

ROYAL OBSERVATORY EDINBURGH
C2 DATA ROOM COOLING
STATEMENT OF REQUIREMENT
2015

ROYAL OBSERVATORY EDINBURGH

C2 DATA ROOM COOLING PROJECT

Introduction

1. The C2 Data Room at The Royal Observatory is located in a 60's built accommodation originally designed and used as a canteen area. The aim of this document is to outline the requirements and specification for the installation of suitable and efficient cooling and upgrade to the Data Room to provide sustainability and assurance for the next 10 years.
2. The current data centre space has served the organisations data centre requirements for 10 years but the cooling systems is approaching its end of life. Recent improvements have been made with an upgrade to the UPS and batteries for a more efficient system. However, the remaining data centre power, cooling, fire & security protection and data infrastructure does not lend itself to facilitate the organisations future growth demands with increased capacity.
3. With the planned construction of new buildings and owing to the changes in the sites infrastructure it is considered that this is the right time to create a more modern environment based on the latest design guides, best practises and recommendations.
4. The works will need to be carried out within a fully operational data centre environment and downtime required to implement new supporting infrastructure, power and cooling plant should be kept to an absolute minimum, to avoid disruption to business services. Therefore project co-ordination and execution should be communicated and managed carefully.

Aims & Objectives

5. The aims and objective is to deliver an effective, compliant, efficient and up to date Data Room cooling system in the C2 Data Room. The package should be a fully phased design & build and the contract should include project management and site supervision to CDM requirements. The following are a summary of requirements:
 - a. Initial design phase to ensure all clients obligations & objectives are met in full prior to works mobilisation (approx. 2 weeks)
 - b. Builders works to block up windows
 - c. Modifications or removal of existing heavy duty raised flooring system.
 - d. Design & installation of new critical electrical systems within the data centre to N+1 resilience, with the exception sub mains supply, MPDU and UPS which is N.
 - e. Design & installation of non-critical electrical systems, lighting, fire and security systems
 - f. Resilient cooling systems to achieve the desired sensible kW duty N+1 redundancy as a minimum
 - g. Provision of additional 12# 600 x 1200 x 42U server cabinets to facilitate future expansion.
 - h. Provision of hot aisle containment system for efficient operation and managed airflows
 - i. Supply & installation of cabinet PDU's
 - j. Modifications to existing FM200 system to suit new layout or the design and installation of a new fire suppression system

- k. Environmental Monitoring System (EMS) with pricing options for a full data centre infrastructure management system (DCIM)
- l. CAT6 Data Cabling systems within the data centre

Project Schedule

- 6. The project start date is currently planned Monday 19th October 2015 with a proposed completion Date Friday 18th Dec 2015. Any contract mobilisation should take place before 19th October to allow any programmed work to commence on Mon 19th Oct.
- 7. The project Manager is to provide a project schedule to complete the package within this timescale.

Existing Data Centre

General Construction

- 8. The data centre is encapsulated by block walls along with standard fire doors, one for entry and another used as a fire exit and deliveries. A raised access floor has been installed throughout the facility although which measure approximately 200mm in depth. It has been assumed that the flooring is heavy duty specification as typically recommended to support the diverse weight loads of a data centre. There is a ramp at each door to facilitate the movement of server cabinets and other equipment.

Cabinets

- 9. The data centre supports approximately 12# 42U 600mm x 1200mm server cabinets and 1# 42U 800mm x 1200mm network cabinet. The cabinets have been installed in two rows in an attempt to create a hot and cold aisle layout.

