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Ecolibrium

Central intelligence

From its façade to its HVAC, UTS Central impresses.

100 AIRAH

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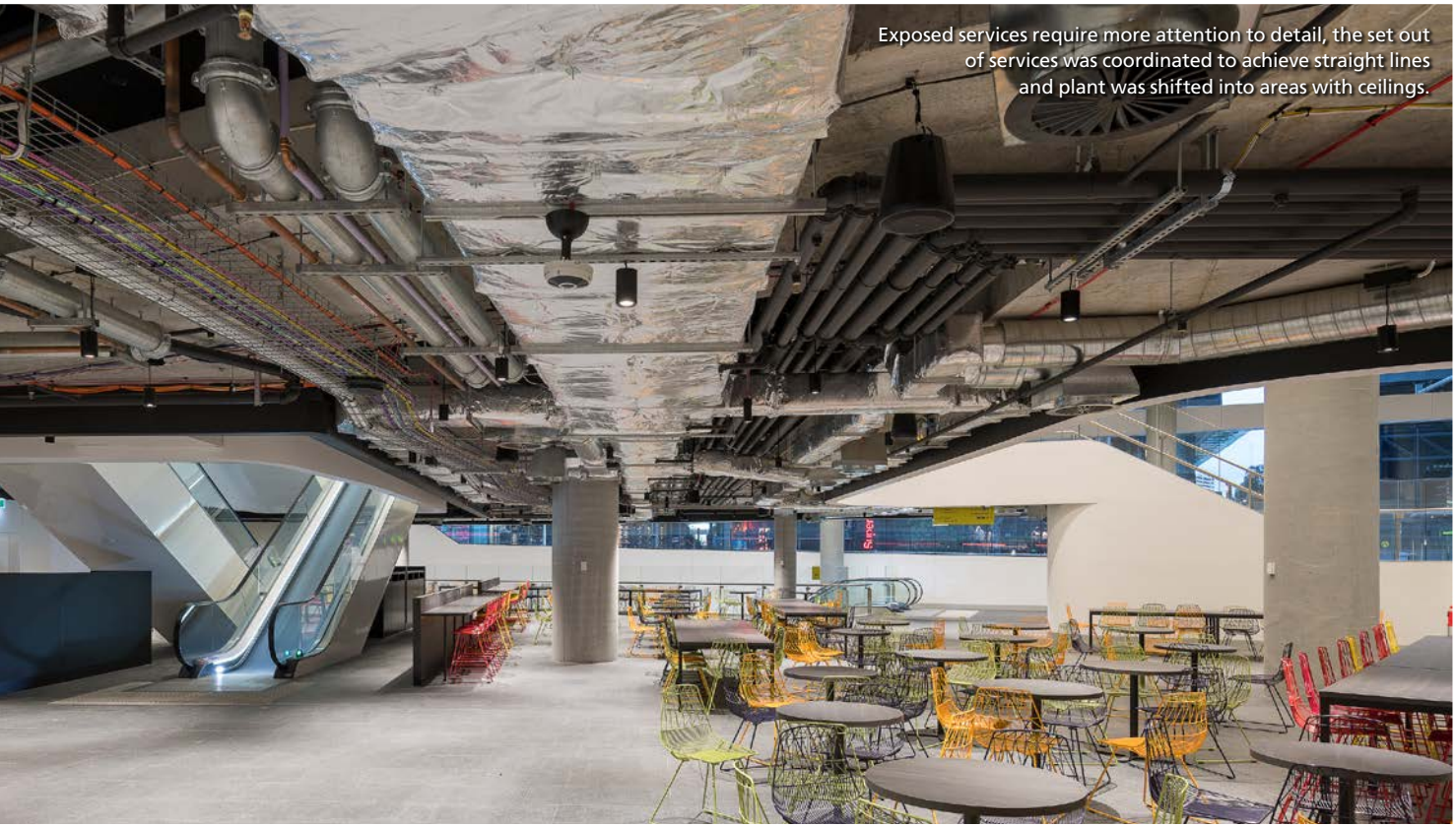
Central intelligence



Exposed services require more attention to detail, the set out of services was coordinated to achieve straight lines and plant was shifted into areas with ceilings.

All images courtesy of A.G. Coombs

As the final building delivered under the University of Technology Sydney's original City Campus Master Plan, UTS Central combines world-leading, collaborative learning spaces that embody contemporary tertiary education. Sean McGowan reports.

