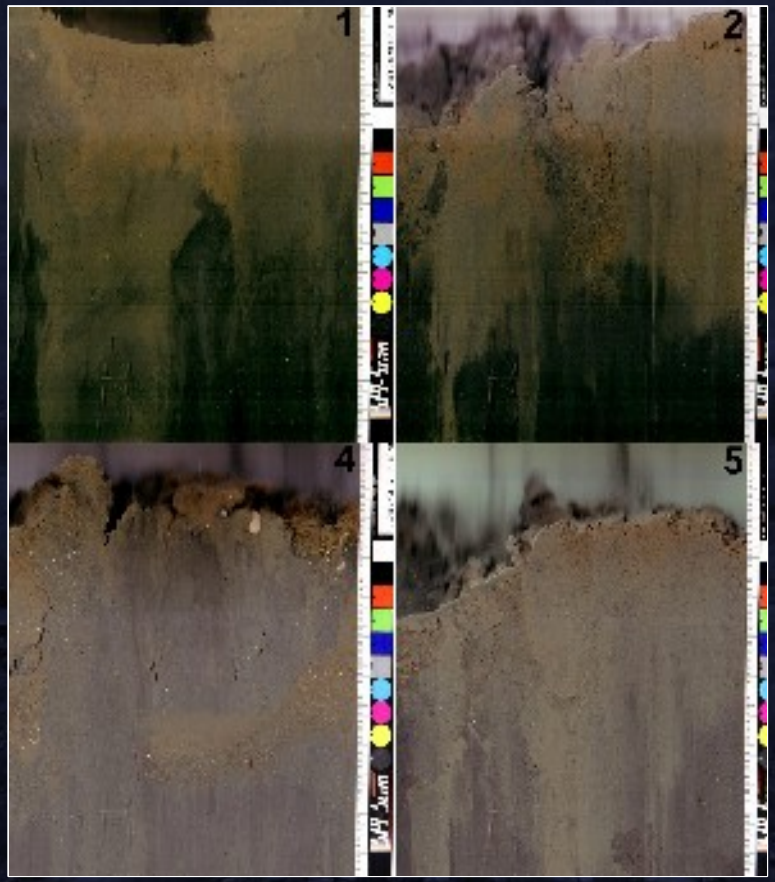
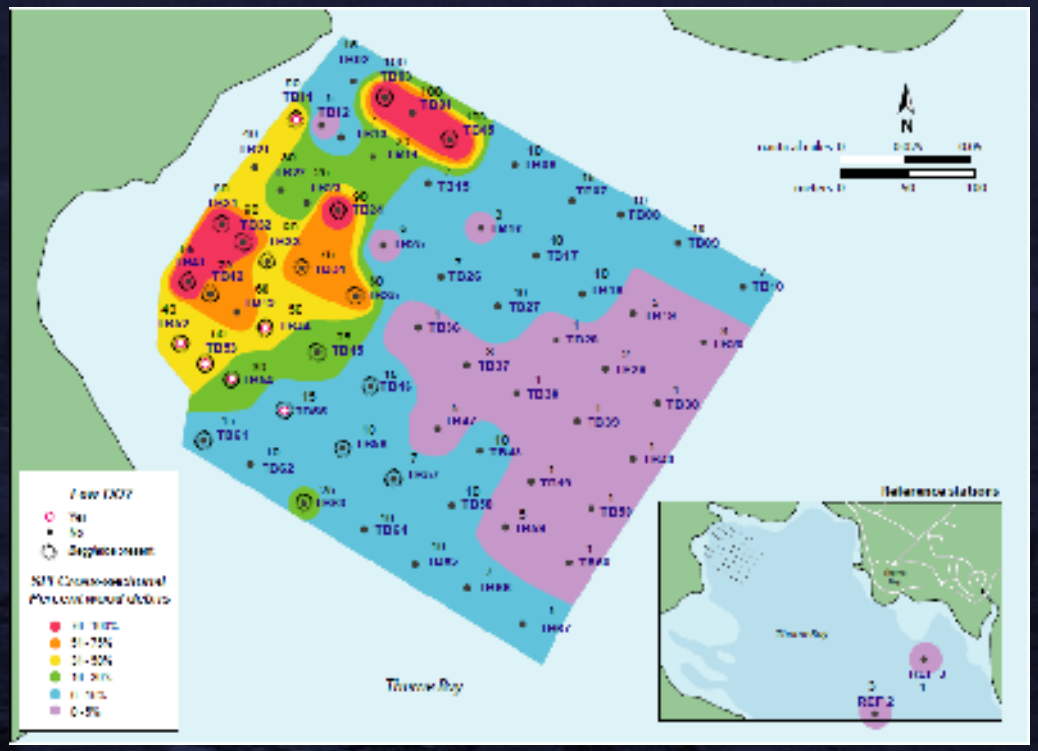
SPI-Scan: Sediment Profile Imagery

