Bureaucratic Affairs Building Description and History

Acknowledgement

This document has been prepared by students of Professor Harriot Woods, PhD and History Department Head as a class project for her course HI400 – Practical Archival Studies in which students are tasked with picking a building on campus and then developing its history by applying standard historical research techniques.

The students would like to formally thank Professor Woods for her leadership and mentoring as they developed this document. We also are deeply grateful to the many faculty members how helped us do research and pointed us towards archival documents and references.

Finally, we wish to thank Wendel Parker III for patiently answering our many questions about his family history and sharing family archives as they pertain to his great grandfather and his vision that ultimately became COSTU.

Introduction

The purpose of this document is to provide you with a description of the Bureaucratic Affairs Building, which is located on the Center of the State University (COStU) campus in the very beautiful town of Golden Girl, Missouri. It is one of the many facilities associated with COStU, which is the major driver behind the economy in Golden Girl.

Figure 1 – The Bureaucratic Affairs Building

Despite being a college town, Golden Girl is a very quaint and quiet place, known for the exquisite beauty of the rolling hills that surround it and the peaceful quiet that settles in at sunset, especially during the summers when the fireflies rise up from the surrounding fields as the sun fades over the horizon and the stars begin to shine.

As a result, out of fear of becoming a sort of mecca for baby boomers, in 1954, the City Council passed a resolution limiting the size of the font used for the town's name on a map to 1 point. As a result, it is unlikely that you will find it if you go looking for it on a map of Missouri. That said, it is South and West of St. Louis, on the route through Jefferson City to Springfield.

NOAA climate data from the ASOS at the Golden Girl Airport has been provided for reference in Figure 2.

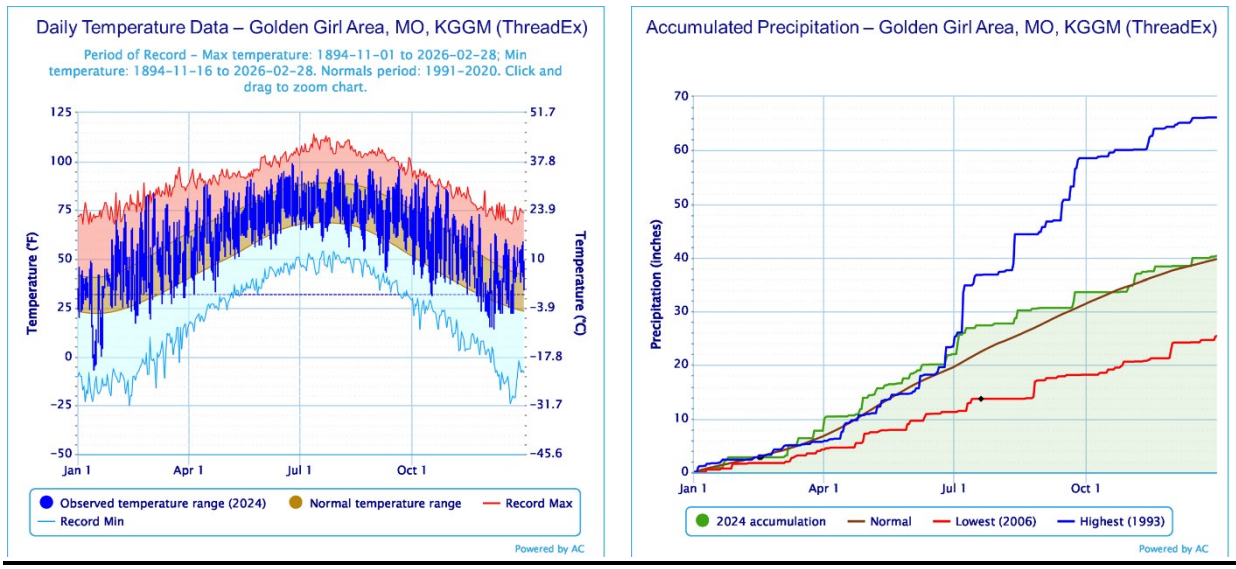

Figure 2 – 2024 Golden Girl Missouri Climate Conditions, Norms, and Extremes

ASHRAE has not developed design data for Golden Girl, but it would be reasonable to use the St. Louis or Jefferson City, Missouri design conditions for design and analysis efforts. Towards that end the St. Louis conditions are provided Figure 3 for your reference.