On a campus that already boasts architectural icons such as the Frank Gehry-designed Dr Chau Chak Wing building, it is no surprise to discover that the new UTS Central building has also pushed the boundaries of contemporary educational architecture.

From its double-helix staircase, to its twisted tower and modernist glass façade, the 17-storey building reflects the experimentation and innovation of the campus's 10-year transformational journey.

And by rising from the foundations of existing Buildings 1 and 2, there is also a sense that UTS Central is built upon all that the University of Technology Sydney (UTS) has become since it was founded in 1988.

"Our decade-long campus redevelopment has revolutionised teaching and learning, allowing us to deliver practice-oriented programs to prepare graduates for the workplaces of today and tomorrow," says UTS vice-chancellor Professor Attila Brungs.

"UTS Central is the confident and contemporary embodiment of that educational evolution."

LIGHTING UP BROADWAY

Located on Broadway in Ultimo, UTS Central was designed by fjmt (Francis-Jones Morehen Thorp) – the elegant, curved lines of the building's façade providing a contemporary contrast to the modular design of the Brutalist UTS Tower to its east.

The building consists of two underground floors, a five-level podium and a 10-level tower sitting above it. The gently twisting design of the tower results in no two floor plans being the same.

The podium levels accommodate a spectacular Reading Room featuring a light-filled three-storey atrium that overlooks Alumni Green, while the UTS Blake Library – occupying levels 7 to 9 – boasts a direct connection to the automated library retrieval system concealed beneath the green.

UTS Central is also home to The Hive Superlab – a science laboratory designed around group learning, with 42 pods accommodating six students each. Research spaces for the Faculty of Engineering and IT, the Research Excellence and Support Hub (RES Hub) and Industry Hub are also accommodated.

The Faculty of Law's new, authentic Moot Court and trial courts are also located in the new building. Designed to reflect real-life courtrooms, the Moot Court seats 120 people in theatre style, while the two trial courts seat 20 people each.

Additionally, three customised collaborative classrooms on levels 5 to 7 can accommodate as many as 350 students. Designed with no obvious "front" to the room, they are divided both physically and with technology into several smaller zones for group learning.

According to Professor Shirley Alexander, deputy vice-chancellor (education and students), learning at university is changing and so too is the nature of the student experience.

"Students must master a body of knowledge, develop the skills to work in a team, communicate effectively in a variety of forms, engage in sophisticated problem-solving, and be creative and entrepreneurial," says Professor Alexander.

"The spaces in UTS Central have been designed to support active and collaborative learning activities. Inspired by research, these spaces enable our students to graduate as highly competent professionals."

Other features include a student learning hub offering UTS student support services, a plastic-free public food court, student study spaces and north and south-facing terraces and gardens.

Semi-enclosed and naturally ventilated winter garden balconies span levels 9 to 16 on the northern façade.

UTS READING ROOM

The design of the UTS Reading Room was inspired by traditional scholarly spaces where academics can engage with current research, exchange ideas and immerse themselves in study.

As a postgraduate architecture student, Richard Francis-Jones spent a lot of time poring over his university's reference books.

"I did my master's at Columbia University in New York and I spent so much of my time in the library," says Francis-Jones. "It was the library during the day and the studio at night. Libraries are such an important part of student life."

Now design director of fjmt, Francis-Jones has helped to bring a new library to life at UTS Central, which is home to the UTS Reading Room and Blake Library.

With a triple-height atrium opening to a large skylight and an uninterrupted glass façade looking over Alumni Green, the UTS Reading Room is a light-filled space for quiet work, reading and contemplation.

"Great reading rooms and great libraries have always been at the heart of leading universities," he says. "The UTS Central Reading Room is part of this tradition but in a 21st-century form – its primary purpose is for quiet, individual study, but together.

"It's easier for us to study and focus when we are in the company of others. There is a sense of camaraderie – when you are going through the hell of pre-exam study together, it is energising and empowering. You're with people doing the same thing, you're in it together and that feels really good."

Source: UTS

DISTRICT ENERGY SHARING

Targeting a 5 star Green Star rating, UTS Central naturally features a number of environmentally sustainable design (ESD) elements, including the use of district cooling in an innovative urban partnership with the adjacent Central Park commercial development (see Ecolibrium February 2015).

This results in the UTS campus's energy and potable water use being reduced while also providing space, power and maintenance savings for the university.

