

# Penetrators EJSM Newsletter

19 January 2011

This newsletter is focused on potential penetrator inclusion on the proposed ESA/NASA EJSM mission of interest to contributors and supporters for a surface element on Europa. Its purpose is to summarize our activities to date, our current status with the mission, and our possible and desired future directions.

I hope you find it informative and useful, and we can bring our aspirations to a successful conclusion through the many uncertainties and hurdles that exist.

## General background

The Penetrator consortium was originally formed of UK members around the MoonLITE proposal to emplace 4 penetrators on the Moon. Though financial events (internally and worldwide) prevented this, a LunarEX proposal was made to ESA (though unsuccessful as were all such lunar proposals), and late last year a new proposal called 'LunarNET' was submitted in response to the new ESA M3 opportunity. This took advantage of the new knowledge that arose from the penetrator system study last year, and the new knowledge of the Moon – in particular the LCROSS detection of water in a polar lunar crater. As a search for such water was previously proposed for MoonLITE and LunarEX, this provided substantial credence to our original proposals aims. One particular aspect of LunarNET - the corollary of detecting associated volatiles in these craters, which could be of astrobiological interest, is an exciting prospect, also relevant to Europa.

Other potential penetrator applications include Mars (both astrobiology from deeper under the surface than current missions, and seismology not affected by surface winds); Titan; other niche Lunar applications; and adoption of extremely rugged and low mass technology to hard landers. These potential applications are relevant to our Europa aspirations, as they all help to drive forward development of the penetrator technologies.

In context, Penetrators remain a potential new cost effective planetary subsurface exploration tool for a wide variety of solar system bodies which can address science of the highest priority not possible from orbit; a generator of interest for upcoming careers in science and space engineering; the consequent drive to extremely rugged and low mass technology appropriate to application to other space utilisation including for example for hard landers, and also for earth based applications.

## Last Year

Major activities last year included:-

1. The culmination of the successful penetrator system study, initiated by the UK and implemented by ESA.
2. The penetrator (DOI) instruments study activities and subsequent reports generated for the ESA EJSM assessment study.
3. Preparation and submission of the LunarNET M3 proposal to ESA.
4. Preparation and submission of an FP7 proposal to study power system for penetrators.
5. Presentations at national and international venues including publication of scientific papers, including our 'Penetrators for in-situ sub-surface investigations of Europa' paper

**These involved a vast amount of work by many people, who I give hearty thanks to here.**

### **The immediate Future**

We expect a new ESA ITT focused on impact survival of penetrator instruments and associated penetrator support elements to start mid-year, and hope that our main aspirations to Europa can move nearer to realisation in the face of the many uncertainties of missions downselection and mission level funding and schedules. We also hope that the seeds sown in 2010 may begin to germinate which include opportunities for Mars, Moon, and Titan.

Events and activities expected this year include :-

- Announcement of opportunity for instruments for NASA JEO spacecraft expected around April.
- Agreement of collaboration between JPL and UK for penetrator/hard lander technologies.
- Preparation of a proposal for penetrators as an add-on the JEO (April start ?)
- Downselect of L-class ESA mission in June this year, which affects EJSM-JGO.
- ITT from ESA for impact survival of penetrator instruments and support elements in time to commence mid-year (800k Euros).
- Results from ESA LunarNet proposals
- Potential re-submission of the penetrator power system proposal, if an applicable EU framework-7 opportunity arises.
- Continuing conferences support; strategic development for future penetrator developments focused on funding to bridge existing gaps; and responses to arising opportunities.

### **Confidentiality**

The considerable international growth of the penetrator consortium has been very welcome, though has outgrown the original UK non-disclosure agreements (NDAs), with the need to protect confidential information from externally outside the consortium, and within the consortium where e.g., there may exist competition between candidate instruments.

This may mean some restrictions on information distribution within the consortium, which we will consider on a case-by-case basis as they arise. Should it be necessary, we could consider adopting a straightforward NDA.

However, engagements with ESA will be covered by standard ESA confidentiality rules.

### **Penetrators for Europa (Cosmic Visions)**

Though penetrators are not part of the baseline for the EJSM mission proposal (Europa-Jupiter System Mission) we believe our lobbying efforts have contributed to a considerable high level U.S. support for a Europa Surface Element. Though scientifically valuable, a penetrator for Ganymede would exceed the current JGO (Jupiter-Ganymede Orbiter) mass budget.

Our current thinking is that potential inclusion of a penetrator on the NASA JEO spacecraft should be as a mission add-on (similar to Huygens) rather than as a response to the upcoming instruments AO expected around April this year. For a comparison, a 2-penetrator mission to Europa would require around a factor 5 less mass than Huygens Probe; have a x30 greater lifetime; and a greatly increased potential scientific return.

Penetrators are one element of possible collaboration between NASA (JPL) and UK discussed at a UK meeting late last year for which we await developments. We also note that JPL have been undertaking studies of an alternative hard lander concept, which avoids uncertainties of a successful penetrator impact into a largely unknown and potentially rough terrain. This is an important issue for a Europa penetrator which needs to be addressed urgently.

The current UKSA budget is insufficient to fund a complete penetrator surface element, but could fund some UK penetrator instruments. This therefore provides greater opportunities for inclusion of non-UK European and U.S. instruments. We have suggested ESA to consider adoption and funding of the Penetrator Delivery System.

Funding for the successful penetrator system study last year was initiated by the UK and implemented via ESA from ESA UK under-return funding, and a further similar arrangement is expected this year focused on impact survival of the scientific instruments and penetrator support systems. Timing of this is unclear but is expected to commence around the middle of the year preceded by the ITT.

Other penetrator elements also require funding, for which contributions could arise from a JPL/UK collaboration. A European Union Framework-7 bid involving UK, France, Ireland and Germany was prepared and submitted last year to support the penetrator power system development, but rejected due to a mistake with Excel which saw the bid amount accidentally exceed the 2M Euro limit. If another opportunity arises, this proposal could be re-submitted this year.

A major challenge this year for penetrator inclusion on JEO is to have in place the necessary high level agency agreements and a secure funding path established in time for the expected JEO AO currently expected in April this year. To achieve this, any NASA/JPL and UK collaborations will need to be clarified beforehand.

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