by
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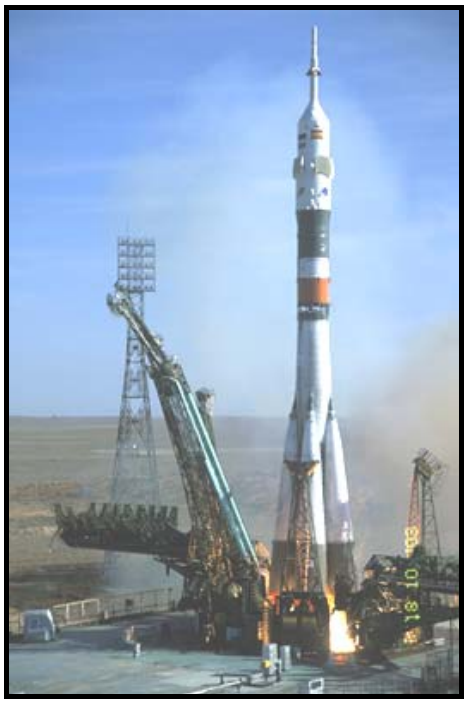
Manual En v1.0

This addon require “Baikonour, LC1-pad5 for Soyuz”

Presentation

The launcher Soyuz exist since the 50's under the general name R7. This launcher known lot of improvments until now but his name is the same. The last versions are Soyuz FG, 2.1a and 2.1b. Nevertheless the commercials versions which launch satellites are generally designate in according of their fairing (S, ST, and STK for the version for Kourou).
Soyouz has a range around 8 differents sizes of fairing in according of the size of the payload. This is too hard to add this in this addon, so we created only a small fairing (version S), a middle fairing (with version STK), and the biggest fairing (version ST) ; in more we addon the fairing for Progress and capsue TMA..
In brief, 5 differents versions of Soyuz are avalaibles in this pack.

If you already see pics of a soyuz launch you can see that Soyuz is brown/grey/khaki before but almost white during the lift off. This white color is the ice formed by the cooling of the fuel tanks.



Under Orbiter it's not technically possible to form this ice during the sequence launch.
So we propose you 5 versions standard « No ice » and also 5 versions « with ice ». that is to say 10 types of Soyuz in this pack.

Installation

To install this addon you must just unzipp the file «Soyuz_series.zip» in your Orbiter directory.

OTHERS ADDONS REQUIRE

This addon is complementary and adapted for addon « Baikonour, LC1-pad5 for Soyuz » which is the launch base for soyuz at Baïkonour in Orbiter. Avalaible on http://orbiter.mustard-fr.com

Nevertheless, this addon also requires somes others addons for payloads, like :

Progress CVEL by D Henderson : http://www.aibs.org.uk/orbiter/
Soyuz TMA 0.6 (CVEL) by D Henderson : http://www.orbithangar.com
Progress-Pirs by Momo : http://orbiter.mustard-fr.com/
Corot by Papyref : http://orbiter.mustard-fr.com/
Metop by Papyref : http://orbiter.mustard-fr.com/
Multistage2 and Spacecraft3 by Vinka : http://users.swing.be/vinka/

Thanks to them for their great works.

The Soyuz versions

This pack contained the Soyuz FG for the ship Progress and for the capsule TMA, and the Soyouz 2.1 for the versions S, ST, and STK. It included also the upper stage Fregat.

On this picture the 5 Soyuz versions with ice.
From left to right :

Soyuz (TMA) with the manned capsule named Soyuz TMA. It has in more a safety rocket on the top.

