

WBS 1.9 - Integrated Control Systems
SNS MONTHLY PROGRESS REPORT
November, 1999

I. Senior Team Leader Assessment

A. R&D

A1. WBS 1.1.9 Integrated Control Systems R&D

Technical Progress/Accomplishments

An Integrated Controls Working Group (ICWG) meeting was held at ORNL on Nov. 3-5. Activities included reviewing activities in progress at each lab, continuing discussions on applications software architecture, and reviewing standards activities. A preliminary block diagram of the proposed SNS timing system was reviewed. Meeting notes are posted at:

http://www.ornl.gov/sns_int/ProjectInformation/SNSteams/Controls/191/presentations/991103%20ICWG%20meeting/

The Controls Group continues to lead in project-wide standardization. A standard for procuring Programmable Logic Controllers (PLCs) has been recommended to purchasing; a discussion paper on fieldbuses was completed; work to update the project device and signal naming convention was started; and work on cable numbering and reviewing cable database software packages continued.

A preliminary design review for the Control System Network was held, with favorable results.

Significant Issues/Actions

No significant issues this month.

Summary Variance Analysis

Variances are within thresholds. Controls R&D continues to have a small negative cost variance due to some mischarging and completing some work sooner than expected. No impact is expected.

B. Integrated Control Systems Subproject

B1. WBS 1.9 Integrated Control Systems

Technical Progress/Accomplishments

The Controls Group made two presentations at the ASAC meeting. One on overall progress to date and another on Timing System preliminary design work. Both were well received and helpful comments are being pursued.

A preliminary design review of the Control System Network was conducted in November as scheduled. The results were favorable, and many useful suggestions were made which will be followed up.

The controls team at LBNL continues to install and test systems, and to place them into operation. Operator acceptance of the computer controls being provided is increasing. At ORNL progress continues in defining interface requirements for conventional facilities and on a fieldbus design criteria document. At BNL, work continued on interface development for PLCs, and on developing interface requirements for beam instrumentation and magnet power supplies. At LANL, a model of the resonance cooling system for the CCL hot model was exercised to determine loop timing parameters, and the design was modified as a result.

Significant Issues/Actions

No significant issues this month.

Summary Variance Analysis

Significant variances exist in WBS 1.9.2 Global Systems and WBS 1.9.4 Linac Controls. Variances in both cases are due to not assigning personnel to the work. No project impact has been caused to date.

Personnel have been assigned to WBS 1.9.2 and the variance is beginning to lessen.

Additional personnel have been assigned to Linac controls but strategic hiring is still required for the Linac Controls Level 3 Team Leader and other positions.

C. Configuration Management

Change Control Actions Incorporated This Period

No PCR actions incorporated this period.

Change Control Actions Pending This Period

A PCR to transfer funds from conventional facilities to WBS 1.9.9 (Personnel Safety) was signed by Dave Gurd and Bob Kustom. The project office needs to obtain concurrence from Rudy Etheridge to make this official.

Cabling PCR-IC-001 (adding scope and funds for cable management) has been signed by Dave Gurd and needs to be signed by Bob Kustom.

D. Milestone Schedule Status

WBS 1.9 has no level 0 or 1 milestones. Level 2, 3 and 4 milestones are listed below.

Level 2 Milestones from PEP and Recommended level 3 Milestones

| Milestone | Level | WBS | Date |
|--|--------------|------------|-------------|
| Complete R&D Tasks | 3,4 | 1.1.9 | June 00 |
| Complete ICS Global Systems Preliminary Design Review | 3,4 | 1.9.2 | March 00 |
| Complete Title II Design Review for Accelerator PPS and Title I Design Review for Target PPS | 3,4 | 1.9.9 | March 01 |
| Begin equipment installation | 2 | 1.9 | July 02 |
| Global controls ready for FE commissioning | 3,4 | 1.9.3 | May 02 |
| Global controls ready for DTL commissioning | 3,4 | 1.9.4 | Nov 02 |
| Design Complete | 2 | 1.9 | April 03 |
| Main Control Room ready for commissioning | 3,4 | 1.9.2 | June 03 |
| Global controls ready for CCL & Linac dump commissioning | 3,4 | 1.9.4 | March 04 |
| Global controls ready for HEBT, Ring, & Inj/Ext dumps commissioning | 3,4 | 1.9.5 | June 04 |
| Global controls ready for RTBT/Target commissioning | 3,4 | 1.9.6 | Dec 04 |
| Complete global controls acceptance test | 2 | 1.9 | Dec 05 |

Level 2 milestones are listed in the PEP. A review of the project detailed schedule has shown that they remain valid. Level 3 and 4 milestones insure that controls systems are ready when needed to support commissioning. Twenty-four level 5 milestones have been identified for FY00. These milestones are the completion of key deliverables in FY00 funding packages.

