OPERATIONS ELECTRONIC LOGBOOK EXPERIENCE AT BNL *

T. Satogata, I. Campbell, G. Marr, P. Sampson,
Brookhaven National Laboratory, Upton, NY 11973, USA

Abstract

A web-based system for electronic logbooks, "elog", developed at Fermilab (FNAL) [1], has been adopted for use by AGS and RHIC operations and physicists at BNL for the 2001–2 fixed target and collider runs. This paper describes the main functional and technical issues encountered in the first year of electronic logbook use, including security, search and indexing, sequencer integration, archival, and graphics management. We also comment on organizational experience and planned changes for the next facility run starting in September 2002.

1 INTRODUCTION

Traditional operations record-keeping in hardcopy logbooks suffers from several drawbacks. Creation (writing comments, pasting in copies of graphics) and backup/duplication are both labor-intensive, and can distract operations from more important machine tasks. Text can be illegible, and valuable copies of logbooks can be misplaced or lost. Most importantly, these logbooks are only available to a few within the organization at any one time; other operators, system specialists, engineers and administrators have to rely on second-hand information.

Our operations group has used electronic logs for shift summaries since 1994. These logs are web-accessible, searchable, and archived both to digital backup and physical hardcopy; they are also automatically emailed to a mailing list upon submission. This system worked well for AGS and Booster operations until RHIC commissioning, where many details of large-scale commissioning were quickly changing. Hard-copy logbooks were then necessary to manage the many graphics and screenshots produced, and these logs had to be shared among many personnel involved in day-to-day commissioning.

Our adoption of a more comprehensive electronic logbook system is motivated by the importance of providing routine real-time access to full detailed commissioning logs to all commissioning personnel. This has the immediate effect of improving meeting efficiency (an observation from FNAL). All interested parties can read recent elog entries and review graphics before each meeting, and thus feel well-prepared to deal with daily issues. Like the shift coordinator summary logs, this elog system also avoids many pitfalls of hardcopy logbooks. It is easily backed-up, printed for hardcopy archives, searched for keywords, and integrated to controls to consistently mark major events such as new ramps, quenches, and beam aborts.

Our use of elog is to provide detailed internal records of day-to-day facility operations, and operations routinely updates separate web pages for current machine status and experiment broadcast. We are also developing teleconferencing capability between our main control room and experiment control rooms to improve coordination as a pilot demonstration for remote operations [2].

2 IMPLEMENTATION

The elog is implemented by approximately 8000 lines of Perl5 CGI scripts beneath an Apache 1.3.20 web server on a Sun Ultra-2 running Solaris 5.7. The original FNAL separation into approximately two dozen Perl files integrated by two master CGI scripts has been maintained; this separates functionality into easily-supported modular components.

We have developed simple small Perl scripts that copy versions of elog between development and operations machines running Solaris and Linux, allowing development and testing of multiple versions. These scripts also are used to copy functional versions of elog to CD-ROM as browsable offline archives. Two other small scripts bypass the CGI interface to append either text or graphics to the current elog; Section 3 discusses how these are used for control system graphics and sequencer integration.

Data files are stored as flat text files for logbook entries, and normal jpg or gif files for graphics. These files are straightforward to maintain, and flat text files can be edited by hand if necessary. However, flat text files are inefficient to manage in bulk, particularly with regards to elog searches for combined keywords as discussed in Section 4. The user interface for elog is any HTML4.0-compliant web browser supporting Javascript, including most reasonable versions of netscape, Mozilla, Opera, and Microsoft Explorer. HTML4.0 is required for elog navagation frame support, while Javascript is used for form submission and client-side integrity checks before data posts. No cookies are used, and no Java is used to keep clients "thin".

Table 1: RHIC/AGS elog usage, 2001–2. Operations summary elogs consisted of only detailed text shift summaries (see Fig. 1), while RHIC machine logs are graphics-intensive and include many entries per shift (see Fig. 2).

