

## Request for Proposals for Payloads for the Mars One 2018 Lander



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## Introduction

Mars One is very excited to release this Request for Proposals (RFP) for the payload on the Mars One 2018 unmanned lander, which is to be launched on a journey to the surface of Mars. The information in this RFP and the associated Mars One Proposal Information Package (PIP) will give a potential proposer all the necessary information to plan and write a good proposal for a payload element on the Mars One 2018 lander. This RFP is only valid for the lander mission in 2018 and is divided into a number of different payload possibilities.

The lander will be built on the same platform that was used for the 2007 NASA Phoenix mission. It is targeted at a nominal landing latitude of 45 degrees north, though latitudes as far south as 42 and as far north as 50 may be considered. More information about the location can be found in the PIP in section 3.2.



## 1. Background

### 1.1 Mars One programmatic overview

Mars One is a not-for-profit foundation that will establish a permanent human settlement on Mars. Mars One has developed a realistic mission plan, built upon existing technologies available from proven aerospace suppliers worldwide. The mission plan consists of cargo missions and unmanned preparation of a habitable settlement, followed by human landings. In the coming years a demonstration mission, communication satellites, two rovers and several cargo missions will be sent to Mars. These missions will prepare the outpost for the arrival of the first crew of four astronauts. The mission design takes into account the expansion of the human colony where a new crew will arrive every two years.

Work on the first unmanned mission, scheduled for launch in 2018, has already started. Mars One plans to land the first crew on Mars by 2025. This ambitious schedule is possible because the crew departing to Mars go there to stay permanently. Instead of trying to bring crews back to Earth, Mars One will send additional crews every two years, establishing the first human settlement outside of the Earth.

Mars One will select and train crews of astronauts. The search for astronauts began in April 2013 in which more than 200,000 applied for this first call for future Mars inhabitants. The first footprint on Mars and lives of the crew thereon, literally the Next Giant Leap for Mankind, will inspire generations to come and will be the biggest media event in the Solar system.

In 2018, Mars One will launch a demonstration mission, which includes a lander and a communication satellite. This RFP is only for the lander payload.

### 1.2 Preparing for RFP response

All proposals participating in the opportunity described here must be submitted in response to this RFP.

This RFP contains opportunities for a number of experiments with goals that are defined in section 2.2. This RFP also includes a payload opportunity for the winning proposal entered into the Mars One university competition. Finally, there are two payload possibilities for which anyone can make random proposals. Mars One will be responsible for the selection of the instruments to fly on board the 2018 lander. In several cases, Mars One's partners and the Mars One community will be involved in the selection.

An instrument team is led by the instrument team leader who is responsible for the in-time delivery of the instrument to be integrated on the spacecraft including all the other milestone deliveries in the PIP, which accompanies this RFP.

Since the prime contractor for the lander will be Lockheed Martin, clear attention in the proposal shall be paid to any United States export control regulations which might be incurred by the proposal (see statement in section 3.6)



## Mars One 2018 lander payload opportunities

### 2.1 RFP schedule

The launch of the first Mars One lander is planned for August 2018. This sets an ambitious schedule for the delivery of the instruments to the spacecraft integrator. The first phase of the project contains the selection of the instrument. The full schedule for this phase is given below.

June 2014:	Release of Request for Proposals including Proposal Information Package
31 July 2014:	Notice of Intent submitted to Mars One
1 October 2014:	Proposal Submission to Mars One
5 January 2015:	Announcement of Selected Proposals
January 2015:	Kick-off Meetings for all Selected Instruments

The following requirements apply to this RFP:

Please address questions concerning any portion of this document to the Points of Contact provided in section 4.4, as appropriate. The period for questions will close two weeks before the proposal due date.

A Notice of Intent (NOI) to propose to this announcement is essential to Mars One and it is mandatory to submit a NOI if a proposal is submitted later. Proposals without a prior NOI will not be taken into account.

#### **Disclaimer:**

Mars One is currently in the process of securing funding for the 2018 lander mission. Any costs incurred by prospective bidders in preparing submissions in response to this notification are completely at the submitter's own risk.

