

SEPT 2001

cover story



Renovating the Pentagon

- 6.6 million square feet
- \$1.2 billion budget
- 20,000 scheduled activities at one time
- One-half million MicroStation drawings and counting


[ADVERTISERS](#)
[MEDIA KIT](#)
[MSM STAFF](#)
[SEARCH](#)
[Cover Story](#)
[Inside View](#)
[Analysis](#)
[MicroStation V8
Unveiled](#)
[Mace and the
MB1 Alliance](#)
[Review](#)
[The Project
Files](#)
[Ramsey &
Stefanchuk](#)
[New Products](#)
[Editorial](#)
[News](#)

By Michelle Poggi

Designated a National Historic Landmark in 1992, the Pentagon is the world's largest low-rise office building. Headquarters to the United States' national defense organization, it houses approximately 23,000 military and civilian employees and about 3,000 non-defense support personnel. It has its own heating and refrigeration plant, water and sewage facilities, police force, fire station, heliport, child-care center, cafeterias, stores, Metro station and medical clinic. Original construction was completed in 1943, and it has never undergone a major renovation. Now, after 58 years, renovation is essential in order to meet current health, fire and life safety codes and provide reliable electrical, air conditioning and ventilation services. Major building systems have deteriorated to such an extent that repairs are no longer effective and entire systems need to be replaced.

In 1990, it was decided to renovate the building in 1,000,000 gross square foot wedges, with renovation of the basement as a separate endeavor. The plan envisioned complete removal of all support systems (mechanical, electrical, plumbing) down to the base structural system, followed by construction of all new systems. Asbestos-contaminated material—over 28 million pounds in Wedge 1 alone—in the plaster ceilings, floor tile, air conditioning ductwork and pipe insulation has necessitated this full-scale removal. The plumbing systems removal is based on the high probability of catastrophic failure.



The renovation provides all new mechanical, electrical and plumbing systems, sprinkler systems, toilets, vertical transportation, cable management systems, improvements in fire and life safety systems, and flexible ceiling, lighting and partition systems. The renovation will also provide disabled accessibility

features throughout, preserve historic elements, upgrade food service facilities, construct collocated service operation centers, install modern telecommunications support features, comply with energy conservation and environmental requirements, reorganize materials handling and provide safety improvements in vehicular and pedestrian traffic.

The budget for the project was set years ago at \$1.2 billion, before the renovation's true scope and challenges were fully known. When construction of the basement

Solutions

and mezzanine levels came in 150 percent over that phase's portion of the entire budget and over a year behind schedule, the project manager for Wedge 1—the next phase of construction to be started—started building the case for standardizing on MicroStation. One of the first tasks Dave Westrick, Wedge 1 integrated project team leader, and his team were charged with was to conduct a study to determine whether the Pentagon Renovation Program would require their contractors to use AutoCAD or MicroStation.

Building a case for MicroStation 3D

Westrick and his team had to create the \$150 million Wedge 1 master plan from scratch; master record drawings did not exist. The only existing documentation was the original cotton linen plans. So they had to work with approximately 1100 scanned drawings of the original construction, which consisted only of the foundation, as there were no mechanical and electrical plans. Westrick proposed using MicroStation 3D geometry for the project.



"I recommended 3D because we could do so much more with it," Westrick says. "At first, our design contractor, Hayes, Seay, Mattern & Mattern (HSMM), was reluctant to make the initial investment. So we began by doing critical items in 3D. When HSMM saw that we could do AVIs and fly throughs, which enabled you to walk up the steps, into the building and down the corridors and see what the renovated space would look like using MicroStation 3D geometry, that was a big sell."

Because there were several layers of executive decision-makers involved throughout the renovation who were not engineers and, therefore, couldn't easily extrapolate from 2D drawings, Westrick used renderings to present ideas.



New South Terrace pedestrian bridges and ADA-compliant bus shelters.

