$158M chapel renovation to restore original features

Three- to four-year project on Colorado's most visited building will fix leaky roof

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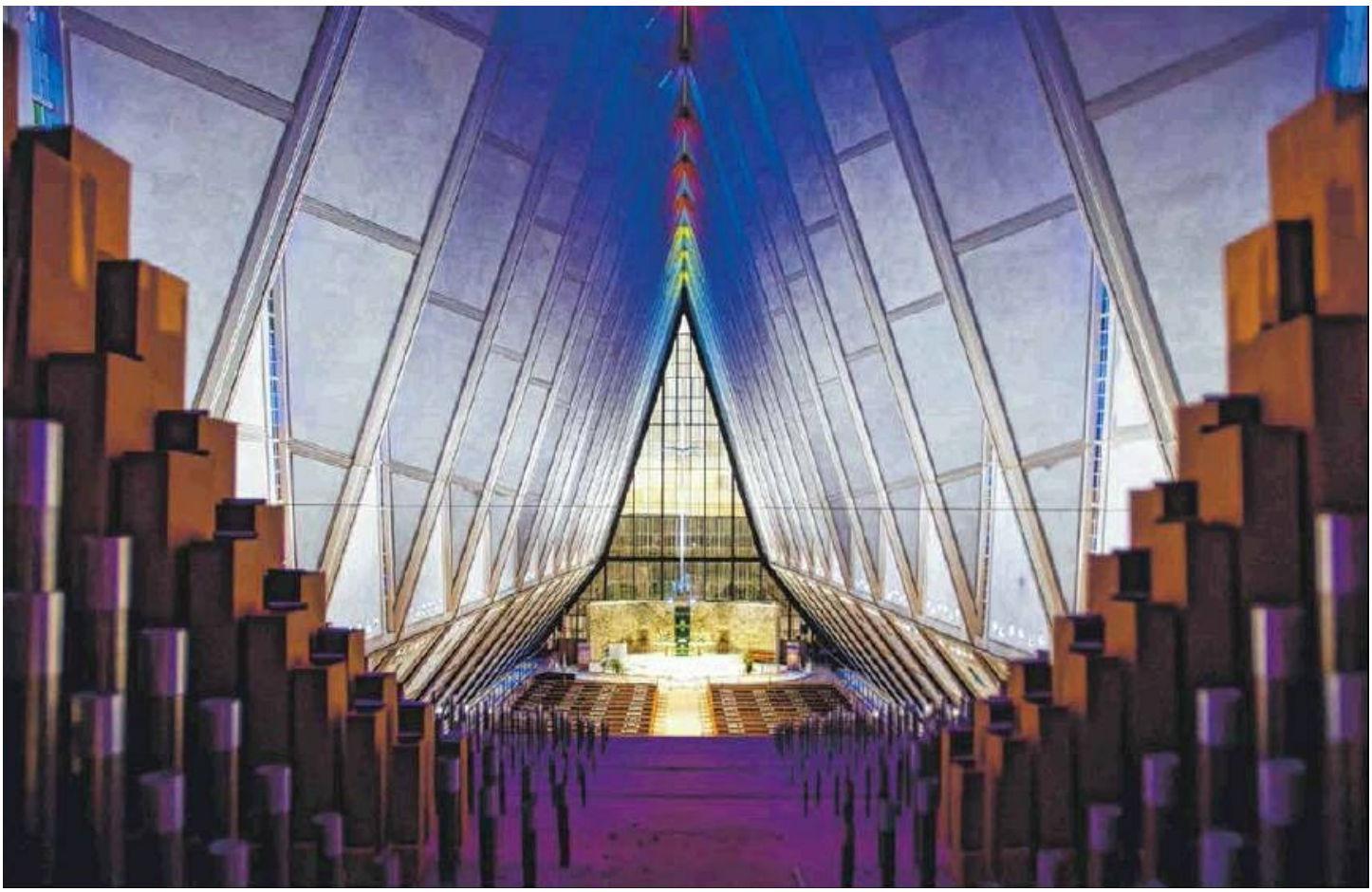

PHOTOS BY PARKER SEIBOLD, THE GAZETTE

Organ pipes at the Air Force Academy Cadet Chapel frame the pews and the altar last month. The main problem that needs to be solved: leaking. Water leakage during storms has done major damage to the chapel over the years, including to the organ. Over 200 of the 4,518 pipes have had to be removed because of water damage.

Since the day the Air Force Academy Cadet Chapel was completed in 1962, water has seeped inside when it rains, severely damaging the iconic building and some of the religious objects inside.

The original design for the 150-foottall chapel included a series of metal flashings intended to keep rain out of the building. But the project was over budget, so the flashings were removed from the design and replaced with 32 miles of caulk.

Visitors admire the exterior of the Air Force Academy Cadet Chapel on Aug. 21. The chapel is the most visited structure in the state, Lt. Gen. Jay Silveria said.

That didn't work.