### 2.2 Payload opportunities

The 2018 Mars One lander will be based on the successful 2007 NASA Phoenix lander, which was also built by Lockheed Martin. The payload mass for the lander is 44kg, allocated to the following payloads:

1. Water extraction (10kg)
2. Soil acquisition (15kg)
3. Thin film solar power demonstrator (6kg)
4. Camera system (5kg)
5. Open for random proposals (2kg)
6. Open for random proposals (2kg)
7. Educational payload (2kg)
8. Winning university experiment (2kg)



### **2.2.1 Payload 1: water extraction**

Water is the key to life and essential for permanent settlement. The water extraction experiment will produce liquid water from the water ice in the Martian soil. The soil will be collected by the soil acquisition experiment (2.2.2).

### **2.2.2 Payload 2: soil acquisition**

The main goal for the soil acquisition system is to collect soil for the water extraction experiment. No predetermined method of soil collection is defined.

### **2.2.3 Payload 3: thin film solar power demonstrator**

The thin film solar power demonstrator will demonstrate the use of thin film solar panels on Mars. Ideally, the panel will be deployed onto the surface of Mars, because the solar panels for the manned mission are used in the same way. The power produced after deployment will be used for the benefit of other payloads on the lander.

### **2.2.4 Payload 4: camera system**

Besides the normal use of cameras on different planets to date, the lander will, in combination with the Mars One stationary orbiter, be able to send a live video feed from the surface of Mars to Earth. The video feed will depend on the successful demonstration of a high bandwidth connection of the lander to the Mars One orbiter and from the orbiter to Earth.

### **2.2.5 Payload 5 & 6: random proposals**

Two payload opportunities are available for random proposals. These can be scientific experiments, technology demonstrations, corporate marketing activities or any other suggested payloads. These payload opportunities are for sale to the highest bidder.

### **2.2.6 Payload 7: educational payload**

The educational payload will be announced at a later date.

### **2.2.7 Payload 8: winning university payload**

This payload opportunity is reserved for the winners of the Mars One university competition. The university competition will be further explained in chapter 6.



## Requirements and constraints

### 3.1 Instrument leader responsibilities

The selected instrument leader shall:

1. Be the instrument primary point of contact with Mars One and its prime contractor regarding the instrument's activities and schedule.
2. Have overall responsibility for scheduling meetings and maintaining communications with Mars One mission manager and prime contractor payload manager.
3. Participate in relevant meetings and associated working groups and provide input on topics, which includes interaction with Mars One during flight operations and surface operations.
4. Generate and maintain documentation as required.
5. Establish, as appropriate, the allocation of funds through negotiation with the responsible funding entity.
6. Demonstrate that the instrument meets its agreed science/technology requirements.
7. Be responsible for data analysis.
8. Ensure that the reduction, analysis, reporting, and archival of the results of the investigation meet the highest scientific standards and completeness within budget.
9. Ensure development and readiness of tools and services that are required for scientific analysis of the instrument data.
10. Ensure the timely provision of each deliverable to Mars One.

Further requirements can be found in the PIP in section 5.

### 3.2 Cost and schedule constraints

Proposals can request funding from Mars One for the instrument or can secure partial or full funding from a different entity, whether it is private, national or governmental.

All proposals must provide letters of financial endorsement from the relevant funding sources. The proposers shall take into account the schedule for payload development in Table 5-2.1 in the PIP.

### 3.3 Technical requirement constraints

All technical requirement constraints are detailed in the PIP and each proposal shall state compliance to each of these requirements. Rare exceptions, if appropriately justified, can be discussed.

### 3.4 Data ownership

The data generated by the selected instruments is co-owned by the Instrument Team and Mars One. Mars One maintains the right to use data from the instruments in close collaboration with the Instrument Leader and its team for public relations and funding events.

Furthermore, it is required that the Instrument Leader will ensure that data from the instrument will be posted on the World Wide Web in its un-calibrated raw form within 30 days after reception of





the data from the ground station. In exceptional cases this requirement can be waived in agreement with Mars One.

### **3.5 Confidentiality**

The content of all proposals will be treated as confidential information. The content will be disclosed only to relevant Mars One team members, Mars One advisers and with the Lockheed Martin team working on the lander. Only persons under NDA will have access to the proposal content.

