Taking an Early BIM Test Flight with NAVFAC via Design-Build Projects

by Scott Harm, AIA, NCARB

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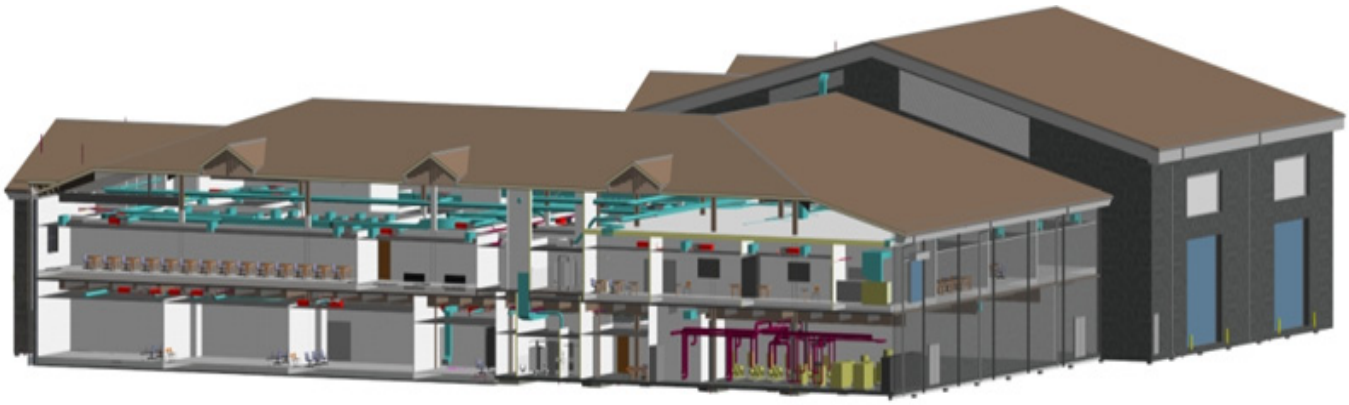
In July 2014, the Naval Facilities Engineering Command Northwest (NAVFAC NW) awarded the Korte Company and Belay, a Division of POWER Engineers (Belay|POWER), three design-build (D/B) projects at Naval Air Station Whidbey Island (NASWI). Awarded in rapid succession, within about 45 days, the three projects had a combined construction value of $110 million and had stakeholder interest as high as the Chief of Naval Operations. With the challenge of delivering these three large projects, a flight simulator and two significant hangar modernizations and renovations, almost simultaneously, both the design and construction teams were faced with obvious management and execution challenges related to schedule, construction, and field management.

With these challenges in mind, the project team thought it was imperative and in the best interest of NAVFAC NW to use Revit Building Information Modeling (BIM) to safeguard the projects' schedules. This decision was made even though the Navy's adoption of BIM was not scheduled until FY16 and the projects' RFPs required drawing submittals in AutoCAD 2010. Based on the Belay|POWER team's recent success using BIM for NAVFAC NW on a Bachelors Quarters (BQ) project and Korte's avid use of the tool in the field, the team had confidence that BIM's capability could seamlessly meet the simulator and hangar projects' challenges. Our team appreciated the capability of BIM to help coordinate multi-discipline teams and identify and remedy systems interferences, engage stakeholders in the design process, and facilitate sound technical decisions, all while keeping complex, fast-track projects like these on schedule.

Additionally, our team believed that early use of BIM would help NAVFAC move closer to full BIM implementation like the U.S. Army Corps of Engineers (USACE) did more than a decade ago. Using BIM before formal implementation would help NAVFAC and its consultants to realize both BIM's advantages and disadvantages, preparing them to meet its challenges with solid solutions.

BIM to Address Lessons Learned:

Belay|POWER's earlier BQ project for NAVFAC NW was a substantial remodel and modernization of standalone, eightplex BQ buildings in a campus-like setting. Working with Coburn Contractors of Montgomery, Alabama, we learned at the post-award kickoff meeting that the project had known, potential challenges. The NAVFAC NW project manager, design manager, and the Resident Officer in Charge of Construction (ROICC) described a number of complex, field-related issues that had not been realized until well into the construction of similar BQ projects nearly completed at the installation. The rigid frame of a cast-in-place and concrete masonry unit superstructure built in the 1970s was making it difficult to implement the new floor plan and to make the mechanical and electrical upgrades. These challenges, largely the result of extremely tight vertical and horizontal clearances,



BIM of NAVFAC NW's P-251A the simulator building at NASWI helps to visualize all systems and interfaces.

