

Instrument task-driven workflow software for cruise and maintenance operations

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Abstract—The Digital Infrastructure group at Ocean Networks Canada (ONC) is in charge of the development and maintenance of the organization’s Data Management and Archiving System (DMAS). The group has been successful in creating a software system that acquires data from large sensor networks, archives them and makes them available to a multidisciplinary community of scientists, the public, government and non-governmental agencies. DMAS also includes tools to manage the underwater infrastructure and the data flow. This paper describes a new arrival in the family of management tools: an instrument workflow system. This in-house software tool facilitates task management for all the network instruments affected in a given maintenance cruise or expedition. It was motivated by a need to ensure that all instruments are properly managed during a busy cruise season that requires domains of expertise throughout the organization. Building upon historical checklists and processes, it was designed by member teams of Digital Infrastructure department (Data Stewardship, Systems/Operations and Software Development) through consultation with key users within Ocean Networks Canada. (Abstract)

Keywords—*workflow; ocean observatories; instrument life-cycle; cruise operations*

I. INTRODUCTION

The Digital Infrastructure group at Ocean Networks Canada (ONC), an initiative of the University of Victoria, is in charge of the development and maintenance of the organization’s Data Management and Archiving System (DMAS). The group has been successful in creating a software system that acquires data from large sensor networks, archives them and makes them available to a multidisciplinary community of scientists, the public, government and non-governmental agencies. DMAS also includes tools to manage the underwater infrastructure and the data flow. This paper describes a new arrival in the family of management tools: an instrument workflow system.

This in-house software tool facilitates task management for network instruments affected in a given maintenance cruise or expedition. It was motivated by a need to ensure that all instruments are properly managed during a busy cruise season that requires domains of expertise found throughout the organization. Its design and implementation also establishes records of events in an instrument’s life cycle, and tracks our processes governing deployments, maintenance and recoveries.

Building upon historical checklists and processes, it was designed by member teams of Digital Infrastructure department (Data Stewardship, Systems/Operations and Software Development) through consultation with key users within Ocean Networks Canada.

II. WORKFLOW COMPONENTS

A. Processes

Designated staff design and implement workflows for instruments, with separate *processes* for installation, recovery and maintenance. Within each process, there are ordered *phases*, which themselves contain *tasks*. For example, an ‘Installation’ process includes instrument acquisition, software development, testing, deployment and commissioning phases. Each phase has a list of tasks to be completed by specific teams. A specialized web-based GUI (refer to Fig. 1) allows the user to create, edit, or delete workflow components.

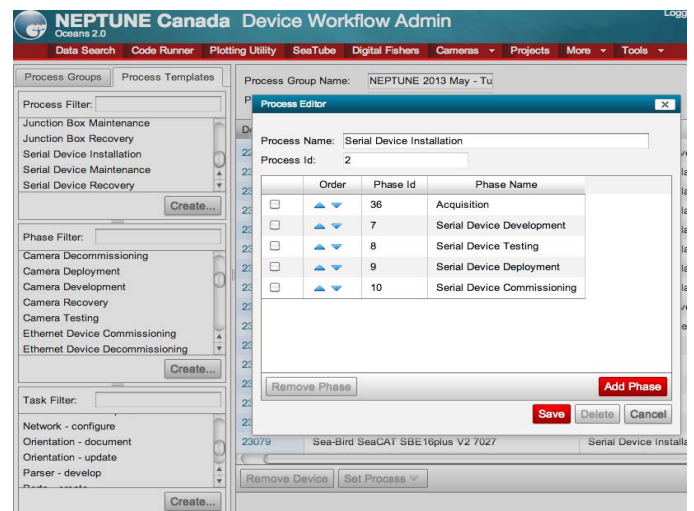


Fig. 1. This screen capture demonstrates the ability for privileged users to generate and manage workflow processes, phases and tasks. Phases within a process can be adjusted and ordered appropriately as the smaller window illustrates.

