UNIVERSITY OF PORTSMOUTH

rac COOLING INDUSTRY AWARDS 14 CLIMATE CENTER WINNER

Case study

University of Portsmouth

Location	Portsmouth
Value	£2.25 Million
Size:	300m² - Modular
Duration	3 Months

About

The University of Portsmouth is ranked amongst the top 400 universities in the world, according to the Times Higher Education World University Rankings. The University has over 23,000 students, including 3,000 from over 100 countries, supported by over 2,500 staff.

The Brief

Sudlows were awarded the contract to design and build a new £2.25million modular facility, to be installed and commissioned ready in time for the start of the new academic year. The primary focus was on the successful migration of the existing Mercantile house data centre to the new, purpose built, modular facility.

The new building was to be a dedicated facility, modular in construction, allowing for a rapid deployment and flexible aesthetics. Once operational, the new facility would provide the University with a highly efficient integrated system with high levels of resilience and incorporating sufficient capacity to allow the University to expand their current IT demands significantly whilst maintaining the designed level of resilience and efficiency.

Data Centre Components

- N+1
- Tier 3 design elements
- 2MVA Capacity
- 25kW High Density Load
- 2 x 35kW Airedale CRAH
- 2 x 80kW Airedale DeltaChill
- 47 x Rack space

Construction

Sudlows' solution to the University specific requirements was a single story modular building facility, fitted out with state-of-the-art power, cooling and environmental management infrastructure with the capacity to support:
35 x No. 42U, 1200mm deep IT Cabinets.

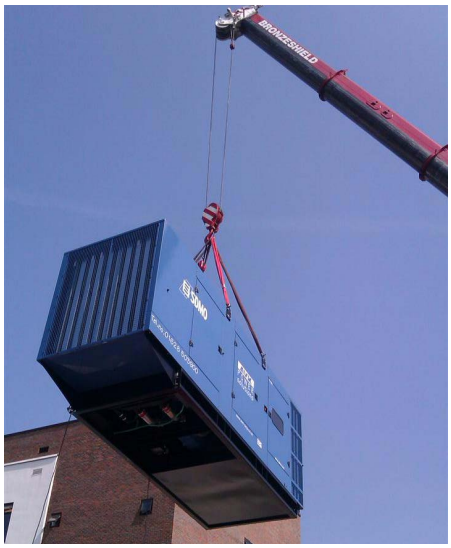
Mechanical and Electrical systems were designed and sized to support a total load of 439 kW, with densities up to 25 kW per cabinet.

Challenges

The proposed location was within a conservation area and so additional landscaping works were incorporated to ensure planning was granted to meet the critical date.Off-site manufacture of elements ensured that the on-site construction deadline was met.

Ground investigation reports prior to works revealed poor soil conditions and a history of heavy bombing from WW2. The risk of unexploded ordnance, alongside the soil issues presented a significant and unique combination of challenges to the project.

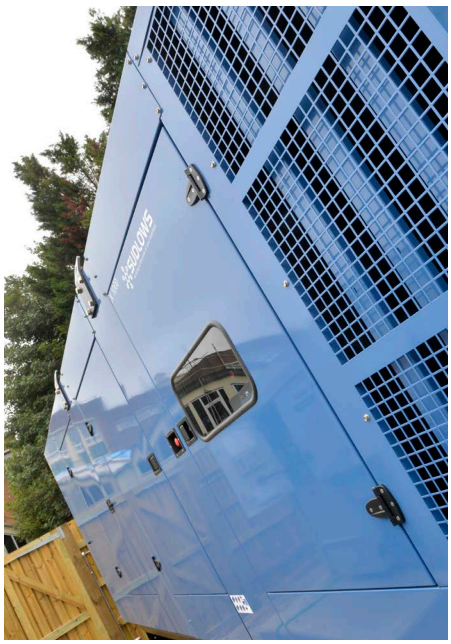
This resulted in a revised and carefully constructed piled foundation design consisting of 40 x 8.5metre deep piles.

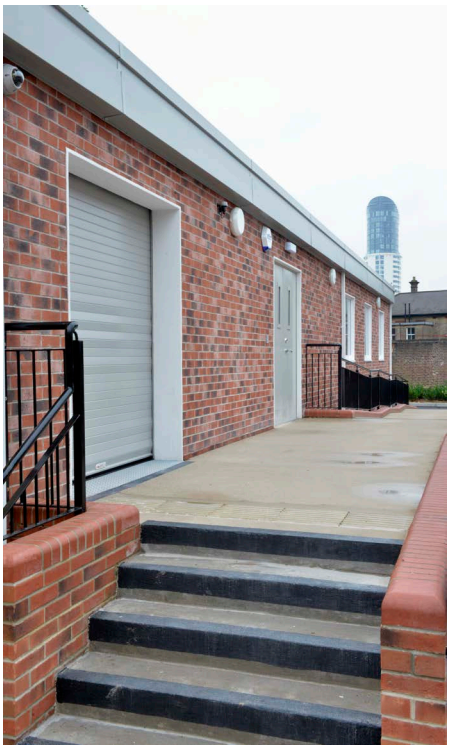


The critical programme required that this element was integrated without delay, despite additional design and construction being required.

Site access presented another challenge as the primary route for all deliveries was obstructed by a railway bridge outside the site entrance, with the entrance itself being only 2.8 metres wide.

Despite all of these challenges the modular building was successfully delivered and quickly assembled in seven separate 3m x 12m sections.





Migration

Sudlows were pivotal in the successful migration of all the existing physical equipment of servers and switches from the original Mercantile data centre in to the new modular facilty.

The migration also provided an opportunity to implement a new core and top of rack switching strategy which was integrated into the on-site programme.