Level 3,4, and 5 milestones will be entered into the detailed schedule in January.

No milestones were due in November.

D. Critical Path Analysis

R&D for controls consists of small effort to complete some software drivers and evaluations of some vendor hardware. This effort is neither near the project critical path nor a controlling activity within WBS 1.9

The strategy for line item work is to have all hardware and software for WBS 1.9 elements tested to the degree needed to support technical systems commissioning prior to its being needed. Thus, WBS 1.9 would not lie on the project critical path.

Schedule update activities in November showed that controls does not lie near the project critical path and thus, this strategy is still viable.

II. Detail R&D Subproject Status

A. WBS 1.1.9 Integrated Controls Systems R&D

A1. Technical Progress/Accomplishments

WBS 1.1.9.2 Standards. Work continued towards implementing a PLC procurement standard. The proposed standard parts list was revised and a cursory “cost avoidance” analysis was made. SNS Procurement staff have been officially requested to formulate a procurement strategy and begin negotiations. SNS Procurement is proceeding to develop a DOE-wide procurement via the Integrated Contractor Procurement Team (ICPT) program. This will allow the entire DOE complex to receive substantial discounts on this type of equipment.

Java implementations at JLAB and ANL were installed and studied. The JLAB implementation worked fine. The ANL implementation had some difficulty which is being studied.

Sample signal names were circulated among working group members in preparation for a signal naming “mini-workshop” to be held in early December.

WBS 1.1.9.3 Subsystems. A draft “Fast Protection System Requirements Document” was written and posted on Controls Group web page for comments. See at:

http://www.ornl.gov/sns_int/ProjectInformation/SNSteams/Controls/192/1923/1923.html

Using “Netmeeting,” a discussion of the preliminary timing system was held during the November ICWG meeting.

A2. Significant Issues/Actions

No significant issues this month.

A3. Variance Analysis (Cumulative To-date) (\$k)

Variances are Within Thresholds. No Variance Analysis Required.

III. Detail Line Item Subproject Status

A. WBS 1.9.1 Integration

Technical Progress/Accomplishments

(This WBS element covers the management costs for WBS 1.9, including the salaries of the Senior Team Leader and Lead Engineer.)

An Integrated Controls Working Group meeting was held at ORNL on Nov. 3-5. Activities included the following:

- reviewed activities in progress at each lab
- continued discussions on applications software architecture
- reviewed standards activities
- reviewed preliminary timing system block diagram

A preliminary set of meeting notes are posted at:

http://www.ornl.gov/sns_int/ProjectInformation/SNSteams/Controls/191/presentations/991103%20ICWG%20meeting/

Preparation of new, more detailed work packages began as instructed by the SNS project office.

Systems for cost and performance (CPR) and schedule reporting were improved. The schedule was revised to correct logic links and make it consistent with FY00 funding packages.

A signed letter with requirements for PLC standardization was transmitted to procurement. A white paper containing justification and a recommendation for standardization of control systems networks was drafted. A white paper for standardization of power supply interfaces was drafted.

Several software packages and numbering systems for cabling management were reviewed.

The cabling PCR and the Safety cabling PCR were signed by the Global Controls STL. Work to update the existing standard for Device and Signal Naming was started.

Significant Issues/Actions

The cabling PCRs need to be processed by the project office.

Variance Analysis (Cumulative To-date) (\$k)

Variances are Within Thresholds. No Variance Analysis Required.

B. WBS 1.9.2 Global Control System Subsystems

Technical Progress/Accomplishments

WBS 1.9.2.1 Control System Network. A preliminary design review of the ICS network was held. The review committee was chaired by Dr. Bill McDowell, APS and reviewers included independent network professionals from ANL, BNL, and ORNL. The review was held by videoconference, which worked well for this uncontroversial case. A preliminary set of comments has been received, and the review committee has given the “go ahead” for start of detailed design. Many useful comments were received, particularly in the realm of network security. Review materials and preliminary comments are posted at:

http://www.ornl.gov/sns_int/ProjectInformation/SNSTeams/Controls/192/1921/PrelimDesignReview/networkDesignReview.htm

Review materials were prepared in advance and presented by Bill DeVan, Lead Engineer for SNS Global Controls. Help and advice came from the ORNL networking group.