The heterogeneous mix of instruments introduces complexity; categories include junction boxes, serial and Ethernet instruments, cameras, autonomous instruments, samplers, and cruise-based instruments. Every one of these is considered a “device.” Each type warrants a different process,

NEPTUNE Canada Device Workflow Admin

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Data Search Code Runner Plotting Utility SeaTube Digital Fishers Cameras Projects More Tools

Process Groups Process Templates

Process Group Name: NEPTUNE 2013 May - Tully
Process Group Id: 4

Listing of instruments, assigned process and phase status for a particular grouping of instruments

Device Id	Device Name	Process	Required Tasks	Optional Tasks	Last Completed Phase
10011	BC Pod #1 Axis JB-02	Junction Box Maintenance			Servicing
23031	Sea-Bird SeaCAT SBE16plus V2 7029	Serial Device Installation			Serial Device Development
10600	Sea-Bird SeaCAT SBE16plus V2 6812	Serial Device Recovery			Serial Device Decommissioning
23108	Kongsberg Mesotech Rotary Sonar 1171 (1206086)	Serial Device Installation			Serial Device Commissioning
23157	Ocean Sonics icListen HF Hydrophone 1251	High Security Device Installation			High Security Device Development
23077	ROS PT-25 Ti 10297	Camera Installation			Acquisition
23032	Sea-Bird SeaCAT SBE16plus V2 7028	Serial Device Installation			Acquisition
23073	ROS Pan/Tilt 10293	Camera Installation			Acquisition
23030	Sea-Bird SeaCAT SBE16plus V2 7026	Serial Device Installation			Acquisition
23156	Ocean Sonics icListen HF Hydrophone 1253	High Security Device Installation			Acquisition
23106	Kongsberg Mesotech Rotary Sonar 1171(1206084)	Serial Device Installation			Acquisition
23047	Sea-Bird SBE 63 Dissolved Oxygen Sensor 630110	Serial Device Installation			Acquisition
11401	Kongsberg Mesotech Rotary Sonar 1071 sonar head 1	Serial Device Installation			Acquisition
23043	Sea-Bird SBE 63 Dissolved Oxygen Sensor 630279	Serial Device Installation			Acquisition
23153	DragonFish Camera SUBC13116	Camera Installation			Acquisition
23154	DragonFish Camera SUBC13113	Camera Installation			Acquisition

Remove Device Set Process Add Device... Save Delete Cancel

Create Process Group

Process groups organize instruments affected by a particular maintenance/deployment operation

Fig. 2. The administrative section of the instrument workflow tools allows designated users to create process groups which organize instruments affected by a particular maintenance or deployment operation. Selecting a process group, shows a listing of all the affected devices, their assigned process, and last completed phase.

whether it be driven by engineering, software or science requirements.

Tasks can be associated with a reference URL to an internal wiki space with task-specific pages for descriptions and outlines of the relevant ITTO (Input, Tools & Technologies, Output).

By versioning processes and phases, organizational method and process changes are tracked over time. For example, in 10 years, there may be a new method to calibrate instruments or deploy moorings or additional data quality control steps.

B. Process Groups

Given that the tool is primarily intended to support cruises and maintenance expeditions, instruments affected by a particular operation are added to a *Process Group* (e.g., ‘NEPTUNE Canada May 2013 Tully Cruise’) and assigned a relevant process (e.g., ‘Serial Device Installation’ or ‘Camera Recovery’). Over an instrument’s lifetime, it may undergo numerous processes. Thus, the tool serves an additional function of tracking an instrument’s life cycle and process iterations.

A summary page for each expedition (refer to Fig. 2) includes a table listing devices with their processes and most recently completed phase – easily sortable by any column. This page is a valuable reference for staff to display all of the instruments included in an expedition. It also highlights which instruments require immediate attention leading up to the expedition and during the commissioning period that follows.

Designated users can create or edit process groups, add or remove devices to the process group, and set the process applicable to each device.

C. Task Completion

Once an instrument is assigned a process, a worksheet populates with a list of all its tasks grouped by phase (as shown in Fig. 3). Permissions-based user access allows individuals to update each task from an incomplete to complete or non-required status. They can also input a comment and an identifier that hyperlinks to a relevant JIRA ticket (JIRA is a project and issue tracking software).

Tasks are hyperlinked to the specified URL for detailed descriptions, providing an important and easily accessible resource. These information pages are intended to assist new staff and provide standard guidelines for instrument activities across departments.

Each entry in the worksheet shows the last person to update or complete the task, which can easily facilitate communication, answer questions and pinpoint the correct person to consult. In a large organization with many different departments and challenges, this feature serves to keep the appropriate individuals informed.

