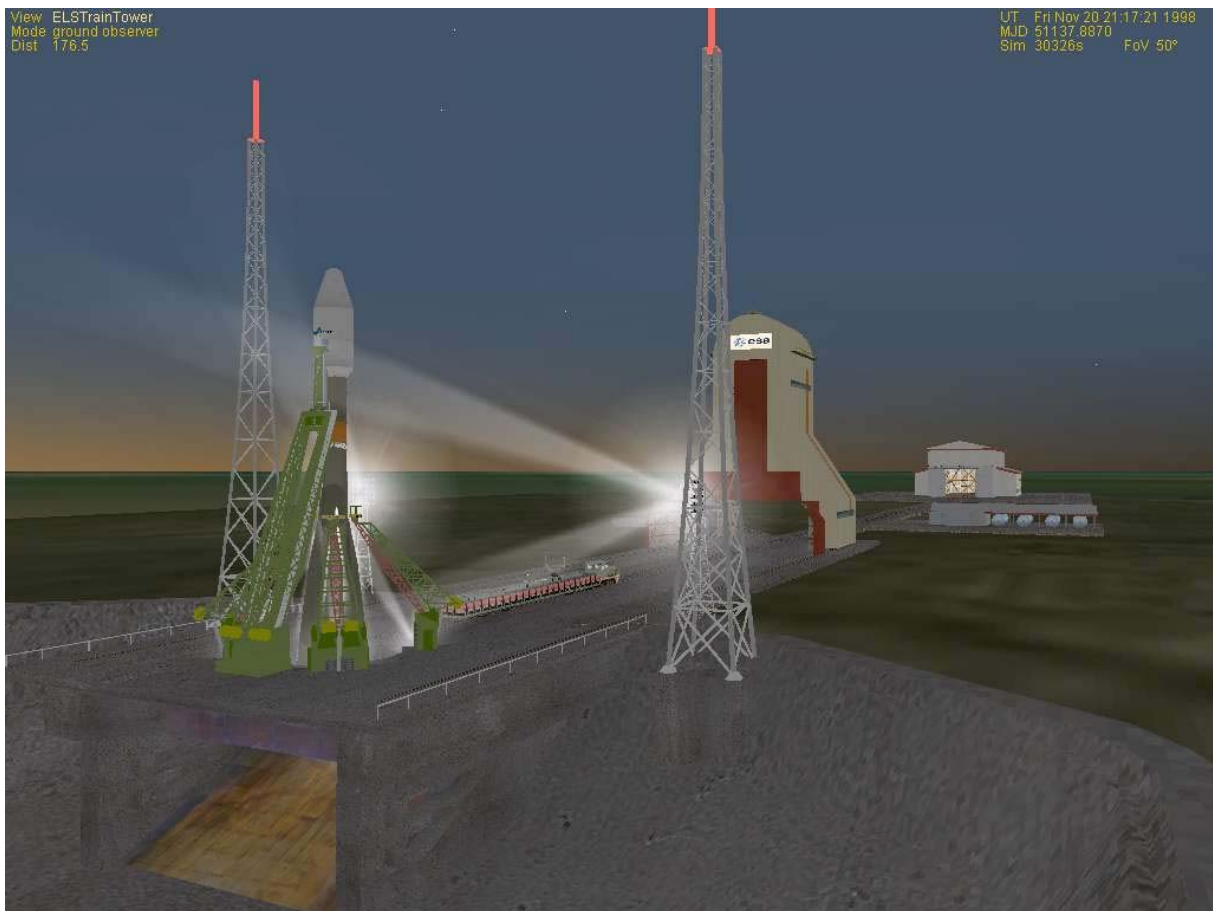


KOUROU – ELS

By Papyref
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PRESENTATION

The site Soyuz (ELS) located in Guyana is similar to those existing in Baïkonour and Plessetsk. Contrary to what is done in Russia, the payloads will be installed on the launcher in vertical position what justifies the presence of a mobile tower of assembly and a simplification of the launch table which includes only the umbilical points and the 4 arms of maintenance.

The Soyuz ELS is about 20 kilometers north-west from the pads dedicated to ARIANE and it extends on 120 hectares.

