

ROSETTA AND PHILAE OPERATIONS TIMELINE AROUND COMET LANDING 11-12 NOVEMBER 2014

Note: All times are subject to change and should not be assumed confirmed. Actual times may vary considerably. Please follow ESA TV, the Rosetta website, the Rosetta blog and ESA social media for the latest updates. All are linked via <http://rosetta.esa.int>

OWLT 00:28:20 Earth dis 511 Mkm
CET Offset 01:00:00

Date	UTC at spacecraft	UTC on Earth	CET on Earth	DSN	DSN	ESA	ESA	Event
11/11		01:48:49	02:48:49			NNO		BOT ESA New Norcia (NNO)
11/11		03:10:00	04:10:00					BOT NASA DSN Canberra
11/11		12:25:00	13:25:00					EOT Canberra
11/11		13:40:00	14:40:00		DSS4			BOT DSN Madrid
11/11		13:58:05	14:58:05				MLG	BOT ESA Malargüe (MLG)
11/11		14:00:00	15:00:00					Flight Dynamics Team at ESOC begin orbit determination procedure to accurately fix Rosetta's precise trajectory
11/11		14:30:17	15:30:17			NNO		EOT ESA NNO
11/11	18:05:00	18:33:20	19:33:20					Lander switch-on. Includes switching on Electrical Support System, which controls orbiter communication interface with the lander
11/11	18:37:00	19:05:20	20:05:20					Lander batteries and compartment heating ADS Tank (Active Descent System - provides cold gas thrust upwards to avoid rebound upon landing) opening
11/11	18:57:00	19:25:20	20:25:20					Lander Primary Battery conditioning start; about 28 mins
11/11		19:00:00	20:00:00		DSS4			EOT DSN Madrid
11/11		19:30:00	20:30:00					GO/NOGO1 - Last full orbit determination; ESOC Flight Dynamics confirms Rosetta trajectory is correct
11/11		20:03:00	21:03:00		DSS25			Rosetta starts slew to pre-delivery manoeuvre attitude (expected loss of signal)
11/11		20:20:00	21:20:00		DSS25			BOT DSN Goldstone
11/11		20:43:00	21:43:00					End of Rosetta slew
11/11	20:24:00	20:52:20	21:52:20					Start Lander flywheel operation - provides stability during descent
11/11		23:25:00	00:25:00					BOT DSN Goldstone
11/11		23:40:00	00:40:00		DSS45			BOT DSN Canberra
12/11		00:00:00	01:00:00		DSS25			EOT DSN Goldstone
12/11		00:00:00	01:00:00					GO/NOGO 2(a) - Telecommands to control delivery sequence are ready GO/NOGO 2(b) - ESOC confirms Rosetta is ready
12/11	00:35:00	01:03:20	02:03:20					Lander generates final TM on-board prior to GO/NOGO for SEP decision
12/11		01:35:00	02:35:00					GO/NOGO 3 - Confirm Philae is ready for landing
12/11		01:46:10	02:46:10			NNO		BOT ESA New Norcia
12/11		03:02:50	04:02:50				MLG	EOT ESA Malargüe
12/11	03:35:00	04:03:20	05:03:20					Start of Separation, Descent & Landing (SDL) activities on Philae Start switching Lander instruments ON; ROMAP first

Date	UTC at spacecraft	UTC on Earth	CET on Earth	DSN	DSN	ESA	ESA	Event
12/11	04:00:00	04:28:20	05:28:20					Earliest possible start of ROS slew into manoeuvre (MVR) orientation
12/11	04:06:00	04:34:20	05:34:20					Start heating Lander batteries to separation temperature
12/11	05:35:00	06:03:20	07:03:20					Earliest start Rosetta pre-delivery manoeuvre <i>Burn will be followed by loss of signal due to subsequent slew for separation</i> <i>Manoeuvre expected to be about 0.46m/s & about 6 mins duration</i>
12/11		06:35:00	07:35:00					Earliest GO/NOGO 4 - final decision to go for landing
12/11	06:35:00	07:03:20	08:03:20					Latest start Rosetta pre-delivery manoeuvre
12/11		07:35:00	08:35:00					Latest GO/NOGO 4 - final decision to go for landing
								<i>Following MVR, ESOC Flight Dynamics conducts rapid assessment of MVR performance to verify burn results</i>
12/11	07:21:00	07:49:20	08:49:20					Switch on MUPUS
12/11	07:24:00	07:52:20	08:52:20					Start MUPUS operation and switch-on CivaRolis ÇIVA and ROLIS are imaging systems; ÇIVA makes panoramic images, ROLIS looks down
12/11	07:27:00	07:55:20	08:55:20					Start CivaRolis operation and switch-on SESAME (dust sensor)
12/11	07:36:00	08:04:20	09:04:20					Start SESAME operation
12/11	08:18:00	08:46:20	09:46:20					Start MSS (Mechanical Support System), which executes the mechanical separation from the Orbiter
12/11	08:18:00	08:46:20	09:46:20					Separation Motors ON
12/11	08:21:00	08:49:20	09:49:20					Start CONSERT Orbiter operation
12/11	08:22:00	08:50:20	09:50:20					Start CONSERT Lander operation
12/11	08:23:00	08:51:20	09:51:20					Start MSS sequence - internal autosequence to prepare for landing
12/11	08:25:00	08:53:20	09:53:20					Lander now on internal battery power
12/11								<i>Screws in Separation Motors start to rotate and impart deployment speed to push Lander away, retrograde .21 m/s</i>
12/11	08:35:00	09:03:20	10:03:20					PHILAE SEPARATION (Forecast; 94-sec window) Separation confirmation received on ground via ESA's NNO New Norcia station
12/11	08:35:52	09:04:12	10:04:12					Lander (ÇIVA) obtains first images of Orbiter (FAREWELL1)
12/11	08:37:57	09:06:17	10:06:17					Lander (ÇIVA) obtains seconds images of Orbiter (FAREWELL2)
12/11	08:43:57	09:12:17	10:12:17					Lander / Orbiter separation distance now ~100m Earliest autodeployment of landing gear and ROMAP boom antenna
12/11	08:57:30	09:25:50	10:25:50					Lander starts rotation of 14deg to stable landing orientation
12/11	09:15:00	09:43:20	10:43:20					Rosetta performs post-delivery manoeuvre <i>Burn will be followed by loss of signal due to subsequent slew back to nominal pointing</i> <i>Manoeuvre magnitude to be determined on 12/11</i>
12/11	09:18:57	09:47:17	10:47:17					Lander completes all post-Separation activities
12/11	10:25:00	10:53:20	11:53:20					Acquisition of signal (AOS) from Rosetta Expected AOS; link with Rosetta now re-established
12/11	11:31:00	11:59:20	12:59:20					Start of stored data downlink from Rosetta & Philae
12/11	11:51:40	12:20:00	13:20:00		DS\$45			EOT DSN Canberra
12/11	12:46:40	13:15:00	14:15:00	DS\$55				BOT DSN Madrid
12/11	13:26:40	13:55:00	14:55:00				MLG	BOT ESA MLG

