**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)<br>C3-057 (p. 11) |
| TP3 | Describe the history of reaction engine development, to include:<br>a. Hero's aeolipile toy;<br>b. Chinese gunpowder rockets;<br>c. Leonardo Da Vinci's chimney jack;<br>d. Branca's stamping mill;<br>e. Stolze's first gas turbine engine;<br>f. Whittle's gas turbine for jet propulsion;<br>g. the flight of the Heinkel HE-178;<br>h. Whittle's Gloster Meteor turbojet; and<br>i. Anslem's axial-flow turbojet. | Interactive Lecture | 10 min | C3-088 |
| TP4 | Explain the advantages of using a turbine, to include:<br>a. compression requirement;<br>b. running at static conditions; and<br>c. power to operate ancillary systems. | Interactive Lecture | 5 min | C3-084<br>C3-087 |

| TP | Description | Method | Time | Refs |
|---|---|---|---|---|
| TP5 | Identify and describe the parts of a gas turbine turbofan engine, to include:<br>a. fan;<br>b. compressor;<br>c. combustor;<br>d. turbine;<br>e. nozzle; and<br>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**:

a. 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.

b. 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**:

a. C0-003 (ISBN 0-943210-44-5) Pike, B. and Busse, C. (1995). *101 More Games for Trainers.* Minneapolis, MN: Lakewood Books.

b. C3-016 EG-2003-01-108-HQ NASA. (2003). *Rockets: A Teacher's Guide With Activities in Science, Mathematics, and Technology.* Washington, DC: NASA.

c. C3-057 ISBN-10 1-59647-055-0 Sobey, E. (2006). *Rocket-powered Science.* Tucson, AZ: Good Year Books.

d. 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.

e. C3-086 NASA Glenn Research Center. *Engines 101.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/icengine.html.

f. C3-087 NASA Glenn Research Center. *Propulsion Index.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html.

g. 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

h. 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**:
   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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