

Multi Axis Spin Test Inertial Facility

MASTIF Space Progress Report

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One of the problems facing man when he first begins to travel in space is whether or not he can properly orientate and control the flight of his space vehicle. The National Aeronautics and Space Administration has constructed a multi-axis test facility at its Lewis Research Center in Cleveland.

With this facility it is possible to recreate any type of tumbling that the space vehicle might encounter when it is separated from its rocket booster in space. The multi-axis test facility consists of three concentric cages, each of which is gimbal-mounted to permit independent freedom of rotation. Rotation is induced using high-pressure nitrogen contained in spherical bottles on each cage. The nitrogen is ejected through small nozzles at the ends of each cage producing a thrust reaction that turns the cage. Each cage can be rotated about its axis at speeds of five to sixty rotations per minute.

The goal of the tests is first to study the ability of the pilot to orientate himself with instruments while tumbling. The second is to study the ability of the pilot to correct the tumbling by means of the nitrogen jet-reacted control system operated by the hand controller.

The research engineers brief the pilot regarding the test to be undertaken and discuss with him the sensations that he might expect. The pilot ascends to the test chair in the innermost cage.

This chair is constructed of a plastic that is specially molded to accommodate the pilot's body. As an added feature, the pilot is restrained in the chair with straps and a chest harness to prevent shifting of his weight during the tests. Only his arms are free to move. The pilot can communicate with the test engineers and the data collection center by means of a radio.

The pilot has an on/off type hand-controller which he operates with his right hand. The left hand is free to operate the radio transmission switch. The pilot's hand-controller can start nitrogen jets which can pitch, roll, or yaw the yellow cage in either direction or in any combination of these directions. He can thus counteract the rotation in the three cages induced by the test engineer in setting up the test conditions.

The test engineer starts the three cages rotating in roll, pitch, and yaw by means of the nitrogen pressure tests at rates designated for the test. When desired condition for the test is reached control is given to the pilot. He then proceeds to fly the space vehicle. By the proper operation of his hand-controller the pilot can orientate his vehicle into an upright position while the outer cages are still rotating.

The pilot's ability to control the tumble of the vehicle and his reaction to the high rates of rotation are recorded, as well as the length of time required for him to recover from simple single-axis maneuvers to those involving rotation about all three axis.

The results of this investigation will permit an estimate of some of the difficulties encountered when man first ventures into space as well as provide future training for astronauts in the attitude control of a space vehicle.

--This is the transcript from a motion picture film that served as Space Progress Report for November 1, 1959.