"Many of the people involved in the decision-making process are not engineers. They're executives, accountants and planners, and are not accustomed to reading 2D drawings," he explains. "It's unreasonable to expect them to see a plan view and an elevation view and then put the two together to make a picture. But with 3D, it becomes easy to see the whole picture, and that makes it an effective and powerful tool."

In 1995, William Skinner joined the Pentagon Renovation Program as the second document control manager when the first of three phases of basement and mezzanine construction were in full swing and the \$250 million Wedge 1 was ramping up. The basement and mezzanine Phase I as-built drawings were being produced in AutoCAD, while Wedge 1 was being designed in MicroStation. Skinner decided to find out why the Renovation Program was required to use two different CAD file formats. After doing some research, he found out that, in the early years of the renovation, the CAD-related decisions were made by the document control manager. At that time, the document control manager had created a one-page CAD standard requiring all construction drawings to be submitted in Drawing Exchange Format (DXF), Autodesk's recommended file format for sharing files with other applications. At the same time, the document control manager's market research led to recommending that the Renovation Program invest in MicroStation as the CAD application to view, edit and print CAD deliverables. When the first DXF deliverables were opened using MicroStation, the document control manager quickly discovered that importing DXF files not created by MicroStation resulted in distorted or missing data. In order to eliminate the negative affects of data translation, he revised the CAD standard to MicroStation DGN as the CAD deliverable format.

Skinner remarks, “Unfortunately, the revised CAD standard did not always make it into the many contracts that were awarded after the revised CAD standard was published. In some cases, the resources were not available to adequately enforce contracts that contained the correct CAD standard.”

Shortly after concluding his research, Skinner began lobbying for a requirement that all CAD deliverables be provided in MicroStation for the remaining work (Wedges 2 through 5), as well as the dozens of ancillary projects that are performed by government staff or awarded to contractors each year.

After expanding the vision and mission of document control to include additional information management services, Skinner persuaded Lee Evey, the then-new Pentagon program manager, to rename the department as the Information Resource Center (IRC). Today, the IRC is responsible for managing all project data from design through commissioning for the entire renovation. As the IRC’s leader, Skinner’s responsibilities entail developing, promoting and enforcing electronic data standards; and receiving, cataloging and indexing all studies, reports, design submissions, as-built documentation, and other construction-related deliverables. The IRC mission is to ensure there is a government record of Renovation Program deliverables and ensure that all renovation team members can access the information contained in the deliverables.



River Terrace ramp for persons with disabilities.

Avoiding reinventing the wheel

The Pentagon Renovation Program needed a standard by which all the contractors who would be providing data could organize and deliver their data.

“The government could dictate the deliverable format but not the application the contractor used to produce CAD drawings,” explains Skinner. “I eventually realized I was going to have limited success in terms of getting people what they needed. With help from a local subject matter expert and Tri-Services CADD/GIS Technology Center, we formed an Electronic Data Standards (EDS) Integrated Project Team (IPT) and included members of the Renovation. We did some pilot efforts on facility data management software systems, and, through participating in these pilot projects, it became very obvious that we needed electronic data standards for both drawings and tabular data.”

The EDS IPT adopted the Tri-Services CADD Standards as the basis of what is now known as the Pentagon Renovation Electronic Data Standards; one section of it deals with CAD and one section deals with documents.



South Terrace elevator lobby.

Skinner accepted the fact that many of the smaller contractors would use AutoCAD to produce their CAD files, converting them to MicroStation to meet the Renovation Program’s requirement. Skinner and the IRC tirelessly promoted the Program’s prescriptive electronic data standards, because they believed the standards would allow them to control the total cost of using the tens of thousands of files created by hundreds of contributors, to maximize the return on the taxpayer’s investment in MicroStation and the data.

Design/build saves time and money

Skinner also had to abide by the directives of Pentagon Renovation Program

Manager Lee Evey. When Evey took over as overall program manager, he restructured the program's management team, reorganized the program into functional and geographic construction integrated product teams (IPT).