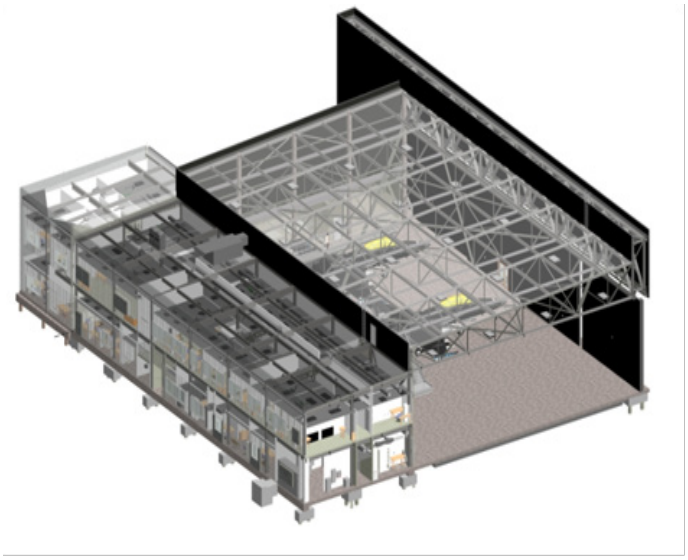
were negatively impacting the schedule.

After some preliminary discussions about how to address these challenges, the D/B team invited the Contracting Officer's Technical Representative and the Navy's project and design managers to the first Design Quality Control (DQC) meeting via WebEx, a video conferencing medium. During the meeting, we introduced the concept of working with BIM and "flew around" the preliminary virtual model we had created. After we reassured the Navy's team that formal submittals of design documents would be per the RFP requirements, they were quickly excited by the platform's efficiencies and its ability to convey design intent to our specialty subcontractors in the field. After that first meeting, the Navy continued to join every other weekly DQC meeting, which helped them to see, literally, that we were proactively addressing the concerns of the earlier projects and providing appropriate solutions for each issue.

Current Challenges and Future Advantages:

Our current NASWI projects include extensive modernizations and expansions to two 1950s-era maintenance hangars and a seven-bay flight simulator building. These projects are in support of the platform transition to the P-8A "Poseidon" and the EA18-G "Growler." Adding another level of complexity to a an already rigorous volume of work, our sub-consultant and subcontracting teams on the combined projects include KPFF Consulting Engineers for civil/ structural design and three different combinations of mechanical, electrical, and plumbing (MEP) engineers and integrated MEP D/B subcontracting firms. All team partners in each of the three configurations had to buy-in to the BIM commitment in order for the Korte and Belay|POWER senior management team to achieve the desired, successful outcome.

Requiring each design team member to participate in the BIM process despite the RFP requirements and the design fees submitted during the lowest price technically acceptable selection process was a challenge that has already returned dividends. For example, during our coordination meetings with specialized subcontractors, we immediately took advantage of the opportunity to tailor our design details to coordinate with the equipment that had already been incorporated into the bid price. We were able to confirm with the contractors who would be implementing the design in the field that our details suited their means and methods. This early coordination and concurrence maximized opportunities, confirmed tolerances, and expedited the specification and equipment schedule and submittal process. We believe that using the models to communicate design intent to our subcontractors, the Navy, and the Boeing Company (tenant) has increased their level of confidence that the projects' deadlines will be met and issues causing the most concern are being adequately explored and resolved.



Partial section rendering of P-239 Hangar 10 expansion

BIM of NAVFAC NW's P-251B Hangar 6 at Naval Air Station Whidbey Island.