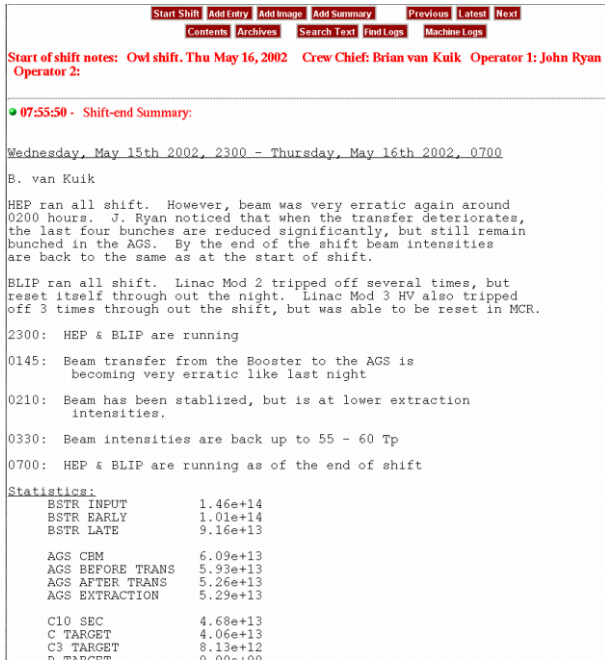| Machine	Dates (2001–2002)	elog size [Mb]
Operations elog	2001	5.5
	2002	2.0
RHIC / Au	May 24–Nov 26	303
RHIC / $\vec{p}\vec{p}$	Nov 30–Jan 24	124

Figure 1: A sample operations electronic log summary, including machine performance information, suitable for shift-by-shift email reports. A navigation button frame is at the top.

Figure 2: A sample RHIC commissioning log page, including an embedded HTML table of ramp settings, thumbnail graphics, and graphics comments.

3 FUNCTIONALITY AND USE

Individual elog entries can be text or graphics, and are timestamped to the second. An unlimited number of timestamped comments may be added to any entry, including graphics, and links and logbook cross-references can also be embedded in entries and comments, providing complete hypertext functionality. The capability to email links to individual elog entries is also available; this was used during RHIC commissioning to notify engineers and physicists of certain entries that were relevant to their support. A "Quick Entry" field is also available in all elog notebooks to allow quick entries in case of emergency.

3.1 Operation Coordinator Logs

The operations coordinator summary log has several functions. It relays detailed information about uptime and efficiencies, and summarizes significant events of the shift in a machine chronology. It outlines machine setup changes, improvements, and special and/or temporary setups, including involved personnel. It lists specific problems to be addressed by subsequent shifts, such as midnight shifts listing non-critical items to be addressed during the next day shift. It also lists personnel who are called in during off-hours critical system repair, including what was done and success of the repair.

This log also itemizes communications with experiments and program issues, such as beam sharing, target changes, experiment rates, dump sequences, and dump frequencies.
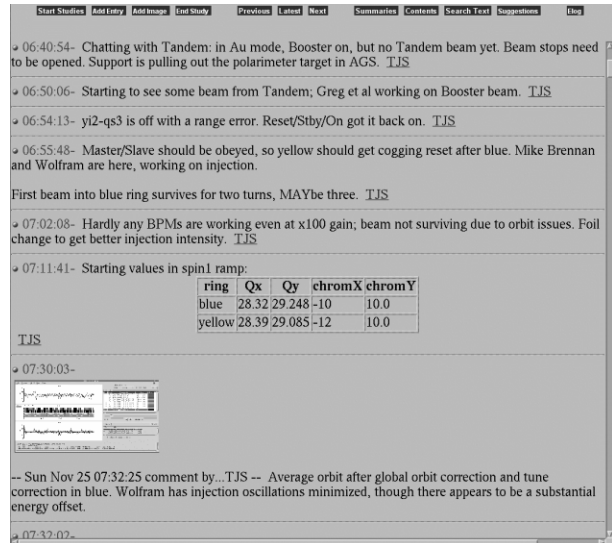
As shown in Fig. 1, the operations coordinator log is a text shift summary that is automatically emailed to interested parties at shift end. This provides physicists, management, and experimenters with shift-by-shift highlights of operation. Only a single operations coordinator elog can be open at any given time.

Most operations coordinators still write single end-shift summaries instead of "real-time" shift entries. This is mostly due to technical problems that are expected to be resolved before the next AGS/RHIC run (see Section 4). Machine physicists are using separate machine elog notebooks for documentation of individual systems and setup details.

3.2 RHIC Machine Logs

In contrast to the coordinator summary log, the RHIC machine logs were used to record all activities associated with machine startup and 2001–2 operations. This included graphic snapshots of fill, ramp, and collision performance, and results of routine machine activities such as tuning changes, orbit correction, maintenance, and performance requests from experiments. This resulted in a much more detailed (and occasionally noisier) elog than the coordinator summaries, but both elogs are routinely used by those analyzing RHIC run performance.