All of this was successfully achieved within a planned 72 hour period fully tested and operational.

Cooling

The high density cooling concept is based on an extremely efficient Dynamic Free-Cooling chilled water Solution.

The design supply air temperature of 27°C allows the number of hours of free cooling available to be maximised, while maintaining the resiliency of Mechanical cooling when required. During free cooling, both chillers are designed to operate simultaneously to maximise coil area and performance.

Heat rejection is via two Airedale air-cooled chillers configured with N+1 redundancy which support and feed the On-Rack coolers and CRAH units within the Data Centre. Inverter driven pumps allow for variable flow within the system which complements the variable temperature operation.

At the heart of the system is an innovative control system which implements several continuous control loops to ensure optimum operation, with all systems working together.

The whole system is dynamic to match chilled water temperature and flow rate to the installed load. The system has an anticipated annualised PUE of 1.14 when populated over 20%.

Even during initial population, prior to the installation of the high density super computer equipment, the PUE was recorded at only 1.9 and the ambient temperatures exceeding 20°C.

In addition to this, a manual data centre temperature override is also included to allow for optionally cooler working environments to be achieved even during high ambient days.

The system, when operating in automatic mode, utilises the full ASHRAE recommended envelope to operate without compressor based cooling for the majority of the year.

Power

The facility was provided with a new high voltage supply together with a new high-impedance 1000kVA - 3 phase super-low-loss amorphous core transformer.

3 x No. 300kVA High-Efficiency Double-conversion static UPS systems are configured to provide N+1 redundancy while the on-site power generation system provides 1000kVA of standby power for 24 hours.

Due to the dynamic and adaptive control system, no changes to the proposed cooling infrastructure will be required to accommodate future changes in densities and distribution of load within the facility.

The design of the UPS room evolved through the use of computational fluid dynamics. This resulted in the inclusion of a bespoke air containment system to ensure optimal airflow. The system operates with no mechanical cooling throughout the year, further enhancing overall power efficiency.

Sudlows also procured, managed and delivered the supply of the HV ring mains on behalf of the University with a COMA agreement for the maintenance of the HV supply and transformer.

Facilities Management

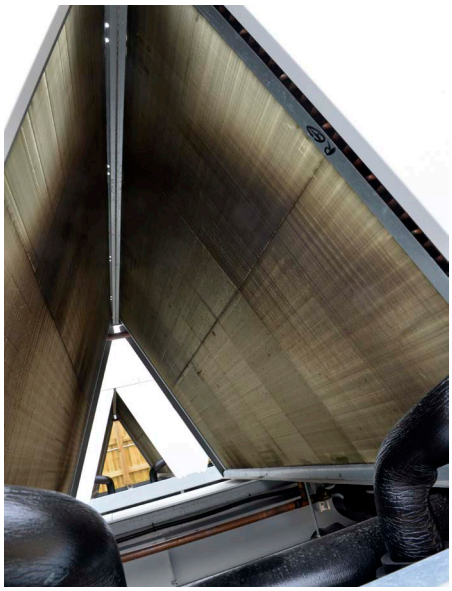
Sudlows Managed Services team also provide long term core services support to the University with a bespoke action plan that will deliver regular service and maintenance to the critical infrastructure including;

- **UPS**
- **Chilled water and cooling systems**
- **Fire suppression**
- **HV transformer, critical power supplies**
- **BMS with remote 24/7 monitoring**
- **Generator fuel management plan**
- **CFD and Thermal image analysis**

Core services support programmes ensure that critical facilities, such as the University of Portsmouth data centre, can always operate at its optimum level.

"The new facility will see the University benefit from a number of technical innovations that will deliver significant increases in energy efficiency and will support the University's plans for expanding research programmes and student support services."

"Across the UK we are seeing a number of minnovative educational institutions, such as University of Portsmouth, looking to update their legacy data centres to benefit from energy efficiency and to provide students and staff with a significantly more resilient and dynamic infrastructure"
Andy Hirst, Technical Director at Sudlows



James Holland, Data Centre Network & Security Services Manager for University of Portsmouth added;

"Sudlows won the competitive tender to design and build this impressive facility following a rigorous selection process.Sudlows created an excellent facility that the University can rely upon to deliver world class academic support and research development."

Conclusion

The entire project was completed within a 9 week on-site timeframe and utilised off-site manufacture to achieve this programme. Despite several circumstances that threatened to delay the project, a successful migration taking only 72 hours was delivered, as scheduled, from the outset.

An innovative dynamic control system integrates several control loops to provide for adaptive and optimised free cooling. This is achieved with concurrent modulation of chilled water flow rate and temperature, together with adoption of the full ASHRAE Envelope for maximal efficiency, even at part loads.

The system is designed to support densities from 8kW / Rack up to a maximum of 25 kW / Rack and achieves this with a Rear Door Cooling System. Chilled Water Temperatures are intelligently controlled based on actual demand. Airflow is controlled based on differential air pressure within the rack.

"Sudlows created an excellent facility that the University can rely upon to deliver world class academic support and research".

The careful design of the UPS room was optimised through the use of computational Fluid Dynamic Modelling to ensure that the space could be cooled with a low-energy, ventilation system for 100% of the year further contributing to this leading data centre's cutting-edge design.

The University of Portsmouth is a typical mixed use data centre which houses multiple vendors' equipment and therefore needs to be flexible in accommodating changes in IT approach over the 20 year design life. The solution delivered successfully achieves this whilst supporting the densities required with maximised efficiency.

Sudlows London | Manchester | Dubai
T. 0800 783 5697 | E. hello@sudlows.com
www.sudlows.com