PO 431

1. **Performance**: Explain Principles of Flight

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.

3. **Standard**: The cadet will explain principles of flight by:

   a. explaining features of wing design; and

   b. describing flight instruments.

4. **Remarks**: Nil.

5. **Complementary Material**:

   a. Complementary material associated with PO 431 is designed to enhance the cadet's knowledge of principles of flight, specifically:

      (1) EO C431.01 (Explain Flight Performance Factors),

      (2) EO C431.02 (Demonstrate Turns, Climbs and Descents in a Flight Simulator), and

      (3) EO C431.03 (Fly a Radio-Controlled Aircraft).

   b. Complementary material from PO 331 that was not conducted in the previous year may be selected as complementary training in Proficiency Level Four.

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EO M431.01

1. **Performance**: Explain Features of Wing Design

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.

3. **Standard**: The cadet shall explain features of wing design, to include:

   a. airfoils,

   b. high-lift devices, and

   c. spoilers and speed brakes.

4. **Teaching Points**:

TP	Description	Method	Time	Refs
TP1	Explain airfoils, to include: a. chord, b. conventional airfoils, c. laminar flow airfoils, d. planform, e. aspect ratio, f. angle of incidence, g. wash-out, and h. wash-in.	Interactive Lecture	10 min	C3-116 (pp. 26–27)
TP2	Explain high-lift devices, to include: a. wing-tip design, b. wing fences, c. slats, d. slots, and e. flaps.	Interactive Lecture	10 min	C3-116 (pp. 27–30)
TP3	Explain spoilers and speed brakes.	Interactive Lecture	5 min	C3-116 (p. 28)

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 clarify, emphasize, and summarize features of wing design.

7. **References**: C3-116 ISBN 0-9680390-5-7 MacDonald, A. F. & Peppler, I. L. (2000). *From the ground up: Millennium edition*. Ottawa, ON: Aviation Publishers Co. Limited.

8. **Training Aids**:

   a. Presentation aids (eg, whiteboard / flip chart / OHP / multimedia projector) appropriate for the classroom / training area,

   b. Model of a light fixed-wing aircraft with wing struts, fixed gear and control surface detail, and

   c. Model of a wing.

9. **Learning Aids**: Nil.

10. **Test Details**: This EO is assessed IAW Chapter 3, Annex B, Aviation Subjects–Combined Assessment PC.

11. **Remarks**: Cadets who are qualified Advanced Aviation may assist with this instruction.

EO M431.02

1. **Performance**: Describe Flight Instruments

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.

3. **Standard**: The cadet shall describe flight instruments, to include:

   a. reviewing pitot static systems and instruments;

   b. describing the gyroscope and gyroscopic instruments;

   c. describing angle of attack indicator; and

   d. describing Mach indicator.

4. **Teaching Points**:

TP	Description	Method	Time	Refs
TP1	Review the pitot static system and pitot static instruments: a. airspeed indicator (ASI), b. altimeter, and c. vertical speed indicator (VSI).	Interactive Lecture	25 min	C3-116 (pp. 39–45)
TP2	Describe the gyroscope and gyroscopic instruments: a. heading indicator, b. attitude indicator, c. turn and slip indicator, and d. turn co-ordinator.	Interactive Lecture	15 min	C3-116 (pp. 45–49)
TP3	Describe the angle of attack (AOA) indicator.	Interactive Lecture	5 min	C3-116 (p. 49)
TP4	Describe the Mach indicator.	Interactive Lecture	5 min	C3-116 (p. 50)

5. **Time**:

   a. Introduction / Conclusion: 10 min

   b. Interactive Lecture: 50 min

   c. Total: 60 min

6. **Substantiation**: An interactive lecture was chosen for this lesson to clarify, emphasize, and summarize flight instruments.

7. **References**: C3-116 ISBN 0-9680390-5-7 MacDonald, A. F., & Peppler, I. L. (2000). *From the ground up: Millennium edition*. Ottawa, ON: Aviation Publishers Co. Limited.

8. **Training Aids**:

   a. Presentation aids (eg, whiteboard / flip chart / OHP / multimedia projector) appropriate for the classroom / training area,

   b. Large mock-up of an ASI,

   c. Large mock-up of an altimeter,

   d. Large mock-up of a VSI, and

   e. Gyroscope.

9. **Learning Aids**: Nil.

10. **Test Details**: This EO is assessed IAW Chapter 3, Annex B, Aviation Subjects-Combined Assessment PC.

11. **Remarks**: Cadets who are qualified Advanced Aviation may assist with this instruction.

EO C431.01

1. **Performance**: Explain Flight Performance Factors
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.
3. **Standard**: The cadet shall explain flight performance factors, to include:
   a. left turning tendencies,
   b. climbs and glides,
   c. turns,
   d. stalls, spins, and spirals, and
   e. airspeed limitations.
4. **Teaching Points**:

TP	Description	Method	Time	Refs
TP1	Explain the following left turning tendencies: a. torque, b. asymmetric thrust, c. precession, and d. slipstream.	Interactive Lecture	15 min	C3-116 (pp. 32–33)
TP2	Explain climbs and glides.	Interactive Lecture	10 min	C3-116 (pp. 33–34)
TP3	Explain turns.	Interactive Lecture	5 min	C3-116 (pp. 34–35)
TP4	Explain stalls, spins, and spirals.	Interactive Lecture	15 min	C3-116 (pp. 35–38)
TP5	Explain airspeed limitations.	Interactive Lecture	5 min	C3-116 (pp. 38–39)

5. **Time**:
   a. Introduction / Conclusion: 10 min
   b. Interactive Lecture: 50 min
   c. Total: 60 min

6. **Substantiation**: An interactive lecture was chosen for this lesson to clarify, emphasize, and summarize flight performance factors.

