INTEGRATED MANAGEMENT TOOL FOR CONTROLS SOFTWARE PROBLEMS, REQUESTS AND PROJECT TASKING AT SLAC

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Abstract

The Accelerator Directorate (AD) Instrumentation and Controls (ICD) Software (SW) Department at SLAC, with its service center model, continuously receives engineering requests to design, build and support controls for accelerator systems lab-wide. Each customer request can vary in complexity from a small software engineering change to a major enhancement. SLAC's Accelerator Improvement Projects (AIPs), along with DOE Construction projects, also contribute heavily to the work load. The various customer requests and projects, paired with the ongoing operational maintenance and problem reports, place a demand on the department that consistently exceeds the capacity of available resources. A centralized repository - comprised of all requests, project tasks, and problems - available to physicists, operators, managers, and engineers alike, is essential to capture, communicate, prioritize, assign, schedule, track, and finally, commission all work components. The Software Department has recently integrated request / project tasking into SLAC's custom online problem tracking "Comprehensive Accelerator Tool for Enhancing Reliability" (CATER) tool. This paper discusses the newly implemented software request management tool – the workload it helps to track, its structure, features, reports, work-flow and its many usages.

CONTROLS SOFTWARE WORKLOAD

The ICD Software Department, comprised of about 25 engineers, provides complete, long-term, robust, software engineering solutions for control of distributed accelerator systems lab-wide. The department responsibilities include host computing infrastructure, networking, relational databases, real-time embedded (and host-level) device, subsystem, and instrumentation control, process control, engineering/operational GUIs, and service oriented architectures. It also performs user support, upgrade and maintenance activities. The Software Department uses the EPICS (Experimental Physics Industrial Control System) toolkit and its extensions as the basis for most software engineering implementations. The department also fully supports the legacy SLAC Linear Collider (SLC) VMS-based Control system.

ICD Software Department personnel currently spend, on average, 25% of their time in support of LCLS and FACET program operations. All SW (along with other Hardware (HW)) Problems (or trouble reports) newly entered into SLAC's CATER system are discussed at the daily 08:15 maintenance meeting and are usually assigned to a resource by a Lead within hours of creation. One software engineer per week, on a rotational basis, acts as a Controls Deputy (CD) liasion between LCLS Operations and the Software Department. The CD attends the daily meetings, work planning meetings, works and resides within the Control Room, and carefully helps to coordinate the weekly software releases.

For the remaining 75% of the time, software engineers perform development work which can be categorized as either a) customer requests or b) project work. Project work is typically funded and approved by the AIP or DOE (such as the LCLS II Construction Project). Until recently, customer requests were typically delivered verbally or via email to engineers; oftentimes the supervisor or lead remained unaware. Task scheduling and tracking then varied by individual or lead; commonly by a combination of memory, spreadsheets, lists, emails, and disparate project schedules. Both customers and supervisors had limited visibility into work planned, in progress, or accomplished. It remained difficult to assess whether additional resources were justifiable. Furthermore, the work was hard to prioritize and load balance without a centralized list of all department problems, requests, and project tasking

PROBLEM TRACKING TOOL

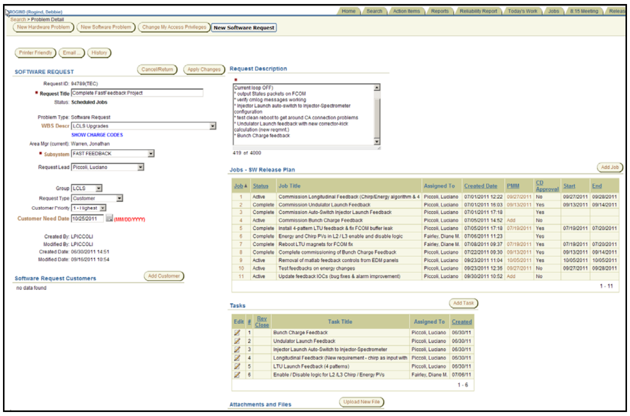
The CATER Problem Tracking Tool in its current implementation has been in wide use across many organizations at SLAC since 2008. The reports and workflow drive all of the daily LCLS (now joined by FACET) Operations/Maintenance meetings, software and hardware problem and maintenance work tracking, and contribute to the planning of the weekly machine development/access days. CATER is Oracle based, developed with Application Express (APEX), and has one full time developer (outside of ICD) allocated due to ever increasing feature demands.

