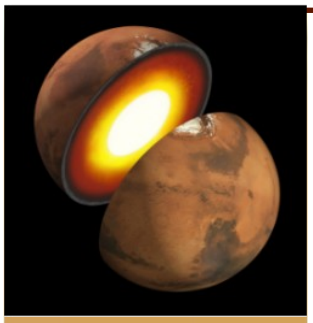
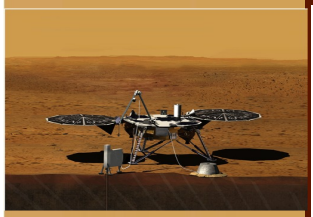


Newsletter

APRIL 2013

Let's keep in touch with InSight Mission !

N°2



CONTENTS

Editorial	1
SEIS-SP: Silicon in for a shock	1
SEIS Acquisition & Control Electronics and Electronics Box	2
SPH VBB, on the right track	2
ISAE: SEIS science performance management	3
From JPL: things are going well	3
2013, a crucial year	4
A muscle machine for LVL's linear actuator	4
Upcoming Events	4

Editorial

Review Pyramid ?

Only 2 years, 11 months to launch! 2013 will be a critical year for InSight (as will, of course, be 2014, 2015,…). In August, we will hold the PDR (Preliminary Design Review) for the mission. This review will establish whether our design, which must be completely determined by that time, is sound. The results of this review will be reported to NASA and will form the basis of their Confirmation Review in September, during which the decision will be made whether InSight will proceed from "formulation" to development. It is only then that InSight becomes a "real" mission. But the mission PDR collects the results of element PDRs (e.g. spacecraft, payload, operations); the element PDRs collect the results of the sub-system PDRs (e.g. the various instruments as part of the payload); and many of the sub-systems have sub-sub-system PDRs (e.g. the VBB, SP, Ebox, and leveling systems for SEIS). So this "pyramid" of reviews has to begin in earnest this month and continue with almost no break through the summer. This means that very little can be changed after this spring – the decisions we make now must be wise, as we will have to live with them for the life of the project!

Bruce Banerdt
InSight Principal Investigator
JPL

SEIS-SP: Silicon in for a shock

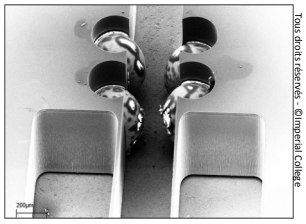
The SEIS-SP team, at Imperial College London and Oxford University, are now running at full strength, with funding from the UK Space Agency now secured for InSight. At the heart of the SEIS-SP microseismometer is the delicate silicon suspension which will pick up vibrations from Martian seismic activity.

There has been over a decade of work on refining our microseismometer suspension design. Unlike the VBB, where the springs can be formed from metal using a wide range of three-dimensional geometries, we machine our suspensions in a single step that can only break up the silicon wafer with vertical slices. Although we can make those slices curved and very thin, down to 20 µm across, we still have to design all the mechanical parts of our microseismometer to be fabricated in a single step.

The first silicon suspensions designed for the InSight mission are now emerging from microfabrication at Imperial College. We need to make them not only sensitive to pick up a very small acceleration of one nano-g or less, they also have to withstand shocks of up to 2 kilo-g, a range of more than twelve orders of magnitude! We've introduced solder into our suspensions to form bumpers that can protect our delicate springs from these shocks.

Now we're testing these suspensions in a drop-test rig. The loud bang of impact is not good for our nerves but does mean that when InSight lands on Mars, we can be confident that SEIS-SP will be ready to start listening.

Tom Pike
SEIS SP Project Manager
Imperial College London



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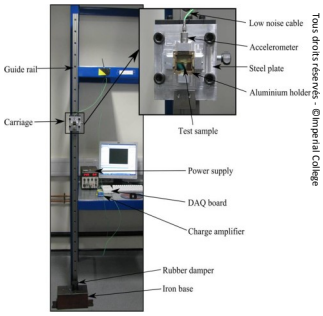
Solder bumpers



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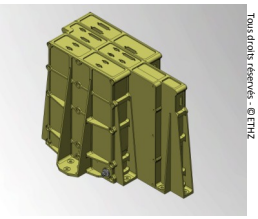
The drop-test rig

SEIS Acquisition & Control Electronics and Electronics Box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E-BOX Model in April 2013

In January 2013, Syderal SA was selected by ESA-Prodex and ETH for the industrial development of the Acquisition and Control Electronics as well as the Ebox housing. Syderal entered the project with high motivation and made substantial development progress during last two-and-a-half months. Numerous meetings and telecons between Syderal and partners helped to clarify the mechanical and electrical interfaces.

The mechanical design of the Ebox and its interfaces to the subsystems could be consolidated. Several changes were introduced as follows:

- PTW board was moved out of the Ebox (now constitutes the PAE = Payload Auxiliary Electronics).
- The leveling control electronics LVL-MDE became redundant.
- The short-period feedback board SP-FB has grown larger.
- The accommodation of the three VBB feedback boards VBB-FB needed some more volume.

