



Reduction of Flap Side Edge Noise — the Blowing Flap

A technique to reduce the noise radiating from a wing-flap side edge is being developed. As an airplane wing with an extended flap is exposed to a subsonic airflow, air is blown outward through thin rectangular chord-wise slots at various locations along the side edges and side surface of the flap to weaken and push away the vortices that originate in that region of the flap and are responsible for important noise emissions. Air is blown through the slots at up to twice the local flow velocity. The blowing is done using one or multiple slots, where a slot is located along the top, bottom or side surface of the flap along the side edge, or also along the intersection of the bottom (or top) and side surfaces.

This work was done by Florence V. Hutcheson and Thomas F. Brooks of Langley Research Center. Further information is contained in a TSP (see page 1). LAR-16946-1

Preventing Accidental Ignition of Upper-Stage Rocket Motors

A report presents a proposal to reduce the risk of accidental ignition of certain upper-stage rocket motors or other high-energy hazardous systems. At present, mechanically in-line initiators are used for initiation of many rocket motors and/or other high-energy hazardous systems. Electrical shorts and/or mechanical barriers, which are the basic safety devices in such systems, are typically removed as part of final arming or pad preparations while personnel are present. At this time, static discharge, test equipment malfunction, or incorrect arming techniques can cause premature firing. The proposal calls for a modular “out-of-line” ignition system incorporating detonating-cord elements, identified as the donor and the acceptor, separated by an air gap. In the “safe” configuration, the gap would be sealed with two shields, which would prevent an accidental firing of the donor from igniting the system. The shields would be removed to enable normal firing, in which shrapnel generated by the donor would reliably ignite the acceptor to continue the ordnance train. The acceptor would then ignite a through bulkhead initiator (or other similar device), which would ignite the motor or high-energy system. One shield would

be remotely operated and would be moved to the armed position when a launch was imminent or conversely returned to the safe position if the launch were postponed. In the event of failure of the remotely operated shield, the other shield could be inserted manually to “safe” the system.

This work was done by John Hickman, Herbert Morgan, and Michael Cooper of Goddard Space Flight Center and Marcus Murbach of Ames Research Center. Further information is contained in a TSP (see page 1). GSC-14691-1

Designing Flight Deck Procedures

Three reports address the design of flight-deck procedures and various aspects of human interaction with cockpit systems that have direct impact on flight safety. One report, “On the Typography of Flight-Deck Documentation,” discusses basic research about typography and the kind of information needed by designers of flight-deck documentation. Flight crews reading poorly designed documentation may easily overlook a crucial item on the checklist. The report surveys and summarizes the available literature regarding the design and typographical aspects of printed material. It focuses on typographical factors such as proper typefaces, character height, use of lower- and upper-case characters, line length, and spacing. Graphical aspects such as layout, color coding, fonts, and character contrast are discussed; and several cockpit conditions such as lighting levels and glare are addressed, as well as usage factors such as angular alignment, paper quality, and colors. Most of the insights and recommendations discussed in this report are transferable to paperless cockpit systems of the future and computer-based procedure displays (e.g., “electronic flight bag”) in aerospace systems and similar systems that are used in other industries such as medical, nuclear systems, maritime operations, and military systems.

Another report, “Human Factors of Flight-Deck Checklists: The Normal Checklist,” analyzes aircraft checklists (which are regarded as the foundation of pilot standardization and cockpit safety). The improper use, or non-use, of the normal checklist by flight crews is often cited as the probable cause or contributing factor to many aircraft accidents. The report

addresses the functions, format, design, length, usage of cockpit checklists, and the limitations of the humans who must interact with it. The development of the checklist from certification of a new aircraft to its delivery and use by the customer is also discussed in the report. A list of design guidelines for normal checklists is also provided.

Finally, the “On the Design of Flight-Deck Procedures” report examines the general topic of flight-deck procedures, which are the backbone of cockpit operations and a critical aspect of flight safety, and provide a general framework (called the 4 P’s) for developing procedures. The report argues that the procedures are not only hardware/software dependent, as traditionally believed, but are also dependent on the operational environment, the type of people who operate them and the culture of the company they work for, and the nature of the companies’ operations. Four factors are emphasized throughout the document: compatibility, consistency, quality management, and feedback. Although the report is based on airline operations, the issues addressed in the report have already been applied to other complex and high-risk systems, such as nuclear power production, manufacturing process control, space flight, military operations, and high-technology medical practice.

This work was done by Asaf Degani of Ames Research Center and Earl Wiener of the University of Miami. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to the Technology Partnerships Division, Ames Research Center, (650) 604-2954. Refer to ARC-15248-1.

Update on High-Temperature Coils for Electromagnets

A report revisits the subject matter of “High-Temperature Coils for Electromagnets” (LEW-17164), *NASA Tech Briefs*, Vol. 26, No. 8, (August 2002) page 38. To recapitulate: Wires have been developed for use in electromagnets that operate at high temperatures. The starting material for a wire of this type can be either a nickel-clad, ceramic-insulated copper wire or a bare silver wire. The wire is covered by electrical-insulation material that is intended to withstand operating temperatures in the range from 800 to 1,300 °F (≈430 to ≈700 °C): The starting wire is either primarily wrapped with S-glass as