simcosmos
virtual dreams

NASA DIRECT SDLV v0.1

for Orbiter v060929 (2006P1)

9th, December 2006

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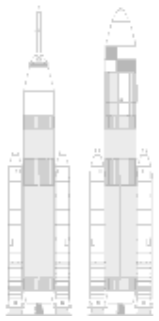
DIRECT CLV and HLV (basic) variants (HLV not in v0.1)

v0.1 is a **development version** of DIRECT SDLV Orbiter addon**:**
high possibility of missing, incomplete, incorrect info / pictures / components!

0. Contents

1. Introduction



DIRECT CLV + HLV
Image credit:
Ross B. Tierney

NASA is currently between two eras of space exploration: the **S**pace **T**ransportation **S**ystem (**STS**) and its famous winged Orbiter vehicle are in their final operational years (ending operations ~2010) and new launchers / mission objectives are being prepared. Low Earth Orbit objectives might still be around but more ambitions goals lay ahead: NASA wants to go to the Moon, Mars and beyond as per the goals of the **V**ision for **S**pace **E**xploration (**VSE**).

NASA's initial chosen path for the new VSE launchers was to go an almost 100% Shuttle Derived way (4 seg. SRB for CLV, SSME*, heavy lifter's core diameter equal to STS ET, 5 segment SRB, etc). Some of those conceptual ideas came from the **E**xploration **S**ystems **A**rchitecture **S**tudy (**ESAS**):

http://www.nasa.gov/mission_pages/exploration/news/ESAS_report.html
http://www.nasa.gov/mission_pages/exploration/spacecraft/ares_naming.html

The designs are still being tweaked (and changed from the initial concepts) but the basic idea is still to have a +/-22t (up to 26t?) smaller payload **C**rew **L**aunch **V**ehicle (**Ares I**), now composed by a 5 segment SRB and a second stage powered by a J-2X engine (Apollo heritage) and then, there are the **Ares V** plans: a very capable heavy lifter with some STS ET heritage (but powered by 5 x RS-68 and a 10m larger core), two 5 segment SRB, EDS with J-2X and capable of lifting about 125t to 130t to LEO.

In concept this seems to be a capable approach when considering all the constraints around the VSE hardware development (those constraints are not only technical or economical but also have a strong political component).

However, there could probably exist better technical, cost effective and with much less development risk approaches which would still fulfil all required goals and eventually even bring operational advantages over the current path.

A few months ago I was contacted by Ross B. Tierney regarding my interest and availability to make some 3D models / multimedia for the DIRECT Launcher Proposal and about bringing the concept to Orbiter Space Flight Simulator, one of the best space simulators / visualization tools around… and free! (thanks to Dr. Martin). I accepted, also contributed for DIRECT's site design and… you will now be able to experiment v0.1 of such "DIRECT" launcher concept (just the CLV, for the moment).

The objective here is to at least provide a fun and interesting 'conceptual toy' for people to play with in the comfort of their home computers and, at the same time, try to evidence an eventual alternative approach for VSE launchers that would still accomplish all the political goals, would require much less infrastructure changes, smaller development risks and a more intensive and *direct* use of current STS components (or derived components from existing USA vehicles), current production techniques, even flight procedures (for some configurations), with all the associated advantages. That is why the addon is called **DIRECT S**huttle **D**erived **L**aunch **V**ehicle (Ares II could also be a logical designation if Ares I / V plans were exchanged for this Direct approach or… we could simply call Ares CLV / Ares Heavy to the basic DIRECT variants). The primary launcher design assumptions will be developed in later pages (or later versions) of this document. You can also read the work in progress / most current DIRECT proposal at www.directlauncher.com.

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high possibility of missing, incomplete, incorrect info / pictures / components!

DIRECT SDLV Basic Assumptions:

- "ET" Derived Core: same diameter and slightly increased propellants quantity than the ET used in STS operations (tank capability could be further increased for eventual upgrades to the basic launcher). Modifications in the bottom (for engines structure) and in the top (for in-line payload integration), etc. Keeping core diameter from STS allows for much easier VAB / MLP / launch pad adaptations

- Core's Propulsion: 2 x RS-68* (first few flights, mainly for near-term ISS missions). Two RS-68R (regenerative nozzle) for the exploration launcher variants (3 x RS-68R for Growth Options, if needed).

- Boosters: 2 x 4 segment Solid Rocket Booster (SRB), exactly the same as current STS (optional optimizations to the 4 seg. SRB or adoption of 5 seg. SRB or even new type of boosters could eventually also be used to boost performance in the future, if required)

- Upper Stage: 1 x J-2X Earth Departure Stage (EDS) to maximize DIRECT's basic design payload into LEO missions and beyond (EDS could be updated later, if following Upgrade Paths). Design probably based in Centaur Tech (and ICES?).

The above components are the base in which several DIRECT variants could be built using a more phased and with bigger commonality approach than what will ever happen with STS to Ares I / V transition and even between Ares I vs V.

The utilization of a single ~70t up to ~100t capable DIRECT SDLV family for both manned, unmanned and mixed missions would require less facilities changes (from STS era), less development constraints and could cost less, increase flight rate, deliver more and help to build optimum launch proficiency for the near, middle and long-term demanding VSE objectives.

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DIRECT SDLV Addon for Orbiter Simulator…
…what is it and what it is not?

Due to several constraints, this addon / simulation does not pretend to be ultra-realistic: such objective would only be possible with a much more careful and professional study / implementation and…with some real life tests!

So, when "playing" with this Orbiter simulator addon please have in mind the following aspects:

a) V0.1 is the first of other (hopefully) to come addon development versions that will be incrementally released and, in the end, that will result in **v1.0.**

Note: I think that will start following this development approach from now on, regardless other addons I might have produced in the past (you can look at them as v0.1 too… or less :-))

b) Even when v1.0 is released, it will still be a work in progress: there is always space to improve the simulation!

c) From v0.1 towards v1.0 (and eventual future versions) it is then very likely that you will see the 3D models, textures, scenarios, mission profiles, automatic guidance files, documentation, etc being updated, upgraded and / or replaced by more correct and visually nicer / optimized work. Again, the addon is a constant work in progress.

d) Last two points: this is all done in the free times! Also: I'm not a rocket scientist neither do I pretend to be one. Please respect these last two aspects of the addon's development work when / if analyzing it or when / if providing feedback, in particular, if you work in the aerospace industry: any constructive criticism is always welcomed!

Having written the above *blablablablabla*, please do have an attentive look at all the rest of the documentation in order to better use the current version of DIRECT addon.

Hope you have fun ;-)

Thanks,
António Maia

9th, December 2006
(Portugal)

2. Installation

It should be relatively easy to install these files:

Step1 – Orbiter2006P1 + DIRECT v0.1

If not having one yet, you really need an install of **Orbiter2006P1 (060929)**:
http://orbit.medphys.ucl.ac.uk/download.html

Note: do not mind about additional packages if this is the very first time you try Orbiter or if you have a lower computer specification. See the above link for download / installation instructions: you need to install, at least, the Base (full) 060929 (orbiter060929_base.zip).

After installing Orbiter:
Just unzip DIRECT addon contents (**NASA_DirectSDLVv0.1.zip**) into your main Orbiter directory (keeping the zip's folder structure) and you will then have the basic to start playing with DIRECT Launcher (see Flight Manual) but… please have a look at the following steps!

Step2 – Overwrite Alert!

