Waterfront Partnership – Integration and Cooperation in Submarine Repair

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Synopsis

HMCS Victoria Repair Work Period was a strategic partnership between a naval repair facility and an industry partner fostering ground up cultural change and pushing the limits of integration at the waterfront. Many traditionalists might argue that partnering with industry via in-service-support (ISS) contracts is a precursor to rendering naval maintenance facilities redundant, thus accelerating their obsolescence. However, the HMCS Victoria Repair Work Period (VIC RWP) in the Royal Canadian Navy's (RCN) dry dock in Esquimalt, BC presented a unique opportunity to further a philosophy predicated on an integrated and synergetic approach. A vast work scope, complex submarine design, supply chain issues exacerbated by specialized labour shortages, spurred a change to a long standing approach to submarine maintenance, namely with a Request for Proposal for integrated support resulting in a long-term partnership aimed at achieving the operational requirements of the RCN.

Keywords: Work Period, Submarines, Industry Partnership

1. Introduction

Some traditionalists would argue that partnering with industry via in-service-support (ISS) contracts is a precursor to rendering naval maintenance facilities redundant, thus accelerating their obsolescence. However, the HMCS Victoria Repair Work Period (VIC RWP) in the Royal Canadian Navy's (RCN) dry dock in Esquimalt, British Columbia (26 June 17 – 29 June 18) presented a unique opportunity to further a philosophy predicated on an integrated and synergetic approach. A vast, unpredictable work scope, a complex submarine design, supply chain challenges and shortages of specialized labour skillsets spurred an evolution toward the amalgamation and leveraging of the two organizations' extensive submarine maintenance acumen.

Whereas previous maintenance periods for RCN submarines were conducted solely by one of the two coastal RCN Fleet Maintenance Facilities (FMFs), the breadth of the VIC RWP necessitated a forward leaning strategy: increased platform availability to satisfy operational requirements. This presented a unique opportunity to implement a nascent 'waterfront management' strategy that emphasized industry partnership at all levels, with the intent of gaining significant innovation and expedient problem resolution. Borne from the RCN's recognition that long term submarine maintenance success would inherently be built on a partnership foundation, Babcock Canada – a subsidiary of Babcock International Group (BIG) – significantly supported by the production workforce of its subcontractor Seaspan Victoria Shipyards Ltd. (VSL), was inculcated into the existing FMF project management (PM) organization. It is proposed that when common submarine safety and availability objectives are established and the relational partnership is managed, world-class innovation and leading edge performance is achieved.

2. Waterfront Management Strategy

With an ever increasing demand from submarines and the planned arrival of new platforms, it became imperative for the RCN to improve and expand its service delivery strategy. While the strategic need for a government service provider is always extant, it is becoming increasingly important to establish and reinforce a framework that acknowledges increased industry involvement for submarine support. As a result, it was expected that the complexity of existing planning, coordination and reporting functions would increase proportionately with the volume of industry support occurring within the naval dockyards. To deal with this increasing complexity whilst continuing to deliver cost effective and efficient engineering services, a single lead was established under the control of the FMF Operations Department. This single lead is vested to oversee the delivery of all 2nd and 3rd line engineering and maintenance services, irrespective of the service delivery agent. With the establishment of this new framework, the dockyards evolved from a single service environment into a fully integrated industry partnership overseen by a single coordinating authority.

The Waterfront Management Strategy permits the fluid integration of numerous in-service support contracts, many of which are significantly dissimilar, into one cohesive service delivery entity. The new model introduced total coordination of defence contractors including all OEMs permitting the dissolution of antiquated rigidity between 2nd and 3rd line activities while offering decentralized management of maintenance services. With

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contractual delegation in place, Waterfront Management permits the fluid interchange of 2nd and 3rd line efforts amongst service providers as capacity constraints fluctuate offering excellent flexibility.

