

SECTION 16**PO 140 – PARTICIPATE IN AEROSPACE ACTIVITIES**

1. **Performance:** Participate in Aerospace Activities
2. **Conditions:**
 - a. Given:
 - (1) Supervision, and
 - (2) Assistance, as required.
 - b. Denied: Nil.
 - c. Environmental: Classroom or training area large enough to accommodate the entire group including areas suitable for water and foam rocket launching.
3. **Standard:** The cadet will launch a rocket, to include:
 - a. discussing Newton's Laws of Motion, and
 - b. launching a water rocket.
4. **Remarks:** Cadets qualified as Advanced Aerospace may serve as assistant instructors.
5. **Complementary Material:** Complementary material associated with PO 140 is designed to further the cadets' interest in space and aerospace through a number of activities:
 - a. EO C140.01 (Launch a Foam Rocket), and
 - b. EO C140.02 (Discuss Sleep Patterns in Space).

THIS PAGE INTENTIONALLY LEFT BLANK

EO M140.01 – LAUNCH A WATER ROCKET

1. **Performance:** Launch a Water Rocket

2. **Conditions:**

a. Given:

- (1) Water rocket launch system,
- (2) Pump,
- (3) Two-litre plastic bottle,
- (4) Safety glasses / goggles,
- (5) Supervision,
- (6) Assistance as required.

b. Denied: Nil.

c. Environmental: Classroom or training area large enough to accommodate the entire group.

3. **Standard:** The cadet shall:

- a. discuss Newton's Laws of Motion; and
- b. launch a water rocket.

4. **Teaching Points:**

TP	Description	Method	Time	Refs
TP1	Explain and discuss Newton's three Laws of Motion.	Interactive Lecture	15 min	C3-351
TP2	Have the cadets launch a water rocket.	In-Class Activity	65 min	C3-351

5. **Time:**

- | | |
|-------------------------------|--------|
| a. Introduction / Conclusion: | 10 min |
| b. Interactive Lecture: | 15 min |
| c. In-Class Activity: | 65 min |
| d. Total: | 90 min |

6. **Substantiation:**

- a. An interactive lecture was chosen for TP 1 to orient the cadets to Newton's Laws of Motion.
- b. An in-class activity was chosen for TP 2 as a fun way to have the cadets launch a water rocket in a safe and controlled environment.

7. **References:**

- a. C3-266 Science Toy Maker. (2008). Making (and using) an overhead water rocket launcher. Retrieved October 1, 2008, from <http://www.sciencetoymaker.org/waterRocket/buildWaterRocketLauncher.htm>
- b. C3-291 Retter, Y. (2008). *Water Rocket – Skewer Design*. Retrieved November 21, 2008, from <http://www.geocities.com/yoramretter/SkewerDesign-v02.html>
- c. C3-351 National Aeronautics and Space Administration. (2008). *Adventures in Rocket Science*. Retrieved October 27, 2011, from http://www.nasa.gov/pdf/265386main_Adventures_In_Rocket_Science.pdf

8. **Training Aids:**

- a. Water rocket launch system,
- b. Pump,
- c. Two-litre plastic bottle,
- d. Safety glasses / goggles, and
- e. Presentation aids (eg, whiteboard / flipchart / OHP / multimedia projector) appropriate for the training area.

9. **Learning Aids:** Safety glasses / goggles.

10. **Test Details:** Nil.

11. **Remarks:**

- a. Cadets qualified as Advanced Aerospace may serve as assistant instructors during this lesson.
- b. The water rockets may be launched indoors in an area easy to clean up (eg, gymnasium floor) or out of doors in favourable weather.

EO C140.01 – LAUNCH A FOAM ROCKET

1. **Performance:** Launch a Foam Rocket
2. **Conditions:**
 - a. Given:
 - (1) 30-cm piece of polyethylene foam pipe insulation (for ½ inch pipe),
 - (2) Rubber band size 64,
 - (3) Bristol board,
 - (4) 7 to 8 inch cable ties,
 - (5) 75-cm string,
 - (6) Scissors,
 - (7) Meter stick,
 - (8) Push pin,
 - (9) Washer, nut or other small weight that can be attached to a string,
 - (10) Quadrant plans,
 - (11) Masking tape,
 - (12) Rocket construction instructions located at Attachment A,
 - (13) Launcher Quadrant Pattern located at Attachment B,
 - (14) Launch record sheet located at Attachment C,
 - (15) Supervision, and
 - (16) Assistance as required.
 - b. Denied: Nil.
 - c. Environmental: Classroom or training area large enough to accommodate the entire group and an outdoor area or gymnasium with a high ceiling.
3. **Standard:** The cadet, in groups of 4, shall:
 - a. construct a foam rocket; and
 - b. launch a foam rocket.
4. **Teaching Points:**

TP	Description	Method	Time	Refs
TP1	Have the cadets, in groups of 4, construct a foam rocket.	In-Class Activity	25 min	C3-349

TP	Description	Method	Time	Refs
TP2	Have the cadets, in groups of 4, launch a foam rocket and record the launch data.	In-Class Activity	25 min	C3-349
TP3	Conduct an activity debriefing.	Group Discussion	5 min	

5. **Time:**

- | | | |
|----|----------------------------|--------|
| a. | Introduction / Conclusion: | 5 min |
| b. | In-Class Activity: | 50 min |
| c. | Group Discussion: | 5 min |
| d. | Total: | 60 min |

6. **Substantiation:**

- An in-class activity was chosen for TPs 1 and 2 as it is an interactive way to demonstrate rocket propulsion to cadets. This activity contributes to the understanding of rocketry in a fun and challenging setting.
- A group discussion was chosen for TP 3 as it allows the cadets to interact with their peers and share their knowledge, opinions, and feelings about their experiences launching foam rockets.

