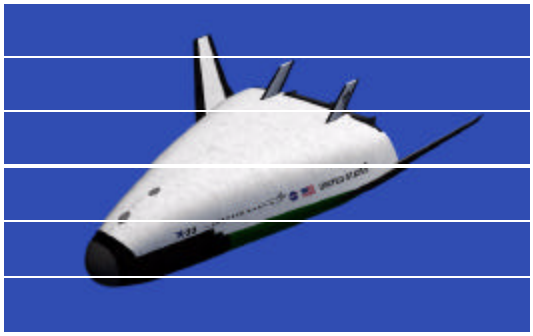
This document contains excerpts from the X-33 Independent Assessment Report (title page shown below). Only those sections which relate to the PBMA element **Software Design** are displayed.

The complete report is available through the PBMA web site, Program Profile tab.

X-33

Safety & Mission Assurance Review



NASA Office of Safety & Mission Assurance

March 5, 1998

3.8 Software Independent Verification & Validation (IV&V) Process

Discussions with LMSW software experts during the on-site review resulted in an agreement to provide the MSFC SMA representative with updated, hardware and software testing requirements for systems and subsystems. LMSW agreed that system level testing shall be accomplished using flight software. LMSW agreed that all updated test plans will emphasize the requirement to test using the flight software.

Software Availability for Integrated Systems Testing

It is recognized that software development is behind schedule. Thus concerns exist that these delays will make it difficult to implement integrated ground testing of systems such as the engine controller which uses software-driven risk mitigation capabilities (e.g., cross-functional turbo-pump capability to use a single pump to serve both engines in the event of a failure).

NASA IV&V Support to X-33

Allied Signal and LMSW are the principal developers of the X-33 software. The NASA IV&V facility in Fairmont initiated support to the X-33 program in November of 1997. The Fairmont level of effort is estimated to represent 10 person-years in 1998 and 10 person-years in 1999. Even though the IV&V support is provided under a task order agreement to LMSW, NASA will be able to assert a greater level of insight by virtue of this arrangement.

Pre-and Post-Flight Certification Process

The pre-and post-operating procedures define the process for test, review, approval, and implementation of configuration changes to the ground and flight software. Launch "I-Loads" will be verified prior to each flight by the Integrated Test Facility. The review team software analyst and LMSW software managers also discussed the extent to which end-to-end verification and validation will be conducted (flight and ground software) between each flight of the X-33. The review team feels that this is an issue worthy of further assessment by the NASA X-33, SMA support.