Aboriginal Affairs and Northern Development Canada

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Preliminary Functional Program

Canadian High Arctic Research Station (CHARS)

Cambridge Bay, Nunavut

Prepared By

AANDC Arctic Science Policy Integration, Northern Affairs Organization

and

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1. INTRODUCTION

1.1 BACKGROUND

1.1.1 NEED FOR AN ARCTIC RESEARCH STATION: THE CANADIAN HIGH ARCTIC RESEARCH STATION (CHARS)

.1 The 2007 Speech from the Throne set out a requirement to strengthen Canada's global leadership in Arctic science and technology (S&T) and the Government's year-round presence in the High Arctic by building "a world-class Arctic research station that will be on the cutting edge of Arctic issues, including environmental science and resource development."

.2 In 2008, the Government's Science & Technology (S&T) Innovation Council also identified the Arctic as an important foundation for Canada's Northern Strategy priorities, which consists of four pillars:

- .1 Exercising our Arctic sovereignty;
- .2 Protecting our environmental heritage;
- .3 Promoting social and economic development; and,
- .4 Improving and devolving Northern governance.

.3 The four pillars are underpinned by science and technology to support sound decision making.

.4 To this end, the Government has committed that this station (CHARS) will be *"built by Canadians, in Canada's Arctic, and it will be there to serve the world."*

.5 CHARS will provide the ability to:

- .1 Address pressing issues in Canada's Arctic by conducting word-class research and delivering excellent and relevant science and technology;
- .2 Complement the network of Arctic expertise and facilities across Canada's Arctic and the whole of the country;
- .3 Promote partnerships and collaboration among the private, Aboriginal, academic, and public sectors both domestically and internationally;

.4 Work with Aboriginal peoples of Canada's Arctic and recognize the importance of traditional knowledge in advancing Arctic research;

.5 Integrate across disciplines and across activities – from problem identification, through research and development, to solutions;

.6 Ensure effective use of data, information, and technology through open and timely access and knowledge application; and

.7 Demonstrate leadership in sustainable technology applications for the Arctic.

.6 As the lead department on the Government's Northern Strategy, Aboriginal Affairs and Northern Development Canada (AANDC) was selected to champion the CHARS initiative.

.1 Refer to Appendix A for more information on AANDC.

1.1.2 RELATED DOCUMENTS AND ORDER OF PRECEDENCE

.1 This Preliminary Functional Program must be read, used and applied in conjunction with the terms and conditions of the contract, including the Architectural and Engineering Services Terms of Reference for CHARS, Design and Space Standards and Public Works and Government Services Canada (PWGSC) General Procedures and Standards (GP&S), as all these documents are complementary.

.2 In the event of a conflict between any of these documents, the contents of a higher precedence document must govern and override a lower precedence document.

.3 The order of precedence of these specific related documents is as follows:

.1 Terms and Conditions of Contract and TOR;

.2 Preliminary Functional Program document (main body) and

.3 Accommodation Survey / Space Data Sheets [Appendices B and C].

.4 GP&S

1.2 STRATEGIC CONTEXT

1.2.1 THE MANDATE FOR CHARS

.1 The mission of the Canadian High Arctic Research Station is to be a sophisticated, technically advanced world-class research station in Canada's Arctic that is on the cutting edge of Arctic issues.

.2 The Station will anchor a strong research presence in Canada's Arctic that serves Canada and the world. It will advance Canada's knowledge of the Arctic in order to improve economic opportunities, environmental stewardship, and the quality of life of Northerners and all Canadians.

.3 It will be designed in a manner that integrates into the existing community, in order to complement existing facilities in Canada's North, leverage international interest, and support Canadian priorities in polar S&T.

1.2.2 A WORLD-CLASS FACILITY

.1 The Canadian High Arctic Research Station will provide a year-round facility for world-class science and technology in Canada's Arctic.

.2 The Station will include research labs, centres for technology development and traditional knowledge, and facilities for teaching, training, and community engagement.

.3 It will provide scientific, technical, and logistical services to strengthen Canada's leadership in Arctic science and technology.

.4 It will create a dynamic environment for leading Canadian and international scientists and engineers to come together with Northerners, the private sector, and other stakeholders to address complex challenges facing the Arctic and the globe.

1.2.3 CUTTING-EDGE SCIENCE AND TECHNOLOGY

.1 CHARS will ensure Canadians lead the way in addressing the challenges facing Canada's Arctic by conducting world-class research and delivering excellent and relevant science and technology.

.2 The Station will help to build the next generation of polar scientists, innovators, and managers.

.3 The knowledge produced through the Station will be mobilized to support the responsible development of Canada's Arctic and to inform Canadian and global responses to the changes happening in this unique region.

1.2.4 A STRONG RESEARCH PRESENCE ACROSS CANADA'S ARCTIC

.1 CHARS will be at the centre of a strong Canadian network of Arctic research infrastructure capable of meeting science and technology needs that match the size and diversity of Canada's Arctic.

.2 This network will include regional laboratories, field camps, monitoring sites, ships, and satellites.

.3 The Station will leverage the efforts of polar researchers, the private sector, and communities throughout Canada while engaging the world to address national priorities.

1.3 CHARS PROGRAM

1.3.1 GENERAL CONTEXT

.1 This document outlines the preliminary Functional Program for CHARS and is only intended to provide a general overview of the space needs and technical requirements outlined in sufficient detail for the Consultant team to gain a reasonable understanding of the scope of the project.

1.3.2 AREA REQUIREMENTS

.1 The area requirements are based on the estimated minimum dimensions for each required space developed during the preliminary determination of the program.

- .1 The Consultant team will be required to meet with the users to either confirm or adjust area requirements to meet more specific program objectives.

1.3.3 GENERAL TECHNICAL REQUIREMENTS

.1 The general technical requirements outline some of the challenges and opportunities associated with this project.

- .1 They also include some of AANDC's preferences for specific technical approaches and performance levels, which the Consultant team will be required to consider when determining design solutions or resolving issues.

1.3.4 GENERAL PERFORMANCE REQUIREMENTS

.1 The general performance requirements outline the preferred or minimum performance standards for the architectural, structural, mechanical and electrical Systems for the project.

- .1 The Consultant team will be required to consider the performance requirements carefully when determining design options for each system.
- .2 Alternate applicable standards of performance may be utilized in the final design, subject to review and approval from the Departmental Representative.

1.4 SPACE PROGRAM

1.4.1 SPACE REQUIREMENTS

.1 The space requirements outlined in the space program provide a general overview of the purpose and function of each space, with a basic description of the major components, equipment and specific requirements.

  .1 At the time of developing the preliminary program, some general assumptions have been made to establish preliminary requirements.

.2 The Consultant team will be required to meet with users during the pre-design and design stage to confirm detailed space requirements.

  .1 Specific equipment requirements will have to be determined in consultation with AANDC's S&T program personnel as some equipment may not be shown on the space plans and other components shown on the space plans may not be required.

    .1 For example, a fridge, freezer or dishwasher may not be required in a lab if the users can take advantage of the central fridge/freezer or the central autoclave rooms.

1.4.2 SPACE DATA SHEETS

.1 Preliminary Space Data Sheets are included in Appendix C of this Functional program.

  .1 The space plans included with the Space Data Sheets have been developed primarily to demonstrate that the minimum net area identified for each space is sufficient to meet the basic functional needs of each specific space, and are not necessarily indicative of a preferred layout.

    .1 These net areas have been applied to the net to gross ratios to determine the probable gross area requirements for the purpose of establishing a reasonably probable cost for the project, based on a cost per square meter approach.

    .2 Walls and doors are indicated on space plans to define the space, but the need for actual walls will be determined by the Consultant team in consultation with users, as some spaces may function more efficiently as open spaces, contingent upon technical and safety considerations.

  .2 The information contained in the space data sheets should not be construed to be all-inclusive.

    .1 All space requirements, layouts, dimension, equipment, components, systems, etc. are to be confirmed by the Consultant team in concert with AANDC's S&T program personnel and PWGSC to determine and propose the best solution.

  .3 Preliminary planning has been based on *'a modular approach'* to planning complex laboratory projects.

  .4 The Consultant team will be required to:

    .1 Apply a '*modular approach'* to planning the laboratory component of this project to ensure that labs can be easily and economically reconfigured to accommodate changes and future programs.

      .1 The *'modular approach'* will also enable future expansion of the Station to be more easily incorporated into the existing facility.

    .2 Meet with AANDC's S&T program personnel to determine specific program objectives and apply them to the modular configuration in a manner that minimizes custom modifications to the basic 'modular' concept, while still meeting the fundamental program needs.

2. PROJECT DESCRIPTION

2.1 PROJECT OBJECTIVES

2.1.1 OVERALL OBJECTIVES

.1 The overall objectives for the Canadian High Arctic Research Station are to mobilize Arctic science and technology and:

- .1 To develop and diversify the economy in Canada's Arctic;
- .2 To support the effective stewardship of Canada's Arctic lands, waters, and resources;
- .3 To create a hub for scientific activity in Canada's vast and diverse Arctic;
- .4 To promote self-sufficient, vibrant, and healthy Northern communities;
- .5 To inspire and build capacity through training, education, and outreach; and,
- .6 To enhance Canada's visible presence in the Arctic and strengthen Canada's leadership on Arctic issues.

2.1.2 DESIGN GOALS

.1 The general goals in designing a research facility with laboratory, education, and outreach components is to provide an inviting research and education atmosphere while planning user spaces in a manner that minimizes hazard potential and environmental impacts.

