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Chapter 1 : SYSTEMS ENGINEERING PRINCIPLES AND PRACTICE | Ahmad Rohman - calendrierdelas

*Systems Engineering Principles and Practice [Alexander Kossiakoff, William N. Sweet, Samuel J. Seymour, Steven M. Biemer] on calendrierdelascience.com *FREE* shipping on qualifying offers. The first edition of this unique interdisciplinary guide has become the foundational systems engineering textbook for colleges and universities worldwide.*

The JHU program has the objective of providing students with the knowledge and problem solving skills that are required to guide the engineering development of modern complex systems. These include the broad technical literacy necessary to integrate multidisciplinary system elements, and to make the system-level tradeoffs between performance, cost, and schedule. The students are expected to develop skills and habits of thought employing the principles of systems engineering. In this program, students learn from reading and from interactive presentations by experienced systems engineers, and by applying this knowledge to solving practical systems problems. They learn the systems engineering software tools available and can focus in domain areas most appropriate to their employment and careers. The growing online public offering has nearly students enrolled. An overview of the field and the textbook for the Introductory course was written by the program founder and recently released as a second edition: Systems Engineering Principles and Practice 2nd ed. The function of systems engineering is to guide lead, manage, or direct, usually based on the superior experience in pursuing a given course the engineering application of scientific principles to practical ends; as the design, construction, and operation of efficient and economical structures, equipment, and systems of complex diverse and have intricate relationships systems a set of interrelated components working together toward some common objective Kossiakoff. A system is a construct or collection of different elements that together produce results not obtainable by the elements alone. The elements or parts, can include people, hardware, software, facilities, policies, and documents; that is, all things required to produce systems-level results. The results include system level qualities, properties, characteristics, functions, behavior, and performance. The value added by the system as a whole, beyond that contributed independently by the parts, is primarily created by the relationship among the parts; that is, how they are interconnected Rechtin. Systems engineering is an interdisciplinary approach and means to enable the realization of successful systems. It is the design, production, and maintenance of trustworthy systems within cost and time constraints Sage. It is a discipline that concentrates on the design and application of the whole system, as distinct from the parts. It involves looking at the problem in its entirety, taking into account all the facets and all the variables and relating the social to the technical aspects Ramo. Students who do not have a technical background, but have work experience in design and development of systems products in software or hardware, can succeed in this program as has been demonstrated by many students over the years. The challenge for such students is to engage in logical thinking, sequential processing, and analytical problem solving that is characteristic of the systems engineer. The more experience a student has in the workplace conducting engineering and developing systems components as part of or leading a technical team, the better the match to the program. Sweet, Wiley Interscience, , a treatise and a textbook, the capstone of over 50 years of fundamental research in systems engineering at the Johns Hopkins University Applied Physics Laboratory and its application to real world problems. The text lays the basis of understanding for the development of systems, systems-of-systems, and enterprise systems. It describes the systems engineering concepts and methodologies required by large, complex problems containing multiple technology disciplines and a variety of enterprise contributions that are part of the solution. The Kossiakoff text describes in detail the typical process the systems engineer engages in for a traditional development project as shown in the next figure. According to Kossiakoff, "the systems engineering life cycle model consists of three stages, the first two encompassing the developmental part of the life cycle, and the third the post-development period. These stages mark the more basic transitions in the system life cycle, as well as the changes in the type and scope of effort involved in systems engineering. The above names for the individual stages are intended to correspond generally to the principal type of activity characteristic of these stages. Systems engineering plays the lead role in translating the operational needs into a technically and economically feasible system concept. The level of effort during this stage is generally much smaller than in subsequent stages. The principal objectives of the concept development stage are to: Establish that there is a valid need and market for a new system that is technically and economically feasible. Explore potential system concepts and formulate and validate a set of system performance requirements. Select the most attractive system concept, define its functional characteristics, and develop a detailed plan for the subsequent stages of engineering, production, and operational deployment of the system. Systems engineering is primarily concerned with guiding the engineering development and design, defining and managing interfaces, developing test plans, and determining how discrepancies in system performance uncovered during test and evaluation should best be rectified. The main bulk of the engineering effort is carried out during this stage. The principal objectives of the engineering development stage are to: Develop any new technology called for by the selected system concept, and validate its capability to meet requirements. Perform the engineering development of a prototype system satisfying the requirements of performance, reliability, maintainability, and safety. Engineer the system for economical production and use, and demonstrate its operational suitability. Also, continuing advances in technology often require in-service system upgrading, which may be just as dependent on systems engineering as the concept and engineering development stages. The post-development stage of a new system begins after the system successfully undergoes its operational test and evaluation and is released for production and subsequent operational use. While the basic development has been completed, systems engineering continues to play an important supporting role in this effort. Each of the process diagrams and approaches can be considered for use depending on the nature of the system under development, the organization or enterprise traditions, and the systems maturity of the contributors. An example of a system life cycle, using the loop and a description of the activities in each phase, is shown below. Operational data collection, or mission analysis, may reveal a need to achieve new capabilities. Scientific evidence from experimental work may