An open source undersea research platform

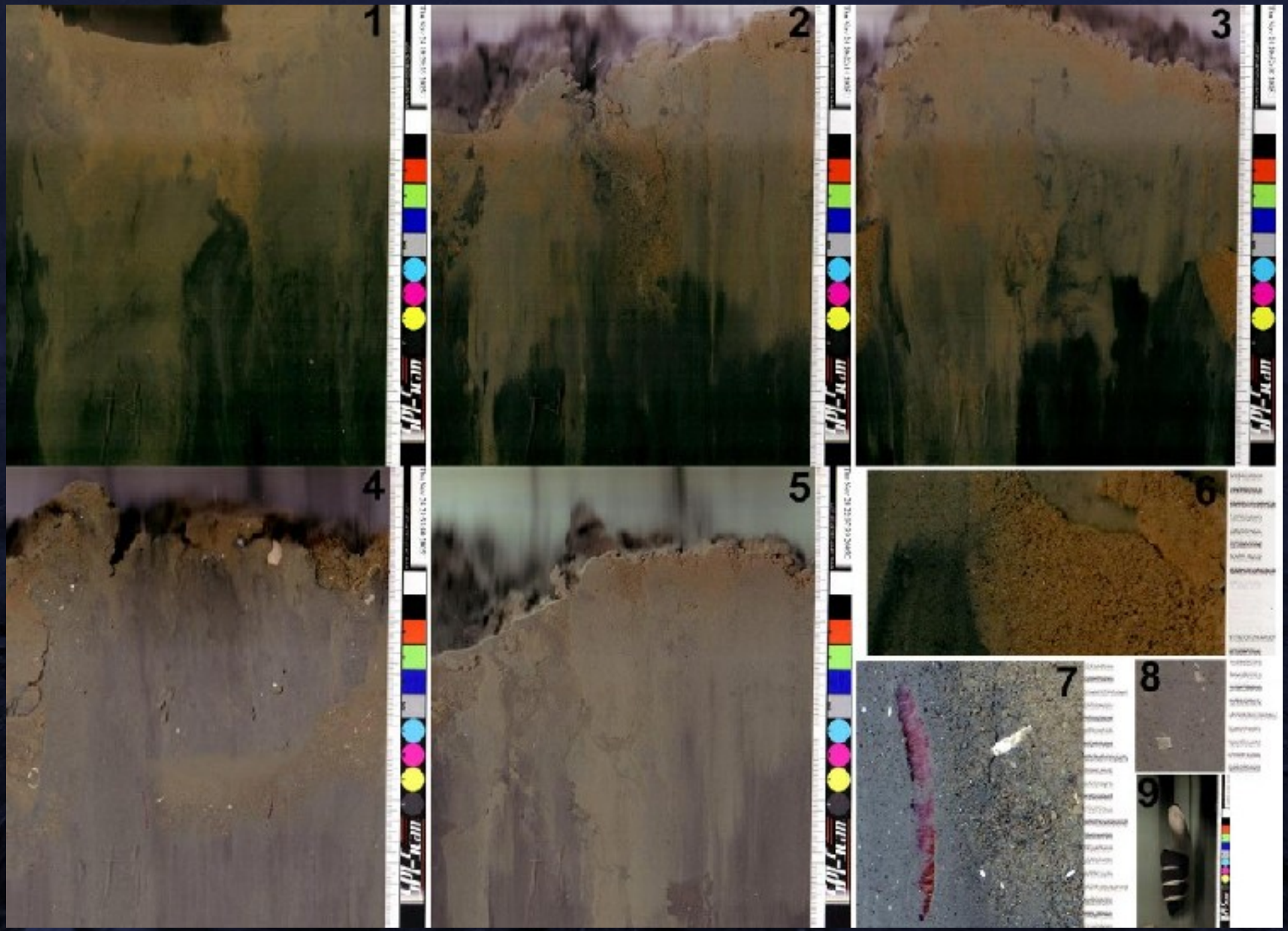




Benthic Science LTD

Presentation 22 March 2012

Primary output (sediment profile image)



This image is a typical 300 dpi scan (17 seconds)

Available resolutions range from 75-1200 dpi*

Geotag and/or timestamp from GPS feed

The *technique* of SPI has been around since the late 70s, has been written into the European Union Water Directive Standards, has been accepted in the US for 25 years, and has more recently come to Australia and NZ. The instrumentation to do SPI depends upon the project (deep or shallow) and research group funding.