.2 Considering that the Station will establish a Canadian footprint on international polar research, the planning should strive for a high standard of design.

- .1 The Station will acknowledge the importance of an appropriate aesthetic for the Government of Canada in the Arctic.
- .2 This aesthetic or image will also recognize that the building(s) are the `architectural face' onto the culture of the existing community and all northerners, and thus respect the community scale and its values.

.3 As CHARS continues to evolve under future program changes, the original concept should reflect an understanding of the changing nature of the station and its adaptation to both financial and program adjustments.

- .1 This laboratory in the Arctic will have to appreciate all of the design and operational constraints associated with current lab planning, as well as those associated with the unique Cambridge Bay location.

2.1.3 FLEXIBILITY

.1 Science has a penchant for unpredictable change.

- .1 Almost daily, scientific technology is altering methods, which requires adaptable facilities that can also change.
- .2 Flexibility should be considered in both the ability to change over time, but also in terms of being able to provide multiple services to the same space in order to support simultaneous needs.

.2 A key to flexibility in a laboratory building is the manner in which the various services are provided to the laboratory users.

- .1 The question of vertical or horizontal distribution and similar decisions must be reviewed and made on the basis of life-cycle values.

.3 The rationale of interstitial space is adopted where more sophisticated environments are developed.

- .1 Widely spaced columns and spacious horizontal areas allow users to configure and reconfigure space without bumping into barriers.

.4 Individual spaces should also be designed with flexibility in mind.
  .1 Laboratories are not typically as flexible as office spaces where infrastructure remains nearly the same and the insides can easily be changed out regardless of the user.
  .2 Conversely, scientists may need specialized communication capabilities to transmit complex images and data, specialized HVAC and plumbing systems, or other specific requirements.
  .3 These spaces may need to be reconfigured to accommodate different research needs.

.5 Design of initial components and systems must acknowledge the need for flexibility to accommodate expansion.

.6 The design should be able to accommodate varied groups of users and visitors that require different levels of privacy.
  .1 It should be able to offer fully serviceable areas with minimum obstructions to obtain the most advantageous layouts for individual projects.
  .2 New design methods for conferencing, teaching and laboratories have achieved this by minimizing the number of fixtures in the spaces and opting for dividable spaces with modular pieces instead.
  .3 As well, spaces will need to be able to accommodate the need for computers, data transmission capabilities, and other electronic access throughout facilities.
  .4 Fundamentally, researchers using the laboratories and other spaces at CHARS must be able to design the space to best suit their work and activities.

.7 The accommodation of various users can also include `plugging in' moveable lab components.
  .1 Canadian research vessels are currently being designed to allow labs fitted into standard containers to be lifted onto the vessel for operation at sea.
  .2 Incorporation of the Canadian Coast Guard Modular Mission Payload specification (Appendix D) into the planning and design of the Station would allow for the direct interfacing and exchanging of these modular container research labs with any new Canadian Research vessels.

.8 Flexibility should also consider the international receptivity of the facility and the various technical needs of these visitors (e.g. power sources).

.9 Although total flexibility may not be practical or achievable, every effort must be made in determining the kinds and extent of flexibility that can be practically planned from the beginning of the design process.

2.1.4 SUSTAINABILITY

.1 One of the largest ongoing costs of an Arctic research facility is energy; therefore, designing an energy efficient facility may add a cost premium at the initial construction stage but will help to alleviate future operational budget pressures.

.2 A detailed life cycle analysis should be performed on all key sustainable design initiatives proposed for CHARS.

.3 While `green' technical approaches identify possible avenues for reducing outside energy input to the station; the challenge at CHARS will be the integration of distinct building operational systems and as such, implies a much broader scope than simply insulation and solar gain.
  .1 The LEED approach to evaluating building sustainability recognizes this overall approach by including embedded building energy used in the manufacture and delivery of building components, recycling, heat recovery, operational building energy expended during the delivery of program services and resources which the community provides.

- .2 While LEED may not be directly applicable to CHARS due to its Arctic site, certain LEED components can be modified to allow setting of sustainability targets.
- .3 Other sustainability initiatives such as the 2030 Challenge, Living Building Challenge, Labs 21 and current building codes and best practices for the Arctic (considered at the time of writing this preliminary functional program) should be factored in setting the most effective, efficient and probable sustainability framework for CHARS.

.4 It should be noted that the incorporation of sustainability as an operational objective does pose challenges for an Arctic environment.

- .1 Costs of more durable materials and choices made to achieve higher energy operational efficiencies will need to be measured against potentially lower ongoing O&M costs.
- .2 Considering the remoteness of the station some initial costs may be considerably more than for a southern Canada location.
- .3 Also, systems simplicity is paramount, as difficulties in accessing spare parts and specialized technicians, combined with local weather related access issues make complicated or potentially unreliable technologies undesirable.

.5 Sustainable building design should consider the broader Arctic context, such that concepts demonstrated at CHARS can be transferred and used in planning other Arctic community infrastructure.

.6 The design should strive to conform to ASHRAE 189.1; Standard for the design of high performance buildings.

- .1 The CHARS building(s) itself can be a demonstration project and test facility to showcase innovation in energy systems. Building performance should be monitored and data communicated online in an open-source format for interested researchers and the public.

2.1.5 Facilities

.1 The Accommodation Survey sets out the size requirements for each of the areas related to laboratories, offices, living area, commercial space and supporting spaces (refer to Appendices B).

- .1 The associated Space Data Sheets identify specific technical requirements, desirable space relationships, and special proximity considerations.
- .2 No determination on whether the facility should be multi-storey or low-rise in nature has been made.
  - .1 This decision will be based on the evaluation of the cost effectiveness of the each option, the relative operational efficiency of the choices, the allowable building footprint on the chosen site(s), as well as input from the Cambridge Bay Community leaders.

2.1.6 Community Integration

.1 The need for flexibility at CHARS relates not only to the realignment of operations to meet ongoing program changes but also to the broader community role in CHARS.

.2 As small Arctic community, Cambridge Bay has an established scale and operational capacity.

.3 Planning for the introduction of CHARS into Cambridge Bay has to take in a review of community capacity.

.4 This review will also recognize those areas such as Storage, Recreation, Maintenance Services, etc. that the community may be capable of providing for CHARS.
   .1 The introduction of major building components requires careful integration within the community so that secondary impacts such as community housing demand, cost of existing services (e.g. water, electrical), access to community services (e.g. health) are not compromised for the current residents.
   .2 Provision of some CHARS services through existing or upgraded community services will not only reduce the overall CHARS building footprint(s), but will also bring the community of Cambridge Bay closer to the research community.
   .3 The amalgamation of certain operational aspects of the Station will also promote ongoing job creation and Inuit employment, during construction and for on-going operations.

.5 Buildings and the surrounding site development must project a character and image appropriate for the Government of Canada.
   .1 A campus approach to CHARS will strengthen ties with other institutions, such as Nunavut Arctic College, that are located in the community.
   .2 It will provide an environmentally sustainable research platform that promotes the creativity of the professional, technical, and administrative staff and visitors working at the facility.
   .3 The grouping and distribution of spaces throughout the community will need to be based on the optimal relationship between the site, surroundings, and CHARS activities.

.6 It is expected that there will be CHARS component spaces integrated into existing community infrastructure.
   .1 Health and recreation facilities as well as some accommodation are just a few examples of community integration possibilities.
   .2 CHARS component spaces will only be adapted as appropriately determined through discussions with the Cambridge Bay building owners and community leaders.

2.1.7 Quality of the Working Environment

.1 Given the inherent need for laboratories to be kept up to stringent user protocols and safety standards, the quality of the working environment could be a design challenge. Laboratory designs have evolved to include components such as maximum use of natural light to complement artificial light, appropriate use of sound insulation, and flexible/moveable fixtures so that optimal working environments are supported.

.2 Thermal comfort must be modeled and strictly proven to meet ASHRAE 55 for all office and lab areas.

.3 The use of natural and artificial light will be a critical factor in achieving a favourable working environment at CHARS, due to the extremes of 24-hours sunlight and 24-hour darkness experienced in Cambridge Bay.

.1 Many structures in the high Arctic are now equipped with full spectrum lighting and blackout shutters to accommodate this range in natural light.

.2 While natural light will generally be desirable for CHARS working areas, some lab work and specialized equipment cannot or should not be exposed to it.

.3 Planning of research spaces will need to accommodate the requirement for these various working conditions.

.4 The flexible nature of the work spaces, as described above, will also lend itself to promoting a quality work environment where researchers and other users are free to adapt the spaces to make themselves more comfortable and efficient.

.5 An important factor to the design should be the promotion of interaction between users, whether they are permanent staff or short-term visitors.

.6 While researchers will form the largest user group for CHARS, visitors to the facility will likely include school groups, politicians/diplomats, local community members and others.

.1 Considerations for allowing the visitors to visit the CHARS facilities and see activities taking place will also need to ensure that researchers can work peacefully without constant interruption.

.2 Viewing stations and teaching lab spaces could be considered as some of the options for creating an open facility while allowing work to proceed.

.7 Acoustics is another factor that will play a vital role in the overall quality of the environment throughout the facility.

.1 In some spaces including the laboratories and study areas, minimizing noise levels will be a significant factor in the success of the space.

.2 In other areas such as classrooms and auditoriums, ensuring that speakers can be easily heard will be of primary importance.

.3 In cases where viewing or observatory stations are present, the need for soundproofing will be necessary so that the viewers can converse freely while the people within the other activity area can continue to work.

