**351 SILVER STAR SQUADRON**

**LESSON PLAN**

| **Identification And Lesson Information** | |
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| *Instructor*: Sgt Isaac Lo | *Date*:  Apr 20 |
| *EO number:*  *EOC 232.01* | *EO title:*  *Identify characteristics of gas engines* |
| *Teaching points*: | *Duration*: 60 min |
| *Trainees level: 2* |
| *Method(s)*: Interactive lecture | *Training aids*:  N/A |
| *References:*  Level 2 IG | *Learning aids*:  Reference Images |
| *Material needed for lesson:* | *Classroom setting:* |

| **Introduction** | Time | Action |
| --- | --- | --- |
| Importance (Why) |  |  |
| Enables them to recognize a variety of propulsion applications and to recognize reasons for the performance differences between various types of aircraft |  |  |
| Objective |  |  |
| Cadets shall identify the characteristics of gas turbine engines |  |  |

| **TP 1 of 6** | Time | Action |
| --- | --- | --- |
| Introduction |  |  |
| A jet engine is a reactive engine, while propels itself by ejecting material to create a force |  |  |
| Body |  |  |
| Newtons third law states that for every action there is an equal and opposite reaction  All propulsion systems rely on this, as a jet engine propels itself in one direction by ejecting a fluid (hot gas) in opposite direction  Amount of thrust depends on mass and velocity of material ejected  More mass/velocity = more thrust  Most mass from jet engine come from air, scooped from the atmosphere that the jet is passing through  Scooped air is raised to high velocity by burning fuel, more fuel available = longer duration of thrust | 10 min |  |
| Confirmation |  |  |
| 1. What is newtons third law? 2. For every action there is an equal and opposite reaction 3. What determines the amount of thrust from a jet engine? 4. Mass/velocity of ejected material 5. What determines the possible duration of a jet engine’s thrust? 6. Amount of fuel |  |  |

| **TP 2 of 6 (Potentially have to cut for time)** | Time | Action |
| --- | --- | --- |
| Introduction |  |  |
| Cadets will build and operate a pop can Hero engine |  |  |
| Body |  |  |
| Materials  Nail  Empty pop can  Bucket of water  String  To make pop can Hero engine, punch a hole in pop can with nail, then push upper end of nail to the side to bend the hold  Fill tubs half full of water to refill an empty pop can  Give each group one empty pop can which still has the opening lever attached and bent straight up from the center  Give group 1m of string  Rotate the pop can and punch one hole/90 degrees, with 4 holes  Threat string through can opener  Have cadets fill pop cans with water  Insert the nail back into hole and bend each hole in the same direction  Have cadets refill cans with water so engine can spin | 15 min | Activity |
| Confirmation |  |  |
| N/A |  |  |

| **TP 3 of 6** | Time | Action |
| --- | --- | --- |
| Introduction |  |  |
| Introduce a brief history of turbine engines |  |  |
| Body |  |  |
| 150BC: Hero  Egyptian philosopher and mathematician invented a toy (Aeolipile) that used steam to rotate on top of boiling water. Steam could move nozzles arranged on a wheel  1232 Battle of Kai-Keng  Rockets made with burning gunpowder were used by Chinese, and Mongols spread the technology to Europe  1500 Leonardo da Vinci  Drew sketch of chimney jack device, which used steam to rotate a shaft  1629 Giovanni Branca  Developed a stamping mill for bending metal, used jets of steam to spin turbines and rotate a shaft to operate  1872 Dr. F Stolze  Designed first true gas turbine engine using a multi stage turbine section and a flow compressor  1930 Sir Frank Whittle  Designed a gas turbine for jet propulsion, and was successful in 1937  1939 Heinkel Aircraft Company  Flew the first gas turbine jet (HE 178)  1941 Sir Frank Whittle  Designed first successful turbojet airplane, Gloster Meteor  1942 Dr Franz Anslem  Developed axial floor turbojet, first operational jet fighter Messerschmitt Me 262  Jet engines became the most popular method of powering high performance aircraft after WW2  Activity  Cadets will construct a simple gas turbine that converts axial gas flow into rotary motion  Materials  Scissors,  Straight pin  Pencil with eraser  ACTIVITY INSTRUCTIONS  1. Cut out the rectangle shown in Figure B-1. Next, cut along each dotted line stopping about two centimetres  from the hole in the centre of the square.  2. Take a straight pin and punch a hole in the top left corner of each of the four flaps. (No two holes should be next to each other.)  3. Pick up a flap at a punched corner and carefully curve it over toward the centre hole, securing it with the pin. Repeat this for the other flaps.  4. When all four flaps are held by the pin, carefully lift the paper without letting the flaps unfurl.  5. Lay the pencil flat on a table and carefully push the point of the pin into the side of the eraser.  Cadets make turbine spin by blowing directly into center of blades  Rotary motion of turbine can be used to operate an air compressor or electrical generator | 20 min | Interactive Lecture  Activity |
| Confirmation |  |  |
| 1. What was the earliest known use of hot gases to produce rotary motion   Hero, Egypt, 150BC   1. What did Leonardo da Vinci use hot gases to produce rotary motion for   Chimmeny jack device   1. What aircraft was the first to fly with a gas turbine get?   HE 178 |  |  |

| **End of Lesson Confirmation / Test** | Time | Action |
| --- | --- | --- |
| Introduction |  |  |
| /NA lesson continues |  |  |
| Confirmation Question / Activity / Test Details |  |  |
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| **Conclusion** | Time | Action |
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| Restatement Of Why (From Introduction) |  |  |
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| Summary |  |  |
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| Remotivation |  |  |
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| Overview of next lesson |  |  |
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