



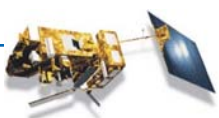
Soyuz/ST launching MetOp-A

Monday, July 17, 2006

Flight Documentation

ST-MTP-PDP-39 - Edition 03





Contents

1 - Flight main information	3
2 - Countdown	7
3 - Soyuz/ST ascent phase	10
4 - Fregat orbital phase	16



1 - Flight main information

Launch time
Main flight events

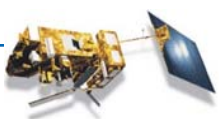


Launch time

◆ MetOp-A injection using Soyuz/ST

- ◆ **Launch site:** **Baikonur Cosmodrome, Kazakhstan**
- ◆ **Launch date:** **Monday, July 17, 2006**
- ◆ **Lift-off time:** **19h 28mn 09.6s DMT***
 - ◆ GMT DMT-3 hours = 16h 28mn 09.6s July 17, 2006
 - ◆ Paris time DMT-1 hour = 18h 28mn 09.6s July 17, 2006
 - ◆ Moscow time DMT+1 hour = 20h 28mn 09.6s July 17, 2006
 - ◆ **Baikonur time DMT+3 hours = 22h 28mn 09.6s July 17, 2006**

*DMT : Moscow Decree Time (GMT + 3 hours)



Main flight events (1/2)

FLIGHT EVENT	DMT	UTC	Time from lift-off		Paris	Baikonur
	h:mn:s	h:mn:s	sec	h:mn:s	h:mn:s	h:mn:s
Soyuz/ST ascent phase						
Lift-off	19:28:10	16:28:10	0,00	00:00:00	18:28:10	22:28:10
1st stage separation	19:30:08	16:30:08	118,20	00:01:58	18:30:08	22:30:08
Exit from shade	19:30:18	16:30:18	128,00	00:02:08	18:30:18	22:30:18
2nd stage separation	19:32:58	16:32:58	287,60	00:04:48	18:32:58	22:32:58
Aft section separation	19:32:58	16:32:58	288,08	00:04:48	18:32:58	22:32:58
Fairing separation	19:32:59	16:32:59	289,16	00:04:49	18:32:59	22:32:59
Illrd stage cut-off	19:36:56	16:36:56	525,81	00:08:46	18:36:56	22:36:56
Fregat + MetOp-A separation	19:36:59	16:36:59	529,11	00:08:49	18:36:59	22:36:59
First Fregat burn - injection to the transfer orbit						
Start of pre-burn acceleration	19:37:04	16:37:04	534,11	00:08:54	18:37:04	22:37:04
Fregat main engine ignition	19:37:59	16:37:59	589,11	00:09:49	18:37:59	22:37:59
End of visibility from Russian stations	19:41:57	16:41:57	827,00	00:13:47	18:41:57	22:41:57
Fregat main engine cut-off	19:45:33	16:45:33	1042,57	00:17:23	18:45:33	22:45:33
Coast phase on the transfer orbit - "barbecue" mode						
Coast phase start	19:45:43	16:45:43	1052,57	00:17:33	18:45:43	22:45:43
Attitude maneuver start	19:46:30	16:46:30	1100,00	00:18:20	18:46:30	22:46:30
3-axis attitude start	19:48:30	16:48:30	1220,00	00:20:20	18:48:30	22:48:30
3-axis attitude end, attitude maneuver for the 2nd burn	20:27:40	17:27:40	3570,00	00:59:30	19:27:40	23:27:40
Second Fregat burn - injection to the separation orbit, MetOp-A separation						
Start of pre-burn acceleration	20:30:07	17:30:07	3717,10	01:01:57	19:30:07	23:30:07
Fregat main engine ignition	20:31:02	17:31:02	3772,10	01:02:52	19:31:02	23:31:02
Entry to the shade	20:31:35	17:31:35	3805,00	01:03:25	19:31:35	23:31:35
Fregat main engine cut-off	20:31:54	17:31:54	3823,83	01:03:44	19:31:54	23:31:54
Beginning of attitude maneuver for MetOp-A separation	20:31:55	17:31:55	3824,63	01:03:45	19:31:55	23:31:55
AOS by Kerguelen (elevation angle 5°)	20:36:20	17:36:20	4090,00	01:08:10	19:36:20	23:36:20
MetOp-A separation command	20:36:54	17:36:54	4123,93	01:08:44	19:36:54	23:36:54



Main flight events (2/2)

FLIGHT EVENT	DMT	UTC	Time from lift-off		Paris	Baikonur
	h:mn:s	h:mn:s	sec	h:min:s	h:mn:s	h:mn:s
Fregat second coast phase						
Beginning of Fregat attitude maneuver for thermal mode	20:37:00	17:37:00	4130,00	01:08:50	19:37:00	23:37:00
End of visibility from Kerguelen (elevation angle 5°)	20:49:16	17:49:16	4866,00	01:21:06	19:49:16	23:49:16
Exit from the shade	21:03:49	18:03:49	5739,00	01:35:39	20:03:49	00:03:49
AOS by Russian ground stations (elevation angle 5°)	21:04:52	18:04:52	5802,00	01:36:42	20:04:52	00:04:52
S/C contingency separation command	21:04:55	18:04:55	5805,10	01:36:45	20:04:55	00:04:55
MetOp-A separation confirmation	21:10:00	18:10:00	6110,00	01:41:50	20:10:00	00:10:00
Third Fregat burn - deorbitation to the reentry trajectory						
Beginning of Fregat attitude maneuver	21:11:00	18:11:00	6170,00	01:42:50	20:11:00	00:11:00
Start of pre-burn acceleration	21:14:00	18:14:00	6350,00	01:45:50	20:14:00	00:14:00
Fregat main engine ignition	21:14:55	18:14:55	6405,00	01:46:45	20:14:55	00:14:55
Fregat main engine cut-off	21:15:15	18:15:15	6425,00	01:47:05	20:15:15	00:15:15
End of visibility from Russian stations	21:21:57	18:21:57	6827,00	01:53:47	20:21:57	00:21:57
Fregat atmosphere reentry	21:52:51	18:52:51	8681,00	02:24:41	20:52:51	00:52:51

Notes:

- AOS - Acquisition of signal
- GTS - Ground Tracking Station
- LO - Lift-Off



2 - Countdown

Summarized launch preparation schedule



Summarized launch preparation sequence (1/2)