reveal the need for a new scientific instrument to collect specific new information towards a scientific discovery. Analysis and planning are performed to define the need for a system, both operational and technical, and then determine its feasibility. These needs can be communicated through such diverse media as scientific papers, studies, or official military documentation. Once a need is recognized, it is always prudent to determine whether presently available systems and operational capabilities could be leveraged to meet the need, for instance, via new tactics or procedures. This can be via analysis or studies, further data collections, or critical experiments. If it is determined that a new system is needed, an appropriate architecture compatible with related systems may be identified. If a new system capability is needed, whether it is the first of its kind or a spiral upgrade of an existing system capability, candidate concepts and corresponding modeling and analyses are often developed. One next explores technology readiness and alternative systems concepts, conducting critical experiments and studies of new features of the system design. The one or few concepts emerging as the leading candidates are often modeled and defined in increasing detail to gain more definitive characterization of these metrics and to support drafting of operational requirements and specifications. If a significantly different capability, or significant development risk, is accepted for the selected conceptual approach, prototyping of parts or all of a system may be required. This may be for one of several purposes such as to validate an emerging technology, to validate and refine production requirements, and to verify that the design can be produced in numbers and is operationally suitable. Often this involves formal demonstration in a representative laboratory or simulated operational environment. During this phase, fabrication of the production article, and operational tests and evaluation activities are conducted to validate the satisfactory performance of the system leading to full-scale production of an affordable and functional system. The system is taken to the field for operational use with data collected to ensure that the system continues to meet its operational requirements and satisfy the need for which it was built. If a new threat or needs gap emerges, or there are advances in technology that indicate a new need, then the spiral of activities shown in the Figure may be re-entered, and a new round of the activities described above may be initiated. Career Planning Notes The field of systems engineering is relatively new, but has significant and increasing relevance in the development of both government and civilian systems. Systems engineers are highly sought after because their skills complement those in other fields and often serve as the "glue" to bring new ideas to fruition. Career choices and the related educational needs for those choices is complex, but they can be considered in the context of the following diagram. Four potential career directions are shown, where there are varying degrees of overlap between them. The systems engineer focuses on the whole system product leading and working with many diverse technical team members, following the systems engineering development cycle, conducting studies of alternatives, and managing the system interfaces. The systems engineer generally matures in the field after a technical undergraduate degree with work experience and a Master of Science degree in systems engineering, with increasing responsibility of successively larger projects, eventual serving as the chief or lead systems engineer for major systems, or systems-of-systems development. Note the overlap and need to understand the content and roles of the technical specialists and the program manager. The project or program manager with a technical or business background is responsible for interfacing with the customer and defining the work, developing the plans, monitoring and controlling the project progress, and delivering the finished output to the customer. The financial career path that ultimately could lead to a Chief Financial Officer position usually includes a business undergraduate and MBA degrees. Individuals progress through their careers with various horizontal and vertical moves, often with specialization in the field. There is overlap in skill and knowledge with the program manager in areas of contract and finance management. Many early careers start with a technical undergraduate degree in engineering, science, or information technology. The technical specialist makes contributions as part of a team in the area of their primary knowledge, honing skills and experience to develop and test individual components or algorithms that are part of a larger system. Contributions are made project-to-project over time and recognition is gained from innovative, timely, and quality workmanship. Technical specialists need to continue to learn about their field, and stay current in order to be employable compared to the next generation of college graduates. Often advanced degrees MS and PhDs are acquired to enhance knowledge, capability, and recognition; job responsibilities can lead to positions such as lead engineer, lead scientist, or Chief Technology Officer in an organization. The broader minded or experienced specialist often considers careers in systems engineering. Systems Engineering Admissions Admission requirements in the JHU systems engineering program focus on academic and professional experience credentials. No standard exams or tests are needed. There are no specific prerequisites or make-up courses. The applicant is to have one year of relevant work experience as shown on a current resume. Relevant means that the applicant has been engaged in some activity in the design, development, or testing of a system. The requirements have some degree of flexibility with longer years of work experience balancing a lower GPA, or a higher GPA balancing less than one year of experience. It is desired that the student be prepared to understand and utilize the knowledge gained in class the next day, so maturity and experience will assist in this preparation. The only difference is the undergraduate degree with which the students enter. Please refer to the catalog for further details. Applicants do not need to specify the degree, since it is determined by your undergraduate transcript. Official admission decisions come only from the admissions committee. Please direct all admission issues and pre-admission questions to ep-se jhu. An official response from JHU typically takes two to four weeks. The admissions committee has three options: The field of systems engineering has traditionally been populated by engineers. However, it is recognized that complex systems encompass multiple fields such as finance, medicine, education, infrastructure, communication, and information systems, etc. The JHU official notification of admission will come only after receipt of the official transcripts. Please request these be sent ASAP after you apply. The receipt of the transcripts is on the critical path for an admission decision. This step takes the longest time. Admissions are done on a rolling basis. Applications are processed in the order received.

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