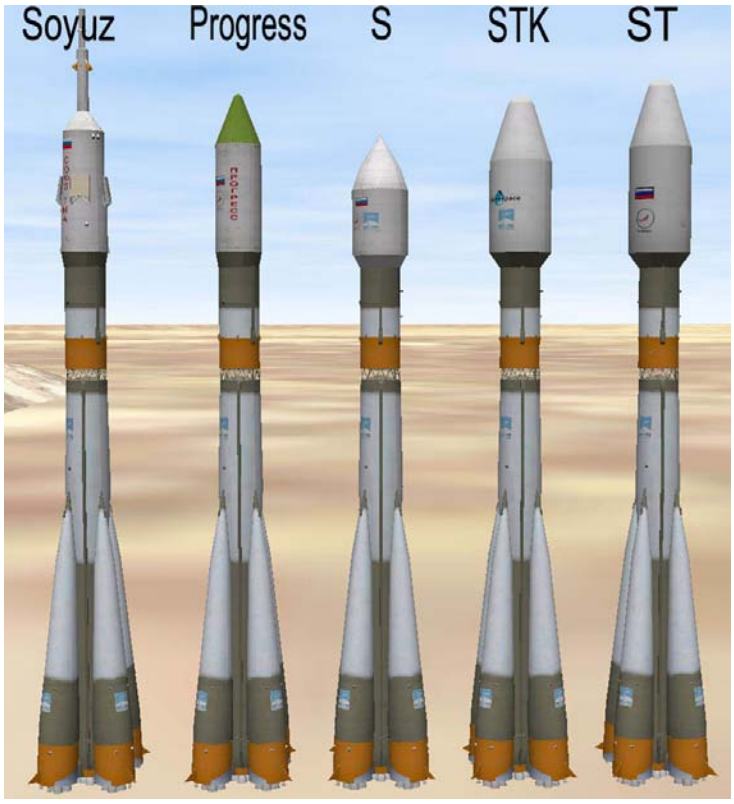
Soyuz Progress with the supply automatique ship Progress, very similar of the capsule TMA.

Soyuz S is a commercial launcher for small payloads.

Soyuz STK is the soyuz version for the european base at Kourou in french Guyana. The first real launch is planned for 2010.

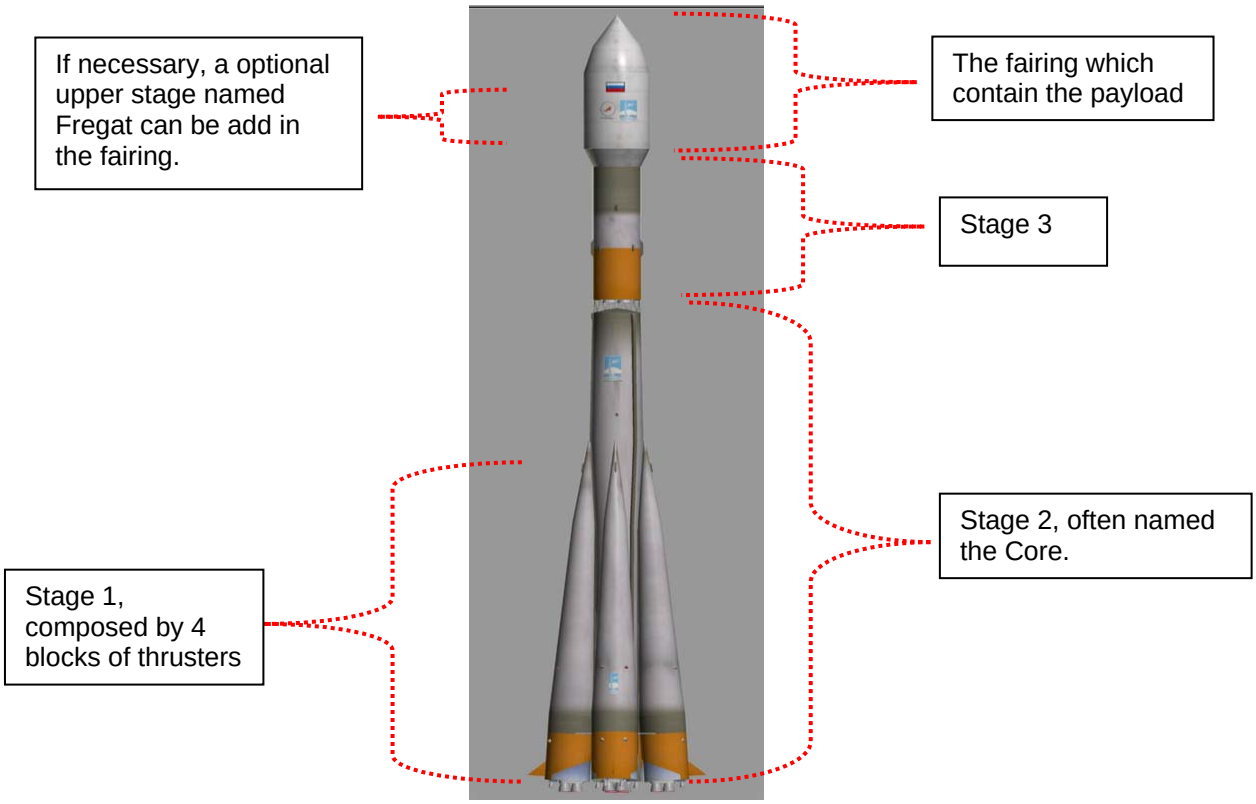
Soyuz ST is a commercial launcher for heavy payload (8t max).