2.1. Key Philosophy

While the concept of proceeding with a project that contained both 2nd and 3rd line components was a requirement by necessity, the philosophy of leveraging a 3rd line In-Service Support Contract embedded within the planning and program umbrella of a 2nd line repair facility was certainly a novel and unproved concept. By combining 2nd and 3rd line maintenance elements we were potentially increasing the risk of integrating incompatible work elements and operations, requiring vastly different skill sets and following dissimilar critical paths. That said, the benefit of leveraging the strengths of these two maintenance approaches presented an outstanding opportunity whose potential benefits outweighed the risks and opened the prospect for future projects under a similar partnership constructs.

2.2. Integration/Partnership

2.2.1. Joint Project Charter

Foremost, a joint project charter was established to identify the overall RWP objectives and a set a common baseline of goals spanning both 2nd and 3rd line project requirements. The establishment of this joint charter was critical to the alignment of numerous internal and external project stakeholders and to provide a framework for scope and deliverable accountability to be clearly delineated.

In addition to requiring numerous standard project management elements such as weekly update reports and monthly progress review meetings, the joint charter enabled various innovative methods for achieving information exchange, including merging of metrics and using common operational planning tools. The span of controls distributed between project sponsors, project manager and the various team leads was specific yet flexible for execution permitting innovation, performance optimization and maximization of the underlying Waterfront Management framework.

To increase flexibility further, as part of the joint charter, funds from DMEPM(SM) associated with the work package for all Babcock work were released to the FMF along with delegated financial authority to execute and manage the work locally. This gave the project significant additional flexibility to augment and manage scope in a dynamic and fluid way via scope change notices.

While the project had relatively equal 2nd and 3rd line components and volume levels, the charter also enabled effective scope management by articulating the authority lines with respect to scope increases permitting quick resolution of scope concerns as balanced by the operational, system and design authorities respectively.

2.2.2. Contractual Leveraging

The contractual leveraging and application of a 3rd line In-Service Support Contract toward a 2nd maintenance period was cognizant of the complexity of not only the required weld mapping, related radiographs and weld repairs, but also the sizeable and complex submarine licensing extension package comprised of significant preventative maintenance and inspections. Furthermore, the integration of a 3rd line industry partner permitted the leveraging of various other areas that would otherwise not have been accessible to a 2nd line repair facility. In particular, the significant contractor technical expertise available on hand as required to assess design intent, provide recommendations or prepare deviations to design intent as applicable, was invaluable. In essence, marrying the technical proficiency that comes with deep 3rd line maintenance activity involvement with the expedient job resolution skills that come with 2nd line service delivery, created a robust and highly effective team. While not immediately apparent, the unification of service providers under one project also created a particular synergy in terms of supply chain challenges, often permitting 2nd line project leads to gain immediate visibility into 3rd line repair and overhaul activities andacces to an additional bank of spares which would otherwise have required lengthy stores demands via life-cycle managers. Lastly, the partnership also enabled increased access to critical skillsets, such as 2nd line welders being used for specialized baseline weld repairs or supplemental industry support being brought online to support critical path 2nd line jobs necessary to keep schedule on track.

2.2.3. Project Management

The key to effective project management spanning the two service providers, each providing specialized expertise, was the use of common methodologies for schedule integration and execution control. The use of common tools was particularly important given the complexity of the WBS and the need to fully understand

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predecessor and successor relationships. Moreover, it became apparent early in the project that fundamental differences in scheduling practices required an enhanced focus on achieving common baseline standards for metrics and reporting such that coherent performance goals could be established.

To deal with the discrepancies of integrating schedules, daily de-confliction exercises with joint engineering, production and regulatory entities were held permitting greater awareness of the challenges which were, in all cases, dealt with by starting at the common reporting baseline and working from there to achieve a successful solution. In fact, an essential element achieved from a project management perspective in this partnership was a well-established communication strategy that essentially linked all levels of management directly with their counterpart for periodic and impromptu meetings emphasizing a one-team approach and enabling the management of scope at daily and program levels.