Except for two textures, all other DIRECT files are stored in custom **NASA_DirectSDLV** subfolders (or use a naming convention) and should not overwrite any of Orbiter's default files (for easier addon maintenance). Please see pages 7, 8 and 9 for the complete list of files included in the present addon version.

However, two files of your Orbiter\Textures\ folder are surely overwritten in Step1… Do not worry too much if this "overwrite alert" seems a bit weird, for example, if it is the first time you install Orbiter. This is nothing serious but I should write about it anyway, just for reference.

The overwritten files are:
\Textures\Horizon.dds
\Textures\Star.dds

These are just my custom textures for Earth*'s Horizon and for the Sun.
The Horizon.dds was conceived for usage with my addon's scenarios and with the following atmospheric parameters available inside **00_Earth.cfg**:

\Config\NASA_DirectSDLV\System\03_Earth\00_Earth.cfg

AtmColor0 = 0.239 0.455 1
AtmHazeColor = 0.812 1 1

Original Orbiter parameters in **\Config\Earth.cfg**
AtmColor0 = 0.61 0.8 1.0
AtmHazeColor = 0.75 0.9 1.0

Step2.1) If liking my new Sun texture + Horizon texture and related parameters you might like to open Orbiter's default **\Config\Earth.cfg** and replace the original **AtmColor0** and **AtmHazeColor** by the ones above, **IF** wanting to see that atmospheric effect in all other scenarios (exterior to my work) and which, because of that, usually use Orbiter's default Earth.cfg.

Step2.2) If disliking my Sun + atmospheric textures and settings:

Delete:
\Textures\Horizon.dds
\Textures\Star.dds

Find:
\Textures\Horizon_Orbiter20060929BACK.dds
\Textures\Star_Orbiter20060929BACK

Rename the backups to **Horizon.dds** and **Star.dds** and, last but not least, copy Orbiter's default parameters into my addon's **00_Earth.CFG** (see information above) plus re-check Orbiter's default Earth.cfg.

Step3 – Required / Recommended or Included Addons

Daniel Polli aka Dansteph's Orbiter Sound:

http://orbiter.dansteph.com/index.php?disp=d
(http://orbiter.dansteph.com)

- Required only **IF wanting to have sound while running Orbiter**: highly recommended if you wish to greatly improve your Orbiter simulator experience and, in particular, if wanting to hear DIRECT's launcher countdown, the *Ratatatata* of the SRB or… other *interesting* sounds during the ascent…

Orbiter Sound comes with an executable: just run it and point to your Orbiter folder.

Franz Berner aka Francisdrake's ESAS CEV addon:

http://www.orbithangar.com/searchid.php?ID=1972

- Required only **IF wanting to have a functional CEV after DIRECT's CLV core separation**. Not required if just wanting to simulate the launch and orbital injection (CEV stowed meshes are included in NASA_DirectSDLVv0.1, thanks Franz). Please see chapter5 (Flight Manual) for more details + read also the respective scenario description.

Unzip ESAS CEV addon into your Orbiter folder (keeping file structure).

Vinka's Multistage and Spacecraft Generic dlls:

http://users.swing.be/vinka/

- All required **generic dlls and respective .cfg / .INI files are already included** inside NASA_DirectSDLVv0.1 package's own directory structure (thanks Vinka!).

Note: these generic dlls are a method of implementing launcher configurations and also to implement spacecraft inside the simulator without the need to code c++ (it is all done via simple text files - .cfg and structured .INI - that can be opened with notepad). Vinka's generic dlls documentation is also distributed under **\Doc\NASA_DirectSDLV**

However, if wanting to have the original complete generic dll packages with related documentation, examples and other files, please download them from Vinka's site. But again, all what is needed to run DIRECT is already included in NASA_DirectSDLVv0.1.zip: I'm writing this note just in case you wish to have a look at the original generic dll packages.

Next is the complete list of files included in NASA_DirectSDLVv0.1.zip:

\README_NASA_DirectSDLV_v0.1.htm
Doc\NASA_DirectSDLV\NASA_DirectSDLV_v0.1.pdf
Doc\NASA_DirectSDLV\VINKA_multistage02_050721.pdf
Doc\NASA_DirectSDLV\VINKA_spacecraft03_060302.pdf

Scenarios\NASA_DirectSDLV\Description.txt
Scenarios\NASA_DirectSDLV\mD010_CEV-E_ISS.scn

Modules\NASA_DirectSDLV\Vinka_genericDLL.txt
Modules\NASA_DirectSDLV\multistage01.dll (+ 02.dll)
Modules\NASA_DirectSDLV\spacecraft01.dll (+ 02.dll +03.dll)
Modules\NASA_DirectSDLV\Stage.dll

Config\Vessels\NASA_DirectSDLV\Stage.cfg
Config\Vessels\NASA_DirectSDLV\StageINV.cfg

Config\NASA_DirectSDLV\Launchers\!README_CODES!.txt
Config\NASA_DirectSDLV\Launchers\Direct.cfg
Config\NASA_DirectSDLV\Launchers\Direct_ballast45t.cfg
Config\NASA_DirectSDLV\Launchers\Direct_LES.cfg
Config\NASA_DirectSDLV\Launchers\mD010_CEV-E_ISS.ini
Config\NASA_DirectSDLV\Launchers\mD010_CEV-E_ISS.txt

Config\NASA_DirectSDLV\Spacecraft\spacecraft01.cfg (+ 02cfg + 03cfg)
Config\NASA_DirectSDLV\Spacecraft\CEV_Franz\spacecraft01.cfg
Config\Spacecraft\[DSDLV]CEV-E_ISS.cfg

Config\NASA_DirectSDLV\System\Sol.cfg
Config\NASA_DirectSDLV System\03_Earth\00_Earth.cfg
Config\NASA_DirectSDLV\System\03_Earth\Base\Canaveral_SC2015.cfg,
(*rest of bases are equal to Orbiter's default ones… for now)*
Config\NASA_DirectSDLV\System\03_Earth\Base\Facilities\Direct_MLP01.cfg
Config\NASA_DirectSDLV\System\03_Earth\Base\Facilities\Direct_MLP02.cfg
Config\NASA_DirectSDLV\System\03_Earth\01_Moon.cfg
Config\NASA_DirectSDLV\System\03_Earth\01_Moon\Base\
Copernicus.cfg, Descartes.cfg, Fra_Mauro.cfg, Hadley.cfg, Marius_Hills.cfg,
Procellarum.cfg, Taurus_Littrow.cfg, Tranquillity.cfg (thanks to AMSO)

Meshes\NASA_DirectSDLV\Launchers\ET-2xRS68R.msh

Meshes\NASA_DirectSDLV\Launchers\SRB4_1.msh
Meshes\NASA_DirectSDLV\Launchers\SRB4_2.msh

Meshes\NASA_DirectSDLV\Launchers\PLF-Extras\ballast45t.msh
Meshes\NASA_DirectSDLV\Launchers\PLF-Extras\LES_1.msh

Meshes\NASA_DirectSDLV\Launchers\PLF-Extras\SLA_5.5_NASA_1.msh
Meshes\NASA_DirectSDLV\Launchers\PLF-Extras\SLA_5.5_NASA_2.msh

Meshes\NASA_DirectSDLV\Spacecraft\CEV_Franz\CEV-E-launch.msh

Meshes\NASA_DirectSDLV\Bases\03_Earth\00_Home\KSC\Direct_Pad39.msh
Meshes\NASA_DirectSDLV\Bases\03_Earth\00_Home\KSC\Direct_MLP01.msh
Meshes\NASA_DirectSDLV\Bases\03_Earth\00_Home\KSC\Direct_MLP01.msh

