December 2011 MSS/LPS/SPS Joint Subcommittee Meeting
ABSTRACT SUBMITTAL FORM

The submission of an abstract is an agreement to complete a final paper for publication and attend the meeting to present this information. Complete all information requested in the author and co-author information sections; the first author listed will receive paper acceptance notices and all correspondence. Abstracts must be submitted electronically; submittal instructions are located in the call for papers. **The abstract deadline date is June 13, 2011.**

ABSTRACT INFORMATION

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MANAGEMENT APPROVAL

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Unclassified Abstract

(250-300 words; do not include figures or tables)

The J2X Gas Generator engine design specifications include dynamic, spontaneous, and broadband combustion stability requirements. These requirements are verified empirically based high frequency chamber pressure measurements and analyses. Dynamic stability is determined with the dynamic pressure response due to an artificial perturbation of the combustion chamber pressure (bomb testing), and spontaneous and broadband stability are determined from the dynamic pressure responses during steady operation starting at specified power levels. J2X Workhorse Gas Generator testing included bomb tests with multiple hardware configurations and operating conditions, including a configuration used explicitly for engine verification test series. This work covers signal processing techniques developed at Marshall Space Flight Center (MSFC) to help assess engine design stability requirements. Dynamic stability assessments were performed following both the CPIA 655 guidelines and a MSFC in-house developed statistical-based approach. The statistical approach was developed to better verify when the dynamic pressure amplitudes corresponding to a particular frequency returned back to pre-bomb characteristics. This was accomplished by first determining the statistical characteristics of the pre-bomb dynamic levels. The pre-bomb statistical characterization provided 95% coverage bounds; these bounds were used as a quantitative measure to determine when the post-bomb signal returned to pre-bomb conditions. The time for post-bomb levels to acceptably return to pre-bomb levels was compared to the dominant frequency-dependant time recommended by CPIA 655. Results for multiple test configurations, including stable and unstable configurations, were reviewed. Spontaneous stability was assessed using two processes: 1) characterization of the ratio of the peak response amplitudes to the excited chamber acoustic mode amplitudes and 2) characterization of the variability of the peak response's frequency over the test duration. This characterization process assists in evaluating the discreteness of a signal as well as the stability of the chamber response. Broadband stability was assessed using a running root-mean-square evaluation. These techniques were also employed, in a comparative analysis, on available Fastrac data, and these results are presented here.