Also the electrical interfaces between the sub-systems could be optimized and clarified:

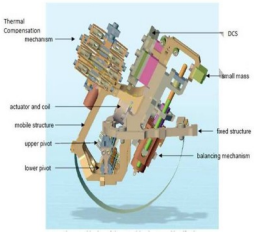
- VBB-FB interface confirmed.
- LVL-MDE with added heater functionality, supplied by SEIS-DC.
- SP-FB simplified by removal of serial interface.
- Interface to PAE (ex-PTW) reduced to the 1-Hz synchronization signal (PAE power supply and data acquisition by PDDU/C&DH).

The Ebox control, i.e. Ebox-to-C&DH SW interface and the Simu-SEIS functionality, is currently in discussion and in the process of detailed definition.

ETHZ was busy in backing Syderal by clarifying requirements and raised questions, in updating the requirements specification according the agreements and in supporting the internal ICD update issued in February.

Peter Zweifel
SEIS AC Project Manager
ETHZ

SPH VBB on the right track



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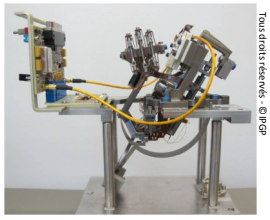
VBB Side View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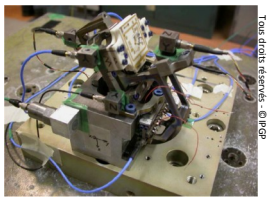
VBB5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STM Pendulum # 2

SPH VBB PDR on January 2013

As part of the InSight mission, IPGP has the responsibility of SPH VBB's subsystem. It is to be built with the help of SODERN and EREMS, French industrial suppliers located in the suburbs of Paris. Last January, a detailed design review of VBB pendulum took place at Sodern's headquarters.

The project design was presented to the review panel on the 7th of January. There followed a free discussion session between the panel and the project teams where several additional actions were identified.

The review panel's main findings:

- All teams have worked in accordance with the spatial specifications' needs.
- To avoid manufacturing risks, some actions and recommendations have been identified.
- An EQM model and a copy will be manufactured at the same time, in order to avoid AIT and qualification risks.

In conclusion, the review panel emphasized the good team spirit between CNES, IPGP, Sodern and Erems.

Test STM Pendulum # 2

Last December, SODERN evaluated the VBB pendulum mechanical behavior under vibration.

The first results were discouraging ; the pivot blades were broken and didn't endure the vibration test.

Causes of the failure were identified, corrections were made and the STM was retrofitted.

A second STM test was performed on the 24th of February, and all parts of the pivot successfully passed the vibration test.

A new stage was crossed. Next will be the performance test on the EM VBB5. Its integration is nearly finished and delivery is expected soon.

Sébastien de Raucourt
SEIS SPH VBB Project Manager
IPGP

ISAE: SEIS science performance management

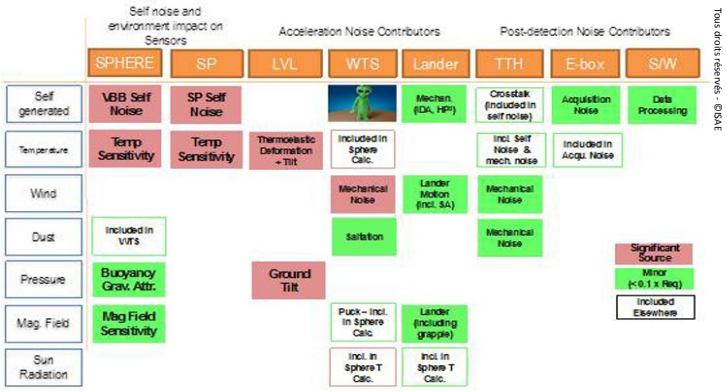
The project scientist team is under the authority of the principal investigator. His role is to be the embedded in the project team as the preferred interface for SEIS performance aspects. With respect to the project, he is in charge of:

- The validation of instrument requirements for relevant aspects of performance.
- The establishment and follow-up of the performance allocation and budgets (with the support of the "performance group ").

The ISAE team will therefore coordinate the test plans and operations of the instrument with respect to scientific performance.

The ISAE team will also contribute to the ground segment processing definition, by participating in the validation and calibration procedures.

David Mimoun
SEIS Project Scientist
ISAE



SEIS Preliminary Performance Budget

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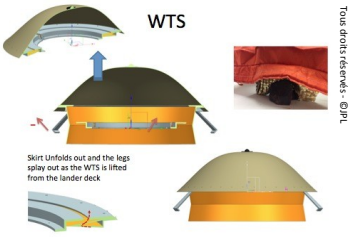
From JPL , things are going well

The WTS/TBK thermal team has identified a new way to write the thermal requirement for the 5.5 hour time constant that will allow us to maintain the time constant while separating the design of the WTS/TBK from the thermal design of the LVL and permitting subsystem testing.

The Spanish Centre for Astrobiology (CAB) in Madrid will contribute two temperature and wind sensors, called TWINS (Temperature and Wind for INSight). One will be mounted on the arm and one is fixed to the lander deck. They are identical to the REMS booms on MSL.