Meshes\NASA_DirectSDLV\Zahadum\zahadum.msh
Meshes\NASA_DirectSDLV\Zahadum\zahadum_1.msh
Meshes\NASA_DirectSDLV\Zahadum\zahadum_2.msh
Meshes\NASA_DirectSDLV\Zahadum\zahadumMach1_1.msh
Meshes\NASA_DirectSDLV\Zahadum\zahadumRS68_1.msh

Textures\Star.dds
Textures\Star_Orbiter20060929BACK.dds
Textures\Horizon.dds
Textures\Horizon_Orbiter20060929BACK.dds

Textures\NASA_DirectSDLV\contrail1w.dds
Textures\NASA_DirectSDLV\contrail2.dds
Textures\NASA_DirectSDLV\exhaust2_noalpha.dds
Textures\NASA_DirectSDLV\exhaust_crcs
Textures\NASA_DirectSDLV\exhaustMcWatsme.dds
Textures\NASA_DirectSDLV\exhaustMcWLOxLH2.dds

Textures\NASA_DirectSDLV\Launchers\ET_Direct_RS-68R.dds
Textures\NASA_DirectSDLV\Launchers\ET_Direct_IN.dds
Textures\NASA_DirectSDLV\Launchers\SRB4_rec0.dds
Textures\NASA_DirectSDLV\Launchers\SRB4_recL.dds
Textures\NASA_DirectSDLV\Launchers\SRB4_recR.dds
Textures\NASA_DirectSDLV\Launchers\SRB4_side.dds
Textures\NASA_DirectSDLV\Launchers\SRBbottom.dds
Textures\NASA_DirectSDLV\Launchers\SRBtopL.dds
Textures\NASA_DirectSDLV\Launchers\SRBtopR.dds
Textures\NASA_DirectSDLV\Launchers\SRBsmoke
Textures\NASA_DirectSDLV\Launchers\RS-68R.dds
Textures\NASA_DirectSDLV\Launchers\RS-68R_IN.dds

Textures\NASA_DirectSDLV\Launchers\PLF-Extras\LES.dds
Textures\NASA_DirectSDLV\Launchers\PLF-Extras\SLA_5.5_NASA.dds

Textures\NASA_DirectSDLV\Spacecraft\CEV_Franz\cev-decals.dds
Textures\NASA_DirectSDLV\Spacecraft\CEV_Franz\cev-hatch.dds
Textures\NASA_DirectSDLV\Spacecraft\CEV_Franz\cev-rad.dds
Textures\NASA_DirectSDLV\Spacecraft\CEV_Franz\cev-silver.dds
Textures\NASA_DirectSDLV\Spacecraft\CEV_Franz\cev-solar.dds

Textures\NASA_DirectSDLV\Bases\03_Earth\00_Home\KSC\Direct_Pad39_Ramp.dds
Textures\NASA_DirectSDLV\Bases\03_Earth\00_Home\KSC\Direct_MLP01.dds
Textures\NASA_DirectSDLV\Bases\03_Earth\00_Home\KSC\Direct_MLP02.dds

Sound\NASA_DirectSDLV\NASA_DirectSDLVsounds.txt
Sound\NASA_DirectSDLV\Direct_Countdown-20clv.wav
Sound\NASA_DirectSDLV\Direct_SRB124s.wav
Sound\NASA_DirectSDLV\Direct_SRBsep.wav
Sound\NASA_DirectSDLV\Direct_LESsep.wav
Sound\NASA_DirectSDLV\Direct_PLF.wav
Sound\NASA_DirectSDLV\Direct_RS-68Rin.wav
Sound\NASA_DirectSDLV\Direct_RS-68Rnosound.wav

Sound\NASA_DirectSDLV\Direct_Ascent00_GO.wav
Sound\NASA_DirectSDLV\Direct_Ascent01_Roll.wav
Sound\NASA_DirectSDLV\Direct_Ascent02_EngOK.wav
Sound\NASA_DirectSDLV\Direct_Ascent03_EngUp.wav
Sound\NASA_DirectSDLV\Direct_Ascent04_SRBVisors.wav
Sound\NASA_DirectSDLV\Direct_Ascent05_LESwow.wav
Sound\NASA_DirectSDLV\Direct_Ascent06_1.3G.wav
Sound\NASA_DirectSDLV\Direct_Ascent07_NegativeReturn.wav
Sound\NASA_DirectSDLV\Direct_Ascent08_AllNominal.wav
Sound\NASA_DirectSDLV\Direct_Ascent09_HorizonATO.wav
Sound\NASA_DirectSDLV\Direct_Ascent10_3GPressToMECO.wav
Sound\NASA_DirectSDLV\Direct_Ascent11_MECO.wav

3. Uninstalling

It should also be relatively easy to remove these files:

Step1 – Deleting DIRECT files…

Just search for all folders called **NASA_DirectSDLV** under your Orbiter sub-folders:

\Doc, \Config, \Config\Vessels, \Modules, \Meshes, \Textures, \Sound, \Scenarios, etc

See also \Config\Spacecraft\ for files with **[DSDLV]** designation.

In case of doubt, please have a look at the list of files available in the previous pages.

Step2 – Remember the **Overwrite Alert!**

Please see Step2 of the installation and check the information regarding…
\Textures\Horizon.dds
\Textures\Star.dds

Step3 – Removal of Required / Recommended or Included Addons

Vinka's Multistage and Spacecraft.dll: http://users.swing.be/vinka/

- The generic dll files included inside DIRECT addon's directory structure are removed if deleting Modules\NASA_DirectSDLV during Step1 above.

Note: not related with DIRECT addon but just in case you, for some reason, installed the full original packages / docs (from Vinka's site) and do not wish to keep them, please refer to that addon support site / docs / zip. Remember that many addons use those generic files in their default locations: you might want to keep them anyway.

Dansteph's Orbiter Sound: http://orbiter.dansteph.com

- ATTENTION: Are you sure that really want to remove Orbiter Sound!? Even if you uninstall DIRECT addon from your Orbiter folder I highly recommend that you keep Orbiter Sound for a much nicer simulation experience with the default spacecraft and other addons. If still wanting to uninstall Orbiter Sound, please refer to that addon support site / docs / zip / exe.

Franz Berner aka Francisdrake's ESAS CEV addon:
http://www.orbithangar.com/searchid.php?ID=1972
- Please refer to ESAS CEV's documentations / original zip but you might want to keep Franz addon installed, even if removing DIRECT files.

STEP4: Delete also:

\README_NASA_DirectSDLV_v0.1.htm
(in Orbiter's root folder)

4. The DIRECT Launcher Concept (v0.1): CLV

This version of the addon (v0.1) only includes one DIRECT Launcher variant: the **C**rew(ed) **L**aunch **V**ehicle ("phase II" = 2 x RS-68R = with regenerative nozzle). As can be seen from the first pages of the present document, the CLV uses the same ~8.4m diameter / ~56m length main core and the two 4 segment SRB of other DIRECT variants. The only differences are the presence of a specific design for the fairing / spacecraft adapter (SLA) and, of course, the **C**rew(ed) **E**xploration **V**ehicle and respective Launch Escape System (LES) at the top.

Inside the SLA there is a ballast container capable of carrying ~45t of water. The 22.6t demonstration CEV plus the 48.9t maximum mass of the ballast container result in a little more than ~70t, which is this launcher's (CLV) maximum payload to LEO.