.4 Sound insulation, and absorption and projection materials and equipment, will need to be incorporated throughout the spaces in order to manage the range of acoustical needs.

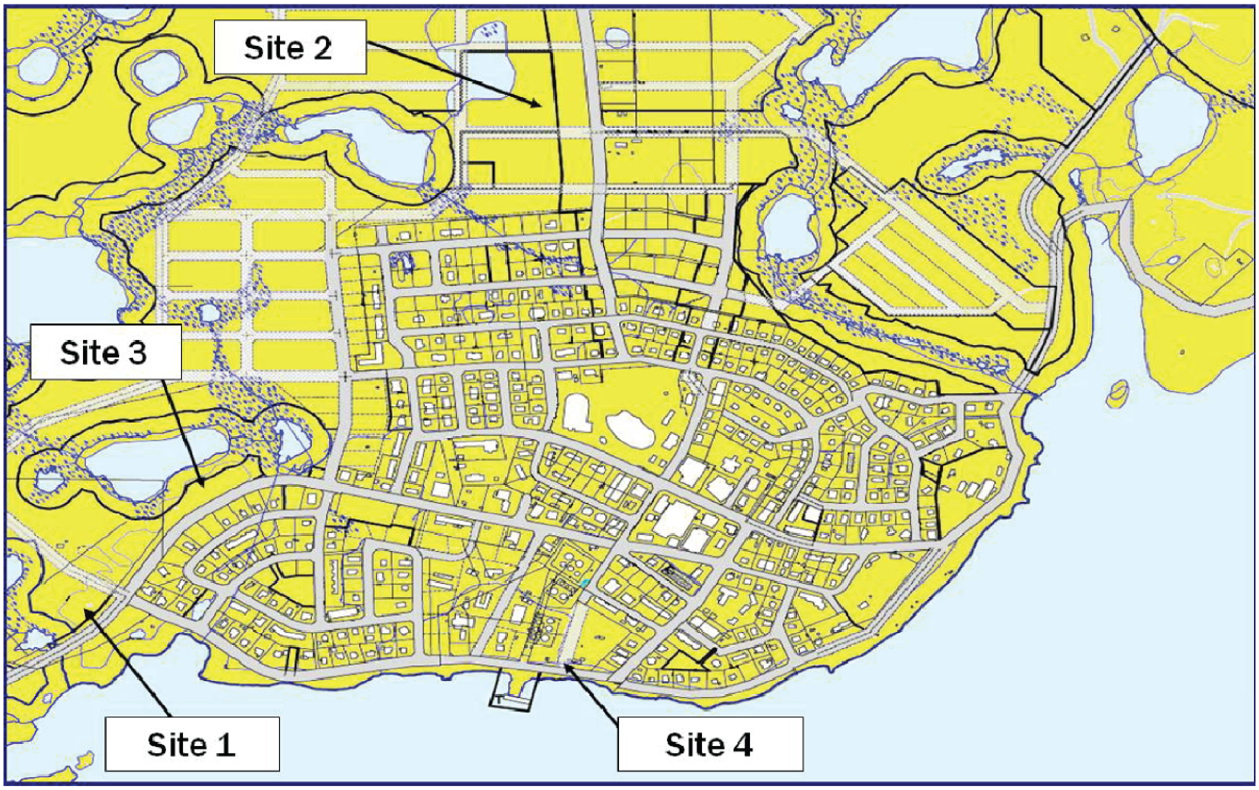
.8 While these facilities will be non-smoking environments, consideration should be given to the fact that smokers will try and escape harsh Arctic winter conditions by clustering in entry ways and wind sheltered building nooks.

.1 This can result in unsightly debris at the Station entries.

.2 The Government of Canada building in Iqaluit installed a wind shelter to accommodate materials deliveries in the winter and it also served to take smoking away from the major public entries. A similar solution could be explored for CHARS.

2.1.8 POTENTIAL SITES FOR NEW CONSTRUCTION

.1 Community Map showing potential sites for the CHARS project.



2.2 DESIGN REQUIREMENTS

2.2.1 LABORATORY DESIGN

.1 Modern laboratory models create environments that are responsive to present needs and capable of accommodating future demands.

- .1 The specifics of the S&T program are still being developed. In the absence of specific program requirements, S&T spaces will be designed to accommodate the widest possible range of research.
- .2 Most or all lab spaces will be designed to have the capacity to be converted from dry labs to wet labs.
- .3 This could be accomplished through the use of centralized service corridors which connect the research areas and contain access to all of the water/plumbing, mechanical, electrical, and ventilation services needed to convert the labs to meet future program requirements.
  - .1 Other approaches, such as servicing through the interstitial spaces, could also contribute to meeting the requirement of flexibility to accommodate future research needs.

2.2.2 TRENDS

.1 While research methods, equipment and space layouts continue to evolve and will need to be taken into consideration, the following represent some of the current overall trends in planning laboratories.

.2 Open and Closed Laboratories:

.1 Open lab layouts encourage a collaborative and team approach. They allow more flexibility in design and lower costs. However, this approach has other issues that must be addressed, such as housekeeping of the common fume hoods and other chemical and other storage areas; greater risk of spills and leaks; responsibility of the common areas; and security and privacy concerns.

.2 Closed lab layouts allow for unique environmental controls, processes, security and noise management. It allows for different types of occupancy and thus greater energy saving; a single source of responsibility of the area; more privacy; containment of spills and leaks, or a clean room environment. However, it may become a valuable space that is non-productive when unoccupied; take up more floor space; and increase construction costs.

.3 Laboratory Furniture:

.1 Mobile casework for storage and workstations.

.2 Adjustable shelving to make maximum usage of the volume of lab space.

.3 Lab benches to be adaptable, interchangeable, and reconfigurable.

.4 Fume Hood and Local Exhaust Devices

.1 Low flow fume hoods to be specified to minimize make-up air requirements, contingent upon safety considerations.

.2 Specialized local exhaust devices to capture fumes and exhaust from local equipment.

.3 Consideration for centralizing fume hood services to better-manage energy and ventilation requirements.

2.2.3 PLANNING CONSIDERATIONS

.1 Flexibility:

.1 A modular approach shall be used for architectural, structural, mechanical, and electrical systems, for ease of adaptability and future program modifications.

.2 Spare capacity shall be provided for future loads such as fume hoods and biosafety cabinets.

.3 Spaces should allow for installation of new equipment including future major floor load and systems changes.

.4 Planning to include consideration for future building expansions is essential.

.5 Utilize flexible workspaces that can adapt to changes in research protocols, methods, and equipment. The use of `plug and play' planning for both lab equipment and entire container labs (refer to Appendix D) can be used to forecast research programming across many distinct locations.

.2 Sharing of Space and Equipment:

.1 Explore possibility of sharing lab equipment such as fume hoods, autoclaves, freezers, and other equipment. Designing larger open lab areas which contain a number of similar research programs and rely on shared centralized support rooms for large fixed equipment, environmentally controlled work, fume hood work, chemical storage, etc., will increase flexibility of spaces.

.2 The appropriate balance of open to closed labs and support spaces helps to foster interaction and team based research while creating an open `social atmosphere' at the lab. This is especially important in an Arctic location where many of the initial CHARS researchers may be from southern Canada and a large portion of the year will be in darkness.

2.2.4 ENVIRONMENTAL CONSIDERATIONS

.1 Natural Daylight:
  .1 Use of natural daylight will reduce electrical energy use and improve comfort and productivity.
  .2 The amount of glazing is to be optimized by energy analysis & daylighting programs to ensure an appropriate balance between space conditioning requirements and natural lighting.

.2 Environmental sustainability
  .1 The green initiative and sustainable design of the laboratory will be based on the LABS21 Environmental Performance Criteria (EPC), a rating system based on the LEED-NC Version Rating System.
    .1 The system outlines ratings for different aspects of design, such as sustainable sites; water efficiency; energy and atmosphere; materials and resources; indoor environmental quality; and innovation and design process.
    .2 It does not, however, specify the threshold values for certified, silver, gold, and platinum levels, as does LEED-NC.
    .3 A reasonable and consensus value can be selected as the rating for the laboratory, on the basis of life-cycle analysis.
    .4 The EPC is a comprehensive and powerful design criteria tool that the consultant shall use in the design of the laboratory.

.3 Energy conservation considerations:
  .1 High efficiency equipment to be specified.
  .2 Low pressure drops for air distribution systems and components.
  .3 Energy recovery for exhaust air, contingent on safety considerations relating to cross-contamination.
  .4 Cascaded ventilation where allowed by Code.
  .5 Application of outdoor air for free cooling.
  .6 Occupancy-based control strategies for space conditioning, lighting and other plug loads, and ventilation. Consideration for reduced ventilation rates, set-point temperatures, and lighting intensity during unoccupied hours.
  .7 Manifolding of fume hood exhaust and/or clustering for proper dilution and dispersion as well as opportunities for heat recovery.
  .8 Right-sizing of prime movers such as boilers and air handling units and associated components, with consideration for future expansion.
  .9 Locating high heat-generating equipment to a common shared space for more efficient environmental control and for effective use of heat recovery.
  .10 Consideration to reduce the number and size of fume hoods.

.4 Water Efficiency considerations:
  .1 Equipment process water shall be a closed-loop, rather than open-loop, recirculation system.
  .2 Select equipment that shall use minimum process water.
  .3 Investigate the use of low-flow water fixtures with aerators.