2.2.4. De-confliction between Repair Facilities

One of the key success factors for the RWP was the role of the FMF Operations Department working with the BCI project lead to de-conflict work on a regular basis and set performance goals for the various phases within the project. The de-confliction efforts were largely a balance between focused schedule integration enabling equal efforts from each service provider on any given day to the temporary prioritization of certain work elements being privileged and the suspension of others. An example of this was the need to suspend 2nd line efforts in order to focus on achieving a particular baseline welding rate per week to meet the overall schedule. The balancing of short term work integration goals coupled with long term prioritization of phases permitted minimal loss of time in progressing project requirements.

2.2.5. Commissioning/testing

The FMF-Babcock/VSL partnership provided an excellent and reliable framework for managing the commissioning and testing phase of the project. Most notably, the significant commissioning experience available to Babcock was instrumental in identifying essential commissioning activities that were to occur in a sequential manner and supporting Joint Test Group (JTG) meetings established for assessing test form status. While the commissioning and testing activities themselves were largely independent from each other, based on the individual scope delineation, the combining of these towards the common goal of relicensing was essential and could only be achieved via the common practices and culture that was achieved and ultimately harnessed via months of having worked side-by-side.

2.2.6. Execution (lock-out/tag-out and SEMS support)

The integration of safety teams uncovered a notable challenge of integrating and complying with both Federal and Provincial standards. Notwithstanding the intricate nature of this, the Waterfront Management framework permitted a systematic process of joint SEMS (Shipboard Engineering Management System) review to occur on a daily basis to ensure adherence to the highest safety standard. As an example, hazard analyses were conducted in a joint fashion permitting risky evolutions to occur simultaneously which would traditionally be done sequentially such as concurrent welding and battery installation.

Via a Ships Control Office and lockout/Tagout trailer managed by BCI, the detailed work of commissioning and testing for both service providers could be safely progressed with minimal down time. Assigning the role of drafting, authorizing and installing of lock-outs, rip-outs and tag-outs to a single lead permitted a clear accountability for safety and a comprehensive database to be maintained. In addition, the introduction of a Master Record Database (MRD) which was an instrumental tool for tracking a comprehensive status of systems onboard enabled commissioning and reactivation test forms to progress in an efficient manner.

2.3. Shared Resources

Historically, work packages have been developed and then allocated to industry partners as part of the broader WBS for each work period. Discrete work packages were structured so as to be the sole responsibility of the subcontractor. Rarely – if ever – were personnel resources shared between the FMF and industry.

2.3.1. Rigging

During the planning stages, it was identified that ideally some resources could be shared between the RFs. For example, FMF would provide yard services, including crane support and staging, and Babcock Canada also offered the assistance of its schedulers to assist in developing and maintaining the integrated schedule. But one of the most demonstrable examples of integration stemmed from the drive shaft replacement. This intricate work package involved extensive coordination between FMF crane operations, rigging and staging, VSL riggers and mechanics, Babcock Engineering as well as an additional subcontracted crane support necessitated by the two crane lift for the shaft removal and installation. With approximately 2cm circumferential clearance in the stern gland at its narrowest point, the intricate crane movements were successful due to close cooperation between the FMF, Babcock and VSL teams.

2.3.2. Welding

The VIC RWP WBS also included a large scope of weld repairs on copper nickel pipe (CuNi). This type of welding is subject to a very stringent weld procedure and standard in accordance with the relevant DEFSTAN – one that very few welders can achieve. A small pool of qualified welders from the VSL labour force meant that the required schedule could not be met despite every available welder being committed to the project. An honest and transparent assessment of these personnel limitations led to a more forward leaning approach to resolving the issue, namely the use of a welding team from the FMF to augment the VSL teams. This team was comprised not only of welders, but as importantly a supervisory element and welding QC. As a resource, the team was then incorporated into the overall welding schedule and assigned welding jobs by the Babcock PM as the work became available.

