Temperature Effects on Acoustic Interactions between Altitude Test Facilities and Jet Engine Plumes

Authors: K. K. Ahuja, K. C. Massey, C. K. Tan, R. R. Jones; GEORGIA TECH RESEARCH CORP ATLANTA

The specific objective was to determine the effect of heating the jet on its coupling with the diffuser used in a typical jet engine. Additional objectives included analytically examining the behavior of jet instability waves as a function of temperature and any potential of strong coupling between the jet instabilities and diffuser duct resonance. A nozzle in a test setup that simulates a supersonic jet exhausting into a cylindrical diffuser was measured. The measured jet and ducted plume for a range of jet exit Mach numbers and four modes excited the most amplified wave of the jet. Screech, Altitude test facilities, Instability...

Study of Visible Exhaust Smoke from Aircraft Jet Engines

Authors: John Stockham; Howard Betz; ITI RESEARCH INST CHICAGO IL

The objective of this study was to relate the visibility of inflight exhaust to the SAE smoke number. A method based on photographic photometry was developed for measuring the optical density of smoke plumes. This method was related to visibility and to the smoke number through transmitter measurements and visibility theory. A portable ... the engines investigated, indicate that SAE smoke numbers below 23 were associated with invisible exhaust plumes. Samples of the exhaust smoke showed the particles to be composed of lacy agglomerates. At the...

Approximate Determination of Jet Contours near the Exit of Axially Symmetrical Nozzles as a Basis for Plume Modeling.

Authors: H. H. Korst; ARMY MISSILE COMMAND REDSTONE ARSENAL ALA AEROSBALLISTICS DIRECTORATE

The analysis is based on concepts developed by Johannesen and ... for plume shape determination can be utilized to model at least the geometric aspects of prototype plumes as well as to account for significant inviscid and viscid aspects of the base flow problem. A...

Measurements of Ions Formed in Jet Engine Exhaust Plumes

Authors: F. L. Elseth; GEORGIA TECH RESEARCH INST ATLANTA ELECTRO-OPTICS ENVIRONMENT AND MATERIALS L AB

An atmospheric pressure chemical ionization mass spectrometer was modified to measure either ion or neutral effluents from a jet engine. The instrument was set up behind an F-15 aircraft at Eglin Air Force Base and measured the ions formed in both the positive and negative spectrum. Since the ion concentrations in the jet plume were quite small and measurement times relatively short, most of the measurements ... the exhaust using a corona ion source. The most obvious change in the ion spectrum after the jet engines were started was the dramatic increase in what appeared to be sulfuric acid. The...

Development of Dynamical and Mathematical Models of Exhausted Plasma Plumes and Plasmoids in Space

Authors: Valery I. Garkusha; CENTRAL RESEARCH INST FOR MACHINE BUILDING MOSCOW (RUSSIA)

The paper contains the dynamical problem solutions for certain thermal modes of artificial plasma expansion in space, codes to calculate the parameters of freely expanding plasma jet and plasmoid, representative samples of calculations, comparison of theoretical results obtained with data of measurements in plumes of electric and conventional gas thrusters, comparison of self-similar solutions obtained with published data of analytical and numerical calculation of parameters for plasma and gas jets.

Effect of Mixture Ratio on UV, Visible and Infrared Radiation from Exhaust Plumes

Authors: D. B. Ebeoglu; C. W. Martin; AIR FORCE ARMAMENT LAB EGLIN AFB FL

... with the design goals of approximating threat aircraft/missile signatures required the identification of major physical and chemical parameters which affect the radiation characteristics (spectral and spatial intensity) of jet aircraft and missile exhaust plumes. Investigations have been carried out to determine the spectral distributions of general hydrocarbon exhaust and combustion between 0.3 and 14 microns. Gaseous, liquid and solid...
An Investigation for Modeling Jet Plume Effects on Missile Aerodynamics
Authors: James H. Henderson; NEW TECHNOLOGY INC HUNTSVILLE AL
Results of an investigation of concepts for modeling jet plume effects on missile aerodynamics tend to confirm the concepts proposed by Korst. Comparisons were made of afterbody pressure distributions influenced by plumes of the same shape but with different plume Mach numbers and with a solid plume. These comparisons indicate that increasing effect becoming more pronounced with increasing freestream Mach number. The solid plume has the greatest effect on afterbody pressures with the effect increasing considerably at Mach numbers of 1.25 and higher. (Author)

An Approach to Experimental Investigation of Jet Plume Effects on Missile Aerodynamics
Authors: George M. Landingham; ARMY MISSILE COMMAND REDSTONE ARSENAL AL SYSTEMS SIMULATION AND DEVELOPMENT DIRECTORATE
An approach to modeling a rocket's plume effects based on the theory of Korst is presented. To implement the modeling scheme an interactive Fortran program was developed which designs model nozzles that produce geometrically similar plumes with similar base flow characteristics as prototype nozzles but use argon or some other medium instead of a propellant. Included are the modeling theory, experimental results and the Fortran program with a sample case. (Author)

ARO and AFOSR Contractors Meeting in Chemical Propulsion, Held in Virginia Beach, Virginia on 3-6 June 1996
Authors: David M. Mann; Mitat A. Birkan; Julian M. Tishkoff; AIR FORCE OFFICE OF SCIENTIFIC RESEARCH BOLLING AFB DC...
...: Supercritical droplet behavior; Fundamentals of acoustic instabilities in liquid-propellant rockets; Modeling liquid jet atomization processes; Liquid-propellant droplets dynamics and combustions in supercritical forced convective ... flow conditions; Dropet collision on liquid propellant combustion; Combustion and plumes; Development of a collisional radiative emission model for strongly nonequilibrium flows; Energy ... states in reacting rocket flows; modeling nonequilibrium radiation in high altitude plumes; kinetics of plume radiation, and of HEDMs and metallic fuels combustion; Nonsteady ...

DSMC Calculation of Supersonic Free Jets from an Orifice with Convex and Concave Corners
Authors: Masaru Usami; Koji Teshima; MIE UNIV TSU (JAPAN) DEPT OF MECHANICAL ENGINEERING
... jets from an orifice with convex and concave corners are investigated in three-dimensional field by the DSMC method. The plumes develop faster from the concave corners of a hexagram orifice with symmetric cross section than those from the ... right behind the orifice. The directions of flow are also investigated in various cross sections of a jet. There is a complicated flow-field and several circulations of flow are observed. The variation of cross section of a star shaped jet along the jet axis changes with the ratio of a stagnation pressure to a background pressure. In an asymmetric orifice, ...

Source Characterization of Heavy Gas Dispersion Models for Reactive Chemicals. Volume 1
Authors: Phani K. Raj; John A. Morris; TECHNOLOGY AND MANAGEMENT SYSTEMS INC BURLINGTON MA
... vapors generated by accidental spills. This report describes the mathematical models developed to described a variety of source types and the dispersion of vapor clouds/plumes in the atmosphere. Sixteen different source types are modeled including pressurized liquid releases, flashing and aerosol formation, two phase jet releases, explosive releases and releases of high vapor pressure liquids, cryogenic liquids and gases. Dispersion model takes into account the differences in source ...

Total Results: 11
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