All of this 5 launchers are also avalaible in standard version, no ice.

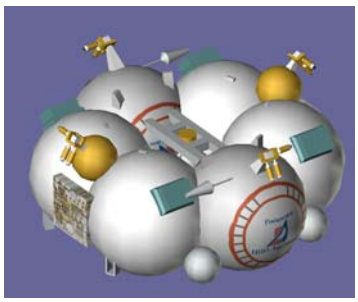


Note that in this addon the sound during launch is the real sound of the soyuz launcher.

Composition of the Soyuz launcher



Fregat stage



Fregat is a optional stage located in the fairing under the payload. It allow to add more power of the launcher to place heavy payload or to place a payload in higher orbit for GTO or SSO.

This mesh of the stage was kindly offer by Kodiak. Thanks to him for his work and his free use.

Fairing

The Soyuz launchers have more 8 diffeents sizes of fairing in according of the payload size. In this pack we created only 3 differents sizes, with the smallest to the biggest.

For version without Fregat, you can use the socle to support the payload. You will must eject it with key J before the payload jettison

Version « No ice » and « With Ice »

See at the beginning of this manual, the soyuz launcher change his color during the final launch sequence because the cooling of tank form ice on the external side.
In Orbiter it's not technically possible to form that during a scenario. So we propose 5 soyuz versions in standard (No ice) and 5 soyuz versions with ice, that is to say 10 types of soyuz in this pack.

On this picture you can see on the left the standard version (No ice) and on the right the ice version.

We advise to use the standard version for the scenarios with Soyuz on the train or on the pad for no immediate launch, and then change scenario to put the ice version before the lift off.
I know that it's not very practical but there are others possibilities.

M_Sat1

In this addon you can find a fictive sat named M_sat1. It used for payload exemple with some missions.

Launch

After choosing a scenario, and turning the pad towards your azimth desirate (see the manual of the addon « Baikonur LC1-Pad5 for Soyuz) you can launch Soyuz in manual or automatic mode. We advise you the automatic mode in order to make the most of the animations of pad and sounds during the launch. The sounds are the real sounds of a Soyuz rochet.

Manual flight :
In first you must open the ombilical arms, so open the controlbox with F3 and take the control of pad named BLC1arms, then hit the key K. Go back to the soyuz control with F3 and start engines little by little with keys CTRL and + *numpad.*
At the moment of lift off the petals arms will open and the smoke will arrive under the pad. After that you must control the rochet to his orbit. When a stage is empty, it's automatically jettison but you can jettison it by key J. Also don't forget to jettison th efairing by key F.

Automatic flight (recommanded) :
Hit key P (under soyuz control) and see until the payload jettison on orbit. However you can cancel the automatic flight by key P.
This automatic flights are very recommanded because only all of them have the real sounds of surrounding.

 Warning with the addons Soyuz CVEL TMA 0.6 and Progress CVEL, you need to hit 2 times on key J to jettison the payload to have the control with fuel at 100%. If you do J just one time the fuel is 0%. Remember that.

