FIU Department of Mechanical and Materials Engineering

SENIOR DESIGN PROJECT SYNOPSIS – SPRING 2013

HYSOL (INTEGRATED SOLID HYBRID ROCKET)
A PROJECT SPONSORED BY ENVIRONMENTAL AEROSCIENCE CORPORATION (EAC)

Team 20: Pedro Serrat, Dennis Moreno, Eduardo Gorrochotegui **Faculty Advisor: Dr. Tsukanov**

In December 2008 the United States Government increased the limitations for Amateur Rockets. Originally set under 80 miles, the current law allows Amateur Rockets to fly up to an altitude of 93 miles. The challenge being faced is having enough thrust for initial lift off and rise, as well as enough fuel to continue towards our altitude goal of 93 miles.

Two types of rocket systems were integrated to achieve the desired outcome. A solid rocket system will be used initially and then there will be a transition into the hybrid rocket system. The solid rocket segment provides a high thrust, high chamber pressure, as well as short burns duration with no shut off opportunities. The hybrid rocket stage provides a long burn rate, low thrust, as a result of a lower chamber pressure while having the ability to throttle if needed.

Being able to bring the benefits of both of these rocket systems together will magnify the altitude and help achieve the desired goal. In order to bring both of these fuel forms together, a valve system was developed to allow the transition from the solid portion, to the hybrid portion. N_2O will be injected from a separate tank to be used as the oxidizer on the hybrid portion of the flight. The valve system is the most important part of the rocket. Proper timing, flow and heat transfer will need to be considered to implement for the oxidizer to be released.

The team worked with the principle engineers of Environmental Aeroscience Corporation. With the slogan of “The Thrust you can Trust” they provided the rocket propulsion system for SpaceShipOne during ground testing. In 2004 the company was sourced to provide The “Go Fast” rocket, a 92,500 lb-sec solid motor that would propel the 435 lb. 175” long rocket 72 miles into the sky at Mach 5 that would be the first armature rocket to reach space. With the vast knowledge and experience of the company they were the main contributor that allowed the team to accomplish the overall goal. The initial prototype is a 4” diameter rocket, which allowed us to determine if the valve system worked properly. Once all proper testing is complete, a full sized rocket will be built. The design consists of a 12” diameter and 20-22’ long rocket motor. The incorporated valve system will release the oxidizer into the core at the optimal time and will allow the rocket to have a smooth transition from the initial solid rocket booster phase to the longer lasting hybrid system.