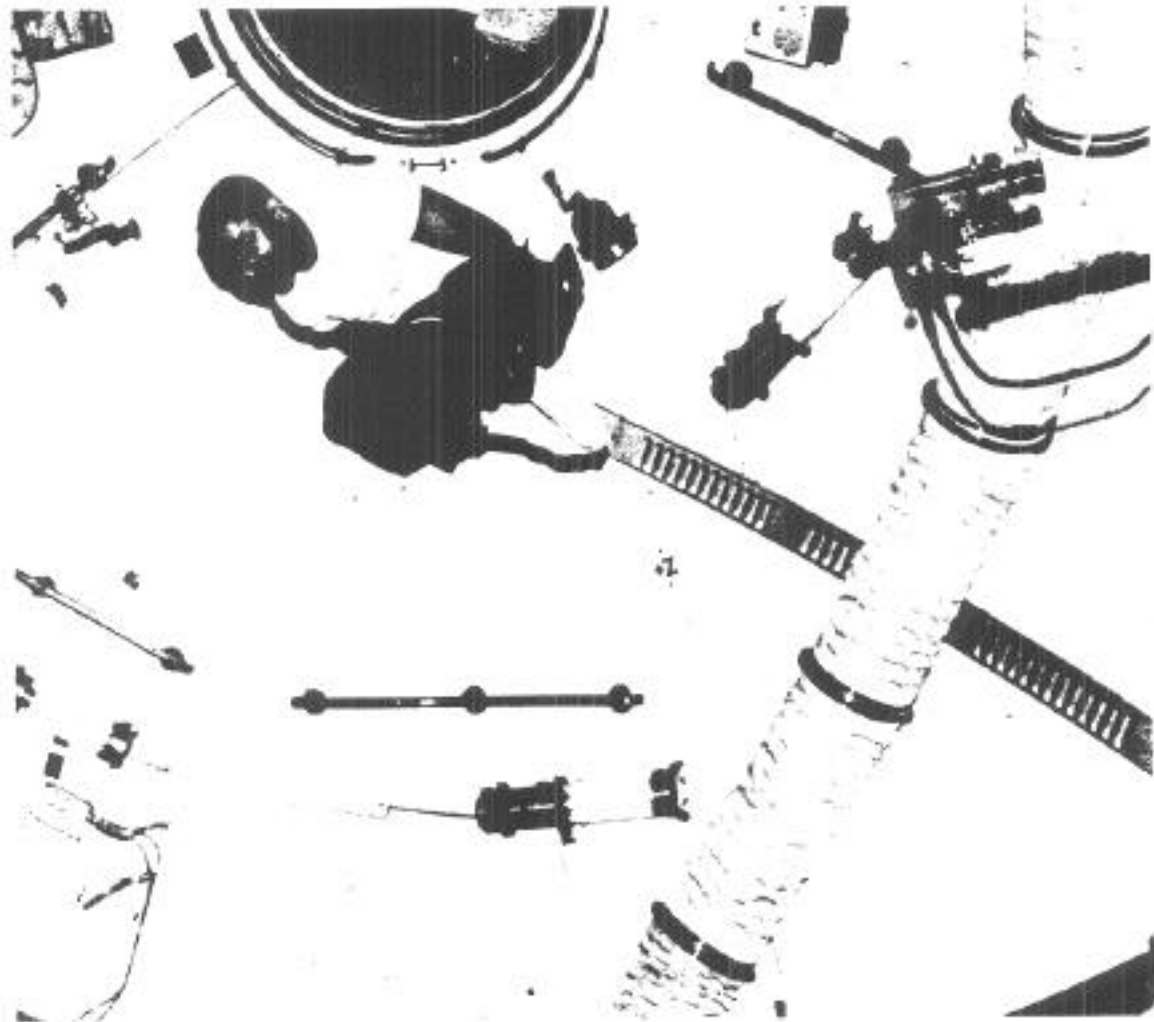


A Teachers Guide for the Videotape
Segment 5

Starts at 08:11:00
Run Time 02:07:00

ACROBATIC ASTRONAUTS



NASA
National
Aeronautics and
Space
Administration

FILM FOOTAGE FROM NASA SKYLAB MISSIONS

Edited and Produced for the AAPT
by Thomas Campbell
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I. Introduction

In 1973, during the Skylab program, three crews of three members each inhabited a large orbiting space vehicle. During these three missions, which totaled 171 days in space, astronauts were subjected to record breaking periods of weightlessness. Since this weightlessness cannot be duplicated on earth, and because the living quarters provided the crew were much larger than those available in any previous space flights, the astronauts' activities related to living and working in space were unique. Perhaps none of these activities seems more unusual than the freedom of body motion they experienced.