While seemingly simple to coordinate, using the newly acquired resource proved more challenging than initially anticipated. At the onset, in order to ensure availability of the team to meet project demands, the FMF welding team was dedicated solely to the VIC RWP. As a result, any down time was scrutinized and mistakenly attributed to poor schedule management, as the team sat idle between jobs. Pipe welding on a submarine cannot be reduced to the simple striking of an arc and while seemingly straight forward, involved a considerable amount of preparatory work. Extensive work in way, complex lock out procedures and elaborate fit up requirements meant that each job was uniquely sequenced and not always conducive to the constant utilization of each welding team. While well understood within the PM teams for both the FMF and Babcock/VSL, management within the FMF did not have the same level of understanding, and the day-to-day complexities and welding success became overshadowed by a seemingly idle welding resource. The need for even more transparent and readily apparent resource allocation spurred greater communication between the Babcock and the FMF project teams. By identifying gaps in the schedule during which the FMF welding team could be utilized for FMF work, both RFs benefitted (and hence the VIC RWP project), recognizing that some FMF work took secondary priority. Stepping back from an all or nothing dedicated resource to a shared resource optimized the effectiveness and efficiency of this limited skill set.

The execution of weld repairs, all told 113 welds and 30 brazes, was also unique in that the engineering specifications, pipefitting and non-destructive examination (NDE) were executed by contractor resources, all in direct support of the FMF welders which resulted in a truly integrated execution of work. This also necessitated an advanced level of cooperation. Babcock Canada engineers developed the particularized maintenance repair specifications (PMRS), including all the necessary drawings. VSL pipefitters then undertook all the necessary fit up requirements prior to welding starting, which also necessitated witnessing and sign off by Babcock Canada engineering and FMF welders. Additionally, yet another subcontractor, Applus RTD SKC, completed both pre- and post-welding NDE. For each completed weld, all four organizations needed to interact and work in concert to achieve an acceptable weld. Developing an agreed SOP took a concerted effort by all four partner organizations.

2.3.3. MATCERT

Additionally, the finished work also resulted in a unique circumstance in which the subcontractor's QA was reviewing the customer's (FMF) welding documentation, or OQE (Objective Quality Evidence). The review and acceptance of documentation was the subject of spirited debate as issues of accountability, liability and culpability were discussed at length. Consensus was ultimately achieved and the Material Certification (MATCERT) fed into the overall MATCERT process, which is ultimately overseen by the Fleet Technical Authority (FTA), another agent of the customer, through which all of the work packages of both RFs pass for final review and acceptance. Less well-executed was parallel completion of work folders for progressive close-out in order to satisfy material certification, a process as important as the completion of physical work. An opportunity exists for future work periods for a more robust plan to ensure timely close-out.

2.4. Technical Innovation

While the Babcock/VSL contractor alliance was tasked with several involved work packages for the RWP, the most critical was to address several welding defects found in CuNi pipework. This labyrinth of piping is the key supplier of two main driving forces for critical systems onboard: air and hydraulics. Work previously undertaken in some cases did not meet the requirements of the relevant DEFSTAN and therefore necessitated repair. However, non-destructive examination records from a previous (and no longer used) NDE subcontractor were circumspect, and the necessary OQE did to exist to correlate NDE reports to individual welds onboard, calling into question the validity of acceptable/non-acceptable assessments IAW the required standard. Thus, the overall OQE picture was muddled and extensive investigation was required to rectify the overall picture, well before any physical repairs could be undertaken.