WBS 1.9.2.5 Application Software. The October Applications Workshop at ORNL precipitated many undocumented follow-up discussions. A proposal was submitted by Nikolay Makitsky for a test application development environment. A review of this proposal is scheduled following the December ASAC meeting at BNL. At the same meeting, a strategy will be developed to create a prototypical configuration database that could be used to generate EPICS databases.

A list of possible improvements to the EPICS core software was developed and circulated within the EPICS community. A meeting to discuss these proposals is planned for the week of January 10 at LANL. Although this is an “EPICS core group” meeting, SNS will be represented, as many of these improvements will be important to SNS.

Considerable effort has been expended at LANL in addressing new-found EPICS bugs. Of particular interest to SNS are IOC “crashes” which manifest themselves at APS in the same (newly-installed) high-speed network environment which is planned for SNS.

A demonstration system to test DeviceNet was added to the PLC lab at BNL and some testing performed. Development of the EPICS driver for the module (5136-DN-VME) was started. A draft design for the EPICS Application Development Environment (ADE) Graphical User Interface (GUI) was completed and will be sent to the ADE working group for comments. EPICS support for a General Purpose Instrument Bus (GPIB) -Ethernet Converter from National Instruments was implemented on Sun Solaris with the EPICS Portable Channel Access Server. Testing with a GPIB plotter went well. Testing of an HP converter was also conducted.

Significant Issues/Actions

No significant issues this month

Variance Analysis (Cumulative To-date) (\$k)

| <u>BCWS</u> | <u>BCWP</u> | <u>ACWP</u> | <u>SV</u> | <u>%</u> | <u>CV</u> | <u>%</u> |
|-------------|-------------|-------------|-----------|----------|-----------|----------|
| \$167.7K | \$66.7K | \$42.2K | (\$101K) | (60%) | \$24.5K | (38%) |

1. Problem Statement:

This variance is due mainly to not having personnel assigned to tasks in this area.

2. Potential Project Impact:

If allowed to continue, this personnel unavailability could have an adverse schedule effect. However, no project impact is forecast at this point.

3. Corrective Actions:

Some additional personnel are being assigned and work to identify other personnel sources is underway.

C. WBS 1.9.3 Front End Control System

Technical Progress/Accomplishments

1.9.3.2 and 3: FE Controls Ion Source/LEBT and RFQ

The team at LBNL worked closely with Ken Evans at the APS to upgrade the EPICS display manager (MEDM) to the current version, and apply it to the Front End Control System. This fixes many bugs, as well as adding some color rules. The EPICS Alarm Handler was brought on line, and a prototype operator console with dual screens was implemented. Operator screens have been built for all interfaces devices in the Source, LEBT and RFQ. Control of a mass flow controller has been implemented and tested. More Group 3 equipment has been received, and the Group 3 work has been documented.

1.9.3.6 FE Controls Vacuum/Utility

Started building vacuum and utility screens for the LEBT and RFQ. The initial PLC ladder logic for the LEBT vacuum was completed, and a temporary installation made.

Significant Issues/Actions

No significant issues this month

Variance Analysis (Cumulative To-date) (\$k)

Variances are Within Thresholds. No Variance Analysis Required.

D. WBS 1.9.4 Linac Control System

Technical Progress/Accomplishments

WBS 1.9.4.7 Non Recurring Design.

The dynamic control model of the CCL hot model was applied to a number of possible scenarios. Loop time constants are now better understood, and the design will be modified accordingly. A proposal was made which would facilitate debugging of the low-level RF systems by simplifying switches between Labview and EPICS control.

Significant Issues/Actions

Staffing of the Linac Controls effort continues to be a concern, although some manpower has been identified. Kay Kasemir began participation in discussions of the controls for the CCL hot model, and met with the group that had responsibility for this task until now. There is still no progress in filling the WBS 1.9.4 Level Three Team Leader position.

Variance Analysis (Cumulative To-date) (\$k)

| <u>BCWS</u> | <u>BCWP</u> | <u>ACWP</u> | <u>SV</u> | <u>%</u> | <u>CV</u> | <u>%</u> |
|--------------------|--------------------|--------------------|------------------|-----------------|------------------|-----------------|
| \$190K | \$64.4K | \$26.9 | (\$125.6K) | (66%) | \$37.5K | (58%) |

1. Problem Statement:

The variance is due to personnel unavailability.

2. Potential Project Impact:

If allowed to continue, this personnel unavailability could have an adverse schedule effect.