Hundreds of pipes from the 4,518-pipe organ in the Protestant chapel have become too damp to work properly. (Others are being protected by plastic trash bags.) About a decade ago, a ceiling panel degraded by water crumbled and fell into pews. Floors become slippery and hazardous during wet weather.

"Every storm's a little different, so it might not leak in the same places all the time, based on where the storms are coming from, winds and things like that," said Pete Peterson, the chapel's director of public relations. "We put a lot of buckets out, but those

PARKER SEIBOLD, THE GAZETTE

Band-aid fixes can be seen on the exterior of the Air Force Academy Cadet Chapel, where they have been trying for nearly 60 years to stop water from leaking into the building. The original design included a series of metal flashing intended to keep rain out of the building, but were removed from the design and replaced with 32 miles caulk as a way of cost-cutting after the project went over budget.

buckets are strategically located based on the certain storm. So, a storm two days ago will have 13 buckets out, and a new storm, we may have five that are in a different area, which is so weird."

So, after decades of Band-Aid fixes, the chapel will close Wednesday for a massive renovation. It will take three to four years and cost $158 million.

That's more than five times what the building originally cost. The academy says it cost $3.5 million to build the shell of the building and the surrounding grounds — nearly $30 million in today's dollars, adjusted for inflation.

Furnishings, pipe organs, liturgical fittings and adornments were given by various people and organizations, and in 1959, an Easter offering was taken at Air Force bases across the world to help complete the interior, the academy says.

"I have to tell you that as a graduate, this chapel, for me, in a lot of ways, is an old friend," said Academy Superintendent Lt. Gen. Jay Silveria. "I came here in 1981 originally, and the chapel, whether you were worshipping in here or not — or just looking for a place where there was some quiet — this is an old friend. And our old friend, my old friend, needs some help and has leaked from the day that it was opened, so we are in desperate need of repair."

The chapel is the most-visited man-made structure in the state, Silveria said. So far this year, it has seen nearly 700,000 visitors.

"We tell everyone all the time that seven days a week, 9 to 5 every day, you can come to your Air Force Academy," Silveria said. "Visit, see the trails, see the roads, hiking and biking. See the sights, see the events that the cadets are participating in, all the Division I athletics, et cetera. So we always want to be open, and part of that has always been the chapel."

Peterson emphasized that the chapel is a religious structure first and a tourist attraction second.

The upper level houses a Protestant chapel, its largest worship space with seats for 1,200 people and a 120-seat choir loft. The lower levels contain a Catholic chapel, a Jewish synagogue, a Muslim prayer room, a Buddhist chapel and an all faiths room, which can be set up to accommodate almost any faith tradition.

The average tourist doesn't see how many problems the chapel has, and some might not understand why the repairs are necessary, Peterson said.

But "it needs to happen," he said. "The building won't survive on its own without this project."

History of the chapel

From the start, the chapel's design was controversial, said academy architect Duane Boyle.

It initially was envisioned as a folded-plate concrete building — a modern approach that was seen as a "bold step" for a religious structure, Boyle said.

The final design — an intricate aluminum, glass and steel structure made out of 100 tetrahedrons — has become iconic, but some criticized it at the time.

"I think the big thing, too, is the context in which it was designed," Peterson said. "You think in the mid-'50s, what did a typical church or a chapel look like? ... So imagine seeing a design concept or a scale model of this. They were losing their minds. How could that be a church?"

Construction began on the academy's campus north of Colorado Springs in 1955, the year the first class was sworn in at a temporary site, Lowry Air Force Base in Denver. The project was led by Walter Netsch of Skidmore, Owings & Merrill, a Chicago architecture firm. Netsch oversaw the design of the entire campus, but he was more personally involved in the design of the chapel.

Architect Boyle said Netsch, who was a mentor to him, didn't mind that his chapel, which wasn't prioritized in early construction, wasn't universally beloved.

"Walter explained to me his thoughts on that. He said, 'I'm really glad that it was controversial, and I'm really glad that some people had a negative opinion about it, because it showed that they were thinking about it,'" Boyle said. "And he'd much rather have that than a mundane building that nobody really cares about. And of course now, you know, everybody — well, there's probably still some people that don't like it, but the vast majority of people really love the building."

Many have theories about Netsch's inspiration for the structure, but most are "folklore," Boyle said. To gather inspiration, the architect visited famous chapels across Europe.

"When (Netsch) had all the designs for all the rest of the buildings and all the construction drawings well in hand — and he had over 600 architects working on this project at one time because it was huge — he decided to take a sabbatical to Europe because they weren't going to go back to that folded plate concrete building design," Boyle said.

He was inspired by the flying buttresses on the exterior of Chartes Cathedral in Chartes, France. He also admired the flying buttresses and height of Notre Dame in Paris and the quality of light coming that filtered into Sainte-Chapelle in Paris.

