

EUROPEAN SPACE AGENCY

ROBOTIC EXPLORATION

TECHNOLOGY PLAN

Addendum to November 2011 Programme of Work 2009-2014

This document is an addendum to the November 2011 Programme of Work and includes new activities in the Exploration Technology Programme (ETP, funded by MREP) that are supporting the implementation of ESA's Robotic Exploration Programme from 2009-2014.

**This document is provided for information only and is subject to future updates.
June 2012**

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Scope

This Robotic Exploration workplan update

This technology plan update is a minor addendum to the full Robotic Exploration workplan that was approved in November 2011 (ESA/PB-HME(2011)60 and ESA/IPC(2011)138) which defined the activities that are being implemented in 2012.

This addendum is being submitted for approval of a few activities that have been defined to complete satisfactorily the MREP ETP budget geo-return to the Participating States before the end of 2012. As for the previous plans, the list of activities was built using the ESA TECNET (TECHnology NETwork) process, in coordination with activities planned in other Directorates in particular HSO, and using for the best the industrial and internal studies achieved so far for future Mars missions.

The next full update of the Robotic Exploration Technology Workplan is anticipated to be prepared following the C-Min (2012).

Annex I:
List of new and modified ESA Robotic Exploration Technology Development Activities

Summary of new and modified activities seeking approval for 2012 implementation

| Prog. | IPC Appr. | ESA Ref. | Activity Title | Budget | | | | PP | C'try | SW Clause applicab. | Remarks |
|--------------|-----------|------------|------------------------------------------------------|----------|----------|------------|----------|------|-------|---------------------|----------------------------------------------------------------------------------|
| | | | | 2010 | 2011 | 2012 | 2013 | | | | |
| ACP | IPC | A923-001FI | Extremely low power timer board EM for landers - CCN | 0 | 0 | 280 | 0 | DN/C | AT | NA | CCN to running activity E901-001ED with RUAG (AT) |
| ETP | IPC | E918-001MP | Subsonic parachute trade-off and testing - CCN | 0 | 0 | 350 | 0 | DN/C | UK | NA | Only phase 1 (130kEuros) intended for 2012 of which 120k is intended for Canada. |
| ETP | IPC | E905-017FT | Accelerometer to TRL5 - CCN | 0 | 0 | 300 | 0 | DN/C | CH | NA | |
| Total | | | | 0 | 0 | 930 | 0 | | | | |

Annex II:
**Detailed description of new and modified ESA Robotic
Exploration Technology Development Activities**

| Extremely low power timer board EM for landers - CCN | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--------------------|---------------------------|-------------------------------|------|
| Programme: | ACP | | Reference: | A923-001FI | |
| Title: | Extremely low power timer board EM for landers - CCN | | | | |
| Total Budget: | 280 | | | | |
| Objectives | | | | | |
| ASIC development and manufacturing of an extremely low power timer EM for Mars landers | | | | | |
| Description | | | | | |
| <p>In an on-going activity with RUAG Austria an extremely low power timer EM for Mars landers, realised as a discrete solution, is under development (E901-001ED). This discrete concept is expected as a reliable and conservative solution. The aim of the proposed CCN is to develop in parallel an ASIC solution for the extremely low power timer.</p> <p>If it would be possible to have the same function and reliability with an ASIC instead of a discrete solution this would give a large reduction of size and mass. For higher TRL levels an ASIC gives also the option to include the timer function on the onboard computer board instead of on an own board which would result in an additional reduction of mass and size.</p> <p>This activity will consist of:</p> <ul style="list-style-type: none"> - Design Trade Offs and Preliminary Design with respect to (non-exhaustive): power consumption, reliability, radiation hardness, level of integration (e.g. internal or external switcher transistor), form of redundancy - Detailed Design - Test Plan - ASIC Manufacturing - Breadboard Manufacturing - Test Set-Up, Test and Reporting - Activity Synthesis | | | | | |
| Deliverables | | | | | |
| Breadboard, a few ASICs, Documentation | | | | | |
| Current TRL: | 2 | Target TRL: | 4 | Application Need/Date: | 2015 |
| Application Mission: | All Mars missions | | Contract Duration: | 15 | |
| S/W Clause: | NA | | Reference to ESTER | | |
| Consistency with Harmonisation Roadmap and conclusion: | | | | | |
| N/A | | | | | |