3. Corrective Actions:

Some manpower has been identified and the problem is somewhat alleviated. Strategic hiring is still required, however, in particular for the Linac Controls Level 3 Team Leader position. Staffing at LANL presents a difficult problem, as a laboratory-wide staffing freeze is in effect.

E. WBS 1.9.5 Ring Control System

Technical Progress/Accomplishments

WBS 1.9.5.1 Integration

We are working with the diagnostic group to test algorithms for the processing of BPM data. One goal is to determine if a standard PowerPC processor has the CPU power to perform necessary calculations. First tests indicate this can easily be accomplished. Now we are testing to see if it is possible to eliminate the FGA using the PowerPc to process the 20MHz data directly.

WBS 1.9.5.5 Application Programming

Implementation of the Accelerator Optics Model for the Ring and Transport systems was started. This will allow the implementation of XML-Server-Oracle structure over the next few months.

Construction of the magnet database was started. This was a recommendation from the applications workshop held at ORNL in October.

Work continued on the installation and evaluation of database tools.

Significant Issues/Actions

No significant issues this month

Variance Analysis (Cumulative To-date) (\$k)

Variances are Within Thresholds. No Variance Analysis Required.

F. WBS 1.9.6 Target Control System

Technical Progress/Accomplishments

Effort this month included an Instrumentation and Controls Working Group (ICWG) meeting. Topics at this meeting included standardization of PLCs and fieldbuses. As a result of this meeting, a technical paper on fieldbuses—including ControlNet and Profibus—was prepared and submitted for review. This

paper recommended that ControlNet be selected as a PLC peer-to-peer fieldbus for the SNS Integrated Control System. The signal and naming convention for the SNS was reviewed and is currently being used on some of the process control diagrams being made for the target utilities.

Significant Issues/Actions

None. There were no milestones due this month.

Variance Analysis (Cumulative To-date) (\$k)

Variances are Within Thresholds. No Variance Analysis Required.

G. WBS 1.9.7 Instruments Control System Interface

Technical Progress/Accomplishments

No progress reported this month. (This WBS element includes only the purchase of one VME crate and associated processor for each instrument.)

Significant Issues/Actions

No issues this month.

Variance Analysis (Cumulative To-date) (\$k)

Variances are Within Thresholds. No Variance Analysis Required.

H. WBS 1.9.8 Conventional Systems Control System Interface

Technical Progress/Accomplishments

Requirements for the conventional facilities controls to EPICS interface were documented for insertion into the Systems Requirements Document (SRD) for conventional facilities controls.

Significant Issues/Actions

No significant problems this month

Variance Analysis (Cumulative To-date) (\$k)

Variances are Within Thresholds. No Variance Analysis Required.

H. WBS 1.9.9. Personnel Safety Systems

Technical Progress/Accomplishments

Final drafts of the system requirements document, the safety requirements specification and the interface control document for WBS 1.9.9.1 have been prepared. These documents have been processed through technical editing and will be formally issued for comment early January.

We have obtained copies of procedures from the High Flux Isotope Reactor (HFIR) used for control of design, facility configuration and procurement. We intend to use these procedures as a basis for developing SNS specific procedures for accelerator and nuclear based safety related systems.

A project change request was prepared to transfer funds from conventional facilities to WBS 1.9.9.1 and 1.9.9.2. This PCR transfers responsibility for the design, procurement and installation of safety related cabling from conventional facilities to controls. The PCR has been approved by the Accelerator Division Head and is being processed by the project office.

Significant Issues/Actions

No significant issues this month

Variance Analysis (Cumulative To-date) (\$k)

Variances are Within Thresholds. No Variance Analysis Required.

