Solaris MkII – Engine Function

Engine Assembly

To understand the launch sequence the condition of the engine prior to launch must be known. The engine is assembled with 3 RNX ignitor “slices” epoxied to the inside of the fuel grain at the top of the combustion chamber. Each slice has a pre-drilled hole where an e-match and some steel wool are inserted. The e-matches then all come out the bottom of the combustion chamber and are shorted to each other.

The Motor Controller top and bottom board are mounted as well as the capacitive fill sensor board. Present is also a thermocouple and pressure transducer on the bottom and top of the tank respectively. The bottom board is connected to the thermocouple and pilot valve motor which operates the engines main valve. The top board is connected to the capacitive fill sensor, pressure transducer and active vent.

This is the configuration the engine is stored in prior to flightline.

Engine Launch Sequence

Flightline

The engine will first integrate a coupler on the top tank bulkhead and will get power from air brakes which sits above. The rear tube will slide onto the engine and the quick disconnect will be installed out the side with fishing line. The quick disconnect will then have e-matches hot glued into two ports for redundancy.

Prior to the rocket being taken to the rail the pad side equipment will be set up in accordance with our checklists.

Pad operations

Once the rocket is on the rail a compression fitting coming from the rocket side of our fill GSE will attach to the quick disconnect for fill and a magnetic connector will attach above the tank for communications between Pad Station and Motor Controller.

At this stage everyone leaves the pad barring two propulsion members with PPE and the FoR.

Launch operations

When all the fittings on the GSE side are checked and the Pad Station is connected to control side we will then test all valves. Both the fill and dump valve on the fill GSE will be operated and set to their closed positions and the pilot valve and active vent will be actuated in both directions and held in their closed and open positions respectively.

The e-matches are then connected to a set of alligator clips and the two quick disconnect e-matches are also connected to two separate alligator clips and relays. Continuity on all e-matches will be checked during assembly and before wiring. The wires are then insulated with electrical tape to avoid accidental shorting.

The pad team will then be asked to arm cameras before proceeding to the final step. The pad team opens the nitrous oxide bottle which allows nitrous oxide to flow between the supply bottle and the fill valve. The pad team will confirm no leaking. A pressure reading will be quoted by the pad members on a gauge and by the control team who will have live pressure readout from a pressure transducer. The pad team will then immediately evacuate the pad. Leaving the bottle opening to the last step ensures minimal risk for the pad members.

Once they have returned to the pad the control team can begin launch operations. Once given clearance to proceed with launch operations the launch operations lead will call out “opening fill valve” over radio, at which point nitrous oxide will begin entering the onboard tank. Once the mass reads close to the desired mass the team

will switch to a fill algorithm which will maintain a certain mass and temperature in the onboard tank through automated actuation of the fill valve and active vent. At this stage the team can hold for further instruction to launch. When the team is given permission to launch the fill valve and active vent will be closed and the quick disconnect e-matches will be fired. The rocket is now separated from the fill station and the onboard nitrous can either be dumped through the active vent in 20 minutes or through the combustion chamber with no ignition if required. The ignitor can then be armed and we can hold for launch or proceed straight to launch. When "ignition" is called out over radio the RNX will ignite, smoke will be visible from the nozzle and the pilot valve will begin actuation and ignition should occur approximately 10 seconds later followed by immediate take-off.

Post-launch operations

Following the launch the launch operations lead, the control team and the pad team will move to "safe" the system by approaching the launch pad and closing the nitrous oxide bottle, returning to a safe distance while the control team dumps the excess nitrous oxide in the lines.