

Fan Noise

National Aeronautics and Space Administration (NASA)

Controlling Ventilation Noises Armour Research Foundation (U.S.),1957

Transonic Fan Noise D. Hawkings,Aeronautical Research Council (Great Britain),1972

Comparison of the Noise Characteristics of Two Low Pressure Ratio Fans with a High Throat Mach Number Inlet Howard L. Wesoky,1978

Analytical Parametric Investigation of Low Pressure Ratio Fan Noise F. B. Metzger,1973 The results of an analytical study are reported which shows the effect of various physical and operating parameters on noise produced by low pressure ratio propulsive fans operating at subsonic tip speeds. Acoustical duct lining effects are included in the study. The concepts used to develop the noise theory used in the study, as well as the correlation between the theory and model test results are also presented. It is shown that good correlation has been established between theory and experiment. Using the theory, it is shown that good aerodynamic design, maximum acceptable fan solidity, low tip speed operation and use of few blades and vanes leads to the lowest noise levels. Typical results of the study indicate that a fan operating at 1.2 fan pressure ratio and 700 ft/second tip speed with 12 blades and 7 vanes and including modest acoustic treatment on the duct wall would produce levels allowing a 100,000 lb. STOL aircraft to meet a noise level objective of 95 PNdB at 500 ft at takeoff.

Active Control of Fan Noise National Aeronautics and Space Administration (NASA),2018-07-02 This report describes the Active Noise Cancellation (ANC) System designed by General Electric and tested in the NASA Lewis Research Center's (LERC) 48

inch Active Noise Control Fan (ANCF). The goal of this study is to assess the feasibility of using wall mounted secondary acoustic sources and sensors within the duct of a high bypass turbofan aircraft engine for global active noise cancellation of fan tones. The GE ANC system is based on a modal control approach. A known acoustic mode propagating in the fan duct is canceled using an array of flush-mounted compact sound sources. The canceling modal signal is generated by a modal controller. Inputs to the controller are signals from a shaft encoder and from a microphone array which senses the residual acoustic mode in the duct. The key results are that the (6,0) was completely eliminated at the 920 Hz design frequency and substantially reduced elsewhere. The total tone power was reduced 6.8 dB (out of a possible 9.8 dB). Farfield reductions of 15 dB (SPL) were obtained. The (4,0) and (4,1) modes were reduced simultaneously yielding a 15 dB PWL decrease. The results indicate that global attenuation of PWL at the target frequency was obtained in the aft quadrant using an ANC actuator and sensor system totally contained within the duct. The quality of the results depended on precise mode generation. High spillover into spurious modes generated by the ANC actuator array caused less than optimum levels of PWL reduction. The variation in spillover is believed to be due to calibration procedure, but must be confirmed in subsequent tests. Pla, Frederic G. and Hu, Ziqiang and Sutliff, Daniel L. Glenn Research Center...

Effects of Long-chord Acoustically Treated Stator Vanes on Fan Noise: Effect of long chord (taped stator) ,1975

Fan Noise Prediction Dennis L. Huff,1998

Noise Source Analysis and Control for Small Axial-Flow Fans Chen Wang,2017-01-26

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and rotary noise radiated by the upstream fan all increase gradually with decreased plate-fan spacing. However, the rotary noise radiated by downstream fan is hardly affected by the obstacle plate, whatever the plate-fan spacing is. The flow straightener between the two fans contributes to considerable improvement of aerodynamic performance for free inlet case, while it has a limited role in remedying the severe inlet distortion when placed in front of the upstream fan. From the derived formula of acoustic spectrum from rotor blade forces resulting from the viscous and potential wakes of the upstream counter-rotating blade row impinging in the downstream one, two obvious mechanisms for interaction noise reduction can be easily found, which are either to increase the order of the Bessel function of the first kind, or to reduce the interaction fluctuating forces which can be realized by reducing the magnitude of the wake centerline velocity deficit or broaden the wake width. Several passive methods for reducing the aerodynamic interaction noise of a newly designed small axial-flow contra-rotating fan are explored. These methods include: (1) Perforated trailing edge for the upstream rotor and perforated leading edge for the downstream rotor; (2) Slitted trailing edge serration for the upstream rotor; (3) Chordwise perforated leading edge of the downstream rotor. Up to 5-7 dB overall noise reduction at all directions is achieved through the first two methods compared under the same aerodynamic output. Only 1.3 dB of acoustic benefit is achieved by the third method, but it hardly causes any adverse impact on the aerodynamic performance. The findings are useful and helpful in designing a quiet coaxial fan (two/multiple-stage or contra-rotating) and adopting an appropriate approach for noise mitigation. Subjects: Fans (Machinery) Noise control