Time of report		Содержание доклада	Contents of report
DMT	Before LO		
July 17, 2006			
03:18:10	16:10:00	Прибытие команды по операциям с КС в бункер	S/C Operation team arrival in bunker
09:23:10	10:05:00	Контроль связи.	Network verifications
09:28:10	10:00:00	Готовность к пуску – 10 час.	Readiness for launch – 10 hours
09:28:10	10:00:00	Готовность РБ ФРЕГАТ к началу работ пускового дня.	Confirmation of FREGAT readiness for beginning of launch day activities
11:28:10	08:00:00	Расчет РН занял рабочие места, приступил к работе по графику пускового дня.	Launcher personnel begins operations according to the launch day schedule
11:58:10	07:30:00	Начаты защитные операции по СУ РБФ	Beginning of preliminary check-out of FREGAT Control System
12:23:10	07:05:00	Готовность к пуску - 7 час	Readiness for launch – 7 hours
12:58:10	06:30:00	Начато контрольное включение ТМИ РБФ	Beginning of FREGAT TM system verification
13:23:10	06:05:00	Готовность к пуску - 6 час	Readiness for launch – 6 hours
14:18:10	05:10:00	Начат набор стартовой готовности РБФ.	Beginning of FREGAT launch readiness setting
14:23:10	05:05:00	Готовность к пуску – 5 час. Электромагнитная совместимость на СК в норме.	Readiness for launch – 5 hours. Electromagnetic environment is nominal
15:23:10	04:05:00	Готовность к пуску – 4 час. Получены метеоусловия в районе стартовой позиции. Температура под ГО – норма	Readiness for launch – 4 hours. Weather report is received. Temperature under the fairing is normal.
15:28:10	04:00:00	Начато заседание Гос. Комиссии по заправке РН	Beginning of the State Commission meeting for launcher fuelling authorization
16:08:10	03:20:00	Начата заправка РН компонентами топлива.	Beginning of Launch Vehicle fuelling with propellant components.
16:23:10	03:05:00	Готовность к пуску – 3 час	Readiness for launch – 3 hours
16:42:50	02:45:20	Получены результаты регистрации температуры под ГО	The temperature measurements under the fairing are received
17:23:10	02:05:00	Готовность к пуску – 2 час	Readiness for launch – 2 hours
17:58:10	01:30:00	Получены результаты регистрации температуры под ГО	The temperature measurements under the fairing are received
18:18:10	01:10:00	РН заправлена всеми компонентами топлива.	Launch Vehicle is fuelled with all propellant components
18:23:10	01:05:00	Готовность к пуску – 1 час	Readiness for launch – 1 hour
18:33:10	00:55:00	Включение системы телеметрии ТМ1 Фрегата	Fregat Telemetry system TM4 switched ON



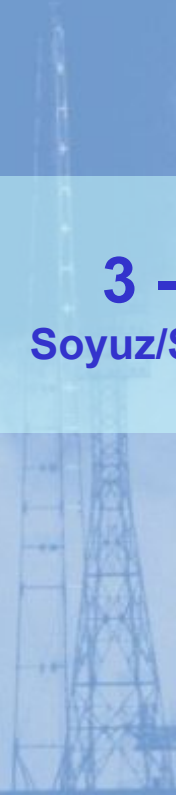
Summarized launch preparation sequence (2/2)

Time of report		Содержание доклада	Contents of report
DMT	Before LO		
July 17, 2006			
18:53:10	00:35:00	Готовность к пуску – 30 минут	Readiness for launch – 30 mn
18:58:10	00:30:00	Включение системы телеметрии ТМ6 Фрегата и системы спутниковой навигации	Fregat Telemetry TM6 and Navigation ASN systems switched ON
18:58:10	00:30:00	Начат отвод ферм обслуживания. Готовность РН и БВ к разведению ферм обслуживания	Beginning of servicing tower retraction. Launch Vehicle and Upper Composite readiness for servicing tower retraction
19:08:10	00:20:00	Включение системы РДМ Фрегата	FREGAT Tracking RDM system switched ON
19:08:10	00:20:00	Доклад о готовности – 15 мин. ФО разведены. Проведено включение системы измерения и оценка параметров РН.	Readiness for launch – 15 mn. Servicing tower are retracted. Launcher TM system is switched ON
19:12:50	00:15:20	Готовность к пуску – 10 минут.	Readiness for launch – 10mn
19:17:10	00:11:00	«ПРОТЯЖКА I»	Tape advance I: Launch Vehicle Ground equipment telemetry recording ON
19:17:50	00:10:20	Доклад о готовности – 5 минут. Выдан сигнал «Готовность КГЧ»	Readiness for launch – 5 mn. Upper composite Readiness signal is issued
19:22:00	00:06:10	Готовность к пуску – 1 минута	Ready for launch at H0 – 1 mn report
19:23:00	00:05:10	«КЛЮЧ НА СТАРТ»	Key on start
19:23:10	00:05:00	Переход РБ Фрегат на бортовое питание	FREGAT transfer to onboard power supply
19:23:10	00:05:00	«ПРОДУВКА»	Purging
19:24:35	00:03:35	«ПРОТЯЖКА II»	Tape advance II: Launch Vehicle On board telemetry recording ON
19:25:05	00:03:05	«КЛЮЧ НА ДРЕНАЖ»	Key to the drainage
19:25:35	00:02:35	Команда на сброс отрывных разъемов БВ. «НАДДУВ»	Upper Composite Umbilical "Ш0" drop off command. Pressurization
19:27:25	00:00:45	СИСТЕМА КОНДИЦИОНИРОВАНИЯ ВЫКЛЮЧЕНА. «ЗЕМЛЯ – БОРТ»	Air conditioning system is switched off. Ground-board
19:27:50	00:00:20	«ПУСК», «БОРТОВОЕ ПИТАНИЕ»	Launch, "On-board power on"
19:27:53	00:00:17	«ЗАЖИГАНИЕ», «КИСЛОРОД»	Ignition, "Oxygen"
19:27:55	00:00:15	«ПРЕДВАРИТЕЛЬНАЯ СТУПЕНЬ»	Preliminary thrust level
19:28:03	00:00:07	«ПРОМЕЖУТОЧНАЯ СТУПЕНЬ»	Intermediate thrust level
19:28:04	00:00:06	«ОТП»	Inertial platform release
19:28:07	00:00:03	«ГЛАВНАЯ СТУПЕНЬ»	Full thrust level
19:28:10	+00:00:00	«ПОДЪЕМ» (19:28:09.6 MDT, 16:28:09.6 UTC)	Lift-off (19:28:09.6 MDT, 16:28:09.6 UTC)