### **3.6 United States international export control regulations**

All payload selections for the 2018 Mission will be made in compliance with United States export control regulations as applicable to deep space missions. These regulations are currently being revised by the US Government and payload selections for future missions will be compliant with US export control regulations in effect at the time of their solicitation.



## Proposal preparation

The proposal preparation information given here is for all payloads except for the university competition.

### 4.1 Notice of intent

The NOI should include a preliminary list with the proposing team members, their affiliation and e-mail contact information, and an abstract (one page maximum) describing the instrument and its capabilities. Please refer to the NOI Template included in Appendix A of this document.

The NOI must be submitted electronically, in Word (.doc or .docx) format.

### 4.2 Proposal content

Proposal content must conform to the guidelines set forth in this RFP and in the applicable PIP.

Proposals must include:

1. An informative title such that by reading the title a person should understand the goal of the proposed investigation; plus a one-word name or acronym for the proposal.
2. A summary (one page maximum) of the proposal's scientific objectives and the means to address them.
3. The detailed affiliation and contact details of every member in the proposing team. There is no limit on the number of investigators that may take part in a proposal, provided all team members have a well-defined scientific and/or technical role.
4. A brief outline (one short paragraph per person) of the expertise that each investigator will contribute to the proposed payload.
5. The proposed instrument's scientific and technical description, including heritage and maturity, as applicable (twenty pages maximum).
6. The proposed instrument's implementation, management, schedule, collaboration arrangements, work breakdown structure, and cost table (twenty pages maximum).
7. If applicable: proposed deviations from the requirements and the PIP constraints.
8. If applicable: request for funding for the instrument from Mars One.
9. Letters of financial commitment from the proposal's Lead Funding Entities.
10. A section containing the curricula vitae from all team members (maximum 1 page per person).

Note: proposals must be submitted electronically as a single PDF file not exceeding 10 MB.

### 4.3 Submission requirements

#### 4.3.1 NOI submission

The submission of the NOI shall be done in PDF and sent to [noi@mars-one.com](mailto:noi@mars-one.com). The submission deadline is 1<sup>st</sup> of September 2014 at 12:00 PM Central European Time.

The size of the NOI shall not exceed 100 KB.



#### 4.3.2 Proposal submission

The submission of the proposal shall in PDF format and sent to [proposal2018@mars-one.com](mailto:proposal2018@mars-one.com).  
The submission deadline is 30 November 2014 12:00 PM Central European Time.

The size of the proposal shall not exceed 10 MB.

#### 4.4 Questions / point of contact

All questions related to this RFP and PIP shall be directed to [2018lander@mars-one.com](mailto:2018lander@mars-one.com).  
Mars One will strive to answer your questions within five working days.

No correspondence is possible after the selection of the payload and Mars One will also not debrief proposers whose proposal were not selected.



## Proposal evaluation and election

### 5.1 Evaluation / selection process

The evaluation process will be performed by Mars One in close collaboration with its prime contractor and specific advisers of Mars One. Mars One might also invite scientists and engineers from space agencies to assist in selecting the final payload complement. Information in the proposals will be treated as proprietary information.

### 5.2 Selection criteria for all payloads

The following requirements are important for all payloads:

- It is expected that the proposals will contain an instrument with a full compliance list to all the requirements in the PIP. Mars One will be extremely rigid regarding allowing non-compliances, as this will lead to an increase of overall cost of the mission. Well justified non-compliances that create a real new opportunity for doing science on Mars or leading to a significant technology demonstration will be discussed between Mars One and the prime contractor, however Mars One will maintain the right to disapprove the non-conformance. The requirements for integrating the payload in the lander can be found in the PIP, sections 3.3.2.1 – 3.3.2.8.
- Maturity: the time line for the development of the payload as given in Table 5.2-1 leaves two years for payload development. A high maturity payload will have strong potential of being selected over lower maturity instruments.

### 5.3 Additional selection criteria for payload 1 - 4

The following criteria are important and shall be noted by potential proposers.

For the 'defined' payloads 1 - 4 described in section 2.2, the important criteria are:

- Funding: Mars One is willing to fund development of the instrument, but proposals that are able to secure their own funding are preferred. Proposals need firm Letters of Commitment for any funding that is not expected to come from Mars One.
- Budgets: proposals with smaller mass and power budgets will be favored.