"The IRC is a functional IPT," says Skinner. "After the reorganization under Lee was completed, he became even more supportive of policies and directives that required electronic data standards to be contractually binding. He also supported a directive that requires at least one hard copy and electronic copy of all documents, drawings and data deliverables be distributed to the IRC."

Evey also shifted the program from a design/bid/build delivery system to design/build contracting, altered the procurement methodology and adopted a performance-based approach to the contractors' guidelines in order to increase and work within the strict budget and schedule restrictions.

"After the transition to Lee's design/build and performance specification philosophy, we chopped the 100-page prescriptive standard down to a two-page performance standard," Skinner states.

According to Skinner, some of Evey's requirements for the IRC included being able to convey various options, decisions and problems in pictures, because pictures can convey complex problems and solutions in a very simplified way, quickly. This, in turn, would facilitate the decision-making process.

Improving customer service

In the early years of the renovation, Real Estate & Facilities (RE&F) directorate, the Renovation Program's customer, assumed it would get electronic documentation but had not dictated any specific requirements. As the data liaison between the Renovation Program and RE&F—the owner/operator that is dictating requirements and will be maintaining the facility—Skinner determined that he was going to have trouble fulfilling that role. He found that deliverables were not being consistently funneled to the IRC, the designated central repository for the Renovation Program.

Skinner recalls, "There were few formal policies and procedures in place that required the documents and drawings be turned over to the IRC in a consistent and timely fashion. In many cases, these documents weren't transferred over at all, which was going to present a problem when it came time for RE&F to take over with operations and maintenance."

Skinner credits Evey's transformation of the program's acquisition approach (from design/bid/build to design/build) as the main reason why RE&F's data requirements have been properly addressed in new contracts. In 2000,

The Pentagon—A city within itself

Pentagon facts

Total land area	583 acres
Government owned	296 acres
Purchased or condemned	287 acres
Original total cost of land	\$2,245,000
Area of Pentagon building	34 acres
Area of center court	5 acres
Area of heating and refrigeration plant	1 acre
Area of sewage structures	1 acre
Access highways built	30 miles
Overpasses and bridges built	21
Parking space	67 acres
Vehicle capacity	8,770
Original cost of building	\$49,600,000
Original total cost of project	\$83,000,000

Pentagon building statistics

Gross floor area	6,636,360 sq. ft.
------------------	-------------------

toward the end of Skinner's tenure as the IRC leader, he began to promote the term "data commissioning" to describe the process of how the Renovation Program would formally hand over tens of thousands of CAD files and other facilities data to RE&F as each section of the renovation ends.

With leadership from Skinner, RE&F and the Pentagon Renovation Program are the first to initiate a comprehensive, consolidated effort to standardize and organize electronic data in the Pentagon's 58-year history.

"They never had the policies, the procedures, the technology, this scale, all those things," Skinner says. "There have been attempts, but with an entity of this size and with all the parties involved, a comprehensive effort never quite took off. We're essentially starting from scratch. We were relying on the original construction documents, survey documents and anecdotal information about the space. Although we have an enormous amount of legwork ahead of us, in the end, the information we'll have will be that much more valuable for all involved."

The added value of using 3D

Skinner's next step was to build an argument to the renovation's high-level decision-makers for requiring intelligent 3D data to be delivered.

"Starting out with data that's complete, accurate, uniform and organized is paramount to the renovation's success and to making our customer, RE&F, happy. Such data is also essential to the operations and maintenance process being successful. We need this type of data—DGN data—so they can plug it into their system and start using it, rather than try to figure out what's missing, supplement it, then try to make it homogenous because it has been done five different ways in the five different wedges."

When Skinner met with some resistance over the increased costs for 3D in the design phase, he explained the benefits and efficiencies over the life of the renovation and the life of the renovated Pentagon after occupancy.