Power Systems

- 10. The existing underfloor power distribution system within the C2 Data Centre is compliant with BS7671 as a stand-alone system. The system consists of 3# runs of 3-phase bus-bar trunking populated with integral socket outlets. Each run of trunking is protected by a 63A 3 phase circuit breaker. However, there is no fuse fitted within the 'tap-off' plugs therefore every Power Distribution Bar which is plugged into the trunking is fused at 63A (the main trunking circuit breaker). The cables which run from the 'tap-off' plugs to the 16A commando sockets are 4mm² (capable of carrying 32A) and the flex which runs from the commando plugs to the Power Distribution Bars range from 2.5mm² to 1.5mm² (capable of carrying 25A and 16A respectively).
- 11. Each and every data cabinet 'power bar' is non-compliant with BS7671 and there is concern that these may become overloaded generating a risk of fire.
- 12. Another major consideration with the present set-up is discrimination. Basically any fault in an individual cabinet could potentially cause the main circuit breaker to trip and effectively isolate every other data cabinet connected to the associated 3-phase trunking. This is the foremost reason why underfloor bus-bar trunking is no longer recommended for use in data centres.
- 13. The data centre is fed from two different locations within the main building. The UPS is fed via switch gear located within the basement plant room, and the mechanical systems are fed from switch gear located within 1963 switchroom. The UPS is rated at 120kVA (108kW) and is fed from 250A thermally adjusted MCCB located within the main switch gear. The essential services board located within the data centre is fed from the UPS via a bypass panel.
- 14. Power to the cabinets is fed via three TPN (3ph) busbars which are located within the existing heavy duty floor void. Plugs are taken from the busbar's to feed PDU's within the server

cabinets. It was not clear if the cabling systems to these supplies confirm to the latest 17th edition electrical standards or equivalent, which now recommend a suitable diameter earth for IT loads due to large amount of earth leakage IT hardware omits.

15. The current IT load within the data centre has been calculated at around 35-40kW

Cooling & Ventilation

16. Cooling to the data centre is provided by 2# 45kW net sensible direct expansion (DX) CRAC units (computer room air-conditioning) the design of the CRAC units are up flow and not ideal for data centres. Cold air is rejected at the top of each cooling unit via a small plenum box with the hot air returning back into the return air grille located on the front at the bottom of the unit, thus creating an issue with short cycling with the CRAC units.

Each unit will be able to deliver around 45kW of cooling based on an average 24°C return air temperature, and at time of survey the cooling system was operating at around 19°C.

Fire Protection Systems

17. An FM200 fire suppression system has been installed within the data centre. Although not a mandatory requirement for data centres, the need to install specialist fire protection systems such as gas agents and hi-fog mist is generally driven by the business or organisations own business continuity policies or Data Room contingency.

The fire suppression system consists of FM200 cylinders that are located outside the data centre in a purpose made cupboard, and an extinguishing panel with standard photo optical smoke heads on two zones. Due to the proposed layout and the construction of a new fire rated wall the positioning of the gas discharge nozzles will need to be modified to cover the new data centre space.

18. As an alternative solution, we would recommend that the smoke heads are removed as a minimum an aspiration or Very Early Smoke Detection Apparatus (VESDA) systems should be installed within the data centre to provide and are a much preferred system due to the air velocities within data centres

19. Remainder of works as per Project Schedule.

Data Centre Requirements

20. The existing data centre is primarily responsible for the organisations general office IT requirements as well as hosting IT services for research purposes both internal and also hosted systems for third party businesses and similar organisations to Royal Observatory Edinburgh. The new data centre will provide the organisation with a suitable facility to cater for future growth and also provide increased resilience and redundancy to the power and cooling systems within a fully controlled & efficient environment which is now required by all server hardware manufacturers to validate equipment warranties.

Energy Efficiency

21. The final Data Centre Design should provide a PUE of around 1.5 or better.

New Data Centre Performance Specification

22. The principles of all new data centre designs are based on the characteristics of the IT load its supports. As a minimum we would recommend N+1 with the cooling systems, N for a centralised UPS & battery system, N for the non-essential electrical systems and N+1 for the UPS protected or critical electrical systems.

23. No back-up generator will be required as a new much larger centralised generator will be installed as part of the new research centre which will provide backup power to Citrucel area of the Blackford site.

Build Works

- I. Strip out of existing services
- II. Provide 1 hour fire rated wall
- III. Builder work as required
- IV. Provide 2# 900mm doors
- V. Block up windows
- VI. Painting & Decorating as required
- VII. Provide new heavy duty vinyl flooring or alternatively modifications to existing access flooring system
- VIII. Provide new suspended ceiling system to facilitate hot aisle return.