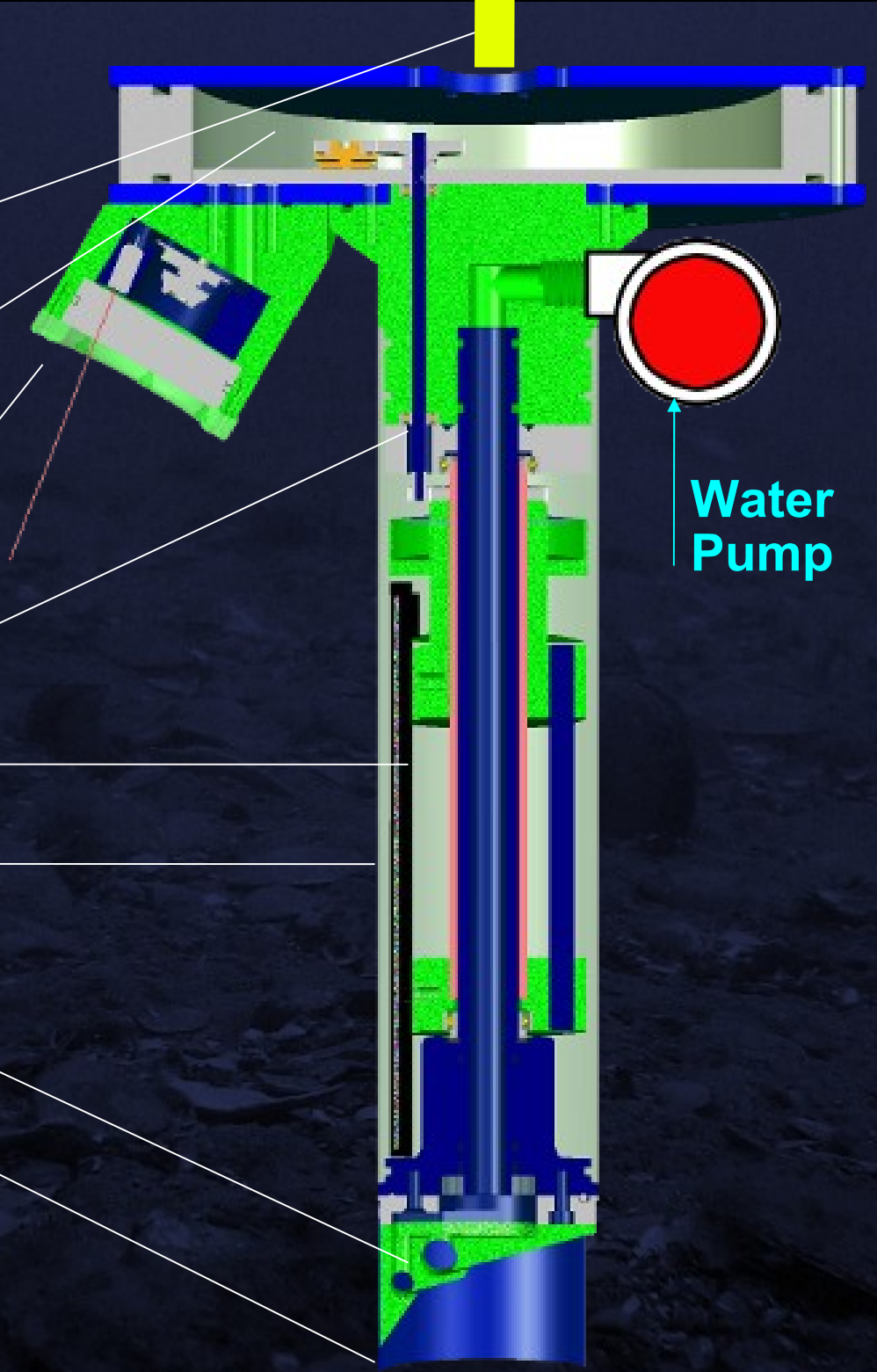
REMOTS® Traditional SPI

- × 200 – 400 kg
- × >$60k
- × Requires large vessels

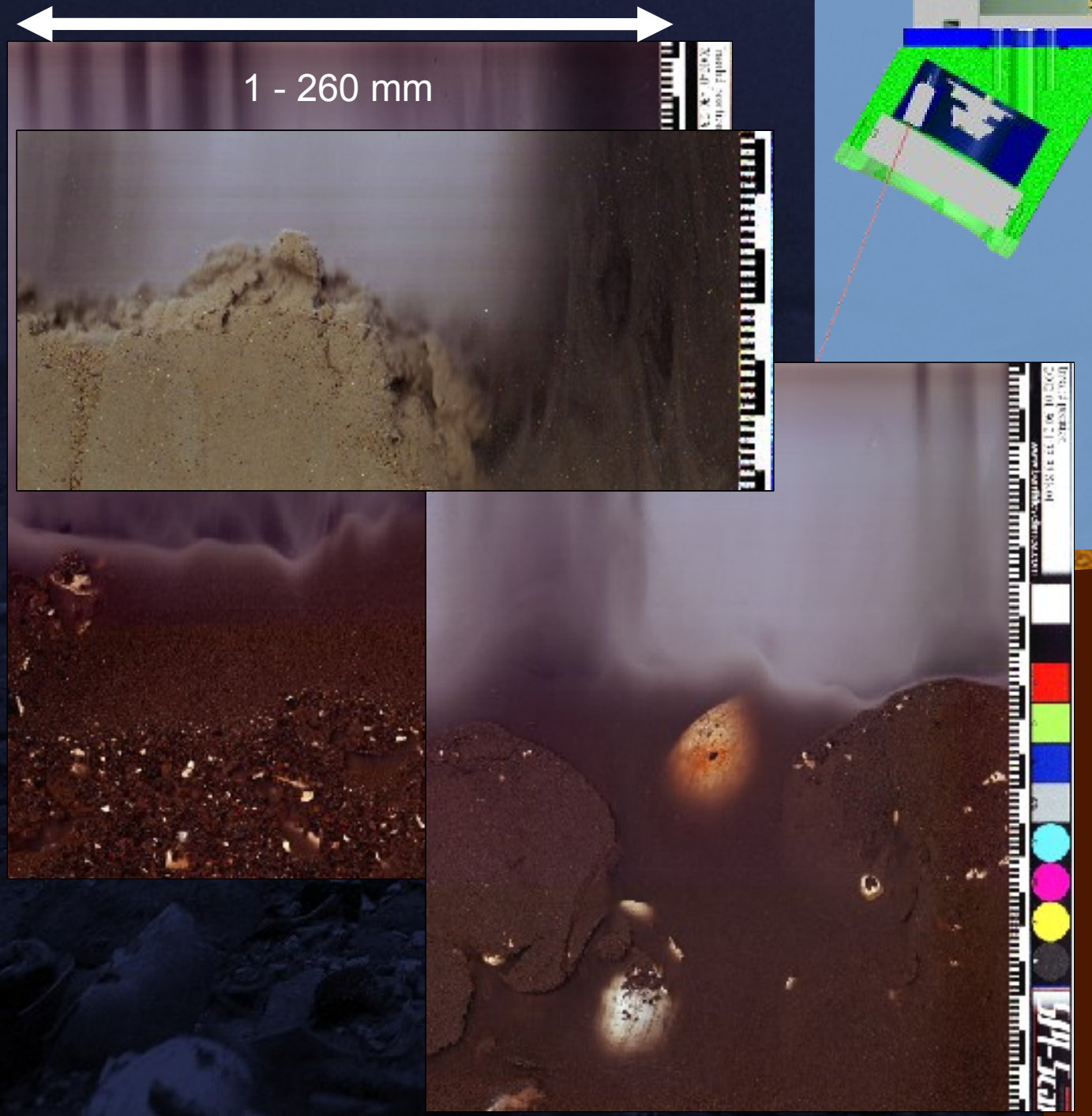
