



DELTA TUG

user manual

Yuri Kulchitsky
web-site www.kulch.spb.ru, e-mail postmaster@kulch.spb.ru

June 23, 2007

Disclaimer

This software is provided as it is without any warranty of any kind.

The project has been developed to be used as an add-on for Orbiter Space Flight Simulator by Martin Schweiger (www.orbitersim.com). **Designed for Orbiter 2006 Edition, patch 1 (build 060929).**

Introduction

new !

Delta Tug. This is a towing vehicle for using with the all *DeltaGlider* family vessels (including *DeltaGlider-HR*, *DeltaGlider-III* and *DeltaGlider-IV*). Delta Tug can be used as upper stage for *Energia HLLV* or *TX winged booster*.

Credits

Meshes are created with 3DSMax software, export script by **Alexander Blass** (www.nestadlinn.de/orbiter).

Texture for exhaust flame (RCS and separation solid engines) is taken from Space Shuttle Atlantis addon (thanks to **Don Gallagher**, **Damir Gulesich** and **David Hopkins**).

Installation

Follow the setup program instructions.

Requirements

1. Activate built-in Orbiter Scenario Editor for configuring Delta Tug.
2. Required add-ons:
DeltaGlider-III or *DeltaGlider-IV* by DanSteph, orbiter.dansteph.com
ENERGY project (Energia HLLV), see kulch.spb.ru/Eng/downloads.shtml or www.orbithangar.com/searchid.php?ID=1036
TX winged space launcher, see www.orbithangar.com/searchid.php?ID=421
Read the requirements for these addons, please.

Quick flight

Start Orbiter and select scenario in *Delta Tug* scenario folder.

Available scenarios:

Delta Tug 25

Here is ready to takeoff TX on a runway of SRC Space Port with Delta Tug/DeltaGlider system as a payload. Start the TX, make orbital insertion and hit **[J]** key to jettison Delta Tug with DeltaGlider.



Required add-on – *TX winged space launcher*. For details how to control TX vessel – see TX manual.

Delta Tug 70

This is a heavy version of Delta Tug. At the launch site of SRC – Space Polygon you can see the Energia HLLV with Delta Tug and DeltaGlider as a payload. Energia is programmed to make orbital insertion at 300 km altitude and 52 deg equatorial inclination (for docking with ISS) or 29 deg inclination (for Earth – Moon flight). Launch the Energia immediately (**[S]** key or push the *Start* button on Energia control dialog).

Delta Tug with DeltaGlider will be automatically carried into desired orbit. After automatic payload separation you can control Delta Tug in free flight.



Required addon – *ENERGY project*. For details how to control Energia – see addon manual.

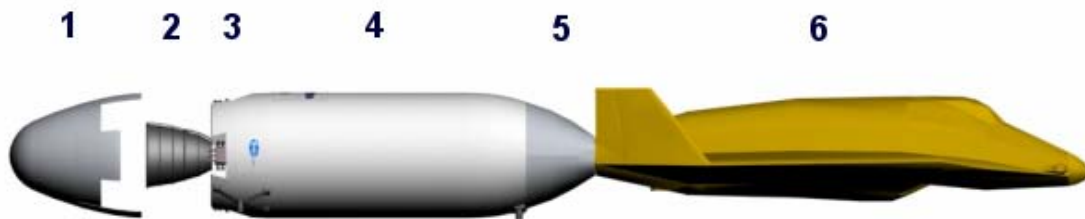
To make separation of DeltaGlider hit **[J]** key. Another way – start the DeltaGlider's main engines and Delta Tug will be jettisoned automatically.



1. You can switch the control between vessels using **[F3]** key.
2. The back aeroshell of Delta Tug will be jettisoned automatically according to atmospheric conditions (dynamic pressure and altitude).
3. It is not possible to dock DeltaGlider to any space station during the joint flight with Delta Tug. Please, jettison Delta Tug first.