The Basilica of Saint Francis of Assisi "has an upper chapel and a lower chapel, which convinced Walter that you could actually do that successfully in one building," Boyle said. "That's why we have the upper and the lower chapels here, is because of Assisi."

Netsch's design initially featured 21 spires "because he thought that the 21 spires gave the chapel more of a cathedral-like proportion," Boyle said. But that was quickly recognized as being too expensive, so it was dropped down to 19 spires, then to 17.

But still, the chapel was over budget.

The idea was that the building's aluminum skin would serve as a rain screen, and most of the water would flow off of it, Boyle said. But the water that got into the joints — because the joints weren't caulked — would hit a series of internal flashings, which would act like rain gutters, sending water out of the building.

The flashings ultimately were removed from the design, but the caulk that was used instead has never been able to keep the rain at bay.

"The building moves a lot — it's not a structural issue, really, but it moves a lot — so all of those joints full of caulking, they're constantly opening and closing, and it just tears the caulking," Boyle said. "The problem that we've had, as we went through repetitive sealant jobs, is that every time we'd take old sealant off and put new sealant on, the new sealant doesn't stick as well as the old sealant did because the previous sealant had started to contaminate the metal. For the last few years, we've basically been in a downward spiral as far as trying to find ways to correct the leakage without doing a major project."

The renovation primarily is intended to stop the building from leaking, but it also will address problems

including asbestos and code violations.

Despite the leaking, the chapel has been widely recognized as a feat of American architecture.

In 1996, it won the American Institute of Architects' 25-year award, which is "the most prestigious award that a building can receive," Boyle said. It honors "buildings that have stood the test of time, still have their same function and have become a significant part of American architectural heritage."

The renovation

After the chapel closes, academy staff will have about two months to protect some items inside and move others out of the building before the keys are handed over to JE Dunn Construction of Kansas City, Mo.

It will be a massive undertaking: Each item that is be removed has to be put back in the exact same place.

For example, each piece of stained glass "has to be catalogued, noted, taken out, cleaned, repaired if they require repair, and it all has to go back in in the exact same location in the exact same orientation," Boyle said.

And some of the religious artifacts in the chapel are valuable, Peterson said. A series of nine paintings in the Jewish synagogue are worth at least $1 million each.

Some of the items that are moved will be displayed in other buildings across campus. Others will be taken to the locations around campus that have been set up for cadets to attend religious services during the construction.

The organs in the Protestant and Catholic chapels, as well as the pews in the Protestant chapel, will be taken out and sent to be refurbished. The renovation will focus on the frame of the building and its upper level.

Once the contractor takes over the site, crews will bring in trailers and get the area fenced off. A large structure will be built over the chapel.

"It's basically going to be like putting the chapel in a hangar, and the reason for that is they can work 24/7, 365 days a year if they want to, and they'll be inside," Boyle said. "They won't be adversely affected by snowstorms, blizzards, rainstorms, things like that."

The building ultimately will be stripped down to the structural steel. Then the rebuilding process begins.

After saying in March that the renovation would be delayed indefinitely, the Department of Defense said July 31 that the Air Force had awarded a contract to complete the project by Nov. 1, 2022. The construction will be managed by the Air Force Civil Engineer Center on Joint Base San Antonio-Lackland in Texas, Boyle said.

The renovation was canceled after its initial $68 million in funding was reallocated to Tyndall Air Force Base in Florida to repair damage inflicted by Hurricane Michael in October.

Now money for the project is coming from the Air Force's operations and maintenance fund for fiscal year 2019. That $158 million is more than twice the initial budget because of increased costs for labor and materials, especially the aluminum panels for the roof, said academy spokesman Michael Kucharek.

Congress passed a supplemental appropriations bill that provided $14.2 billion for disasters, allowing the

Air Force to restore funding for the Cadet Chapel and 60 other projects that had been deferred.

Because the academy's Cadet Area became a National Historic Landmark in 2004, it's important to meticulously match the materials used decades ago.

"It's expensive — it's more than we thought it was going to be — but it's very elaborate, very time-consuming, and there's no other building like this in the world," Boyle said.

It's been especially difficult to match the aluminum used on the outside of the building, which has an appearance that changes with the light, Boyle said. The issue still hasn't been resolved, but a metallurgy test of the existing aluminum showed that it contains more iron than modern aluminum.

"Walter's design for this building, he really wanted this building to be a living building, so depending on what the seasons are or what time (it is) during the day, where the sun is at, the building changes character as the sun moves around the chapel, where all of the rest of the buildings in the cadet area stay very static," Boyle said.

But Boyle hopes to get the building as close to Netsch's original intent as possible.

"The chapel's never really looked like what Walter had intended to look like, except for a very short time at the end of construction in '62," Boyle said. "Because after that, all these Band-Aids started getting put on the building, which really detracted from the design intent.

"When we did this project, we looked at what Walter's intent for the design was, and we did the project so it would bring all those features back. So when this project is done, it's going to look exactly like what the chapel was supposed like when it was being designed."