"If you start with a 3D model, using MicroStation TriForma, where you can derive construction documents as a by-product of your 3D model, you can gain efficiencies," he elaborates. "We needed both 2D and 3D. But, by starting with an intelligent 3D model, 2D can be dynamically derived from it. Which means, when we make our edits to the 3D model, the 2D automatically updates itself. Therefore, you end up doing half as much work. Yes, you may start out with a cost savings at the creation with stagnant 2D and stagnant 3D, but, over time, throughout the change process, having the dynamic link between 2D and 3D is much more cost effective. That's how we sold the idea to upper management."

The renovation entails six-and-one-half-million square feet of building space and a

Net space for offices, concessions and storage	3,705,793 sq. ft.
Cubic contents	77,015,000 cu. ft.
Length of each outer wall	921 ft.
Height of building	77 ft. 3.5 in.
Number of floors, plus mezzanine and basement	5
Total length of corridors	17.5 miles
Glass area	309,276 sq. ft. or 7.1 acres
Number of:	
Stairways	131
Escalators	19
Elevators	13
Fire hose cabinets	672
Rest rooms	284
Fixtures	4,900
Drinking fountains	691
Electric clock outlets	7,000
Clocks installed	4,200
Light fixtures	16,250
Lamp replacements (daily)	250
Windows	7,754

life cycle of at least 50 years with a continual cycle of design and construction and updating data, once the 15-year renovation is complete.

“We acknowledged that, yes, we can build in 2D,” Skinner says. “But we certainly can’t produce our best design for a six-million-square-foot project using 2D. Since the systems are so complex, we believe, and industry evidence confirms, that 3D will give us a better quality, more coordinated design, which should lower construction costs. Because to find out about a design problem during construction, for example, is infinitely more expensive than catching it during the design phase. Plus, RE&F wanted more benefits and wanted to make better decisions, which required the data to be more complex. So we really couldn’t afford not to be in 3D.”

In addition, one of Skinner’s long-term visions is to create a 3D model of the entire Pentagon reservation, which includes the Pentagon proper, several adjacent facilities and miles of underground utilities on nearly 500 acres—within the same spatial model. He also believes that this same spatial model needs to be scalable to accommodate another 120 additional facilities that are either owned or leased by RE&F.

▶ **Continued**

© 2001 by Bentley Systems, Incorporated. All rights reserved.

© 1996 - 2002 Bentley Systems, Incorporated

SEPT 2001

cover story


[ADVERTISERS](#)
[MEDIA KIT](#)
[MSM STAFF](#)
[SEARCH](#)
[Cover Story](#)
[Inside View](#)
[Analysis](#)
[MicroStation V8
Unveiled](#)
[Mace and the
MB1 Alliance](#)
[Review](#)
[The Project
Files](#)
[Ramsey &
Stefanchuk](#)
[New Products](#)
[Editorial](#)
[News](#)

Renovating the Pentagon

[◀ Back to beginning](#)

MicroStation passes the test

With an average of 400 Pentagon Renovation staff members, other government professionals and independent contractors on site, more than 20,000 activities on the schedule, roughly 1 million square feet of space under construction and 3,000 drawings in use at any given time, it was essential for the IRC to establish some ground rules and choose a software application by which to accomplish its objectives.



All new systems for improved airflow and dispersion.

Keeping an overall goal of lowering total cost of ownership and maximizing the return on the investment in mind, the Pentagon Renovation Program developed an extensive "graphic data life cycle questionnaire" and submitted it to Bentley and Autodesk for completion. The document required Bentley and Autodesk to address meeting criteria across several categories, which included graphic data interoperability and non-graphic data interchange; 2D design, as-built and record drawing; 3D modeling and presentations; project controls integration, security and virus susceptibility; collaboration and coordination; COTS software integration; software configuration and administration; and support services.

Based on past experience, Skinner, Westrick and their teams preferred MicroStation, but had to convince several layers of upper level management that it was the best option to use.



Blast-proof glass for increased safety.

According to Stacie Condrell, Pentagon Renovation Program Group Leader for Planning, Relocation, Requirements Integration, Standards and Space Management, one of the simple, but significant benefits of MicroStation, is its smaller file size.