.5 Effluent Waste Disposal:

.1 Standard Operation Procedures (SOP) to be created to properly manage disposal of chemicals and biological effluents; e.g. prohibit disposal of chemicals and biological effluents through drainage without proper treatment.

2.2.5 OPERATIONAL CONSIDERATIONS

.1 Maintainability:

.1 Sufficient spaces shall be provided to maintain equipment to enhance system reliability and operation and maintenance.

.2 Build-in redundancy to be provided for critical components for basic laboratory operation.

.3 Propose methodology to keep the laboratory operational at all times and under failure conditions.

.4 Layouts of mechanical and electrical distribution systems are such that they shall allow daily maintenance without interruption and interference of on-going lab activities.

.5 Systems and building automatic controls shall be simple and easy to maintain.

.6 Industrial grade components are to be specified to improve system reliability.

.2 Commissioning:

.1 Systems shall be properly and thoroughly commissioned prior to take-over of the facility.

.2 Prospective maintenance staff shall be involved in the commissioning activities as part of training exercises.

.3 Telecommunications:

.1 The use of reliable high speed telecommunications is important for research in the Arctic.

.1 Communications between labs and buildings within Cambridge Bay and the rest of the world will allow immediate multisite networking, which will reinforce and promote partnerships between government, private sector, industry and academia.

.2 Depending on the bandwidth strategies, the use of video conferencing technologies may also play a central role in bringing CHARS to an international audience.

.3 Presently, satellite links are the common method for accessing telecommunications networks in the Arctic, but there have also been various other proposals, including undersea fibre optic cabling and microwave towers.

.1 Consideration should be given in the design of CHARS' telecommunication systems to allow easy connection to future service provision via non-satellite means.

2.3 SPACE REQUIREMENTS

2.3.1 Functional Component Spaces

.1 To ensure year-round activity at CHARS, an in-house Science &Technology (S&T) Program will anchor the work of the Station. AANDC will seek approval for the S&T Program during the design phase.

.2 The in-house S&T program will link to, and complement, the efforts of visiting scientists, both domestic and international, and harness the global network of polar researchers through leading-edge telecommunications technologies to advance Canadian priorities.

.3 To support both resident and visiting scientists, the Station will house:

- .1 World-class laboratories;
- .2 A technology development centre;
- .3 Conference and meeting spaces;
- .4 Traditional knowledge areas, and
- .5 Knowledge application, education, and outreach facilities

.4 Accommodations will also need to be included in the final mix of spaces associated with CHARS.

- .1 Potential partnerships, such as with the Canada Mortgage and Housing Corporation, Nunavut Arctic College, and the Nunavut Housing Corporation, will be pursued in order to determine the scale and nature of new accommodations required to service CHARS, and the partnership opportunities that could help to meet these needs.

2.3.2 Users

.1 It is anticipated that 35-50 full-time-equivalent resident staff will be employed at the Station in science and technology, lab management, facilities management, and general administration.

- .1 The mix of existing federal positions re-located to CHARS and new positions will be determined during the design phase (pursuant to Cabinet approval).
- .2 Based on the number of users at other facilities of similar scope and size, it is estimated that CHARS could host an additional 75-115 visitors during the summer, which is the peak research season, and a smaller number of visiting users the rest of the year.
  - .1 These visitors may comprise 'transient' visitors that use CHARS as a staging ground for field work and are only present for several days or weeks, and 'pay-per-use' visitors that use the facilities on a longer-term basis.

.2 Resident staff, transient users, and pay-per-use visitors will potentially make use of all aspects of the facility.

2.3.3 Options

.1 Three options were developed for the overall scale of the new research station:

- .1 Build a modest station similar in scale and functionality to current research facilities in Canada's North (5,600 m^2).
- .2 Design CHARS as a leading player in Arctic S&T with the infrastructure to support delivery of the Northern Strategy (7,500 m^2).
- .3 Scale CHARS to match the largest polar research stations in order to signal Canada's intent to lead the world in Arctic S&T (9,990 m^2).

.2 It was concluded that the construction of a research station of approximately 5,500 m^2 to 8,500 m^2 would encompass the required functions in a manner that is scaled to the needs of Canada's Arctic S&T community and world-class in quality.

.1 It would provide sufficient space for a diversity of research labs, centres for technology development and traditional knowledge, and facilities for teaching, training, and community engagement.
.2 With this scale, CHARS could be designed with the tools – both infrastructure and programmatic – to support the delivery of the Northern Strategy.
.3 CHARS, at this size, would be comparable to leading polar stations such as Rothera, Antarctica (UK) and Scott-Amundsen, Antarctica (USA).

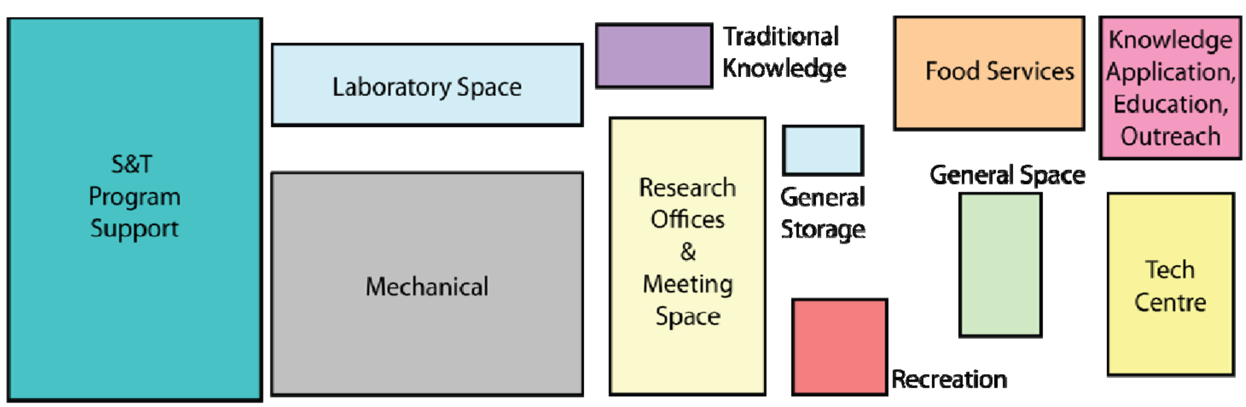
.3 This option will provide the following benefits to Canada:
.1 Support for Northern economic development and diversification and for the effective stewardship of Canada's Arctic lands, waters, and resources;
.2 A significant year-round federal presence in Canada's High North that is sustainable over the long-term;
.3 Promotion of self-sufficient, vibrant, and healthy Northern communities;
.4 Increased capacity in Arctic S&T through training, education, and outreach;
.5 Creation of a hub for world-class S&T in Canada's Arctic through the provision of cutting-edge facilities further north than currently available;
.6 Positioning of Canada as a global leader in Arctic S&T by sizing the new Station on the scale of other leading polar stations; and,
.7 Support for the delivery of the Northern Strategy through increased knowledge of Canada's Arctic.

.4 The final size of the Station will be determined during the design phase as opportunities for partnerships, co-location, and the sharing of facilities are negotiated with the community, the territory, and other potential collaborators from academia, the private sector, government, or the international polar S&T community.
.1 The final footprint will be influenced, in particular, by the site(s) available within Cambridge Bay for building and by the requirements for accommodation associated with the Station.

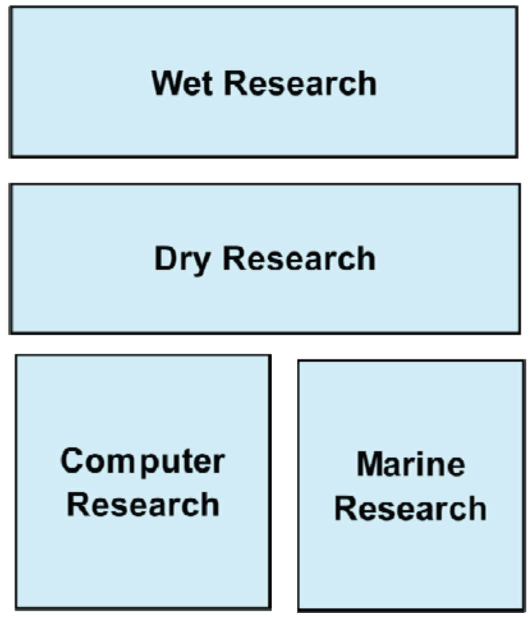
2.4 OVERVIEW OF CHARS COMPONENT SPACES

2.4.1 KEY COMPONENTS SPACES

.1 The different component spaces are shown in the figure below (not to scale).
.2 The major component areas are discussed in the following sections.



2.4.2 SCIENCE & TECHNOLOGY COMPONENTS



.1 Core activities will take place in the science and technology laboratories, traditional knowledge, and social science spaces. It is expected that these spaces will be used by both CHARS staff and external users from the public, private, academic and international sectors. Security and access issues will be determined through consultation and specific user needs.

.2 Flexibility in both space usage and facility operations will be key factors in the design directions of CHARS. Ever-changing protocols, technologies, and mandates will impose operational as well as architectural and engineering challenges that can only be met by reconfiguration and realignment of existing spaces.

.3 According to the *Whole Building Design Guide*,[1] many private research companies make physical changes to an average of 25% of their labs each year. Most academic institutions annually change the layout of 5-10% of their lab space.