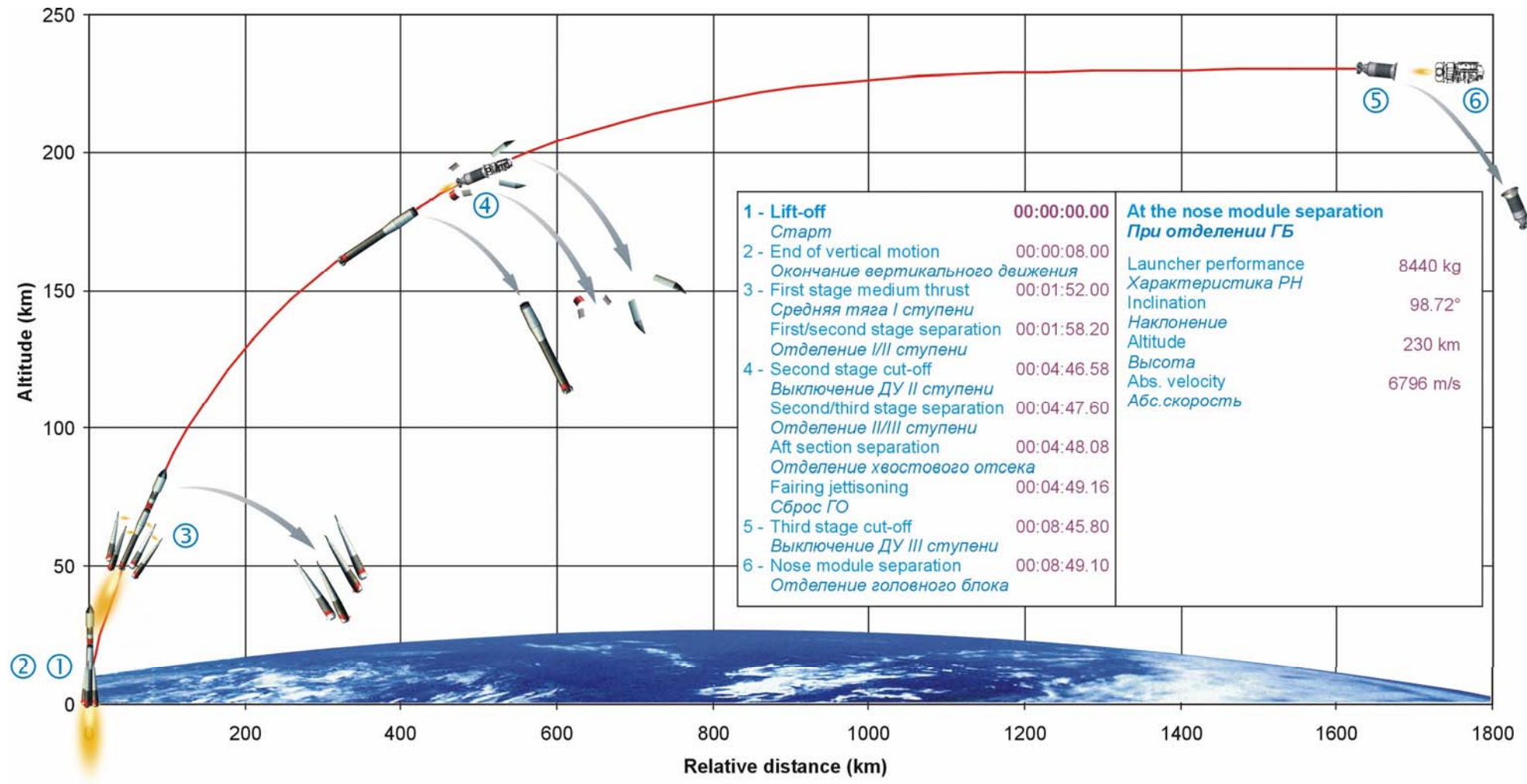
3 - Soyuz/ST ascent phase

Soyuz/ST flight phase description and timeline



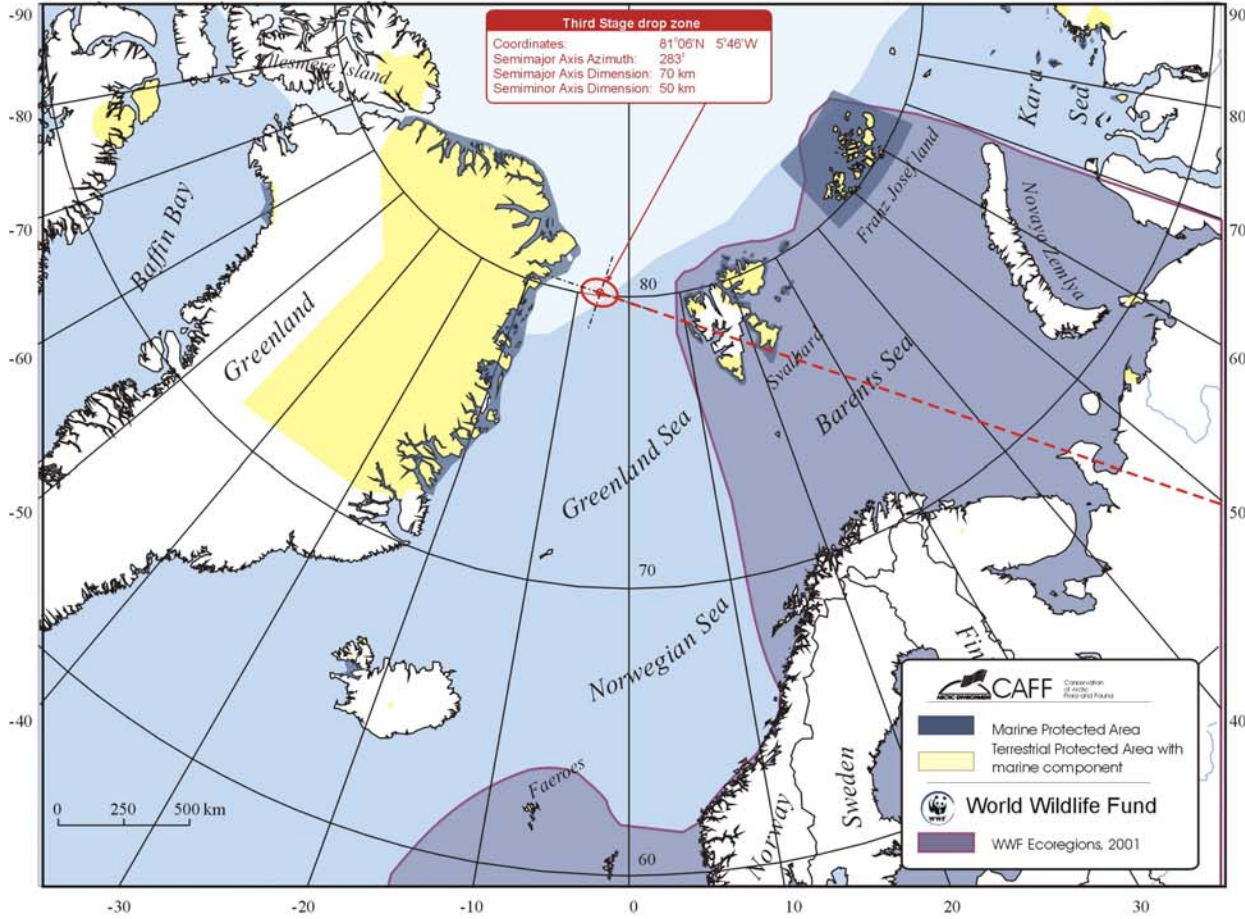


Soyuz/ST ascent phase description (1/2)





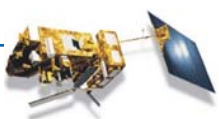
Soyuz/ST ascent phase description (2/2)





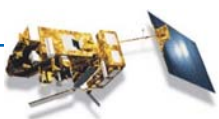
Soyuz/ST flight timeline (1/3)

Time of report		Содержание доклада	Contents of report
DMT	Flight time (s)		
July 17, 2006			
19:28:10	0	Прошел контакт подъема	"Lift-off" command passed
19:28:20	10	Параметры системы управления РН в норме	Launcher control system parameters are nominal
19:28:30	20	Двигатели 1й и 2й ступеней работают устойчиво	Engines of 1st and 2nd stages operate normally
19:28:40	30	Параметры конструкции РН в норме	Launcher structure parameters are nominal. Roll maneuver completed
19:28:50	40	Стабилизация изделия устойчивая	Launcher stabilization is nominal
19:29:00	50	Давление в камерах двигателей в норме	Pressure in engines chambers are nominal
19:29:10	60	Тангаж, рыскание , вращение в норме	Pitch, Yaw and Roll are nominal
19:29:20	70	Полет нормальный	Flight is nominal
19:29:30	80	Параметры системы управления РН в норме	Launcher control system parameters are nominal
19:29:40	90	Двигатели 1й и 2й ступеней работают нормально	Engines of 1st and 2nd stages operate normally
19:29:50	100	Параметры конструкции РН в норме	Launcher structure parameters are nominal
19:30:00	110	Тангаж, рыскание , вращение в норме	Pitch, Yaw and Roll are nominal
19:30:10	120	Есть выключение двигателей боковых блоков. Есть отделение боковых блоков (118.20 с)	Cut-off of lateral booster's engines. Separation of lateral boosters (118.20 s)
19:30:20	130	Стабилизация изделия устойчивая	Launcher stabilization is nominal
19:30:30	140	Параметры конструкции РН в норме	Launcher structure parameters are nominal
19:30:40	150	Двигатель 2й ступени работает нормально	Engine of 2nd stage operates normally
19:30:50	160	Параметры системы управления РН в норме	Launcher control system parameters are nominal
19:31:00	170	Стабилизация изделия устойчивая	Launcher stabilization is normal
19:31:10	180	Параметры конструкции РН в норме	Launcher structure parameters are nominal



