Perdigao ISS Site Survey

Bill Brown, Lou Verstrate, Mary Hanson

The ISS site survey was conducted April 20 - 23, 2016 by Bill Brown, Lou Verstraete and Mary Hanson. We were initially chaperoned by Jose Carlos Matos from INEGI and visited potential ISS sites in and around the valley, then visited the IPMA offices in Lisbon.

Fig 1: Overview Google Earth image of the potential ISS sites discussed in this document.

1290 MHz Wind Profiler Sites

The NCAR 1290 MHz radar wind profiler will be installed in early December, 2016. The preferred site is 1.7 km west of the valley on a ridge occupied by a MEO cell phone tower (ISS_Profiler_1 on Fig 1). The site is one of the few locations in this area where both power is available and there is sufficient separation from houses that could be disturbed by RASS. Access is via a winding gravel road from the village of Ladeira. It has tight turns and overhanging trees and is passable for SUVs and pick-up trucks, although not large trucks and small cars. The site is an approx 6m x 60m strip running along the access road. The ground is rough with soft loose shale rock that will need some smoothing with a compactor under the profiler and shelter locations. There are low olive trees to the west and scrub to the east, and a few scattered pine trees at either end of the site.

The profiler may receive some clutter signals from the turbine and the 40m tall cell tower, although with careful positioning and orientation of the antenna, these effects can be minimized.
A radio spectrum scan found few signals in the 1290 MHz band, with just occasional signals around 1280 MHz. Power can be obtained from the cell tower. The road is too rough to bring up a full lab container, so a smaller shelter will have to be constructed or rented. There is strong cell coverage both from the tower (MEO) and a nearby Vodafone tower. Speed tests found MEO 6 Mbps down and 1.3 Mbps up and a strong 3G signal from Vodafone. There is also be a good view to the ISFS Wifi network. The long access road and power line, and tall cell tower makes the site unsuitable for soundings.

Photos of the profiler site, looking south towards the cell tower (left) and north back along the access road (right). The profiler would be west of the road.

A possible alternative site is a shed area about half way along the cell tower access road (marked ISS_Profiler_2 on Fig 2) although that would require a power drop be installed along the power line running to the cell tower.

On the east side of the valley, a potential location for the proposed NCAS 1290 MHz profiler was identified at an old church just west of the village of Rodeios. If approved, this system would be installed at the beginning of the IOP in early May, 2017.

**Sodar-RASS Sites**

The NCAR sodar-RASS will be installed in early December, 2016. Two potential locations for the were identified at the south end of the Cobrao valley. Another site has since been identified at the north end of the valley, although not visited yet. Note that a University of Notre-Dame
sodar-RASS system is planned for the area east of the valley (near the village of Chao das Servas) during the IOP.

**ISS Sodar 1 Site:**

This site is a fenced farm storage compound at the far south end of the valley, about 0.6 km along the Vale Cobrao road from the N3 and A23 highways, and about 2km from the main study area. The compound is around 30m x 50m, has a stone shed with power and scattered fruit trees and crops. The access road is suitable for trucks, although within the compound the road turns to dirt and would not support large vehicles. Cell phone coverage is fairly good, with MEO 2.6 Mbps down and 1.4 Mbps up noted, and 3G Vodafone coverage. The site may not be visible to the ISFS WiFi network. Nearby a high voltage power line with pylons mean that the site is not suitable for soundings. These power lines and the many trees may generate clutter signals on sodar.

**ISS Sodar 2 Site:**

An alternative site is much closer to the main study area (ISS_sodar_2 in Fig 2). This site is much closer to the main study area being between 150m to 200m east of tower 47 (vall 1).
Power is uncertain; it may be possible to run a line from that tower, or a power drop may need to be installed. There are a couple of access points off the valley road; at the south end is a gated road marked “Quinta do Cabecudo” and at the north end is a simple pull-off that may require a gravel pad. The nearest houses are about 400m to the west, partly hidden by the terrain and trees. This is about as far into the valley as possible without the sodar noise disturbing the village. This site would be well within the ISFS WiFi network, but also has good cell coverage. Nearby power lines and the many trees may generate clutter signals for the sodar, and also make the site unsuitable for soundings.

**ISS_Sodar_3 Site:**
Given the uncertainty in power at the second site, another potential site (Sodar_3 in Fig 2) has been identified. The area is adjacent to tower 52 (vall 6) from which power will be available. This area appears to accessible by 4WD pickup and appears to have sufficient open clearings to position the sodar. The nearest house is about 300m to the southeast through trees, which is likely far enough away so as to not disturb the residents. The site has yet to be visited so it’s suitability is not confirmed, however appears promising from aerial photos.

**Sounding Sites**
Several sites within and outside the valley were examined for suitability for sounding operations. Many sites, particularly within the valley, are problematic because of limited access, view, trees, and power lines. At all sites there is the potential of sondes being blown out of line-of-sight under high wind conditions at altitude. In addition to the sites described below, we identified potential sites outside the valley (eg, near Ladeira and Alvaiade). The sounding system will be installed in April, 2017 so there is some time to further consider siting issues.

