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Distortion Synthesis/Estimation Techniques

RATIONALE

This document contains information that is fundamental to the discipline of inlet-engine compatibility and is expected to remain stable for the foreseeable future.

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FOREWORD

Since aircraft and engine manufacturers began obtaining high-response, inlet-total-pressure data for the purposes of achieving inlet-engine compatibility, there has been significant interest in making the necessary aerodynamic stability estimates with smaller data sets than the data set required from a full 40-probe aerodynamic interface plane array as set forth in ARP1420. The technique for attempting to accomplish this action is called “distortion synthesis/estimation.”

This document provides background information, reviews of literature where such techniques have been employed, and recommendations for improving the technique and for where the technique might best be employed.

The SAE S-16 Committee welcomes input from both industry and government organizations relative to the contents of this document.

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1. SCOPE

This document provides a review of published methods that have been used to provide estimates of the levels of distortion and/or the concomitant loss of stability pressure ratio that can occur when the recommended full complement of aerodynamic interface plane high-response instrumentation is not used when obtaining inlet data. The methods have been categorized based on the underlying mathematical representation of the aerophysics. Further, the use of maximum value statistics, which has been used to further improve the results where short-duration time records have been employed, is discussed.

2. REFERENCES

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of this publication. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 Applicable Documents

- 2.1.1 SAE International Aerospace Recommended Practice, "Gas Turbine Engine Inlet Flow Distortion Guidelines," SAE Standard ARP1420B, Reaf. July 2011.

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