Cooling & Ventilation Systems

- I. Provide 90kW N+1 cooling system
- II. Down flow CRAC units
- III. Plenums
- IV. Condensers/chillers
- V. Pipework
- VI. Fresh air supply
- VII. Installation & commissioning

Electrical Systems

- I. New 160A CPDU with 32A MCB's & Metering
- II. 32amp SPN commando electrical supplies to 28# cabinets
- III. TPN supplies for CRAC units
- IV. 40amp TPN Sub LV Panel to include
- V. 2# double gang cleaners sockets red (32amp ring)
- VI. Spurs fire systems
- VII. 1# spur fresh air ventilation
- VIII. 1# spur gas suppression extract
- IX. 600 x 600 light fittings (allowance for E/L as required)
- X. All electrical containment
- XI. All earthing including cabinets, ceiling grid and RAF

Fire Suppression & Protection Systems

- I. Fire Suppression System compatible with this design & layout
- II. Control panel & ancillary devices
- III. All fixed wiring
- IV. Gas extract system
- V. Installation & commissioning

Data Cabling

- I. 27# 24way CAT6 UTP cabinet patch links
- II. All containment
- III. Installation & commissioning

Monitoring System

- I. Environmental Monitoring System
- II. Temperature & Humidity sensors

Project Management & Supervision

- I. Full time project manager
- II. Full time site supervision
- III. AutoCAD Design drawings
- IV. Health & Safety CDM
- V. O&M manuals

Preliminaries

- I. Temporary Lighting & 110V Power
- II. Site Office & Signage
- III. Waste management

Building Codes & Standards

24. Contractors are to work to best practise recommendations that cover the data centre construction, power, cooling and network infrastructure. All specifications will be based on current building regulation codes or equivalent, along with data centre design standards (or equivalent) from recognised industry bodies such as the telecommunications industry association (TIA942-2) and the Uptime Institute Tier Classifications. Other recommendations and standards (or equivalent) organisations that promote efficient design will be the European Code of Conduct for Efficient Data Centre Design, the Green Grid PUE metrics and the 2008 ASHRAE Environmental Guidelines for Datacom's Equipment.
25. Contractors are to employ the services of Quality Assured & Qualified Sub Contractors and Suppliers that frequently work within live or operational data centre environments. All Contractor employees and sub-contractors are to hold current CSCS cards and all products and materials shall have Product Conformity Certification (CE) provided by the manufacturer.
26. The Building Regulations and The Building (Approved Inspectors etc.) Regulations 2010
27. All applicable regulations and standards (or equivalent) to this project must be followed.

Estate Opening Times & Parking

28. The Estate is open for normal daily business from 8.00am – 5.00pm Monday to Friday and closed at the weekends. The site is opened by the Estates team at 7.00am. For the duration of the contract, work may commence as from 7.30am but must be completed by 5.00pm. If planned weekend or overtime is required then this is to be agreed with the Estates Manager so that access and manpower arrangements can be put in place.
29. The entire Observatory site remains in use during the contract and no parking is permitted within the site except for delivery of materials, plant and equipment. A public car park is available outside the main gate. All vehicles are to be roadworthy and used safely. A 10 MPH Speed restriction is in force on site and should be observed.

30. Owing to major building construction taking place in the vicinity of this project, parking will be restricted. Removal and delivery of materials and equipment will need to be carefully co-ordinated.

Canteen / Washroom Facilities

31. Canteen facilities will be in place for the duration of this project and may be used by contractors. Facilities are open for breakfast rolls and lunch. Tea & Coffee is available throughout the day. To reduce the impact on soft furnishings, Contractors are to remove coveralls when using the canteen.
32. Washroom & WC facilities are available on site.