SPI-Scan (rSPI)

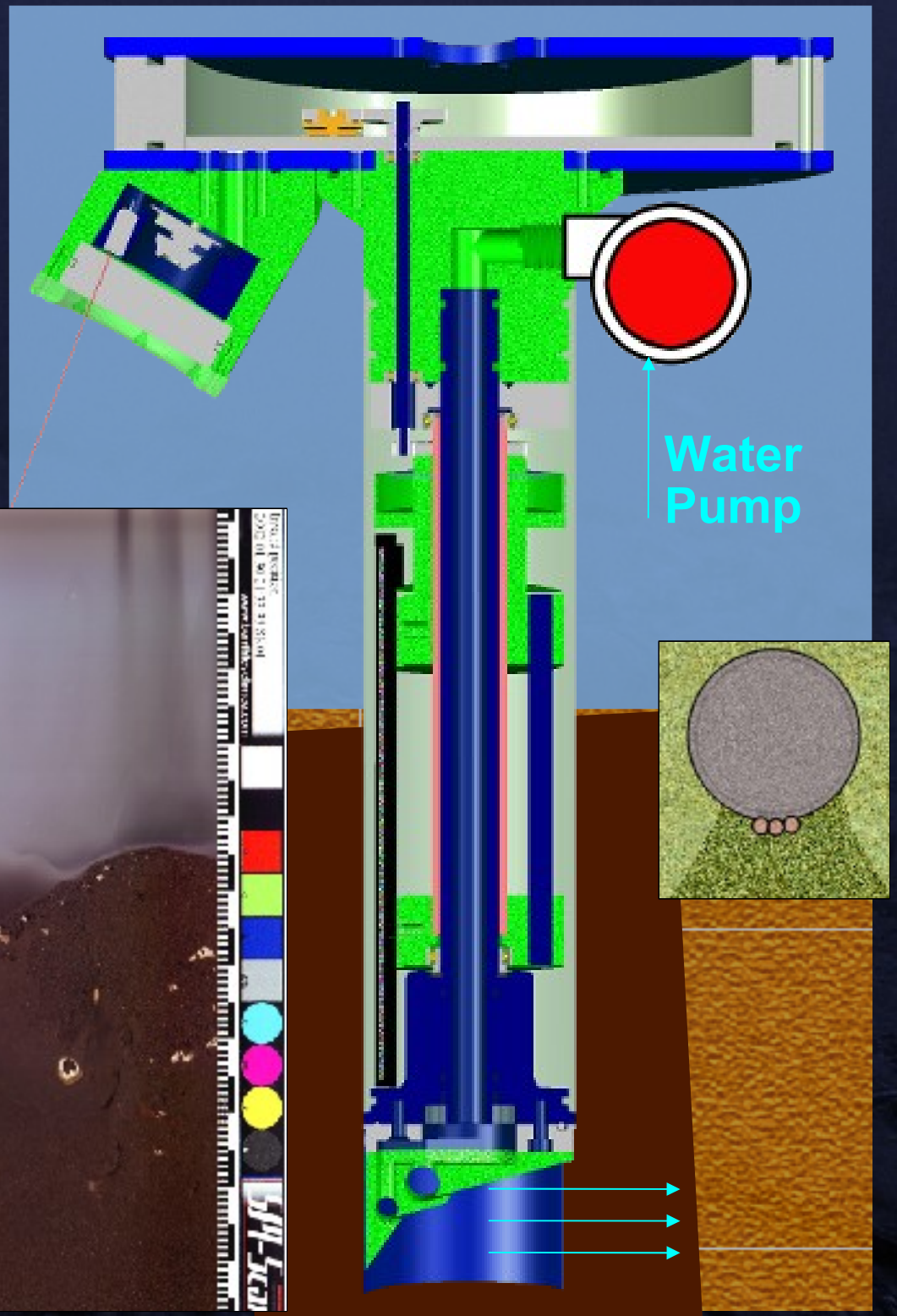
- ✓ 25 – 50 kg
- ✓ <$20k
- ✓ Deployed by 2 people from a small vessel (5 m)