The RHIC machine elog was often used to share data between groups working in separate locations. This was particularly important during beam study periods, when the elog provided details of current plans and expectations between physicists and engineers in instrumentation, RF, and the main control room. This was also important during system commissioner support off-hours from home, allowing support personnel to make elog entries directly.

3.3 Graphics and Commenting

The AGS/RHIC Control system had an existing utility, `PrintUtility`, that allows single-click printing of any graphic item (such as a full desktop, or an Xwindow and its contents) on a user's screen. This program now supports the option to dump the graphic into the machine elog instead of printing, using an accessory script that appends a given graphic file directly to the elog database files, bypassing the CGI interface. The default graphic format for window dumps is GIF, because it is lossless yet self-compresses reasonably well. No other graphics compression is used, and currently no separate thumbnails are generated (see Section 4). An unlimited number of timestamped text comments may be added to elog graphics.

Using old logbooks, commissioners and operators would often draw pictures and diagrams directly in the logbook. Users can now use standard graphics tools (such as xfig or gimp) to draw graphics, then dump them into the logbook directly. A scanner is also available to to scan in hardcopy pictures, photos, and other materials.

3.4 Sequencer Integration

The RHIC operations sequencer[3] automates complicated multi-system tasks, such as energy ramping, RF rebucketing, and machine main magnet hysteresis. A sequencer primitive, `elog`, appends a specified sequencer message to the current machine elog. This is used to automatically insert elog comments for ramp numbers, beam quenches, permit drops, and other important events. Searches for these automated comments work well because they are always consistently phrased.

Any text or graphics that can be assembled by the sequencer may benefit from automatic logbook entries. One example is ramp efficiencies, where the sequencer automatically calls another ramp diagnosis script at the end of every successful acceleration ramp. This script assembles statistics such as incremental and total ramp intensity and efficiency from the RHIC logging system, and inserts a ramp performance table into the electronic logbook.

3.5 Security and Accessibility

Users of elog are divided into four categories based on IP address: no access, read-only, read-add (user can make entries), and read-add-edit (user can edit existing entries). At present all users behind the operations firewall are read-add, with the main control room consoles, operations coordinators desktops, and elog administrators having read-add-edit access. There has been no necessity to lower privileges to read-only.

To restrict but not eliminate external access, the elog web server is located behind a departmental operations firewall that requires a valid BNL Cryptocard. All remote users have read-write access and are permitted to make entries; this is often useful during remote diagnosis and support.

4 DEVELOPMENT PLANS

Search capability at present is limited to single contiguous strings. SQL-type searches on single and multiple logbook entries is preferred. We are investigating the implications of moving all elog text files to a relational database such as Sybase (already used in AGS/RHIC operations) or MySQL. This would improve overall elog performance at the expense of portability, and tools would need to be developed to translate between flat file and database formats.

Images are currently stored in elog without compression. Elog thumbnails such as in Fig. 2 are only visually scaled using HTML `<img>` modifiers — the entire original image is still transferred. The resulting bandwidth sometimes slows server response when serving many clients, and often leads to very long page load times on slow connections. We plan to implement server-side image compression to a thumbnail cache, which will improve server response and reduce page load times to reasonable levels.

Currently our operations elog is still aligned to the FNAL 8-hour shift clock, making the coordinator wait until a certain time has passed until new entries can be made. By removing this restriction and providing cleaner HTML to text format translation for email shift reports, we expect that the operations summary elog will be used more like machine notebooks in the future.

With sequencer and electronic logbook integration, the question of logging system integration often arises. Many graphics that are now statically copied into elog could be dynamically created with information from RHIC data loggers. However, performance requirements and elog integrity are pushing development in the opposite direction, towards logging tools that will integrate with the sequencer to dump standard pictures, as well as standard tables and text, into elog. In this sense elog does not integrate with the logging system, but complements it by providing a written context for logged data analysis.

5 ACKNOWLEDGEMENTS

REFERENCES

[1] T. Meyer and W. Kissel, "The Electronic Logbook Project at Fermilab",
`http://medusa.fnal.gov/e-log_about.html`

[2] F. Willeke et al., "How to Commission, Operate and Maintain a Large Future Accelerator Complex from Far Remote Sites", ICALEPCS 2001.

[3] T. D'Ottavio et al., "Description of the RHIC Sequencer System", ICALEPCS 2001.