UTS Central features a mechanical services design concept by engineer Steensen Varming that was cleverly reconfigured by mechanical services design and construct contractor, A.G. Coombs Projects.

Appointed to the project in April 2017 by construction manager, Richard Crookes Constructions, A.G. Coombs sought to add value to the project by developing a cost-effective, energy-efficient design that took the performance requirements of the Steensen Varming concept on board.

"We presented our design concept during the tender phase to give Richard Crookes Constructions and UTS confidence that it met the requirements of the project," says A.G. Coombs senior project engineer Dennis Ngov.

Laboratories are served by manifolded fume cupboard systems and strobic exhaust fans.

An aggressive design program was set after the contractor was awarded the project, with the design delivered on a floor-by-floor basis every two weeks in the podium, and every week in the tower so as to provide progressive resolution and approvals.

Ngov says this required an agile approach to not only stage the design, but still make it cohesive while addressing vertical elements up front.

At the core of the approach is the use of a centralised low-temperature system that combines EC (electronically commutated) fans with the latest air handling unit (AHU) technology.

This design takes advantage of the existing chilled water supply from the city campus central energy plant at the base of the building. This incorporates additional cooling capacity from the central plant within the adjacent Central Park development.

COMBINING THE OLD AND NEW

The UTS Central project presented a number of technical challenges – none more so than the coordination of services within both the existing structure (formerly Buildings 1 and 2) and the architecture of the new building.

"A major part of the works was to re-divert existing services through the new building," says A.G. Coombs project manager Leigh Walters.

"These services had previously run through the old building and had been temporarily diverted in works carried out before we commenced. This required dilapidation reporting and assessment of how these could be re-diverted when they were operational while working through a construction site."

Additionally, the existing central heating hot water (HHW) plant that serves a number of selected buildings within the campus was also upgraded. An existing boiler was replaced to increase capacity and meet the additional heating demand created from UTS Central.

The works also included the decommissioning and removal of flue dilution systems that served the existing boiler plant, which were designed and installed to enable Building 2 to be demolished to make way for the UTS Central project.

"UTS had concerns about keeping this as a permanent solution," says Walters.

"In response, we coordinated a path through the new building for new dedicated flues for each boiler as a permanent, robust solution."

Taking the lead for services coordination on the project, A.G. Coombs relied upon the use of building informational modelling (BIM).

