which will result in a defined (designed) part.

To plan a project, as a team:

1) Understand the problem – keep asking questions until you are certain you really understand the problem – otherwise, you may solve the wrong problem.
2) Define the problem in writing; clearly, unambiguously, and without suggesting a solution.
3) Define the criteria; describe as specifically as possible what the finished product is to achieve. The criteria should be so well defined that if given to any group of competent engineers, they will produce a finished successful product that satisfies the customer. The criteria, in effect, are a complete and very detailed problem definition.
4) Identify the key characteristics of the finished design. In other words, identify what the features of the product are that really matter. Then determine what is needed in order to properly design/define those features.
5) Once the engineer has all the knowledge necessary to properly define the key characteristics, the design work becomes a series of tasks to define a product that satisfies the key characteristics.

Typically, the first three steps should be accomplished before making a project plan. Accomplishing steps 4 and 5 are what the plan is all about. This is not trivial. It may be necessary to iteratively apply all five steps throughout the design process – breaking a large problem into smaller and smaller pieces until problems are of manageable size.

a) Think about what it is you really need to know to define the finished product (in other words, what do you need to know to complete the design).
b) Then determine what tasks will be necessary for you to gain that knowledge.
c) Determine how you will use that knowledge to define (design) the overall product.
d) These steps (a, b, and c) may need to be repeated/iterated for greater levels of detail (concept, subsystem, components, etc.)

Key Characteristics:

AS9100 is a widely adopted and standardized quality management system for the aerospace industry. It was released in October, 1999, by the Society of Automotive Engineers and the European Association of Aerospace Industries. Standard 9103 defines Key Characteristics as follows:

The feature of a material or part whose variation has a significant influence on product fit, performance, service life or manufacturability

- **Key characteristic for a part, sub-assembly or system**: selected geometrical, material properties, functional and cosmetic features which are measurable and whose variation is necessary in meeting Customer requirements
- **Key characteristic for a process**: selected measurable parameters of a process whose control is essential
- **Substitute Key characteristic**: when Customer defined key characteristic is not readily measurable and other characteristic may need to be controlled

Key Characteristics (KC's) can be defined at any stage of the design process. For example, the key characteristic of any airplane is the wing. At a concept level, a key characteristic of a wing could be its location: *above or below the fuselage*. Refined KC's for the wing could be *lift and drag produced*. Further refinement of KC's could be specific geometry: chord length, camber line, length, etc. It could include assembly features such as determining how best to attach the wing to the fuselage (this is challenging: a joint located at the location of maximum bending moment – therefore, the joint design itself could be a KC). Even further refinement of KC's could be *material strength, density, stiffness* and *geometric tolerances*. Design is an iterative process. A good project plan for "wing design" should include each of these iterative phases of design and include all five steps as described above for each phase.