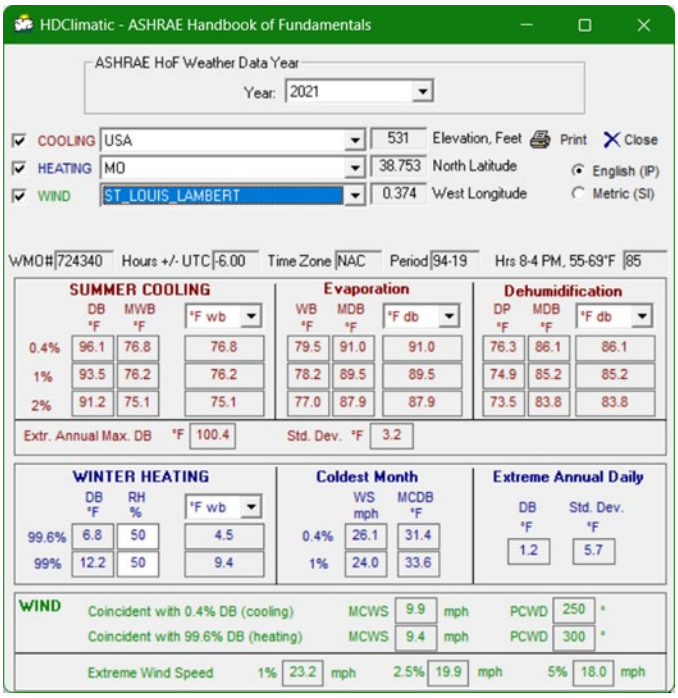

Figure 3 – St. Louis Design Conditions

COSTU History

COSTU started out as the Golden Girl College of Aviation and Agriculture, which was founded by Wendel Parker in 1932. Wendel had grown up on a farm and loved farming but was also fascinated by airplanes. As a result, he earned his pilot's license in 1925.

After reading about the successful exploits of Army Air Corps pilot Lieutenant John A. Macready, who used a modified Curtiss JN4 Jenny to spread insecticide over a six acre grove of catalpa trees on a farm in Troy, Ohio, Wendel became convinced that crop dusting had a big future since Lieutenant Macready had accomplished in a matter of an hour or so what would have taken ground based laborer's days to complete. The challenge was that most farmers could not afford an airplane and adapting current models for the purpose could be challenging. And the looming potential for a war in Europe was causing manufacturers to shift their focus to war-time production.

Seeing the potential for a business that combined the things he loved in life, Wendel created an airstrip on his farm, invested in several Jenny's like the ones Lieutenant Macready had used, modified them for crop dusting - including a few innovations of his own - and started a crop-dusting business.

In 1938, General Hap Arnold reached out to Oliver Parks (founder of Parks Air College) and others to establish the Civilian Flight Training Program (at their own financial risk), anticipating the need for thousands of pilots for the looming conflict. Oliver, having been Wendel's flight instructor, and knowing of his business venture, reached out to his young protégé to see if he was interested in joining the effort and offered to loan him the funding needed if he was interested.

Inspired by his mentor's confidence in him, Wendel decided to take the leap and established Golden Girl College of Aviation and Agriculture and on land bequeathed to him by his Aunt Vivian across from his farm. The curriculum focused on pilot training, primarily targeting training for the military but also offering a crop-dusting certification, aircraft maintenance training and certification, a degrees in aviation business administration, agronomy, and horticulture.

After the war, the college continued to grow and expand with the boom in the application of aircraft in agriculture, including establishing programs in farm management, aircraft maintenance engineering, meteorology, and aerospace engineering. Aviation was still the primary focus and the college flying team – the Flying Farmers - became a regular winners at National Intercollegiate Flying Association events.

Following the pattern of his mentor, Oliver Parks (who donated Parks College to St. Louis University in 1946 to provide a broader academic curriculum to the students), Wendell decided to offer the Golden Girl campus to the University of Missouri system when they formally organized in 1963. Delighted at the prospect of adding the reputation of the Flying Farmers to their sports program, the State of Missouri jumped at the opportunity and COSTU was established, becoming a thriving but slightly smaller and less well know member of the system.