"With a project as large as the Pentagon Renovation, we can take detailed construction documents of a portion of the building, join them with the detailed drawings of other project areas and then use that stitched together drawing to plan and communicate the larger picture," Condrell says. "Daily we look at six and a half million square feet of space, on an 11 x 17 inch drawing where the initial CAD work was done by 10 or 15 firms over many years. We would not be able to do that as efficiently with any other CAD platform."

Applying MicroStation throughout the life cycle

The renovation's scope and duration required a solution that would perform throughout the project's life cycle.

Solutions

“Based on the replies to our questionnaire, our own experience and market research, we are convinced Bentley has created a tool set that allows the author of a design file and the temporary steward, like the Pentagon Renovation Program, and the long-term owner, like RE&F, to use that same data set in the same environment with the various folks that will plug into MicroStation. And that data will perform for all of us,” Skinner elaborates. “We believe that, within the MicroStation environment, designers can use it to design and build the structure, and the construction contractor can update the changes they make as part of the as-built process. Furthermore, the renovation is not just passing this data through; we have plans to interrogate these drawings and pull out information in order to support the decisions we make during the renovation. The information demands at the Renovation Program are constantly changing and are increasingly more complex as each phase progresses. After all, we are the master architect and the advisor overseeing the design-build contractor.”

He maintains that MicroStation will allow them to support those three major roles throughout the life cycle of the renovation—the design builder, the renovation and the owner-operator. According to Skinner, the design-builder will be starting from scratch using the graphic data creation tools. The renovation is going to view, print, publish and do quality assurance. On the operations and maintenance side, RE&F is going to use the data to do their long-term facility and infrastructure management, which includes using it to support energy reduction, lower maintenance costs, lower operations costs, improve security, reduce life safety issues, support alteration projects and as the foundation for their rent charge-backs, and so on.

“We did our best to translate the benefits of having these standards and working with MicroStation into the real dollars they’d save throughout the process,” he adds. “This way, they could understand how much they’d lose and could gain in the long run—how one day lost in construction could mean \$20 thousand, on the operations and maintenance side, how they could save a million dollars in energy costs by sharing the as-built facility data with energy management systems that do things like turn off the lights when people leave the building.”



New escalator banks for improved vertical mobility.

Establishing credibility

Having the most up-to-date and accurate information and being able to present it quickly and easily are critical for establishing credibility among the executive decision-makers, who included Pentagon Renovation Program Manager Lee Evey, two-, three- and four-star generals, on up to the Deputy Secretary of Defense.

“Sometimes, we had to portray the entire six million square feet of space on a single 8 x 11 inch sheet of paper,” Skinner explains. “If Lee Evey wants to see the architectural new work plan of all five floors at one time on one piece of paper, it could take a hundred CAD files to represent that picture. So you need to have those referenced in a single drawing. Well, not every system can do that efficiently. It’ll crash. If your CAD package isn’t very robust and isn’t designed to have that amount of graphic data displayed at one time, you won’t be able to convey that picture. And if you can’t convey your picture in a timely way, you’re not going to get your message across to your audience. We do a lot of presentations to people above the program manager level. Because their time is very important, we have to convey things quickly and can’t afford to get into the techno-details. We have had a lot of success with MicroStation.”

Master planning and move planning with MicroStation



MicroStation renderings were used to study interior lighting and design options.

In addition to renovating the facility, the scope of the project branched out to include master planning to bring departments that had been fragmented throughout the facility and its 120 outer buildings back together to work more efficiently. In the old Pentagon, different groups sat side by side. The renovation plan calls for them to be stacked in a wedge, grouped together to work more productively.

“We knocked out walls to open up the space,” explains Westrick. “People were practically sitting on top of each other. It looked like a sweatshop. None of the space met code. We walked through the Air Force space and there were literally three and four desks in each office. Now, we’re using the space more efficiently, and everyone gets their own workspace.”

