4-FOOT SUPERSONIC PRESSURE TUNNEL

Speech at 1951 Biennial Inspection

MODELS AND TESTING TECHNIQUES OF THE 4- BY 4-FOOT SUPERSONIC PRESSURE TUNNEL

By Donald D. Baals

Also given by:
M. L. Spearman
J. H. Hilton Jr.

You are now in the test chamber of the Langley 4-foot supersonic pressure tunnel. On this pictorial drawing of the facility you are located about here. This is a variable density tunnel with a drive system totaling 60,000 horsepower. It permits simulation of full-scale conditions for many aircraft and missiles over a test Mach number range of 1.2 to 2.2.

This model, which was constructed for testing in the 4-foot supersonic tunnel, is shown here with its normal set of instrumentation. The model is equipped with a 6-component balance which is housed within the model and is connected to its load indicator above. The most important feature of this balance is that it measured the direct forces on the model itself. It does not include the large and unknown tare forces of the model support system that would have occurred had we used some external type of balance.

The various forces and moments measured by this balance can be illustrated as follows. This is the LIFT component. The DRAG component acts in the axial direction. Note that as I apply a pure LIFT load, there is no reaction on the DRAG. This the PITCHING MOMENT. This is a positive moment; this is negative. The moment of an applied force will be zero when I reach the pitch center - - - here. We normally design the model so that the pitch center and the center of gravity of the configuration are located at the same station. The three lateral components are ROLLING MOMENT, YAWING MOMENT, and SIDE FORCE. Note that any forces on the supporting sting are not included in the balance readings.

In order to study control effectiveness, the model is equipped with movable forward control surfaces and ailerons. To save tunnel time, the angle of the forward control surfaces can be varied during the tests by means of an electric motor housed within the model. The control position is indicated on the dial overhead. Note the control surface changing angle and the reading of change in the control position indicator. In addition, the hinge moments resulting from the aerodynamic loads on the forward control surfaces and the ailerons are indicated on separate balances . . . . . here.

This model is illustrative of one of the types of work which can be accomplished in the 4-foot supersonic pressure tunnel. This model and its instrumentation will permit evaluation of the general aerodynamic and stability and control characteristics. By tests of the various components alone and in combination the general interference effects may also be evaluated. The variable pressure feature of this tunnel permits study of another important field of work - the problem of boundary layers. The next speaker, _____, will discuss some of the boundary layer problems of aerodynamic heating and skin friction at supersonic speeds

