

SECTION 13**PO 232 – IDENTIFY CHARACTERISTICS OF PISTON-POWERED AIRCRAFT**

1. **Performance:** Identify Characteristics of Piston-Powered Aircraft
2. **Conditions:**
 - a. Given:
 - (1) Supervision; and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Suitable classroom facility to accommodate the entire group.
3. **Standard:** In accordance with specified references, the cadet will identify the characteristics of piston-powered aircraft, to include:
 - a. types of engines;
 - b. the components of an internal combustion engine;
 - c. the four-stroke cycle; and
 - d. the functions of oil.
4. **Remarks:** N/A.
5. **Complementary Material:**
 - a. Complementary material associated with PO 232 is designed to enhance the cadet's knowledge about how other aircraft are powered:
 - (1) EO C232.01 (Identify the Characteristics of Gas Turbine Engines);
 - (2) EO C232.02 (Identify the Characteristics of Rocket Engines); and
 - (3) EO C232.03 (Identify the Characteristics of Helicopter Engines).
 - b. Complementary training associated with PO 232 is limited to a total of six periods, which may be conducted during sessions or on a supported day. Squadrons are not required to use all six periods.

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EO M232.01 – IDENTIFY TYPES OF AIRCRAFT ENGINES

1. **Performance:** Identify Types of Aircraft Engines
2. **Conditions:**
 - a. Given:
 - (1) Supervision; and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Suitable classroom facilities or training area large enough to accommodate the entire group.
3. **Standard:** In accordance with specified references, the cadet shall identify types of aircraft engines, to include:
 - a. rocket engines;
 - b. gas turbine engines; and
 - c. piston-powered engines.
4. **Teaching Points:**

TP	Description	Method	Time	Refs
TP1	Explain that a powered aircraft needs a means of propulsion to overcome drag and allow the wings to generate lift. Identify common engine types used for propulsion, to include: <ol style="list-style-type: none"> a. rocket engines; b. gas turbine jet engines; and c. piston-powered engines. 	Interactive Lecture	10 min	C3-116 (p. 51) C3-084 C3-086 C3-087 C3-088
TP2	Explain combustion in rocket, gas turbine and piston-powered engines.	Interactive Lecture	5 min	C3-087
TP3	Explain the oxidization process for the different types of engines.	Interactive Lecture	5 min	C3-084 C3-088
TP4	Identify aircraft and associated engine types.	Interactive Lecture	5 min	C3-116

5. **Time:**
 - a. Introduction / Conclusion: 5 min
 - b. Interactive Lecture: 25 min
 - c. Total: 30 min

6. **Substantiation:** An interactive lecture was chosen for this lesson to introduce types of aircraft engines and give an overview of them.
7. **References:**
 - a. A3-031 Canadian Forces. *Aircraft*. (2006). Retrieved 20 November 2006, from http://www.airforce.gc.ca/equip/equip1_e.asp.
 - b. C3-084 NASA Glenn Research Center. *Engines 101*. Retrieved 21 February 2007, from <http://www.ueet.nasa.gov/Engines101.html#Aeronautics>.
 - c. C3-086 NASA Glenn Research Center. *Engines 101*. Retrieved 21 February 2007, from <http://www.grc.nasa.gov/WWW/K-12/airplane/icengine.html>.
 - d. C3-087 NASA Glenn Research Center. *Propulsion Index*. Retrieved 21 February 2007, from <http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html>.
 - e. C3-088 NASA *Welcome to the Beginner's Guide to Rockets*. Retrieved 21 February 2007, from <http://exploration.grc.nasa.gov/education/rocket/bgmr.html>.
 - f. C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition*. Ottawa, ON: Aviation Publishers Co. Limited.
 - g. C3-120 Pratt & Whitney Canada. (2006). *Imagine the Power*. Retrieved 18 March 2007, from http://www.pwc.ca/en/3_0/3_0_3/3_0_3_3_1.asp.
 - h. C3-121 NASA. (2007). *Missions: Space Shuttle Main Engines*. Retrieved 18 March 2007, from http://www.nasa.gov/returntoflight/system/system_SSME.html.
8. **Training Aids:** Presentation aids (e.g. whiteboard/flipchart/OHP) appropriate for the classroom/training area.
9. **Learning Aids:** N/A.
10. **Test Details:** N/A.
11. **Remarks:** If a computer and projector are available, software to demonstrate engine operation can be found at the Websites listed under reference para 7c.