Work began in December 2005 and should be completed at the end of 2008

The rockets launched on this pad will be derived from basic Soyuz in version Soyuz 2-1a and 2-1b. They will have a larger fairing and a numerical control system making it possible not to use a rotating launch table to adjust the heading of launching.

They will receive the load in vertical position.

Pad ELS represented in this add-on was inspired from some models and sights of artists and photographs of the beginning of the earthwork and if it does not represent exact reality it must be close to.

It makes it possible to use a train to transport Soyuz and raise it on the pad.

ACKNOWLEDGMENTS

I thank particularly:

Mustard and No Matter for Soyuz pack and the elements of the launch table which I re-used Momo for the Pirs+Progress module

Vinka for Spacecraft and Multistage

Brian Jones who with carried out the dll for arms animations, the lights and the Vox

Martin Schweiger for Orbiter without nothing would be possible

Jacquemomo for the pad texture integrated with his Kourou texture tiles

And all those which I could have forgotten.

I hope that you will appreciate their work as much as mine!

INSTALLATION

Unzip Kourou-ELS pack in Orbiter folder to install

CAUTION

Check that the last issues of Spacecraft 3 and Multistage 2 of Vinka are installed in your file (see site <http://users.swing.be/vinka/>)

The joined scenarios use

- some Soyuz which are in the pack of Mustard**
- the satellites Metop and Corot by Papyref**
- The module Pirs+Progress by Momo**

You must load these elements on the site <http://www.orbiterfrancophone.com/> and to install them

ANIMATIONS

A - For the train and the tower

Select ELS TrainTower by opening the choice table with F3



Caution – Don't have the numeric key lock on the numeric pad

The possible orders are as follows (use the left Shift)

Orders for the tower:

- **K and CTRL+K to advance and move back the tower (3)**
A support on K stops the move which can be started again by a new request
- **G to open/close the lower doors (1)** allowing the passage of the train
- **Shift+ 1 to open the higher doors (2)** for payload installation
Caution, this order functions only if the ordering of the train is not activated (see below)

Orders for the train:

It is ordered as a robotic arm with the keys of the numeric keypad associated with the Shift key.

Activate / deactivate the train control by Ctrl + Spacebar

Caution !

Untick "Display a T-time counter at launch during 300s" in SoundConfig.exe
If it is not done there is a conflict of display and the train cannot be ordered.

- **Shift + 4 (or 6) allow to cycle in the orders for train:**
Move train (4) → Raise/Lower launcher (5) → Release launcher (6)
Release launcher simulates only the opening of the jaws and the fall of the back cables but does not release the rocket of the support
- **Shift + 8 (or 2) allow to carry out the movements for the selected order**
Release the Shift key **before** the numerical key 8 or 2 and the movement continues. It can be stopped by remaking an order
- **Shift + 0 (zero) allow to release the launcher of the support of the train once that it is raised on pad**
One can control if the launcher is well released by making Shift + Q which display the state of the point of fixing (Free or Soyuz)

Notes:

The train can be moved until the MIK (building of assembly)
With key 8 the train advances, with key 2 it moves back.

By reason of Spacecraft limitations, the operations are not locked between them. It is not advised to make Shift + 0 for example when the train is elsewhere than finally on the pad.
In the same way it is to better think of opening the lower doors of the tower before to move the train.

B - For the arms



ELS has two umbilical arms and four maintain arms and it is not rotating
The launchers for ELS have a new system of numerical guidance which makes it possible to launch towards the desired final heading with 0 initial heading

The sequence in opening which lasts 15 s until the departure of Soyuz is as follows:

- H-15: Opening in 6 seconds of the large umbilical arm (1)
- H - 9: Opening in 6 seconds of the small umbilical arm (2)
- H - 3: Opening in 3 seconds of the 4 arms (3)

In closing the operations are in the opposite order

If the launcher is raised on the pad, using the train, the umbilicals and the arms are set up and they will open automatically with launching.