 Depending of the power of your computer, the autopilots can give differents results. This autopilot are built with CPU Athlon 3000+. If you have a old computer the orbit can chess, particularly if you use warp time. In this case we recommand you to build your own autopilot files or to do a manual flight.
Also avoid the warp time. If you PC is not old you can use x10 but not more.

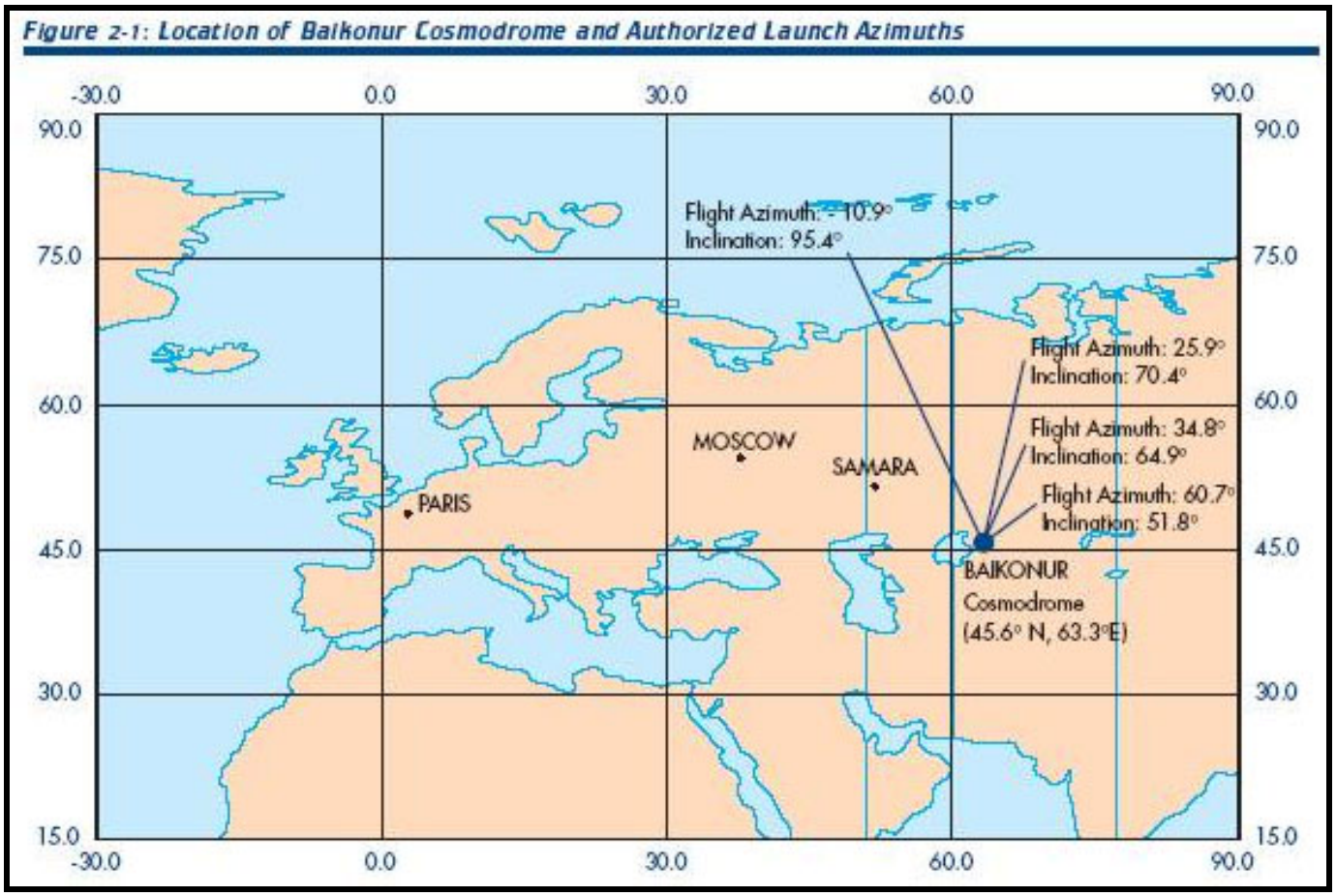
Types of orbit

It exist some types of orbit for payload :