EO M232.02 – IDENTIFY THE COMPONENTS OF PISTON-POWERED INTERNAL COMBUSTION ENGINES

1. **Performance:** Identify the Components of Piston-Powered Internal Combustion Engines
2. **Conditions:**
 - a. Given:
 - (1) List of questions and answers at Annex E;
 - (2) Coin;
 - (3) One large die;
 - (4) Coloured poster board;
 - (5) Masking tape;
 - (6) Supervision; and
 - (7) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Suitable classroom facilities or training area large enough to accommodate the entire group.
3. **Standard:** In accordance with specified references, the cadet shall identify the components of piston-powered internal combustion engines, to include:
 - a. stationary engine parts;
 - b. moving engine parts;
 - c. timing system components;
 - d. fuel/air delivery components; and
 - e. electrical spark distribution system components.
4. **Teaching Points:**

TP	Description	Method	Time	Refs
TP1	Identify and explain the operation of the major components of a piston-powered four-stroke internal combustion engine, to include: <ol style="list-style-type: none"> a. the cylinder; b. the piston; c. the connecting rod; d. the crankshaft; e. the camshaft; f. the distributor; g. the carburetor; and h. the oil sump. 	Interactive Lecture	25 min	C3-116 (pp. 41–71) C3-086

TP	Description	Method	Time	Refs
TP2	Explain that some early aircraft engines used rotary engines in which the cylinders themselves rotated around the central crankshaft. These were different than the later radial engines in which the stationary cylinders were arranged around the rotating crankshaft.	Interactive Lecture	5 min	C3-087
TP3	Describe other piston-powered engine arrangements that have been used in aircraft, to include: a. engines with in-line cylinders; and b. engines with horizontally-opposed cylinders.	Interactive Lecture	10 min	C3-116
TP4	Play a game of piston-powered baseball.	In-Class Activity	15 min	C3-003 (p. 70)

5. **Time:**

- | | |
|-------------------------------|--------|
| a. Introduction / Conclusion: | 5 min |
| b. Interactive Lecture: | 40 min |
| c. In-Class Activity: | 15 min |
| d. Total: | 60 min |

6. **Substantiation:**

- An interactive lecture was chosen for TP1 to TP3 to introduce the components of internal combustion engines and give an overview of them.
- An in-class activity was chosen for TP4 as it is an interactive way to provoke thought and stimulate interest among cadets.

7. **References:**

- C3-003 (ISBN 0-943210-44-5) Pike, B. and Busse, C. (1995). *101 More Games for Trainers*. Minneapolis, MN: Lakewood Books.
- C3-086 NASA Glenn Research Center. *Engines 101*. Retrieved 21 February 2007, from <http://www.grc.nasa.gov/WWW/K-12/airplane/icengine.html>.
- C3-087 NASA Glenn Research Center. *Propulsion Index*. Retrieved 21 February 2007, from <http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html>.
- C3-116 A-CR-CCP-263/PT-001 (ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition*. Ottawa, ON: Aviation Publishers Co. Limited.

8. **Training Aids:** Presentation aids (e.g. whiteboard/flipchart/OHP) appropriate for the classroom/training area.
9. **Learning Aids:** N/A.
10. **Test Details:** N/A.
11. **Remarks:**
 - a. It is recommended that the two periods required for this EO be scheduled consecutively.
 - b. If a computer and projector are available, software to demonstrate engine operation can be found at the Websites listed under reference para 7c.

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EO M232.03 – EXPLAIN THE CYCLES OF A FOUR-STROKE PISTON-POWERED ENGINE

1. **Performance:** Explain the Cycles of a Four-stroke Piston-powered Engine
2. **Conditions:**
 - a. Given:
 - (1) Supervision; and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Suitable classroom facilities or training area large enough to accommodate the entire group.
3. **Standard:** In accordance with specified references, the cadet shall explain the cycles of a four-stroke piston-powered engine, to include:
 - a. the purpose of each stroke;
 - b. the intake/exhaust valve operations; and
 - c. the ignition spark timing methods.
4. **Teaching Points:**

TP	Description	Method	Time	Refs
TP1	Explain the purposes of the strokes of a four-stroke piston, to include: <ol style="list-style-type: none"> a. the intake (induction) stroke is responsible for drawing fuel and air into the combustion chamber; b. the compression stroke forces the fuel and air into the combustion chamber; c. the power (combustion) stroke transmits the energy of the exploding fuel to the crankshaft; and d. the exhaust stroke cleans the cylinder of exhaust fumes and prepares it for the next intake stroke. 	Interactive Lecture	15 min	C3-116 (p. 43) C3-086
TP2	Identify and explain the operation of: <ol style="list-style-type: none"> a. valves; and b. cam shafts. 	Interactive Lecture	5 min	C3-116 (p. 43) C3-086