Safety, Health & Environment (SHE)

33. The Contract Project Manager will be responsible for CDM.
34. Contractors are to provide and wear PPE as required and all portable equipment is to be usable, safe and compliant with current regulations.
35. A site safety induction brief will be given to the contractors prior to commencing the project.
36. Control of Contractors - The works are to take place in the secure environment of the Royal Observatory Edinburgh, Blackford Hill. Access to the ROE is controlled; all tradesmen and delivery drivers must sign in and out and carry visitors' badges.
37. The main construction area will be placed out of use to building users. However, parts of the building are in use. Therefore, during the contract period all conditions relating to minimising inconvenience for the users will be strictly enforced. No radios or music is to be played.
38. The entire Observatory site remains in use during the contract. Parking is restricted and no contractors are to park on site. A specific area will be made available for delivery of materials etc.

Warranties, Guarantees & Liability.

39. Unless otherwise stated, all workmanship, materials, fixtures and fitting are to be guaranteed for a minimum period of 12 months
40. Insurance cover to the limit of Contractors standard policy but not less than £5,000,000.00.
41. Contractors Design Liability. The Contractor shall provide details to adequately explain the Contractors proposals for the execution of the work specified as contractor designed. Such Contractors proposals shall be submitted to the Client via the Project Manager for approval in sufficient time that their implications can be considered and properly catered for in the planning of the works specified by its performance or design.
42. A copy of all the design plans are to be made available to the client in paper and electronically.
43. A Health & Safety File for the works is to be maintained from the outset of the project, be available for consultation at all times, and be handed over at the end of the project without delay.

Security / Protection / Nuisance

44. Security - The whole of the Royal Observatory is subject to security restrictions which the Contractor must comply with. All site operatives must sign in and out and wear visitor badges. Most buildings are kept locked and the Contractor should do nothing to breach this security.
45. Occupied Premises - Existing buildings throughout the site will generally be occupied and/or used during the contract. The Contractor shall carry out the Works without any undue inconvenience or nuisance and without damage to the existing property and its contents and without danger to occupants and users. Radios or music playing equipment are not permitted on site.
46. Existing Features – Prevent damage to existing buildings, glass, doors, walls, roads, paved areas and other site features which are to remain in position during the execution of the Works. Maintain security of existing building. The contractor shall prepare and lodge with the Employers representative one copy of a full photographic survey showing the condition of all adjacent works. In the absence of photographic evidence being supplied all adjacent works are deemed in good order.
47. Existing Work - Maintain security of existing building – see Under Management of the works. Prevent damage to existing property undergoing alteration and make good without reimbursement to match existing any defects so caused. Remove any existing work, where necessary, with due care to reduce the amount of making good to a minimum.
48. Materials & Delivery – All materials should arrive on site and any waste leaving the site must do so in a safe condition. Large and bulky materials must be off-loaded in the specific area set aside for the project. Ideally, materials should arrive on site early in the working day to avoid disruption to the site.
49. Waste - Skips to be supplied by the contractor and located onsite in the space allocated by the Client will be no larger than the standard 8 cubic yards and will be kept covered. Remove rubbish, debris, surplus material and spoil regularly and keep the site and Works clean, tidy and litter free.
50. Evidence of waste disposal notes are required to be copied to Project Manager e.g. copy invoices from skip Hire Company plus photocopy of their Licence. Remove all rubbish, dirt and rubbish from voids and cavities before closing. Ensure that non-hazardous materials are disposed of at a tip approved by the Waste Regulation Authority. Ensure no material or waste can be blown around in high winds.
51. Cleaning – On completion clean down entire works and remove rubbish.

Facilities / Services

52. Electricity – Electricity for the Works will be provided free of charge from the Employers supplies. The Employer will not be held responsible for the effects of any inadvertent failure of supply. Contractors are to make sure that all their electrical equipment is fully serviceable and compliant.
53. Water – Water for the Works will be provided free of charge from the Employers supplies (but without guarantee that there will not be a charge from the statutory authority).