“Compare it to the concept of defragging a hard drive,” Skinner explains. “We’re trying to reunite the groups that started out together, the army, navy, air force, etc., and we’re using MicroStation to graphically display how well we’re consolidating each group as we progress. It’s no longer a function of moving people out into the swing space until their wedge is renovated. I’ve been told that some are going to stay there until they can be consolidated with the group they need to work closely with. For example, let’s say Army Subgroup 1 contains 1000 people located in 15 different areas. As the renovation progresses, and someone asks how we’re doing with consolidating this group, we’ll be able to turn on and hatch where all those people are and see the progress.”

Master planning and move planning with MicroStation

In order to group departments and configure the space effectively, as well as plan the actual moves of people out of the old and into the new spaces as they’re completed, the renovation team had to conduct “move scenarios.” These simulations involved using MicroStation to portray the million feet of renovated space, the million feet of to-be-renovated space and the million feet of swing space; the tenant alias or code names and number of people; all the furniture and equipment to be moved with the tenants; and a number of dates—the earliest date they can move, the latest date they can move and their readiness to move—all on a single sheet in an architectural plan. The Pentagon Renovation team would then run several of these scenarios to determine the most efficient and cost-effective way to remain on schedule.

“Our objectives are to shorten the interruptions of people being offline, stay on plan and keep cost low as we go,” Skinner explains. “The simulations show what would happen if we change the sequence of who moves when. Can we shorten the schedule? Or, if we change the sequence of who moves when, can we save money? Can we reduce the

A work in progress

The Pentagon Renovation Program is a 15-year, \$1.2 billion project. Planning for the project revolves around retaining a majority of the building’s occupants and offices and maintaining uninterrupted operations while the building undergoes renovation. Over 25 different options were developed for the renovation in its conceptual stage. Requirements such as maintaining mechanical, plumbing and heating and cooling for areas not under construction were major factors in developing the seven-phase plan.

Phase I

A majority of the work for Phase I, the Heating and Refrigeration Plant, was performed outside the Pentagon. Completed in the fall of 1997, this included construction of the new Heating and Refrigeration Plant, the new Classified Waste Incinerator, and a new utilities distribution system.

Phase II

Phase II, the Basement and Mezzanine, concentrates on removing hazardous materials and replacing the original basement concrete slab floor with a structurally supported slab. The basement, which lies below two fifths of the Pentagon, was divided into three areas—Basement Segments 1, 2 and 3. Work

total number of moves and what are the impacts on time, costs and construction? If we pour a little bit more money into this phase of construction and get them to finish earlier in this area, we would pay one percent more in construction costs but save twice that amount on move costs. And we're able make many of these determinations using MicroStation, a few third-party applications and some custom coding. This combination allows us to configure the floor plan space with all this information using different colors and different patterns to represent all the military agencies and their subgroups and delineate what space is vacant, using labels to show all the move dates and so on. MicroStation helps us convey these options clearly for the decision-makers, so they can make decisions quickly."

Making light of matters

When the Pentagon Renovation team went through a cost-cutting halfway through the project and needed to reduce the amount of dark terrazzo flooring to be used in the hallways, for example, MicroStation helped the team quickly portray what the revised design would look like. Using samples and extrapolating from them the wall, ceiling and floor finishes, the team was having difficulty representing what the finished hall would look like to decision-makers, who were finding it difficult to picture the end result.

"We needed to go from three bands of color down to two to eliminate some of the expense of having multiple color bands," said Westrick. "And we were getting into these long debates, which were causing delays. So we rendered different options, and they could see immediately what it would look like. The terrazzo you see now used to be three bands of colors, with dark in the center, surrounded by white, then black on the edges meeting the walls. Well, we went to two-with black in the center, but, when you looked on the rendering, you could see the hallway was still really dark. The black absorbed the light. Then the building manager said to try another suggestion, reversing the white to be in the middle and the black to border the white. Sure enough, it was a good idea, because it lightened up the corridor."

"If we were to take that one step further, we'll be able to save money on the operations and maintenance side, since the white terrazzo will reflect more light and, thus, require fewer lights to be on or lights of a lower wattage," Skinner adds.

began in Segment 1 in 1994.