Original 1940 Facility

Building Description

The college initially had two buildings in addition to the hangers at the airstrip, and the BAB was one of them. The facility first opened its doors in early 1940, housing the campus administration offices along with some classrooms and offices for the professors. It is a two-story building with 10,000 square feet per floor for a total of 20,000 square feet.

The building used a reinforced concrete frame and floor system with brick veneer over a wood framing system with drywall. The flat roof used a built up roofing system.

The long, narrow floor plan was intended to provide access to natural light and ventilation for most areas in the building. Windows were single pane, with an operable section in each window to provide ventilation.

A walkable utility tunnel connected the building to central plant and carried the following utilities to the building.

- Steam with condensate pumped back to the central plant
- Electricity
- Domestic water
- Compressed air
- Communications

The utility tunnel terminated in a utility room below the 1st floor at the south end of the mechanical room with stairs up to the mechanical room. The utility room contained:

- A steam pressure reducing station that took the 160 psig steam from the central plant and reduced it to 5 psig for use in the facility.
- A compressed air pressure reducing station.
- Condensate pumps to return condensate to the plant.
- A steam fired domestic hot water heater.
- A 13.8 kV to 480 volt step down transformer servicing the distribution panel in the mechanical room. 480 volt to 208Y120 volt transformers in the Electrical/Telecom room created the distribution voltages used for the lighting and plug loads.
- Lighting was generally fluorescent with some incandescent lighting used for accents, exterior illumination, and other special functions.

System Descriptions

The original facility was served by an economizer equipped, constant volume air handling system. The system included provisions for adding a cooling coil, but no mechanical cooling was provided at the time. Capacity was also provided in the power distribution system to allow upgrading to mechanical cooling at some point in the future.

Heat was provided by a district steam system fed by the central boiler plant on campus. The steam served:

- A shell and tube heat exchanger that supplied water to a finned tube radiation system (FTR) that picked up the perimeter heating load along with some heating coils that were provided for the core area on the second floor to offset the roof losses.
- A steam-fired domestic hot water system.

The hot water system was controlled by an outdoor air temperature reset schedule that reset the supply temperature from 210°F at 4°F outside (the winter design condition) to 120°F at 65°F (the balance point for the building). In addition, the FTR covers were provided with adjustable dampers to allow local "fine tuning" of the heat delivered by the system for a given section of enclosure.

Each face on each floor of the building was set up as a zone and was provided with a line sized valve that was controlled by a thermostat intended to shut down the FTR for that zone if it was getting too warm due to solar gains or the desired temperature of the occupant in the zone with a thermostat, typically an office for someone high up in the campus administration, like the Dean.

All controls were pneumatic with electromechanical relay logic.

1980 - Mechanical Cooling Addition

Mechanical cooling in the form of an air-cooled condensing unit serving a direct expansion (DX) coil was added in 1980. The project was funded by donations from the student body and alumni after their beloved Dean died at his desk one hot, humid summer evening of a heart attack, brought on by the strain of the demonstrations against the Emergency Building Temperature Control Restrictions Act, compounded by the heat and humidity in the unconditioned facility, which he refused to leave until the National Guard troops deployed to suppress the demonstrations were removed from his campus.

1984-1985 Renovation and Conversion from the Administration Building to the Bureaucratic Affairs Building

The campus grew significantly after the merger with the University of Missouri system, and by the mid 1980's, a new Administration Building was built, and the original Administration Building was converted to its current role of housing the University's Department of Bureaucratic Affairs.

The renovation project was completed in 1985 and in addition to the architectural changes associated with adapting it to it's new role, the project addressed the need to replace aging equipment, perform asbestos abatement, reduce energy consumption, and improve comfort. Figure 4 illustrates the remodeled floor plans for the facility along with the FTR zones that were provided. Figure 5 adds the VAV zones to the floor plan.