Manually move for arms and umbilicals are allowed **before the installation of the rocket**

- **Select ELS arms by opening the choice table by F3**
- **Key G for open/close of the arms**
- **Key K for open/close of the umbilicals**

C – For the lighting and the Vox

- **Lighting of the pad** are done automatically with fallen the day
- **Vox:** Vox appears as soon as the rocket is raised and released from the train by Ctrl + Space

A complete fictitious sequence of launching could be done on the basis of Soyuz on the train in the MIK (building assembly) and arms and umbilicals opened:

- Select ELSTrainTower by F3
- Key G to open the lower doors of the tower
- Ctrl+Spacebar to take the control of the train and to bring it until the pad
- Raise the train support of the launcher and to detach it, the arms are set up automatically.
- Release the rocket of the support by Ctrl + 0 (zero).
- Lower the support and then move the train where do you want
- Open the higher doors of the tower and move it to cap the launcher and to close again the doors to simulate the installation of the satellite.
- Open the doors to prepare launching and to withdraw the tower
- Select Soyuz by F3 and press key P to start automatic launching

To be able to easily move the observation point between the tower, the train, the MIK and the pad it is useful to be placed in Ground mode with Ctrl + F1 and to untick the option Target lock

SCENARIOS

Three types of scenarios are envisaged according to the taste:

Soyuz with ice the body appears frosted what occurs after filling.

Soyuz No ice the body is normal

Soyuz with traintower the tower and the train are used

The first two types are identical except for the aspect of Soyuz.

The basic scenarios are:

- **Soyuz-FG-Progress-Pirs (LEO).scn**
The objective is to place Progress in low orbit in a plan close to that of ISS
- **Soyuz-STK (LEO).scn**
The objective is to place Sat1 in low orbit LEO
- **Soyuz-STK (Metop).scn**
The objective is to place Metop in heliosynchronous polar orbit (altitude = 817 km equatorial Inc = 98,70° in retrograde orbit)
- **Soyuz-STK(Corot).scn**
The objective is to place Corot in a nearly heliosynchronous polar orbit (altitude = 896 km equatorial Inc = 0°)
- **Soyuz-STK-Fregat (MEO).scn**
The objective is to place Sat1 in a medium orbit MEO (ApA<450 km)
- **Soyuz-STK-Fregat(Corot).scn**
The objective is to place Corot in equatorial geostationary orbit at a ApA altitude = 35769 km.

In addition to these scenarios, 6 scenarios show the possibilities using the tower and the train for launch at day or night

Significant remarks

These launchings don't correspond to reality since the launching pad is not yet in service (Corot for example is not in GTO or Progress will never be launched since ELS) but they are imagined to enable you to test the site and the capacities of the launcher.

Each scenario includes an autopilot adapted to the load carried to reach an orbit making possible to manually finish launching to reach the fixed orbit (altitude, alignment of plans, circularization...)

When motors stops, push key [P] after few seconds to disengage the autopilot

You can achieve orbit using fuel remaining of the last stage and then that of **the load which is released while pressing on the key [J]**

It is preferable to avoid accelerating time during the automatic phase of launching

For use of another load , it is often necessary to rewrite the autopilot while being helped of the provided examples and the documentation of Multistage.

HOW TO CHANGE LAUNCHER AND PAYLOAD ?