In the case of CEV (or Orion, for a nicer name) launches - manned or unmanned - the amount of ballast could be adjusted depending of desired mission performance and/or accordingly with the mass of an additional payload that might (or not, it is just an option) be present below the CEV. By using similar launch vehicles for manned, unmanned and mixed missions, it would be possible to increase flight rate, reduce launch costs, build confidence in the hardware, use similar ascent profiles for certain injection conditions (given that the "payload" mass would be fixed for many DIRECT CLV variants either it would be all real payload or partially ballast)…DIRECT would provide one flexible launch system (re)using / adapting the best of STS design and respective facilities and also influences from EELV allowing, that way, an eventually smoother future upgrade path, if extra performance would be required.

In the next pages, the several components of DIRECT launcher (as well its variants, optional upgrade paths, mission profiles) will be presented in a better detail.

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4.1) 4 segment SRB (to be completed later)

4.1.1) Description
4.1.2) Thrust Curve

4.2) ET Derived Core (to be completed later)

4.2.1) Tank
4.2.2) Propulsion
4.2.3) Payload Integration

4.3) Interstage (to be completed later)

4.4) EDS and Upper Stage Options (to be completed later)

4.5) Launcher Variants and Examples of Payloads **(to be completed later)**

4.6) Performance Data (all units in SI)

DIRECT SDLV - CLV ("phase II")	
1st Stage	
Configuration	(2x) 4 segment SRB
Dimensions	45.72m /~3.7m diam.
Propellant Mass	501467.23Kg
Dry Mass	87604.11Kg
Total Mass	589071.34Kg
Max. Thrust	14818805.49 N
ISP	268s
Burn time (operational)	~124s (~128s until full burnout)
2nd Stage	
Configuration	2 x RS-68R
Dimensions	~55.5m / ~8.4m diam.
Propellants Mass	801116.86Kg
Dry Mass	62762.98Kg
Total Mass	863879.84Kg
Max. Thrust (vac)	~ 7323552.07 N 2 x **3661776.03 N**
ISP (vac)	435.4s
Burn time (@100% thrust / vac.)	~467.1s
Vehicle Performance	
Max Q	~33KPa 8.32Km, ~Mach1.16 MET=045s
SRB separation	~47Km to 50Km alt., Mach~3.94 MET=124s
LES separation	~85Km alt., Mach~8.75 MET=232s
MECO	MET=499s (ISS) (mission / payload type dependent)
Max Gs	~3.6g (4.0g max. allowed)
Payload 28.5 deg	**??t** , ??Km x ???Km alt. (not simulated / tested yet)
Payload 51.6 deg	**75.5t***, 70Km? x 400Km? alt. ("Real" Payload for CLV is **71.5 t***)

Extra performance / development data / sources are available inside: \Config\NASA_DirectSDLV\Launchers\(see INI)

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Global Comments:

a) These are +/-maximum performance numbers from Orbiter's current simulation development phase (v0.1)and when making ascent tests to ISS: they might slightly differ from the "official" DIRECT Launcher Proposal but, overall and despite some constraints / in a first order comparison, they are +/- coherent with it.

b) The included automatic guidance(s) is (are) not optimised yet. The residuals in the core (at MECO) are ~1% (0.5% minimum) of total propellants.

c) *The above 75.5t (51.6º) payload number for DIRECT CLV includes the SLA (4000Kg, which stays attached until MECO) + CEV (22643Kg) + Ballast Container (48900Kg). LES is 6000Kg. Higher mass payload numbers might be possible for lower apogee and/or ~28 degrees inc.

5. Flight Manual

5.1) Automatic Guidance and Ascent Modes

There are three different ways of launching Ares DIRECT SDLV (CLV, v0.1):
- Automatic mode
- Manual mode (!)
- Mixed mode

5.1.1) Automatic Mode

Attention! Attention! Attention! Attention! Attention! Attention! Attention! Attention!
Do NOT use time acceleration if activating the Automatic Mode!

Despite being activated with just a single press on the "**P**" key, the automatic launch procedure is, from a certain point of view, the most realistic of the three launch methods: the hard job is left to the computers in real life! Astronauts keep a close eye in the instruments / MFD and, except for a few *minor* button pressing, only take manual control if a serious anomaly arises during the ascent (and if such manual override is even possible, it would depend of the emergency type and phase of the ascent).

The file responsible for such automatic ascent has a .txt extension and is located inside **\NASA_DirectSDLV\Config\Launchers** with the same name of its respective scenario (in this case - v0.1 - the guidance file is called **mD010_CEV-E_ISS.txt**).

If opening that file, you will see that it is responsible for:
- engine throttling
- roll program / azimuth targeting
- pitch profile
- separation events (such as SRB, LES, spacecraft…)

I recommend people to use the automatic ascent program at least once: another side advantage of using the provided automatic guidance are custom DIRECT CLV sounds such as the final countdown, SRB… and a few other sounds that were taken from recent STS missions or created by me.

Custom sounds
These were implemented with the main objective of creating some flight ambience (cool sound factor is the equivalent to *eye-candy* in the graphics department): they do not pretend to be 100% realistic even because some of those sounds are about STS, which, despite many similarities, has a few obvious differences regarding DIRECT launcher configuration and ascent profile. This to say that there are things you will listen and that are clearly out of context: maybe I will do a little more of sound editing in a next version!

Computer Specifications / "Eye-Candy" and Impact on Guidance Behaviour
Please also have in mind that the results of the automatic guidance might vary depending of computer specification and, to be more specific, if during key moments of the ascent:
- having other programs running in the background,
- taking screenshots,
- changing between external / internal views,
- using external view with the camera pointing into the SRB smoke trail (using high resolution items or graphic card settings at their maximum might also impact)…

It might be natural that people with higher computer specs than my development PC (PIII@600Mhz, 384SDRAM, GeForce 5200FX 124MB RAM, Windows XP) might end up with different apogee / perigee than what I have here, in particular if following the entire launch in *internal view*.

One particularly sensitive phase happens when the automatic guidance is trying to *hunt* the intended launch azimuth, after starting the roll procedure: depending of the above constraints, that hunting and respective azimuth *lock* can take more or less time to accomplish having then an influence regarding the execution of the pitch program… For example, the pitch program might freeze until the azimuth is *locked* and, after that, the guidance will try to compensate by quickly changing to the pitch that should be happening at that given Mission Elapsed Time (MET). Another thing to remember is that, even not considering external interferences, the roll program is far from perfect: in v0.1 the DIRECT CLV, launched in automatic mode, will fly a trajectory not as depressed as it should be… (see notes about extra ascent modes).

The default camera modes available in the demonstration scenario have been conceived to at least try to minimize the interference of *eye-candy* items (such as the SRB smoke trail). If having problems with the launch azimuth *hunt + lock* I recommend that you do not pan the external camera position (for example, with the mouse, see Orbiter manual) at least until SRB separation (else, you can always try the ascent in manual / mixed mode, if the *autopilot* is not working well there or if you wish to make a better ascent!).

Still about the default external camera position: it has been properly placed for you to enjoy other *eye-candy* effects such as the RS-68R throttling up and down for maxQ, CLV going supersonic, sky getting darker with altitude, SRB separation motors…

Guidance Parameters
As you probably already concluded from the above talk, the provided automatic ascent is in a very early alpha state but it should (?) get people up into a suitable injection *orbit*. Such *orbit* should have the perigee below 90Km altitude (to make the core reenter and impact in one of our oceans, Indian or Pacific, again it might depend of guidance behaviour under a number of different operating conditions) but with a high enough apogee that CEV crew can then use as a starting point to raise perigee and fine tune ISS rendezvous (see scenario's description or ascent description for CEV keys plus read Orbiter manual to learn how to navigate in space).