IV. Earned Value Reports and Charts

**U.S. DEPARTMENT OF ENERGY
COST PERFORMANCE REPORT - WORK BREAKDOWN STRUCTURE (FORMAT 1)**

| PROJECT TITLE: SPALLATION NEUTRON SOURCE | | | | REPORTING PERIOD: November 01, 1999 through November 30, 1999 | | | | PROJECT NUMBER: 99-E-334 | | | | | | |
|--|-------------------|-------------------|--|---|--------|-------------------|--------------------|--|----------|-----------------------------------|----------|---------------------|----------|--|
| PARTICIPANT NAME AND ADDRESS: Oak Ridge National Laboratory Oak Ridge, TN | | | | BCWS PLAN DATE: July 1999 | | | | START DATE: October 1998 | | | | | | |
| | | | | | | | | COMPLETION DATE: December 2005 | | | | | | |
| WORK BREAKDOWN STRUCTURE | CURRENT PERIOD | | | | | | CUMULATIVE TO DATE | | | | | AT COMPLETION | | |
| | Budgeted Cost | | Actual Cost of Work Performed | Variance | | Budgeted Cost | | Actual Cost of Work Performed | Variance | | Budgeted | Revised Estimate | Variance | |
| | Work Scheduled | Work Performed | | Schedule | Cost | Work Scheduled | Work Performed | | Schedule | Cost | | | | |
| 1.1.9 Global Controls R&D | 82.5 | 82.5 | 77.7 | 0.0 | 4.8 | 1,554.3 | 1,554.3 | 1,578.7 | 0.0 | (24.5) | 1,707.3 | 1,707.3 | 0 | |
| 1.9 Integrated Control Systems | 294.6 | 170.9 | 178.4 | (123.7) | (7.5) | 1,423.9 | 1,132.5 | 1,077.7 | (291.4) | 54.8 | 53,700.9 | 53,700.9 | 0 | |
| 1.9.1 ICS Integration | 52.5 | 52.5 | 48.5 | 0.0 | 4.0 | 107.1 | 107.1 | 75.0 | 0.0 | 32.1 | 4,797.7 | 4,797.7 | 0 | |
| 1.9.2 Global Systems | 80.7 | 41.7 | 42.2 | (39.0) | (0.5) | 211.6 | 110.6 | 86.1 | (101.0) | 24.5 | 10,001.5 | 10,001.5 | 0 | |
| 1.9.3 Front End Systems | 17.9 | 17.2 | 40.7 | (0.7) | (23.5) | 59.5 | 59.5 | 97.9 | 0.0 | (38.4) | 978.8 | 978.8 | 0 | |
| 1.9.4 Linac Control Systems | 70.5 | 20.5 | 12.5 | (50.0) | 8.0 | 257.3 | 131.8 | 94.2 | (125.6) | 37.5 | 17,395.3 | 17,395.3 | 0 | |
| 1.9.5 Ring Control Systems | 52.0 | 16.3 | 16.3 | (35.7) | 0.0 | 676.8 | 623.0 | 623.0 | (53.9) | 0.0 | 12,656.8 | 12,656.8 | 0 | |
| 1.9.6 Target Global Controls | 6.0 | 7.6 | 3.7 | 1.6 | 3.9 | 61.3 | 61.3 | 66.2 | 0.0 | (4.9) | 1,971.4 | 1,971.4 | 0 | |
| 1.9.7 Control Systems | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.2 | 9.3 | 9.3 | (10.9) | 0.0 | 358.6 | 358.6 | 0 | |
| 1.9.8 Conventional Facilities Global C | 4.0 | 4.0 | 2.8 | 0.0 | 1.2 | 8.0 | 8.0 | 4.9 | 0.0 | 3.1 | 1,006.0 | 1,006.0 | 0 | |
| 1.9.9 Personnel Protection | 11.0 | 11.0 | 11.6 | 0.0 | (0.6) | 22.0 | 22.0 | 21.1 | 0.0 | 0.9 | 4,534.8 | 4,534.8 | 0 | |
| 1.9.10 ORNL Field Coordination | | | | | | | | | | | | | | |
| WBS SUBTOTAL | 377.1 | 253.4 | 256.1 | (123.7) | (2.7) | 2,978.1 | 2,686.8 | 2,656.4 | (291.4) | 30.3 | 55,408.2 | 55,408.2 | 0 | |
| UNDISTRIBUTED BUDGET | | | | | | | | | | | | | | |
| SUBTOTAL | 377.1 | 253.4 | 256.1 | (123.7) | (2.7) | 2,978.1 | 2,686.8 | 2,656.4 | (291.4) | 30.3 | 55,408.2 | 55,408.2 | 0 | |
| MANAGEMENT RESERVE | | | | | | | | | | | | | | |
| TOTAL | 377.1 | 253.4 | 256.1 | (123.7) | (2.7) | 2,978.1 | 2,686.8 | 2,656.4 | (291.4) | 30.3 | 55,408.2 | 55,408.2 | 0 | |
| RECONCILIATION TO CONTRACT BUDGET BASE | | | | | | | | | | | | | | |
| DOLLARS EXPRESSED IN: Thousands | | | | SIGNATURE: Dan Gurd, Controls System Senior Team Leader | | | | | | DATE: December 28, 1999 | | | | |

