NNC15S600819

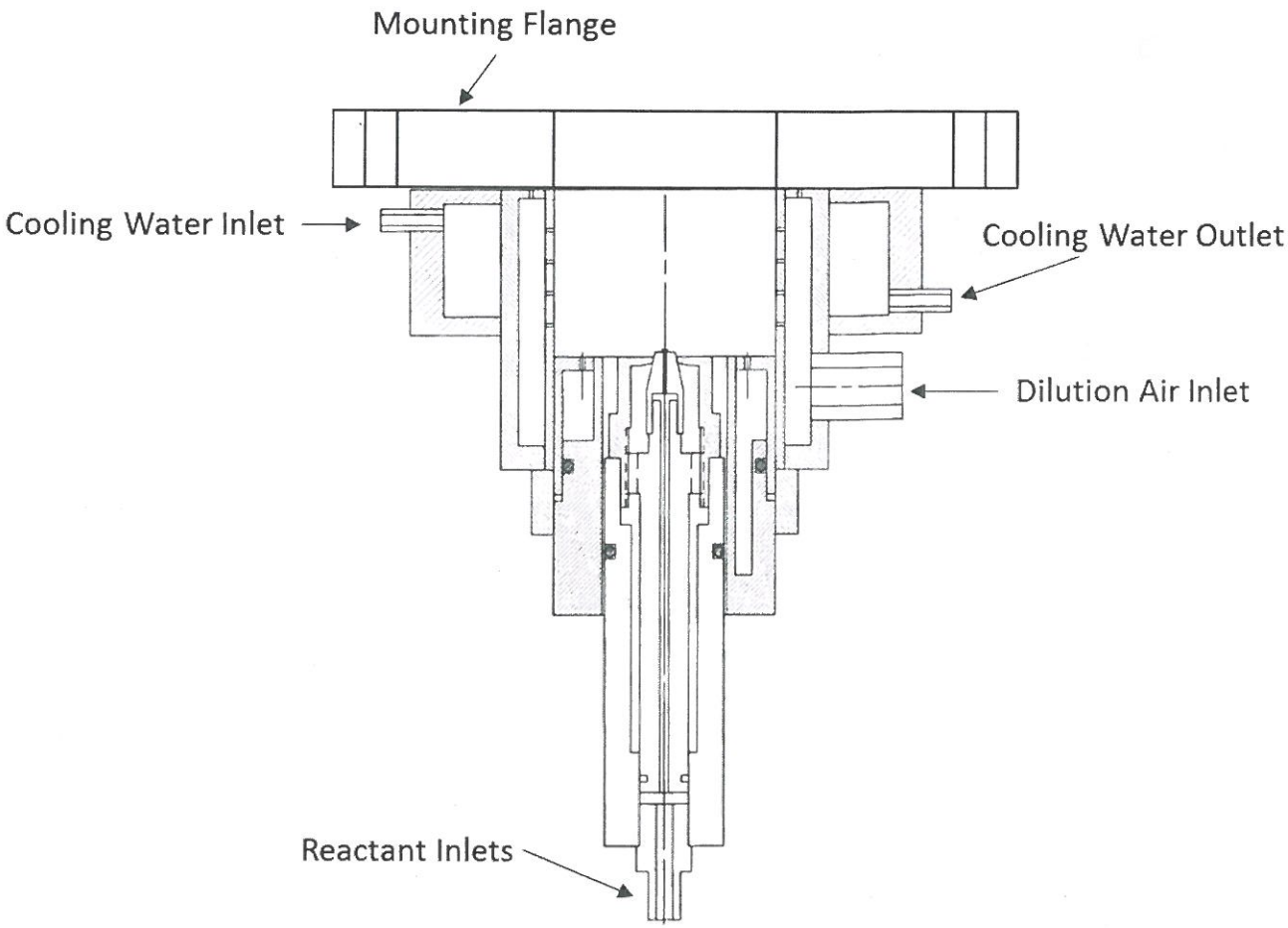
The NASA Glenn Research Center (GRC) is seeking to extend and improve the operating regime of the Flame Calibration Fig (FCR). As part of that effort, a new Dual Fuel Combustor (DFC) and Dual Fuel Injector are required in order to extend the range and accuracy of the existing burner for use in diagnostic development and testing. The combustor will be used to simulate conditions observed in aircraft combustor exit and exhaust at cruise conditions. As a result, the DFC effluent must resemble said emissions with respect to temperature and species concentrations. In addition, the flame emissions must have a very low contribution from soot incandescence, *i.e.*, it must be a Blue Flame. Unlike standard aircraft engines, the DFC is only expected to operate stably at standard Sea-Level pressure. The dual-fuel injector shall have separate paths for the liquid and gaseous fuels. The combustor assembly shall mate to the existing facility piping via a 6" ConFlat type Flange allowing no more than 3.000" of hot exhaust gas flow cross section. The Open Flame Burner (OFB) is a more traditional type of injector that simulates the exhaust effluents of traditional aircraft combustors. As such it is not required to produce a low soot incandescence flame. However, it does require operability with either gaseous or liquid fuels in order to achieve the desired exhaust effluent conditions and constituents. Detailed specifications, a notional drawing, and a list of Deliverables are given below.

