

Call for ExoMars 2018 Landing Site Proposals

Ref: EXM-SCI-LSS-ESA/IKI-001
Version: 1.0, 17 December 2013

The European Space Agency (ESA) and the Space Research Institute of the Russian Academy of Sciences (IKI) [on behalf of the Russian Federal Space Agency (Roscosmos)] invite the scientific community to propose candidate landing sites for the ExoMars 2018 mission.

The ExoMars Landing Site Selection Working Group (LSSWG) will support ESA and Roscosmos in evaluating the proposals received, consulting with the wider scientific community, and identifying candidate site(s) for more detailed studies. The LSSWG will then formulate a recommendation to ESA and Roscosmos for the mission's landing site(s).

INTRODUCTION TO THE EXOMARS 2018 MISSION

The ExoMars Programme's scientific objectives are:

1. To search for signs of past and present life on Mars;
2. To investigate the water/geochemical environment as a function of depth in the shallow subsurface;
3. To study martian atmospheric trace gases and their sources;
4. To characterise the surface environment.

The 2018 mission includes two science elements: a Rover and a Surface Platform. The ExoMars Rover will carry a comprehensive suite of instruments dedicated to geology and exobiology research named after Louis Pasteur. The Rover will be able to travel several kilometres searching for traces of past and present signs of life. It will do this by collecting and analysing samples from outcrops, and from the subsurface—down to 2-m depth. The very powerful combination of mobility with the ability to access locations where organic molecules can be well preserved is unique to this mission. After the Rover will have egressed, the ExoMars Surface Platform will begin its science mission to study the surface environment at the landing location.

From a science point of view, a landing site satisfying the Rover mission's search-for-life requirements is expected to be also interesting for the Surface Platform.

For the ExoMars Rover to achieve results regarding the possible existence of signs of life, the mission has to land in a scientifically appropriate setting:

1. The site must be **ancient** (older than 3.6 Ga)—from Mars' early, habitable period: Pre- to late-Noachian (Phyllosian), possibly extending into the Hesperian;
2. The site must show abundant morphological and mineralogical evidence for long-duration, or frequently reoccurring, **aqueous activity**;
3. The site must include numerous **sedimentary rock outcrops**;
4. The outcrops must be **distributed** over the landing ellipse to ensure that the rover can get to some of them (typical rover traverse range is a few km);
5. The site must have **little dust** coverage.

PROPOSAL CONTENT

The response to this Call will be in the form of a *Landing Site Proposal*, not longer than six pages (A4 format, 11-pt character size), which must be compiled using the *ExoMars 2018 Landing Site Proposal Guide & Template*, following the instructions included therein.

Support Material:

- ExoMars 2018 Landing Site Proposal Guide & Template;
- ExoMars 2018 Landing Site Selection User's manual.

PROPOSAL SUBMISSION

The proposals, in PDF format (file size limit 35 MB), shall be submitted to the following e-mail address:

exomars_landing@rssd.esa.int

and must be received within **Friday, 28 February 2014 (12:00 CET—noon)**.

SCOPE

This Call is open to the international Mars science community.

The members of the Landing Site Selection Working Group (LSSWG) cannot propose landing sites or be part of landing site proposals.

LANDING SITE SELECTION PROCESS

The LSSWG will analyse the proposals received in response to the call to assess their compliance with science, engineering, and planetary protection requirements. Sites deemed to be non-compliant will be rejected and proposers informed accordingly.

Next, the LSSWG will support ESA and Roscosmos to organise a first open scientific workshop, to take place at ESTEC on 26–28 March 2014, to discuss each of the landing site proposals considered viable. The LSSWG will present the information compiled on all proposals: Sites will have received a preliminary classification in terms of science and safety interest. Proposers will be invited to present their candidate site, which will be discussed by all participants. The result of the workshop will form the basis for prioritising and narrowing down the list of candidate landing sites.

Following the workshop, the LSSWG will take into account the information presented at the workshop, plus the outcome of discussions for the various proposed sites, and the interest of participants as expressed during the workshop to produce a ranked list of candidate landing sites. No more than four sites will be shortlisted for further detailed evaluation. All of the shortlisted sites must be scientifically compelling and safe for landing (based on the available information). The LSSWG will aim to make this recommendation in time for the mission's System Preliminary Design Review (S-PDR) closeout, planned for June 2014.

Following their first recommendation, the LSSWG, with further support by Project Team, and Industry, will perform a very accurate assessment of the sites' landing safety. Likewise, the proposers and the LSSWG will continue to study the sites' science interest. Please note that the LSSWG, ESA, and IKI/Roscosmos will keep open the possibility to replace an already shortlisted site until 30 January 2015—in case one site were to prove unfeasible or if compelling new information were to make a new site particularly interesting. However, the preferred course of action would be not to have to exercise this possibility.

Other landing site workshops will follow, typically once a year. A desirable goal would be to complete the certification of a suitable (science, engineering, and planetary protection) landing site by the mission's Critical Design Review (CDR), presently planned for September 2016.