Application of Coherence in Fan Noise Studies Joseph R. Balombin,1980

A Method to Further Reduce the Perceived Noise of Low Tip Speed Fans

National Aeronautics and Space Administration (NASA),2018-06-16 The use of low tip speed, high bypass ratio fans is a method for reducing the noise of turbofan jet engines. These fans typically have a low number of rotor blades and a number of stator vanes sufficient to achieve cut-off of the blade passing tone. Their perceived noise levels are typically dominated by broadband noise caused by the rotor wake turbulence - stator interaction mechanism. A 106 bladed, 1100 ft/sec takeoff tip speed fan, the Alternative Low Noise Fan, has been tested and shown to have reduced broadband noise. This reduced noise is believed to be the result of the high rotor blade number. Although this fan with 106 blades would not be practical with materials as they exist today, a fan with 50 or so blades could be practically realized. A noise estimate has indicated that such a 50 bladed, low tip speed fan could be 2 to 3 EPNdB quieter than an 18 bladed fan. If achieved, this level of noise reduction would be significant and points to the use of a high blade number, low tip speed fan as a possible configuration for reduced fan noise. Dittmar, James H. Glenn Research Center NASA/TM-2000-210457, E-12453, NAS 1.15:210457

Fans Thomas Carolus,2022-12-24 This textbook combines in a unique concept the design and construction of radial and axial fans with the problem of noise generation as well as its mitigation already in the fan development stage. The aim is to describe selected, easily applicable methods of aerodynamic design and noise prediction and to demonstrate their physical principles. Exercises with solutions facilitate understanding. The completely revised and expanded edition now also includes guidance on selecting fans

for a given task, simulation-based optimization methods for fan design, and psychoacoustic methods that can be used to measure the quality of fan noise. This book is a translation of the original German 4th edition Ventilatoren by Thomas Carolus, published by Springer Fachmedien Wiesbaden GmbH, part of Springer Nature in 2020. The translation was done with the help of artificial intelligence (machine translation by the service DeepL.com). A subsequent human revision was done primarily in terms of content, so that the book will read stylistically differently from a conventional translation. Springer Nature works continuously to further the development of tools for the production of books and on the related technologies to support the authors.

Acoustic Performance of Two 1.83-meter-diameter Fans Designed for a Wind-tunnel Drive System Paul R. Soderman, 1977

Evaluation of the Tone Fan Noise Design/Prediction System (TFaNS) at the NASA Glenn Research Center National Aeronautics and Space Administration (NASA), 2018-06-15 Version 1.4 of TFaNS, the Tone Fan Noise Design/Prediction System. has recently been evaluated at the NASA Glenn Research Center. Data from tests of the Allison Ultra High Bypass Fan (UHBF) were used to compare to predicted farfield directivities for the radial stator configuration. There was good agreement between measured and predicted directivities at low fan speeds when rotor effects were neglected in the TFaNS calculations. At higher fan speeds, TFaNS is shown to be useful in predicting overall trends rather than absolute sound pressure levels. Koch, L. Danielle Glenn Research Center E-12011

NASA Technical Memorandum , 1979

Proceedings of China SAE Congress 2021: Selected Papers China Society of Automotive Engineers, 2022-10-22 These proceedings gather outstanding papers presented at the China SAE Congress 2021, held on Oct. 19-21, Shanghai, China. Featuring contributions mainly from China, the biggest carmaker as well as most dynamic car market in the world, the book covers a wide range of automotive-related topics and the latest technical advances in the industry. Many of the approaches in the book will help technicians to solve practical problems that affect their daily work. In addition, the book offers valuable technical support to engineers, researchers and postgraduate students in the field of automotive engineering.

Fan Noise Source Diagnostic Test National Aeronautics and Space Administration (NASA), 2018-05-31 The aerodynamic performance of an isolated fan or rotor alone model was measured in the NASA Glenn Research Center 9- by 15- Foot Low Speed Wind Tunnel as part of the Fan Broadband Source Diagnostic Test conducted at NASA Glenn. The Source Diagnostic Test was conducted to identify the noise sources within a wind tunnel scale model of a turbofan engine and quantify their contribution to the overall system noise level. The fan was part of a 1/5th scale model representation of the bypass stage of a current technology turbofan engine. For the rotor alone testing, the fan and nacelle, including the inlet, external cowl, and fixed area fan exit nozzle, were modeled in the test hardware; the internal outlet guide vanes located behind the fan were removed. Without the outlet guide vanes, the velocity at the nozzle exit changes significantly, thereby affecting the fan performance. As part of the investigation, variations in the fan nozzle area were tested in order to match as closely as possible the rotor alone performance with