Initial assessment began in earnest with a complete review of an existing database, and the review of actual welding and NDE records, part of the contracted scope for Babcock Canada. An overall list of all known welds onboard was created; eliminating redundant or inaccurate references, and in some cases non-existing welds. Once complete, the full potential scope was better understood. Using the list of welds, dubbed the Weld Repair Index, a secondary review was then undertaken by the Babcock team to determine which records could not only be correctly attributable to welds, but as importantly provide adequate confirmation of standard compliance. This triage resulted in a refined list which then necessitated radiographic testing (RT) to determine whether or not welds conformed to the required DEFSTAN. Nearly 300 welds were radiographed. Each weld had a bespoke NDE report which was then sentenced by Babcock engineers. In concert with RCN platform system engineering expertise, the list was further vetted and triaged into three distinct categories: acceptable welds, repairs and welds which were potential candidates for concession to repair – either temporarily or permanently, depending on the egregiousness of the indications found within the weld profile. The decision to defer repair – colloquially referred as 'to deviate' – was predicated on a body of knowledge, the composition of which commenced two years prior when, in a similar circumstance, NDE (although properly correlated to individual welds) was poorly executed and incorrectly interpreted in the majority of cases, which resulted in a several other welds needing repair. At that time, the same triage was performed, and the analysis then began in earnest to understand crack propagation and risk of weld failure.

The technical aspects of the engineering and testing needed to inform the decision to deviate a repair is beyond the scope of this paper. However, Babcock engineering worked alongside SKC Engineering (Vancouver) to develop the mathematical models that would be used to generate probabilities for weld failure in each of the weld types (butt, sleeve or flange joints), for each pipe OD (outside diameter), such as 8mm, 16mm, 38mm, etc. Variables for the system (air or hydraulics) were applied and then calculations were performed to determine failure points, if they existed, following a number of cycles. The system cycling took into account the pressure at start-up, sustained pressure, cycle times, and number of cycles during normal and emergency periods of operations.

To bolster the modelling, actual test coupons were welded and then subjected to destructive testing. BMT undertook the testing under contract to the RCN. The testing results, in conjunction with the modeling and welding engineering expertise, were aggregated and cross-referenced to substantiate decisions to deviate.The analysis was articulated in the official system of record, DRIMS, and added to the OQE for each weld. Welds without a substantiated deviation or an acceptable RT, were deemed mandatory repairs for the work period, constituting approximately 20% of the radiographed welds. Moreover, to ensure that the operational community also reviewed non-repair determinations, a HIRA – Hazard Impact Risk Assessment, was undertaken to ascertain the risks to mission, personnel and equipment in the improbable likelihood of weld failure, based on the physical location of each weld and its proximity to either critical systems (weapons, sensors, etc.) and personnel.

Without the necessary analysis and successful triage of the weld repair scope, the number of welds to repair would have been far greater and the timeline to undertake those repairs would have not only become the critical path, but pushed the timeline beyond the project dates, potentially to the detriment of the project.

2.5. Project Challenges

One of the key challenges of the project was not being able to reliably quantify the full PM and CM scope of the project early on. The complexity and intricate nature of the weld work for Babcock led to significant growth; meanwhile the 2nd line planned maintenance was also generating in excess of 60% growth and arising work, compounding the complexity of scope management.

To effectively leverage an integrated schedule longer term, a rolling look forward must be maintained and a disciplined PM team must avoid getting its attention pulled too severely into daily arising work, thereby taking them away from long term planning. As seen with the dynamic nature of the RWP scope, critical path items often had to have their estimates revised resulting in constantly changing completion timeline. This reality ultimately necessitated an agile form of project management, which in this case was a method that suited the situation and was readily adapted as way of dealing with the high rate of change in project variables and project scope.

From a macro perspective, it was unknown what duration to plan for weld mapping, radiography and subsequent weld repair completion, hence the final planned maintenance and reactivation schedule could not be finalized. These unknowns resulted in delays from the original work period timeline but were mitigated via doubling of partnership efforts; effectively rebalancing scope between the joint service providers.

2.5.1. Material availability

Planning a successful project requires that materials be readily available at planned job start times. For the VICTORIA RWP one of the main risks was related to material being unavailable for essential jobs such as valves and fittings. As a combined team approach together with life-cycle managers and procurements specialists were assigned to deal with the most streamlined and efficient way to procure spares. In several cases, this included leveraging not just the in-service stock but also accessing 3rd line material via the VISSC contract enabling efficiencies that would otherwise not have been available without the special project partnership.

