Ed - I'll get this to you in std. format & adequate detail ASAP but the important thing at the moment is establish a date of conception
W. Thornton
19 Oct, '88

DISCLOSURE

1. Means for Isolation of Shock and Vibration in Spacecraft.

2. William Thornton
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3. NASA JSC

4. a. Aug. '88 B-15 C. Wheelwright, Tracor
b. Sep. '88 Personel Notebook 1988-I
c. Sep. "88 Personal Notebook 1988-I
d. None
e. None

5. Has been frequently discussed in JSC meetings on problem ,

6. Tracor and MACDAC personnel

7. None

8. None

9. a. To effectively isolate either sources of Shock and Vibration or devices sensitive to Shock and Vibration in a weightless vehicle.

b. Prior methodology used passive damped compliances which attentuate higher frequencies of Shock and Vibration. More recently means of actively displacing an element in opposite direction with respect to supporting structure undergoing Shock and Vibration have been used.

c. In the case of passive isolation, the frequency range is inadequate to cover the extremely low frequencies desired here. Active means are complex and required relatively large amounts of power. Neither means approach the desired level of attenuation.

d. A mass of sufficient magnitude to support the apparatus and constrain Shock and Vibration effects (motion) to acceptable limits is mechanically isolated from the surrounding structure except for positioning elements which are designed to prevent transmission of detectable Shock Vibration yet maintain a mean fixed position. Structural limits may be provided to constrain the "floating" mass within its operating range in case of unforseen displacements and monitoring elements may be added to warn of too close approach to the isolated structure.

e. The preferred method of positioning will use active combined sense and position filaments and this methodology will allow very high levels of isolation say 120 db - at the expense of some power (watts) and complexity. An alternative is a separate sensor and aerodynamic thrusting which could offer even greater isolation. Simpler passive magnetic positioning would provide less isolation and for relatively small isolation, springs could be used with sensors and augmentation.

f. Current "requirements" for space station specify acceleration levels of 10^{-6} G. and a rigidly coupled T.M. would generate ~ 10^{-3} G in the structure hence some 60 db. isolation is required for this gear. Other devices have similar problems. Since this device is bilateral the vibration sensitive equipment may be mounted on this arrangement and be isolated from the station.

Previous devices cannot provide the level of isolation required. At the moment large sums are being expended in detailed studies of the Shock and Vibration generators, apparently in hope that some combination of existing methodology will solve the problem. The simplicity and efficiency of this method makes that unnecessary. This scheme may be partially tested in 1g and fully tested on the Shuttle.

g. The use of existing mass in the spacecraft eg. stores, lockers, etc., by-simply disconnecting structural links to rigid structure. The use of sensors and limited force generators for trimming position of a free floating mass. The use of sensors as warning of proximity of free floating mass. The use of magnetic or aerodynamic force elements to maintain position of the element. The use of snubbers to limit exercusion of a floating element. The use of a floating mass as a counterpoise to reduce excursions from Shock and Vibration coupled to the mass.

Disclosed to and understood by me this 19TH day of October 1988.

FRANK L. CULBERTSON, JR.

_____Branch No. _____

NASA Case No. _____

NASA
National Aeronautics and Space Administration

Disclosure of Invention

This is an important legal document. It should be carefully completed by the inventor(s) and forwarded to the Patent Representative. Two copies of each document are desired.

1. **Descriptive Title of Invention**
Means for Isolaiton of Shock and Vibration in Spacecraft

2. **Name(s), Title(s), and Home Address(es) of Inventor(s)**
William Thornton
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Friendswood, TX 77546

3. **Name and Address of Employer**
NASA/Johnson Space Center

4. Stage of Development	Date Month/Yr.	Location	Identify persons or records supporting facts stated in 4a-4e
a. First disclosure to others	Aug. '88	Bldg. 15	C. Wheelwright, Tracor
b. First sketch or drawing	Sep. '88		Personal Notebook 1988-I
c. First written description	Sept. '88		Personal Notebook 1988-I
d. Completion of first model or full size device	None		
e. First successful operational test	None		

5. **List other pertinent notebook entries, photographs, reports, drawings.**
Has been frequently discussed in JSC meetings on problem

6. **If the invention was disclosed outside of NASA, identify the individuals, the companies or activities they represent, and the date of disclosure.**
Tracor and MACDAC personnel

7. **List any known or contemplated public use, publication, or oral presentation of the invention.**
None

8. **Indicate any past, present, or contemplated Government use of the invention.**
None

9. **Give a concise technical description of the invention. The description should include the following:**
   a. general purpose of the invention
   b. prior art (previous) methods, materials, or devices performing function of the invention
   c. disadvantages of prior art
   d. identification of component parts, or steps, and explanation of mode of operation of invention
   e. alternate embodiments of the invention
   f. advantages of invention over prior art
   g. features of the invention believed to be new
   h. if a joint invention, the contribution of each inventor.

   The completed description should be signed by the inventor(s), and then read and signed by a technically competent witness, using the statement, "Disclosed to and understood by me this day of ____ 19 ." Drawings, sketches, photographs, reports, if available, may form a part of the disclosure, and reference thereto can be made to complete this description. See Attached and subsequent disclosure.

10. **Recommended Security Classification of Invention.**
☐ Unclassified ☐ Confidential ☒ Secret ☐ Other (Specify) _____

11. **Signature of Inventor(s) and Date**
W. Thornton 19 Oct. 1988