the fan performance obtained with the outlet guide vanes installed. The fan operating performance was determined using fixed pressure/temperature combination rakes and the corrected weight flow. The performance results indicate that a suitable nozzle exit was achieved to be able to closely match the rotor alone and fan/outlet guide vane configuration performance on the sea level operating line. A small shift in the slope of the sea level operating line was measured, which resulted in a slightly higher rotor alone fan pressure ratio at take-off conditions, matched fan performance at cutback conditions, and a slightly lower rotor alone fan pressure ratio at approach conditions. However, the small differences in fan performance at all fan conditions were considered too small to affect the fan acoustic performance. Hughes, Christopher E. and Jeracki, Robert J. and Woodward, Richard P. and Miller, Christopher J. Glenn Research Center AERODYNAMIC CHARACTERISTI

Active Control of Fan Noise by Vane Actuators National Aeronautics and Space Administration (NASA), 2018-08-27 An active noise control system for ducted fan noise was built that uses actuators located in stator vanes. The actuators were piezoelectric benders manufactured using the THUNDER technology and were custom designed for the application. The active noise control system was installed in the NASA ANCF rig. Four actuator array with a total of 168 actuators in 28 stator vanes were used. Simultaneous reductions of acoustic power in both the inlet and exhaust duct were demonstrated for a fan disturbance that contained two radial mode orders in both inlet and exhaust. Total power levels in the target modes were reduced by up to 9 dB in the inlet and total tone levels by over 6 dB while exhaust power levels were reduced by up to 3 dB. Far field sound

pressure level reductions of up to 17 dB were observed. A simpler control system, matched to the location of the disturbance with two radial actuator arrays, was demonstrated to control total acoustic power in four disturbance modes simultaneously in inlet and exhaust. The vane actuator met the requirements given for the ANCF, although in practice the performance of the system was limited by the constraints of the power amplifiers and the presence of control spillover. The vane actuators were robust. None of the 168 vane actuators failed during the tests. Curtis, Alan R. D. Glenn Research Center; Langley Research Center ACTIVE CONTROL; AERODYNAMIC NOISE; NOISE REDUCTION; PIEZOELECTRICITY; SOUND PRESSURE; ACTUATORS; FAR FIELDS; STATORS...

Active Control of Fan Noise National Aeronautics and Space Adm Nasa, 2018-11 An extension of a prior study has been completed to examine the potential reduction of aircraft flyover noise by the method of active noise control (ANC). It is assumed that the ANC system will be designed such that it cancels discrete tones radiating from the engine fan inlet or fan exhaust duct, at least to the extent that they no longer protrude above the surrounding broadband noise levels. Thus, without considering the engineering details of the ANC system design, tone levels are arbitrarily removed from the engine component noise spectrum and the flyover noise EPNL levels are compared with and without the presence of tones. The study was conducted for a range of engine cycles, corresponding to fan pressure ratios of 1.3, 1.45, 1.6, and 1.75. This report is an extension of an effort reported previously. The major conclusions drawn from the prior study, which was restricted to fan pressure ratios of 1.45 and 1.75, are that, for a fan pressure ratio of 1.75,

ANC of tones gives about the same suppression as acoustic treatment without ANC. For a fan pressure ratio of 1.45, ANC appears to offer less effectiveness from passive treatment. In the present study, the other two fan pressure ratios are included in a more detailed examination of the benefits of the ANC suppression levels. The key results of this extended study are the following observations: (1) The maximum overall benefit obtained from suppression of BPF alone was 2.5 EPNdB at high fan speeds. The suppression benefit increases with increase in fan pressure ratio (FPR), (2) The maximum overall benefit obtained from suppression of the first three harmonics was 3 EPNdB at high speeds. Suppression benefit increases with increase in FPR, (3) At low FPR, only about 1.0 EPNdB maximum reduction was obtained. Suppression is primarily from reduction of BPF at high FPR values and from the combination of tones at low FPR, (4) The benefit from ANC is about the same as the benefit from passive treatment at fan pressure ra...

NASA Technical Note United States. National Aeronautics and Space Administration, 1974

Vibrations and Noise in Pump, Fan, and Compressor Installations Institution of Mechanical Engineers (Great Britain). Fluid Machinery Group, 1975

Unveiling the Magic of Words: A Review of "**Fan Noise**"

In a world defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their capability to kindle emotions, provoke

contemplation, and ignite transformative change is actually awe-inspiring. Enter the realm of "**Fan Noise**," a mesmerizing literary masterpiece penned by a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve to the book is central themes, examine its distinctive writing style, and assess its profound affect the souls of its readers.

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