FINAL REPORT

STUDY OF THE FEASIBILITY OF USING A SAILPLANE AS AN INSTRUMENT PLATFORM FOR THE STUDY OF WAKE VORTEX PHENOMENA

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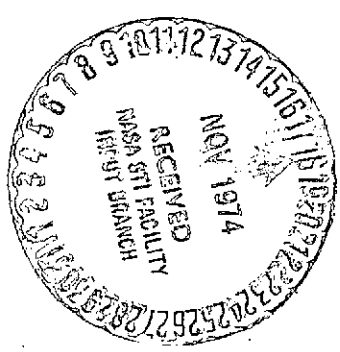

Introduction

This study, initiated in 1972, had as its objective the determination of the feasibility of utilizing instrumentation mounted on the wing of a sailplane to be flown in the wake of a large aircraft. The large aircraft utilized was a DC-3 and the program attempted to determine the ability of the sailplane pilot to hold position in the vortex wake with sufficient precision to permit meaningful measurements.

Instrumentation

The DC-3 aircraft was equipped with a wing tip pod containing four yellow M-18 grenades activated sequentially from the cockpit by electrical signals. The sailplane instrumentation consisted of a rotating vane vorticity meter and static and total pressure tubes mounted in a pod on the glider wing tip. Output from this instrumentation was recorded on a tape recorder.

Test Operations

Three test flights were conducted during the winter of 1973-74. They consisted of a rendevous at approximately 5,000 feet AGL at which point the sailplane released from the tow plane and moved into position behind the DC-3. Upon request from the sailplane pilot, the smoke grenades were fired one at a time. The sailplane pilot attempted to hold his wing tip instrumentation within the smoke trail. Each grenade provided approximately 90 seconds of run time and although not all grenades fired on all flights, the number of runs were adequate to assess the feasibility of this approach to vortex wake measurement.

Results

In all three runs the glider pilot was successful in controlling his aircraft attitude and in obtaining descent rate changes of the DC-3 to maintain approximate range and glide path angle consistent with the requirements of the experiment. He was not successful in maintaining a steady position with the wing tip in the smoke plume for more than one or two seconds at a time, chiefly due to the instability of the glider in this flow environment. No difficulty was encountered in maintaining a wing level attitude. The roll control of the sailplane was more than sufficient for this purpose.

The glider experienced two modes of instability in attempting to hold the position. The more common mode was one which tended to move the glider laterally away from the vortex. The other mode was experienced on two occasions in which the glider was thrown into a wings-level circuit of the vortex.

The glider pilot experienced difficulty in judging the location of the smoke plume. The plume was not sufficiently dense to be able to distinguish its passage over the glider wing. This experience occurred over a variation in range from the DC-3 of from approximately 50 yards to one mile. During the course of the experimental tests, the smoke plume exhibited on some occasions a straight stable configuration and on other occasions a breakup into a Crow type of sinusoidal configuration. The controllability of the glider did not seem to depend to a great extent on the type of plume configuration.

Conclusions

As a result of the experience gained from this study, it is felt that

sailplane mounted instrumentation for measuring vortex properties behind large aircraft is not feasible. A 16mm movie of the flight tests was made and a copy transmitted to the contract monitor with this report.