By lowering the original slab two feet, designers were able to "squeeze" a 220,000-sq. ft. mezzanine level between the basement and the first floor. Segment 1 was completed in the summer of 1998. Demolition and remediation efforts have been completed in Segments 2 and 3, and some areas have been converted to occupiable office space. The remaining unfinished areas in the basement may be built out later in the Renovation Program schedule.

Phases III-VII

Renovation of the upper floors (1-5) constitutes Phases III through VII of the program. One-fifth of the building, or one "wedge," will be renovated at a time. The wedge concept is similar to the way in which the building was originally constructed and ensures mechanical, electrical and plumbing systems will be maintained in the remainder of the building. These areas have been determined to be the optimum divisions for renovation while continuing operations.

Wedge 1 encompasses the areas between Corridors 2 1/2 through 4 1/2 and has recently been completed. Pentagon Renovation Program officials held a ribbon-cutting ceremony in March 2001, when the first tenants moved in.

Wedges 2 through 5 (all five floors) are currently being planned as a single acquisition, with phased construction. The approved acquisition strategy will use a design-build project delivery method with performance-based criteria. The project also includes providing utilities for future occupation of the Pentagon's basement and mezzanine, which will be sequenced with the work in the wedges above.

Swing space

To vacate each wedge prior to renovation, tenants will be moved either to leased swing space or to space identified within the Pentagon. To keep the Pentagon operational at all times during renovation, one fifth of the building's 25,000 occupants must be relocated to swing space, temporary office space in and around the Pentagon. The vacated wedge of the Pentagon is then sealed off for demolition and renovation.

Working together with Bentley

Sharing similar philosophies was also an essential component for the Pentagon Renovation Program in choosing Bentley's offerings.

"When you adopt a company's CAD format as your standard, you're really buying into more than just their technology, you are buying into their view of best practices, "More important than MicroStation helping us complete the renovation more efficiently from a CAD perspective is that we've bought into a whole set of Bentley technology and best practices Skinner explains. We don't just want to buy software. We want a partner that sees and understands our vision. We want to develop a solution-focused relationship with all our partners. Also, are Bentley's vision and our vision compatible? We found out, when Bentley explained the E/C/O (engineering, construction and operations) continuum, the answer is clearly yes. What we hope to gain from partnering with Bentley is that, by teaming with an industry leader, we can create and maintain a world-class building with the best tools and support available."

In fact, for Evey, the ability to facilitate maintenance of the Pentagon after renovation is complete was a key factor in the evaluation of available 3D software packages.

"We wanted to ensure that the personnel who will maintain the Pentagon long after the Renovation Program is complete will have a clear, accurate and comprehensive picture of the entire Pentagon Reservation, including all building and mechanical systems, space layouts and allocations, mission-critical operation centers and other important data," says Evey. "During our evaluation of 3D software products, it became evident that MicroStation is extraordinarily effective and extremely reliable at integrating massive amounts of data into cohesive three-dimensional images. We intend to build on these MicroStation characteristics, leaving a clear record for future use."

Already at more than one-half million CAD files after ten years of renovation and over 1.5 million square feet of space renovated, acres of civil work and replacing miles of underground utilities, the Pentagon Renovation Program has five million square feet of space in Wedges 2 through 5 to go. The renovation team expects to complete construction by 2014.

Michelle Poggi is Editor of Bentley Today Online and a frequent contributor to MSM. Officials from the Pentagon Renovation Program will present a session at the [Bentley International User Conference](#) on Wednesday, September 26 from 11:30 a.m. - 12:30 p.m. During "Bentley Technology at the Pentagon," officials will explain who they are, the Pentagon Renovation Program's purpose and how they are using Bentley software on the project.

[SEND COMMENTS](#) to editor

© 2001 by Bentley Systems, Incorporated. All rights reserved.

© 1996 - 2002 Bentley Systems, Incorporated