Soyuz/ST flight timeline (2/3)

Time of report		Содержание доклада	Contents of report
DMT	Flight time (s)		
July 17, 2006			
19:31:20	190	Двигатель 2й ступени работает нормально	Engine of 2nd stage operates normally
19:31:30	200	Параметры системы управления в норме	Control system parameters are normal
19:31:40	210	Полет нормальный	Flight is normal
19:31:50	220	Стабилизация изделия устойчивая. Время КП	Launcher stabilization is normal. Lift-off time information.
19:32:00	230	Двигатель 2й ступени работает нормально	Engine of 2nd stage operates normally
19:32:10	240	Тангаж, рыскание , вращение в норме	Pitch, Yaw and Roll are nominal
19:32:20	250	Параметры конструкции РН в норме	Launcher structure parameters are nominal
19:32:30	260	Полет нормальный	Flight is normal
19:32:40	270	Параметры системы управления в норме	Control system parameters are normal
19:32:50	280	Прошел гарантийный наддув бака окислителя 3й ступени	Pressurization of 3rd stage oxidizer tank was performed
19:33:00	290	Есть запуск двигателя 3й ступени. Есть выключение двигателя 2й ступени. Стабилизация изделия устойчивая	3rd stage engine started. 2nd stage engine cut-off confirmed. 2nd stage separation confirmed (287.6 s).
19:33:10	300	Есть сброс панелей хвостового отсека (288.1 с). Есть сброс створок головного обтекателя (289.16 с)	Separation of the aft section of 3rd stage (288.1 s). Fairing separation accomplished (289.16 s)
19:33:20	310	Стабилизация изделия устойчивая	Launcher stabilization is nominal
19:33:30	320	Параметры конструкции РН в норме	Launcher structure parameters are nominal
19:33:40	330	Двигатель 3й ступени работает устойчиво	Engine of 3rd stage operates normally
19:33:50	340	Параметры системы управления в норме	Control system parameters are nominal
19:34:00	350	Полет нормальный	Flight is normal
19:34:10	360	Тангаж, рыскание , вращение в норме	Pitch, Yaw and Roll are nominal
19:34:20	370	Параметры конструкции РН в норме. Прошло вакуумирование ДУ СОЗ РБФ.	Launcher structure parameters are nominal. Fregat ACS depressurisation confirmed
19:34:30	380	Двигатель 3й ступени работает устойчиво.	Engine of 3rd stage operates normally.