Note: for v0.1 I will not provide instructions about how to select other launch azimuth or about how to edit other guidance parameters. This information is available in Vinka's multistage.dll documentation anyway, if you wish to research and play with it.
(please see \Doc\NASA_DirectSDLV\)

5.1.2) Manual Mode

Given that we are in virtual world, it is always a LOT more fun to ride a rocket or spacecraft in full manual mode, don't you think so? If you are an experienced Orbiter user or have some Flight / Astronautics / Physics background it should not be very hard to do a manual launch at the first try (and even have much better results than if using the alpha automatic guidance!). On the other hand, if being a new Orbiter user, maybe it would be best to have a look first at the full automatic mode.

To launch in manual mode is just a matter of pressing **Ctrl** and +: in this implementation (Vinka's generic dll), the two SRB will be ignited when the main engines reach 95% nominal thrust. Then, to control the launcher's attitude, use the numeric keyboard (again, please see Orbiter / Vinka's manuals); please also note that the pitch / yaw commands might be a bit slow in v0.1.

Attention! Attention! Attention! Attention! Attention! Attention! Attention! Attention!
Remember that without the automatic guidance, the user has to do everything!

Main Engines Throttling: in real world this is needed to control maxQ and g loads.

For this simulation and if launching in manual mode, you are free to not simulate / do not even worry about these aspects: the launcher will not be destroyed and the crew will always survive but… for a better realism and warm fuzzy feeling inside, you might want to replicate something like what is seen in the automatic mode :-)

Note: use **Ctrl** and **+** or **Ctrl** and **-** to throttle the main engines up and down (the SRB have their own built-in thrust curve). In theory you would use only two throttle settings for the main engines: max thrust and something between 54% to 60% of max. thrust.

Roll Program / Azimuth Target: now, this might be hard for less experienced users… On the other hand, you are now completely free to choose any launch heading allowed for KSC operations (and even beyond that, hehe).

Pitch Profile: reaching orbital injection conditions is a matter of converting vertical velocity into a given amount of horizontal velocity… This is why rocket trajectories are a kind of arc in the skies (switch to external view and zoom out when launching in automatic mode and while the SRB are still burning to see what I mean).

Different launch systems / different missions require different pitch programs… If wanting to simulate things in a more or less realistic way for DIRECT CLV v0.1 and while in manual mode, try to aim for 47Km to 50Km altitude and a pitch attitude (relative to horizon) of ~16 to ~20 degrees (or so) at MET=124s. From there, tune the pitch to achieve whatever injection conditions you wish and, at the same time, making sure your perigee stays below 90Km for a safe core disposal (look at Map MFD in order to control perigee at MECO = core's impact point… please make sure you do not impact the DIRECT CLV ET derived core into someone's head, ok?).

Separation Events:
There are three key events requiring user intervention if flying in manual mode…

MET / Alt	Event	Key
124s / 50Km	SRB separation	**J**
232s / 85Km	LES separation	**J**
MECO+	CEV separation	**J** then **F**
MECO++	CEV activation **(only if having ESAS CEV installed!)**	**J**

5.1.3) Mixed Mode

There is also the mixed mode: you are free to start in automatic mode (press **P**) and then kill the autopilot (press **P** again) and continue the flight in manual mode as long as remembering the following important rules:

a) Once the automatic guidance is turned off there is no way to turn it back on.

b) In the current simulation, the autopilot can't be turned off at any moment: the launcher should be in a stable attitude. Switching to manual mode while the guidance is busy with an intensive pitch / yaw / roll change will probably mean the end of the mission given that the launcher might start to tumble without control (it depends of MET)

Constant pitch phases where auto to manual transition can be safely achieved are:
MET=1s
MET=120s to 124s, 16 degrees pitch (previous to SRB separation)
MET=140s to 250s, 30 degrees pitch (LES is ejected during this phase)
MET=437s to 455s, 10 degrees pitch (when preparing MECO)

Note1: remember that the autopilot should only be started while at the pad!
Note2: there might be other phases of the ascent where should be possible to make an auto to manual transition, in particular if the launcher is making smooth attitude changes.

Mixed mode allows a bit more flexibility to the virtual astronaut, for example:

- If simulating an ISS mission some persons might wish to let the automatic guidance do the SRB part of the ascent and then take control after SRB separation…

- Others might prefer to wait for the *30 degrees* constant pitch phase, disengage the auto and try to simulate a probably unrealistic but interesting (in virtual reality) Return To Launch Site abort with the CEV by making something similar to the STS RTLS procedure: pointing the core back to KSC, keep it at a safe altitude, managing the return in order to make the core hit the Atlantic but making the capsule land near the coast… All this while operating in a *safe* flight envelope. It should be a possible simulation: I already tried and landed the CEV in the beach.

- Some others might prefer to wait for the *10 degrees* phase to fine tune injection / MECO conditions… I recommend that you at least use the *10 degrees* (or the last *8 degrees*) constant pitch phase to keep an eye in **Map** or **Orbit MFD** anyway, even if making a fully automated launch! You might need to switch to manual for MECO if, in your computer, seeing that the core's perigee will not end up in one of our Oceans and / or if the apogee is becoming much higher than the intended!

Attention! Attention! Attention! Attention! Attention! Attention! Attention! Attention!

Remember that the automatic guidance is also responsible for the final countdown, SRB and other sounds: some users might prefer to press **P** just to hear the countdown and then kill the autopilot (**P** again) as soon as the SRB ignite: this would also allow to at least have the (cool?) SRB sounds while still doing a 100% manual launch to any intended heading. As alternative, manual mode enthusiasts / advanced users might prefer to adapt the scenario and guidance file in order to just include the sound calls.

v0.1 is a **development version** of DIRECT SDLV Orbiter addon**:**
high possibility of missing, incomplete, incorrect info / pictures / components!

5.2) DIRECT SDLV - CLV: CEV Mission to ISS (v0.1)

In this section I will make a descriptive walkthrough about the main events for a nominal CEV mission to ISS with DIRECT CLV.

By attentively reading this description, the previous pages and also with the ascent table available next (perhaps you would like to print it and have at hand, when playing with DIRECT CLV v0.1) I believe that you will be more than ready to fly this rocket!

Note1: in a later version I might use Orbiter's replay feature and prepare a full ISS mission demo with a few on-screen comments (unless someone wishes to contribute such good quality replay first!)

Note2: when starting Orbiter for the first time, make sure you have all realism settings ON (see Parameters tab). Then go to the Scenarios tab, search for NASA_DirectSDLV, double-click to open the folder, click in the scenario to read its description, double-click to run it.

5.2.1) DIRECT CLV: launch to injection (CEV - ISS mission)

The **mD010_CEV-E_ISS** demo scenario starts with an external view of DIRECT CLV, almost ready to launch.

As previously noted, it is only needed to press **P** to start the automatic ascent program. But attention! The moment for liftoff will depend of the orbital plane alignment with the intended target, in this case, the ISS. When the scenario starts we are not quite in the best launch opportunity yet…

Launch Preparation

Press **F1** to go into internal view and check **Map MFD** (already selected at left) or select **Align MFD.** The ISS orbital path projection should be very near KSC.