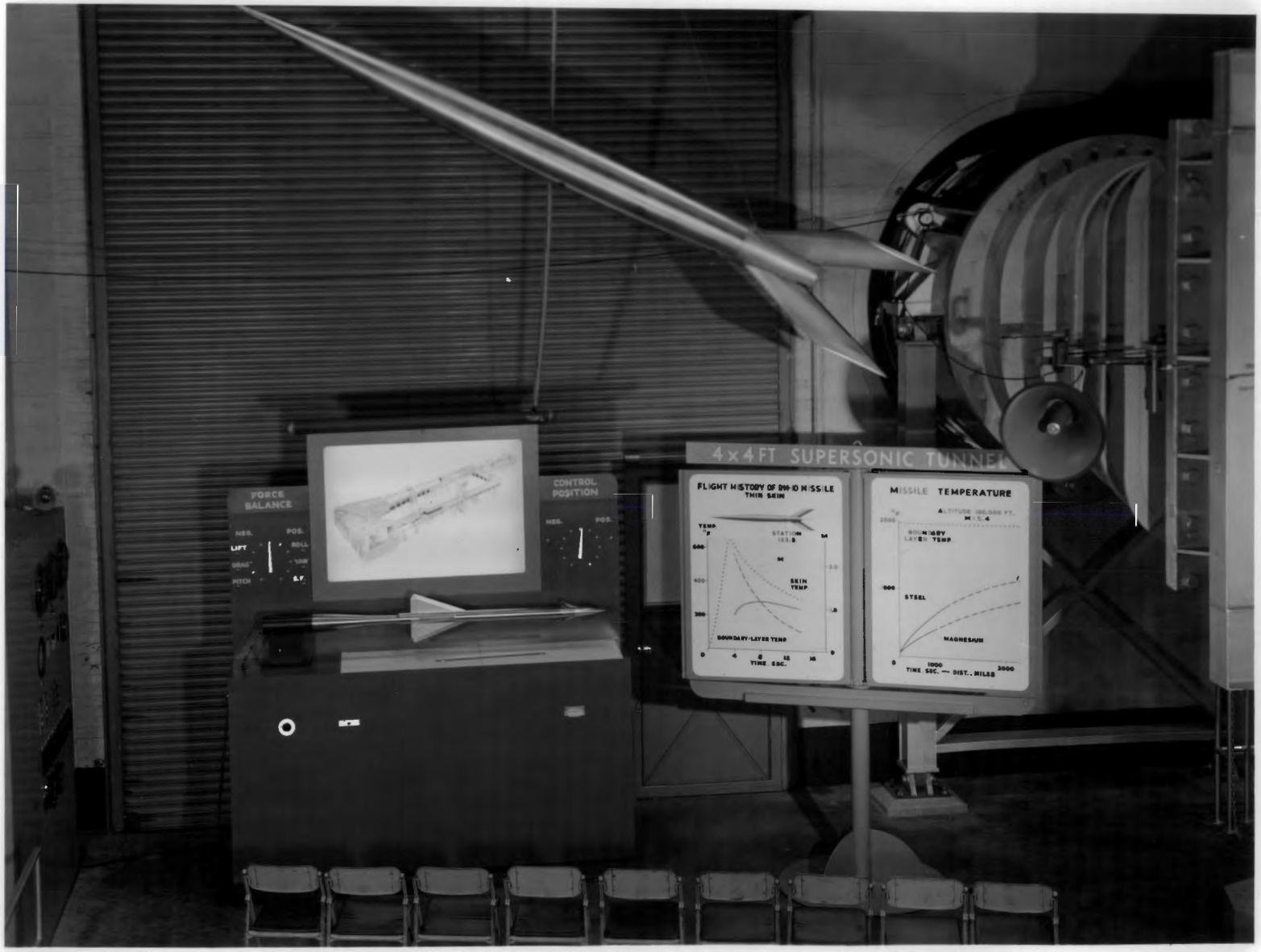
---

Talk by Dr. Rubert on Aerodynamic Heating and Skin Friction.

On display for your inspection are a number of exhibits. On your right - and the missile model overhead - are exhibits illustrating the

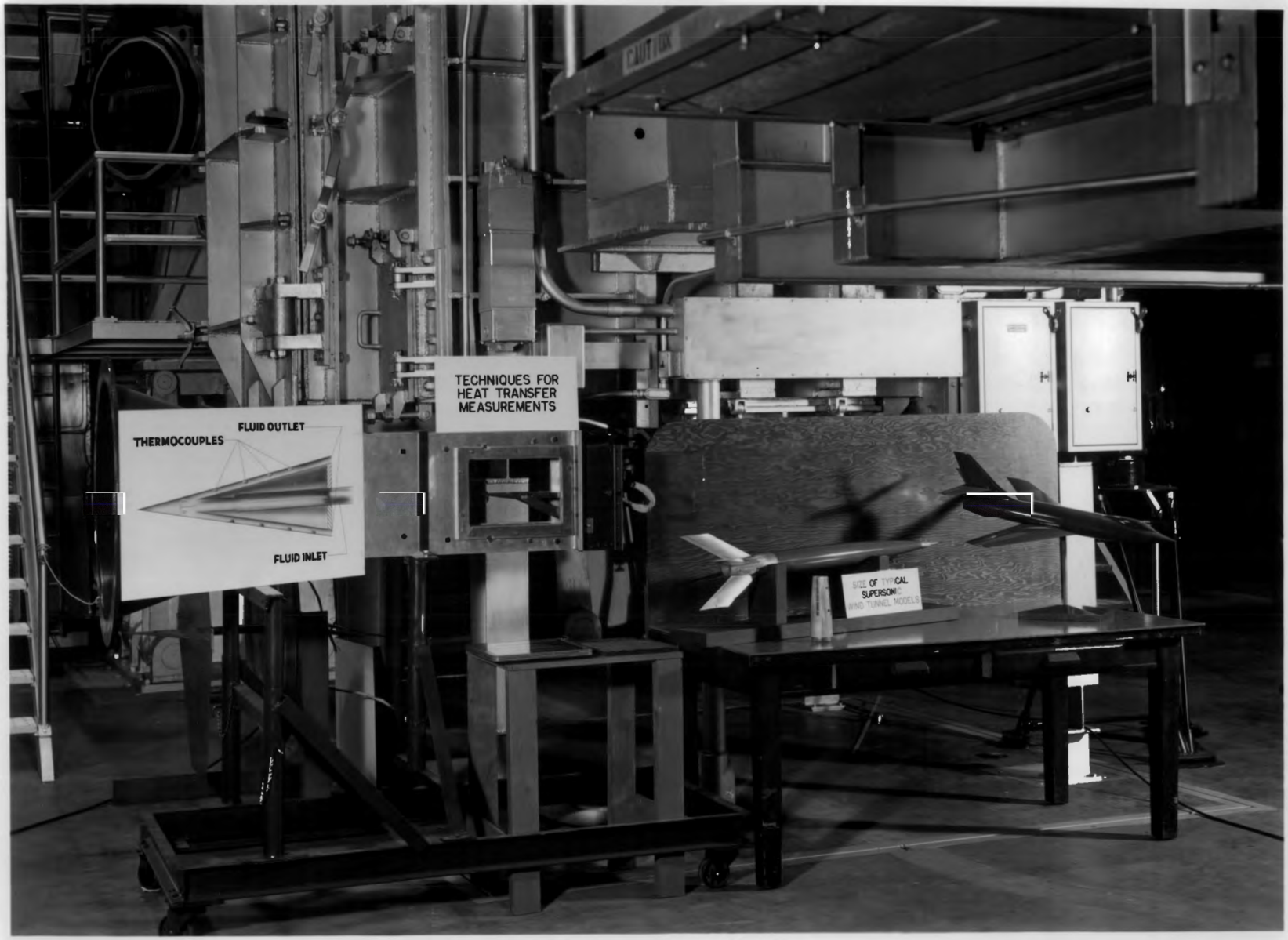
1951 BI
4' Baals

technique of measurement of heat transfer in wind tunnel and in flight. You may go up on the platform at the rear and inspect the model in the test section. On your far right is the tunnel control room. Staff members are on hand at each exhibit to explain and answer any questions.



NACA

LAL 70519



NACA

LAL 70520