MOBILE, INSTRUCTOR-LED WORKSHOPS WITH THE INTEGRATED SOFTWARE FOR IMAGERS AND SPECTROMETERS (ISIS) PACKAGE. S. C. Sides[1], J. A. Anderson[1], K. Becker[1], T. Becker[1], S. Lambright[1], D. Brown[1], M. Milazzo[1], and M. Eis[1],[1]Astrogeology Science Center, U.S. Geological Survey (2255 N. Gemini Dr., Flagstaff, AZ 86001; ssides@usgs.gov).

Introduction: The Integrated Software for Imagers and Spectrometers (ISIS) package is a cartographic image processing suite designed to process images from instruments aboard planetary spacecraft. The software contains generalized image processing functions as well as instrument specific calibration and camera models for nearly fifty instruments.

The planetary science community has a steady stream of new scientists, post-docs, and graduate students entering the field. These researchers often need to be trained to radiometrically calibrate and geometrically control the images used in their research. The expenses associated with training include development of the content, instructor fees, travel, facilities, computers, and time to attend. Researchers can get the most out of their training dollars and minimize their expenses by using an established training program.

Background: The USGS ISIS team has held dozens of training workshops over the past twenty years. These usually involve three to six scientists, programmers, and processors presenting the material and assisting the trainees with hands-on exercises using computers set up specifically for the class. Workshops have involved up to forty trainees from all over the world and have been held at the USGS in Flagstaff, Arizona, NASA sites, universities, and international institutes outside the United States.

The workshops cover general ISIS [1-3] tools for visualization, analysis, orthorectification and mosaicking of planetary images. Lessons for specific instrument and mission teams have been developed on request, including: High Resolution Imaging Science Experiment (HiRISE), Lunar Reconnaissance Orbiter Cameras (LROC), Dawn Framing and Visible and Infrared Cameras, Cassini ISS, VIMS, and RADAR, and Mars Global Surveyor MOC. A typical workshop consists of:

- Setup
- Introduction to ISIS
- Basic Visualization Tools
- ISIS GUI and Utility Tools
- Importing Data
- Camera and Photogrammetric tools
- Map Projecting Images
- Uncontrolled Digital Mosaics
- Exporting Data
- Controlled Digital Mosaics
- Mosaicking Tools
- Image-to-ground Registration
- Band-to-band Registration
- Change Detection
- Photometric corrections
- ISIS installation

Challenges: The logistical problems associated with presenting ISIS hands-on workshops include finding appropriate facilities and computer and network access.

The requirements for facilities can vary considerably depending on the number of trainees and the equipment needed for the hands-on exercises. The room where the workshop is being held needs to accommodate everyone involved comfortably. The computers and monitors needed for each participant will dictate the table size and electrical power requirements.

Hands-on ISIS workshops require access to a computer running a supported Linux distribution or Mac OSX, the most recent version of ISIS, the associated SPICE [4] data and digital terrain models of the target bodies. In the past, the USGS has provided these in different ways: 1) Desktop computers with Linux and ISIS preinstalled, 2) Linux virtual machines with ISIS installed on each trainee's Microsoft Windows laptop, 3) Mac OSX or Linux laptop with ISIS installed, and 4) Linux servers with network access via ssh and X Window clients installed on the trainees' laptops. Each of these has its advantages and disadvantages.

Using desktop computers is difficult to justify given they are only used a few times each year and the large physical storage requirements. Providing virtual machines (VM) for trainees' laptops is difficult because of the large amount of required data (up to 193 GB) along with the time-consuming and error-prone task of installing the VMs on many different types of laptops with limited disk space and different versions of Windows using different virtualization environments. Using Mac OSX or Linux based laptops can also be difficult because of the size of the data and getting ISIS to run on the various, possibly unsupported versions of these operating systems. Although using Linux servers avoids many of the problems above, it is still difficult to justify storing $3-4K servers for long periods and this solution has the added problems of

cooling the servers and shipping them to the training location.

Solutions: The ISIS team has developed solutions to minimize the time and cost associated with ISIS workshops. Many training materials have been developed and refined through workshops given over the past few years. Since ISIS is a generic image processing package, most of the existing lessons can use data from any of the currently supported instruments, giving context to the trainees.

The equipment used during hands-on workshops has a direct influence on the facilities, setup time, trainee experience, and cost of the workshop. The different ways computer access was provided in the past has evolved into a simple mobile solution that minimizes the problems. The solution includes a Mac mini server with a quad-core processor and eight gigabytes of memory, installed with Fedora Linux, a full version of ISIS, and all the workshop material. The Mac is connected to a Linksys Wireless 801.11b/g/n router via a Gigabit Ethernet network. Trainees provide a laptop running Microsoft Windows, Mac OSX, or Linux (Figure1) with an 801.11b/g/n wireless adapter.

Figure 1: Mac mini server, Linksys wireless router, and connected laptops.

Each Mac server can accommodate up to seven laptops. The USGS has three of these setups permitting a class size of twenty with one instructor laptop. These setups are light-weight, small, quiet, and require minimal electrical power and operate well in normal room temperatures. All three setups store and ship in a single airport carry-on sized case (Figure 2).

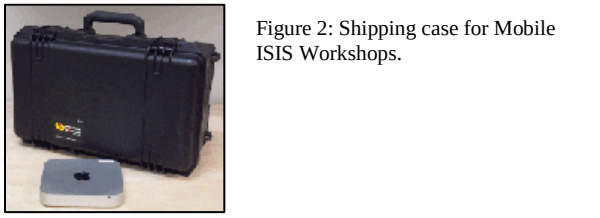

Figure 2: Shipping case for Mobile ISIS Workshops.

The laptops, provided by workshop attendees, are used as X Window servers and connect to the Mac minis via the wireless routers. This requires only two pieces of additional software be present on the laptops, a terminal program and an X Window server. Both Linux and Mac have prebuilt packages for both of these. The free packages, PuTTY and Xming, can be installed on Microsoft Windows laptops, both of which easily fit on a thumb drive provided on the first day of the training.

Conclusion: The USGS Astrogeology ISIS team has the experience, equipment, and course materials necessary to provide well organized and tailored training for researchers and processing personnel involved with individual instruments. Team members are intimately involved with the development and use of the instrument specific code and algorithms such as ingestion, camera model, radiometric calibration, and archiving. The knowledge gained through this in depth involvement uniquely qualifies them to present hands-on workshops regarding the use of the applications. If you would like to discuss arrangements to have an ISIS workshop for your project please contact:

Stuart Sides, ssides@usgs.gov
Laszlo Kestay, laz@usgs.gov

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