Soyuz/ST flight timeline (3/3)

Time of report		Содержание доклада	Contents of report
DMT	Flight time (s)		
July 17, 2006			
19:34:40	390	Параметры системы управления в норме	Control system parameters are nominal
19:34:50	400	Стабилизация изделия устойчивая	Launcher stabilization is normal
19:35:00	410	Полет нормальный	Flight is normal
19:35:10	420	Тангаж, рыскание, вращение в норме	Pitch, Yaw and Roll are nominal
19:35:20	430	Двигатель 3й ступени работает устойчиво	Engine of 3rd stage operates normally
19:35:30	440	Стабилизация изделия устойчивая	Launcher stabilization is normal
19:35:40	450	Полет нормальный	Flight is normal
19:35:50	460	Параметры конструкции РН и РБ в норме.	LV and Fregat structure parameters are nominal.
19:36:00	470	Двигатель 3й ступени работает устойчиво	Engine of 3rd stage operates normally
19:36:10	480	Параметры системы управления в норме	Control system parameters are nominal
19:36:20	490	Стабилизация изделия устойчивая	Launcher stabilization is normal
19:36:30	500	Полет нормальный	Flight is normal
19:36:40	510	Тангаж, рыскание, вращение в норме	Pitch, Yaw and Roll are nominal
19:36:50	520	Система управления работает штатно	Control system is operating normally
19:37:00	530	Есть выключение двигателя 3й ступени (525.8 с).	Cut-off the 3rd stage engine (525.8 s)
19:37:05	535	Есть отделение третьей ступени от ГБ (529.1 с)	Separation of the NM from third stage confirmed (529.1 s)



4 - Fregat orbital phase

Fregat orbital phase description,
flight profile, Fregat flight path,
flight timeline



Fregat orbital phase description

Fregat separation	
T _{SEP}	00:08:49.1
Altitude	230 km
V _{ABS}	6796 m/s
θ - Local pitch	0.2°
Inclination	98.72°
NM mass	8440 kg

Fregat 1 st burn	
T _{ACS}	00:08:54.1
T _{IGNITION}	00:09:49.1
T _{CUT-OFF}	00:17:22.6
Duration	00:07:33.46
ΔV	1289.35 m/s
Fuel spending	2755 kg

Fregat 3 rd burn	
T _{ACS-ON}	01:45:50.0
T _{IGNITION}	01:46:45.0
T _{CUT-OFF}	01:47:05.0
Duration	00:00:20.0
Altitude	828.4 km
ΔV	229.4 m/s
Fuel spending	90 kg

Transfer orbit	
a	6858.86 km
e	0.04676
i	98.74°
RAAN	240.77°
ω	94.50°
3-axis attitude	
Start	00:20:20
End	00:59:30

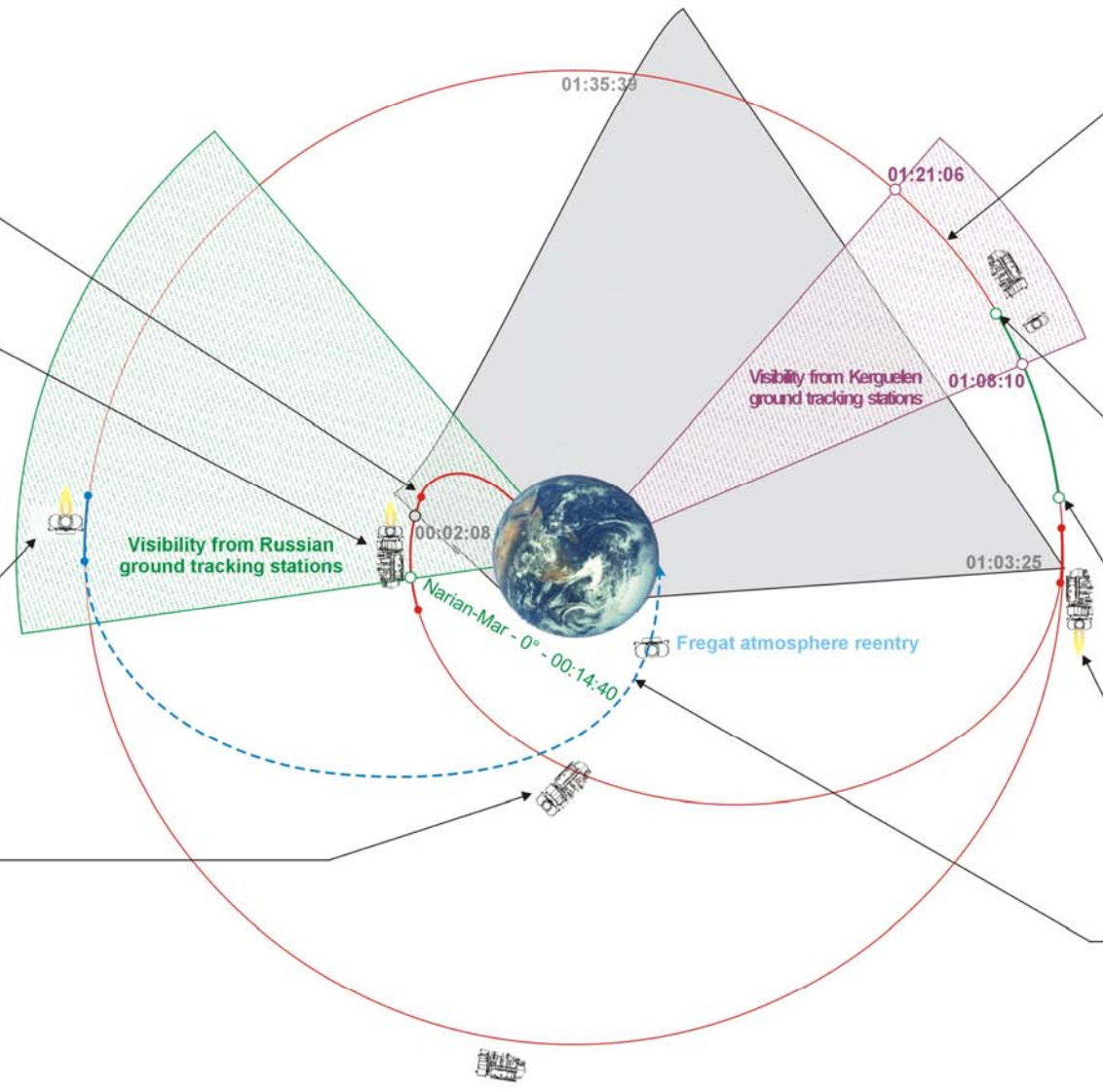
Separation orbit	
T _{OSC}	17:36:53.5 UTC
a	7188.64 km
e	0.00245
i	98.74°
Ω	75.20°
RAAN (J2000)	257.51°
ω	107.80°