Press **T** twice to time accelerate until… hummm… **20:07:00 UTC** (look at the top right corner) should be +/- ok (press **R** twice to return to normal time); once happy, press **P** to start the automatic launch. If having Orbiter Sound installed you will then listen some cool stuff! There will be a -20s countdown… Press **F1** again to return to external view and see the launch in all its glory ;-)

Roll Program and First Moments of the Ascent

After **clearing the tower**, the **roll and azimuth alignment** program will kick-in. You can watch the launch from the ground camera but the rocket will soon become a tiny spot in the sky. At about MET=012s you might wish to select a closer external view (press **F2**).

Note: depending of the already mentioned constraints, the guidance program will try to do its best to properly align the rocket into the intended launch heading (northeast direction in this case) but the roll program + azimuth alignment might be a little clumsy in the current v0.1 implementation. If that is the case there, please try to not change too much the default external camera (do not focus too much the SRB trail), at least not until the launch heading is locked and you feel that the pitch program is running ok (else the launcher will have some delay regarding the start of pitch program and that will impact in things like AOA, perigee / apogee, etc)

MaxQ

At some time of the ascent, the engines will be throttled down in anticipation of **maxQ** (you can change to internal view, select the **Surface MFD** and read there the dynamic pressure): more or less at about the same time you will also see the launcher going transonic (if going back to external view, you will see that I tried to implement something like we see in STS flights, even if not 100% correct).

Note: multiply by 20.8854 if wanting to convert maxQ value from KPa to psf. Exceeding safe maxQ values in this simulation does not have any structural impact in DIRECT CLV… maybe in a later version(?)

After maxQ, the core engines will be throttled up again and the pitch program will be a bit more "aggressive" in order to prepare the launcher for SRB separation attitude.

Note: please do not pay too much attention to AOA / SRB phase, etc… The guidance is really in an alpha state (and there are also a few limitations). Better results might be achieved in manual mode!

SRB Separation / 2nd Phase of the Ascent

SRB separation will happen at MET~124s / 47Km to 50Km altitude.

Note: separation dynamics are not simulated; after separation, the SRB are just dummy (inactive) 3D models and there is not a simulation of their recovery.

After SRB separation, DIRECT CLV will keep a constant pitch attitude of ~30 degrees: one of the several reasons why this happens is because this simple simulation has not functional TVC (Thrust Vector Control) for any of its components (it is all simulated by "fake" forces)… Perhaps the pitch program could be smoother with a few extra tweaks in the guidance, do not know (still researching)…

Anyway, it is in this "nose up" attitude that **LES separation** will happen at MET=232s and at about 85Km altitude.

Note: the LES is just a dummy 3D part (it is not functional) and its separation is automatic.

That "30 degrees constant pitch phase" is also a good time to turn off the autopilot if wanting to simulate a kind of flight challenge… hummm, RTLS procedure? (see comments about Mixed Mode in previous pages).

3rd Phase of the Ascent: building up speed and preparing MECO…

After that, it will be impossible to make a safe return to KSC: DIRECT CLV will start reducing its pitch and building up horizontal speed faster.

At a given moment, the g count will start to increase until a maximum of ~3.6g. The RS-68R will throttle down for the second and last time to compensate for such g build-up. The launcher will also tune its pitch attitude to achieve injection conditions (for an ISS mission you might want to go for ~70Km x ~300Km injection or lower, depending of your mission objectives, payload, etc)

Notes: several abort modes are not quite well implemented or even studied yet; sounds - from STS ascent - might be incoherent, etc. If wanting to have an easy reading of the G your virtual astronauts are experiencing, I recommend any of the available custom MFD addons for that effect such as kwan3217's Accelerometer (http://www.orbithangar.com/searchid.php?ID=2556) or Duncan's Reentry MFD (http://www.orbitermars.co.uk).

MECO and CEV Separation

A few seconds after MECO, the CEV will be automatically separated from the core.

WARNING! Remember that there is the need to "activate" CEV's systems!

In DIRECT addon v0.1, the included CEV you see is just the 3D model in launch configuration: you need to download and install **Franz Berner's ESAS CEV** addon (see installation notes) **if** wanting to have a fully functional CEV and continue with the mission! So, if you have installed ESAS CEV, press **J** after CEV separation to make the CEV become a functional spacecraft and fly it to ISS (see Orbiter Manual, inside \Doc folder, for global space navigation tips, MFD utilisation, etc)…

Note: Else, if you haven't installed ESAS CEV do **not** press J! (or you will have a nice CTD): in a later moment I might reduce this external addon requisite by including my own functional CEV (based in more recent conceptual designs) inside the package (in addition to provide scenarios for Franz's work) or, at least, by implementing a very basic custom configuration file for Franz's CEV or for my CEV (just with global mass properties, RCS, main engine, docking port but not with extended solar panels or capable of reentry).

CEV-E's Custom Control keys (or see Franz Berner's Addon Manual)

Key	Action	Description
C(1)	Deploy drogue chute	Command available if speed is below 1000m/s and the height is below 40Km.
C(2)	Deploy main chute	Command available after drogue chute has been deployed and the speed is below 120m/s. Note: if not triggered manually, the chute is auto-deployed 800m above ground.
E	Perform EVA	Creates an EVA-astronaut outside the hatch.
J	Jettison SM	Jettisons the Service Module.
S	Solar Panel	Deploys the solar panels (and high-gain antenna).

DIRECT CLV Ascent Table: available in the next page is a table that might be nice to have at hand while doing ascents in automatic / manual or mixed mode. All values available there are approximated: please look at it as a rough checklist. Also remember about the limitations of each ascent mode, in particular the tasks requiring user input if flying in manual mode or the correct phases of the ascent where it is more likely to happen a safe switch from automatic mode to manual mode.

v0.1 is a **development version** of DIRECT SDLV Orbiter addon**:**
high possibility of missing, incomplete, incorrect info / pictures / components!

5.2.2) DIRECT CLV: Ascent Table (CEV - ISS mission)

MET (s)	Event	Description	Altitude (km)	Speed (Mach)	g	Manual Mode! (switch)	const. pitch
	WAIT!	Wait for optimum launch window (into 042): **Map MFD** (SHIFT + M): ISS orb. path proj. above KSC **Align MFD** (SHIFT + A): Wait for node				F1 (int. view)	Automatic Guidance
- 020	AUTO	Start launch autopilot: press **P**				**P**	
- 006	MAIN	Main Engines Ignition				F1 (ext.view-pad)	
000	GO!	SRB Ignition: Liftoff!	0.00	0.00	0.00	**P = noAuto!**	
~08	ROLL	Roll Program / Azimuth Target (042)	0.35	0.20	1.30	F2 (ext. view)	Automatic Guidance
020	68D1	RS-68R throttled down	1.80	0.54	1.90	Ctrl and -	
039	Mach1	See transonic “eye-candy” effect ;-) (external view)	6.90	1.00	1.75		
045	MaxQ	Maximum Dynamic Pressure (Surface MFD: dynP ~33KPa)	8.32	1.16	1.69		
055	68U1	RS-68R throttled up to max. setting	12.64	1.48	1.77	Ctrl and +	
120						**P=noAuto!**	16º
124	SRB!	SRB separation	50.00	3.94	1.96	**J**	
140						**P=noAuto!**	30º
232	LES!	Launch Escape System Jettison	85.00	8.75	1.17	**J**	
250						**P=noAuto!**	
273	NRET	Negative Return	90.00	11.20	1.55		Auto Guidance
394	ATO	Abort to Orbit*	98.00	18.55	2.10		
435	PMECO	Press to MECO	98.20	22.23	3.45		
437						**P=noAuto!**	10º
445	68D2	RS-68R throttle down (G control / pre-MECO)	98.15	23.76	2.6	Ctrl and -	
455						**P=noAuto!**	
500	MECO	Main Engines Cut-Off	101.00	26.40	3.0	*	
514	CEV	Separation **Functional CEV** **(only if having CEV-E addon)**	114.00		0.01	**J** then **F** **J**	