- .1 In order for CHARS to accommodate the need for this level of flexibility, create an environment that encourages interaction among researchers from various disciplines, and minimizes disruptions to ongoing work, laboratory modules will be used.
- .2 These modules will generally be designed as wet labs to accommodate future reconfigurations.
- .3 Opting for modularization will also help CHARS to easily adapt to expansions and contractions, including seasonal variation in research activity. Once in place, the laboratory grid should adapt to its financial and operational constraints.

.4 Stakeholder consultations and a refined S&T program will help inform the general needs for each module.

- .1 As part of a Health component, the community Health Centre may be incorporated into the CHARS research program.
- .2 Combined with a video teleconferencing capability, CHARS could provide research and delivery of tele-medicine with links to larger centres such as Yellowknife, as well as the other smaller Arctic communities.

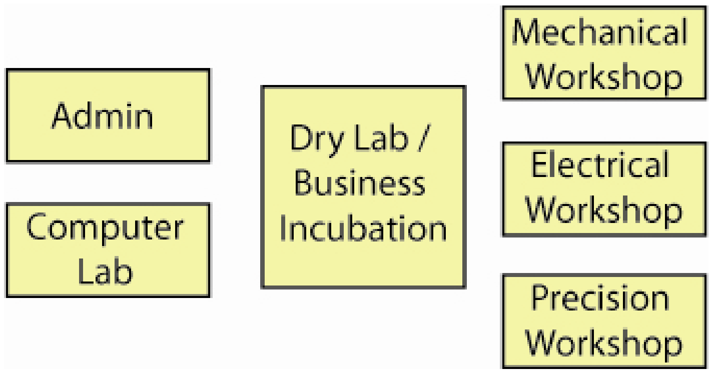
.5 As part of Social Science research, interview rooms will be available.

.6 Technology development will occur both in the field and in the workshops, precision labs and business incubation areas.

- .1 Technology development is seen as a major link to the private sector, especially in the resource sectors, a number of which are close to Cambridge Bay.
- .2 Technology development is also seen as a potential link to community resources such as workshops, maintenance areas, and storage areas.

.7 Technology development components are shown in the figure:

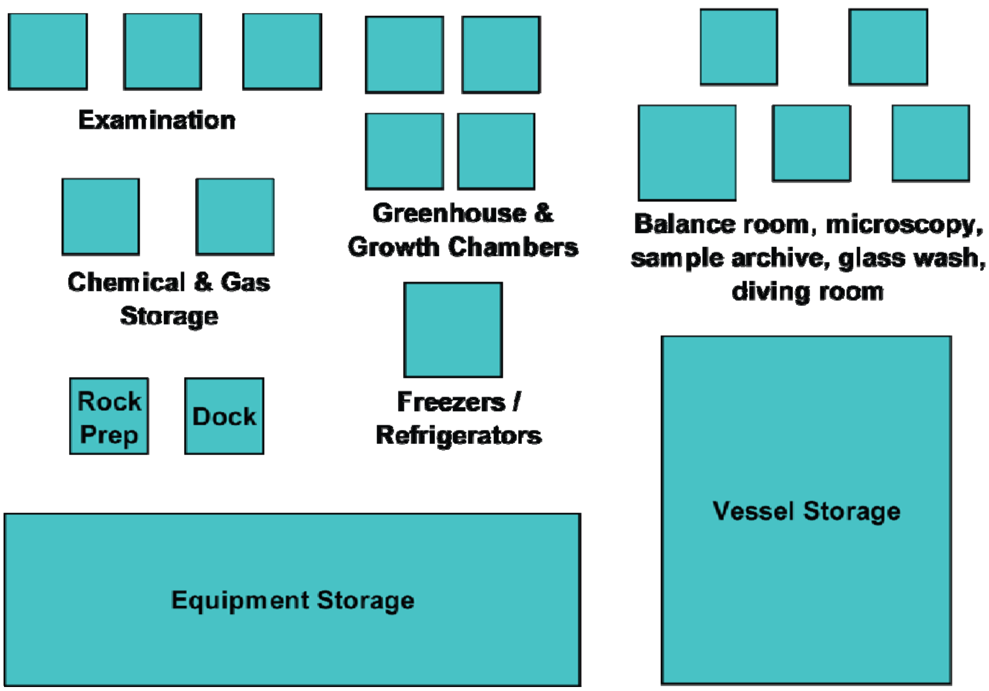
[1] Tolat, D., Watch, D. *Research Laboratory*, Whole Building Design Guide, National Institute of Building Sciences, http://www.wbdg.org/design/research_lab.php



2.4.3 SCIENCE & TECHNOLOGY SUPPORT COMPONENTS

.1 The laboratory support spaces are areas which will be used by researchers while they are working in the laboratory areas.

  .1 These spaces include equipment rooms with specific environmental needs, data management, and storage.



.2 Data management and analysis is an integral aspect of Arctic research and, for many researchers, occurs in southern academic locations.

  .1 With the goal of having researchers conduct the majority of their work at the CHARS facility, the spaces dedicated to computer services and data archives will be considered as priority areas.

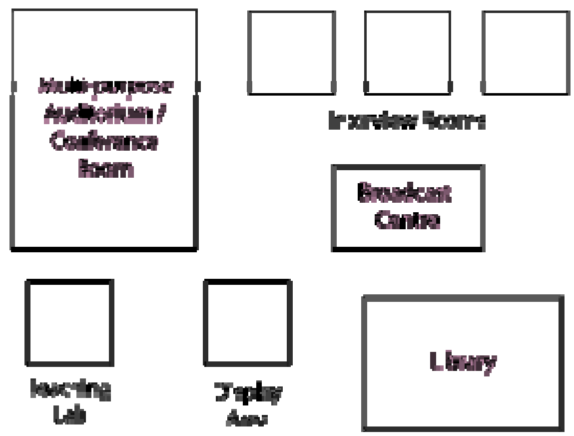
  .2 This will include the capacity or bandwidth to undertake the storage and processing of data that is required for the research priorities of the Station.

  .3 The proposed data management space may include not only the data generated by CHARS staff and visitors but may also be extended to include access to information kept at other Arctic facilities.

.3 Telecommunications will complement the data management aspect by allowing researchers to communicate and network with other researchers across Canada and internationally.
  .1 This will also allow the Station to be accessible by the general Canadian public through interactive web applications.

.4 Storage is another crucial aspect of Arctic research.
  .1 Travel costs are often the largest component of Arctic research projects and as a cost saving measure, researchers often opt to send equipment ahead of time by sealift and/or leave the equipment at a research facility for the duration of the project (which can sometimes be several years).
  .2 As with the data management goal of encouraging on-site work, storage will also have to have sample storage facilities on hand. Therefore, CHARS will have a variety of storage available for Station equipment as well as researcher needs.
  .3 Temperature controlled environments such as freezers, cold and heated storage spaces will be available to the researchers as well as more specialized storage areas such as biological, chemical and glassware storage.

2.4.4 EDUCATION, TRAINING & OUTREACH COMPONENTS



.1 These spaces will be designed to create an inviting environment for the general public of all ages and will help bridge the division between researchers and non-researchers. These spaces and services could also be rented out to supplement the CHARS budget.

.2 Translation space with appropriate equipment will be included in required spaces, such as the auditorium and broadcast centre. This will ensure that Northerners and international visitors will be able to comfortably and effectively participate in conferences, workshops, joint meetings and traditional knowledge and/or cultural activities.

.3 Larger meeting spaces such as auditoria and classrooms of different sizes will facilitate the ability for CHARS to offer teaching opportunities, workshops, conferences, and support other group gatherings.
  .1 Other education and outreach spaces that will be used by both researchers and non-researchers are computer labs with dedicated telecommunications and networking services, the E-health & Examination room, the Library, and the Science Display Area.
  .2 Teaching/training space would be used for the dual purpose of providing researchers with equipment and safety training, and expanding the available meeting space for outreach and engagement activities such as learning sessions with youth.
  .3 Arctic communities generally have a deficit of rentable office space. Business Incubation space at the Station will support the successful development of entrepreneurial activities by members of the Arctic community and may represent a revenue stream for the Station.

.4 These spaces will form one of the key links to the broader hosting community and as such, should be inviting and attuned to traditional and community usage of similar interior spaces.
  .1 In particular, the Outreach Spaces should present opportunities for all ages and sectors of the community to participate in Station activities.

.2 Some of these spaces could be available for rental by the community or other groups when not fully occupied by the CHARS activities, further strengthening community involvement.

.3 Community consultations will also be used to develop the requirements for the traditional knowledge spaces.

2.4.5 Office & Office Support Components

.1 Day to day operations of the Station, staff work areas and temporary offices for researchers will be supported by the office and business components.

.1 These spaces will be used to support ongoing operations and maintenance of the CHARS buildings and program activities.

.2 Business operations in support of the overall programming will include the management of supplies, records management, and telecommunications services.

.3 To accommodate the varying needs of administration, staff researchers and temporary visitors, office space will be available in both open and closed formats with varying access levels, including 'hoteling' space.

.4 Office supplies and photocopy services will be available to all users.

.2 Formal office space is required to support the day to day operations of the Station, as well as provide space for researchers to consolidate and interpret field data, prepare reports, and generally organize research materials.

.1 At times, the offices may not be fully occupied, so space demands can easily be met; at other times, notably during the busy summer research season, offices may need to be shared and at the busiest times, researchers may have to make use of their rooms, the lounge, library, study nooks, and other open spaces for their work.

.2 The challenge in designing the office space will be to view the staff fluctuations and lab flexibility as an ongoing design opportunity.