TP	Description	Method	Time	Refs
TP3	<p>Explain the timing of electrical ignition spark distribution, to include:</p> <ul style="list-style-type: none"> a. the time required for the complete combustion; b. a unique time for each cylinder's detonation; and c. the mechanical arrangements providing timing. 	Interactive Lecture	10 min	C3-116 (p. 43) C3-086
TP4	<p>Explain that all the engine operations must proceed precisely in order and list those operations in order, with emphasis on the simultaneous events, to include:</p> <ul style="list-style-type: none"> a. fuel and air mixture; b. intake stroke; c. intake valve operation; d. compression stroke; e. electrical points operation; f. power stroke; g. exhaust stroke; h. exhaust valve operation; and i. camshaft operation. 	Interactive Lecture	10 min	C3-116 (p. 43) C3-086
TP5	Enact the performance of the four-stroke engine operation in teams of six.	In-Class Activity	15 min	C3-086

5. **Time:**

- | | |
|-------------------------------|--------|
| a. Introduction / Conclusion: | 5 min |
| b. Interactive Lecture: | 40 min |
| c. In-Class Activity: | 15 min |
| d. Total: | 60 min |

6. **Substantiation:**

- a. An interactive lecture was chosen for TP1 to TP4 to introduce the cycles of a four-stroke piston-powered engine and give an overview of them.
- b. An in-class activity was chosen for TP5 as it is an interactive way to provoke thought and stimulate interest among the cadets.

7. References:

- a. C3-086 NASA Glenn Research Center. *Engines 101*. Retrieved 21 February 2007, from <http://www.grc.nasa.gov/WWW/K-12/airplane/icengine.html>.
- b. C3-087 NASA Glenn Research Center. *Propulsion Index*. Retrieved 21 February 2007, from <http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html>.
- c. C3-116 A-CR-CCP-263/PT-001 (ISBN 0-9680390-5-7) MacDonald, A. F. and Pepler, I. L. (2000). *From the Ground Up: Millennium Edition*. Ottawa, ON: Aviation Publishers Co. Limited.

8. **Training Aids:** Presentation aids (e.g. whiteboard/flipchart/OHP) appropriate for the classroom/training area.

9. **Learning Aids:** N/A.

10. **Test Details:** N/A.

11. Remarks:

- a. It is recommended that the two periods required for this EO be scheduled consecutively.
- b. If a computer and projector are available, software to demonstrate engine operation can be found at the Websites listed under reference para 7.b.

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EO M232.04 – RECOGNIZE THE FUNCTIONS OF OIL IN A FOUR-STROKE PISTON-POWERED ENGINE

1. **Performance:** Recognize the Functions of Oil in a Four-stroke Piston-powered Engine
2. **Conditions:**
 - a. Given:
 - (1) Hand cream;
 - (2) Supervision; and
 - (3) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Suitable classroom facilities or training area large enough to accommodate the entire group.
3. **Standard:** In accordance with A-CR-CCP-263/PT-001, the cadet shall recognize the functions of oil in a four-stroke piston-powered engine, to include:
 - a. lubricating;
 - b. sealing;
 - c. cooling; and
 - d. flushing.
4. **Teaching Points:**

TP	Description	Method	Time	Refs
TP1	Explain how oil lubricates the engine and aspects of lubrication, to include: <ol style="list-style-type: none"> a. grades and viscosities of oil; and b. thinning of oil as temperature increases. 	Interactive Lecture	5 min	C3-116 (pp. 57–59)
TP2	Allow the cadets to compare the friction and heat.	In-Class Activity	5 min	C3-116 (pp. 57–59)
TP3	Explain that oil seals the combustion chamber to prevent the expanding gases from leaking out during the power stroke.	Interactive Lecture	5 min	C3-116 (pp. 57–59)
TP4	Explain how oil cools hot spots in the engine.	Interactive Lecture	5 min	C3-116 (pp. 57–59)
TP5	Explain that oil removes and holds particles harmful to the engine.	Interactive Lecture	5 min	C3-116 (pp. 57–59)

5. **Time:**

a. Introduction / Conclusion:	5 min
b. Interactive Lecture:	20 min
c. In-Class Activity:	5 min
d. Total:	30 min

6. **Substantiation:**

- a. An interactive lecture was chosen for TP1 and TP3 to TP5 to introduce the functions of oil in a four-stroke piston-powered engine and to give an overview of them.
- b. An in-class activity was chosen for TP2 as it is an interactive way to provoke thought and stimulate interest among cadets.