In order to take advantage of CATER's existing user base, accounts, roles, relational database management, familiar work flow and familiar GUI, SW Requests (and their associated Tasks) were integrated alongside Problems into CATER in June, 2011. SW Requests are of two types: a) Customer, and b) Project Component. Additionally, a SW Job form was implemented which contains all fields required for software release approval and planning. This SW Job feature has proven very valuable for all software release types. Now for the first time, every software engineer has the capability of viewing all of their work – problems, requests, jobs, and project tasking in one place, via the CATER tool. Each user, upon logon, has a personalized dashboard on their home tab which displays all open assignments (Figure 5)

SOFTWARE REQUESTS AND TASKS

LCLS and FACET customers at SLAC are encouraged to login to the familiar CATER trouble reporting system and create a "New Software Request". There is a constant high volume of customer requests that are small in scale, of limited complexity and involve several people tasked separately. The automated Request system has been particulary efficient for tracking these types of entries that might otherwise get forgotten or not receive the proper visibility. Engineers/Leads also create entries to capture customer requests and components of their project based work. Requests use the existing CATER Problems schema and workflow. Fields include: *Title, Description, Status, Request Type ("Customer" or "Project Component"), Work Breakdown Description (funding source), Subsystem, Request Lead, Group (LCLS, FACET,..), Customer Priority, Customer Need Date, Created by, Modified by, Created Date, Modified Date.* There are buttons to *Add Customer*, *Add SW Job*, *Add Task*, and to *Upload* files.

A large Request, such as "Complete LCLS Fast Feedback Project" (Figure 1) may be further broken down into several Tasks, such as "Bunch Charge Feedback" (Figure 2), "Undulator Launch Feedback" etc. Each Task associates with a single resource and more detailed loading and scheduling information. Task fields include: *Title, Assigned to, Effort, Task Priority, Task Skill Set, Start Date, End Date, % Complete, Description, Status, Created by, Created Date*. There is enough information contained in the request /task database such that weekly reports and/or Gantt charts per individual or per project could be generated (future effort).



SOFTWARE REQUEST

Request ID: 94789(TEC)
* Request Title: Complete FastFeedback Project
Status: Scheduled Jobs

Problem Type: Software Request
WBS Descr: LCLS Upgrades
Area Mgr (current): Warren, Jonathan
* Subsystem: FAST FEEDBACK
Request Lead: Piccoli, Luciano

Group: LCLS
Request Type: Customer
Customer Priority: 1 - Highest
Customer Need Date: 10/25/2011 (MM/DD/YYYY)

Created By: LPICCOLI
Modified By: LPICCOLI
Created Date: 06/30/2011 14:51
Modified Date: 09/16/2011 10:54

Software Request Customers

no data found

Request Description

Current loop OFF)
* output States packets on FCOM
* verify cmlog messages working
* Injector Launch auto-switch to Injector-Spectrometer configuration
* test clean reboot to get around CA connection problems
* Undulator Launch feedback with new corrector-kick calculation (new reqmnt.)
* Bunch Charge feedback

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Jobs - SW Release Plan

Job ▲	Status	Job Title	Assigned To	Created Date	PMM	CD Approval	Start	End
1	Active	Commission Longitudinal Feedback (Chirp/Energy algorithm & 4	Piccoli, Luciano	07/01/2011 12:22	09/27/2011	No	09/27/2011	09/28/2011
2	Complete	Commission Undulator Launch Feedback	Piccoli, Luciano	07/01/2011 16:03	09/13/2011	Yes	09/13/2011	09/14/2011
3	Complete	Commission Auto-Switch Injector Launch Feedback	Piccoli, Luciano	07/01/2011 17:18		Yes		
4	Active	Commission Bunch Charge Feedback	Piccoli, Luciano	07/05/2011 14:52	Add	No		
5	Complete	Install 4-pattern LTU feedback & fix FCOM buffer leak	Piccoli, Luciano	07/05/2011 17:18	07/19/2011	Yes	07/19/2011	07/20/2011
6	Complete	Energy and Chirp PVs in L2 / L3 enable and disable logic	Fairley, Diane M.	07/06/2011 11:23		Yes		
7	Complete	Reboot LTU magnets for FCOM fix	Fairley, Diane M.	07/08/2011 09:37	07/19/2011	Yes	07/19/2011	07/20/2011
8	Complete	Complete commissioning of Bunch Charge Feedback	Piccoli, Luciano	07/22/2011 09:30	09/13/2011	Yes	09/13/2011	09/14/2011
9	Active	Removal of matlab feedback controls from EDM panels	Piccoli, Luciano	09/23/2011 11:04	10/05/2011	Yes	10/05/2011	10/05/2011
10	Active	Test feedbacks on energy changes	Piccoli, Luciano	09/23/2011 12:35	09/27/2011	No	09/27/2011	09/28/2011
11	Active	Update feedback IOCs (bug fixes & alarm improvement)	Piccoli, Luciano	09/30/2011 10:52	Add	No		