This film, featuring astronaut Alan L. Bean, provides a look at acrobatic body motion in space. Commander Bean of the second Skylab crew was a gymnast during his college days at the University of Texas. In this film, he demonstrates a range of body acrobatics available only to a weightless gymnast.

II. Background

Acquaint yourself with several of the gymnastic terms used to identify basic body movements. These terms are listed below and are largely self-explanatory. (For assistance in identifying terms that are not familiar, use a dictionary or an encyclopedia.)

- a. front tuck
- b. double front tuck
- c. handstand
- d. layout
- e. tuck back
- f. double tuck back
- g. full twist
- h. front pike
- i. double front pike
- j. triple front somersault in tuck position

III. Film Synopsis

Although astronaut Bean performs the routines shown in this film in a weightless environment, most of the body maneuvers he displays are similar to those performed by gymnasts on earth. However, there is a significant difference in the length of time he has available for each routine; this allows for an increased number of body maneuvers per routine. The synopsis below provides a description of the routines performed by Bean.

Film Synopsis for Gymnast (commentary by Miss Cherie Winniger, Morton High School, Morton, Illinois.)

Scene 1: The second Skylab crew (Bean, Garriott, Lousma) in comic acrobatics.

Title: Acrobatic Astronauts

- Scene 2: Tuck front somer to a full twist to a double tuck back ending with a layout with a half twist.
- Scene 3: Handstand to a tuck front into a layout to a handstand. From the handstand to a tuck front (7 revolutions) to a handstand.
- Scene 4: Tuck back to a handstand to a tuck back to a handstand.
- Scene 5: Pike front to a front twist to a tuck position. From the tuck position to a layout twist (7 revolutions) to a handstand.
- Scene 6: Triple front tuck to a double twist to a tuck front somer.
- Scene 7: Handstand to a triple tuck front to a double back full twist to a tuck front. From the tuck front to a layout with a one-half twist to a triple tuck back.
- Scene 8: Handstand to a tuck front to a layout front to a tuck with a one-half twist. Then to seven twists in layout position to a tuck front to a double layout front.
- Scene 9: Handstand to a pike front to a tuck front to a pike one-and-one-half to four twists in layout position.
- Scene 10: Layout to a tuck front to a layout with double twist to a tuck front to a handstand.
- Scene 11: Sequence one - Handstand to one-and-one half twist in tuck position to handstand to a tuck front to a handstand. From a handstand to a tuck front (4 revolutions) to a layout with one-half twist to a double back to a layout with a one-half twist.
- Sequence two - Handstand to a layout to pike position into a triple twist in layout position into a double tuck front. Then to a layout with one-half twist to a tuck back.

Questions and Exercises

1. How many of the body movements listed in Section II, Background, can you identify in the film? What similarities or differences do you notice in comparing weightless gymnastics to earth gymnastics?
2. After losing contact with the walls of the Orbital Workshop, astronaut Bean's angular momentum must remain constant. On numerous occasions his direction of spin and his rate of spin seem to change. How can you account for this?
3. Looking at Scene 6 listed above and using the stop frame feature of your projector, test the laws of conservation of linear and angular momentum for the motion of Alan Bean from the dome of the OWS. Does his center of mass move in a straight line with constant velocity? (Note: the camera moves during the filming of this sequence so you will have to consider that as you take your data.) At both the beginning and the end of this scene, Bean is in a tucked position. How do his rates of spin at those two times compare?

References:

Physics Content:

1. D. Halliday and R. Resnick, Fundamentals of Physics, John Wiley and Sons, Inc., New York, 1974.
2. P. Hewitt, Conceptual Physics, Little Brown and Co., Boston, 1974.

Gymnastic Content:

1. A. Schmit and B. Drury, Gymnastics for Women, National Press, Revised Ed., 1969.