2.5.2. Supply Chain

To support and overcome the material availability challenges, the supply chain was broad and flexible from a geographic and process perspective. To deal with material shortages, in several instances spares material was sourced not only nationally but internationally and was prioritized across other submarine projects both 2nd and 3rd line based. The partnership with Babcock via the Victoria in Service Support Contract (VISSC) permitted the sourcing of parts from these other projects expediently and also with minimum contractual overhead.

2.5.3. Personnel resources

Significant shortages of crew availability resulted in the need for innovative solutions to key project activities that relied heavily on ship staff support, all of which were critical path items. The normal staff shortages were aggravated and intensified by the deployment of HMCS *Chicoutimi* to the Far East that drew upon the crew of HMCS *Victoria* leaving her with a temporary crew. Under these severely depleted conditions, an agreement was prepared whereby Babcock Suitably Qualified and Experienced Personnel (SQEP) were used advantageously to augment and in some areas replace the traditional role of ship staff in key activities such as lockout/tagout and test forms. This initiative significantly reduced the delays caused by limited availability of ships staff, especially during after hours, leave and training periods.

2.6. Project Successes

2.6.1. Communication

In order to foster a unified team and bolster the fully integrated approach to the VIC RWP, it was necessary early on to identify opportunities for transparent communication. Much of this was achieved via FMF invitation to some of its internal meetings, normally inaccessible to contractors. For example, the VIC RWP PM was a regular attendee at the Commanding Officer's (CO) weekly Head of Department (HOD) brief, during which the CO was updated on the overall project progress and then individually briefed by both the FMF PM and the Babcock Canada PM. This provided the CO insight into not only the efforts of both teams, but as importantly perspective on the different approaches to data management, scheduling and milestone tracking.

This is best exemplified by the adoption of the dashboard and project metrics used by the Babcock PM by the FMF team as part of its weekly command brief, both internally and externally. Eventually, the individual dashboards were paired down, and combined, to present a weekly snapshot of the project status. While seemingly trivial, this small change provided a constant visual as to the joint nature of the project and it socialized within DND the fact that both RFs were integrated in their approach to project management. Complementing the weekly briefs to the CO were weekly updates with the overall PM, one assigned by the Director Maritime Equipment Management Submarine (DMEPM (SM)). In this teleconference, both the FMF PM and the Babcock PM provided updates into key activities and highlighted areas where support from DGMEPM was necessary to progress work, notably material management and technical review/responses from both naval platform and combat systems. By engaging teams within the HQ, the DMEPM (SM) PM was able to remove roadblocks on the coast for the RFs, as well as provide the financial oversight of the subcontracted labour force and PM team.