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Tasks

Edit	#	Rev Close	Task Title	Assigned To	Created
✎	1		Bunch Charge Feedback	Piccoli, Luciano	06/30/11
✎	2		Undulator Launch Feedback	Piccoli, Luciano	06/30/11
✎	3		Injector Launch Auto-Switch to Injector-Spectrometer	Piccoli, Luciano	06/30/11
✎	4		Longitudinal Feedback (New requirement - chirp as input with	Piccoli, Luciano	06/30/11
✎	5		LTU Launch Feedback (4 patterns)	Piccoli, Luciano	06/30/11
✎	6		Enable / Disable logic for L2 /L3 Chirp / Energy PVs	Fairley, Diane M.	07/06/11

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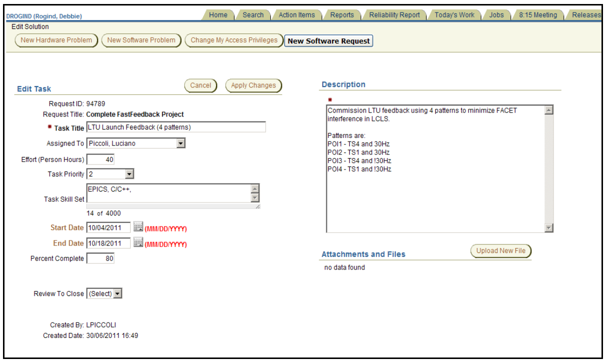
Attachments and Files

Figure 1: Sample Request Page.



Edit Task

Request ID: 94789
Request Title: Complete FastFeedback Project
* Task Title: LTU Launch Feedback (4 patterns)
Assigned To: Piccoli, Luciano
Effort (Person Hours): 40
Task Priority: 2
Task Skill Set: EPICS, C/C++,
14 of 4000
Start Date: 10/04/2011 (MM/DD/YYYY)
End Date: 10/18/2011 (MM/DD/YYYY)
Percent Complete: 80

Review To Close: (Select)

Created By: LPICCOLI
Created Date: 30/06/2011 16:49

Description

*
Commission LTU feedback using 4 patterns to minimize FACET interference in LCLS.

Patterns are:
POI1 - TS4 and 30Hz
POI2 - TS1 and 30Hz
POI3 - TS4 and !30Hz
POI4 - TS1 and !30Hz

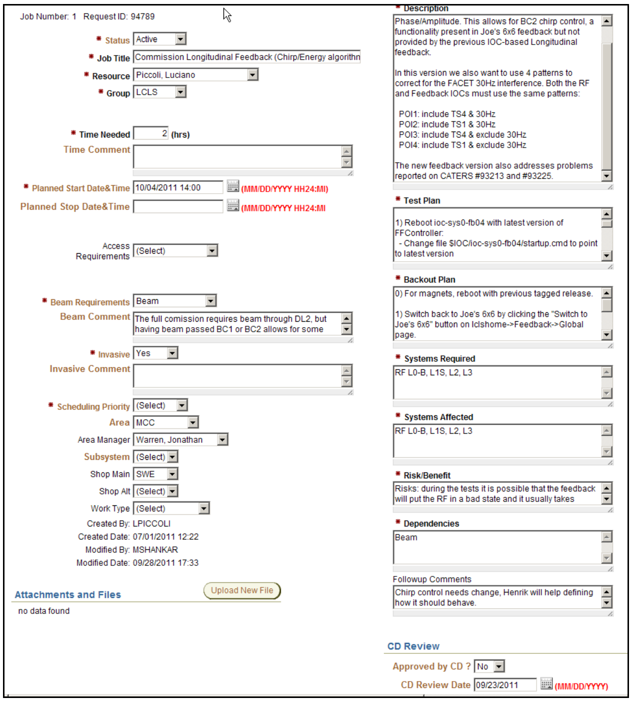
Attachments and Files

no data found

Figure 2: Sample Task Page.

