Integrated Design & Assurance System, IDAS

Overview

IDAS means "Integrated Design & Assurance System." IDAS strategically selects and links "best-in-practice" software tools targeted for the design and assurance (safety, reliability, logistics, human factors, etc) areas. The software tools that make IDAS originated from and are used in part by industry, military, and NASA, are immediately available to all NASA Centers, and some are available to NASA at no charge. IDAS is not a drawing or computer-aided design or manufacturing (CAD/CAM) system.

A major piece of IDAS (that acts like the truss on Space Station) is the 13 software modules by Relex Software Corporation. For example, one of the Relex modules has the capability to allow NASA to operate and manage its multiple and dissimilar PRACA (problem reporting and corrective action) systems for the entire Agency (assuming we wanted to go that far). And Relex's PRACA module can be set up (configured) without having to know or use computer-programming skills. Last, the Relex PRACA module could provide NASA the capability to search across all of its PRACA databases which we can not do now.

In addition to IDAS being a system that provides a common and integrated platform of tools to do technical design and assurance processes and activities, IDAS in particular can do tasks over the life cycle such as design, model, simulate, analyze, forecast, and cost spacecraft elements and track, trend, and disposition reported problems. Thus, with IDAS as an integrated system of tools it allows the engineering and assurance functions, if desired, to work together in a concurrent and collaborative manner.

The long-term goal of IDAS is for any or all Programs at NASA to provide to the design engineers, sustaining engineers, and assurance engineers an effective, efficient, and appealing suite of tools that are comprehensive, integrated, adaptable (i.e., customize the tools to work in the way we do business—and not the other way around), scalable (i.e., no job is too big since the major portion of the IDAS software was purchased and installed on a server with the capability to operate at the Enterprise level).

The short-term goal of IDAS is to immediately provide a workable and adaptable system that will allow the NASA community to explore and test (i.e., have a "hands-on" experience with) the IDAS tools either in an individual or integrated manner without stopping or changing their current work processes and policies. Another benefit of IDAS when only partially used is it will allow engineers to perform and share technical work using tools specifically designed for design and assurance work as opposed to using Microsoft Office tools (e.g., Word to make FMEAs, PowerPoint to make fault trees, and Excel to make reliability predictions).

The IDAS "hands-on" experience provides knowledge to allow requirements, if later needed, to be written based on an experience using modern tools as opposed to experience heavily based on paper-based processes and legacy tools.

In summary, IDAS allows the design, sustaining, and assurance engineers to "work smarter instead of harder" both for existing (Station and Shuttle) and new (Exploration) NASA Programs.

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Challenge

A system can serve its intended purpose most effectively when both its technical and operating characteristics are engineered into the design. Technical characteristics address the system's functional capability[1], and operating characteristics address the system's operating outcomes[2]. For complex systems, both sets of system characteristics come from a variety of disciplines and are orchestrated by the systems-engineering process. A major contribution of the systems-engineering process is discipline synergy that must occur early in the systems' life cycle (especially in or before the design phase) and in an integrated manner.

The challenge is to enable the various types of engineering teams to perform their tasks[3] in a concurrent and collaborative manner that is effective, efficient, and appealing. If the systems-engineering process is lacking or does not address this challenge, discipline isolation will occur naturally and easily because,

- The physics-based engineering disciplines, the traditional disciplines found in Design Engineering, contribute the most to a system's functional capability (as opposed to the operational outcomes), and
- The assurance-based engineering disciplines, the disciplines noted for having special processes and techniques that address a system's operational outcomes (as opposed to the functional capability), though chartered to focus on operational outcomes seldom own it since operational outcomes are design-dependent parameters.

Thus, if this challenge is not addressed, system operating characteristics with many falling under the umbrella of assurance will automatically default to Design Engineering.

Notes:

1 - **Functional Capability**: Technical and physical characteristics (e.g., size, weight, volume, shape, accuracy, capacity, flow rate, throughput, units per time period, power output) the system (when operating) must exhibit to accomplish its intended function.

2 - **Operating Outcomes**: Non-technical and non-physical characteristics the system (when operating) must exhibit to accomplish its intended function. These operational behaviors though abstract are still "design for" parameters with the major parameters being: Safety (freedom from accident and loss), Reliability (time to failure), Maintainability (time to repair or maintain), Availability (mission readiness), Usability (interfaces between human and hardware and human and software), Supportability and Serviceability (support and service through out the planned life cycle), Producibility (ease and economy of producing), Disposability (disassembly and disposal) and Affordability (life-cycle cost or total cost of ownership and not just system acquisition cost).

3 - Design and reliability engineers design systems from concept and predict the reliability and availability of the system. Risk and safety engineers analyze the risks associated with the design and construct the probabilistic risk assessment (PRA). Cost engineers perform cost-alternative analyses on the design. Logistics and maintainability engineers assess required sparing and periodic maintenance levels on the system. Human Factors engineers analyze the usability (operability) and maintainability factors. Quality Engineers track test and field failure information and perform trending analyses.

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Vision

For all NASA Centers and Programs, an integrated and comprehensive system that enables design, sustaining, safety, reliability, maintainability, quality, logistics, cost, human factors, and risk engineers to collaboratively design and model systems, track changes, and provide performance feedback over the systems' entire life cycle.

Mission (at the Level of the KSC Office of the Chief Engineer)

Design, develop, deploy, and demonstrate an integrated design and assurance system, **IDAS**.

IDAS' Goal

The goal of IDAS is to provide an effective, efficient, and appealing suite of comprehensive, integrated, adaptable, and scalable **tools** that can be configured, deployed, and supported as a **system** that:,

- Integrates design and assurance processes and activities (e.g., design, model, simulate, analyze, cost, track, trend, and disposition spacecraft elements and supporting systems over the life cycle).
- Can be used in a concurrent and collaborative manner.
- Focuses on system deployment and demonstration as opposed to writing requirements for tools or capabilities that are readily available in the market or from other government sources.

IDAS is not a drawing or computer-aided design or manufacturing (CAD/CAM) system. Thus with the exception of the deterministic-type reliability prediction modules, IDAS will not address system technical or physical characteristics (e.g., size, weight, volume, shape, flow rate, power output, etc).

IDAS' Need

New programs (e.g., Exploration) that develop new spacecraft should not be distracted or consume resources in developing fundamental, mature, and proven tools. IDAS can be operational with minimal start-up time, has been used by other high-tech industries, has integrated tools, scalable, can be customized, and available at a relatively low cost.

Existing programs (e.g., Space Shuttle, Space Station) that operate aging spacecraft should not be locked in with aging infrastructure or legacy sustaining engineering processes. For example, IDAS provides a new and improved way to do problem reporting and corrective action (PRACA). IDAS' PRACA is believed not only to be better but less costly as well. This is especially important since PRACA as an assurance strategy is one of the few strategies available for operating mature systems in an effective and efficient manner. In addition, IDAS' PRACA system can be brought up and operate in parallel with the current PRACA system—thus, reducing the risk in erroneously modifying or prematurely turning off the current PRACA system.

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