As a part of this project:

1. The original operable casement windows were replaced with fixed pane double glazed windows with thermal breaks in the frames and lightly tinted glass. This improved comfort and reduced the losses and gains through the envelope, including infiltration. But it made the facility totally dependent on the mechanical cooling process during hot weather.
2. The air handling unit was replaced and converted to Variable Air Volume reheat (VAV reheat). The air handling replacement conversion consisted of:
    - Replacing the original air handling unit with a modular unit complete with economizer section, 30% ASHRAE dust spot efficiency prefilters, 65% ASHRAE dust spot efficiency final filters, a warm-up coil, a DX cooling coil, and a Double Width, Double Inlet Air Foil supply fan (DWDI AF).
    - Retaining the original low velocity supply duct system, including some modifications for zoning purposes and installing pneumatic VAV reheat terminals.
    - Retaining the low velocity return mains but eliminating the return branches in favor of a ceiling return plenum approach.
    - Retaining the original roof mounted relief hoods associated with the economizer cycle.

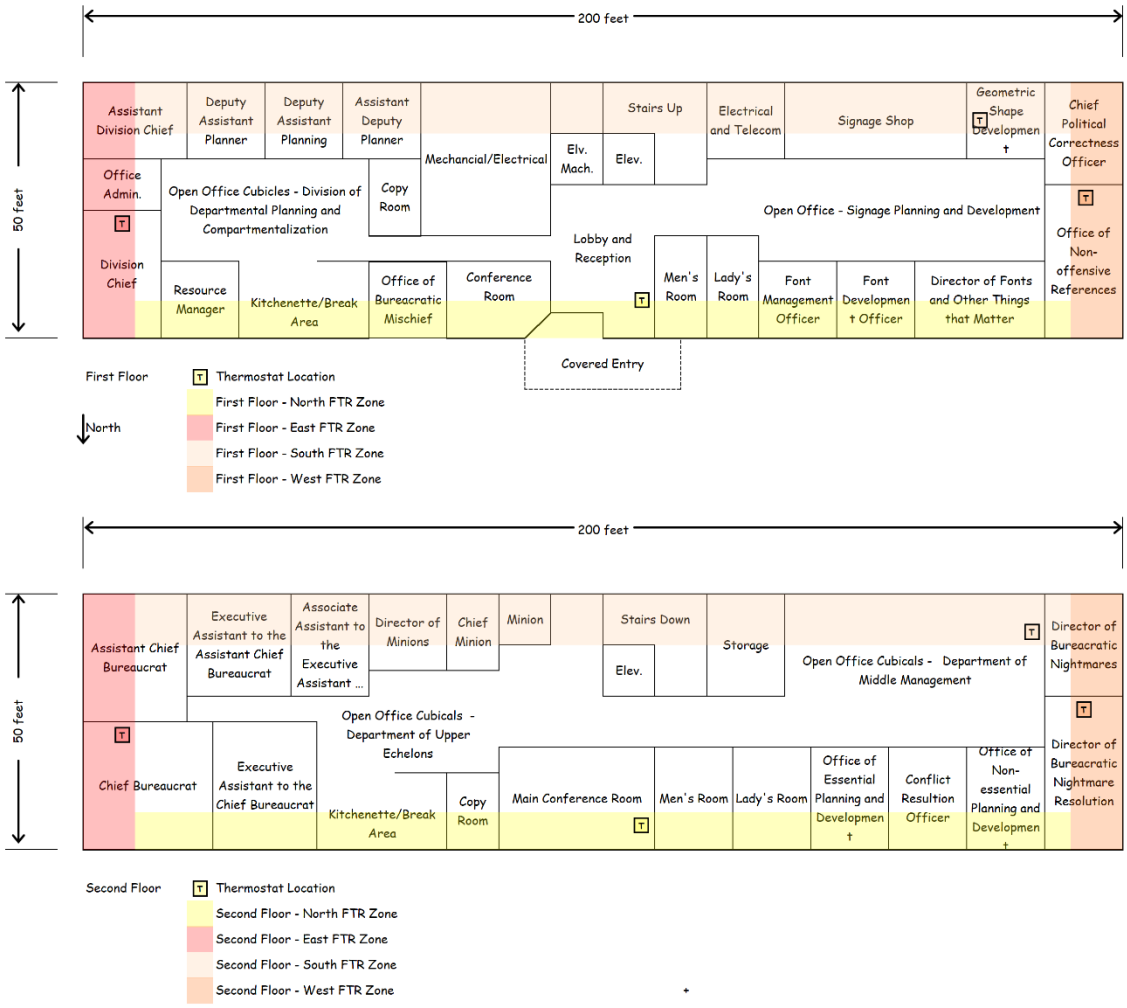

Figure 4 - Bureaucratic Affairs Building Floor Plans with FTR Zones

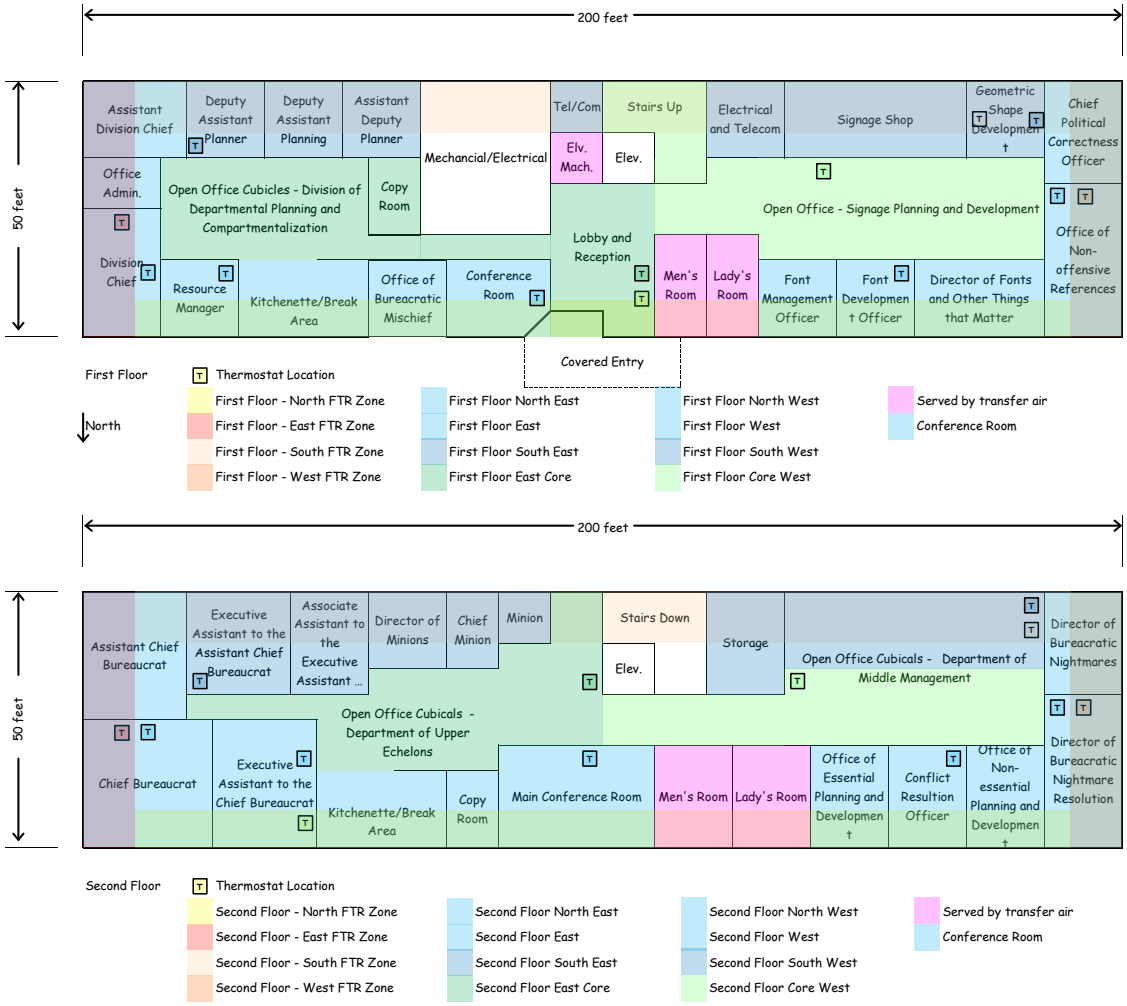

Figure 5 - Bureaucratic Affairs Building Floor Plans with FTR Zones and VAV Zones

3. The existing air handling unit economizer process was non-integrated to prevent short cycling the Dx compressors. During design development, an air-cooled chiller serving a chilled water system with a buffer tank was explored as an option to the Dx coil, which – it was thought - would allow an integrated economizer cycle. This design concept was incorporated into the project, but the system still experienced short cycling issues.
4. The hot water, steam, and condensate piping and associated equipment were reinsulated as a part of the asbestos abatement project. The hot water system was tapped to serve the reheat coils and the existing finned tube radiation system was retained.

