Performance of Subsonic Transports and Cargo Aircraft

The overall high speed performance of subsonic transports and cargo aircraft is improved primarily by bettering the lift-to-drag ratios and increasing the cruise speed toward the speed of sound. As a result of the research of the past decade it is now possible to design a transport or cargo airplane configuration with very high lift-to-drag ratios at Mach numbers close to the speed of sound. Such a configuration would have a high aspect ratio, specially cambered wing with a sweep back of roughly 45°. The fuselage would be contoured on the basis of the area rule and the engine nacelles would be placed on the aft portion of the upper surface of the wing. Also means are available to improve the performance of existing configurations. Such means consist of additions to the wing and fuselage.

Future research on transport and cargo airplane configurations will be directed toward obtaining small further improvements of the lift-to-drag ratios and speed. The high performance configuration described above presents certain structural problems which may exclude its use. Therefore, other approaches to obtaining improving performance will be investigated. Much of the additional research will be done for configurations with the engine attached to aft portion of the fuselage. This research on configurations will be carried out primarily in the 16-foot transonic tunnel. An average of approximately 2 research engineers will be involved.

The performance of such transport and cargo aircraft is also increased by improving the efficiency and thrust of the installed engines. Most current high performance designs incorporate turbo jet and turbo props for which the background of research information on the engines and their installation is extensive.
However, most future subsonic transport and cargo airplanes will utilize turbofan engines since the thrust and efficiency of such engines are significantly greater than for turbojets and the weight and complexity is less than for turbodrops. Little research will be done on the turbofan engine itself. However, significant research will be carried out to improve the intake of air to such engines. For example, for some such engines the fan is at the aft end of the engine. Investigations will be carried out to determine the best methods for taking air into this aft fan. Further investigations will be made of various air inlets for fan engine placed on the aft portion of the upper surface as described in the preceding paragraph. This research on turbofan installations will be done primarily in the 16-foot transonic and 8-foot transonic tunnels. An average of 2 research engineers will be utilized.
Dynamic Loads on Subsonic Transports and Cargo Airplanes

Subsonic transports and cargo airplanes have a number of special problems pertaining to flutter, and gusts. For example, research has indicated that the aerodynamic efficiency of a subsonic transport type airplane is improved by locating the engines along the aft region of the wing. Such installations may lead to adverse flutter characteristics. Also, the higher aspect ratios of the wings for such airplanes make the gust problem more severe than for supersonic type airplanes. Research will be done on these problems primarily in the Transonic Dynamics Tunnel. An average of approximately 2 research engineers will be utilized.