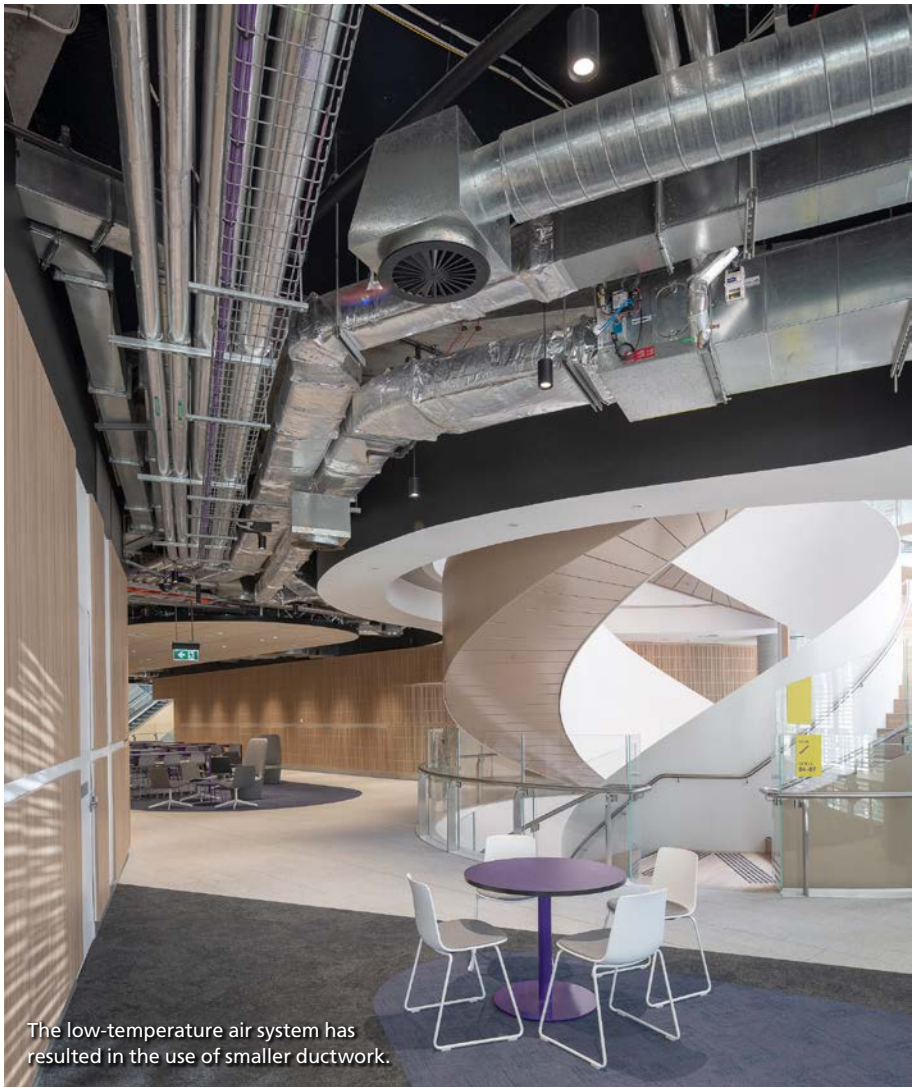
CHILLED WATER

UTS Central utilises a secondary chilled water circuit (located in the retained structure of Building 2) that is fed from the central chilled water plant located in the retained structure of Building 1.

The central chilled water plant includes six chillers that have received progressive upgrades since the original building's completion in 1974.

"UTS added capacity to the plant in a separate project by installing an energy transfer station (ETS) to tap into the existing chilled water supply from a central energy plant within the adjacent Central Park commercial development," says A.G. Coombs' Dennis Ngov.

This arrangement forms part of Australia's first district energy-sharing project.


The low-temperature air system has resulted in the use of smaller ductwork.

BIM enabled the new plantrooms to be designed with a minimal footprint. This assisted with design coordination for very tight spaces – particularly where a ceiling was present.

In other areas, services have been left exposed according to the design concept.

"The architectural and structural principles that defined space for services in ceiling voids and plantrooms were defined before we commenced on the project," says Walters.

He says by using lower supply temperatures, smaller airflow requirements were created for the air-handling systems that resulted in the ability to utilise smaller ductwork.

"The smaller ductwork sizes could still be at the low velocities required to meet the stringent noise criteria for the project, but made the coordination of reticulation routes achievable without adversely affecting the architectural outcome."

In areas where the ceiling was removed, the opportunity was taken to provide more space for services.

"Exposed services, however, require more attention to detail in the layout and installation to ensure they look appealing," says A. G. Coombs strategic development director Bryon Price, F.AIRAH. "Flexible ductwork was replaced with solid ductwork and the set-out of all services

LESSONS FROM THE MECHANICAL SERVICES DESIGN AND CONSTRUCT CONTRACTOR

A.G. Coombs project manager, Leigh Walters and senior project engineer, Dennis Ngov share some of the lessons learned from the UTS Central project.

Working in or adjacent to a large operational building has its challenges. Connecting into existing central thermal plants adds another dimension. It is important to engage with the client/operator to understand how systems operate and when items of plant can be shut down. The contractor and developer worked extensively with UTS to plan and document the staged changeover of plant activities. It's important to take the time, involve the client and manage risks with them.

Architectural shafts and plenums for return air, relief air and smoke exhaust were an important design solution adopted on the project to minimise the riser space and maximise floor space. The project had a mix of new and old building structure, and leakage in these shafts became a significant challenge. Testing shafts and reviewing construction of the shafts is critical to working through leakage problems as early as possible.

Earlier engagement on projects has potential for better outcomes. At the time we were engaged the building structure, architectural layout and construction methodology had been largely defined. There was still ability to progress the design to better integrate the HVAC solutions. However, the design was far too advanced to accommodate a multiple-level prefabricated plantroom solution that we proposed. Earlier engagement would have also assisted the architect to plan the plantrooms with less iterations and better integration.

Keep evolving designs where there is an opportunity to simplify the solution for the client. As an example, the preconditioning system for the tower was removed as the design was developed further, as the energy savings were no longer apparent. This project has less equipment to operate and maintain than the original design concept without changing the performance requirements.

was coordinated as much as possible in straight lines for aesthetics."

Additionally, items of plant were moved into areas where a ceiling would conceal them.

