Engineering a System with Global Reach:
The Global Positioning System

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GPS Overview

- Primary components: Control + Space + User

- Navigation, tracking, safety & rescue, surveying, etc.
- Military origin but now provides society with unrestricted access to critical information: space and time data

Design Questions

- Frequency, power; satellite design, receiver design (antenna, amplifier, packaging/size), control station design → they all play together; how do they compensate for different climates, etc?
Systems Engineering

• Dr. Geoffrey Okogbaa, Professor of Industrial and Management Systems Engineering, USF

Systems Engineering Process

The systems engineering process is a top-down comprehensive, iterative and recursive problem solving process, applied concurrently (rather than sequentially) through all stages of a product life-cycle, specifically to:

1. Transform needs and requirements into a set of system, product and process descriptions (adding value and more detail with each level of development)

2. Generate information for decision makers

3. Provide input for the next level of development
Systems Engineering Process

- Requirements Analysis
- System Analysis and Control (Balance)
- Functional Analysis and Allocation
- Design Synthesis
- Verification
- Design Loop
- Requirements Loop

PROCESS INPUT

Designing for the Life Cycle

- The life-cycle or concurrent engineering design approach for bringing competitive products into being goes beyond the consideration of the life-cycle itself.
- It must simultaneously embrace the life-cycle of the manufacturing processes including that of the product service system.

The resulting three concurrent life-cycles progressing in parallel are:
- The need for the product which gives rise to the Conceptual and Preliminary Design
- The need for production which gives rise simultaneously to manufacturing configuration & Operations Design
- The logistics support activities that is often neglected until product and production design is completed. Logistic support is needed to service the product during use and eventual retirement or phase-out.
Creating the Global Network

- How might the systems engineering process be applied in terms of frequency selection?

![Diagram showing the systems engineering process with steps: Requirements Analysis, Functional Analysis, System Analysis, Design Synthesis.]

GPS – Wrap Up

- Great example of a complex engineered system that has transformed many facets of society and daily life
- Impossible to conceive without comprehensive top-down systems engineering design process