**Foz do Cobrao site (ISS_Sounding_1)**

*Photo of the Foz do Cobrao site looking east. The church is on the left; the adjacent shelter to the right is part of a restaurant below where equipment would be located.*
This is the preferred site for sounding operations from a logistical point of view. The site is in the village of Foz do Cobrao at the north end of the valley, approx 2.4 km from the main study area. There is a church with a large courtyard elevated above the surrounding buildings. There are clear views from the west, through north most of the way to the south. There are hills nearby to the east and south, and further away in other directions, however soundings could likely be tracked to greater altitudes here than at any of the valley sites. Soundings could be launched in any direction, although under some directions care will be needed to avoid the church and nearby trees.

The church is apparently rarely used, just for occasional cultural events and funerals. Under part of the courtyard is a restaurant that is also not regularly used, just for occasional catered events. The owner is the same owner as the Incentivos Outdoor Ida hotel and restaurant in Vila Velha de Rodao (where we stayed during the site survey) and has offered us access and room at one end to install a sounding rack. The owner also said we could install antennas on a disused VHF TV antenna. There is a new hostel across the street where operators can stay.

**Valley Sounding Sites**

![Valley Sounding Sites](image)

*Fig 2: Detail of the central valley area, showing the main valley road (M1355, yellow line), and the village of Vale do Cobrao with the access road loop marked in white. The red numbers indicate the locations of measurement towers to be installed for the campaign. The image is rotated so that northwest is to the left, and southeast to the right.*
Photo looking northeast from turbine across the valley to the sounding 2, 3, 4 and sodar 2 & 3 sites.

All potential valley sites have limited views due to the depth of the valley, so under high wind conditions (particularly northeasterly or southwesterly) the sounding balloon will be blown out-of-sight over the ridgelines. In addition there are many obstacles in the valley, such as trees, towers, power lines, and communication lines. Care will have to be taken to ensure the balloons and sondes don’t get tangled up in these obstacles, especially the power lines. These sites may also be suitable for co-hosting the NCAR Water Vapor DIAL, OU CLAMPS, CU and Notre Dame equipment.

ISS_Sounding_2

Panorama photo of ISS_Sounding_2 location looking west through northwest.

An open field with scattered trees just north of the northern access road to Vale Cobrao on the west side of the valley road (see Fig 2). This is the best of the valley sites, however Jose Carlos reports that the farmers are reluctant to allow activities because they use the land for
crops. The site with relatively open views in most directions, although there are trees nearby and a 3m high coms cable line across the site. Access road is limited but serviceable.

ISS_Sounding_3

![Panorama photo of ISS_Sounding_3 site looking southwest through northwest.](image)

Another mainly open field just north of the southern access road to Vale Cobrao on the west side of the valley road. Again a relatively open site, with trees nearby and the same 3m coms line across the site. Tower number 25 (trSE 9), 100m tall, will be erected about 100 m west from the site, which will be a significant obstacle for soundings requiring care to be taken during launches. The access road is adequate for limited traffic.

ISS_Sounding_4

![Panorama photo of ISS_Sounding_4 site looking north through east.](image)

A recently cleared area just south of the northern access road to Vale Cobrao on the west side of the valley road. Again a smaller although adequate site, with rough ground covered in ferns and weeds, trees nearby and the coms line across the site. The number 25 tower (100m tall) will be about 150 m from the site, which will be an obstacle in high northerly winds. There is a pull-out from the valley road although an access driveway would need to be constructed.
IPMA Meetings.

We spent most of Friday April 22 in meetings at IPMA (Instituto Português do Mar e da Atmosfer, the agency that includes the Portuguese weather service) in Lisbon. The topics discussed included radiosondes, Helium, aviation requirements, radio frequency allocation and logistical matters. In attendance were Margarida Pereira, Sergio Barbosa, Paulo Pinto, and Jorge Marques from IPMA. We also met briefly with manager Pedro Viterbo, and also with administrators (Paula, Suzianna and another Suzianna). In addition Jose Carlos called in briefly via Skype.

Radiosondes: the proposal to pool NCAR, OU and IPMA soundings was discussed. They are open to adding their radiosondes to the pool and have staff to help with soundings if necessary. They are interested in using some soundings to study stratification and convective weather events. This topic will be discussed further with the PIs during the May meeting.

Helium: we met with an Air Liquide representative (Paulo Rodrigues) and discussed cylinder sizes and pressures. They can supply cylinders of the same size as we use in the US (their equivalent to T or 300 size cylinders is called size “49”), and are pressurized similarly. They can supply appropriate fittings to connect to our fittings. They will prepare a cost estimate and can divide the billing between the multiple groups requiring Helium. They can accept returned unused cylinders provided the seal is not broken. They can also supply liquid nitrogen to calibrate microwave radiometers.

Aviation Approval: IPMA can arrange approval for launches from the Portuguese aviation authority who will issue NOTAMs. They prefer that we come up with a launch schedule that includes all possible launches, even if not all slots are used.

Radio Frequency Approvals: IPMA will arrange for all necessary radio frequency approvals from ANACOM (the Portuguese communications agency). Preliminary checks indicate that both the 1290 MHz and 1292 MHz slots are available for the radar wind profilers and the sodar-RASS systems. Appropriate frequencies are also available for soundings. They request a complete inventory of all radio frequency emissions including the ISFS WiFi network.

Logistics: A meeting was held with IPMA administrators to discuss logistical and contractual issues. If ANACOM requests a fee, then it will be possible for IPMA to act as an intermediary for funds from NCAR to cover this, however they are reluctant to act as conduit for any other financial transactions (such as paying for radiosondes or Helium). They are willing to receive goods (such as radiosondes) but the suppliers (eg, Vaisala) should direct bill to NCAR.