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12/11	13:58:40	14:27:00	15:27:00			NNO		EOT NNO
12/11	14:30:37	14:58:57	15:58:57					Switch-on Anchor & CivaRolis
12/11	14:33:37	15:01:57	16:01:57					Start imaging landing site and switch on ADS (Active Descent System)
12/11	14:38:42	15:07:02	16:07:02					ROLIS begins imaging
12/11	14:48:55	15:17:15	16:17:15					On board Lander, systems conduct final pre-touch-down operations
12/11	14:54:00	15:22:20	16:22:20					<i>Start of Lander touch-down window</i>
12/11	15:34:00	16:02:20	17:02:20					EXPECTED LANDING and receipt of signal (Forecast; 40 min variability)
12/11								Upon landing: Start post-touch-down operations; these include: ** ADS thruster fires for ~15 sec to avoid rebound ** Harpoons (X2) fire to secure Lander to surface ** Flywheel off
12/11	15:38:52	16:07:12	17:07:12					ÇIVA-P panoramic imaging on Lander obtains first images of surface and transmits same (Forecast; depends on landing time)
12/11	15:38:54	16:07:14	17:07:14					SDL (Separation, Descent & landing) science observations continue; Ptolemy & COSAC begin science gathering; data collected during descent and initial surface observations will be uploaded
12/11	16:11:19	16:39:39	17:39:39					Lander completes SDL operations; upload of science data
12/11	17:20:47	17:49:07	18:49:07					Lander begins First Science Sequence (FSS) Block 1; runs about 7 hours
12/11		19:00:00	20:00:00	DSS5				EOT DSN Madrid
12/11	18:34:40	19:03:00	20:03:00					End of Lander/Orbiter First Communication Window
13/11		01:43:00	02:43:00			NNO		BOT ESA NNO
13/11		02:59:00	03:59:00				MLG	EOT ESA MLG

BOT Begin of track
 EOT End of track
 NNO ESA - ESTRACK 35m New Norcia tracking station, Australia
 MLG ESA - ESTRACK 35m Malargüe tracking station, Argentina
 LDR Philae Lander
 ROS Rosetta Orbiter
 LCC Lander Control Centre, DLR/Cologne
 ESOC Rosetta Control Centre, ESA/Darmstadt
 ROLIS Rosetta Lander Imaging System (ROLIS): CCD imager designed to return images of the landing site before and after Philae has landed
 ADS Active Descent System (ADS) - this system emits cold gas thrust at touchdown to avoid rebound.
 BOT Indicates when station is pointing & ready. Actual acquisition of signal may come only afterwards
 DSS 25 NASA - DSN 34m Goldstone tracking station, California, USA
 DSS 45 NASA - DSN 34m Canberra tracking station, Australia
 DSS 55 NASA - DSN 34m Madrid tracking station, Spain
 DSS 54 NASA - DSN 34m Madrid tracking station, Spain
 MVR Manoeuvre - a thruster burn to change direction and or speed
 MSS (Mechanical Support System) is the lander side of Philae which executes the mechanical separation from the orbiter.
 ESS ESS (Electrical Support System) is the orbiter part of the lander. The ESS controls the orbiter communication interface with the lander. ESS itself operates as usual as power and data

Link to Lander science instruments via http://www.esa.int/Our_Activities/Space_Science/Rosetta/Lander_Instruments
 ÇIVA, CONSERT, COSAC, PTOLEMY, MUPUS, ROLIS, ROMAP, SD2, SESAME