

Pre-Lab Briefing MW54 Mini-Turbojet Engine

Aeropropulsion System Laboratory
Department of Mechanical and Aeronautical Engineering
Western Michigan University

- 1. Choose an ENGINE OPERATOR, a SAFETY, and the rest will be the ENGINEERS.**
 - Engine Operator – stationed in the control room as “Pilot”.
 - Safety – Stationed behind the Safety Line in front of the test cell with the fire extinguisher.
 - Engineers – Make sure everything is set right
 - Assist input of performance data
- 2. Make sure all members in the team read and completely understand the Pre-Startup Checklist and the Startup Procedure.**
- 3. Have all necessary data sheets printed out before the lab.**

Pre-Startup Checklist MW54 Mini-Turbojet Engine

Aeropropulsion System Laboratory
Department of Mechanical and Aeronautical Engineering
Western Michigan University

1. Clear the engine table to make sure nothing is loose underneath or anything on the table that can be sucked into the engine inlet.
 2. Make sure the **FLOW VALVE** underneath the fuel tank is fully turned **OPEN** (unscrew manner).
 3. Clear the room and the area near the **EXHAUST** of the jet engine of human or objects that can be BBQ.
- !!! From this point on, only one team member is allowed to enter the test cell to carry out the final adjustment. !!!**
4. Make sure the serial cable is connected to the computer and the **FADEC ECU** with the **SPECIAL LAN** cable.
 5. Open and run the LabView program "**AAE 466 MW54 Lab.vi**".
 6. Switch **ON** the **FADEC ECU** and make sure the readout from the ECU display matches with the LabView display (such as EGT and RPM).
 7. Push the **MASTER**, **AUX 2**(24Vdc), and **COMPUTER** (12Vdc) power buttons underneath the monitor to **ON** (Green Light).
 8. *Switch the **COMPRESS AIR** to **ON** and a click should be heard.
 9. **Turn **BOTH MECHANICAL VALVES** on the compress air supply to **ON** position.
 10. Adjust the compressor air pressure to **80psi** manually with the knob behind the gauge (the engine will rev up to ~10,000 RPM) and signal the operator to **TURN OFF COMPRESS AIR ON LABVIEW**.

11. Turn the valve on the propane tank to fully **ON** and make sure the propane **PRESSURE** on the gas regulator is not more than **20psi (On the 20PSI Line)**.
12. Make sure the **EMERGENCY STOP** is at the **ON** (up) position.
13. ***Click on the **Start** button below **Data Acquisition**. Enter the name of the file where data will be saved in the pop-up window. (Take note of the directory saved in)
14. Toggle the **Fuel Acquisition** switch to **ON**.

Important Notes and Precautionary:

- * Be prepared to turn the compress air OFF when signaled by your team member.
- ** Note that you have turned on the compress air valve. BEFORE turning on the mechanical valve ON, let everyone around you know so you don't give them a heart attack as it will spin the engine up.
- ***To store data to the file, first enter the Case Pressure from the pressure gage readout and hit **Store Data** button. If a set of data is stored, the **No. Data Store** should display "1" and so on.

Startup Procedure MW54 Mini-Turbojet Engine

Aeropropulsion System Laboratory
Department of Mechanical and Aeronautical Engineering
Western Michigan University

1. Switch the **GLOW PLUG** and the **FUEL VALVE** switches to the **ON** positions (up).
2. Wait for **5 SECONDS** to preheat the glow plug.
3. Switch **COMPRESS AIR ON** to bring the RPM up and shut it **OFF** at **10,000 RPM**.
4. *At **5,000 RPM**, switch **PROPANE ON** and if a ‘**POP**’ sound is heard **OR** the **TEMPERATURE (EGT)** rise switch **COMPRESS AIR ON**
5. When the **EGT** reaches **100 °C**, the **Fuel Pump Power** indicator will start to increase and the fuel pump will start pumping fuel into the engine. At this point the engine will rev up very quickly so be prepared for the next 2 steps!
6. Let engine rev up to about **30,000 RPM**, **SHUT OFF PROPANE**.
7. **When the engine accelerates up to **40,000 RPM**, **Shut OFF** the **COMPRESS AIR** and the **GLOW PLUG**. The engine RPM should rev up to about 45,000 (the default idle setting).***
8. Once the engine reaches idle, note that the EGT will start to drop. Increase the throttle one Click at a time until engine RPM increase, wait until EGT drops slightly before and future increase in throttle.
9. To bring the engine back to idle, reduce the throttle slowly to avoid high EGT and flame out.

Important Notes and Precautionary:

- *If there is no **TEMPERATURE** rise, push **EMERGENCY STOP** to **OFF** (down) and switch **ON** the **COMPRESS AIR** to 'clean up' the propane gas for 2 minutes. Switch **ALL** controls to **OFF** and repeat Start-Up the procedure.

- **If compress air is left on for too long, the engine **WILL** flame out (RPM, EGT, and Pump Power starts to drop). Push **EMERGENCY STOP to OFF** and let Compress Air cool the engine down to about **~30°C** and switch all **CONTROLS to OFF**, **CALM DOWN** and repeat procedure from the start.

- ***If the compress air is shut off too late and the engine rev up to **>45,000 rpm DON'T PANIC!** Wait for the ECU to bring the engine back to **~ 45,000 rpm** idle.

Shut-Down Procedure MW54 Mini-Turbojet Engine

Aeropropulsion System Laboratory
Department of Mechanical and Aeronautical Engineering
Western Michigan University

- 1.** In order to shut off the engine, reduce **throttle** to **Zero**, Shut **OFF** the **FUEL VALVE** and switch **COMPRESS AIR ON** to let the engine cool down to $\sim 30^{\circ}\text{C}$.
- 2.** Shut OFF Compress air and **Push EMERGENCY STOP DOWN**
- 3.** Turn off the **MASTER**, **AUX 2**(24Vdc), and **COMPUTER** (12Vdc) power.
- 4.** Stop “**AAE 466 MW54 Lab.vi**” Labview program by clicking on the **STOP BUTTON** on the screen.
- 5.** Turn off the **Fadec Ecu**, Propane gas, and both mechanical valves on the compress air supply.
- 6.** Shut off the fuel tank valve.