CHALLENGING TECHNOLOGY, AND TECHNOLOGY INFUSION INTO 21ST CENTURY

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Introduction: In preparing for the space exploration challenges of the next century, the National Aeronautics and Space Administration (NASA) Center for Integrated Space Micro-Systems (CISM) is chartered to develop advanced spacecraft systems that can be adapted for a large spectrum of future space missions. Enabling this task are revolutions in the miniaturization of electrical, mechanical and computational functions. On the other hand, these revolutionary technologies usually have much lower readiness levels than those required by flight projects. The mission of the Advanced Micro Spacecraft (AMS) task in CISM is to bridge the readiness gap between advanced technologies and flight projects.

Objectives and Approach: One of the key objectives of the AMS as a focused technology development program is to infuse technologies into target missions under NASA's mission themes. In order to ensure a gradual and smooth transition of technologies from research and development environment to flight project environment, the AMS will develop two stages of testbeds to facilitate the technology infusion: the Proof-of Concept Testbed and the Engineering Testbed. These testbeds are developed by the Advanced System Development Team (ASDT) and the Advanced System Infusion Team (ASIT), respectively, under the AMS task [13.

The Proof-of Concept (POC) Testbed has flexible configuration and uses prototype flight *software* to create a realistic system environment to validate the advanced technologies. The POC Testbed can also be used to perform experiments for advanced system architecture concepts.

The Engineering Testbed will merge POC technologies to technology readiness level 6 hardware or qualifiable system hardware that meets the form factor, thermal, power and other requirements of flight projects. As part of CISM's commitment to technology infusion, a major focus of ASIT is to understand mission needs verses technology capabilities and implementation trade-off studies for the flight projects.

Moreover, it should be mentioned that the technology infusion process is not merely a reactive response to mission requirements. Innovations are used throughout the process to fuel the advancement of the state-of-the-art of avionics systems.

The technology infusion process is depicted in Figure 1, and the interfaces between the elements in this process are explained in the following sections.

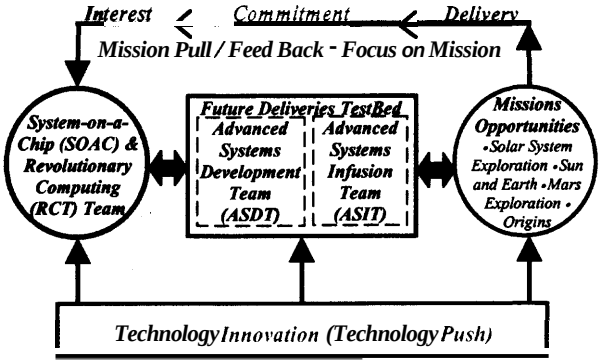

Figure 1

SOAC/RCT and ASDT Interface: The System-on-a-chip (SOAC) and the Revolutionary Computing Technology (RCT) Teams are two other elements in CISM that develops advanced technologies. These two teams provide technology products that are compliant with the POC Testbed interfaces to the ASDT. The ASDT then validates these technologies within the POC Testbed.

ASDT and ASIT **Interface:** The ASDT provides POC validated system technologies to the ASIT. The ASIT synthesizes a mechanical / packaging system consistent with a candidate **mission's** system wide architecture. Additionally provides a platform for complete environmental testing and develops a test *a structure to support the new technologies. Both teams' work interactively together to performing trade-off studies and implementation approaches that best meet mission needs and requirements.

ASIT **and Flight Project Interface:** The ASIT encourages user interactive participation to solve design challenges in a system environment. The goal is to provide a user based Testbed. Focus on mission needs and requirements by providing Product Specification documents and tools for bench marking and validation.

Conclusion: Technology infusion into flight missions has always been a difficult problem. To capitalize on NASA's technology investment it is believed that the process outlined in this paper will improve the technology infusion into flight missions for NASA.

References: [1] S. Chau and Don Hunter, *X2000 Future Deliveries FY'01 Task Plan, JPL Internal Document.*

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