7. **References**: C3-116 ISBN 0-9680390-5-7 MacDonald, A. F., & Peppler, I. L. (2000). *From the ground up: Millennium edition*. Ottawa, ON: Aviation Publishers Co. Limited.

8. **Training Aids**:

   a. Presentation aids (eg, whiteboard / flip chart / OHP / multimedia projector) appropriate for the classroom / training area, and

   b. Model aircraft with articulated control surfaces and flaps.

9. **Learning Aids**: Nil.

10. **Test Details**: Nil.

11. **Remarks**: Cadets who are qualified Advanced Aviation may assist with this instruction.

EO C431.02

1. **Performance**: Demonstrate Turns, Climbs and Descents in a Flight Simulator

2. **Conditions**:

   a. Given:

      (1) Flight simulator,

      (2) Supervision, and

      (3) Assistance as required.

   b. Denied: Nil.

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

3. **Standard**: The cadet shall demonstrate turns, climbs and descents in a flight simulator.

4. **Teaching Points**:

TP	Description	Method	Time	Refs
TP1	Explain any safety considerations related to the location or design of the flight simulator.	Interactive Lecture	5 min	C3-156
TP2	Explain: a. how to manipulate the necessary control inputs, to include: (1) the control column or yoke, (2) the rudder pedals, and b. the location of necessary instruments, to include: (1) the airspeed indicator (ASI), (2) the vertical speed indicator (VSI), (3) the altimeter, and (4) the turn coordinator.	Interactive Lecture	10 min	C3-139 C3-156
TP3	Explain, demonstrate and have the cadets practice turns, climbs and descents using a flight simulator.	Demonstration and Performance	70 min	

5. **Time**:

   a. Introduction / Conclusion: 5 min

   b. Interactive Lecture: 15 min

   c. Demonstration and Performance: 70 min

   d. Total: 90 min

6. **Substantiation**:

   a. An interactive lecture was chosen for TPs 1 and 2 to give direction on procedures and present basic or background information about flight simulation.

   b. A demonstration and performance was chosen for TP 3 as it allows the instructor to explain and demonstrate turns, climbs and descents in a flight simulator while providing an opportunity for the cadets to practice the skills under supervision.

7. **References**:

   a. C3-139 ISBN 0-7715511-5-0 Transport Canada. (1999). *Flight training manual 4th edition revised*. Ottawa, ON: Transport Canada.

   b. C3-156 *Computerized Aircraft Simulation Center*. (2007). Retrieved October 2, 2007, from http://www.regions.cadets.forces.gc.ca/pac/aircad/flight/casc_lessons_e.asp

8. **Training Aids**: Flight simulator.

9. **Learning Aids**: Flight simulator.

10. **Test Details**: Nil.

11. **Remarks**:

   a. All staff should be familiarized with the operation of the flight simulator prior to the cadets arriving. This will allow them to troubleshoot, and give them a better perspective for instructing.

   b. Additional instructors are required for this lesson. There should be one instructor per two flight simulators.

   c. Cadets who are qualified Advanced Aviation may assist with this instruction.

EO C431.03

1. **Performance**: Fly a Radio-Controlled Aircraft

2. **Conditions**:

   a. Given:

      (1) Radio-controlled aircraft,

      (2) Supervision, and

      (3) Assistance as required.

   b. Denied: Nil.

   c. Environmental: Large indoor area (eg, gymnasium or drill hall) or a large outdoor area for flying a radio-controlled aircraft.

3. **Standard**: The cadet shall fly a radio-controlled aircraft.

4. **Teaching Points**: IAW the instructions supplied with the radio-controlled aircraft and the Model Aeronautics Association of Canada (MAAC) safety code, have the cadet fly a radio-controlled aircraft.

5. **Time**:

a.	Introduction / Conclusion:	10 min
b.	Practical Activity:	80 min
c.	Total:	90 min

6. **Substantiation**: A practical activity was chosen for this lesson as it is an interactive way to introduce the cadets to flying a radio-controlled aircraft in a safe and controlled environment. This activity contributes to the development of skills and knowledge in a fun and challenging setting.

7. **References**: C3-303 *Model Aeronautics Association of Canada Safety Code*. (2008). Retrieved February 5, 2009, from http://www.maac.ca/docs/2007/maac_safety_code_v008sept30_08_english.pdf

8. **Training Aids**: Radio-controlled aircraft.

9. **Learning Aids**: Radio-controlled aircraft.

10. **Test Details**: Nil.

11. **Remarks**:

   a. It is recommended that the three periods required for this EO be scheduled consecutively.

   b. The radio-controlled aircraft can be flown individually or in small groups of two to four cadets.

   c. Assistant instructors are required for this lesson.

   d. Suitable model aircraft may be chosen from the following:

      (1) Blade CX2 / CX3 (radio-controlled electric helicopter),

      (2) Blade MCX (radio-controlled electric helicopter),

      (3) SPAD Debonair (radio-controlled airplane),

(4) Alpha 40 DSM2 RTF (radio-controlled airplane),

(5) Vapor Bind-N-Fly / RTF (radio-controlled airplane), and / or

(6) an alternate choice (or choices) selected by the Squadron CO.

e. The helicopter being selected should have the counter-rotating rotor system with a 2.4 GHz radio transmitter.

f. Radio-controlled aircraft simulators such as RealFlight (Knife Edge Software) or FS One (Hangar 9) that run on a personal computer may also be used.