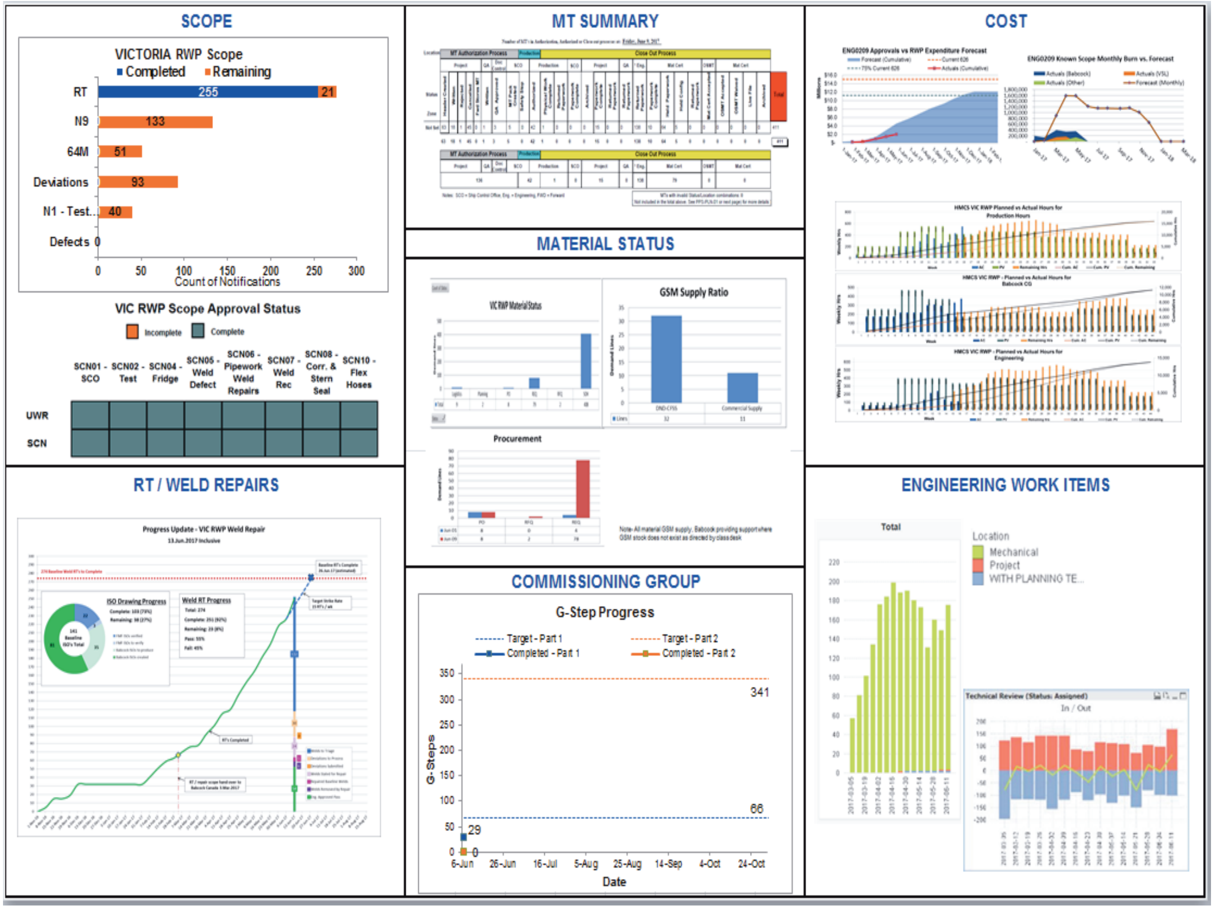

Figure 1 – Sample dashboard (numbers do not reflect project disposition)

2.6.2. Integration

Another instance of integrated project management was the Plan of the Day/Plan of Tomorrow (PLOD/PLOT) meeting which was established for the work period. During these meetings, work packages being executed onboard were coordinated between the crew, the FMF and Babcock/VSL. Each Project Leader used the PLOD/PLOT forum to de-conflict work, identify constraints and to prioritize work. Doing so at the working level precluded the need to constantly elevate conflicts to either the program manager at FMF or to the DND PM. However, in some cases this was necessary and in those cases the order of priority was determined by the FMF PM as the prime contractor, following a discussion with the Babcock PM. Without this daily interaction, coordination would have been untenable and conflicting jobs would have been scheduled simultaneously. The meeting was also an important forum for the crew, and one of the only opportunities for it to be engaged in the work taking place onboard its vessel. Crew support was instrumental, particularly given that the crew needed to endorse and place all lock-outs for both FMF and Babcock/VSL jobs, witness testing and oversee key evolutions and tank closures. Having crew visibility into the project was a key success factor in the successful execution. Moreover, the crew was also able to participate in the de-confliction discussion, which was essential to ensuring schedule adherence; even more so when an acceleration to the schedule was needed to meet project deadlines.