7. **Reference:** C3-349 *Rocket Activity, Foam Rocket*. Retrieved October 1, 2008, from http://www.nasa.gov/pdf/295787main_Rockets_Foam_Rocket.pdf8. **Training Aids:**

- 30-cm piece of polyethylene foam pipe insulation (for ½ inch pipe),
- Rubber band size 64,
- Bristol board,
- 7 to 8 inch cable ties,
- 75-cm string,
- Scissors,
- Meter stick,
- Push pin,
- Wash, nut or other small weight that can be attached to a string,
- Quadrant plans,
- Masking tape,
- Rocket construction instructions located at Attachment A,
- Launcher Quadrant Pattern located at Attachment B, and
- Launch record sheet located at Attachment C.

9. **Learning Aids:**
 - a. 30-cm piece of polyethylene foam pipe insulation (for ½ inch pipe),
 - b. Rubber band size 64,
 - c. Bristol board,
 - d. 7 to 8 inch cable ties,
 - e. 75-cm string,
 - f. Scissors,
 - g. Meter stick,
 - h. Push pin,
 - i. Wash, nut or other small weight that can be attached to a string,
 - j. Quadrant plans, and
 - k. Masking tape.
10. **Test Details:** Nil.
11. **Remarks:** Nil.

THIS PAGE INTENTIONALLY LEFT BLANK

EO C140.02 – DISCUSS SLEEP PATTERNS IN SPACE

1. **Performance:** Discuss Sleep Patterns in Space
2. **Conditions:**
 - a. Given:
 - (1) Reaction Time Sheet,
 - (2) Ruler,
 - (3) Sleep Log Sheet,
 - (4) Fraction Wheel for 24 Hours,
 - (5) Fraction Wheel for One Complete Day,
 - (6) Supervision, and
 - (7) Assistance as required.
 - b. Denied: Nil.
 - c. Environmental: Classroom or training area large enough to accommodate the entire group.
3. **Standard:** The cadet shall discuss sleep patterns in space.
4. **Teaching Points:**

TP	Description	Method	Time	Refs
TP1	Explain sleep patterns in space to include: <ol style="list-style-type: none"> a. effects of lack of sleep, and b. types of sleep. 	Interactive Lecture	10 min	C3-350
TP2	Have the cadets participate in an activity where they measure their current state of alertness, to include: <ol style="list-style-type: none"> a. describing how tired they feel, b. completing the ruler test, c. discussing reaction times in relation to their sleep pattern, and d. completing a take-home assignment. 	In-Class Activity	15 min	C3-350
TP3	Have the cadets participate in an activity where they discuss their sleep patterns from the preceding two weeks, to include: <ol style="list-style-type: none"> a. building a fraction wheel for hours slept, b. plotting sleep patterns, and c. discussing the sleep patterns. 	In-Class Activity	25 min	C3-350

5. **Time:**

- | | |
|-------------------------------|--------|
| a. Introduction / Conclusion: | 10 min |
| b. Interactive Lecture: | 10 min |
| c. In-Class Activity: | 40 min |
| d. Total: | 60 min |

6. **Substantiation:**

- a. An interactive lecture was chosen for TP1 to orient the cadets to the problems astronauts face sleeping in space.
- b. An in-class activity was chosen for TPs 2 and 3 to allow the cadets to experience some of the factors facing astronauts sleeping in space.

7. **Reference:** C3-350 The science of Sleep and Daily Rhythms. (2009). *Sleep Patterns*. Retrieved December 13, 2011, from http://www.nsbri.org/default/Documents/EducationAndTraining/MiddleSchool/Sleep/TSO_Sleep.pdf

8. **Training Aids:**

- a. Presentation aids (eg, whiteboard / flip chart / OHP / multimedia projector) appropriate for the training area,
- b. Reaction Time Sheet,
- c. Ruler,
- d. Sleep Log Sheet,
- e. Fraction Wheel for 24 Hours, and
- f. Fraction Wheel for One Complete Day.

9. **Learning Aids:**

- a. Reaction Time Sheet,
- b. Ruler,
- c. Sleep Log Sheet,
- d. Fraction Wheel for 24 Hours, and
- e. Fraction Wheel for One Complete Day.

10. **Test Details:** Nil.

11. **Remarks:** Allow two weeks in the schedule between TPs 2 and 3. This will ensure sufficient time for the cadets to log their sleep and participate in the final activity and discussion.