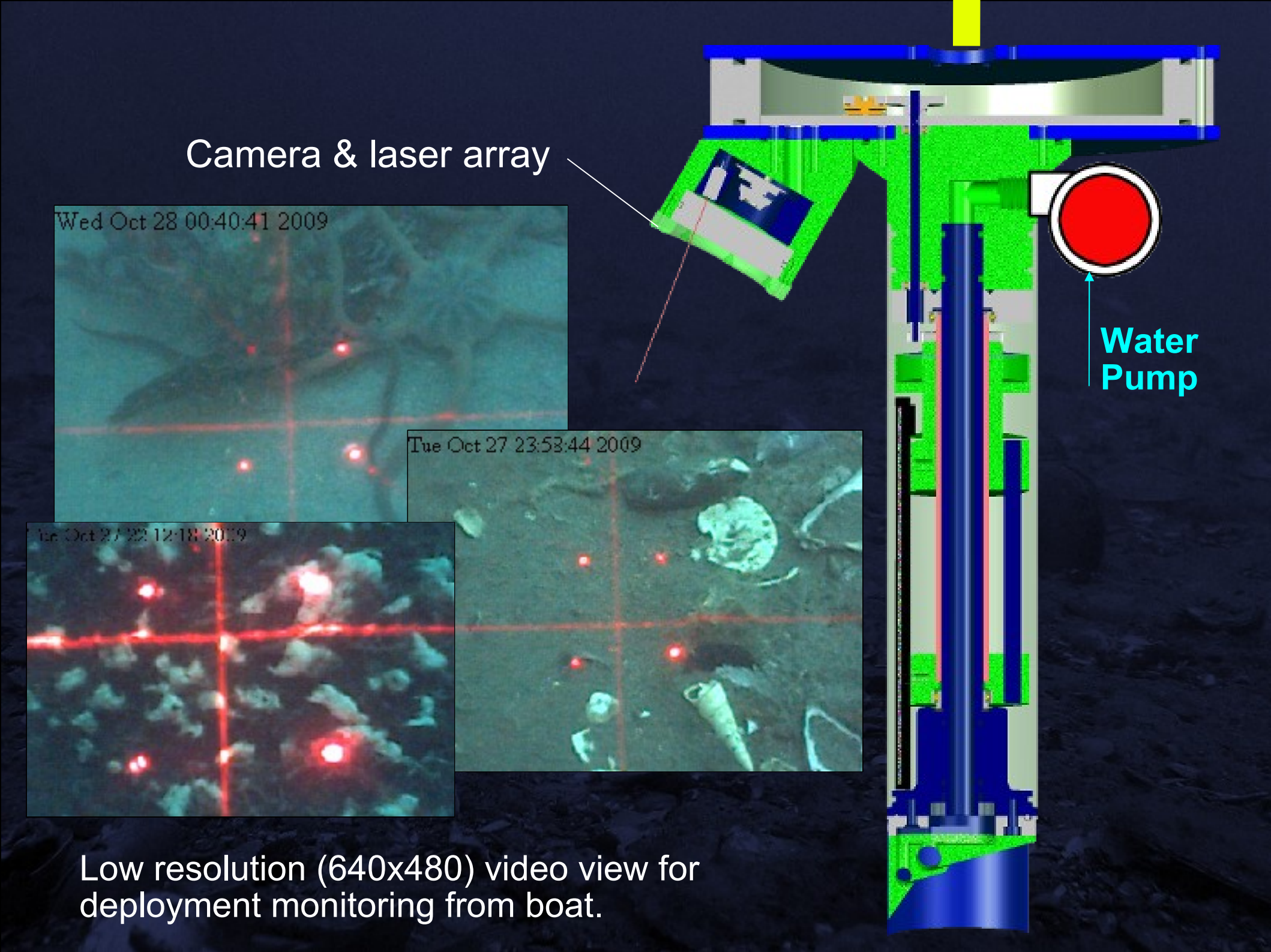
How SPI-Scan (rSPI) works



How SPI-Scan (rSPI) works

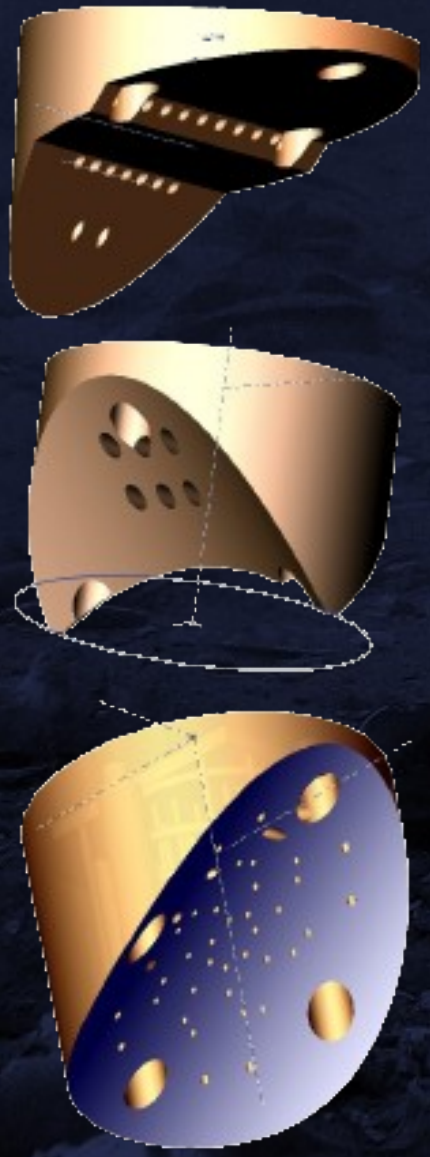


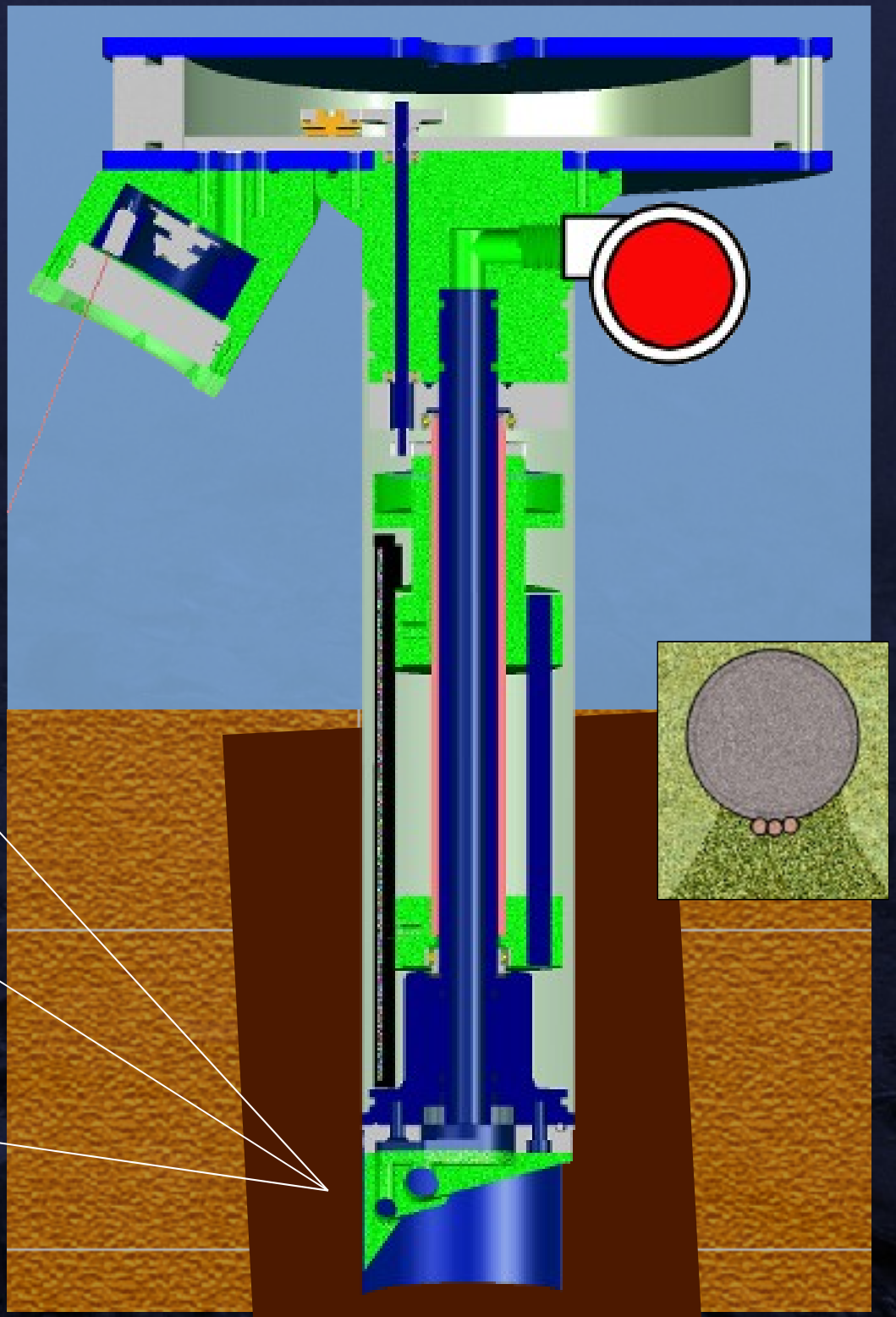




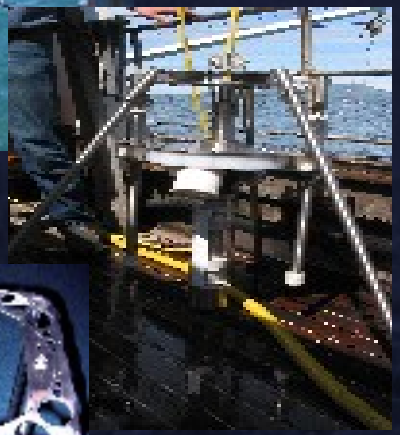
Low resolution (640x480) video view for deployment monitoring from boat.

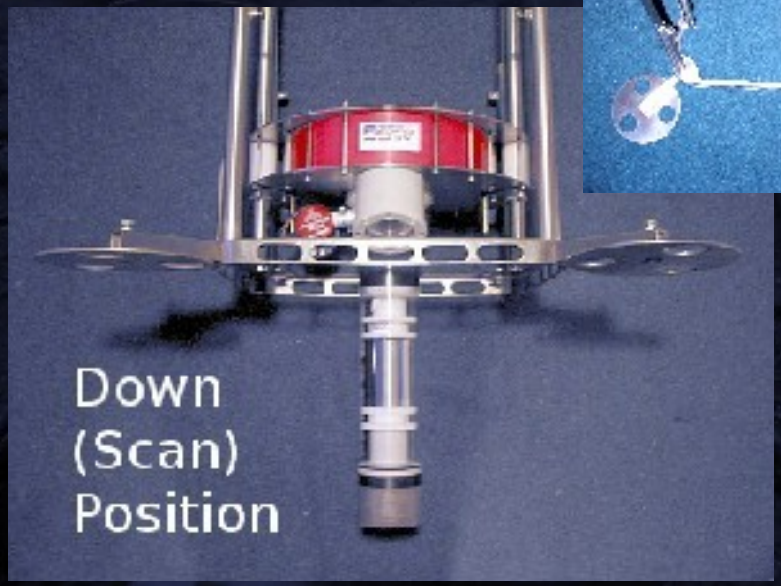
Different penetrator heads can be changed in the field to match sediment requirements