7. **References:** C3-116 A-CR-CCP-263/PT-001 (ISBN 0-9680390-5-7) MacDonald, A. F. and Pepler, I. L. (2000). *From the Ground Up: Millennium Edition*. Ottawa, ON: Aviation Publishers Co. Limited.

8. **Training Aids:**

- a. Presentation aids (e.g. whiteboard/flipchart/OHP) appropriate for the classroom/training area; and
- b. Hand cream.

9. **Learning Aids:** Hand cream.

10. **Test Details:** N/A.

11. **Remarks:** N/A.

EO C232.01 – IDENTIFY THE CHARACTERISTICS OF GAS TURBINE ENGINES

1. **Performance:** Identify the Characteristics of Gas Turbine Engines
2. **Conditions:**
 - a. Given:
 - (1) Supervision; and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Suitable classroom facilities or training area large enough to accommodate the entire group.
3. **Standard:** In accordance with specified references, the cadet shall identify the characteristics of gas turbine engines, to include:
 - a. describing general gas turbine theory; and
 - b. identifying various aspects of gas turbines.
4. **Teaching Points:**

TP	Description	Method	Time	Refs
TP1	Explain that a jet engine is a reactive engine that propels by ejecting material as per Newton's third law of motion.	Interactive Lecture	5 min	C3-116 (p. 85)
TP2	Have the cadets explore Newton's third law of motion by making and operating a Pop Can Hero Engine.	In-Class Activity	15 min	C3-016 (p. 29) C3-057 (p. 11)
TP3	Describe the history of reaction engine development, to include: <ol style="list-style-type: none"> a. Hero's aeolipile toy; b. Chinese gunpowder rockets; c. Leonardo Da Vinci's chimney jack; d. Branca's stamping mill; e. Stolze's first gas turbine engine; f. Whittle's gas turbine for jet propulsion; g. the flight of the Heinkel HE-178; h. Whittle's Gloster Meteor turbojet; and i. Anslem's axial-flow turbojet. 	Interactive Lecture	10 min	C3-088
TP4	Explain the advantages of using a turbine, to include: <ol style="list-style-type: none"> a. compression requirement; b. running at static conditions; and c. power to operate ancillary systems. 	Interactive Lecture	5 min	C3-084 C3-087

TP	Description	Method	Time	Refs
TP5	Identify and describe the parts of a gas turbine turbofan engine, to include: a. fan; b. compressor; c. combustor; d. turbine; e. nozzle; and f. afterburner.	Interactive Lecture	5 min	C3-086
TP6	Conduct a crossword game based on jet power.	In-Class Activity	15 min	C0-003 (p. 70)

5. **Time:**

a. Introduction / Conclusion:	5 min
b. Interactive Lecture:	25 min
c. In-Class Activity:	30 min
d. Total:	60 min

6. **Substantiation:**

- An interactive lecture was chosen for TP1 and TP3 to TP5 to introduce the characteristics of gas turbine engines and give an overview of them.
- An in-class activity was chosen for TP2 and TP6 as it is an interactive way to provoke thought and stimulate interest among cadets.

7. **References:**

- C0-003 (ISBN 0-943210-44-5) Pike, B. and Busse, C. (1995). *101 More Games for Trainers*. Minneapolis, MN: Lakewood Books.
- C3-016 EG-2003-01-108-HQ NASA. (2003). *Rockets: A Teacher's Guide With Activities in Science, Mathematics, and Technology*. Washington, DC: NASA.
- C3-057 ISBN-10 1-59647-055-0 Sobey, E. (2006). *Rocket-powered Science*. Tucson, AZ: Good Year Books.
- C3-084 NASA Glenn Research Center. *Engines 101 – Ultra-Efficient Engine Technology (UEET)*. Retrieved February 21, 2007, from <http://www.ueet.nasa.gov/Engines101.html#Aeronautics>.
- C3-086 NASA Glenn Research Center. *Engines 101*. Retrieved 21 February 2007, from <http://www.grc.nasa.gov/WWW/K-12/airplane/icengine.html>.
- C3-087 NASA Glenn Research Center. *Propulsion Index*. Retrieved 21 February 2007, from <http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html>.
- C3-088 NASA Glenn Research Center. *Beginner's Guide to Rockets*. Retrieved 21 February 2007, from <http://exploration.grc.nasa.gov/education/rocket/bgmr.html>
- C3-116 A-CR-CCP-263/PT-001 (ISBN 0-9680390-5-7) MacDonald, A. F. and Pepler, I.L. (2000). *From the Ground Up: Millennium Edition*. Ottawa, ON: Aviation Publishers Co. Limited.