2.4.6 Living & Recreation Components

.1 It is expected that most users will be living in Cambridge Bay for much of the duration of their project or activity. A variety of living spaces, both at the Station and in the community, will be part of CHARS accommodations.

.2 Accommodations for permanent, short-term, and long-term visitors will be available.

.1 As part of the strategy to encourage researchers to conduct all aspects of work on site, length of stay will correlate to the type of accommodation available - the longer the stay, the larger and/or more private the accommodation. Laundry facilities will be among the service/spaces in the living components.

.3 Kitchen, dining, and food storage spaces will complement the activities of the accommodation spaces and the meeting/conferencing spaces.

.1 Dry goods are expected to be ordered and shipped through the sealift and will require a large storage space to house the year's worth of supplies.

.2 The dining space could be used as swing space for additional meeting space.

.4 Recreation spaces will also be part of future CHARS planning.

.1 Spaces such as a fitness area, lounge, entertainment room, and study nooks could be among the amenities at the Station. These spaces should be appropriately integrated into the overall layout to provide opportunities for informal interaction between visitors and resident staff.

.5 In Cambridge Bay, existing accommodation and recreation spaces and services will complement CHARS spaces. Spaces in the community could be upgraded rather than being constructed at the Station.

.1 For the recreation spaces in particular, negotiations with the community could be pursued to obtain quid pro quo arrangements so that community members can further benefit from CHARS, and Station visitors have greater access to community infrastructure.

.6 In addition to the potential integration of some of the living and recreational spaces into the existing community infrastructure, a portion of the housing requirement should be viewed as an opportunity to develop an Arctic housing research platform or demonstration site.

.1 The Canada Mortgage and Housing Corporation and Natural Resources Canada are potential partners for a project to use housing in the Arctic to evaluate building and energy systems.

.2 While these units could help to meet the overall housing needs of the station, they would also be designed in a way to allow future structural modification. Instrumentation and sensors would be used to monitor the performance of various systems within such a house.

.3 This platform will allow long-term monitoring and testing of a variety of housing components, materials, and energy systems, as well as act as a demonstration centre for new and emerging technologies.

2.4.7 Commercial Components

.1 Commercial space will be available for rental and development by interested parties.

.2 This space should be designed in conjunction with the main access to the Station in order to provide the maximum visibility and integration into Station operations.

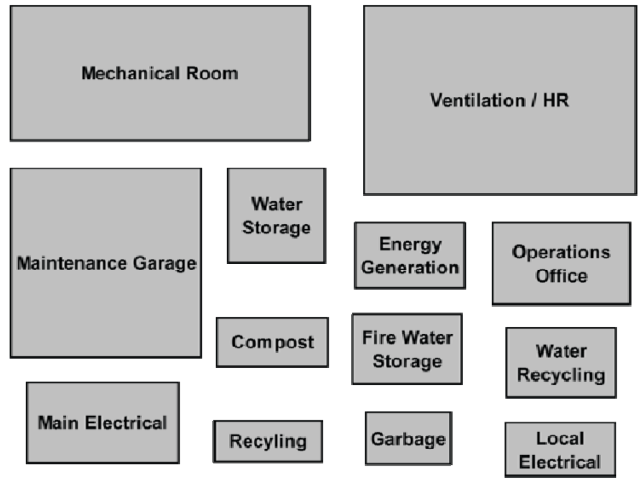
.1 Close proximity to display areas and the entry and reception areas could provide additional benefits to businesses locating within CHARS.

.3 Since this will likely be an enterprise dependent on clientele, the success of any commercial venture cannot be seen as a stable resource.

A display area, showing Arctic wildlife and traditional Inuit technology

2.4.8 Building Support & Mechanical Components

.1 Mechanical/electrical spaces, waste and water services, and energy generation will account for a significant part of the overall Station in terms of infrastructure and operating budget.



.1 The design and construction phases will seek out the best of traditional and alternative methods to attain the highest efficiency, have the smallest environmental footprint possible, and act as a demonstration centre to inspire changes in other Arctic communities.

.2 The preference is to favour capital investment now to reduce operations & maintenance outlays in future years.

.2 Research staff and visitors are not expected to have general access to these areas.

.1 An exception is where the spaces are being used for experimental testing of products or are part of a monitoring or demonstration program.

.3 Traditionally, the incorporation of dedicated service corridors has resulted in easy supply of services to the lab areas.

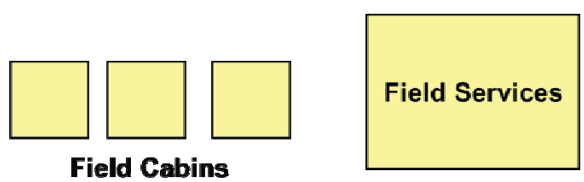
.1 These corridors allow for regular maintenance and future reconfiguration of lab services without major construction disturbances to lab operations.

.2 Another approach could be to incorporate services within an oversized ceiling cavity, to allow for maintenance or alterations without disturbing lab operations.

2.4.9 Logistical Components

.1 A major component in any polar research program is the logistics required to bring research staff and materials to the research sites.

.1 The present operations at the Polar Continental Shelf Program (PCSP) in Resolute Bay devote a major portion of their resources to the delivery of research teams to their sites through the use of chartered aircraft and boats.



.2 Other logistics activities include housing researchers for short periods of time, and maintaining communications with groups in the field.

.3 PCSP has demonstrated that effective logistics requires a significant amount of field equipment storage and maintenance capacity.

.4 This capacity has been itemized for CHARS through the Storage, Workshop, and Maintenance areas.

.2 Further to the storage of equipment and delivery of researchers to their sites, logistics also encompasses monitoring of the status of all researchers in the field.

.1 Daily radio contact between the station and field personnel is an absolute necessity.

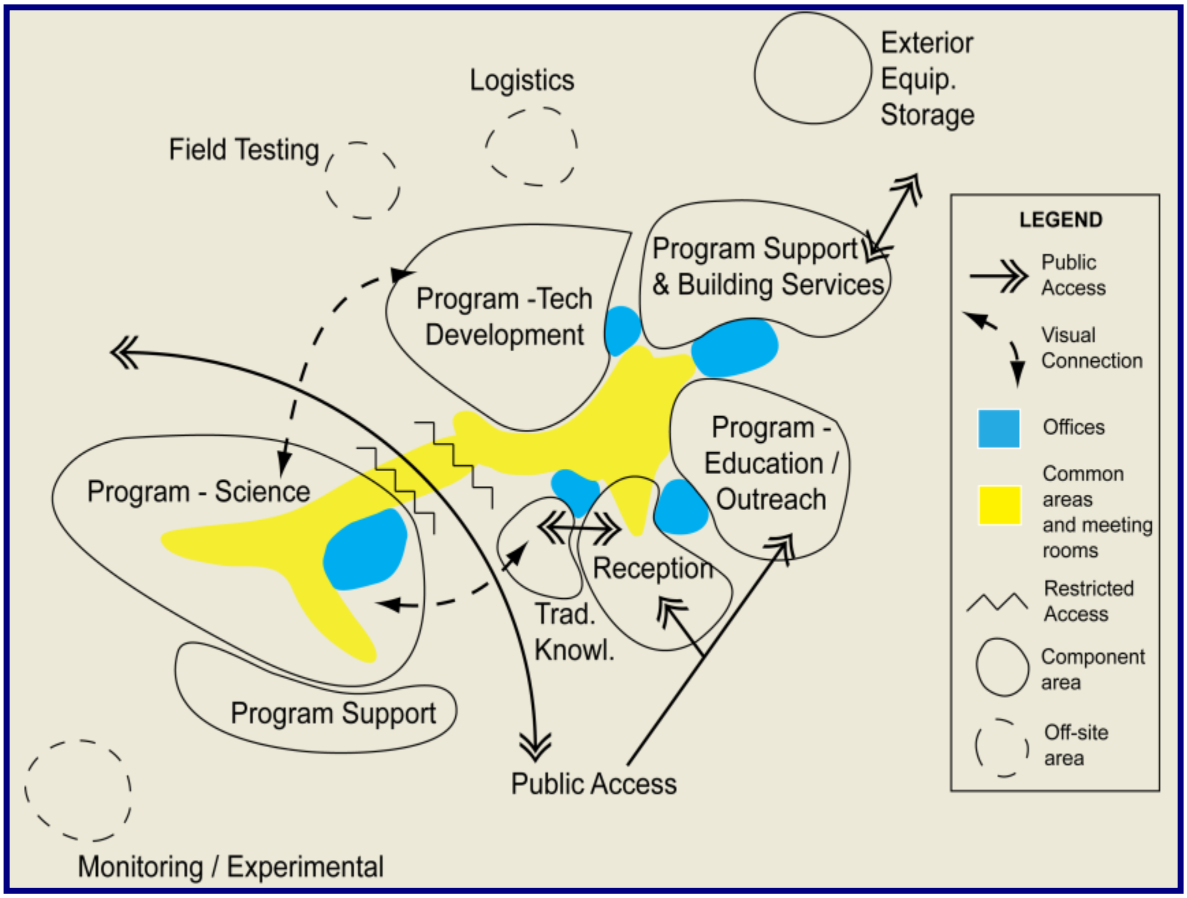
.2 This contact is needed to monitor the well-being of researchers, verify pick-up schedules, and provide weather updates.

.3 Also, as part of the logistics, the pilots, boat personnel, and researchers are given daily weather briefings before they leave the station for the field.

2.4.10 Schematic Layouts

.1 The design intent is to support and encourage interaction amongst the research staff, operational staff, and visitors.