2.6.3. Schedule adherence

Submarine refits are constrained not only by the overall schedule, but also by space limitations (only so many workers can fit in any one space at a time), system lock-out/tag-out requirements and sequencing. However, while schedule adherence was deemed acceptable for the contractor, it became apparent early in the project that crashing the schedule in favour of schedule acceleration was preferred by the customer. In those instances, it was even more important to have clear work priorities. Acceleration demands also undermined previously sequenced work and created new de-confliction requirements. Higher level prioritization was also therefore necessary for as the number of work conflicts increased.

Unfortunately, not every efficiency was identified, and as a result opportunities were missed during which the team could have completed work packages more quickly. In some cases this can be attributed to a lack of complete system knowledge, misunderstanding as to actual work scope, or in other cases an unwillingness to work within the vicinity of other teams. That said, in general terms, schedule acceleration yielded significant dividends downstream in the project, particularly for welding. Following the triage of weld repairs vs. non-repairs, it became readily apparent that standard estimated timelines would not meet project requirements. To progress in an accelerated manner, the PM team worked closely with the welders to sequence every weld/braze. Under normal circumstances this would have been poorly received by the production element and viewed as overly prescriptive. But, given that the pipefitters and welders were consulted in the breakouts sessions during which the work was sequenced, there was considerable buy-in from the shop floor which resonated all the way up to the CO's briefing room. And, given the complexities of the repairs, the challenges encountered in meeting the required welding standards and the extensive work in way requirements, it became apparent that the optimized schedule achieved far more repairs in a condensed timeframe, and finished ultimately in line with the best case scenario schedule created at the onset of the project.

Ultimately a complex Work Breakdown Structure (WBS) could only be managed via a detailed integrated schedule, using common tools and applying a daily de-confliction exercise that ultimately pushed the boundaries of the contractor/customer relationship. Scheduling, particularly predecessor and successor relationships, revealed fundamental differences to scheduling practices and were overcome via innovative methodologies including the use of new PM tools, work tracking metrics and helping to set performance targets to ensure schedule adherence.

2.6.4. Material management

Supporting all of the WBS execution was a requirement for the timely acquisition of material. Without a sufficient advanced planning timeframe due to the emergent nature of the work, many material items were identified as long lead items. Part of the contractual arrangement with the subcontractor was that all material would be GSM (Government Supplied Material), and thus the responsibility of the customer. However, it became apparent early on that the demands of an extensive work period exceeded the supply from the existing stores. As a result, excessive demands were placed on government procurement. In many instances the material management staff was able to support the project. However, many critical items from hard to manage suppliers, or items with historically long lead times, were pushed to the Babcock materials management team for procurement. This was not only in direct support of contracted work, but as importantly for FMF work as well. In other words, the Navy engaged a subcontracted material management infrastructure to successfully acquire parts in sufficient time to meet its own requirements. The overall benefit to the project cannot be understated as Babcock leveraged its client status with vendors to support both RFs.

3. Conclusion

The breadth of the VIC RWP necessitated a forward leaning strategy. The Waterfront Management framework was the mechanism by which the strategy for incorporating Babcock/VSL and the FMF into a combined 2nd and 3rd line project was achieved.

While cultural norms in both RFs would lead one to believe that that overcoming animosity, whether real or perceived, would be difficult, a common focus and consummate professionalism bolstered a sincere desire to successfully execute complicated and demanding work, and in turn transcended any historical divisions, uniting the team. This would not have been possible without the dedication of professional project management teams, highly supportive project sponsors and a focused submarine community.

A demanding operational schedule and intensive maintenance periods necessitate a mature and dedicated integrated workforce, one likely to be leveraged in the future following its success during the VIC RWP. This experience demonstrated that the Waterfront Management Strategy is not only viable, but exemplary in its leveraging of contractor resources to the betterment of submarine work periods, an experience already well worth sharing with other Naval and industry partners.

4. Acknowledgements

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