METOP separation	
T _{SEP}	01:08:43.93
Latitude	69.96°S
Longitude	82.71°E

Separation sequence	
T _{SEQ}	01:03:44.6

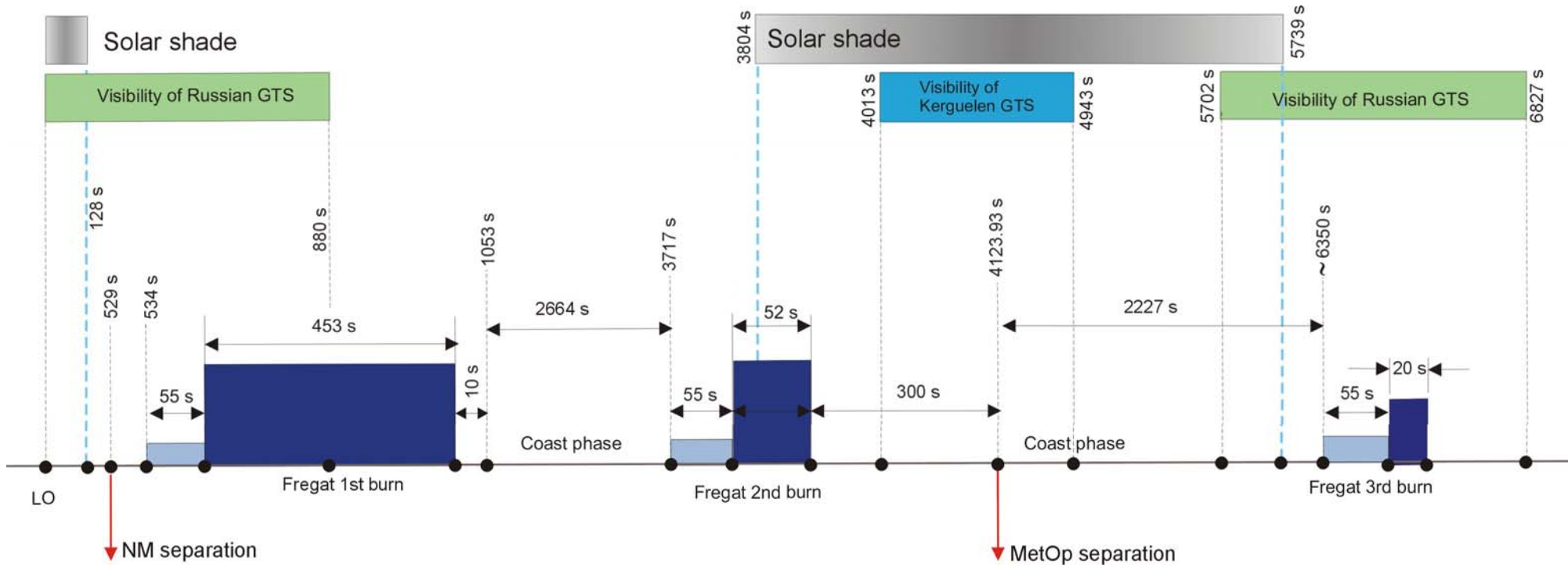
Fregat 2 nd burn	
T _{ACS}	01:01:57.1
T _{IGNITION}	01:02:52.1
T _{CUT-OFF}	01:03:43.8
Duration	00:00:51.7
Altitude _{ACS}	848.9 km
ΔV	182.1 m/s
Fuel spending	319 kg

Fregat re-entry	
Altitude	100 km
Entry angle	-2.13°
V _{entry}	8.03 km/s
Latitude	25.64° S
Longitude	145.22° W





Fregat flight profile





Orbit parameters

1. Sub-orbital trajectory	
Fregat + MetOp-A separation time	529.11 s
Altitude	230 km
Inclination	98.72°
Absolute velocity	6 796 m/s

First burn ↓

2. Transfer orbit	
Tosc = 1052.57 s	
Inclination	98.74°
Semi major axis	6858.9 km
Eccentricity	0.04676
Longitude of asc. node	75.20°
Argument of perigee	94.50°

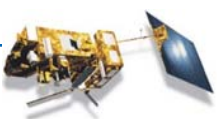
Second burn →

4. Fregat re-entry orbit	
Re-entry time	8681 s
Re-entry coordinates	
Latitude	25.64° S
Longitude	145.22° W
Re-entry altitude	100 km
Re-entry velocity	8.03 km/s
Re-entry azimuth	-167.30°

