

SECTION 13**PO 331 – DESCRIBE PRINCIPLES OF FLIGHT**

1. **Performance.** Describe Principles of Flight.
2. **Conditions**
 - a. Given:
 - (1) Supervision, and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Classroom or training area large enough to accommodate the entire group.
3. **Standard.** The cadet will describe principles of flight to include aircraft stability.
4. **Remarks.** N/A
5. **Complementary Material**
 - a. Complementary material associated with PO 331 is designed to enhance the cadet's knowledge of the principles of flight, specifically:
 - (1) EO C331.01 (Review Principles of Flight),
 - (2) EO C331.02 (Read Pitot Static Instruments),
 - (3) EO C331.03 (Identify Aspects of Helicopter Aerodynamics),
 - (4) EO C331.04 (Demonstrate Attitudes and Movements in a Flight Simulator), and
 - (5) EO C331.05 (Participate in a Presentation Given by a Guest Speaker From the Local Aviation Community).
 - b. If EO C331.01 (Review Principles of Flight) is chosen as a complementary lesson, it should be scheduled before EO M331.01 (Describe Aircraft Stability).
 - c. EO C331.05 (Participate in a Presentation Given by a Guest Speaker from the Local Aviation Community) may be used to cover topics in both PO 331 (Describe Principles of Flight) and PO 337 (Develop Air Navigation Skills, [Section 15](#)).

THIS PAGE INTENTIONALLY LEFT BLANK

EO M331.01 – DESCRIBE AIRCRAFT STABILITY

1. **Performance.** Describe Aircraft Stability.
2. **Conditions**
 - a. Given:
 - (1) Supervision, and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Classroom or training area large enough to accommodate the entire group.
3. **Standard.** The cadet shall describe:
 - a. characteristics of stability;
 - b. stability around the axes of rotation; and
 - c. features of the aircraft that provide stability.
4. **Teaching Points**

TP	Description	Method	Time	Ref
TP1	Demonstrate the characteristics of stability, to include: <ol style="list-style-type: none"> a. the contrasts between static and dynamic stability, b. positive stability, c. neutral stability, and d. negative stability. 	In-Class Activity	15 min	C3-116 (p. 31, p. 32) C3-229 (pp. 57–99)
TP2	Review the axes of an aircraft, to include: <ol style="list-style-type: none"> a. the longitudinal axis and roll, b. the lateral axis and pitch, and c. the normal (vertical) axis and yaw. 	Interactive Lecture	10 min	C3-116 (p. 30)
TP3	Explain longitudinal stability, to include: <ol style="list-style-type: none"> a. the effects of the horizontal stabilizer, and b. the effects of the centre of gravity. 	Interactive Lecture	10 min	C3-116 (p. 31, p. 32) C3-229 (pp. 57–99)
TP4	Explain lateral stability, to include: <ol style="list-style-type: none"> a. the effects of dihedral and anhedral, b. the effects of sweepback, and c. keel effect. 	Interactive Lecture	10 min	C3-116 (pp. 31–32) C3-229 (pp. 57–100)

TP	Description	Method	Time	Ref
TP5	Explain directional stability and the effects of the fin.	Interactive Lecture	5 min	C3-116 (pp. 31–32) C3-229 (pp. 57-99)

5. **Time**

- | | |
|-----------------------------|--------|
| a. Introduction/Conclusion: | 10 min |
| b. In-Class Activity: | 15 min |
| c. Interactive Lecture: | 35 min |
| d. Total: | 60 min |

6. **Substantiation**

- An in-class activity was chosen for TP 1 as it is an interactive way to introduce aircraft stability.
- An interactive lecture was chosen for TPs 2–5 to review axes of rotation and introduce stability about the axes.

7. **References**

- C3-116 (ISBN 0-9680390-5-7) MacDonald, A. F., & Pepler, I. L. (2000). *From the Ground Up: Millennium Edition*. Ottawa, ON: Aviation Publishers Co. Limited.
- C3-229 (ISBN 0-521-02128-6) Abzug, M. J., & Larrabee, E. E. (2002). *Airplane Stability and Control* (Second Edition). Cambridge, UK: Cambridge University Press.

8. **Training Aids**

- Presentation aids (eg, whiteboard/flip chart/OHP) appropriate for the classroom/training area,
- Model airplane illustrating the three axes,
- Tennis ball,
- Three marbles,
- Table,
- Tape, and
- Two bowls.

9. **Learning Aids**

- Tennis ball,
- Three marbles,
- Two bowls,
- Table, and
- Tape.

10. **Test Details.** This EO is assessed IAW Chapter 3, [Annex B](#), [Appendix 5](#), (Aviation Subjects – Combined Assessment PC).
11. **Remarks**
 - a. If EO C331.01 (Review Principles of Flight) is chosen as a complementary period, it should be scheduled prior to EO M331.01 (Describe Aircraft Stability).
 - b. When developing activities for the mandatory familiarization flying/elemental training day, it is recommended that the cadet be given the opportunity to identify and describe the stability of the aircraft.