All 316 stainless steel construction
78 cm high
0-9.6 kg of standard dive weights
Remove 2 uprights and feet for packing




Down
(Scan)
Position


FEET TOP
RIGHT TOP

Basic junction box

- Inside a splash-proof Pelican® case
- The junction box connects to
  - an external 24 VDC power supply
  - a powered USB port on the users computer
  - SPI-Scan's tether
- Provides
  - power on/off
  - pump control
  - indicators for computer and imager communication
  - fuse protection

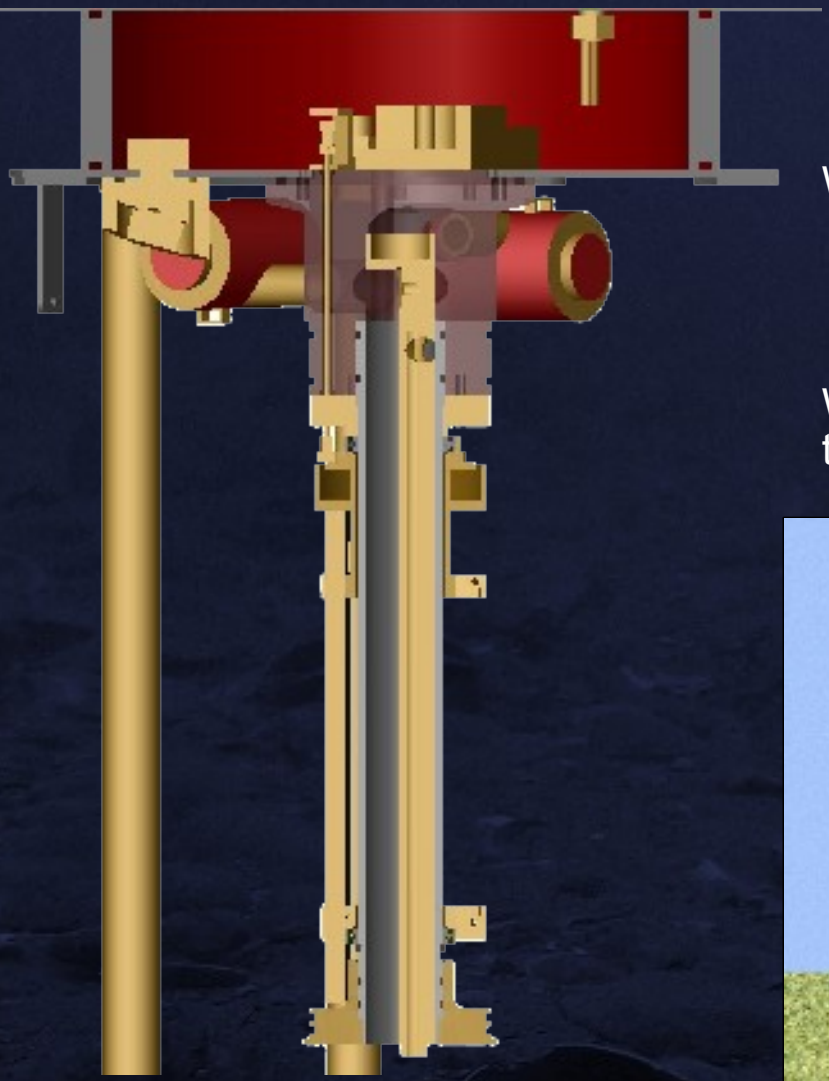
Junction box upgrade also includes

- Two internal 9 AH sealed gel batteries for a full-day's work
- Internal (110 – 240 VAC) battery charger
- Preconfigued netbook computer which can run off junction box powerl

Existing C++ software

- Saves SP images in geotiff format so they are automatically placed in the right position as raster data on GIS.
- Remote still photo trigger
- User can enter notes that are saved and tagged with each image
- Sequentially numbers SPI to avoid naming confusion
- Timelapse mode (any interval >60 seconds)