8. **Training Aids:**
 - a. Presentation aids (e.g. whiteboard/flipchart/OHP) appropriate for the classroom/training area; and
 - b. Coloured marking pens.
9. **Learning Aids:**
 - a. Straight pin;
 - b. Empty pop can;
 - c. Nail;
 - d. Scissors; and
 - e. Pencils with erasers.
10. **Test Details:** N/A.
11. **Remarks:** It is recommended that the two periods required for this EO be scheduled consecutively.

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EO C232.02 – IDENTIFY THE CHARACTERISTICS OF ROCKET ENGINES

1. **Performance:** Identify the Characteristics of Rocket Engines
2. **Conditions:**
 - a. Given:
 - (1) Supervision; and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Suitable classroom facilities or training area large enough to accommodate the entire group.
3. **Standard:** In accordance with specified references, the cadet shall identify the characteristics of rocket engines, to include:
 - a. general rocket theory; and
 - b. liquid and solid fuel oxidization methods.
4. **Teaching Points:**

TP	Description	Method	Time	Refs
TP1	Explain aspects of reactive thrust in various methods of propulsion, to include: <ol style="list-style-type: none"> a. jet systems; b. propeller systems; c. wheeled vehicles; and d. walking. 	Interactive Lecture	5 min	C3-087 C3-016 (pp. 13–17) C3-037
TP2	Have the cadets explore Newton's third law of motion by staging and operating balloon rockets on a string, followed by a discussion.	In-Class Activity	20 min	C3-016 (pp. 63–64) C3-057 (pp. 42)
TP3	Explain how rocket systems operate in space because they are self-contained and require no atmospheric oxygen.	Interactive Lecture	5 min	C3-016 (pp. 18–24)
TP4	Explain the differences between solid-fuel and liquid-fuel rocket engine systems, to include: <ol style="list-style-type: none"> a. construction; b. vehicle applications; and c. fuels and oxidation. 	Interactive Lecture	10 min	C3-016 (pp. 5–12)

TP	Description	Method	Time	Refs
TP5	Discuss launch vehicles, to include: a. American; b. Russian; c. European; and d. Chinese.	Interactive Lecture	15 min	C3-100 C3-112 C3-113 C3-114

5. **Time:**

- | | |
|-------------------------------|--------|
| a. Introduction / Conclusion: | 5 min |
| b. Interactive Lecture: | 35 min |
| c. In-Class Activity: | 20 min |
| d. Total: | 60 min |

6. **Substantiation:**

- An interactive lecture was chosen for TP1, TP3, TP4 and TP5 to introduce characteristics of rocket engines and give an overview of them.
- An in-class activity was chosen for TP2 as it is an interactive way to provoke thought and stimulate an interest among cadets.

7. **References:**

- C3-016 (ISBN EG-2003-01-108-HQ) NASA. (2003). *Rockets: A Teacher's Guide With Activities in Science, Mathematics, and Technology*. Washington, DC: NASA.
- C3-037 *Space Exploration*. (2006). Retrieved 25 May 2006, from <http://www.space.gc.ca/asc/eng/exploration/exploration.asp>.
- C3-057 (ISBN 10-1-59647-055-0) Sobey, E. (2006). *Rocket-powered Science*. Tucson, AZ. Good Year Books.
- C3-087 NASA Glenn Research Center. *Propulsion Index*. Retrieved 21 February 2007, from <http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html>.
- C3-088 NASA Glenn Research Center. *Beginner's Guide to Rockets*. Retrieved 21 February 2007, from <http://exploration.grc.nasa.gov/education/rocket/bgmr.html>.
- C3-100 China In Space. *The Long March Space Rockets*. Retrieved 26 February 2007, from <http://www.spacetoday.org/China/ChinaRockets.html>.
- C3-112 Federal Space Agency. *Rocket1Show*. Retrieved 26 February 2007, from <http://www.roscosmos.ru/RocketsMain.asp>.
- C3-113 European Space Agency. *ESA Launch Vehicles*. Retrieved 26 February 2007, from <http://www.esa.int/esaCP/index.html>.
- C3-114 NASA. *Countdown! NASA Launch Vehicles and Facilities*. Retrieved 27 February 2007, from <http://www-pao.ksc.nasa.gov/kscpao/nasafact/count1.htm#nasa>.