Fabrication functionality was also added to the BIM model and used to support the accurate manufacture of components offsite.

LOW-TEMP SOLUTION

The adoption of the low-temperature air system was in response to a number of drivers, including the need to reduce airflow to accommodate the use of smaller ductwork.

"Lower airflows resulted in lower fan energy, but also a smaller footprint for the AHUs," says Ngov.

EC fans were specified in the AHUs because they presented a compact solution while also delivering energy efficiency. The use of EC fans also resulted in significantly lower noise levels that reduced attenuation requirements.

"This was important, as space for attenuation was limited and plantrooms were located close to noise-sensitive areas," Ngov says.

The plantrooms serving the UTS Central building are generally located on a floor-by-floor basis next to valuable floor space.

The use of smaller air handling plant resulted in plantroom space having less impact on the layout and functionality of the building. It also assisted in achieving better maintenance access into the plantrooms.

The operational demands of The Hive Superlab also required that a separate air handling plant be installed to maintain reliable operation with airflows inwards to the room.

Taking its name from the hexagonal design features and "buzzing" atmosphere of a beehive, the colourful

The spectacular 3 storey Reading Room.

Hive Superlab is a world-class teaching lab designed to a PC2 (Physical Containment Level 2) standard.

The laboratory spaces are also served by a manifolded fume cupboard exhaust system, with eight connected fume cupboards and strobic exhaust fans at roof level in a duty/stand-by arrangement. In total, five individual fume cupboard systems are provided, including a DDA (Disability Access) fume cupboard specifically designed to ensure the reach ranges, working height, services and clearances all meet AS 1428.2 DDA design requirements.

The lab accommodates up to 270 students with specialist audio-visual facilities (including bone conduction headphones) to allow for seven classes to run simultaneously.

CLEVER FAÇADE

The glazing applied to the façade of UTS Central is extensive, and was installed by two specialist subcontractors who each worked on the tower façade and podium façade exclusively.

The tower façade features a closed cavity design, while the podium façade is made up of approximately 1,100 panels from 40 different glass types – the largest measuring 6m by 2.3m and weighing around 700kg.

To control solar penetration, regulate natural light and help to control internal temperatures, UTS Central features a bespoke sun shading system.

Geometric panels on the building's northern façade are programmed to respond to the azimuth of the sun across the calendar year. Adjustable louvre blinds encapsulated within the façade of the upper levels give the building its distinctive white veneer.

As well as blind control, the tower façade is also served by filtered, pressurised and humidity/temperature-controlled air delivered to the façade panels to assist with thermal comfort.

FINE-TUNING

UTS Central officially opened to students and the public in August 2019, with the UTS Reading Room, UTS Blake Library, RES Hub and Industry Hub all opening later in November 2019.

Despite its staggered opening, building tuning is well under way, with the secondary chilled water and heating water loops being targetted for efficiency and operational improvements.

And with the occupation of spaces varying significantly due to the mix of spaces and uses in the building, the fine-tuning of air systems is also under way.

"Now that the building is occupied," says Walters, "we have the chance to revisit some of the air systems and tune them."

Other areas of UTS Central, including the Faculty of Law located across levels 14 to 16, were slated to open in early 2020.

PROJECT AT A GLANCE

The personnel

- Architect (Original Broadway Podium): **Lacoste + Stevenson with DJRD**
- Architect (UTS Central): **fjmt**
- Developer and owner: **UTS**
- Façade engineer: **Surface Design**
- Fire engineering: **ARUP**
- Managing contractor: **Richard Crookes Constructions**
- Mechanical services D&C contractor: **A.G. Coombs Projects**
- Sustainability and ESD: **Steensen Varming**

The equipment

- AHUs: **GJ Walker**
- BMS: **Optergy (Alerton Australia)**
- Boilers: **Hunt**
- Control valves: **Belimo EPIV**
- Dampers: **Celmec**
- Diffusers: **Smartair**
- Duct: **Kavanagh Industries**
- Fans: **Fantech**
- FCUs: **Temperzone**
- Fume cupboards: **Dynaflow**
- Manifold exhaust fans: **Strobic**
- Grilles: **Ideal Air**
- In-row coolers: **Schneider Electric**
- Pumps: **HVAC Pumps**
- VAV boxes: **Celmec**
- Variable speed drives: **ABB**
- VAV diffusers: **Rickard**

(Source: A.G. Coombs)