Delta Tug capabilities

Delta Tug vessel consist of the following parts: main tanks, main engine SE-38h, RCS module, payload adapter and back aero shell, see the picture:



Legend:

- | | |
|---|--|
| 1. back aeroshell with separation solid engines | 4. main fuel tank |
| 2. main engine (SE-38h model) | 5. payload adapter |
| 3. RCS module | 6. payload – DeltaGlider family vessel |

There are two modifications of Delta Tug vessel – *model 25* and *model 70*. Model 25 uses TX as a launch platform, model 70 is Energia based. Back aeroshell is intended to reduce the back aerodynamic resistance. The aeroshell jettison is fully automatic (you can reattach the aeroshell using the Scenario Editor).

Main capabilities:

	model 25	model 70
Empty mass, t	4.1	6
Main engines fuel mass, t	20.4	63.5
RCS engines fuel mass, t	1.5	2.5
Aero shell mass, kg	70.8	70.8
Gross takeoff mass, t	~26	~72
Effective velocity, km/s (delta V, for DeltaGlider mass = 22.5 tons)	~2.3	~4.4

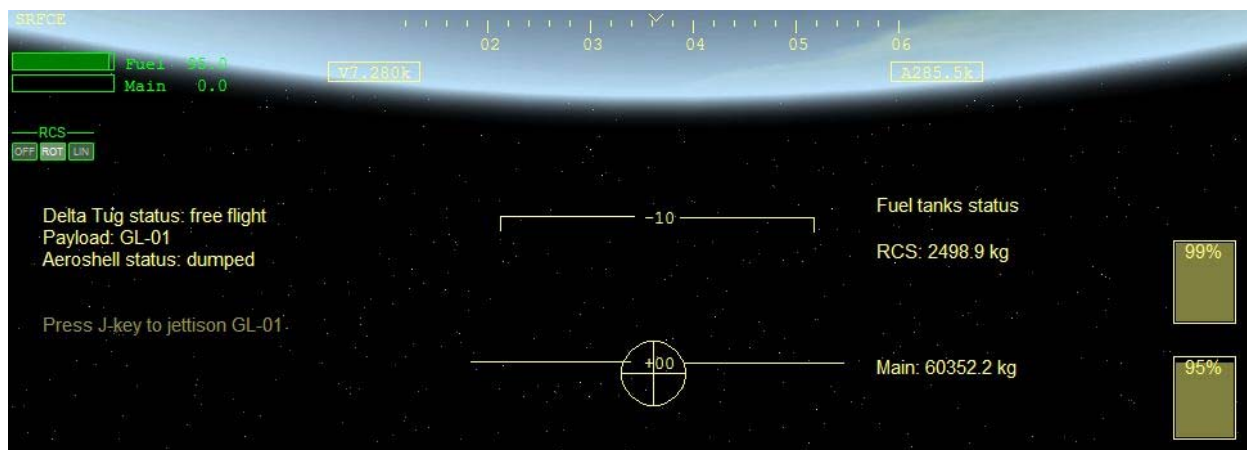
SE-38h engine characteristics:

Fuel type	LOx/LH2
Vacuum thrust, tf	38.0
Suspension type	2-dimensional gimbaled

new !

HUD

Delta Tug is equipped with a special HUD, see the picture:



The HUD shows current tug state, payload name and amount of fuel in main and RCS tanks separately.

Keyboard interface

In addition to a usual Orbiter keyboard layout the following keys are used:



Payload jettison



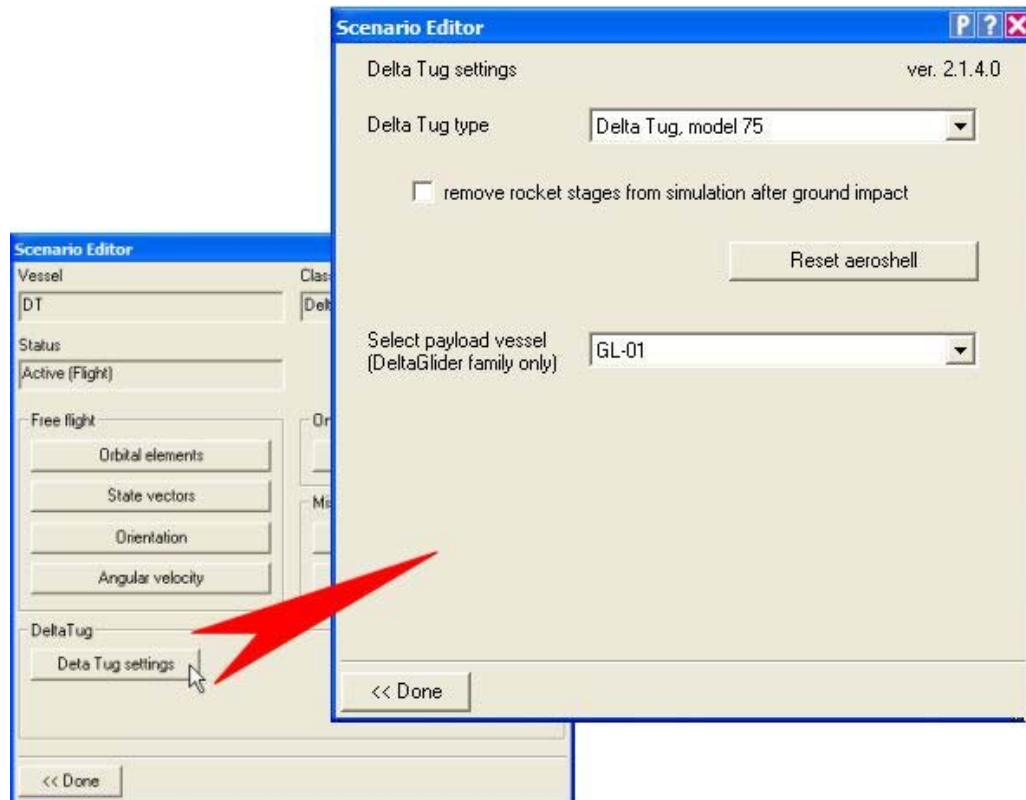
The separation also can be done by applying of DeltaGlider's main thrusters. During separation Delta Tug RCS automatically switches to linear mode and applies 10-seconds back thrust impulse.

new !

Configuring

Delta Tug can be tuned with Orbiter's *Scenario Editor* (read more about Scenario Editor in *Doc\ScenarioEditor.pdf* manual).

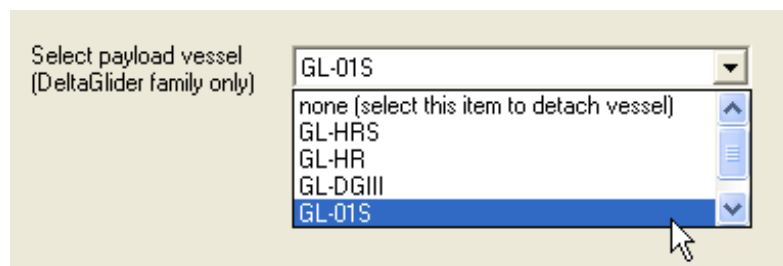
Delta Tug has a special configuration page in Scenario Editor, see the picture:



Delta Tug modification can be chosen in *Delta Tug type* combo. Checkbox *remove rocket stages from simulation after ground impact* if checked means that Delta Tug and its aeroshell will be deleted after ground impact on Earth or another planet surface.

You can create Delta Tug vessel using Scenario Editor. Editor creates all vessels in space at near Earth orbit. So the aeroshell will be dumped here. If you have placed the Delta Tug on Earth or in atmospheric flight you can get back the aeroshell by clicking *Reset aeroshell* button.

