



# A Novel Approach to Modular Ramjet Inlets

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## Background

This project is operated under the organization Experimental Jet Engine Propulsion (XJEP). XJEP focuses on research and experiments related to air breathing jet engine propulsion. XJEP has completed and has ongoing projects related to test cell design, thrust augmentation, afterburner design and testing, and now ramjet design.

The afterburner and ramjet engine are designed to be modular. This concept was chosen to provide a platform for future research to club members. The modular design saves time and money during the manufacturing period. This project plans to test and compare a traditionally manufactured and an additive-manufactured ramjet inlet. By choosing a modular design the test section will be manufactured in such a way that if different deflection angles or objects need to be tested, the section where the testing object is held simply comes out and is swapped out.

## Project Goals

1. The first goal of the project is to design, manufacture, and successfully operate a modular ramjet inlet
2. The secondary goal is to compare flow separation and shockwave formation between a conventionally machined inlet cone, and multiple produced with different additive manufacturing methods

## Current Standing

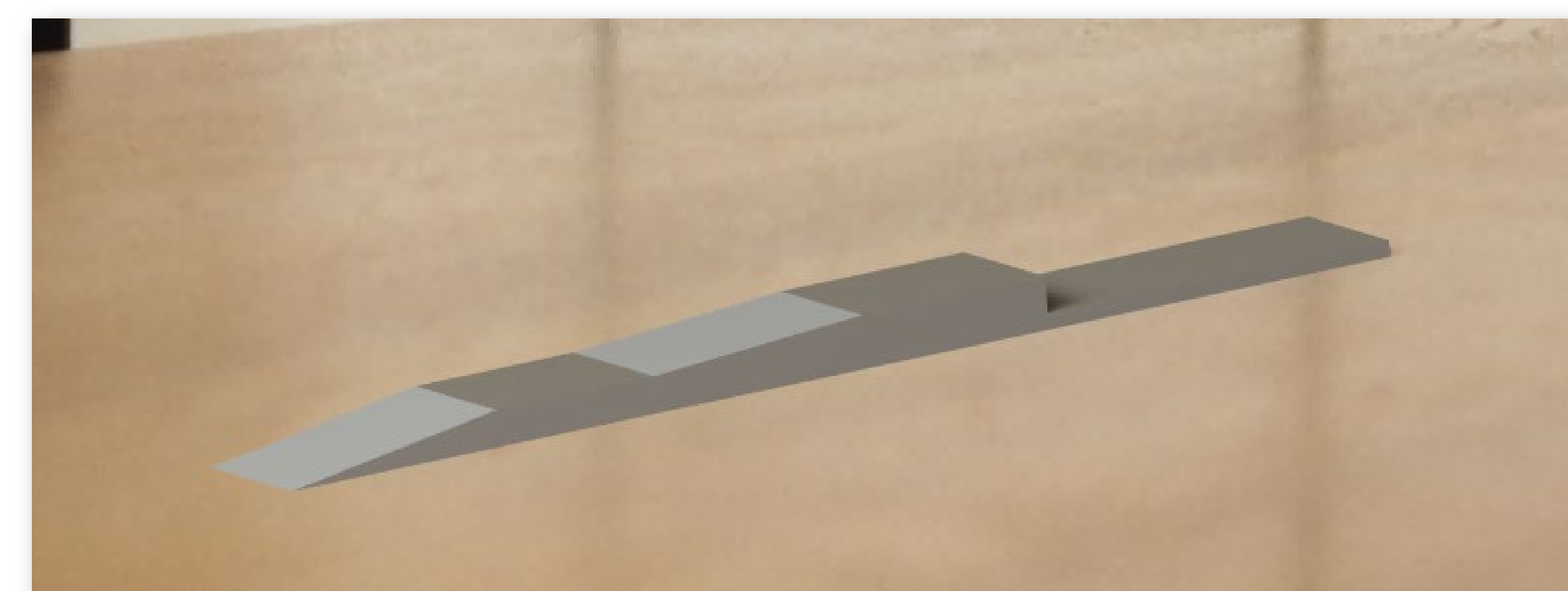
Final computational fluid dynamics simulations are being run right to confirm the design. Multiple initial iterations were completed throughout the semester with this design being chosen. The two pictured designs are the current inlet by itself and the whole test section. The test section is being designed in such a way that the part where the ramjet inlet is can easily be swapped out for other parts. This allows for testing of the differently manufactured inlets. The additive-manufactured inlets will vary in orientation and print pattern to test the most effective one. They also will not be coated.

