

**Activity 2.2.2 Engine Simulator**

Introduction

Turbine engines have predictable performance based altering several parameters. This predictability allows an engine to be designed with the assistance of a software simulator. This reduces design cost and improves safety and performance.

In this activity you will learn how to use a software simulator to design a turbine engine.

Equipment

* Computer with access to EngineSim software
* Engineering notebook

Procedure

In this project, your teacher may have you work alone or with a partner. If you work with a partner, it would be best for you to divide the responsibilities. However, you will need to be sure you understand what your partner did and you will need to explain to your partner what you did as each of you will be responsible for all of the work of your team.

You may access the [EngineSim version 1.7a](http://www.grc.nasa.gov/WWW/K-12/airplane/ngnsim.html)software at the [NASA-Glenn Research Center Beginner’s Guide to Propulsion](http://www.grc.nasa.gov/WWW/K-12/airplane/bgp.html), http://www.grc.nasa.gov/WWW/K-12/airplane/bgp.html, after reading and learning about the four main propulsion systems as described in the guide. If access to the software is not readily available, your teacher may have a version already for you to use on your PC.

1.      Set the following conditions in EngineSim:

* Design Mode
* English Units (Imperial)
* Turbojet (above the animated graphic)
* Input speed + altitude

2.      Set the flight conditions for the following: Airspeed = 0, and altitude = 0, and throttle = 100.

3.      Record the net thrust (FN) \_\_\_\_\_\_\_\_\_\_\_and the Fuel Flow \_\_\_\_\_\_\_\_\_\_.

4.      Change the altitude to 10,000 ft. and the Airspeed to 350.

5.      Did the thrust increase or decrease?

6.      Did the fuel flow increase or decrease?

7.      What are the Thrust \_\_\_\_\_\_\_\_ and fuel Flow\_\_\_\_?

8.      What happens when you choose a different engine? Explain.

9.      Choose a jet with afterburner and record the thrust \_\_\_\_\_\_\_\_\_\_\_ and the fuel flow \_\_\_\_\_\_\_\_\_\_\_\_?

10. Choose a turbofan engine and record the thrust \_\_\_\_\_\_\_\_\_\_\_\_\_ and the fuel flow\_\_\_\_\_\_\_\_.

11. What can you conclude about the effect of an increase in altitude and airspeed on thrust? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and on fuel flow? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

12. Based on your findings, which engine is more fuel-efficient? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Conclusion**

1. Explain how this tool could help aircraft designers.
2. What factors made the largest impact on thrust and fuel flow?