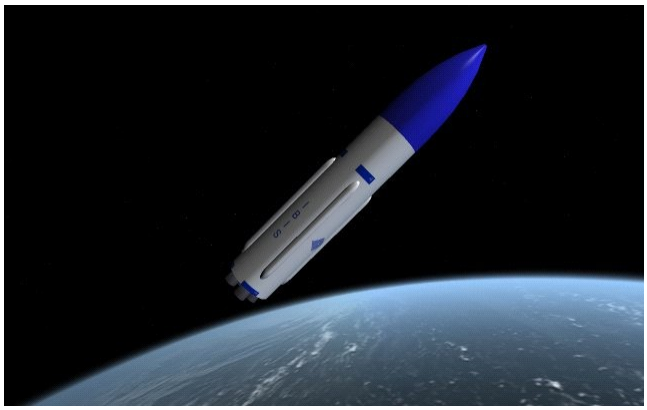
IBIS

for Orbiter Spaceflight Simulator 2010
27th November 2013
By Phoenix



DESCRIPTION

This is a compact, single-stage, four-engined rocket that I have developed as an exercise in how to write a vessel add-on for Orbiter, specifically one using thrust-vectoring for guidance, and with reconfigurable propellants. Source code is included.

INSTALLATION

Extract the zip file into the root folder of your Orbiter installation. There are no dependencies on other Orbiter add-ons.

The vessel DLL was compiled using Visual Studio 2012 Express, so you may need to download and install Microsoft's 2012 C++ redistributables, or you can re-compile the source code yourself using a previous version of Visual Studio.

USAGE

Double click on the *Ibis* scenario in the Orbiter launchpad. Standard Orbiter controls are used. Use maximum thrust at lift-off, although you may want to reduce thrust once the rocket becomes lighter, for easier attitude control.

Thrust vectoring controls the roll, pitch and yaw of the rocket in addition to producing forward thrust. If the engines aren't producing thrust, you cannot control the attitude of the rocket. Autopilot controls such as kill rotation don't function, so you'll have to constantly work at keeping the rocket orientated in the direction you want.

CONFIGURATION

The default propellant is kerosene and hydrogen peroxide, but you can change this by modifying the *Ibis.cfg* file in the *Config/Vessels* folder, using a text editor such as Notepad.

You need to know four values to define a propellant: the name; the overall bulk density of the propellant combination in kilograms per cubic metre; the sea level I_{SP} in seconds; and the vacuum I_{SP}. There are some other propellants already defined in this file. To use them, comment out the ones you don't want by entering a semi-colon at the beginning of each line, and uncomment the lines that define the propellant you do want, or write your own.

This is a small rocket, about 8m long by 1.5m in diameter. The propellant tank volume, and empty mass of the rocket are fixed at $5.5m^3$ and 800kg. The engines have their rated-thrust calculated to give 1.2Gs of acceleration at lift-off, assuming Earth sea-level pressure, and this can be redefined in the configuration file.

The potential ΔV of the rocket using the specified propellant is displayed on the Orbiter screen, along with the propellant details. In reality, you won't reach this change in velocity because the calculation is done using only the vacuum I_{SP} value, and without taking into account gravity losses, or atmospheric drag.

To reach Earth orbit and beyond with this rocket, you'll have to use some form of nuclear driven propellant, or a HEDM (High-Energy-Density Materials) propellant such as metallic hydrogen. Metallic hydrogen is defined in the *Ibis.cfg* file with a vacuum I_{SP} of 1800s and a density of $3580kg/m^3$.

To give a more animated effect to the exhaust flames, there is some random oscillation applied to the thrust directions of each thruster. However, this oscillation can make the rocket more difficult to control. You can switch it off by setting *MAX_OSC_AMP* in the *Config/Ibis.cfg* file to zero radians.

Created using Paint.NET, Blender, the Blender to Orbiter mesh Python script by vlad32768, and Microsoft's Visual Studio Express 2012.