LEO	Low Earth Orbit, situated between 200 and 1500km. It's generally the area for scientific sats, manned flights, somes astronomic, earth observatory and few comm sat.
LEO with rendez vous	The Soyuz TMA (manned) and Progress are regularly launch for a Rendez vous to ISS or MIR according of the period. The best way is to wait that the trajectory of the target go over the pad. It's also advise to have the target near over your base instead of other side of earth. Because this method will save lot of fuel for the orbital approch. Don't forget to turn the pad toward a good azimuth depending of th etarget. Generally it's use 63° for ISS.
MEO	It's the Middle Erath Orbit, between 2000 and 20 000km. Not use in this addon.
SSO	It's the Sun Synchronous Orbit. Situated around 800-900km but the particularity is a north or south launch. That is necessary if you want that sat pass each day at the same hour over a ground point. Usually SSO is use for earth observatories and scientifics sats. In this case remember to turn pad to a adapted azimuth. Generally it's around 0° (North). Usually th esat is placed in an intermediate orbit and Fregat do some engine ignitions to put the sat in higher and circular orbit.
GTO	It's the Geostationnary Tranfer Orbit, note that GTO is not same that GEO. In fact all launchers never place a sat directly on the final place in geosynchronous and circular orbita t 35400km. No, in reality the sats are placed in intermediate orbite, named tranfer, with an elliptic orbit of 200km to 35400km. When sat arrive near of the Apogee point the sat finish his orbit with his engine. That can use lot of days.
ESCAPE	It's a earth escape trajectory use by the probe. Not use in this addon.

In this addon we used for autopilot files :
Otto.txt for LEO Progress to ISS or sat 8t max,
Otto1.txt for LEO TMA (manned) to ISS
Otto2.txt for LEO of sat around 4t to 300km (circular orbit)
Otto3m.txt for SSO of 4t (m=metop) (orbit 800km but depending of the azimuth use)
Otto4.txt for GTO of 1.8t

Here a borad with the launch azimuths used at Baïkonur :



In our scenarios you can find :

- 1 scenario with Soyuz S on the train. You can put it on the pad, raise it, and grap it with pad for a launch (see the manual of Baikonour LC1-Pad5)
- 2 Scenarios Progress, one to ISS and the other to LEO (220x200km)
- 2 Scenarios TMA, one to ISS and other to LEO (220x200).

Note that Soyuz and Progress are never launch directly to the same orbit (altitude) that ISS but on a LEO orbit. After the ship raise is altitude to the station with his engine.

- 1 Scenario Progress-Pirs, a module for ISS (by Momo)
- 1 Scenario Soyuz S for LEO with a fictive M_sat1 of 4 tons
- 1 Scenario Soyuz S in night flight for LEO with the fictive sat M_sat1 of 4t
- 1 Scenario Soyuz ST for LEO with the fictive sat M_sat1 of 2t
- 1 Scenario Soyuz ST for GTO with Fregat and the fictive sat M_sat1 of 1.8t
- 1 Scenario Soyuz ST for SSO with Fregat and sat Corot of 650kg
- 1 Scenario Soyuz ST for SSO with Fregat and sat METOP of 4t
- 1 Scenario Soyuz STK for LEO with M_sat1 of 2t
- 1 Scenario Soyuz STK for GTO with M_sat1 of 2t

Make a scenario and put your own payload

Put a payload

To place a other payload you must go in the ini file corresponding of the version of soyuz wish. For that go in Orbiter/Config/M_soyuz , you can find a list of files corresponding at all types of Soyuz. The name determine the type by a sequence of letters, for example :

Soyuz_ST.ini = Soyuz ST, no ice, no Fregat
Soyuz_Si_f.ini = Soyuz S, ice, with Fregat.
Soyuz_STi_f_METOP.ini = Soyuz ST, ice, Fregat, METOP (ffile dedicate for a specific sat)