SOFTWARE JOBS

LCLS hardware maintenance / repairs and software releases which require machine access (no beam) are typically scheduled every other week during user runs, while software releases / physicist machine development opportunities requiring an operational machine are scheduled once per week. To help maintain very high LCLS machine availability, all software releases are carefully evaluated for risk / benefit and are detailed in a new SW Job form that includes fields: *Job title, Resource, Time needed, Time Comment, Planned Start/Stop Date/Time, Access Requirements, Beam Requirements, Beam Comment, Invasive (Y/N), Invasive comment, Area, Subsystem, Test Plan, Back out Plan, Systems Required, Systems Affected, Risk/Benefit*. Refer to Figure 3 for a sample SW Job. The SW Jobs submitted each week are reviewed and scheduled in a weekly meeting between the program physicist and Controls Deputy; there are typically 15-20 SW Jobs of varying complexity submitted per week for LCLS. The Controls Deputy plays a pivotal role, especially on release day(s), coordinating the various software engineers along with parallel operational and physicist activities. (Refer to Figure 4, Sample Controls Deputy Report.)



Job Number: 1 Request ID: 94789

* Status	Active
* Job Title	Commission Longitudinal Feedback (Chirp/Energy algorithn
* Resource	Piccoli, Luciano
* Group	LCLS
* Time Needed	2 (hrs)
Time Comment	
* Planned Start Date&Time	10/04/2011 14:00 (MM/DD/YYYY HH24:MI)
Planned Stop Date&Time	(MM/DD/YYYY HH24:MI
Access Requirements	(Select)
* Beam Requirements	Beam
Beam Comment	The full comission requires beam through DL2, but having beam passed BC1 or BC2 allows for some
* Invasive	Yes
Invasive Comment	
* Scheduling Priority	(Select)
Area	MCC
Area Manager	Warren, Jonathan
Subsystem	(Select)
Shop Main	SWE
Shop Alt	(Select)
Work Type	(Select)
Created By:	LPICCOLI
Created Date:	07/01/2011 12:22
Modified By:	MSHANKAR
Modified Date:	09/28/2011 17:33

Attachments and Files

Upload New File

no data found

* Description

Phase/Amplitude. This allows for BC2 chirp control, a functionality present in Joe's 6x6 feedback but not provided by the previous IOC-based Longitudinal feedback.

In this version we also want to use 4 patterns to correct for the FACET 30Hz interference. Both the RF and Feedback IOCs must use the same patterns:

POI1: include TS4 & 30Hz
POI2: include TS1 & 30Hz
POI3: include TS4 & exclude 30Hz
POI4: include TS1 & exclude 30Hz

The new feedback version also addresses problems reported on CATERS #93213 and #93225.

* Test Plan

1) Reboot ioc-sys0-fb04 with latest version of FFController:
 - Change file $IOC/ioc-sys0-fb04/startup.cmd to point to latest version

* Backout Plan

0) For magnets, reboot with previous tagged release.

1) Switch back to Joe's 6x6 by clicking the "Switch to Joe's 6x6" button on lclshome->Feedback->Global page.

* Systems Required

RF L0-B, L1S, L2, L3

* Systems Affected

RF L0-B, L1S, L2, L3

* Risk/Benefit

Risks: during the tests it is possible that the feedback will put the RF in a bad state and it usually takes

* Dependencies

Beam

Followup Comments

Chirp control needs change, Henrik will help defining how it should behave.