6. DIRECT Sol System: KSC, Earth's Atm, Moon, the Sun…

6.1) Custom Solar System

DIRECT addon uses a custom Solar System configuration, which, for the moment, is different from Orbiter's default system in the following aspects:

- Earh's KSC default launch pads 39-A/B have been replaced by custom work
- Moon has the Apollo landing sites defined as ground bases
(locations *borrowed* from AMSO addon)

Note: to load DIRECT's System configuration the following system line must be present in the **Environment** definition of the distributed scenario file(s) or in any other newly created scenario:

```
BEGIN_ENVIRONMENT
  System NASA_DirectSDLV\System\Sol
  Date MJD 56522.8282205092
END_ENVIRONMENT
```

6.2) DIRECT SDLV pad designs assume that:

- the STS Rotating Service Structure would be removed
- the STS Fixed Service Structure would be adapted for DIRECT operations
- the lightning protection would be removed from the fixed tower and, instead, 3 or 4 lightning protection towers would be placed around the pad (like in Atlas, Ariane pads, etc)
- the Mobile Launch Platforms would be slightly modified and have an Umbilical Tower

(for more details / images please read DIRECT proposal / site)

Observation: as everything distributed in v0.1, the 3D models and textures of the launch pad, MLP (and rocket components, etc) are in a alpha state: this means that the current models have bugs, are non-optimised work or even aren't in complete agreement with DIRECT proposal contents (example: v0.1 pads are incomplete work based in a previous design iteration). In a later version the fixed service tower and umbilical tower will have extra details (such as service arms, crew egress / ingress arm, emergency system, animations, etc).

Note1: The included pad39A and 39B have 2 observer cameras (press **CTRL+ F1 + Ground** to select + see bottom menu; use **target lock** having as target the launcher in one of the pads).

Note2: There are 2 DIRECT pad definitions that can be used in the scenario files:

BASE Cape Canaveral:11 **= 39A**
BASE Cape Canaveral:12 **= 39B**

Note3: The MLP+UT are currently implemented in the scenario(s) as non-selectable "vessels" (unless using the scenario editor): this allows for an easy visual preparation of launch scenarios with the addition / removal of MLP+UT from the pads (using Orbiter's scenario editor or notepad). In the DIRECT CLV v0.1 scenario, MLP1 is assigned to pad 39A, MLP2 to pad 39B:

```
MLP1:NASA_DirectSDLV\System\03_Earth\Base\Facilities\Direct_MLP01
  STATUS Landed Earth
  POS -80.6070050 28.6011520
  HEADING 182.01
END
MLP2:NASA_DirectSDLV\System\03_Earth\Base\Facilities\Direct_MLP02
  STATUS Landed Earth
  POS -80.6235900 28.6195960
  HEADING 182.01
END
```

6.3) Atmospheric Effect + Sun

To end this chapter, as written in the install notes, DIRECT addon v0.1 comes with my own versions for:
· - Earth's horizon (texture and colour)
· - Sun (texture)

These are also work in progress. The starting point for the tweaks, in particular for the atmospheric tweak, was not a 100% realistic concern but, instead, to have something more visually appealing, both when flying at lower altitudes and in Earth's orbit and when comparing with Orbiter's default textures / settings.

The sub-orbital altitudes "requirement" appears because, each time more, Orbiter is having very nice airplanes to play with and I would like to have a better effect for when piloting one of those high altitude WB-57 and while taking virtual photos of an automatic DIRECT launch ;-)

Note: you can grab C3PO's WB-57 at…
http://www.orbithangar.com/searchid.php?ID=1314

Regarding higher / orbital altitudes, I wanted to simulate a bit of that light saturation effect we see in some Mig-25 "Edge of Space" images or in those cameras that ride in STS / other launch systems.

Last but not least, I just wanted to give a bit more blue to our planet's atmosphere: it looks great for LEO screenshots and, despite Orbiter seems to use the same .dds for other planets, it does not look too bad on them either.

Summing up all: just implemented my custom horizon.dds (+star.dds) texture thinking more in the *eye-candy* effect for a wide range of altitudes over concerning if was being realistic or not: like in many other aspects of this addon, I'm trying to balance all in order to produce something that is fun to play with for several and very different user profiles ;-)

7. Legal Stuff, Credits, Thanks and Feedback

7.1) First, about my work (António Maia) and legal "stuff"

Except for the cases that will be referenced in the next page (7.2) or for cases of unintentional mistake or forgotten credits **I'm the author of all contents included in this document's file list.**

Making a few generic comments and sometimes being more specific about the 3D models (DIRECT launcher, pads, etc: original files are in .an8 format (anim8or)): they are not a masterpiece of art but I would like to write some "terms of use":

- People do not need to contact or give me credit when uploading screenshots of these models / addon to public web spaces or forums unless those images are intensively and recursively used for a presentation, multimedia production or any other project. On such cases please let me know about that project and give at least the following credit (or any other credit to the respective authors)

  António Maia (http://simcosmos.planetaclix.pt)
  (as alternative, a link to www.directlauncher.com would also be fine)

- The contents of this package must remain together. Unless for private use or other special occasions (where I should be informed and agree about) people are not allowed to change and / or extract parts of this package and redistribute that derived work without my previous permission. For parts that are not from me, please contact the respective authors and / or read their documentation.

- To be explicit: from my side, it's OK to redistribute this zip package (in compressed state) as long as the original zip name, folder structure and all contents are kept exactly the same as I prepared them. However, have in mind that I only commit myself to quickly support the non-dev marked package versions (the current one is a dev marked zip btw) of the specific Orbiter version they were made for (read: current Orbiter version, in this case 20060929) and that, except for special occasions, only support the packages that I personally uploaded to public distribution places.

In all cases, do not claim to be the author and please give the proper credits (or make them visible, point to them in some way). If having any doubt regarding the above, just contact me (simcosmos@clix.pt) **or the respective authors.**

Other very important notes:

About these files: do not make money with them!

And, the usual:
Use all these files at your own risk!
I'm not liable for any bad stuff that happens!
(CTD, data loss, health problems, if your cat is sad and never stops those long miauuuus, the end of the world, and so on, and so on…)

7.2) Other Credits

This is where I try to sum up the credits for all the included components that were not fully made by me (António Maia aka simcosmos). If seeing any incorrect information or if you feel there is a missing credit please email so that it can be solved as soon as possible. Thanks!