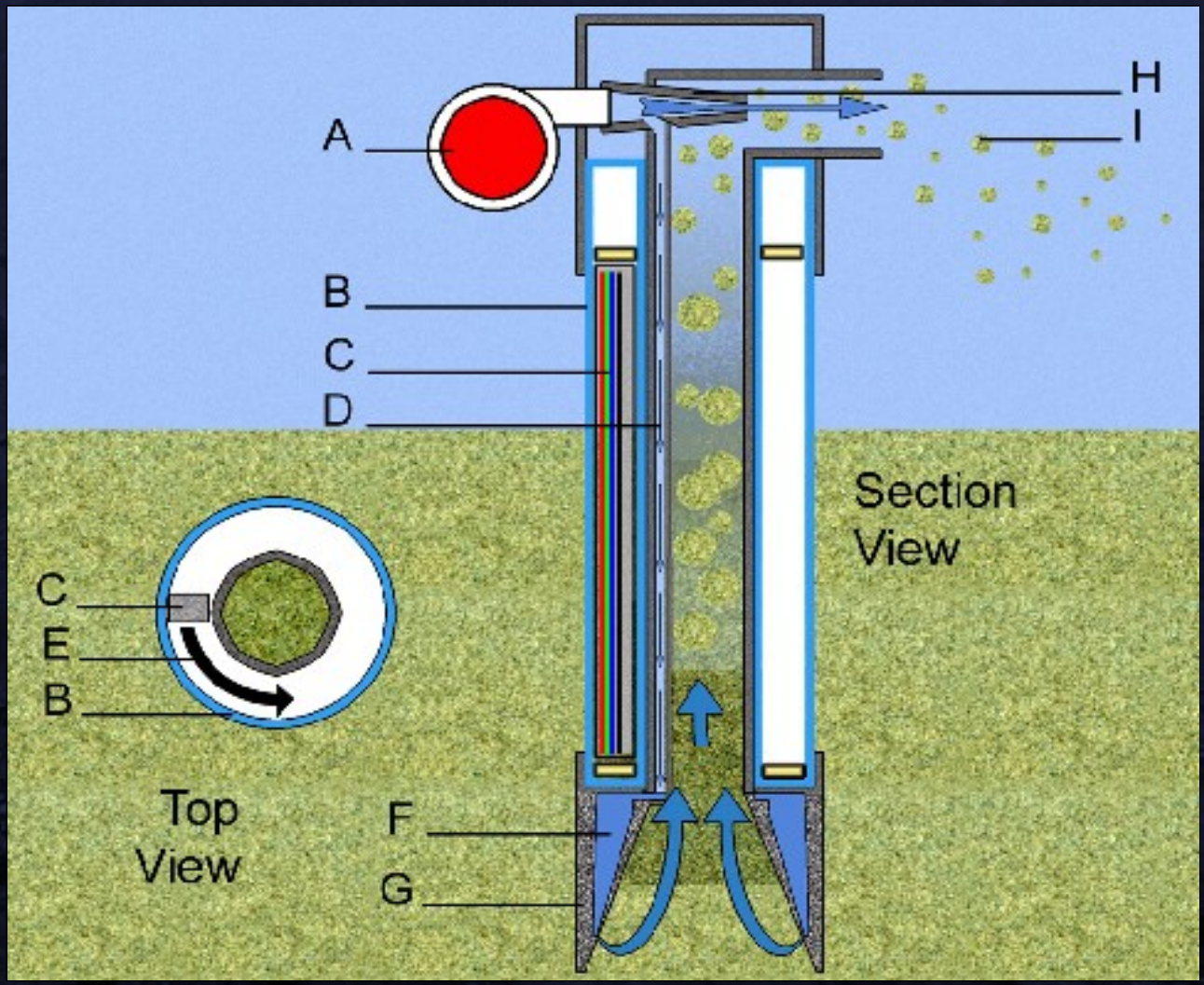
The Next Step: SPI-Scan Surveyor

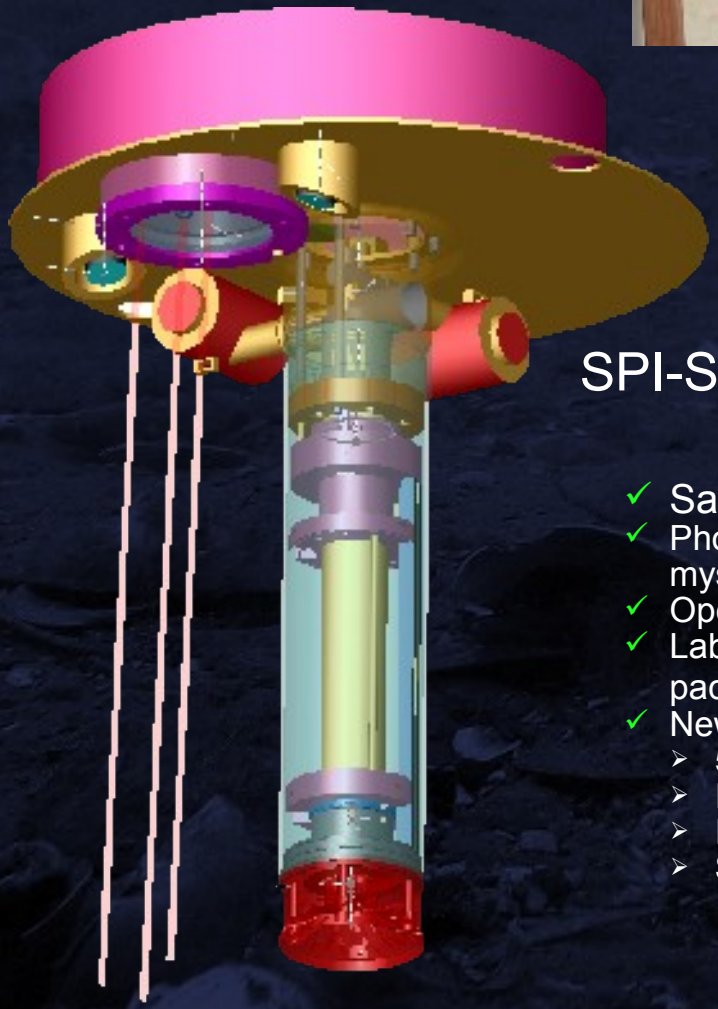


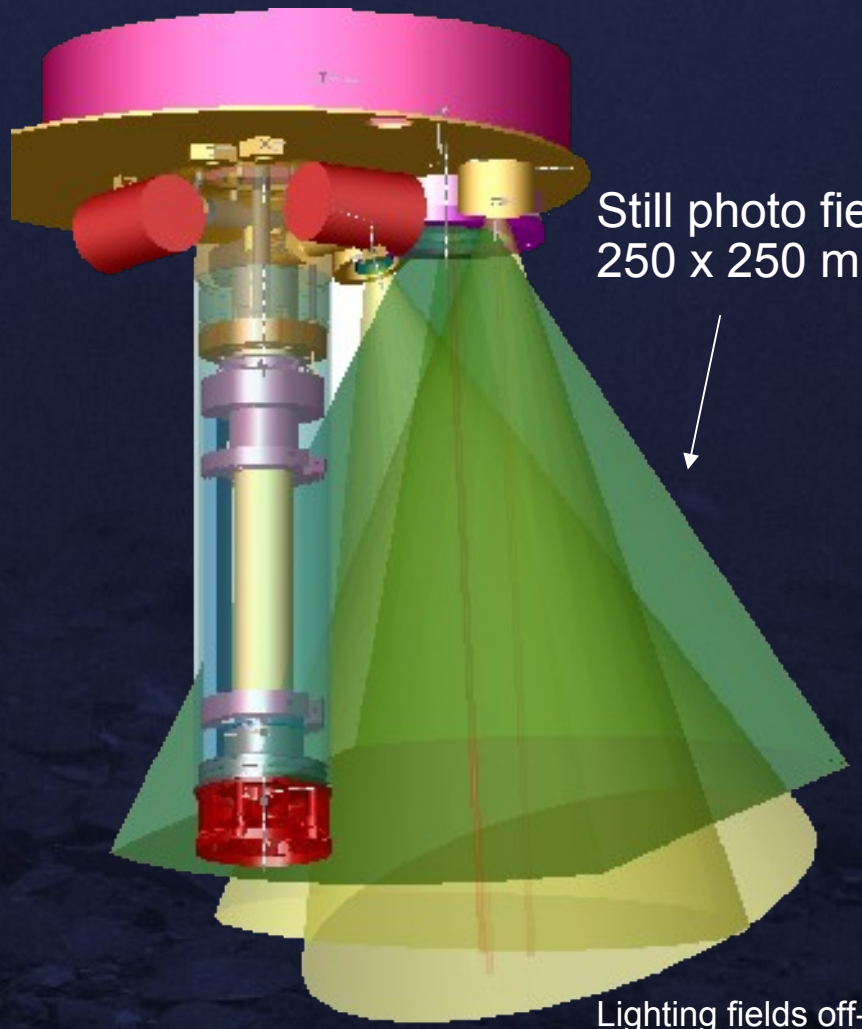
When venturi head is used

- First pump fluidises sediments
- Second pump removes them from the TOP of the column to create a clean bore hole