## Next Steps

The following steps are to start manufacturing the inlet and test section of the project. After this, the test preparations will begin by getting the test section complete with the plexiglass and modular test section. During the time it is being manufactured other possible testing objects will be inquired about for example but not limited to: internal compression ramjet inlet, small-scale ramjet, and others. This will serve as a means to test small-scale future supersonic projects for both club and university.

## Engine Statistics

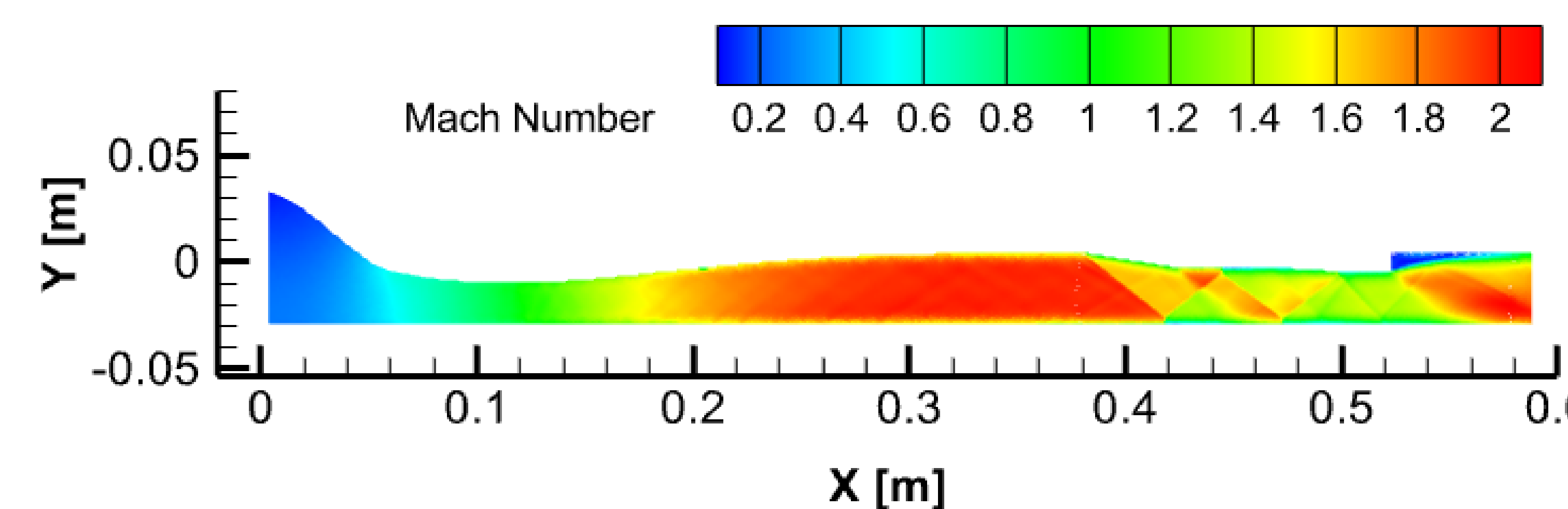
Parameter	Value
Runtime Initial Stagnation Pressure	5.8 seconds
Initial Stagnation Pressure	80 psia
Ramp Design	9° & 4°
Inlet Mach	2
Final Mach before normal shock	1.05



Rendering of the inlet model of the ramjet



Rendering of the direct connect contour test section of the ramjet



Preliminary CFD Simulations