Catalog Data: AE 6372 (3-0-3): *Aerospace Systems Engineering*
Introduction to Aerospace Systems Engineering. Systems engineering and quality engineering methods and tools. Top-down design decision support processes, computer integrated environments, Integrated Product/Process Development (IPPD).

Textbook: Dieter, G.E., Engineering Design, 3rd Edition
McGraw-Hill 2000

References: *Systems Engineering Management Guide,* Defense Systems Management College, 1988.

Coordinator: D.P. Schrage, Professor, A.E.

Description:

Aerospace Systems Engineering has been a key for the large scale system integration successes of the Aerospace community over the last 40 years. The front end emphasis and formal methods for configurations design and synthesis has contributed to high performance systems that helped place the first man on the moon and won the Cold War. In the past decade it has been realized that Aerospace Systems Engineering must be expanded to also reflect the Quality Engineering initiatives of the 1980s and 1990s. In recent years the emphasis has also shifted to include System of Systems. This course will introduce participants to key elements of modern Aerospace Systems Engineering: system engineering and quality engineering methods and tools, decision-making approaches, and computer integrated environments, and how they can be integrated for Integrated Product/Process Development (IPPD). Complex Aerospace System applications, as well as System of System applications will be given.

Goals: The course introduces students to Aerospace Systems Engineering for complex engineered systems. Modern Aerospace Systems Engineering is based on Concurrent Engineering principles, but emphasizes the high leverage front end of the design & development process where overall committed life cycle cost often gets locked in for complex engineered systems. Thus, an Integrated Product/Process Development (IPPD) approach is emphasized. The objectives are:

(a) to provide the student with an understanding of modern Aerospace Systems Engineering based on a generic IPPD methodology that illustrates the integrating nature of IPPD with respect to addressing overall system affordability through cost-performance tradeoffs.

(b) to acquaint the student with systems engineering methods/tools, quality engineering methods/tools, a top down design decision support process, and a computer integrated environment.

(c) to introduce the students to lean manufacturing techniques and the principles of lean

(d) to introduce the student to robust design simulation and how it can be used to address affordability through an Overall Evaluation Criterion (OEC).

(e) to provide the student experience in working on team-involved

Much of the material covering the subject area has been used in industry for education and training of cross-disciplinary teams. The textbook used in this course is a good reference book. The lectures will be supplemented by material from other reference books, as well a course notes developed by the coordinator, which will soon be developed as a textbook.

Prerequisities by Topic:

1. Elementary linear and matrix algebra.
2. Proficiency with personal computing applications, such as spreadsheet analysis.

Topics:

1. Introduction to Aerospace Systems Engineering (1 class)
2. Introduction to generic IPPD methodology (2 classes)
3. Customer identification, marketing principles and team dynamics (6)
4. Systems Engineering methods/tools (4 classes)
5. Quality Engineering methods/tools (4 classes)
6. Decision Based Design and Top Down Design Decision Support Process (4 classes)
7. Lean manufacturing techniques and the Principles of Lean (2 class)
8. Computer Integrated Environment and Product Life cycle Management (PLM) (2 classes)
9. Economics Assessment and Life Cycle Costing (LCC) methods (2 classes)
10. Robust Design Simulation (4 classes)
11. Requirements identification for Complex Engineered Systems projects. (2 classes)
12. Team presentations (4 classes)

Computer Usage:

The course will use several commercial software packages which have been developed to automate brainstorming methods (Seven Management & Planning tools), "voice of the customer" deployment (QFD), and systems decomposition analysis (network diagrams), technology processing and synthesis (morphological matrices), concepts alternative evaluations (Pugh concept system matrix), multi-attribute decision-making methods(MADM) (AHP, Topsis). These commercial software packages run on PC or MacIntosh personal computers.

Laboratory Project:

A major part of the grade, apart from the Mid-Term Exam, is generated from a team based project, where a student working on a team of 5 to 6 students, addresses the system formulation for a number of different complex engineered systems. Given an "established need" the team is required to "define the problem" and then "establish value objectives". Presentations are provided in class and each team is required to submit a final report.