Soon, both the USACE and NAVFAC will have adopted BIM for developing designs, but they will likely continue to rely on hard-copy submittals for review by their technical evaluators. We recently completed the 50% design submittal for the flight simulator building, and our production of hard-copy original prints proved challenging. For that submittal, our production staff had to "flatten" images of the Revit model to create the hard-copy prints. The 2D images are relatively easy to generate, but flattening a BIM image to meet Whole Building Design Guide standards presents its challenges and can often produce anomalies on a drawing surface (shadow images from other sections of the model). To accommodate this issue, design managers should consider that translating the model to hard copy requires additional time which should be accommodated in each milestone design submittal. Not until the software-to-software dialogs are more adequately resolved will the production of hard-copy originals go as smoothly as it should using BIM files. Private-sector projects for the most sophisticated clients (tech companies as an example) are moving quickly to a paperless design submittal process, in part to alleviate this challenge.

Handing It Over and Sharing the Knowledge:

Working within the familiar requirements of DB contracts, our design teams give the original model to the contractor to use for procuring equipment, material take-offs, issuing RFIs, integrating shop drawing details, and for construction-phase submittals. The contractor will input procurement and construction data even while the designers are finishing the design. For example, as the procurement of primary mechanical equipment is achieved, say an Air Handling Unit (AHU), the contractor will input the specific make and model of the AHU into the BIM. This data will be tracked throughout the design process, and eventually incorporated into the design specifications and then to the construction-phase submittals. With the concurrence of NAVFAC field staff, we have often found that a proprietary design document together with a specification enhances the construction submittal process by reducing review times, and can even reduce construction submittals to a formality, saving everyone time and money. In the D/B model, the risk and control associated with the use of the model is owned by the prime contractor, who holds the contract with the designers, until and even after it is turned over to an owner as part of an as-built package.

Conversely, in the Design-Bid-Build (D/B/B) model, where the design services agreement would most likely be held by the owner, the delivery of the original model could introduce opportunities for mismanagement or misinterpretation. This could introduce an increased level of liability to the designer that current model law and most BIM Implementation Plans might not yet adequately address. The prescribed level of design detail found within a model is of particular concern in a design services contract. This level of design might not be understood or clearly articulated to a general contractor who uses the model's intelligence for material takeoffs leading to materials procurement during the bidding process and actual procurement after the post-award "buy out" of a project.

For this reason, there is an increased need for the clear communication of a model's content when it passes from the creator (architect/engineer) to the user (contractor/owner) so that gaps in "quality" and "quantity" are very clearly understood. For example, in the past, the process of hand drafting or using basic CADD allowed architects to derive a detailed wall section and corresponding details from a specific area of a floor plan. The intelligence of BIM enables anyone using the model to potentially choose randomly from any building element a section or detail. If the drafting and production process is not sufficiently addressed in the native model and rigid consistency

Interior rendering of P-239 Hangar 10 expansion

applied throughout, there will be room for misinterpretation and/or conflicting data. Until we are able to go entirely paperless, the solution may still reside in relying on hard-copy prints to demonstrate adequately how a model should be interpreted or manipulated for construction.

It's Not Just a Fad: We continue to applaud the USACE for its earlier adoption of BIM as the desired platform for designing its projects. We have been very encouraged by our interactions with NAVFAC NW staff and their willingness to explore the future of their Command as they complete their own adoption of a BIM Implementation Plan. We have seen firsthand the level of teamwork that takes place among designers, contractors, owners, and tenants/users as they collaboratively develop the model's data. And, we continue to appreciate the model's power to communicate beyond 2D design.

While the primary intent of a building model is to document design, we believe these models will become increasingly valuable to building and utility owners, operators, and developers. A building model that is integrated into an asset management tool (e.g. eOMSI) used to manage equipment procurement dates, warranty information, and maintenance schedules will continue to pay dividends for the foreseeable future. The Navy should be encouraged by its early endeavors to integrate BIM, and we believe their consultants' BIM experience and knowledge will continue to facilitate the transition.

ARCHITECT'S FIELD SKETCH CORNER

In today's architectural practice, architectural design concepts have been conveyed predominately through computer images to others. Even though these images can offer us very realistic feel for our design, but what is missing in most cases is the connection between the artistic emotion of an architect and his design product. To that end, architect's freehand sketches are the most direct translation of his design thought and emotion on paper. Therefore, it is more intimate and closer to our hearts.

- JJ Tang, AIA, APC Committee Chair