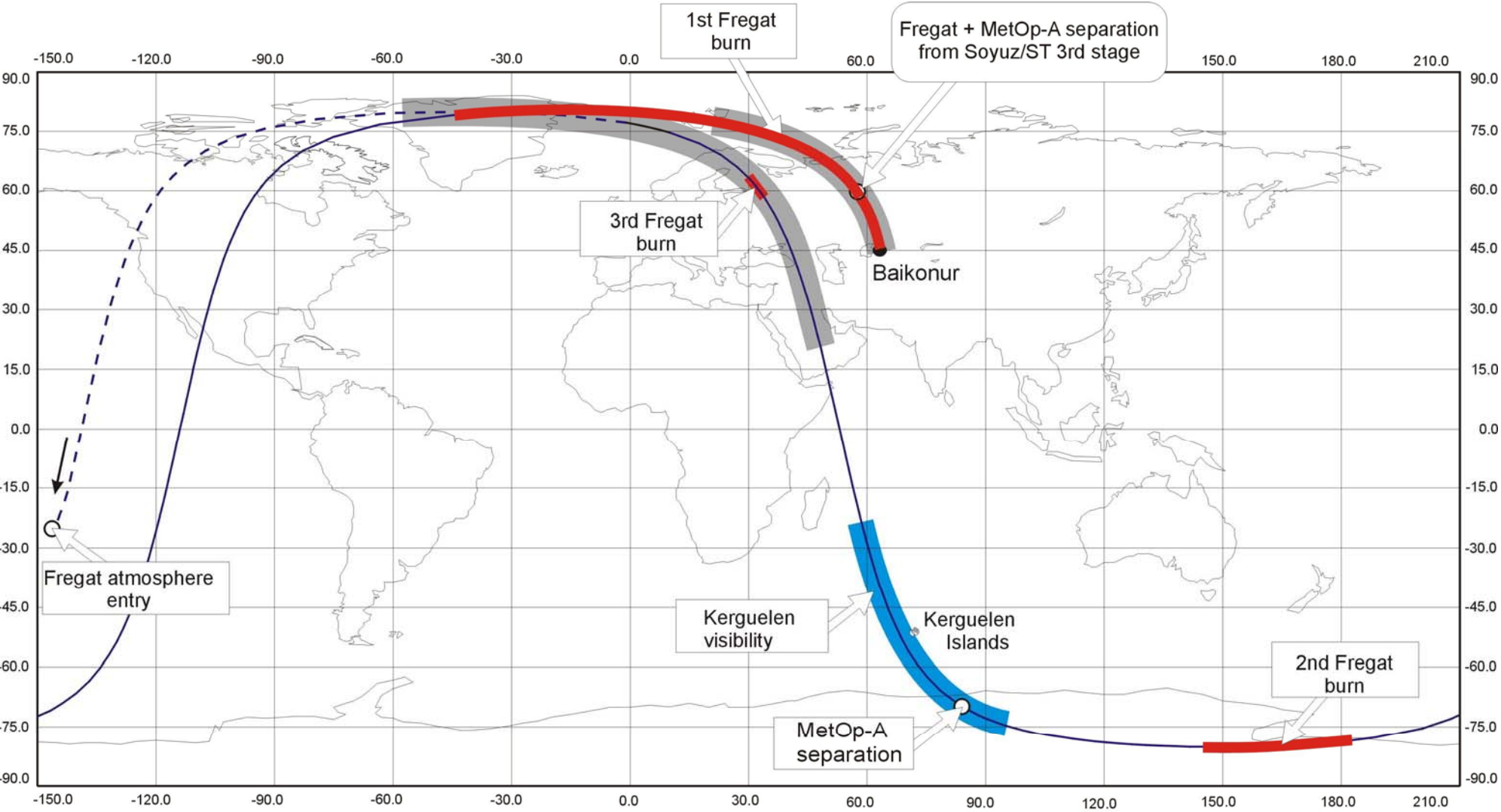
↑ **Third burn**

3. Separation orbit	
Tosc = 4123.93 s	
Inclination	98.74°
Semi major axis	7188.64 km
Eccentricity	0.00245
Longitude of asc. node	75.20°
Argument of perigee	107.80°

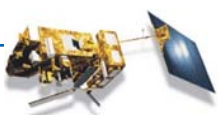
Note: time is counted from lift-off



Fregat flight path

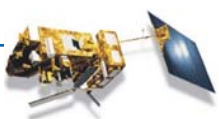


■ - Russian Ground Stations visibility



Fregat flight timeline (1/4)

Time		Event / Operation	Report type	FCC report content	Ground stations					
DMT	from Lift-off				Plesetsk	Vorkuta	Narian-Mar	Baikonur	Schelkovo	Khimky
FIRST FREGAT BURN - TRANSFER ORBIT										
19:36:59	00:08:49	Fregat + MetOp A separation from Soyuz/ST 3rd stage								
19:37:04	00:08:54	Start pre-burn acceleration								
19:37:59	00:09:49	Main engine ignition / Transition to transfer orbit								
19:38:00	00:09:50		VOICE	Confirmation of Fregat pre-burn acceleration start						
19:39:00	00:10:50		VOICE	Confirmation of Fregat main engine ignition						
19:40:00	00:11:50		VOICE	Fregat systems are nominal						
19:40:57	00:12:47	End of RF visibility from Plesetsk GTS								
19:41:00	00:12:50		VOICE	End of visibility from Plesetsk GTS						
19:41:14	00:13:04	End of RF visibility from Vorkuta GTS								
19:41:51	00:13:41	End of RF visibility from Narian-Mar GTS. End of RF visibility from Russian GTS								
19:42:00	00:13:50		VOICE	First summary report						
19:43:00	00:14:50		VOICE	End of visibility from Russian GTS						
19:45:32	00:17:23	Main engine cut-off								
19:45:42	00:17:33	Injection into the transfer orbit, coast phase start								
19:46:30	00:18:20	Attitude maneuver start								
19:48:00	00:19:50		FG0	Precise lift-off time						
19:48:30	00:20:20	3-axis attitude start								
19:49:00	00:20:50		VOICE	First summary report update						
19:56:00	00:27:50		FG2	Information about separation from Soyuz/ST						
19:57:00	00:28:50		FG1	Precise fairing jettisoning time						
20:00:00	00:31:50		FG3-1	Information about the first Fregat burn						
20:13:10	00:45:00		FG7	MetOp-A separation orbit state vector (preliminary <u>forecast</u>)						
20:13:10	00:45:00		FG6j	Separation orbit parameters (preliminary <u>forecast</u>)						
20:18:00	00:49:50		VOICE	Parameters of the unclosed orbit after MetOp-A + Fregat separation from the 3rd stage						
20:18:00	00:49:50		FM1	Unclosed orbit parameters						
20:27:40	00:59:30	3-axis attitude end, attitude maneuver for the 2nd burn								



Fregat flight timeline (2/4)