| Subsonic parachute trade-off and testing - CCN | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------|---------------------------|-------------------------------|------|
| Programme: | ETP | | Reference: | E918-001MP | |
| Title: | Subsonic parachute trade-off and testing - CCN | | | | |
| Total Budget: | 350 | | | | |
| Objectives | | | | | |
| Development of a particle imaging velocimetry (PIV) system for enhanced subsonic wind tunnel testing and testing campaign with additional subsonic parachute designs for Mars missions. | | | | | |
| Description | | | | | |
| <p>This CCN to the running TRP activity (T918-001MP) is intended to develop a system for Particle Imaging Velocimetry (PIV) at the Canadian National Research Council (CNRC) subsonic wind tunnel, in order to enhance the quality of the test data that could be achieved for the development of subsonic parachutes for Mars EDL.</p> <p>The activity is divided into two phases:</p> <p>Phase one: Development of the PIV for the subsonic wind tunnel.</p> <p>Phase two: Production of a few parachute(s) with existing designs but using a material which changes color with strain to visualize the stress distribution, and test in CNRC (where the PIV will be available). Further tests (including design and manufacture) with different parachute type(s) than the one presently foreseen in the subsonic test campaign shall also be included.</p> | | | | | |
| Deliverables | | | | | |
| Fully functional PIV system, scale-model parachutes, test data and documentation | | | | | |
| Current TRL: | 2 | Target TRL: | 4 | Application Need/Date: | 2015 |
| Application Mission: | Mars surface missions | | Contract Duration: | 18 | |
| S/W Clause: | NA | | Reference to | | |

| | | | |
|---------------------------------------------------------------|--|--------------|--|
| | | ESTER | |
| Consistency with Harmonisation Roadmap and conclusion: | | | |
| N/A | | | |

| | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------|---------------------------|-------------------------------|------|
| Accelerometer to TRL5 – CCN | | | | | |
| Programme: | ETP | | Reference: | E905-017FT | |
| Title: | Accelerometer to TRL5 – CCN | | | | |
| Total Budget: | 300 | | | | |
| Objectives | | | | | |
| Additional testing of accelerometer component to achieve TRL 5/6. | | | | | |
| Description | | | | | |
| This CCN is intended to cover additional testing (and possible ASIC and/ or packaging modifications if required) of an accelerometer component that is being developed in an MREP activity (E905-016EC). | | | | | |
| The testing shall include: | | | | | |
| 1) Thermal environment for space and Mars entry | | | | | |
| 2) Mechanical environment of launch, transfer and planetary EDL. | | | | | |
| 3) Life testing (thermal cycling + high temperature accelerated life) | | | | | |
| 4) Constructional analyses | | | | | |
| By the end of the activity, a pre-qualification level of the accelerometer component should be achieved. | | | | | |
| Deliverables | | | | | |
| Tested accelerometer components, documentation | | | | | |
| Current TRL: | 5 | Target TRL: | 5/6 | Application Need/Date: | 2015 |
| Application Mission: | All exploration missions | | Contract Duration: | 9 | |
| S/W Clause: | NA | | Reference to ESTER | | |
| Consistency with Harmonisation Roadmap and conclusion: | | | | | |
| N/A | | | | | |

Annex III

Justification for Proposed Tendering Procedure

**Justification for Proposed Tendering Procedure: DN/C
Industrial Policy Committee**

| ESA Reference | Title | Firm Fixed Price (Keuro) | Proposed Bidder |
|---------------|------------------------------------------------------|--------------------------|-----------------|
| A923-001FI | Extremely low power timer board EM for landers - CCN | 280 | RUAG (AT) |

Justification:

Further development of on-going work in the MREP Extremely low power timer board EM for landers (E901-001ED) activity (300 kEuros) for work on an ASIC implementaton of the current discrete design.

**Justification for Proposed Tendering Procedure: DN/C
Industrial Policy Committee**

| ESA Reference | Title | Firm Fixed Price (Keuro) | Proposed Bidder |
|---------------|------------------------------------------------|--------------------------|-----------------|
| E918-001MP | Subsonic parachute trade-off and testing - CCN | 350 | Vorticity (UK) |

Justification:

Extension of wind-tunnel test capabilities to support further development of subsonic parachute designs for Mars landings in the frame of the running TRP activity T918-001MP Subsonic parachute trade-off and testing (500 kEuros).

**Justification for Proposed Tendering Procedure: DN/C
Industrial Policy Committee**

| TRP Reference | Title | Firm Fixed Price (Keuro) | Proposed Bidder |
|---------------|-----------------------------|--------------------------|-----------------|
| E905-017FT | Accelerometer to TRL5 - CCN | 300 | Colybris (CH) |

Justification:

Extension of test campaign during MREP Accelerometer to TRL5 activity (700 KEuros) in order to bring component technology to TRL5/6.