8. **Training Aids:**
 - a. Presentation aids (e.g. whiteboard/flipchart/OHP) appropriate for the classroom/training area; and
 - b. Slides of American, Russian, European and Chinese launch vehicles.
9. **Learning Aids:**
 - a. Balloons;
 - b. String;
 - c. Straw;
 - d. Tape; and
 - e. Paper or Styrofoam cup.
10. **Test Details:** N/A.
11. **Remarks:**
 - a. It is recommended that the two periods required for this EO be scheduled consecutively.
 - b. Website references should be made available for cadets to explore on their own time.

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EO C232.03 – IDENTIFY THE CHARACTERISTICS OF HELICOPTER ENGINES

1. **Performance:** Identify the Characteristics of Helicopter Engines
2. **Conditions:**
 - a. Given:
 - (1) Supervision; and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Suitable classroom facilities or training area large enough to accommodate the entire group.
3. **Standard:** In accordance with specified references, the cadet shall identify the characteristics of helicopter engines, to include:
 - a. technical development of early helicopter engines;
 - b. challenges of rotary-wing flight; and
 - c. categories of engines in CF helicopters.
4. **Teaching Points:**

TP	Description	Method	Time	Refs
TP1	Explain technological developments that made helicopters viable.	Interactive Lecture	5 min	C3-061
TP2	Have the cadets make and fly a paper helicopter.	In-Class Activity	20 min	C3-056
TP3	Explain why helicopters have a top speed and why helicopter rotors have constant speed.	Interactive Lecture	10 min	C3-055
TP4	Explain how lift of the main rotor is changed during flight.	Interactive Lecture	5 min	C3-061 C3-054
TP5	Explain that most helicopters use turboshaft engines.	Interactive Lecture	5 min	C3-061
TP6	Have the cadets identify the following CF helicopters and discuss each engine of: <ol style="list-style-type: none"> a. CH-149 Cormorant; b. CH-148 Cyclone; c. CH-146 Griffon; d. CH-139 Jet Ranger; and e. CH-124 Sea King. 	Interactive Lecture	10 min	C3-050

5. **Time:**

a. Introduction / Conclusion:	5 min
b. Interactive Lecture:	35 min
c. In-Class Activity:	20 min
d. Total:	60 min

6. **Substantiation:**

- a. An interactive lecture was chosen for TP1 and TP3 to TP6 to introduce characteristics of helicopter engines and give an overview of them.
- b. An in-class activity was chosen for TP2 as it is an interactive way to provoke thought and stimulate interest among cadets.

7. **References:**

- a. C3-050 Department of National Defence. (2006). *Canada's Air Force, Aircraft Main Page*. Retrieved 11 October 2006, from http://www.airforce.forces.gc.ca/equip/equip1_e.asp.
- b. C3-054 Frost, M. (2004). *Force and Movement: Making a Helicopter*. Retrieved 11 October 2006, from http://www.teacherresourcesgalore.com/physics_files/helicopter.doc.
- c. C3-055 University of Sydney. *Helicopters*. (2006). Retrieved 12 October 2006, from <http://alex.edfac.usyd.edu.au/blp/websites/Machan/heli.htm>.
- d. C3-056 US Centennial of Flight Commission. *Helicopters*. (2003). Retrieved 12 October 2006, from <http://www.centennialofflight.gov/essay/Dictionary/helicopter/DI27.htm>.
- e. C3-061 Leishman, J.G. (2000). *A History of Helicopter Flight*. Retrieved 1 November 2006, from <http://www.glue.umd.edu/~leishman/Aero/history/html>.

8. **Training Aids:**

- a. Presentation aids (e.g. whiteboard/flipchart/OHP) appropriate for the classroom/training area;
- b. Completed paper helicopter for demonstration purposes;
- c. Model helicopter with tail-rotor (e.g. Jet Ranger); and
- d. Helium-filled balloon.

9. **Learning Aids:**

- a. Directions to construct and fold a paper helicopter (A-CR-CCP-802/PF-001, Annex D); and
- b. Materials required to construct a paper helicopter.

10. **Test Details:** N/A.

11. **Remarks:** It is recommended that the two periods required for this EO be scheduled consecutively.