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WT 20-583

CAPTIVE DYNAMIC-STABILITY TESTS OF THE GEMINI ABORT-SEAT CONFIGURATION IN THE JPL 20-INCH SUPERSONIC WIND TUNNEL

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I. INTRODUCTION

Wind-tunnel Test 20-583 was a test of the Gemini abort-seat configuration model. The purpose of the test was to obtain dynamic-stability data for the configuration.

The approximate aerodynamic parameters for the test were Mach No. 1.33, 1.65, 2.21, and 2.81, with corresponding Reynolds No./in. and dynamic pressures shown in Table 1. The test variables and ranges were initial angles of attack (α_0) from 0 to 340 deg. The model configuration comprised the Gemini seat and passengers, shown in Fig. 1 and 2.

The test* was conducted at the Jet Propulsion Laboratory (JPL) from November 19 through 21, 1963, for the NASA Manned Spacecraft Center (Houston, Tex.) represented by Mr. J. Hondros.

II. MODEL DESCRIPTION

The models are shown in Fig. 1 and 2. These were scale models of the Gemini abort-seat and passengers. The models were mounted on a ball-bearing support.

III. WIND TUNNEL

Reference 1 describes the construction and operating conditions of the 20-in. supersonic wind tunnel. The wind tunnel has a nominal test-section size of 20 in. square, a Mach range from 1.3 to 5.0, a flexible-plate nozzle, and operates with continuous flow. Table 1 presents representative values of the test-section flow parameters for the Mach numbers at which this test was conducted.

IV. TEST PROCEDURE

Prior to actual test operations, measurements were made to determine the moments of inertia of the models and the calibration sphere. The center-of-gravity of the calibration sphere was offset from the bearing axis. During

*Symbols are defined in the Nomenclature.

a calibration run, the sphere was released 180 deg from its stable rest position. Analysis of high-speed motion pictures of the sphere's motion produced bearing-damping coefficients.

After moments of inertia and bearing-damping coefficients were obtained, the models were tested by releasing them at various initial angles-of-attack and tunnel flow conditions and by simultaneously taking high-speed motion pictures of the models' motions.

V. DATA REDUCTION

The data-reduction procedure is described in Ref. 2 (JPL WT Report No. 20-499, published November 2, 1962).

VI. RESULTS

The actual data reduction was conducted by the NASA Manned Spacecraft Center, and all motion pictures have been forwarded to them.

NOMENCLATURE

M	Mach number
q	dynamic pressure of the free-stream
α	angle between the horizontal axis of the model and the centerline of the tunnel; α is 0 deg when the seat-back is vertical, i.e., the seat-back is perpendicular to the wind and the passenger is facing the wind; α is +90 deg when the seat-back is parallel to the wind and the passenger's feet are facing the wind.
a_0	initial, or release, angle of the model

REFERENCES

1. Jet Propulsion Laboratory, California Institute of Technology, Wind-Tunnel Facilities at the Jet Propulsion Laboratory, Pasadena, California, JPL, January 1, 1962. (Technical Release No. 34-257) UNCLASSIFIED

2. Jet Propulsion Laboratory, California Institute of Technology, Results of the JPL Aerodynamic-Damping-in-Pitch Wind-Tunnel Program, by Duane A. Nelson, Pasadena, California, JPL, November 2, 1962. (JPL WT 20-499) UNCLASSIFIED

Table 1. Average aerodynamic parameters

Parameter	Mach Number			
	1.33	1.65	2.21	2.81
Static pressure (psia)	0.86 6.65	0.56 2.44	0.56 1.76	0.45
Stagnation pressure (psia)	2.49 19.2	2.56 11.6	6.15 19.2	12.5
Dynamic pressure (psia)	1.06 8.21	1.06 4.84	1.94 6.04	2.50
Reynolds number (per in. x 10^{-6})	0.06 0.48	0.06 0.27	0.11 0.35	0.17

NOTE: When two sets of numbers are given, the first number represents a minimum value; the second, a maximum value.

