SUPPORT AND FUTURE VISION FOR THE INTEGRATED SOFTWARE FOR IMAGERS AND SPECTROMETERS (ISIS). L. Keszthelyi[1], T. Becker[1], S. Sides[1], J. Barrett[1], D. Cook[1], S. Lambright[1], E. Lee[1], M. Milazzo[1], K. Oyama[1], J. Richie[1], R. Saleh[1], J. Shinaman[1], T. Sucharski[1], T. Titus[1], J. Walldren[1], L. Weller[1], [1]U.S. Geological Survey, Astrogeology Science Center, 2255 N. Gemini Dr., Flagstaff, AZ 86001 (laz@usgs.gov).

Introduction: ISIS has been a staple for the cartographic and scientific analysis of planetary image data for 20 years with a heritage reaching back another 2 decades [1-3]. It is developed and maintained by the U.S. Geological Survey using funds from the NASA Planetary Geology and Geophysics Cartography Program and various U.S. and international missions. It forms the backbone for some ground data systems that process raw spacecraft data into products suitable for archiving in the NASA Planetary Data System (PDS). For example, the processing of the Lunar Reconnaissance Orbiter LROC and Mars Reconnaissance Orbiter HiRISE images relies on ISIS [4,5].

ISIS was first made public with version 2.0 on VAX/VMS, followed by version 2.1 on Unix. Although ISIS2.1 was last released in 2006, many researchers still use it, especially for working with older data sets and for spectral analysis. Development of ISIS3 started in 2001 and the latest version is 3.4.2. Several distributions of Linux and OS X are supported.

In fiscal year 2013 (starting in October, 2012), the ISIS support process has undergone a major revision. The changes were implemented to address the fact that developers were overtaxed at the same time that users were not receiving fixes in a timely fashion. This abstract summarizes the new process and describes the expected benefits and costs to be seen in the future.

Process: The new ISIS support process has four key elements: (1) a bug tracking software package; (2) a triage team that prioritizes the issues or "tickets;" (3) a quarterly support team that addresses tickets assigned by the triage team; and (4) a ISIS maintenance team that does the actual release of the new version of ISIS3. There is also a "Tiger Team" that is working to improve procedures for both support and ongoing ISIS development.

Tracking software. In the past, the ISIS support board (https://isis.astrogeology.usgs.gov/IsisSupport/) and various internal lists were used to identify issues with ISIS. As many other software development efforts have discovered, we found a need for a systematic database with a good user interface to effectively track bugs and feature requests. Mantis [6] is currently being used as our tracking system but Redmine [7] is being evaluated as a possible alternative.

At this early stage, only USGS staff can enter tickets. Therefore, items raised on the support boards are manually entered for external users. However, the plan is to open the tracking tools to external users by the end of the fiscal year (i.e., before October 2013). The expectation is that the support board will continue to be a useful site for community discussions, especially for providing tips and for answering user questions. The new ticketing system will have required fields for the user to provide specific actionable items for the ISIS developers, such as reproducible bugs and well-described new feature requests.

Triage. Experience shows there will always be more possible improvements to ISIS than can be dealt with at any one time. Thus it is essential to identify the most time critical issues and take on work that matches the available resources. In principle, the top priority is to make sure users are able to produce accurate products to support active research projects. The triage team is led by a very experienced ISIS user who can judge how serious an issue is and how active the research is. She is supported by a similarly experienced software developer who is able to quickly provide a rough estimate of the magnitude of the development effort required to fix the issue. Note that not all issues originate with users; developers often identify bugs and other shortcomings as they work within ISIS and enter these as new tickets.

As in most triage situations, the majority of issues are deemed important but do not require immediate attention. We have encountered the situation where a critical problem [8] is too large (>$100,000) to be dealt with within our ISIS support process. Our response is to write new proposal(s) to obtain the resources to treat this as a project outside the support process. A major effort for the triage team is to select high priority tickets that are well matched to the skills for the quarterly ISIS3 support teams.

