ENGINEERING RESEARCH INSTITUTE
UNIVERSITY OF MICHIGAN
ANN ARBOR

PROGRESS REPORT No. 6

August 1 to October 31, 1952

By

RALPH PHINNEY

Approved by:

J. R. SELLARS

Project M937

WRIGHT AIR DEVELOPMENT CENTER, U. S. AIR FORCE
CONTRACT AF 33(038)-19747, E. O. No. 460-31-12-11 SR-1g

December, 1952

PROGRESS REPORT No. 6

A second short interval of preliminary testing in the wind tunnel was made available so that it was possible to make some china-film runs with the wings in place and also to connect some of the manometer leads to check their response. As a result of the china-film testing it was found that the wing support at the window had too much frontal area and was producing large flow disturbances and a local flow separation. By grinding away the support trunion it was found that the disturbance could be greatly reduced without seriously affecting the support of the wing.

The china film showed that the pin that was to locate the wing with respect to the body was also causing distrubances on the body and wing in the testing region. Even though the surface of the pin was to be flush with the surface of the body and the unused pin holes were to be filled, it was found that these conditions couldn't be fulfilled well enough to get no measurable pressure change on the body. A material could not be found that would fill the unused pin holes, not be eroded by the air stream, and still come out clean enough so that the wing pin would fit well into the cleaned-out hole. In addition the orifice holes are near the pin holes, so that there was a constant danger that the most important holes near the juncture would be plugged with the filling material.

Some deflection tests on the existing wing indicated that there was a deflection of the wing with respect to the body even when the pin was fitted in its hole. It was also found by experimenting with the existing wing that most of the deflection of the wing due to the air loads was taking place in the wing panel itself rather than in the trunion or in the external support. On this basis it was decided to make a new wing which is somewhat thicker and which has a wing-to-trunion transition with the optimum aerodynamic and load-carrying characteristics.

Application of the china-film technique also showed that the shocklet from the nose was hitting the side walls at the position where the wings are supported. The interaction of the two distrubances seemed to be such that it would not be possible to make a body-alone pressure

test, indicating the pressure field of the nose shock, and then have the data apply to the wings and body, since the pressure field of the nose shocklet would be altered by the presence of the wing. In order to circumvent this difficulty it was decided to move the nose shocklet forward out of the influence of the wing and also make it weaker by reducing the nose angle considerably. The new nose was built and tested by the china-film method and found to be a material improvement.

On this series of tests some manometry was done, although getting pressure data was not the prime purpose. Some of the tubes were connected to get an order of magnitude for the pressure changes in the juncture and to test the repeatability of the measuring system. Because of the large number of orifices on the model it was necessary to repair an existing manometer board to handle the surplus orifices.

Since the wind tunnel schedule does not permit the full-scale test to start until the last of this year, it was decided to attempt a solution to the linearized problem of a cylindrical body at an angle of attach and a semi-infinite wing at zero angle of attack. With this solution the pressure field over any cylindrical body—double-wedge-wing combination could be solved with any angle of attack on the body and wing. In the period covered by this report the problem was set up, the potential for the wing that cancels the doublet flow over the body was found, and the normal velocity to the body due to this wing potential was also found. There remains to get the Fourier components of the normal velocity to the body and to find from it the body potential that induces no velocity in the wing plane and that cancels the velocity normal to the body.