5. New hot water pumps were installed sized for the combined flow rate associated with the finned tube elements at full flow along with the warm-up coil at full flow.
6. The supply temperature for the hot water system was reduced from the original 210°F setting to 170°F due to the reduced perimeter load associated with the improved windows and the ability to calculate loads more accurately using computer-based techniques that took things like thermal lags into account.
7. The reheat coils were selected based on the new operating temperature and the reset schedule was eliminated to ensure that the reheat coils would always be supplied with water at the 170°F design temperature.
8. The FTR enclosures were replaced with enclosures identical to the original enclosures but painted to match the new décor and segmented to match the new partition arrangement on the perimeter.
9. Because DDC technology was still evolving and somewhat expensive for zone level control, pneumatic zone level control was retained for the finned tube radiation system and the new VAV reheat terminals.
10. The zone valves for the FTR were retained and the existing thermostats associated with them were replaced, allowing them to modulate the zone valves based on the temperature in each zone at the thermostat location.
11. The campus controls group installed a DDC controller in the main mechanical room that directly controlled the new air handling unit, the heating water pumps, the heat exchanger, and the chiller. The system also monitored zone temperatures at several points on the first and second floor. This project was accomplished totally in-house by a team that was very hands-on and quite competent but not given to formal documentation.

The project planning assumed that the building occupants could be moved into the new Administration Building during renovation after which the Department of Bureaucratic Affairs would move into its new space. But, due to delays in the completion of the new Administration building, the building occupants and contents were housed in temporary trailers to allow the renovation project to proceed while work on the Administration Building was wrapped up.

Unfortunately, during the transition period a powerful storm system moved through the area, spawning a tornado just outside of town. While the tornado missed the campus, the wind gusts associated with it tore the roof off of one of the temporary trailers and much of the contents were lost due to wind and water damage, including the original Architectural, Structural and MEP drawings and related information for the original Administration Building.

1999 COSTU IT Infrastructure Development

In 1999 with the internet expanding at a rapid pace and a demand from the students for internet access in their dorm and classrooms, the Department of Bureaucratic Affairs, Office of Essential Planning and Development established the Office of Internet Technology under the Department of Facilities Engineering. Within two years, the Office of Internet Technology:

- Had become the 3rd largest organization on campus, surpassed only by Campus Administration and the Department of Bureaucratic Affairs.
- Had established Dell as their hardware standard, Windows as their operating system standard, and Cisco as their networking standard and permitted no other technologies to be used on campus.
- Had initiated an IT Infrastructure development project that provided servers and related infrastructure for all departments and provided an open-protocol upgrade to the network that managed all of their current building control systems.
- Had coordinated with the Office of Essential Planning and Development to move the Campus Control Systems Office from oversight by the Department of Facilities Engineering to oversight by the Office of Non-essential Planning and Development.

The latter two moves paved the way for allowing multiple major vendors to bid on control work instead of tying the campus to a sole source hardware solution implemented by in-house staff.

The Office of Essential Planning and Development – after hosting several master planning charette's organized by the campus architect and sponsored by one of the control systems "major players" - had concluded this would reduce their costs by allowing competitive bidding for the control work on campus. They also believed it

would also bring in outside expertise with exposure to a broad range of applications, settings and cutting-edge technology instead of relying on in-house staff who were only familiar with the campus infrastructure, operations, and the systems hardware applied there.

It also led to hiring an assistant for the Conflict Resolution Officer.