The tether specification is almost finished and the layout drawings for the prototype VBB tether are almost done. The VBB prototype tether will be delivered in June to support VBB-FB to VBB-PE connection. PDR season is upon us in April and May.

At JPL, we are now running the WTS/TBK team at nearly full staffing. As a result, many things are starting to happen. The picture shows the current design of the WTS and its skirt. We also have a 3D printed model of the current sensor assembly design that will be used to help design the templates for the thermal blanket enclosing the sensor assembly. We visited Paroscientific in Redmond, Washington, as part of our search for a suitable micro-barometer. We will be visiting another manufacturer (Tavis) in early January. We are examining the new capacitance requirement and its implications for the tether. The project has directed us to examine the feasibility of adding a magnetometer to the suite of environmental instrumentation.



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Kenneth Hurst
SEIS System Engineer
JPL

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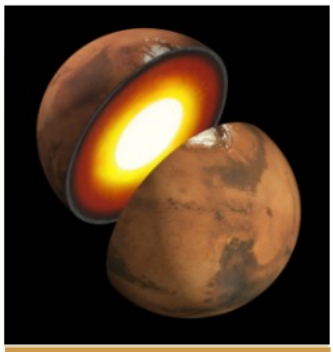

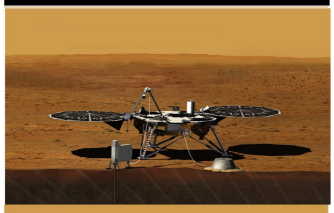

2013, a crucial year

2013 began with a successful vibe test on VBB STM.

This is a good sign for the year 2013 which will be punctuated by many challenges: VBB5 and VBB6 deliveries, integration of SEIS STM model, and beginning of engineering model integration in a new CNES facility, as we did for ChemCam.

This new clean room, specially made for SEIS, will be delivered in September. It will include an ISO5 zone for the integration of SEIS subsystems: Sphere, LVL, SP, Tether, Thermal blankets and Windshield.

Many important milestones are also on our path this year. After the VBB PDR (IPGP/SODERN) in Paris and the Project Mission System Review (JPL) in Pasadena, the Subsystems PDRs are planned in April and May :

- Wind and Thermal Shield,
- Thermal Blanket,
- Tether and storage box,
- Leveling System,
- Short Periods sensors

Then the SEIS PDR (CNES) is planned in mid-May in Toulouse. The two major PDRs after that one are the Payload PDR on July 30th and the Mission PDR on August 13th at JPL in Pasadena. The confirmation review will be held at NASA headquarters to allow us… to continue in the same rhythm!

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ChemCam CNES facility

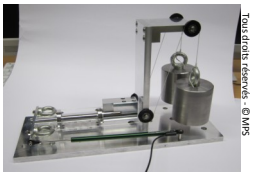
As you see, 2013 is probably the most crucial year for the success of the project. But all reasons to reach our objectives are met: teams are highly motivated and extremely competent, partnerships enable fruitful collaborations, and people eyes are all fixed on only one goal: the delivery of SEIS flight model to JPL… Let's go!

Philippe Laudet
SEIS Project Manager
CNES

UPCOMING EVENTS	DATES 2013
SPH VBB CDR	April 08-09
LVL PDR	April 10-11
PTW BTK WTS PDR	May 01-02
EBOX PDR	May 06-07
SP PDR	May 13
SEIS PDR	May 15-16
Seismic PDR	May 27
1st SEIS Science Team	June 24
2nd InSight Science Team	June 25-26

A muscle machine for LVL's linear actuator

A lot of work was done on design and construction of work on the levelling system mechanism as well as of the motor driver electronics. The first set of parts for the structural ring and the linear actuators is currently in manufacturing. These parts aim to support both an engineering model for MPS and the structural-thermal model (STM) which shall be delivered to CNES in May. To accomplish the tests for the linear actuator, a "muscle machine" was recently developed at MPS. It is a test setup for all kinds of load tests on the legs.



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The muscle machine

Instead of having the foot to couple to the Martian ground at the end, the linear actuator is loaded here with two 2.5kg weights hanging on ropes. The picture shows a structural dummy of the linear actuator and the weights. The white rope is a Dyneema® rope, suitable for vacuum and thermal environment. The green element in front is a linear potentiometer to monitor the linear movement of the actuator. The "muscle machine" test setup shall be used very soon for the design verification and later for the life time test of the qualification model.

Progress was also made on the motor driver electronics (MDE).

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The printed circuit board

The electronics design is now prepared to move and to supervise three stepper motors upon commanding via the serial interface.

Moving forward, the design of the printed circuit board for the electronics engineering model has recently started. An EGSE (electrical ground system equipment) was already developed and assembled in the last month to provide power and a data interface to the motor driver electronics from a standard computer with any terminal program running on it as simplest command interface. Dedicated test software developed with LabVIEW is planned. The other side of the motor driver electronics, a simulator for the LVL with dummy loads for the motors and sensor replacements, is also in development.

Marco Bierwirth
SEIS LVL Project Manager
MPS

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