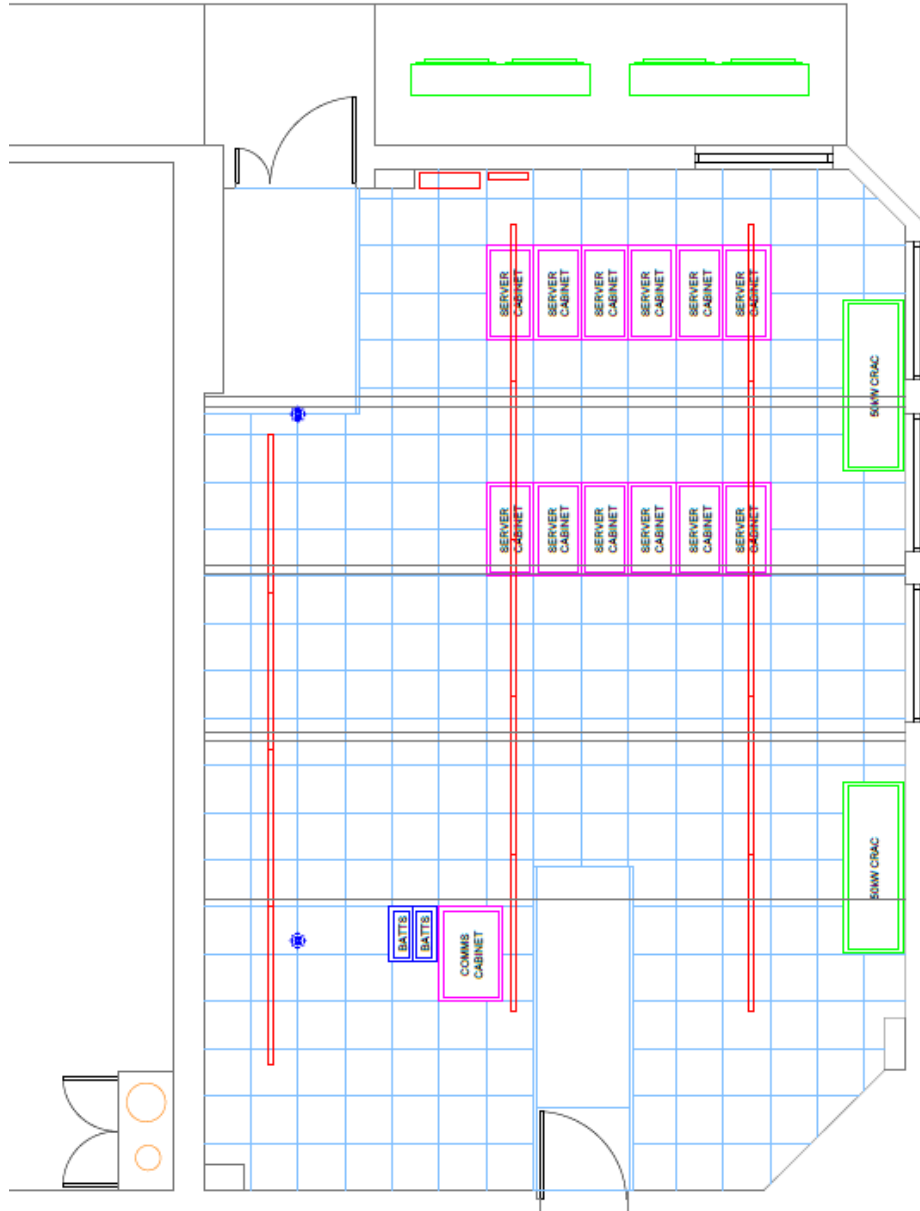
Take On / Progress Meetings

54. Prior to starting the contract, details of progress meetings are to be agreed. A formal fortnightly meeting is to be held and is to cover the following agenda:

1. Apologies.
2. Matters arising from previous meetings.
3. Contractors report on progress.
4. ROE Client report.
5. Finance & Administration.
6. Safety & CDM report.
7. Procurement issues
8. Any Other Business.

55. The client will monitor progress and safety within the vicinity on a daily basis.

Layout Existing Plan



Layout – Plan Proposed