#### 5.3.1 Selection criteria for payload 1: water extraction

Selection criteria for the water extraction experiment are:

- Proposers are invited to cooperate with other entities for proposals for payload 1 & 2 that are matched to one another. Proposers are also allowed to submit one proposal for a combined payload 1 & 2 that performs the tasks of soil acquisition and water extraction.
- Mars One would like to show the world liquid water waiting for the first humans. Proposals are invited to produce up to 0.2 liters of water. Smaller amounts of water are also allowed as of a minimum of 0.05 liters.
- The liquefied water shall be visualized by a camera. This can be either the camera of payload 4 or a separate camera. The resolution should be at least 1920 x 1080 pixels. Additionally, the liquefied water should be detected by at least one other sensor.



- The water extraction shall take 4 months or less. Shorter extraction periods are favored.
- Additional planetary protection issues may arise because of the production of liquid water. Proposals will explain how the risks related to planetary protection will be mitigated.
- Proposals will assume that the soil will be delivered in grinded form in up to 10 batches over a period of 4 months or less. Soil components can be assumed to be smaller than 5mm in diameter.

### **5.3.2 Selection criteria for payload 2: soil acquisition**

Selection criteria for the water extraction experiment are:

- Proposers are invited to cooperate with other entities for proposals for payload 1 & 2 that are matched to one another. Proposers are also allowed to submit one proposal for a combined payload 1 & 2 that performs the tasks of soil acquisition and water extraction.
- Soil acquisition shall take 4 months or less.
- Soil shall be delivered to the water extraction experiment in grinded form with no components larger than 5 mm in diameter.
- Proposers are asked to specify the depth of the digging and an explanation outlining why this depth is suitable for the water extraction as outlined in 5.3.1.

### **5.3.3 Selection criteria for payload 3: thin film solar power demonstrator**

Selection criteria for the thin film solar power demonstrator are:

- The thin film solar panel shall be deployed on the Martian surface
- High power production is favored
- The minimum surface area of thin film solar panel should be greater than 1m<sup>2</sup>

### **5.3.4 Selection criteria for payload 4: camera system**

Selection criteria for the camera system are:

- Take 360 degrees panoramas
- Provide stereo imagery of the sample acquisition workspace
- Image the sun at some point between the hours of 10 AM and 2 PM local true solar time
- Image the water extraction instrument
- Descent imagery is desired, but not required
- A camera head that can be mounted on the sample acquisition system is desired

## **5.4 Additional selection criteria for payload 5 & 6**

The following criteria are important and shall be noted by potential proposers.



For the random payloads 5 & 6 as described in section 2.2, the following criteria are important:

- **Funding:** payload opportunities 5 & 6 are for sale to the highest bidder; a financial contribution to Mars One beyond the cost of the payload or instrument. The proposal shall be backed by a letter of commitment of the funding body, which includes the agreement to fund the payload or instrument if the proposal is selected. The level of commitment of the funding body will be an important factor in the evaluation as the 2018 mission schedule does not allow Mars One to replace payloads whose funding falls away due to low level of commitment.
- **New:** proposed payloads that promise to perform new science or new technologies will be strong contenders as Mars One seeks to improve the understanding of Mars in general.

### **5.5 Payload 7, the educational payload is not discussed in the RFP**

### **5.6 Payload 8, university competition**

The selection criteria are discussed in chapter 6

### **5.7 Final selection**

The final selection of the payload of the 2018 Mars One lander will be announced on the 5th of January 2015 through a press release at 15:00 CET. Winning proposing teams shall be notified before 12:00 PM CET on 5th of January 2015.



## Mars One university competition

### 6.1 Introduction

Mars One wishes to inspire students to increase their interest in science & technology related topics. What better way than to include students in Mars exploration? For this reason Mars One organises two competitions: one for university teams and one for high school students. The competition for high school students will be announced later.