Components	Author and/or Origin and/or + Info
Modules\NASA_DirectSDLV\Stage.dll Modules\NASA_DirectSDLV\multistage01.dll (+ 02.dll) Modules\NASA_DirectSDLV\spacecraft01.dll (+ 02.dll +03.dll) Doc\NASA_DirectSDLV\VINKA_multistage02_050721.pdf Doc\NASA_DirectSDLV\VINKA_spacecraft03_060302.pdf	**Vinka**'s generic DLL (thanks also for 3ds2msh) http://users.swing.be/vinka/
Tip for SRB particle settings: http://www.orbitersim.com/Forum/default.aspx?g=posts&t=3978 (20050802)	**Randolph Vallee** (aka **Lambo**)
DIRECT's core main engine exhaust textures: Textures\NASA_DirectSDLV\exhaustMcWatsme.dds Textures\NASA_DirectSDLV\exhaustMcWLOxLH2.dds----------	Original textures by: **McWgogs** Note: original textures were further compressed Note: added a little more white bright to the center
CEV-E + textures: Meshes\NASA_DirectSDLV\Spacecraft\CEV_Franz\CEV-E-launch.msh Textures\NASA_DirectSDLV\Spacecraft\CEV_Franz\cev-decals.dds Textures\NASA_DirectSDLV\Spacecraft\CEV_Franz\cev-hatch.dds Textures\NASA_DirectSDLV\Spacecraft\CEV_Franz\cev-rad.dds Textures\NASA_DirectSDLV\Spacecraft\CEV_Franz\cev-silver.dds Textures\NASA_DirectSDLV\Spacecraft\CEV_Franz\cev-solar.dds Textures\NASA_DirectSDLV\exhaust_crcs.dds	**Franz Berner** (aka **Francisdrake**) http://francisdrake.freewebspace4all.de/
Textures\NASA_DirectSDLV\contrail1w.dds ---------- Textures\NASA_DirectSDLV\contrail2.dds ---------- Textures\NASA_DirectSDLV\exhaust2_noalpha.dds ---------- Textures\Star_Orbiter20060929BACK.dds---------- Textures\Horizon_Orbiter20060929BACK.dds---------- Config\NASA_DirectSDLV\System\03_Earth\Base\----------	**Orbiter's default / modified files:** contrail1 with small tweak contrail2 (included to avoid other addon's overwrite) exhaust2 but with no alpha included for backup (see install notes) included for backup (see install notes) Earth bases, same as default (at least for now) except for Cape Canaveral
Textures\NASA_DirectSDLV\Launchers\SRBsmoke Textures\NASA_DirectSDLV\Bases\03_Earth\00_Home\KSC\ Direct_Pad39_Ramp.dds, Direct_MLP01.dds, Direct_MLP02.dds Textures\Star.dds Textures\Horizon.dds (…) Sound\NASA_DirectSDLV\NASA_DirectSDLVsounds.txt (see txt for credits)	Images / Sounds produced from STS / Apollo multimedia (wip): **www.nasa.gov**
Thanks for Apollo landing locations "borrowed" from the nice **AMSO** addon: Config\NASA_DirectSDLV\System\03_Earth\01_Moon\Base\ Copernicus.cfg, Descartes.cfg, Fra_Mauro.cfg, Hadley.cfg, Marius_Hills.cfg, Procellarum.cfg, Taurus_Littrow.cfg, Tranquillity.cfg	**Alain Capt** (aka **ACSoft**) http://www.acsoft.ch/AMSO/amso.html
DIRECT Proposal **www.directlauncher.com**	**Ross B. Tierney** (+thanks to input / feedback from many others)

- alpha doc - high probability of missing, incorrect or not final info/pictures - alpha doc -

7.3) Extra Credits and Thanks

Beyond all mentions made in the previous page I would also like to thank:

Dr. Martin Schweiger (and all collaborators)
Orbiter, Orbiter, Orbiter, Orbiter, Orbiter, Orbiter, Orbiter ;-D
http://www.medphys.ucl.ac.uk/~martins/orbit/orbit.html

Read 10Oct2006, 16Sep2004 news to learn about
Orbiter capabilities as a Spacecraft Visualization Tool:
http://orbit.medphys.ucl.ac.uk/news.html

Daniel Polli aka Dansteph for Orbiter Sound
http://orbiter.dansteph.com

R. Steven Glanville
anim8or, not the heaviest 3D editor around…
…and that is why I just love it!
http://www.anim8or.com

Martin Wright
DXTBmp, cool to convert .dds
http://www.mnwright.btinternet.co.uk

Chris Bergin from http://nasaspaceflight.com for such interesting site / forum contents as well to all collaborating / participating there. Thanks also to the **Orbiter Community** in general.

6.4) Feedback (and future plans / work in progress)

If wanting to provide feedback about DIRECT proposal, please contact Ross. If wishing to give feedback about the addon please contact me. For work in progress you might want to check my site's LivePics page or flickr space, from time to time (urls + emails in this document's front page). There are also a number of DIRECT SDLV related forum threads that you might wish to read or use to provide extra feedback (some might be "old" threads, there are also many other DIRECT launcher references in Internet):

DIRECT SDLV Addon v0.1 released!
http:/ / tobewrittenlater or see addon's description in download / DIRECT site

DIRECT SDLV v0.1+ Addon: Support and Development
http:/ / tobewrittenlater or see addon's description in download / DIRECT site

DIRECT Goes Live! (nasaspaceflight forum)
http://forum.nasaspaceflight.com/forums/thread-view.asp?tid=5016&start=1

Nuclear propulsion systems for DIRECT (nasaspaceflight forum)
http://forum.nasaspaceflight.com/forums/thread-view.asp?tid=5627&start=1

DIRECT Alternative (nasaspaceflight forum – past discussion)
http://forum.nasaspaceflight.com/forums/thread-view.asp?tid=4106&start=1

DIRECT Pad Designs (nasaspaceflight forum – past discussion)
http://forum.nasaspaceflight.com/forums/thread-view.asp?tid=4476&start=1

- Boring Appendix: Payload Guide and Customisation Tips -

- alpha doc - high probability of missing, incorrect or not final info/pictures - alpha doc -

Dear reader, if you are new to Orbiter space simulator or if it's the first time you wish to add your own payloads I highly recommend a good, calm and very attentive reading at Vinka's great generic dll documentation available in DIRECT Doc folder or here: http://users.swing.be/vinka/

The process of adding a payload might be simplified in later addon versions (better documentation, eventual interested coders, etc)

But this still might take quite a while to prepare, mostly due to my fault (other ongoing real and virtual life projects…). Meanwhile here go a few tips!

There are 3 types of "vessels" for Orbiter simulator, powered by different "technologies"

- **CFG** vessels
- **Spacecraft generic DLL** based vessels
- **custom DLL** vessels

CFG vessels have all their physical parameters (3D model reference, empty and fuel masses, thrust, cross sections, principal moments of inertia, etc) defined in a simple text file - having **.cfg** as extension - located under \Config or \Config\Vessels (or other places). This is the simplest method of having something in Orbiter but it has limitations such as: not possible to define more advanced physical parameters, animations…

Custom DLL vessels use, as the name implies, a **dll** with all their properties inside (dll called by a very simple cfg). On these cases, the limits of what can be implemented in a given vessel are only imposed by the Orbiter version capabilities and the imagination of the author but… this requires programming skills (c++)… If you do not know what is a compiler or what sdk means then please advance to…

To end, the best of the two worlds: the **spacecraft generic dlls**! These are dll that can be used for a lot of different vessel implementations and that interpret the physical properties from simple text files, this time with an **.ini** extension. People do not need to code c++ but can easily add advanced features to their vessels (such as virtual cockpits, animations, particle effects, custom exhaust textures, advanced physical properties, remote arms, etc) as long as they are supported by the generic dll.

(rest will be completed / adapted from other virtual project in a later occasion)

A) Creating a launcher configuration with custom payload

A.1) About Custom Fairings

A.2) Custom Payloads

B) Guidance File

C) Last Step: the launch scenario