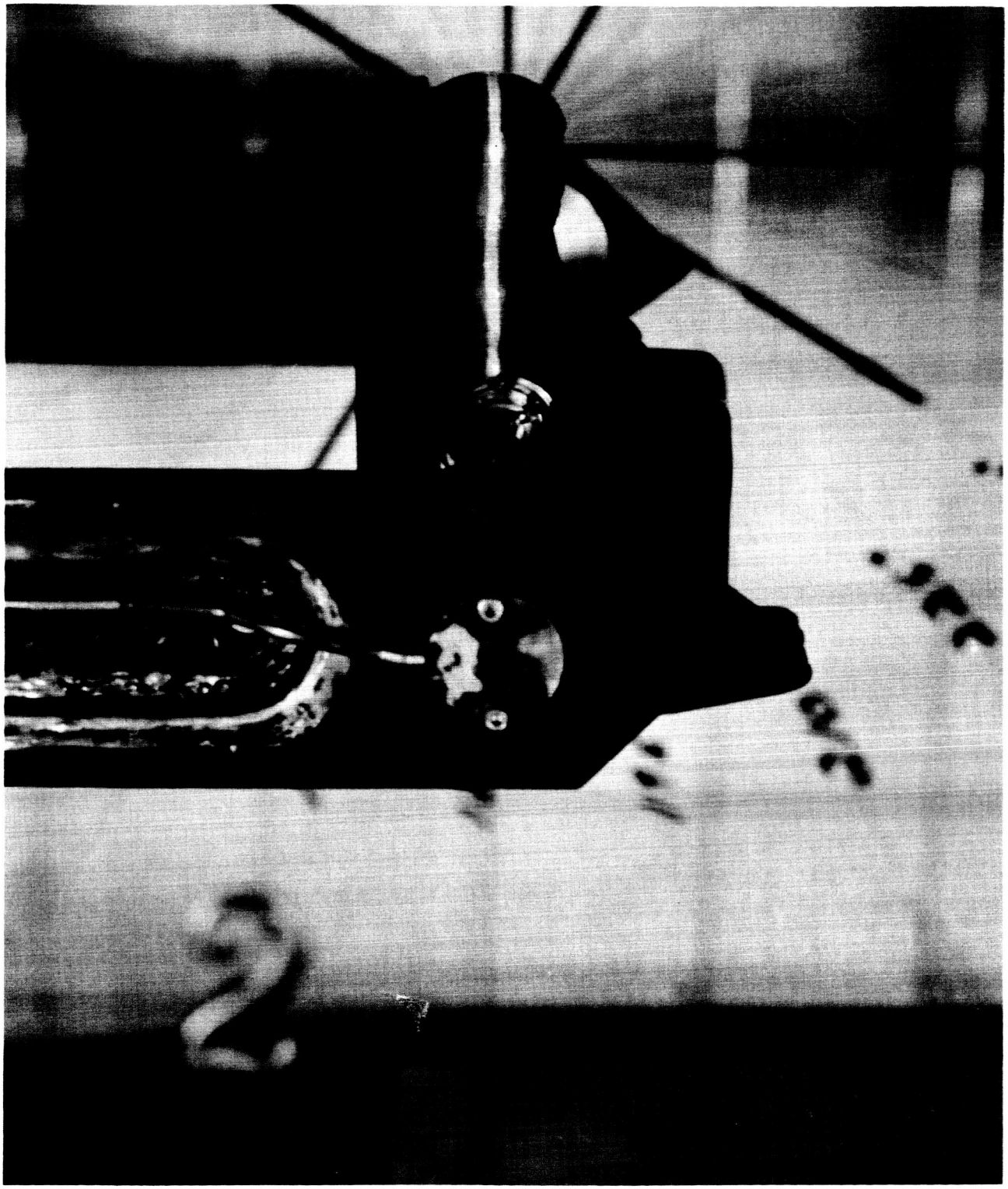

Fig. 1. Installation of model in the 