On occasion, a process is cancelled part way through its phases. For instance, instrument testing may detect a fault which cannot be corrected in time, or extreme weather may prevent an instrument deployment. For those cases, a function to set all the tasks to a cancelled status with explanatory text will be implemented.

Device Id: 23031 Device Name: Sea-Bird SeaCAT SBE16plus V2 7029

General Sensor Ip Electrical Rating Data Rating Nameplate Port Physical Characteristics Device Action Event Site Procurement Additional Attributes

NEPTUNE 2013 May - Tully: Serial Device Installation (Process Group)

Required: 5/5 Optional: 0/0

Task	Area of Responsibility	Status	Comment	JIRA	Required	Last Modified (UTC)	Modified By
Instrument Documentation - collect	Engineering	Complete			true	30-Apr-2013 23:13:33	Meghan Tomlin
Instrument Documentation - publish	DMAS	Complete	http://wiki.neptunecanada.ca/display/instruments/23031	NEPDATA-394	true	22-May-2013 16:42:30	Reyna Jenkyns
Instrument Receiving Form - complete	Engineering	Complete	Incoming-Receiving was completed on April 17, 2012. The instrument was sent back to manufacturer and received at MTC in December 2012, and another report was created for December 18, 2012		true	16-May-2013 16:53:17	Meghan Tomlin
Device - create	DMAS	Complete			true	23-Apr-2013 22:51:03	Reyna Jenkyns
Device Actions - update	Engineering	Complete	December 10, 2012 - Instrument received at MTC with SBE63 Oxygen Sensor (23047). Receiving-Incoming report not completed		true	30-Apr-2013 23:12:07	Meghan Tomlin

Serial Device Development

Required: 10/10 Optional: 0/0

Task	Area of Responsibility	Status	Comment	JIRA	Required	Last Modified (UTC)	Modified By
Network - configure	Systems	Complete			true	13-May-2013 22:06:47	Shane Kerschtnien
IP address -	Systems	Complete	IP address must be updated when		true	13-May-2013	Shane

Fig. 3. A worksheet for each device is generated when it is assigned a process within a process group. Each phase is listed in order with its tasks. Responsible parties update the task as being completed or not required. A comment field is also used to provide particular details.

III. WORKFLOW IMPLEMENTATION

Since the tool was launched in April 2013, approximately 15-20 staff members in various departments have received basic training in order to record completion of tasks for which they are responsible.

Process groups have been initialized for 14 maintenance or deployment expeditions (9 now completed, 5 upcoming). Already, over 300 devices have been assigned a process within one or more expeditions. Commissioning and decommissioning phase activities are now underway for the 9 completed expeditions; instruments affected by upcoming expeditions are in varying stages of preparedness.

The impact on the organization has yet to be thoroughly reviewed, but preliminary feedback is positive. Not only has it enabled us to track our progress, but it has forced the various organization departments to communicate, consolidate and refine processes. During the first few months of implementation, missing and redundant tasks have been identified, meaning that processes are continually rationalized for more efficiency and diligence in our practices.

Additional processes are still being defined for instruments that operate autonomously (mobile and stationary) or collect physical samples.

IV. FUTURE IMPROVEMENTS

It is envisioned that future development of the tool will facilitate better reporting and extensions to expedition workflows.

Facilities for managers to create and design more customized reports, visual representations, spreadsheets and summaries are desired for improved planning and progress reporting. These generated documents would aid in expedition operations, metadata history of instruments, process assessments, and project management. Available to anyone in the organization, better communication and more productive meetings would be expected.

This task-driven workflow tool could be extended to expedition work-flows that outline cruise leg operations (non-instrument specific). Pre-cruise tasks could include booking ROVs and ships, packing equipment, and compiling chemical lists. During cruise tasks could include setting up servers on the ship, collecting and processing samples, and updating dive plans. Post-cruise tasks could include writing cruise reports, updating maps and archiving cruise data.

V. CONCLUDING REMARKS

This task-driven workflow tool has served the organization in one of its busiest operations seasons yet. Easily accessible to all staff, it is mitigating against missed tasks and facilitating

better communication. As the processes become more accurate and reporting facilities improve, increased productivity and reduced overhead is expected.

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