CD Review

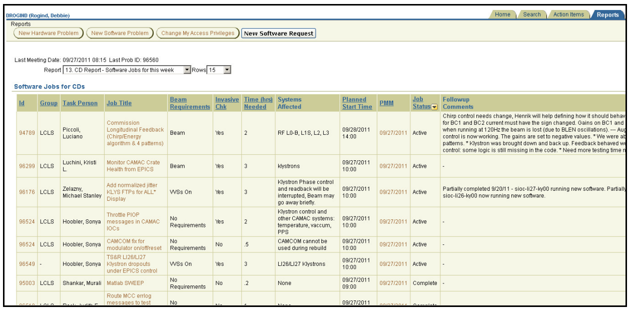
Approved by CD ? No

CD Review Date 09/23/2011 (MM/DD/YYYY)

Figure 3: Sample Software Job (Release Plan) Page.

REPORTS

Once logged onto CATER, all users default to their Home tab (dashboard) that summarizes and links to all assigned open "Problems Assigned to Me", "Requests and Tasks Assigned to Me", and "Jobs Assigned to Me" (Figure 5). There are additional views associated with other tabs. The Search tab provides basic and advanced searches plus an interactive report builder to customize report column data and filters, such as All Customer Requests (224 in number) or All Project Requests. The Report tab has many canned reports including the Controls Deputy Report of SW Jobs up for weekly approval (Figure 4), Work Breakdown Structure Names/Priorities, etc. All reports export to MS Excel.



Reports

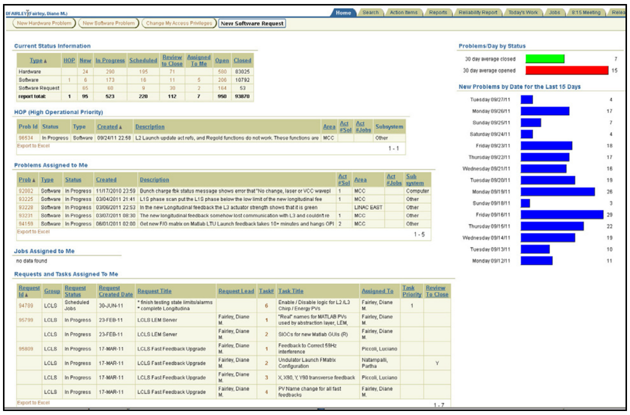
Last Meeting Date: 09/27/2011 08:15 Last Prob ID: 96560

Report 13. CD Report - Software Jobs for this week Rows 15

Software Jobs for CDs

Id	Group	Task Person	Job Title	Beam Requirements	Invasive Chk	Time (hrs) Needed	Systems Affected	Planned Start Time	PMM	Job Status	Followup Comments
94789	LCLS	Piccoli, Luciano	Commission Longitudinal Feedback (Chirp/Energy algorithm & 4 patterns)	Beam	Yes	2	RF L0-B, L1S, L2, L3	09/28/2011 14:00	09/27/2011	Active	Chirp control needs change, Henrik will help defining how it should behav for BC1 and BC2 current must have the sign changed. Gains on BC1 and when running at 120Hz the beam is lost (due to BLEN oscillations). --- Aug control is now working. The gains are set to negative values. * We were ab patterns. * Klystron was brought down and back up. Feedback behaved we control: some logic is still missing in the code. * Need more testing time n
96299	LCLS	Luchini, Kristi L.	Monitor CAMAC Crate Health from EPICS	Beam	Yes	3	klystrons	09/27/2011 10:00	09/27/2011	Active	-
96176	LCLS	Zelazny, Michael Stanley	Add normalized jitter KLYS FTPs for ALL* Display	WSs On	Yes	3	Klystron Phase control and readback will be interrupted, Beam may go away briefly.	09/27/2011 10:00	09/27/2011	Active	Partially completed 9/20/11 - sioc-li27-ky00 running new software. Partially sioc-li26-ky00 now running new software.
96524	LCLS	Hoobler, Sonya	Throttle PIOP messages in CAMAC IOCs	No Requirements	Yes	2	Klystron control and other CAMAC systems: temperature, vaccum, PPS	09/27/2011 10:00	09/27/2011	Active	-
96524	LCLS	Hoobler, Sonya	CAMCOM fix for modulator on/off/reset	No Requirements	No	.5	CAMCOM cannot be used during rebuild	09/27/2011 10:00	09/27/2011	Active	-
96549	-	Hoobler, Sonya	TS&R LI26/LI27 Klystron dropouts under EPICS control	WSs On	Yes	3	LI26/LI27 Klystrons	09/27/2011 10:00	09/27/2011	Active	-
95003	LCLS	Shankar, Murali	Matlab SWEEP	No Requirements	No	.2	None	09/27/2011 09:00	09/27/2011	Complete	-
			Route MCC errlog messages to test	No				09/27/2011			

Figure 4: Sample Controls Deputy Report.