2002 BAB DDC and IT Infrastructure Upgrade Project

The 2002 phase of the DDC and IT Infrastructure Upgrade project extended the campus network to the BAB, adding a dedicated server, UPS, and IT rack to the BAB in the Electrical and Telecom Room. This necessitated that 24/7 cooling be provided for that area since the IT infrastructure costs came in over-budget and the packaged cooling system was eliminated from the project to control costs. The project also replaced the existing hybrid DDC central system/pneumatic zone control system with a full DDC system down to the zone level.

Unfortunately, there was no budget for a formal design process for the control system renovation work. As a result, the bidders were furnished with the 1985 mechanical drawing set and told to bid a like for like replacement. As mentioned previously, documentation of the existing control system was virtually non-existent and there were no copies of the mechanical specification available and thus no narrative sequences or point lists to guide the control vendor bids.

During the pre-bid site visit, one of the control representatives, who had been involved with the 1985 control system installation because he worked for the control shop at the time, discovered copies of the original pneumatic control drawings and some of his field sketches folded up in the DDC panel in the basement and asked that they be addended to the bid documents as a reference. Many of the other bidders felt this would be helpful, but the University project manager felt the documents were not relevant and might even expose the University legally somehow. Ultimately, the Office of Conflict Resolution sided with the project manager and the information was ***not*** incorporated into the project scope of work.

The zone level upgrade was accomplished by specifying the replacement or upgrade of the existing VAV terminals - at the contractor's discretion - with equivalent units that could be integrated with the upgraded DDC system while retaining the existing reheat coils.

Pneumatic actuation was required for the central equipment as a concession to the Department of Facilities Engineering's preference for that approach for major equipment. Zone level actuator selection was left to the control vendor's discretion,

As a budget management strategy, vendors were permitted to reuse existing actuators that they judged to be serviceable. Actuators that were found to have failed were to be replaced, including an upgrade to electric actuators for zone level equipment.

When the bids came in, the three major vendors were all within 10% of each other. But a third, less well-known vendor was 25% lower than the low bid from the majors. The college is legally obligated to take the lowest bid, but there are avenues that allow a bid to be withdrawn after submission and prior to contract signature including discovering a clerical error of some kind.

Given how low the less well known vendor was, the University's Project Manager set up a meeting to review the details of the bid including the points that would be provided, the nature of the controllers, the proposed contract timeline and other details in order to ensure themselves - and the bidder - that they had correctly interpreted the contract documents. To ensure no legal repercussion, they had similar meetings with all of the vendors.

In the meeting, the low bid vendor provided a list of the points included and explained the details of their technology, which included the ability to directly convert a pneumatic terminal unit to DDC without having to retrofit the controller and actuators. In addition, they had included contingency to cover the need to replace failed actuators and controllers if they found any during the installation process.

After the meeting the PM felt much more comfortable because he realized that one of the reasons the bidder was low was that they had not gold plated the job by providing unnecessary points. For example, the air handling system was intended to control for the temperature leaving the fan and the low bid vendor had provided the appropriate sensor and related software points and processes.

The other vendors had not only provided this necessary point, but multiple point scattered through-out the air handling system picking up parameters liked mixed

air temperature and preheat leaving air temperature that sounded impressive, but clearly had nothing to do with controlling the discharge temperature.

He observed a similar economy had been realized at the zone controllers by the vendors proprietary technology, which allowed them to reuse the existing terminal unit hardware with only the addition of a DDC sensor to replace the pneumatic thermostat currently controlling space temperature. In contrast, the other vendors had included unnecessary points like terminal unit flow rates and terminal unit leaving temperatures, all of which were irrelevant if the control system could manage the space temperature based on the space temperature sensor input, which the vendor assured him was possible over lunch.

The PM also noticed that virtually all the adjustable parameters in the low bidder's controllers could be adjusted up to 11, whereas the hardware from the other vendors only went up to 10. Thus, it was clear to him that the low bidder's hardware had the capability to deliver superior performance if properly adjusted.

Satisfied that the low bidder's price was in fact legitimate and nothing was missing, the PM recommended accepting the low bid and contract was signed.

Since it was a small, relatively simple facility, the successful bidder assigned it to some of their younger team members who, while being quite competent at working with the vendor's technology, were relatively new to Heating, Ventilating, and Air Conditioning (HVAC) and its related principles. As a result, they did their best in terms of developing the DDC control sequences but were constrained by their limited experience, the information given to them (the original 1985 mechanical drawings) and the budget that was set by this limited information during the bidding process.