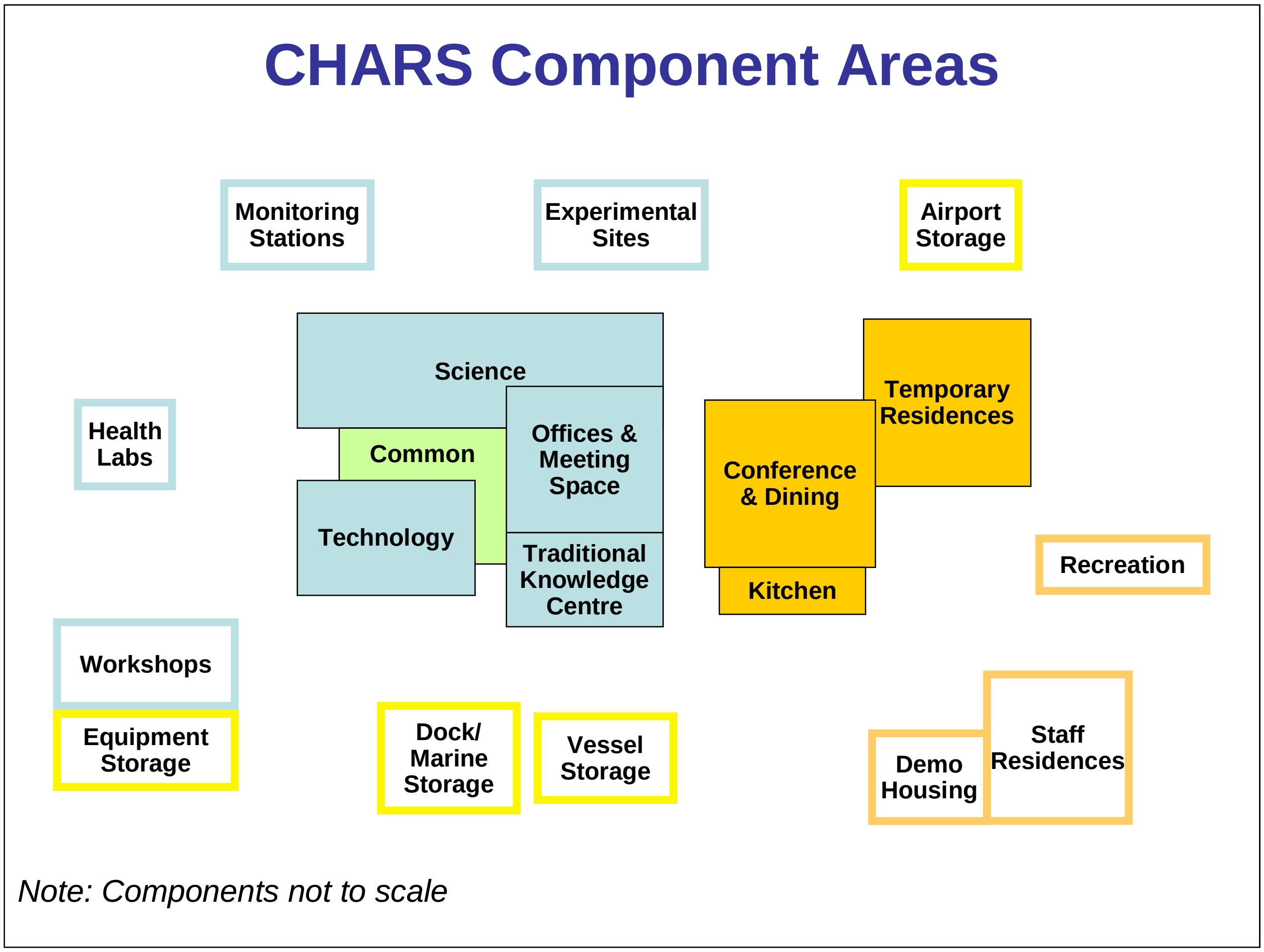
.2 Additionally, locating the Station `on a community pathway' encourages the community to be a part of Station activities. Visual links to some select program areas further encourage interaction & participation.



.3 Existing infrastructure in Cambridge Bay can become part of the CHARS campus.

.4 Further refining the relationships between the Station component areas and the community, the areas defined as solid colours form the core functions for the Station, with the outlined areas identifying potential services for delivery by the community.

.5 The community services will be in conjunction with existing or upgradable capacity.


CHARS Component Areas
Monitoring Stations
Experimental Sites
Airport Storage
Science
Health Labs
Common
Offices & Meeting Space
Technology
Traditional Knowledge Centre
Temporary Residences
Conference & Dining
Kitchen
Recreation
Workshops
Equipment Storage
Dock/ Marine Storage
Vessel Storage
Demo Housing
Staff Residences
Note: Components not to scale

3. TECHNICAL & PERFORMANCE REQUIREMENTS

3.1 CODES, REGULATIONS, STANDARDS AND GUIDELINES

3.1.1 CODES AND REGULATIONS

.1 The NRC National Building Code of Canada 2010
.2 The NRC National Fire Code of Canada, 2010
.3 The NRC National Plumbing Code of Canada 2010
.4 The NRC National Energy Code of Canada for Buildings 2011
.5 The Canadian Electrical Code 2012
.6 The Canada Labour Code
  .1 http://laws.justice.gc.ca/en/L-2/
.7 The Canada Occupational Health and Safety Regulations
  .1 http://laws.justice.gc.ca/eng/SOR-86-304/index.html
.8 All other Territorial and Municipal Acts, Codes, By-laws and regulations appropriate to the area of concern;

3.1.2 STANDARDS AND GUIDELINES

.1 Standards and Directives of the Treasury Board (TB):
  .1 http://www.tbs-sct.gc.ca/pol/index-eng.aspx?tree=standard
  .2 http://www.tbs-sct.gc.ca/pol/index-eng.aspx?tree=directive
  .3 And including;
    .1 Accessibility Standard for Real Property;
      .1 http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=12044
    .2 Fire Protection Standard;
      .1 http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=17316
.2 Labour Canada's, Fire Commissioner of Canada Standards
  .1 http://www.hrsdc.gc.ca/eng/labour/fire_protection/policies_standards/commissioner/index.shtml. And including;
    .1 FC-301 Standard for Construction Operations, June 1982
    .2 FC-302 Standard for Welding and Cutting, June 1982
    .3 FC-311 Standard for Record Storage, May 1979
    .4 FC-403 Fire Protection Standard for sprinkler Systems, November 1994
.3 Labour Canada's, Technical Documents
  .1 http://www.hrsdc.gc.ca/eng/labour/fire_protection/policies_standards/guidelines/index.shtml
  .2 And Including;
    .1 Fire Protection for Information Technology Facilities and Equipment

.4 ACGIH – America Conference of Governmental Industrial Hygienists, Industrial Ventilation: a manual of recommended practice
.5 Air Conditioning and Refrigeration Institute (ARI)
.6 American Conference of Governmental Industrial Hygienists (ACGIH, Industrial Ventilation Handbook)
.7 Air Diffusion Council (ADC)
.8 Air Movement and Control Association (AMCA)
.9 American National Standards Institute (ANSI).

.10 American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), including but not limited to;
  .1 ASHRAE Laboratory Design Guide
  .2 ASHRAE Standards and Guidelines
  .3 ASHRAE Applications Handbook - 2011
  .4 ASHRAE HVAC Systems and Equipment Handbook – 2008
  .5 ASHRAE Fundamentals Handbook – 2009
  .6 ASHRAE Refrigeration Handbook - 2010
  .7 ASHRAE 52.2 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size - 2007
  .8 ANSI/ASHRAE 55, Thermal Environmental Conditions for Human Occupancy - 2004
  .9 ANSI/ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality - 2010
  .10 ASHRAE 90.1, Energy Efficient Design of New Buildings - 2010
  .11 ASHRAE 105: Standard Method of Measuring and Expressing Building Energy Performance - 2007
  .12 ASHRAE 110, Method of Testing Performance of Laboratory Fume Hoods
  .13 ASHRAE 111; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems - 2008
  .14 ASHRAE 114; Energy Management Control Systems Instrumentation
  .15 ASHRAE 135; BACnet: A Date Communication Protocol for Building Automation and Control Networks - 2010
  .16 ASHRAE 140 Standard Method of Test for the Building Energy Analysis Computer Program - 2011
  .17 ASHRAE 189.1, Standard for the Design of High Performance Green Buildings - 2011
  .18 ASHRAE Datacom Series of Guidelines

.11 American Society of Mechanical Engineers (ASME)
.12 American Society for Testing and Materials (ASTM)
.13 American Welding Society (AWS)
.14 ANSI/AIHA Z9.5, Laboratory Ventilation
.15 ANSI Z358.1, Emergency Eyewash and Shower Equipment
.16 Associated Air Balance Council (AABC)
.17 CAN/ ULC –S 524-06 Installation of Fire Alarm Systems
.18 CAN/ ULC S 537-04 Inspection and Testing of Fire Alarm Systems
.19 CAN/ ULC S 537-04 Verification of Fire Alarm Systems
.20 Canada Green building Council Rating Guide for LEED Canada NC, 2009

.21 Canadian Council on Animal Care; Guidelines on Laboratory Animal Facilities - Characteristics Design and Development, 2003

.22 The Canadian Council of Ministers of the Environment (CCME) *Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products* (CCME, 2003)

.23 The Canadian Food Inspection Agency (CFIA) Containment Standards for Veterinary Facilities – undated