Current Status Information

Type ▲	HOP	New	In Progress	Scheduled	Review to Close	Assigned To Me	Open	Closed
Hardware		24	290	195	71		580	83025
Software	1	6	173	16	11	5	206	10792
Software Request		65	60	9	30	2	164	53
report total:	**1**	**95**	**523**	**220**	**112**	**7**	**950**	**93870**

HOP (High Operational Priority)

Prob Id	Status	Type	Created ▲	Description	Area	Act #Sol	Act #Jobs	Subsystem
96534	In Progress	Software	09/24/11 22:58	L2 Launch update act refs, and Regold functions do not work. These functions are	MCC			Other

Export to Excel 1 - 1

Problems Assigned to Me

Prob ▲	Type	Status	Created	Description	Act #Sol	Area	Act #Jobs	Sub system
92082	Software	In Progress	11/17/2010 23:59	Bunch charge fbk status message shows error that "No change, laser or VCC wavepl	1	MCC		Computer
93225	Software	In Progress	03/04/2011 21:41	L1S phase scan put the L1S phase below the low limit of the new longitudinal fee	1	MCC		Other
93228	Software	In Progress	03/06/2011 22:53	In the new Longitudinal feedback the L3 actuator strength shows that it is green		LINAC EAST		Other
93231	Software	In Progress	03/07/2011 08:30	The new longitudinal feedback somehow lost communication with L3 and couldn't re	1	MCC		Other
94159	Software	In Progress	06/01/2011 02:00	Get new F/G matrix on Matlab LTU Launch feedback takes 10+ minutes and hangs OPI	2	MCC		Other

Export to Excel 1 - 5

Jobs Assigned to Me

no data found

Requests and Tasks Assigned To Me

Request Id ▲	Group	Request Status	Request Created Date	Request Title	Request Lead	Task#	Task Title	Assigned To	Task Priority	Review To Close
94789	LCLS	Scheduled Jobs	30-JUN-11	* finish testing state limits/alarms * complete Longitudina		6	Enable / Disable logic for L2 /L3 Chirp / Energy PVs	Fairley, Diane M.	1	
95799	LCLS	In Progress	23-FEB-11	LCLS LEM Server	Fairley, Diane M.	1	"Real" names for MATLAB PVs used by abstraction layer, LEM,	Fairley, Diane M.		
	LCLS	In Progress	23-FEB-11	LCLS LEM Server	Fairley, Diane M.	2	SIOCs for new Matlab GUIs (R)	Fairley, Diane M.		
95809	LCLS	In Progress	17-MAR-11	LCLS Fast Feedback Upgrade	Fairley, Diane M.	1	Feedback to Correct 59Hz interference	Piccoli, Luciano		
	LCLS	In Progress	17-MAR-11	LCLS Fast Feedback Upgrade	Fairley, Diane M.	2	Undulator Launch FMatrix Configuration	Natampalli, Partha		Y
	LCLS	In Progress	17-MAR-11	LCLS Fast Feedback Upgrade	Fairley, Diane M.	3	X, X90, Y, Y90 transverse feedback	Piccoli, Luciano		
	LCLS	In Progress	17-MAR-11	LCLS Fast Feedback Upgrade	Fairley, Diane M.	4	PV Name change for all fast feedbacks	Fairley, Diane M.		