Support Teams. A group of senior and junior developers and users, rotating every 3 months, is assigned to work on ISIS support. One objective is to allow developers to focus on non-support tasks when they are not assigned to one of the support teams. Another is to have people with the mix of needed skills to fully address issues from the underlying application programming interfaces to user documentation.

For any given quarter, the support team is given a set of 15-30 tickets with a clear indication of which are the "baseline" versus "enhanced" targets. In practice, one or two "emergency" items typically appear during a quarter and some adjustment is necessary. However, the support team is focused on the tickets they have been assigned and it is the triage team that monitors

new items to see if any are emergencies. The support team works to close as many of their tickets as possible, in priority order, by a deadline set by the ISIS release cycle.

Releases. ISIS3 releases are currently planned to occur 4 times a year with some flexibility in the exact dates to avoid particularly busy times of the year. Our experience indicates this pace strikes the right balance between stability and timely improvements to ISIS3. It should be noted that the data ISIS uses (e.g., SPICE) is frequently updated and small patches are sometimes put out in between the scheduled releases.

The version that is released to the public undergoes automated testing and a minimum of 2 weeks of in-house use by the USGS. A formal checklist, including consideration of backward compatibility, is followed for all changes to ISIS. A designated "watchdog" confirms that the checklist is being adhered to. These steps significantly reduce, but do not completely eliminate, bugs that make it to the outside users.

Discussion: It is difficult to quantify the improvement this new process brings, since few performance metrics were available under the previous process. However, an important anecdotal observation is that internal USGS ISIS users are now pushing for more stability rather than faster fixes. We have no doubts that the process has significantly improved understanding between internal users and developers with more realistic expectations on both sides. In particular, having visibility into how a particular issue is prioritized, and what is ahead of it in the queue, has been helpful. Bringing this transparency to external ISIS users is a major goal for 2013.

These improvements have come with real costs. In terms of money, ISIS support costs to the PGG Program have roughly tripled to over $500,000 per year. This has been the true cost to the program but had been covered by delays and descopes of other tasks. With the real cost visible, it is apparent that PGG can afford to pay for very few new features and improvements to ISIS. Even user workshops have been sacrificed.

The result is a strong desire to reduce ISIS support costs while maintaining a high level of quality. The Tiger Team is funded by PGG with the expectation that it will find ways to recoup its own cost multiple-fold through process efficiency gains. A key part of this will be to seek external suggestions on improving the ISIS support process. A formal external review is expected in 2014.

One small but overdue step is the elimination of support for ISIS2. The USGS plans to work with PGG to formally end support for ISIS2 sometime in 2014, after more, but not all, ISIS2 capabilities are migrated to ISIS3. There are already known issues with ISIS2

that we have no plans to address since users can accomplish these tasks in ISIS3.

The area where efficiency is most likely to be gained is through improved testing. It is almost always cheaper to fix issues if they are caught earlier in the development process. We are actively being pursuing automated testing of user interfaces with software reproducing scripted user actions. A goal is to also provide a "beta" version of ISIS for testing by outside users prior to a public release.

Future Vision: The current and near-future emphasis for ISIS development is support for the existing ISIS capabilities. However, some work is already underway to expand the utility of ISIS.

One key strength of ISIS is its ability to rigorously "control" planetary image data, calculating the proper location and orientation of the observer and the target. However, this is also the most complicated and time consuming task that ISIS users face. The major focus is on improving the user interface and workflow, but other improvements to allow more reliable automated processing are also being investigated [9,10].

Along similar lines, over the next several years the emphasis will be on improving the workflow for science users. Thus one goal will be to improve the compatibility of ISIS products with other commonly used software tools (e.g., IDL/ENVI, MATLAB, ESRI ArcGIS). Another goal is to incrementally improve ISIS's ability to produce publication-ready figures by, for example, extracting the ancillary data that should be included in figure captions.

While we are working to improve ISIS, we are also cognizant of the trend toward on-demand processing of products that can be viewed online. The USGS is working on multiple projects to bring the power of ISIS to users without the need to install the software locally or learn to use it [e.g., 11,12].

Overall, we are working to assure that the considerable investment the Nation has made in ISIS provides the best value to the user community.

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