### 6.2 Mars One university competition

A 2 kg payload opportunity is available for the winner of the university competition. Proposals can be for scientific experiments, technology demonstrations, marketing or publicity stunts or any other topic. Proposals that are insulting, discriminating or otherwise not desired by Mars One will not be allowed to participate in the competition. Proposals that are meant for advertisement can be exempt from participation at Mars One's discretion. The proposals can be submitted here: [community.mars-one.com/university-competition](http://community.mars-one.com/university-competition). By filling out the following initial form the proposer will receive access to the proposal submission form.

For the university competition, the winning payload can be active and therefore has to adhere to the same requirements in the PIP as all the other payloads.

For both competitions, Mars One will fund the following items:

- Travel and hotel for 2 persons for an introduction workshop to be held in February 2015 (TBC)
- Travel and hotel for 10 persons for the launch of the 2018 Mars One lander

Mars One will not fund the following elements:

- Payload design, development, manufacturing and testing

The selected teams will have to adhere to the schedule in Table 5-2.1 of the PIP.

### 6.3 Schedule

1 <sup>st</sup> of August 2014:	Submit online application (round 1)
1 <sup>st</sup> of September 2014:	Round 2 university teams selected by popular vote of Mars One community
1 <sup>st</sup> of November 2014:	Full proposals submitted
1 <sup>st</sup> of December 2014:	Mars One announces eligible proposals, see 6.4. The resulting proposals can be voted on
5 <sup>th</sup> of January 2015:	Winner selected by popular vote of Mars One community



## 6.4 Feasibility selection criteria

Proposals will be judged by Mars One for their adherence to the following requirements:

- Constraints: the proposal must meet the constraints set in the PIP (mass, power, size, etc.) The requirements on the university payload can be found in the PIP, section 3.3.2.8;
- Funding: proposals need a detailed budget estimate and firm Letters of Commitment for funding the budget;
- Maturity: the timeline for the development of the payload as given in Table 5.2-1 leaves two years for payload development. A high maturity payload will have strong potential of being selected over lower maturity instruments;
- Technical capabilities: proposals need support from a university professor. Mars One recommends proposing teams to seek assistance from aerospace companies.

Note: Mars One will only select proposals for their likelihood to be able to finish the experiment in time. The topic of the payload will not influence Mars One's decision.

## 6.5 Selection of winner by voting

The winning payload is determined exclusively by the Mars One community platform. All members of the Mars One community can vote for one participating university team. Each vote results in points for the university team, which is equivalent to the supporter points the community member has collected on the Mars One community platform. The team that collects most points from the Mars One community members wins.

Proposals are allowed and encouraged to garner support from the Mars One community platform.





## Appendix A: Notice of intent template

The following template shall be used for the NOI to describe the key characteristics of the potential instrument for the first robotic lander of Mars One. The same table will be required in the final proposal with updated values and information.

Instrument Title	<i>Title of the instrument being proposed</i>
Overall goals and justification of instrument	<i>Description of how the potential payload addresses the advancement of the human exploration of Mars and how it helps the overall Mars One goal of landing humans on Mars in 2025.</i>
Working principle	<i>Description of the technique employed and the technology implemented in the proposed payload.</i>
Mass	<i>The mass of the proposed payload element, including applied maturity margin.</i>
Volume	<i>The volume and dimensions of the proposed payload, including applied maturity margin.</i>
Data	<i>The data rate expected from the proposed payload.</i>
Power	<i>The power of the proposed payload, including applied maturity margin.</i>
Operations	<i>Key aspects of the operational cycle.</i>
Driving requirements	<i>The instrument requirements of the instrument towards the lander.</i>
Current maturity (TRL) estimate	<i>The current Technology Readiness Level (TRL) of the concept (1-9). Include a brief description of the necessary steps and effort required to achieve TRL 9 in 2016. Also provide information on heritage from previous flown instruments when relevant.</i>
Preliminary accommodation	<i>Key accommodation issues (e.g. need for access to surface).</i>
Proposed funding scheme	<i>Description of how the proposed payload will be funded, including costs for delivery of flight model and operations support for up to 6 months of mission duration on the surface of Mars.</i>
Anticipated risks	<i>Description of the key risks for the lander if applicable.</i>
Additional Information	<i>Any other information deemed necessary by the proposer.</i>
PROPOSER DETAILS	
Name	
Address and affiliation	
Email Address	
Contact telephone	