THIS PAGE INTENTIONALLY LEFT BLANK

EO C331.01 – REVIEW PRINCIPLES OF FLIGHT

1. **Performance.** Review Principles of Flight.
2. **Conditions**
 - a. Given:
 - (1) Supervision, and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Classroom or training area large enough to accommodate the entire group.
3. **Standard.** The cadet shall review principles of flight, to include:
 - a. the axes of an aircraft, and
 - b. the effects of control surfaces on attitudes and movements.
4. **Teaching Points**

TP	Description	Method	Time	Ref
TP1	Review the three axes of an aircraft, to include: <ol style="list-style-type: none"> a. longitudinal axis, b. lateral axis, and c. vertical (normal) axis. 	In-Class Activity	5 min	C3-116 (p. 30)
TP2	As a member of a group, have the cadet describe a control surface and its effects on attitudes and movements.	In-Class Activity	20 min	C3-116 (p. 30)

5. **Time**
 - a. Introduction/Conclusion: 5 min
 - b. In-Class Activity: 25 min
 - c. Total: 30 min
6. **Substantiation.** An in-class activity was chosen for this lesson as an interactive way for the cadets to review the three axes of an aircraft and control surfaces.
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 airplane with the three axes labelled.
9. **Learning Aids**
 - a. Handout,

- b. Flip chart, and
- c. Flip chart markers.

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

11. **Remarks.** If this complementary EO is chosen, it should be scheduled before any other EOs from PO 331 (Describe Principles of Flight).

EO C331.02 – READ PITOT STATIC INSTRUMENTS

1. **Performance.** Read Pitot Static Instruments.
2. **Conditions**
 - a. Given:
 - (1) Working model of an airspeed indicator (ASI),
 - (2) Working model of an altimeter,
 - (3) Working model of a vertical speed indicator (VSI),
 - (4) Supervision, and
 - (5) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Classroom or training area large enough to accommodate the entire group.
3. **Standard.** The cadet shall read pitot static instruments, to include:
 - a. an ASI,
 - b. an altimeter, and
 - c. a VSI.
4. **Teaching Points**

TP	Description	Method	Time	Ref
TP1	<p>Explain that the basic instruments of an aircraft rely on the pitot source and the static port as sources of information, to include:</p> <ol style="list-style-type: none"> a. pitot and static sources provide information for the ASI, b. static port provides information for the altimeter, and c. static port provides information for the VSI. 	Interactive Lecture	10 min	C3-116 (p. 39) C3-139
TP2	<p>Explain how to read an ASI, to include:</p> <ol style="list-style-type: none"> a. normal operating range, b. cautionary range, c. never exceed speed, and d. units of measurement. 	Interactive Lecture	10 min	C3-116 (p. 43) C3-139
TP3	<p>Explain how to read an altimeter, to include:</p> <ol style="list-style-type: none"> a. units of measurement, b. pressure sub-scale, c. field elevation versus pressure altitude, and d. height above sea level (ASL)/above ground level (AGL). 	Interactive Lecture	10 min	C3-116 (p. 40) C3-139

TP	Description	Method	Time	Ref
TP4	Explain how to read a VSI, to include: a. units of measurement, and b. positive/negative rates of climb.	Interactive Lecture	10 min	C3-116 (p. 44) C3-139
TP5	Have the cadet read pitot static instruments, to include: a. ASI, b. altimeter, and c. VSI.	In-Class Activity	10 min	

5. Time

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

6. Substantiation

- a. An interactive lecture was chosen for TPs 1–4 to introduce pitot static instruments.
- b. An in-class activity was chosen for TP 5 as an interactive way to confirm the cadets' comprehension of pitot static instruments.

7. References

- a. C3-116 (ISBN 0-9680390-5-7) MacDonald, A. F., & Pepler, I. L. (2000). *From the Ground Up: Millennium Edition*. Ottawa, ON: Aviation Publishers Co. Limited.
- b. C3-139 (ISBN 0-7715511-5-0) Transport Canada. (1999). *Flight Training Manual 4th Edition Revised*. Ottawa, ON: Transport Canada.

8. Training Aids

- a. Presentation aids (eg, whiteboard/flip chart/OHP/multimedia projector) appropriate for the classroom/training area,
- b. Working model of an ASI,
- c. Working model of an altimeter, and
- d. Working model of a VSI.

9. **Learning Aids**
 - a. Diagram of an ASI,
 - b. Diagram of an altimeter, and
 - c. Diagram of a VSI.
10. **Test Details.** N/A.
11. **Remarks.** N/A.