When non-venturi heads are used, BOTH pumps can be used to excavate





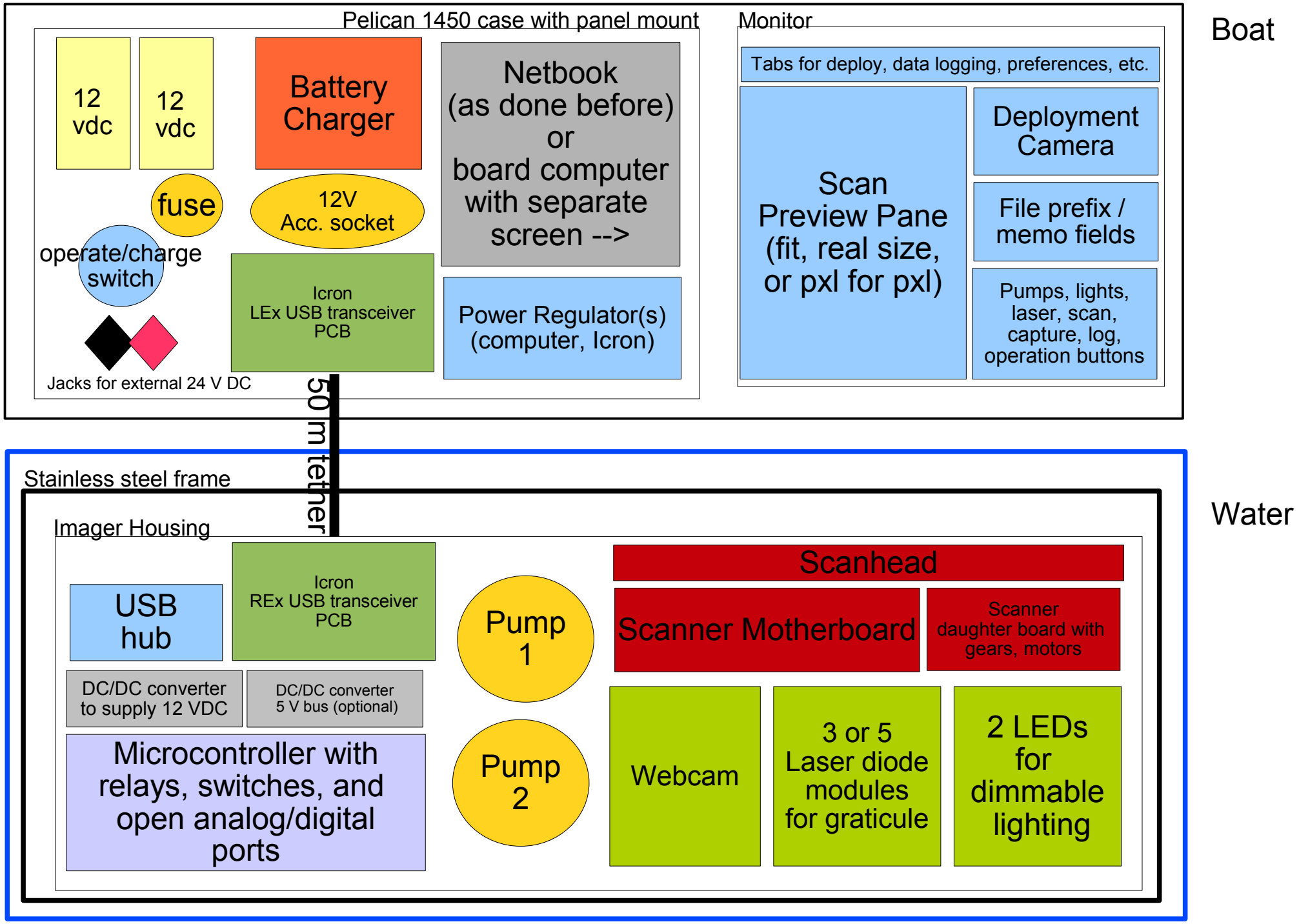


Lighting fields off-axis from camera to improve still images in high turbidity

SPI-Scan Surveyor

- ✓ Same proven dimensions
- ✓ Photo area intercepts SP area so features can help identify mysterious voids
- ✓ Opens up new SPI territory, packed sand, and new functions!
- ✓ Lab venturi tests repeatedly found 250 mm penetration in packed medium sand with only 9 kg!
- ✓ New features include
  - 5 Mpix camera
  - Integrated 3W LED lighting
  - Interchangeable excavation and venturi lift heads
  - Sensor and actuator platform
    - Analog in and outputs
    - Digital in and output channels using the opensource Arduino platform

SPI-Scan Surveyor Electronics Conceptual Model



D-Space Proposal

The project's goals are to create a successful group build project with different levels of involvement for skill sharing, money, fun, and publicity. We need at least one or two key people in each area willing to commit to the build.

- Electronic hardware: Paul's already on task, but may need a hand on a separate board (Eagle skills, basic electronics like DC/DC power supply, voltmeter, and maybe battery charger). We'll hold a fun design review session. Also may be a chance to learn SMD soldering.

- Mechanical engineering: Some tasks remain as basic as cutting, welding, or assembly, can be done to share skills. Some basic Rep-rap design and prints for clever components. Some engineering to finish off odd-bits, create better plans, or think of cheaper, easier, or better ways to do things.

- Software: The lion's share of work to be done. Meeting on Saturday here at 13:00 to strategise. Something to show off at PyCon? One thought is Java GUI on a single-board Linux box passing commands to Arduino. Other is a C# app on a netbook. Other is a suite of browser-based functions interacting with a Python Daemon to Arduino. Others?

D-Space Proposal

- Time: Maybe a 5 week schedule? We want it long enough to be realistic while short enough to have a fun intense group build. Brian opening the workshop 3 days a week (Tue, Thur, Saturday 13:00 - 21:00?)

- Money: Brian expects to essentially pay D-Space's rent for a year ($5k) and a percentage of any units sold (two sales already guaranteed) for those that don't wish to build their own. It is expected that we'll spend around $3k more for additional parts (PCBs, parts, materials, components, etc.) so the focus is on a creative build with widely-available parts, not scrounging.

- Skills and opportunities: Brian will bring in additional tools and materials to the clubhouse to help the project along and facilitate as much as possible. It's always easier to move a project forward when some of the necessary bits are ready-to-hand (fasteners, components, materials, etc.). This project will probably require broadband, so this is an opportunity to bring that into D-Space as well.

- Product: One complete functional system (I'll try to get us on a boat to try it out), plans, source code, and BOMs to move smoothly into building more (we have major parts for two more systems) and strategies for lowering production costs.

Discussion / Questions?