Time	DMT	from Lift-off	Event / Operation	Report type	FCC report content	Ground stations						
						Plesetsk	Vorkuta	Narian-Mar	Baikonur	Schelkovo	Khimky	Krasnoye Selo
SECOND FREGAT BURN - SEPARATION ORBIT - METOP-A SEPARATION												
20:30:07	01:01:57		Start pre-burn acceleration									
20:31:02	01:02:52		Main engine ignition / Transition to separation orbit									
20:31:53	01:03:44		Main engine cut-off									
20:31:54	01:03:45		Beginning of attitude maneuver for MetOp-A separation									
20:32:14	01:04:04		Entry to the shade									
20:36:20	01:08:10		AOS by Kerguelen									
20:36:53	01:08:44		MetOp-A separation command									
20:37:00	01:08:50		Beginning of Fregat attitude maneuver for thermal mode									
20:38:00	01:09:50			FG6	Unclosed orbit parameters (after MetOp-A + Fregat separation from the 3rd stage)							
20:38:00	01:09:50			VOICE	Beginning of visibility from Kerguelen (elevation 5°)							
20:49:16	01:21:06		End of visibility from Kerguelen									
20:50:00	01:21:50			VOICE	End of visibility from Kerguelen							
21:04:11	01:36:01		Fregat exit from the shade									
21:04:52	01:36:42		Baikonur GTS AOS									
21:04:55	01:36:45		MetOp-A contingency separation command									
21:06:00	01:37:50			VOICE	GTS Baikonur started reception and registration of Fregat TM data							
21:06:00	01:37:50			VOICE	TM DT mode: MetOp-A contingency separation command is issued							
21:06:35	01:38:25		Schelkovo GTS AOS									
21:06:36	01:38:26		Khimky (NPO-L) GTS AOS									
21:07:00	01:38:50			VOICE	GTS Schelkovo started reception and registration of Fregat TM data							
21:07:00	01:38:50			VOICE	GTS Khimky (NPO-L) started reception and registration of Fregat TM data							
					Fregat systems are nominal, Contingency MetOp-A separation command is issued							
21:07:58	01:39:48		Krasnoye Selo GTS AOS									
21:08:00	01:39:50			VOICE	GTS Krasnoye Selo started reception and registration of Fregat TM data							
21:08:27	01:40:17		Plesetsk GTS AOS									
21:09:00	01:40:50			VOICE	GTS Plesetsk started reception and registration of Fregat TM data							
21:10:00	01:41:50			VOICE	MetOp-A separation confirmation							
21:10:03	01:41:53		Narian-Mar GTS AOS									
21:10:49	01:42:39		Vorkuta GTS AOS									
21:11:00	01:42:50		Attitude maneuver start for the 3rd burn									
21:11:00	01:42:50			VOICE	GTS Narian-Mar started reception and registration of Fregat TM data							



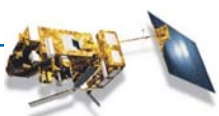
Fregat flight timeline (3/4)

Time		Event / Operation	Report type	FCC report content	Ground stations									
DMT	from Lift-off				Plesetsk	Vorkuta	Narian-Mar	Baikonur	Schelkovo	Khimky	Krasnoye Selo			
THIRD FREGAT BURN - RE-ENTRY TRAJECTORY														
21:12:00	01:43:50		VOICE	GTS Vorkuta started reception and registration of Fregat TM data										
21:14:00	01:45:50	Start of pre-burn acceleration												
21:14:00	01:45:50		VOICE	Fregat started attitude maneuver for the 3rd burn										
21:14:28	01:46:18	Baikonur GTS LOS												
21:14:55	01:46:45	Fregat main engine ignition - transfer to re-entry trajectory												
21:15:00	01:46:50		VOICE	Third Fregat burn is confirmed as nominal. Baikonur GTS LOS										
21:15:15	01:47:05	Fregat main engine cut-off												
21:17:00	01:48:50		VOICE	The time of the 3rd Fregat ignition is nominal										
21:18:00	01:49:50		VOICE	The 3rd Fregat cut-off is confirmed as nominal										
21:19:00	01:50:50		VOICE	Fregat was transferred to the re-entry trajectory										
21:19:33	01:51:23	End of visibility from Schelkovo GTS												
21:19:34	01:51:24	End of visibility from Khimky GTS												
21:20:00	01:51:50		VOICE	GTS Schelkovo and Khimky LOS										
21:20:53	01:52:43	End of visibility from Krasnoye Selo GTS												
21:21:00	01:52:50		VOICE	GTS Krasnoye Selo LOS										
21:22:00	01:53:50		VOICE	Transfer orbit parameters										
21:21:17	01:53:07	End of visibility from Plesetsk GTS												
21:21:21	01:53:11	End of visibility from Vorkuta GTS												
21:21:57	01:53:47	End of visibility from Narian-Mar GTS												
21:22:00	01:53:50		FM2	Transfer orbit parameters (forecast 0)										
21:22:00	01:53:50		FM3	MetOp-A separation orbit parameters (forecast 0)										
21:23:00	01:54:50		VOICE	Russian GTS completed reception of Fregat TM data										
21:25:00	01:56:50		VOICE	Information about the 3rd burn										
21:26:00	01:57:50		VOICE	Information about the 1st and 2nd burns										
21:30:00	02:01:50		VOICE	MetOp-A separation time										
21:35:00	02:06:50		FG9	Information on the MetOp-A separation										
21:35:00	02:06:50		FG3-2	Information about the 1st burn										
21:35:10	02:07:00		FG4	Information about the 2nd burn										
21:38:00	02:09:50		VOICE	Information about the 3rd burn										
21:43:00	02:14:50		VOICE	MetOp-A separation orbit parameters										

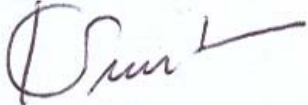




Fregat flight timeline (4/4)

Time		Event / Operation	Report type	FCC report content	Ground stations					
DMT	from Lift-off				Plesetsk	Vorkuta	Narian-Mar	Baikonur	Schelkovo	Khimky
POST FLIGHT INFORMATION										
21:43:00	02:14:50		VOICE	Fregat atmosphere re-entry orbit parameters						
21:43:10	02:15:00		FG5	Information on the 3rd Fregat burn - deorbitation						
21:43:10	02:15:00		FM3	Fregat separation orbit parameters (forecast 1)						
21:43:10	02:15:00		FM4	Fregat separation orbit parameters (forecast 1)						
21:48:00	02:19:50		FG7	S/C separation orbit state vector (forecast 1)						
21:48:00	02:19:50		FG6j	Separation orbit parameters (forecast 1)						
21:48:00	02:19:50		FG6	Fregat separation orbit parameters (forecast 1)						
21:48:00	02:19:50		FG8	Attitude at separation (not issued in nominal case)						
21:52:51	02:24:41	Fregat atmosphere re-entry								
21:54:00	02:25:50		VOICE	Fregat re-entry orbit parameters						
22:08:00	02:39:50		FM2	Transfer orbit parameters (forecast 1)						
22:08:00	02:39:50		FG6	Transfer orbit parameters (forecast 1)						



Signatures

Written by :	Verified by:
<p>Name: Vladimir KOTINE Function : Fregat FMC Manager Date: July 15, 2006 Signature:</p> 	<p>Name: Luce FABREGUETTES Function : MetOp Mission Manager Date: July 15, 2006 Signature:</p> 
Quality :	Authorized by :
<p>Name: Jean-Yves MOALIC Function : VP Quality Date: July 15, 2006 Signature:</p> 	<p>Name: Pascal CLAUDEL Function : VP Technical Date: July 15, 2006 Signature:</p>  <p>Name: Marc GROSHEITSCH Function : VP Missions Date: July 15, 2006 Signature:</p> 