To change launcher

A scenario includes 2 essential parts as in example below

BEGIN_DESC

Launch Progress to reach an lower orbit in a plane near ISS plane

>Press [P] for auto-pilot launch at T-28

END_DESC

BEGIN_ENVIRONMENT

System Sol

Date MJD 51138.4579425162

END_ENVIRONMENT

BEGIN_FOCUS

Ship Soyuz

END_FOCUS

BEGIN_CAMERA

TARGET Soyuz

MODE Extern

POS 4.00 -1.00 -94.82

TRACKMODE Ground Earth

GROUNDLOCATION -52.68953 5.16680 46.76

FOV 50.00

END_CAMERA

BEGIN_HUD

TYPE Surface

END_HUD

BEGIN_MFD Left

TYPE Orbit

PROJ Ship

FRAME Equator

ALT

REF Earth

END_MFD

BEGIN_MFD Right

```

TYPE Map
REF Earth
OTARGET ISS
TRACK ON
END_MFD

BEGIN_SHIPS
ELSarms:ELSarms
  STATUS Landed Earth
  POS -52.6899520 5.1675740
  HEADING 0.00
  PRPLEVEL 0:1.000
  THLEVEL 0:1.000 1:1.000 2:1.000 3:1.000 4:1.000 5:1.000 6:1.000
  NAVFREQ 0 0
  ARMS 0 0.0000
  UMB 0 0.0000
END
ELSTrainTower:Spacecraft/Spacecraft3
  STATUS Landed Earth
  POS -52.6899560 5.1683360
  HEADING 0.00
  NAVFREQ 0 0
  RCS 1
  CTRL_SURFACE 1
  CONFIGURATION 1
  CURRENT_PAYLOAD 0
  SEQ 0 -2 0.000000
  SEQ 1 2 1.000000
  SEQ 2 -2 0.000000
  SEQ 3 -2 0.682075
  SEQ 4 -2 0.000000
  SEQ 5 2 1.000000
  SEQ 6 -2 1.000000END
Soyuz:ELS_Soyuz\Soyuz_prgpirs ; name of cfg file
  STATUS Landed Earth
  POS -52.6899506 5.1675841
  HEADING 0.00
  ATTACHED 0:0,ELSarms
  PRPLEVEL 0:1.000 1:1.000 2:1.000
  NAVFREQ 0 0
  CONFIG_FILE Config\ELS_Soyuz\Soyuz_prgpirs.ini ;name of ini file
  GUIDANCE_FILE Config\ELS_Soyuz\ottoProgress.txt ;name of guidance file
  CONFIGURATION 0
  STAGE_STATE 2
  STAGE_IGNITION_TIME 0.000
  CURRENT_BOOSTER 1
  CURRENT_STAGE 1
  CURRENT_INTERSTAGE 1
  CURRENT_PAYLOAD 1
  FAIRING 1
END
ISS:ProjectAlpha_ISS
-----
END
END_SHIPS

BEGIN_ExtMFD
END

```

In blue all that defines the general elements of display: point of view, view of the MFD, object selected by F3...

In red all elements of the type vessels (Ships) taking part in the scenario.

Here one finds four of them:

- **ELSarms** who characterizes the arms and umbilical points and who must be imperatively present in each scenario
-
- **ELStraintower** who characterizes the tower and the train and who must be imperatively present in each scenario

The elements

SEQ 0 -2 0.000000

```
SEQ 1 2 1.000000
SEQ 2 -2 0.000000
SEQ 3 -2 0.682075
SEQ 4 -2 0.000000
SEQ 5 2 1.000000
SEQ 6 -2 1.000000
```

give the state of sequences in the scenario compared to their position of origin defined in the file ELSTrainTower.ini.du Spacecraft file

These datas correspond so that one obtains when the objects are moved and that the scenario is recorded.

There is normally no reason to modify them it is enough to make a safeguard after having carried out a configuration.

- **Soyuz:ELS_Soyuz< name of the launcher >** which defines which launcher is used in the scenario.
< name of the launcher > is the name of the cfg file which is affected for him

I have separated the cfg and ini files for launchers used in a ELS_Soyuz folder from those of Mustard pack because there are small difference due to specificities of ELS site.

The first 5 lines define the position and the state of the launcher:

- If at the beginning it is attached to the arm

```
Soyuz:ELS_Soyuz\Soyuz_prgpirs ;name of launcher
STATUS Landed Earth
POS -52.6899506 5.1675841
HEADING 0.00
ATTACHED 0:0,ELSarms
```

' If at the beginning it is attached to the train

```
Soyuz:ELS_Soyuz\Soyuz_prgpirs ; name of launcher
STATUS Landed Earth
POS 0.0000000 0.0000000
HEADING 0.00
ATTACHED 0:0,ELSTrainTower
```

To change launcher, it is enough to modify the noun and to place in the ELS_Soyuz file of the Config file the corresponding cfg and ini files.

The cfg file must be copied directly on any example and name simply changed

Two other lines also should be modified:

```
CONFIG_FILE Config\ELS_Soyuz\Soyuz_prgpirs.ini ;name of ini file
GUIDANCE_FILE Config\ELS_Soyuz\ottoProgress.txt ;name of guidance file
```

If an existing autopilot is used, it is enough to quote its name which can be different from that of the launcher

- **ISS:ProjectAlpha_ISS** to be able to use ISS in the scenario. It is an optional element which depends on what you wants to make. There can be others of them.

To modify the Payload

The payload is named in the ini file of launcher used. It is possible to have several payloads if the weight and the size allow it.