Export to Excel 1 - 7

Problems/Day by Status

30 day average closed	7
30 day average opened	15

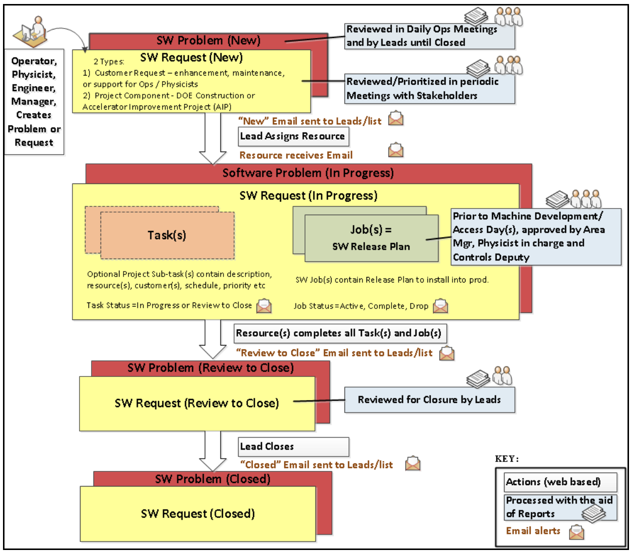
New Problems by Date for the Last 15 Days

Tuesday 09/27/11	4
Monday 09/26/11	17
Sunday 09/25/11	7
Saturday 09/24/11	4
Friday 09/23/11	18
Thursday 09/22/11	17
Wednesday 09/21/11	16
Tuesday 09/20/11	19
Monday 09/19/11	26
Sunday 09/18/11	3
Friday 09/16/11	29
Thursday 09/15/11	22
Wednesday 09/14/11	19
Tuesday 09/13/11	10
Monday 09/12/11	11

Figure 5: Sample CATER Home Tab (Dashboard).

CATER WORK FLOW

Requests follow the same simple, four state, CATER workflow as Problems because a) it has been proven to work effectively, and b) users are familiar with it. All status transitions in the life of a Request/Problem trigger alerts to email distribution lists which always include software leads. All New Requests/Problems have status=New. Once assigned to a resource, status changes to "In Progress" (or "Scheduled Jobs when SW Jobs are active). When all associated SW Jobs and Tasks (/Solutions for Problems) are complete, the status changes to "Review to Close". The Request/Problem is "Closed" by Leads with the appropriate closure privilege after careful review. The states, associated stakeholder review meetings, necessary reports, and email alerts during the life cycle of a Request/Problem are shown in Figure 6.



Operator, Physicist, Engineer, Manager, Creates Problem or Request
SW Problem (New)
SW Request (New)
2 Types:
1) Customer Request – enhancement, maintenance, or support for Ops / Physicists
2) Project Component - DOE Construction or Accelerator Improvement Project (AIP)
Reviewed in Daily Ops Meetings and by Leads until Closed
Reviewed/Prioritized in periodic Meetings with Stakeholders
"New" Email sent to Leads/list
Lead Assigns Resource
Resource receives Email
Software Problem (In Progress)
SW Request (In Progress)
Task(s)
Job(s) = SW Release Plan
Prior to Machine Development/ Access Day(s), approved by Area Mgr, Physicist in charge and Controls Deputy
Optional Project Sub-task(s) contain description, resource(s), customer(s), schedule, priority etc
SW Job(s) contain Release Plan to install into prod.
Task Status =In Progress or Review to Close
Job Status =Active, Complete, Drop
Resource(s) completes all Task(s) and Job(s)
"Review to Close" Email sent to Leads/list
SW Problem (Review to Close)
SW Request (Review to Close)
Reviewed for Closure by Leads
Lead Closes
"Closed" Email sent to Leads/list
SW Problem (Closed)
SW Request (Closed)
KEY:
Actions (web based)
Processed with the aid of Reports
Email alerts

Figure 6: CATER Request/Problem Workflow.

CONCLUSION

Results Achieved

- Customers may view **all** department work to a) direct prioritization; b) better understand why their requests may not have resources allocated, and c) track and aid progress.
- Supervisors/Leads/Staff are informed of all ongoing / upcoming work. Helps to catch potential issues early, prioritize workload, re-task staff, track status, and justify resource decisions

Lessons Learned

- The tool has been particularly useful for tracking the large volume of requests that are small in nature and/or of minor complexity, and require a few hours to a few days of many different resources.
- Integration of Jobs (software test/release plans) for Requests and Problems has been very efficient and well-received for planning and executing machine development days
- Simultaneous development of CATER using Oracle's Application Express (APEX) proves challenging
- Releases for any new Request features are constrained by the normal CATER release cycle

What's next?

- More training and enforcement of data entry
- Roll out to other organizations within ICD; SLAC
- More reporting – weekly reports, Gantt charting