Detailed Specifications, Dual-Fuel Combustor (DFC)

1) The Design Pressure shall be 0 PSIG for the exhaust;
2) The Design Pressure shall be 125 PSIG for the fuel, air and premixed gaseous fuel/air lines;
3) The Maximum Temperature of the DFC body materials shall be 1000°F;
4) The DFC material shall be ASTM A312 TP316H Stainless Steel;
5) The DFC shall have three burner input ports
    a. One for liquid fuel
    b. One for atomizing air
    c. One for a premixed gaseous fuel and air
    d. All three inlet ports shall have SwageLok tube fittings
6) The liquid fuel flow rates shall be in the range of 0.005 to 0.10 Liters per Minute;
7) The atomizing air flow rate shall be in the range 10 to 30 Standard Liters per Minute;
8) The premixed gaseous flow rates shall be in the range 1 to 5 Standard Liters per Minute;
9) The DFC shall operate stably and with a low soot incandescence "Blue Flame" on either the liquid fuel, the gaseous fuel or a combination of either;
10) The DFC shall have a Dilution Air Flame Stabilization Chamber in line with and at the exit of the swirl stabilized burner;
11) The Dilution Air Flame Stabilization Chamber shall have a water cooled jacket;
12) The Dilution Air Inlet shall have SwageLok tubing connections;
13) The Cooling Water Inlet and Outlet shall have SwageLok tubing Connections;
14) The DFC shall light with a sparkplug at all conditions listed in 6 through 8 above;
15) The DFC shall have stable operation at all conditions listed in 6 through 8 above;
16) The DFC flame shall be swirl stabilized by the atomizing air;
17) The Swirler Assembly and Fuel Tube shall be removable for inspection and cleaning;
18) The contractor shall provide alignment tools for installing and aligning the swirler assembly and fuel tube within the DFC;

19) The Mounting Flange shall be a ConFlat type flange with an inner diameter the same as that of the Dilution Air Flame Stabilization Chamber;
20) The Mounting Flange shall be welded to the Dilution Air Flame Stabilization Chamber in such a manner so that the alignment between bolt holes and the fluid inlets mentioned above will not cause interference for the passage of bolts through the holes;