If you want put your sat you must duplicate one of this file, rename it with the name of your sat at the end. Then, in this file go to the line corresponding of the position on the launcher.
For example, open a existing ini, with METOP. At the end you find a area dedicated for the payload :

```
[PAYLOAD_1]
MeshName="Metop"                    Name of the sat mesh
name="Metop"                        Name of the Sat
Module="spacecraft\spacecraft3"     Name of the module use (DLL dedicated or module by vinka)
off=(0.012,-.014,25.9)              Position of sat (X, Y, Z). Adjust it visually under Orbiter.
Diameter=1.8                        Diameter of the sat (no influence)
Height=4.2                          Height of sat (no influence)
Mass=4085                           Mass of sat (with fuel)
render=1                            If Render=0 the sati s hide when fairing is on the rocket, but the sat
                                    appear when fairing is jettison. Useful when sat is bigger than fairing
                                    or to decrease the FPS is the sat has lot of polygons
```

For sat which doesn't use Fregat it recommanded to put a socle under the sat for best appearence. For that addon this lines :

```
[PAYLOAD_2]
MESHNAME="M_Soyuz\Soyuz_socle"
Module="Spacecraft\Spacecraft3"
Name="Spacecraft3"
OFF=(0,0,21.5)
HEIGHT=1
DIAMETER=2.66
Mass=200
```

And save under the new name .ini

To make a scenario

This must be doing in 3 step. Build the .ini file, then the .cfg file, and finally the scenario file.

When your ini file is created like in the previous menu, you must create a corresponding cfg file with the same name that the ini file. It must contain:

```
ClassName = Soyuz_sti          name of your ini file
Module = multistage2
; === Attachment specs ===
BEGIN_ATTACHMENT
P 0  0  -13.8  0  0 -1  0 1  0  SZ
END_ATTACHMENT
; booster height/2 + offset = 13.8
; if NO booster, then stage1 height/2 = 13.55
```

And save under the new name .cfg

In last you must create the scenario. For this go in Orbiter/Scenarios/M_Soyuz/With ice
Select a existing scenario with the launcher wish, and then modify with your spécifications. Here th earea which interest us :

```
Soyuz:M_Soyuz\Soyuz_sti_f_metop        Name of your cfg
  STATUS Landed Earth
  POS 63.3200945 45.9123065
  HEADING 45.00
  ATTACHED 0:0,blc1arms
  PRPLEVEL 0:1.000 1:1.000 2:1.000 3:1.000
  NAVFREQ 0 0
  CONFIG_FILE Config\M_Soyuz\Soyuz_sti_f_metop.ini  Name of your ini
  GUIDANCE_FILE Config\M_Soyuz\Otto3.txt              Name of your  autopilot file desired
  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
```

And save under the new name .scn

Global issues

The soyuz launcher in this addon doesn't reproduce the same sequence that the real Soyuz because Orbiter are not exactly real, so we have manage the features to have a acceptable flight. In more Multistage2 is restrictive, and we can do all with it. You will note somes errors like the small engines not ignited, the skirt are not jettison in 3 parts, and jettison not after 10 sec after 3rd stage's ignition. Same for the emergency tower realised by a trick. Or also the sat's jettison with a fuel at 0%, obliging a second hit key J.
So some small errors that the purists will critize, but it's not solvable with ours tools.

Nevertheless, a future version Multistage3 will fix this issues. When Multistage2 will be released a « Soyuz_series v2 » will be do to fix that.

Limitation and thanks

This addon is free and can not be sell with Orbiter or alone. For a modification, please contact the authors.

Great thanks to :
Papyref for his train and his support
BrianJ for his help for debugging
Kodiak for Fregat kindly offered
Vinka for his modules Multistage2 and Spacecraft3
David Henderson for his addons CVEL

In the hope that this addon will satisfy you.

3D realisation (mesh, textures, search of docs) by Mustard, animations and flight parametering by No Matter.

Mustard & No Matter – Mai 2007

http://orbiter.mustard-fr.com/