20-in. supersonic wind tunnel

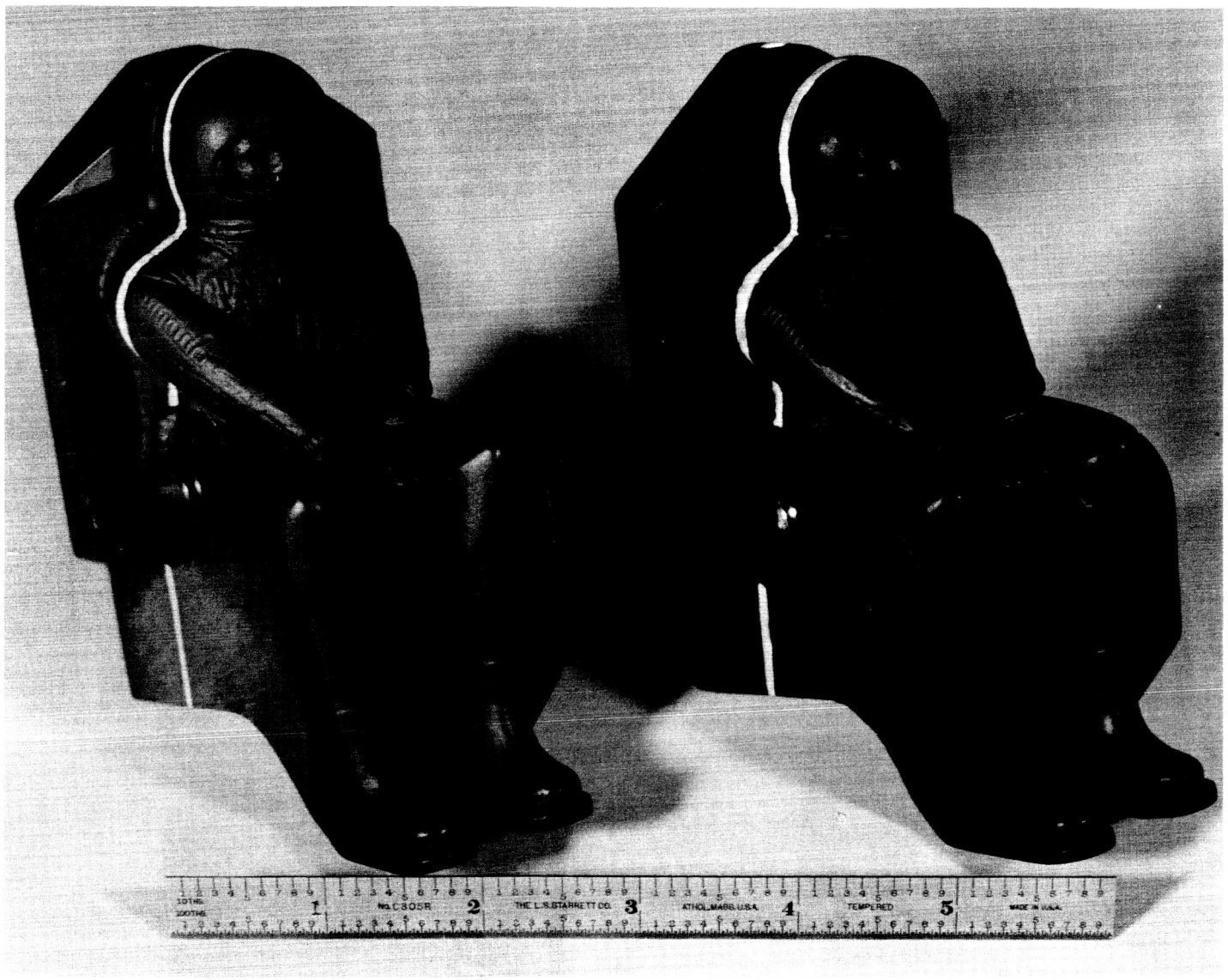

Fig. 2. Models tested