For example for ELS_Soyuz\Soyuz_prgpirs.ini file:

```
[PAYLOAD_1]
off=(0.,0.,24.6)
MeshName="pirsprogress"
name="progresspirs"
Module="progresspirs"
Diameter=3
Height=1.5
Mass=7200
speed=(0,0,1)
Render=1
```

The line `off=(0., 0., 24.6)` allow to position the load under the cap.

It is the third number (here 24.6) which makes it possible to place it ahead or behind. Larger one advances, smaller one moves back.
If there is a load which overflows a little the cap, it should be written Render=0 so that it is not seen as much as the cap is not released.

The lines

```
MeshName="pirsprogress"
name="progressspirs"
Module="progressspirs"
```

define the load with meshname, name and the path for ini or DLL module

The line

```
Mass=7200
```

give the mass of the load in kg. You can modify it to only see which is the influence of the weight of the load on a launching.

As an indication, maximum loadings of Soyuz for launchings are :

```
LEO (low orbit): 9 tonnes
MEO (medium orbit <450km): 4.9t
MEO with Fregat: 5.5t
GTO: 2.7t (geosynchronous transfer orbit 200 x 35789 km)
GEO: 1.4t (geostationary equatorial orbit 35789 km)
SSO: 4.35t (heliosynchronous orbit between 800 et 900 km)
```

Autopilot

It is possible to modify it or to create new

It is described in the file txt called by GUIDANCE _ FILE config such as for example

GUIDANCE_FILE Config\ELS_Soyuz\ottoProgress.txt

```
-20=engine(0,0.00001,0.01) ;for Umbilicals animation
-19=PlaySound(Sound\ELS\Countdown.wav) ;countdown
-13.99=engine(0.00001,0,0.01)
-13.98=engine(0,0,1)
-5=PlaySound(Sound\NM-soyuz\02soyuz_launch.wav)
0=engine(0,100,14)
10=roll(2,90,36,86,1)
15=engine(81,100,150)
24=pitch(86,85,5)
29=pitch(85,80,15)
42=PlaySound(Sound\Vessel\01soyuz_launch.wav)
44=pitch(80,70,15)
59=pitch(70,60,15)
74=pitch(60,50,15)
89=pitch(50,40,15)
104=pitch(40,30,15)
119=pitch(30,20,15)
134=pitch(20,17.5,110)
160=fairing()
244=pitch(17.5,15,50)
294=pitch(15,21,80)
374=pitch(21,14,60)
434=pitch(14,10,16)
450=pitch(10,5,40)
490=pitch(5,-15,42)
532=pitch(-15,0,10)
534=engine(100,0,6)
540=engine(0,0,8)
542=pitch(0,0,20)
5000=roll(0,0,0,0,-1)
```

The blue lines are imperatively to preserve because they define the sounds and the management of motors for launch

The line

```
10=roll(2,90,36,86,1)
```

Give the heading to be followed after the departure by the third number(here 36)
It is the launch heading. 90° for the east and 0° for north

In this example it is the launch heading when ISS is above Kourou to be placed in an orbital plan close to that of ISS to make an encounter.

Heading can take a negative value. For example with the launcher with heading 0 at the launch there is a theoretical plan orbit making 90° with the equator and if 98° is wanted you can take -8° heading for launch

The lines in black include primarily the values of the pitches to be reached with intervals of times fixed to follow a good trajectory according to the load and wished orbit(caution to respect a time continuity for pitch values) and orders for motors

Practice is needed because it is not very easy to carry out a pilot. If you wish to do it, don't discourage because it is necessary to realize many tests before obtaining a correct result.

According to the computing power of the PC used the results obtained can be different and for this reason, I cannot guarantee that your automatic launching will correspond to mine. Sorry!

Some advices

To avoid warp time particularly during the first phase of flight in atmosphere and the end of the placing in orbit.

10x is a maximum between various stage lightings

It is better also not to make changes repeated of display during the use of the autopilot

To wait a few seconds after extinction of the engines at the end of the placing in orbit before the manual order taking. Now push key [P] to disengage autopilot

Not to press on P during the operation of the motors by the autopilot .

To know some more about the pilots read documentation included with Multistage.

To know some more about Geosynchronous, Geostationary and Heliosynchronous orbits, read the tutorials by Papyref which you will find on the DanSteph forum

LIMITATION

This addon is limited to a ludic use with the Orbiter software
Its commercial exploitation is strictly prohibited

Good flights!

Papyref Mars 2010