The final landing site(s) recommendation for the 2018 mission will be produced by the LSSWG prior to the mission's Flight Acceptance Review (FAR), presently planned for October 2017. This recommendation will be delivered to ESA's Director of Science and Robotic Exploration and the appropriate Russian authorities. Roscosmos and ESA will then follow the applicable approval procedure with their Governing Bodies.

Table 1 presents a tentative schedule for the entire LSS process.

Date	Activity
17 Dec 2013	Release of Call for Landing Site Proposals.
28 Feb 2014	LS Proposals due.
Feb/Mar 2014	Screening of candidate LS proposals by LSSWG.
26–28 Mar 2014	First ExoMars 2018 LSS science workshop at ESTEC.
Apr/May 2014	LSSWG prioritisation of candidate LSs (based on science, engineering, and Planetary Protection requirements).
Jun 2014	Up to four top landing locations identified by LSSWG for further, more detailed study. Aim to complete prior to PDR closure.
...	Characterisation work continues. Other science conferences help to further refine findings. Aim to have at least a site certified by CDR (planned for Sep 2016).
Oct 2017	Final LSSWG recommendation to D/SRE and appropriate Russian authorities prior to mission's FAR.

Table 1: Tentative schedule for ExoMars 2018 Landing Site Selection process.

COMPOSITION OF THE LSSWG

The LSSWG composition is presented in Table 2. Additional ExoMars Science Working Team (ESWT) members may be invited to serve in the LSSWG in case this is deemed useful. Likewise, the Project and Industry representation may change depending on the required needs.

#	Name		Expertise	Country
1	Frances Westall	CNRS-Orléans	BIOSIGNATURES/ESWT/PPWG: Preservation, ancient geology	FR
2	Howell Edwards	Bradford U.	BIOSIGNATURES: Preservation, mineralogy, Raman	UK
3	Lyle Whyte	McGill	BIOSIGNATURES: Arctic microbiology, cold drilling	CAN
4	Alberto Fairén	Cornell U.	BIOSIGNATURES: Mars hydrogeology and biosignatures	USA
5	Jean-Pierre Bibring	IAS	GEOLOGY/ESWT: Hydrated minerals, Mars history	FR
6	John Bridges	U. of Leicester	GEOLOGY: LS mapping, topography	UK
7	Ernst Hauber	DLR	GEOLOGY: Topography, layered deposits, alluvial fans	DE
8	Gian Gabriele Ori	IRSPS	GEOLOGY: Sedimentary geology, mapping	ITA
9	Stephanie Werner	U. Oslo	GEOLOGY: Dating, mineralogy, resurfacing processes	NO
10	Damien Loizeau	U. Lyon	GEOLOGY: Dating, geomorphology, mineralogy	FR
11	Ruslan Kuzmin	IKI	GEOLOGY: Ice/water processes	RUS
12	Becky Williams	IPS	GEOLOGY: Fluvial geomorphology and sedimentary processes	USA
13	Jessica Flahaut	VUAmsterdam	GEOLOGY: Mineralogy, layered deposits, mapping	NL
14	François Forget	LMD	ATMOSPHERICS: Atmospheric Modelling	FR
15	Jorge L. Vago	ESA	SCIENCE: ExoMars Project Scientist	ESA
16	Daniel Rodionov	IKI	SCIENCE: ExoMars Project Scientist	RUS
17	Oleg Korablev	IKI	SCIENCE/ESWT: IR mineralogy and atmospheric aerosols	RUS
18	Olivier Witasse	ESA	SCIENCE: TGO Project Scientist	ESA
19	Gerhard Kminek	ESA	SCIENCE/PPWG: Planetary Protection, organics degradation	ESA
20	Leila Lorenzoni	ESA	PROJECT: ExoMars EDL and landing site engineer	ESA
21	Olivier Bayle	ESA	PROJECT: ExoMars EDM systems engineer	ESA
22	Luc Joudrier	ESA	PROJECT: ExoMars Rover GNC and operations engineer	ESA
23	Viktor Mikhaylov	TsNIIMASH	PROJECT: ExoMars EDL & ground testing manager	RUS
24	Alexander Zashirinsky	Lavochkin	INDUSTRY: ExoMars EDL engineer	RUS
25	Sergey Alexashkin	Lavochkin	INDUSTRY: ExoMars DM Chief Designer	RUS
26	Fabio Calantropio	TAS-I	INDUSTRY: ExoMars EDL engineer	ITA
27	Andrea Merlo	TAS-I	INDUSTRY: ExoMars Rover GNC engineer	ITA

Table 2: Landing Site Selection Working Group (LSSWG) team composition. Science members have a yellow and orange colour background, with orange denoting also ExoMars Science Working Team (ESWT) and/or Planetary Protection Working Group (PPWG) representation. Project and Industry members are indicated in blue.