

UNITED STATES GOVERNMENT

# Memorandum

*Thornton*

TO : KA/Manager, Apollo Applications Program

DATE: JAN 2 1969

FROM : CA/Director, Flight Crew Operations

SUBJECT: Support of Experiment T-020, Foot Controlled Maneuvering Unit

Since our initial exposure in January 1967, to Experiment T-020 (then known as "Jet Shoes" for Extra-vehicular Space Locomotion), this Directorate has expressed skepticism about the worth of the experiment's objective and concern over the monetary and manpower expenditures connected with its implementation. As originally stated, the purpose of the experiment was to "determine the feasibility of the "Jet Shoe" concept for extra-vehicular space locomotion in present and future space operations." Our comments on this initial evaluation were contained in my memorandum to you dated April 6, 1967, "Request for removing the T-020 'Jet Shoes' experiment from all AAP flights." Essentially the same memorandum was later prepared as a letter to NASA Headquarters, Attention Mr. Charles W. Mathews, ML, for your signature in accordance with MSC Management Instruction 1450.2 paragraph 7.b. (4). This letter was not signed, and the issue rested temporarily.

In September 1967, Crew Systems Division expressed their concern over the "Jet Shoe" concept in EC63-0143AME. Later in the month a meeting was held at MSC under your auspices with the T-020 investigators. They admitted to certain deficiencies in the original concept and promised an improved version, which has come to be called the "Foot Controlled Maneuvering Unit (FCMU)". It was stated that simulations would be conducted at Langley Research Center to evaluate this concept and a decision would be made at the time of the simulations as to whether the FCMU should be pursued further as an experiment. Last fall (1968) a contract was let for experiment definition and a Preliminary Requirements Review subsequently held. At this review, my representatives expressed concern that the proposed hardware would not result in an operationally useful maneuvering unit. This criticism was tabled pending the promised simulations.

The simulations were finally held this spring (March 24) at Langley Research Center. Our findings were stated in an internal memorandum dated June 9, 1969, "Evaluation of Foot Control Maneuvering Unit (FCMU) simulators at the Langley Research Center (LRC)" and transmitted informally to you following a meeting between Lt. Commander Bruce McCandless II of the Astronaut Office and Mr. David Novik, NASA Headquarters, Office of Advanced Research and Technology, Space Flight Experiment Branch on September 18. This latter meeting was occasioned by the rejection of my Directorate's criticism of the T-020 Experiment at its Preliminary Design Review (September 3-5) and



5010-108

*Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan*

by the statement in a T-020 periodic status report (dated August 22, 1969) to the effect that the March simulations had "answered most of the astronauts questions concerning T-020." The implications were that my Directorate was now satisfied with the experiment. Participation in the review activities without acknowledgment of our reservations amounted to an implied endorsement of the experiment.

On the 5th of November my representative presented our position to the NASA EVA Committee in response to your suggestion to Mr. Larry E. Bell, EC6, the acting MSC member, that the Committee review it. Our presentation was based on two separable contentions: a) the current thruster configuration providing unbalanced couples for attitude control and single axis (head-to-foot) translational thrust capability is operationally unacceptable for a manned maneuvering unit and b) that a requirement to develop a "hands-free" maneuvering capability had not been demonstrated. It is noted that the existing design, due to its thruster configuration requires the use of a crewman's hands anyway for "docking" and "undocking" as it cannot thrust in the fore-and-aft direction.

At this time the Principal Investigator (P.I.), Mr. Don Hewes of Langley Research Center, stated that one of the primary objectives of the experiment was the evaluation of just such an unbalanced, limited capability thruster configuration as they had developed. This was his current interpretation of the original, and never formally modified, manifesto to investigate the "'Jet Shoes' concept" for EVA locomotion in present and future space operations. Acknowledgment was made by him of the generally superior characteristics of a 6 degree of control authority maneuvering unit employing balanced couples, but he maintained that T-020 was intended to provide engineering data on the characteristics of a simple "non-optimal" maneuvering device. He further stated that there was now no intention of developing an operationally usable device, but only of gathering the particular valuable data required by the investigation. No plan concerning the later application of such data was presented.

In a later discussion between T-020 investigators and Mr. W. B. Evans, MLO, regarding the possibility of modifying the experiment to the investigation of the application of foot control to a more versatile thruster configuration (specifically the M-509 Astronaut Maneuvering Research Vehicle), it was stated that the foot control objective was now subordinate to the objective of investigating the characteristics of the thruster configuration specifically proposed for the T-020 experiment.

We agree that no further effort should be expended in attempts to develop the FCMU for operational applications. We also feel that the useful experimental data return from T-020 will be extremely small and cannot be increased by further Flight Crew Operations Directorate (FCOD) participation in the design and development of the FCMU. For these reasons, further FCOD participation in the development of T-020 hardware will be limited to a final evaluation of the experiment hardware from the crew safety and mission suitability standpoints at the commencement of crew training for the mission



upon which the experiment is assigned for operation. In the interim, the appropriate personnel within the Flight Crew Support Division will be available on request for consultation on matters relating to training requirements, training hardware, photographic requirements and hardware, and timeline integration.

*Donald K. Slayton*  
Donald K. Slayton

cc:

CB/AAP Astronauts

CB/T. P. Stafford

CA/T. U. McElmurry

CF131/J. Lee

CF322/J. McKee

CF34/J. Cotter

CF32/H. A. Kuehnel

CF25/D. C. Schultz

KW/F. Koons

EC6/L. Bell

EG25/E. L. Tilton

CB:BMcCandless:dr 11-24-69