You can select the payload in *Select payload vessel* combo. The vessels list contains DeltaGider family vessels only. Currently it can be a stock DeltaGlider (including scram-jet version), DeltaGlider-III or DeltaGlider-IV (by DanSteph, orbiter.dansteph.com) or hi-res version – DeltaGlider-HR (by ae7flux, www.orbithangar.com/searchid.php?ID=2012).

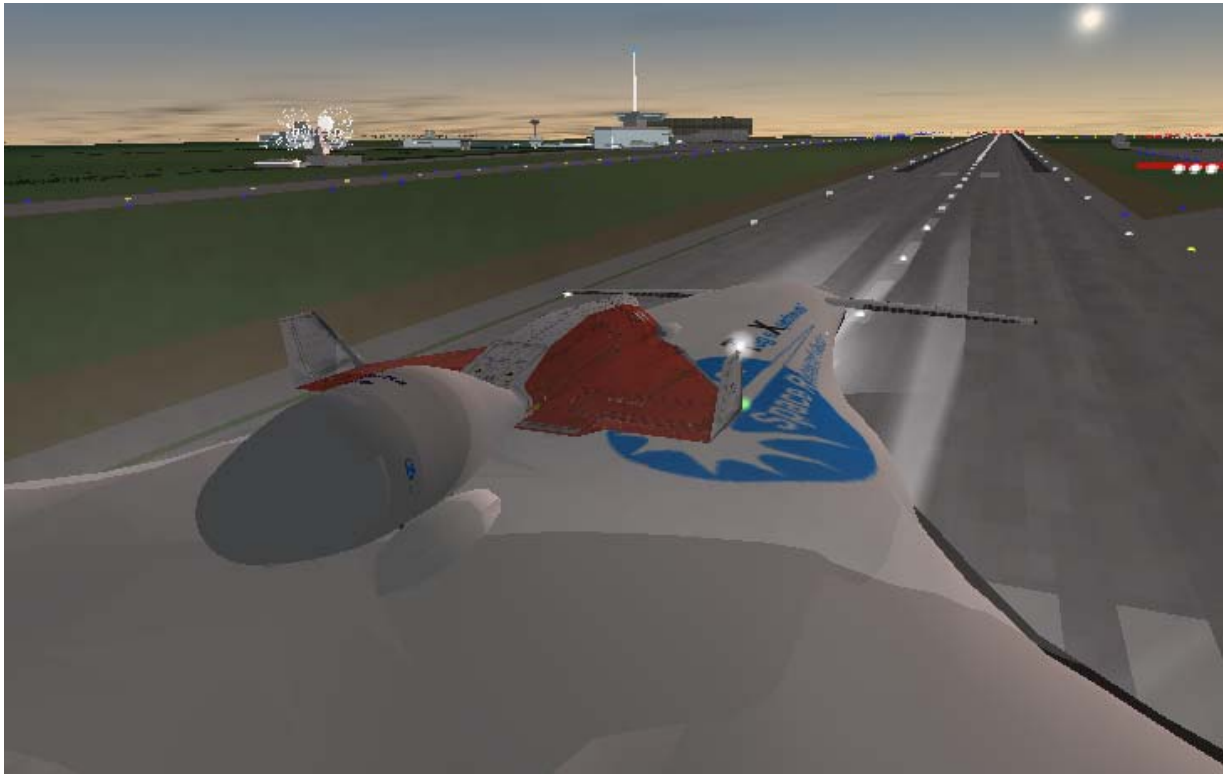


If you want to release the payload just select the *none* item in the combo. Payload will be detached and located at the near planet orbit.



Attaching or detaching the payload vessel occurs instantly if the simulator is not on a pause.

Screenshots



TX is ready for takeoff (Delta Tug 25)



Energia is ready for launch. ISS interception, Delta Tug 70



Launchpad on Sun rising (Delta Tug 70)



© 2007 Yuri Kulchitsky
postmaster@kulch.spb.ru
www.kulch.spb.ru
June 2007
S.-Petersburg, Russia