2014 Campus-wide Monitoring Based Commissioning Initiative

With awareness of the need to improve the efficiency and sustainability of the campus facilities, the University of Missouri System initiated a monitoring based commissioning program with the following elements.

- Installation of metering systems capable of tracking the thermal and electrical energy consumption for each building on an individual basis.
- An EBCx project would be implemented for each building with priority being set based on the buildings EUI benchmark.

- Initiation of an ongoing commissioning process for any building that had undergone and EBCx effort.

Budget constraints and the COVID crisis would ultimately spread the timeline out for this process relative to what was originally anticipated.

2015 Mechanical System Upgrade and Conference Room Improvements

By 2015, the 1985 vintage air handling unit was beginning to show its age and parts were no longer available for the air-cooled chiller. In addition, the original 1946 distribution piping networks were starting to experience significant leakage due to age.

As a result, a design build renovation project was triggered that:

- Replaced the chiller with a current technology equivalent and,
- Replaced the air handling unit with an identical system using components from a modular, double-walled product line, and
- Replaced the mechanical and domestic piping distribution networks outside of the mechanical room with all-copper piping for line sizes 2 inches and under and schedule 40 steel pipe for the larger line sizes. Both welded and mechanical joints were used.
- The conference rooms were upgraded to provide more high-tech meeting spaces.
- Reused the existing controls by removing and then reinstalling them on the new equipment, making only minor modifications as needed to accommodate the specifics of the new machinery.

Existing Building Commissioning (EBCx) Project

At the point in time when you are reading this (several years after the 2015 renovation), the BAB has reached its turn as a target for an EBCx project in an effort to save energy and also address some of the comfort and operational issues that the occupants experience.

During the initial site visit, the operating team, in addition to sharing the information above and walking you through the facility, requested that you focus some attention on the following issues.

1. Even with the hot water system running at a constant 170°F hot water supply temperature as a result of the 2002 control upgrade. But:
   a. While fairly comfortable during hot weather, the building – and conference rooms and core areas in particular - tend to be cold during moderately warm weather. Once the climate pattern switches to late fall and winter conditions, this tends to be less of a problem.
   b. The East end of the first floor tends to be cold during cold weather even though the rest of the building is comfortable.
   c. The perimeter spaces, while comfortable during the peak heating season tend to overheat during the swing seasons and mild, cool spring and fall days.
   d. The settings of the zone thermostats are a constant source of disagreement between the person in the office with the thermostat and others who's offices are on the same zone.
2. The air handling system runs round the clock to ensure that the server/telecom room is always adequately cooled.
3. The chiller cycles frequently, especially during mild weather when it needs to operate to supplement the outdoor air cooling provided by the economizer process.
4. The building is more comfortable during extreme weather than in moderate weather and the swing seasons.
5. The system experiences frozen coils, which usually cost thousands of dollars to repair in addition to the disruption.

Building Documentation

While the historical record of the building is generally good, given its role in the COSTU history, the building documentation is very poor. The original Architectural, Structural and MEP documents were lost during the 1984/1985 renovation project as mentioned previously.

The building documentation was further compromised in 2004 when one of the BAB managers, having become frustrated with the lack of organization in the 2nd floor storage area, had her staff go through the entire room to reorganize it. As part of the reorganization, she had them discard anything that was dated prior to 2000 since because it could not possibly be relevant and should not be taking up valuable

space. Unfortunately, as a result, all of the drawings, specifications, submittals and other documents from the 1984/1985 project were tossed in the dumpster.

Fortunately, Cleetus Montgomery, the long time chief engineer for the building had a partial set of documents that he was very protective of, primarily consisting of the drawings from the 2015 design build project, but also other information he had accumulated over time. So, the operating team was not totally left without any documentation.

However, he and is wife Doreen recently hit it big in the Missouri lottery, causing Cleetus to submit his resignation and retire to their place in Florida. Unfortunately, nobody thought to ask him where he kept the drawings and letters and phone calls asking about them have so far gone un-answered.