THIS PAGE INTENTIONALLY LEFT BLANK

EO C331.03 – IDENTIFY ASPECTS OF HELICOPTER AERODYNAMICS

1. **Performance.** Identify Aspects of Helicopter Aerodynamics.
2. **Conditions**
 - a. Given:
 - (1) Supervision, and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Classroom or training area large enough to accommodate the entire group.
3. **Standard.** The cadet shall identify aspects of helicopter aerodynamics, to include:
 - a. the main rotor,
 - b. the anti-torque rotor, and
 - c. the control inputs.
4. **Teaching Points**

TP	Description	Method	Time	Ref
TP1	Describe the main rotor of a helicopter, to include: <ol style="list-style-type: none"> a. rotor systems, b. rotor drag, and c. factors influencing rotor thrust. 	Interactive Lecture	15 min	C3-249 (p. 45)
TP2	Describe the anti-torque rotor of a helicopter, to include: <ol style="list-style-type: none"> a. location on the airframe, b. function, and c. power source. 	Interactive Lecture	5 min	C3-249 (p. 67)
TP3	Explain the control inputs of a helicopter, to include: <ol style="list-style-type: none"> a. collective, b. cyclic, and c. pedals. 	Interactive Lecture	5 min	C3-249 (p. 77)

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 the cadet to aspects of helicopter aerodynamics.
7. **References.** C3-249 (ISBN 978-1-56027-649-4) Wagtendok, W. J. (2006). *Principles of Helicopter Flight: Second US Edition*. Newcastle, WA: Aviation Supplies & Academics, Inc.
8. **Training Aids**
 - a. Presentation aids (eg, whiteboard/flip chart/OHP/multimedia projector) appropriate for the classroom/training area, and
 - b. Model of a helicopter.
9. **Learning Aids.** N/A.
10. **Test Details.** N/A.
11. **Remarks.** If the squadron has the opportunity to participate in familiarization flights in a helicopter, this EO could be conducted at that time.

EO C331.04 – DEMONSTRATE ATTITUDES AND MOVEMENTS IN A FLIGHT SIMULATOR

1. **Performance.** Demonstrate Attitudes and Movements in a Flight Simulator.
2. **Conditions**
 - a. Given:
 - (1) Flight simulator,
 - (2) Supervision, and
 - (3) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Classroom or training area large enough to accommodate the entire group.
3. **Standard.** In a flight simulator, the cadet shall:
 - a. demonstrate pitch, yaw, and roll; and
 - b. read pitot static instruments.

4. **Teaching Points**

TP	Description	Method	Time	Ref
TP1	Explain safety considerations related to the location or design of the flight simulator.	Interactive Lecture	5 min	C3-156
TP2	Explain how to manipulate the necessary control inputs and the location of necessary instruments, to include: <ol style="list-style-type: none"> a. control column or yoke, b. rudder pedals, c. ASI, d. VSI, and e. altimeter. 	Interactive Lecture	15 min	C3-139 C3-156
TP3	Supervise the cadets as they practice attitudes and movements using the flight simulator.	Simulation	60 min	

5. **Time**

- | | |
|-----------------------------|--------|
| a. Introduction/Conclusion: | 10 min |
| b. Interactive Lecture: | 20 min |
| c. Simulation: | 60 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 simulation was chosen for TP 3 as it is an interactive way to allow the cadet to experience attitudes and movements in a safe, controlled environment. This activity contributes to the development of principles of flight skills and knowledge in a fun and challenging setting.

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 Centre*. (2007). Retrieved October 2, 2007, from http://www.regions.cadets.forces.gc.ca/pac/aircad/flight/casc_lessons_e.asp.

8. **Training Aids.** Computer flight simulator.

9. **Learning Aids.** Computer flight simulator.

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

11. **Remarks**

- a. Concurrent activities will be required based on the number of simulators available.
- b. All staff should be familiar with the operation of the flight simulator prior to the EO. This will better prepare them to troubleshoot and instruct.

EO C331.05 – PARTICIPATE IN A PRESENTATION GIVEN BY A GUEST SPEAKER FROM THE LOCAL AVIATION COMMUNITY

1. **Performance.** Participate in a Presentation Given by a Guest Speaker From the Local Aviation Community.
2. **Conditions**
 - a. Given:
 - (1) Supervision, and
 - (2) Assistance as required.
 - b. Denied: N/A.
 - c. Environmental: Classroom or training area large enough to accommodate the entire group.
3. **Standard.** The cadet shall participate in a presentation given by a guest speaker from the local aviation community, such as:
 - a. a pilot from an aviation company,
 - b. a flight instructor from a flight training school,
 - c. an aircraft maintenance engineer, or
 - d. a private owner.
4. **Teaching Points.** The guest speaker is asked to:
 - a. discuss their role in the aviation community;
 - b. describe highlights of their career;
 - c. describe the aircraft they have flown;
 - d. discuss how to get involved in the local aviation community; and
 - e. bring items to display, to include:
 - (1) uniforms,
 - (2) photographs,
 - (3) models,
 - (4) logbooks, and
 - (5) any other items of interest.
5. **Time**
 - a. Introduction/Conclusion: 5 min
 - b. Interactive Lecture: 55 min
 - c. Total: 60 min

6. **Substantiation.** An interactive lecture was chosen for this lesson to orient the cadets to the topic and generate an interest in the local aviation community.
7. **References.** N/A.
8. **Training Aids.** Presentation aids (eg, whiteboard/flip chart/OHP/multimedia projector) appropriate for the classroom/presentation area.
9. **Learning Aids.** N/A.
10. **Test Details.** N/A.
11. **Remarks**
 - a. Training aids should be determined by contacting the speaker prior to the presentation.
 - b. There is no instructional guide for this EO.