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CR NUMBER G0111	CREW RELATED GFE CHANGE REQUEST	INITIATED BY: J. P. Kerwin

CHANGE TITLE:

Procurement of crew exerciser for selected shuttle missions

CHANGE PROPOSALS/REQUESTS IDENT. NO.	DOCUMENTS AFFECTED

DESCRIPTION OF CHANGE:

It is proposed that a flight version of the prototype exercise device produced under contract number NAS-9-14377 by Whitmore Enterprises, Inc., be procured for use on shuttle flights where a requirement exists for this type of exerciser (see discussion below). The principal characteristics of the device include the following:

1. It is a whole-body exerciser and is aerobic (that is, it exercises the cardiovascular system).

2. It requires no power and has no electrical interfaces with the vehicle.

3. Crew-induced loads are mostly self-contained, simplifying the mechanical interface with the orbiter.

4. It is designed to weigh 35 pounds and stow in two standard lockers.

REASON FOR CHANGE:

The requirement for exercise devices on shuttle is a vexed question, because of the uncertain relationship between mission duration and significant losses in muscle mass and strength. It is known that these changes occur, but the point at which they become operationally detrimental is debatable. However, the following facts about inflight exercise may be considered to have been demonstrated by Skylab:

1. Cardiovascular and muscle changes are profound on flights of 28 days or more. They impair crew performance in gravity, and require countermeasures.

2. Exercise is an effective countermeasure to these changes, if it is the right kind of exercise.

3. The right kind of exercise must include whole-body, aerobic exercise, and must stress the large trunk and leg muscles.

The above facts serve to specify a type of exercise device and a requirement for its use. They do not pinpoint the minimum flight duration for which the

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requirement is valid. But another set of statements may be made about exercise, less quantitative but based on flight experience:

1. Physiologic changes similar to those seen on Skylab, but less intense, have occurred on most crewmen of 7-day or longer flights. The changes on Gemini V and VII, when very little activity was possible, are especially noteworthy.

2. Shuttle reentry imposes greater requirements for head movement and skilled motor activity on the pilots, than did previous programs. Also, although the reentry G levels are much lower, they are in the direction which would aggravate cardiovascular deconditioning.

3. Shuttle crew members, especially payload specialists, will represent a wider spectrum of physical conditioning and G tolerance than has previously been flown.

4. Daily exercise is of subjective as well as objective value. It alleviates the symptoms associated with inactivity and weightlessness, and improves crew well-being and morale. It may improve crew efficiency.

These statements, taken together, do not impose a firm requirement for an exercise device. But they do demonstrate that exercise has benefits on flights of any duration; that, if there were no constraints of weight or stowage volume, it would be wise to fly one on every flight; and that the benefits increase with flight duration and crew size. They suggest a progressive approach toward exercise, with no equipment on very short flights, simple, lightweight equipment (such as an exergenie) on medium-duration flights, and a full capability device on longer flights. Early shuttle experience will permit more accurate determination of what a "longer" flight is.

This exerciser is intended to fill the requirement for the "full capability" device. It is not an experimental device like the Skylab bicycle ergometer. That is considered a separate requirement, and to impose the substantial accuracy and measurement specifications of an experimental device would greatly increase the weight and cost of this one.

It is highly desirable to procure the flight device from the same source as the prototype, in order to get the performance necessary at low cost. In fact, this contract represents a great opportunity to demonstrate that flight-qualified hardware can be obtained at reasonable cost and with a minimum of paperwork. The total cost invested so far in the prototype exerciser is $30,000.

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SYSTEM ELEMENT(S) AFFECTED:

- [X] ORBITER
- [ ] PAYLOADS
- [ ] LAUNCH AND LANDING
- [ ] SYSTEM SOFTWARE
- [ ] OPERATIONS

CHANGE IMPACT:

- [ ] PILOT OPERATIONAL EQUIPMENT
- [ ] SAFETY
- [ ] PERFORMANCE
- [ ] RELIABILITY
- [ ] MAINTAINABILITY
- [ ] PRODUCIBILITY
- [ ] BALANCE & STABILITY
- [ ] GSE
- [ ] SPARES
- [ ] CREW PROCEDURES & OPS HANDBOOK
- [ ] ICD'S
- [ ] FACILITIES
- [ ] FLIGHT OPERATIONS
- [ ] GROUND OPERATIONS
- [X] SIMULATORS & TRAINERS
- [ ] SOFTWARE
- [ ] PAYLOADS
- [ ] OTHER (SPECIFY)
- [X] STOWAGE LIST

WEIGHT IMPACT:	SCHEDULE IMPACT:	COST PER FLIGHT IMPACT:

DDT & E COST IMPACT:	FY	FY	FY	FY	REMAINDER	TOTAL

IMPACT DESCRIPTION:

Stowage weight and volume

IMPACT OF NONINCORPORATION:

No exercise device available for Shuttle missions.

RECOMMENDATION/REMARKS

Approve the change

Concurrence: John W. Young
John W. Young

FORWARDING AUTHORIZATION:

Joseph P. Kerwin
PREPARED BY

DATE

Edwin W. Hoskins
ENDORSED BY
CCB MEMBER/SYSTEMS CONTRACTOR

DATE 5/9/78

CCB PLANNING DATE