Noise Encountered in Rotary-Wing Aircraft

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Citation: The Journal of the Acoustical Society of America **47**, 121 (1970); doi: 10.1121/1.1973993
View online: https://doi.org/10.1121/1.1973993
View Table of Contents: https://asa.scitation.org/toc/jas/47/1A
Published by the Acoustical Society of America

folds. The vestibular entrance is altered by proximity of the epiglottis to the pharyngeal wall. The laryngeal movement is always one of lowering accompanied by a forward tilt.

11:00

7F5. Perceptual Studies of Female Chest and Middle Registers in Singing. JOHN LARGE, *Voice Science Laboratory, Stanford University, Stanford, California 94305,* AND THOMAS SHIPP, *Speech Research Laboratory, Veterans Administration Hospital, San Francisco, California 94121.*—A critical portion of a research program into the nature of vocal registers in singing is to establish their perceptual entity. Selected for study were the chest and middle registers as produced by female student singers. The singer–subjects were trained to produce sustained phonation in one register and, while holding constant the parameters of vowel, voice frequency, and over-all intensity, transit to the adjacent register. These recorded stimuli were presented for register judgment to several groups of student singer–judges in order to obtain samples on which there was unanimous agreement as to the register produced by the singer–subjects. These stimuli were subsequently altered to remove the most obvious possible perceptual cues: by splicing out the interregister transition and by low-pass filtering at 1400 Hz. Another group of student singers was presented with the altered stimuli for judgment. The results suggested that the acoustic information during the transition period contributed little to register identification; whereas the low-pass filtering condition had a marked effect on register identification. [This investigation was supported in part by the National Institutes of Health.]

11:30

7F6. Physiology of Vocal Registers in Singers and Nonsingers. HARRY HOLLIEN, *Communication Sciences Laboratory, University of Florida, Gainesville, Florida 32601,* AND RAYMOND COLTON, *Upstate Medical Center, Syracuse, New York 13210.*—The focus of this presentation includes only three registers (vocal fry, modal, and falsetto) even though it is recognized that other registers and/or subregisters probably do exist. In this regard, data from four studies are presented in order to establish the f_0 boundaries in these three registers for large numbers of nonsingers and smaller groups of singers. Secondly, perceptual and acoustical data from five studies is discussed in which the registers are compared to each other and to other types of phonatory signals. Special emphasis is given to a set of investigations in which perceptual and acoustical differences between modal and falsetto registers (for fundamental frequencies where they overlapped) were studied in a group of singers and a matched group of nonsingers. Finally, a substantial number of published and unpublished studies will be utilized in order to contrast the three specified registers with respect to the underlying physiology of each. Of special emphasis here will be vocal-fold length, vocal-fold thickness, vibratory patterns, subglottic pressure, and air flow.

FRIDAY, 7 NOVEMBER 1969 INTERNATIONAL ROOM, 2:00 P.M.

Session 7G. Noise Control II

NATHAN SHAPIRO, *Chairman*

Contributed Papers (12 minutes)

2:00

7G1. Investigation of a Noise Problem in the Cockpit of a Fighter Airplane. DAVID ALAN BIES, *Bolt Beranek and Newman Inc., Van Nuys, California 91406,* AND RICHARD F. CARMICHAEL, *Northrop/Norair, Hawthorne, California 90250.*—The noise levels during operation in the cockpit of the F5 fighter plane are controlled primarily by the operation of the air-conditioning unit that operates on bleed air from the engine compressors. In one version of the airplane, low-frequency noise in narrow bands at about 135 and 180 Hz was found to be associated with severe pilot complaint about the cockpit acoustical environment. The paper briefly reviews the procedures by which the source of troublesome low-frequency noise was discovered and corrected. The paper also reviews procedures by which the most likely sources of remaining high-frequency noise have been identified and indicates the direction that should be taken to improve further the cockpit environment.

2:15

7G2. Noise Encountered in Rotary-Wing Aircraft. D. C. GASAWAY, *USAF School of Aerospace Medicine, Brooks Air Force Base, Texas 78235.*—The acoustic environment encountered within rotary-wing aircraft constitutes a mixture of several noise-generating mechanisms. Primary and secondary noise-producing mechanisms that are associated with the ground and airborne operation of rotary-wing aircraft are identified, described, and illustrated. Some of the noise sources studied include main rotor(s), antitorque rotor, main and secondary transmission and gear-shaft distribution systems, and auxiliary power units. In addition to reporting specific noise generators, composite noise envelopes are provided, which illustrate typical noise environs found within rotary-wing vehicles with different configurations of rotor-power plant matings. Alterations in internal noise that occur during conditions of hover and forward flight are described, and aeromedical factors such as speech interference and potential auditory risk are identified.

2:30

7G3. Noise Control for Induced-Draft Fan Installations. R. M. HOOVER, *Bolt Beranek and Newman Inc., Cambridge, Massachusetts 02138,* AND C. O. WOOD. *Westinghouse—Sturtevant Division, Boston, Massachusetts 02136.*—Noise-level data on a number of induced-draft centrifugal fans with flat radial blades are presented with emphasis on the level of the normal low-frequency blade-passage tone. Data taken near the fans at