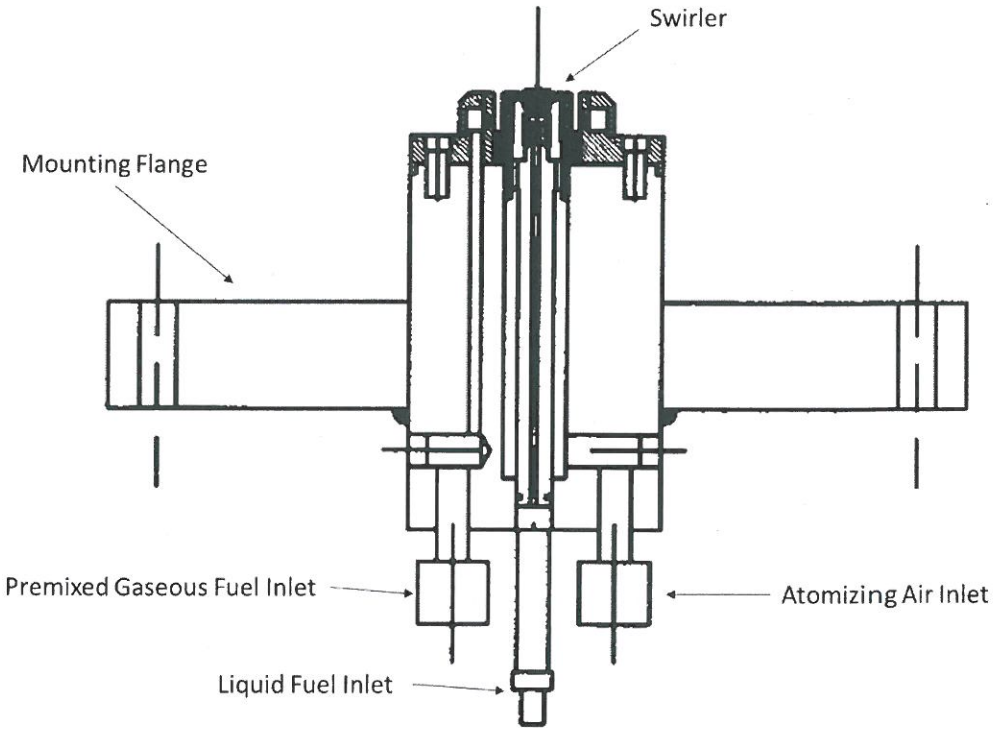
Notional Drawing of the Assembled Dual Fuel Combustor (DFC)



Open Flame Burner (OFB)

1) The OFB will have a mounting flange on the mid body;
2) The OFB shall have three input ports
    a. One for liquid fuel
    b. One for atomizing air
    c. One for a premixed gaseous fuel and air
3) The liquid fuel flow rates shall be in the range of 0.005 to 0.10 Liters per Minute;
4) The atomizing air flow rate shall be in the range 10 to 30 Standard Liters per Minute;
5) The premixed gaseous flow rates shall be in the range 1 to 5 Standard Liters per Minute;
6) The OFB shall light with a sparkplug at all conditions listed in 4 through 6 above;
7) The OFB shall have stable operation at all conditions listed in 4 through 6 above;
8) The OFB shall have a swirl stabilized flow;
9) The OFB shall operate stably and with a low soot incandescence on either the liquid fuel, the gaseous fuel or a combination of either;
10) The contractor shall provide alignment tools for installing and aligning the swirler assembly within the OFB;
11) The OFB shall be mounted such that no less than 0.500" and no more than 1.00" penetrate the Injector Spool;
12) The OFB shall be no more than 3.00" in diameter;

Notional Drawing of the Assembled Open Flame Burner (OFC)



Deliverables

There are Five (5) Deliverables for this effort.

1) Fabrication drawings for both the Dual Fuel Combustor and the Open Flame Burner to be submitted at least 5 work days prior to the start of fabrication of each item;
2) One assembled and tested 316 Stainless Steel production version Dual Fuel Combustor with photographic (or spectroscopic) evidence of low soot incandescence while operating on liquid fuel, gaseous fuel and combinations of both;
3) Two assembled and tested 316 Stainless Steel production version Open Flame Burner with photographic (or spectroscopic) evidence of low soot incandescence while operating on liquid fuel, gaseous fuel and combinations of both;
4) An Acceptance Test of each burner at the Contractor Facility. The test will be considered successful if each item demonstrates ignition on both fuels, stable burning, and operability over the ranges listed in Items 4 through 6 in the Detailed Specifications above;
5) Five sets of swirler assemblies for use in either the Dual Fuel Combustor or Open Flame Burner.