.24 The Canadian Food Inspection Agency (CFIA) Containment Standards for Facilities Handling Aquatic Animal Pathogens – 2010

.25 The Canadian Food Inspection Agency (CFIA) Containment Standards for Facilities Handling Plant Pests - 2007

.26 Canadian Standards Association

- .1 CSA B64-01 Backflow Preventers and Vacuum Breakers
- .2 CSA B51-09 Boiler, pressure vessel and pressure piping Code
- .3 CSA B52-05 Mechanical Refrigeration Code
- .4 CSA B139-09 Installation Code for Oil Burning Equipment
- .5 CSA B149.1-10 Natural Gas and Propane Installation Code
- .6 CSA B651-04 Accessible Design for the Built Environment
- .7 CSA Part 1, C22.1-06
- .8 CAN/CSA-C22.2 No. 214-94 "Communications Cables",
- .9 CAN/CSA-T528-93, "Design Guidelines for Administration of Telecommunications Infrastructure in Commercial Buildings", Canadian Standards Association
- .10 CSA Z316.5-94, Fume Hoods and Associated Exhaust Systems

.27 Design Guidelines – Nunavut Good Building Practice

.28 International Mechanical Code – Latest Version

.29 Institute of Boiler and Radiation, Hydronic Institute (IBR)

.30 J-STD-607A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, ANSI-J-STD-607-A-2002

.31 Laboratory Biosafety Guidelines – 3rd Edition 2004, Health Canada

.32 LABS21, Environmental Performance Criteria

.33 Manufacturers Standardization Society of Valve and Fitting Industry (MSS)

.34 National Fire Protection Association (NFPA)

- .1 NFPA 10; Standard for Portable Fire Extinguishers - 2010
- .2 NFPA 13; Standard for Installation of Sprinkler Systems - 2010
- .3 NFPA 14; Standard for Installation of Standpipe and Hose Systems - 2010
- .4 NFPA 30, Flammable and Combustible Liquids Code
- .5 NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals
- .6 NFPA 780 Standard For Installation of Lightning Protection Systems 2011.

.35 Public Works and Government Services MD Standards

- .1 MD 250005-2009; Energy Monitoring and Control Systems Design Guidelines
- .2 MD 15116-2006; Computer Room Air conditioning Systems
- .3 MD-15126; Laboratory HVAC (currently in draft form)
- .4 MD 15128; Minimum Guidelines for Laboratory Fume Hoods – 2008
- .5 MD 15129; Perchloric Acid Fume Hoods and Their Exhaust Systems - 2006
- .6 MD 15166; Guidelines for Building Owners, Design Professionals and Maintenance Personnel – 2006
- .7 MD 16001; Air Filters for HVAC Systems - 2007

.36 SEFA 1.2, Scientific Equipment & Furniture Association

.37 Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) Standards;

- .1 SMACNA HVAC Duct Construction Standards
- .2 SMACNA HVAC System Duct Design
- .3 SMACNA Air Duct Leakage Test Manual
- .4 Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
- .5 Seismic Restraint Manual Guidelines for Mechanical Systems.

.38 Telecommunications Industry Association (TIA)

- .1 Commercial Building Telecommunications Cabling Standard
  - .1 Part 1: General Requirements, TIA/EIA-568-B.1.
  - .2 Part 2: Balanced Twisted Pair Cabling Components, TIA/EIA-568-B.2.
  - .3 Addendum 1 - Transmission Performance Specification for 4-pair 100 Ohm Category 6 Cabling, TIA/EIA-568-B.2-1.
  - .4 Pathways and Spaces, ANSI/TIA/EIA-569-B
- .2 Optical Fibre Cabling Components Standards, TIA/EIA-568-B.3
- .3 Optical Fibre Cabling Components Standard Addendum 1 - Additional Transmission Performance Specifications for 50/125 µm Optical Fibre Cables, TIA/EIA-568-B.3-1.
- .4 Telecommunications Infrastructure Standard for Data centers TIA-942.

3.2 SAFETY REQUIREMENTS

3.2.1 GENERAL

.1 Safety is a very complex matter to be considered in the design of laboratory facilities.

- .1 Particular attention must be paid to the safety of the worker, and the well-being of those people in a circumstance that may be hazardous.
- .2 Emphasis must also be placed on the engineering systems to provide the major components of safety.
- .3 Several other issues will need to be taken into consideration.
- .4 Finishes applied to the various surfaces must be considered in the context of safety, whether it is durable for continued and heavy use, whether it can be easily cleaned and disinfected, and whether it will become hazardous or slippery if put into contact with various elements.

.2 Cambridge Bay is expanding their piped water infrastructure. However, depending on the final decision of the site for CHARS, piped water may not be available and the Station will have to rely on trucked water.

- .1 The potential lack of piped water to the facility will require that systems be operational with little or no water.
- .2 In the case of sprinkler systems, the feasibility of using options such as waterless systems that are eco-friendly and creative and the use of cistern should be considered.

.3 In addition to the safety of lab personnel, the safety of the community must also be considered.

- .1 While CHARS is not designated as a high level containment lab, some chemicals, gases or substances may be dangerous to the general public if not handled properly or if an accident releases them into the broader community.
- .2 Compliance with WHMIS regulations during lab operations must be considered in the planning of all research areas.

3.2.2 LABORATORY SAFETY

.1 Work will typically involve low risk or inactive agents and as such labs will be designed to maximum Containment Level 2 Biosafety, in accordance with Containment Level definitions contained in Health Canada, Laboratory Biosafety Guidelines, 3rd Edition 2004.

.2 Although not required for BSL2 requirements, office areas will be located outside of the containment lab zone.

.3 Directional inward airflow will be provided such that air will flow towards inwards to dirty labs and outward from clean labs.

.4 Lab suites shall be easily converted to either clean or dirty by mechanical devices and controls that will change the directional airflow. Pressure gradient diagrams will be required to demonstrate the design.

.5 Animal labs shall conform to CFIA Containment Standards for Veterinary Facilities.

.6 Live animal environments must conform to the Canadian Council on Animal Care Guidelines.

.7 All labs must be WHMIS-compliant, with smoke detectors, fire extinguishers, heat detectors, and other required safety equipment.

.8 Emergency Shower: Each lab must be in close proximity to a safety shower and an eye wash station.

.9 Floor drains may not be desirable due to the potential for mixing of chemicals. A preferable approach may be to locate spill kits in proximity to the lab areas.

.10 Staff will be required to wear appropriate personal protective equipment (gloves, clothing and eyewear).

.11 Walls separating the lab zones from administrative zones are considered as a containment barrier. As such, these walls shall extend from the floor to the underside of the structure, and be free of openings with any penetrations sealed.

.12 Appropriate signage indicating the nature of nearby hazards must be posted outside of each laboratory.

.13 All labs require observation windows to an adjoining corridor.

.14 All labs require intercom stations connected to security reception desk.

3.3 SECURITY REQUIREMENTS

3.3.1 Security Challenges

.1 The unique location for CHARS, coupled with the interest to promote community participation at the Station, make strict definition of security zones a program-by-program discussion.

  .1 The Traditional Knowledge area and even some of the Administrative and Office areas may have lower security requirements than labs which involve handling of sensitive substances.

  .2 For this reason the discussion of security requirements will focus on the potential types of security areas with the specifics being defined to meet the ongoing development of the S&T program.

3.3.2 General

.1 The following classifications describe different levels of security throughout the facility:

  .1 Public Zones: The public has unimpeded access and generally surrounds or forms part of a government facility.

  .2 Reception Zones: The transition from a public zone to a restricted-access area is demarcated and controlled.

.3 Operations Zones: Access is limited to most staff there and to properly escorted visitors.

.4 Security Zones: Access is limited to authorized staff and to authorized and properly escorted visitors.

.5 High Security Zones: Access is limited to authorized, appropriately screened personnel and authorized and properly escorted visitors.

.2 Security zones for this project are identified as follows:

.1 Public zones: Identified community/station common areas.

.2 Reception zones: Main entry lobby and Loading dock area.

.3 Operations zones: Balance of the facility except as noted below.

.4 Security zones: Individual lab program suites that require a higher level of security, due to the presence of specific hazardous or sensitive substances.

.5 High Security zones: Potentially the Secure Storage spaces; to be confirmed.

.3 Security Reception Desk

.1 The security reception desk will be staffed as defined by the Operational Program.

.2 During regular working hours, a staff member will provide 'back-up' support to the security guard stationed at the security reception desk.

.3 The security reception desk shall be located such that all persons entering the building from the public entrance must walk past the reception desk in order to access the operational areas.

.1 Visitors will require escorts when accessing operational areas.

.4 The security desk shall hold monitors for the CCTV/IP camera system monitoring, an access control computer and monitor and a regular Station LAN computer and monitor.

.1 These will be installed in a lockable cupboard, which can be secured during the absence of a guard on duty.

.4 Entry Points

.1 Staff and visitor parking will be provided within the main parking area.

.1 Visitors will gain access to secure areas through security staff at the Reception desk.

.2 Only designated staff will be granted access to non-public areas outside of working hours.

.1 An intercom and CCTV/IP camera connecting the secure areas to the reception desk area is required.

.3 An entrance adjacent to the loading area will serve as the entrance for all delivery personnel.

.1 This entrance will open into a secure vestibule, which will be equipped with a camera/intercom connected to the shipping/receiving room and the main security reception desk.

.4 Entrance points to the building are located at the following locations:

.1 Main (public) entrances

.2 Shipping & Receiving Area

.3 Staff entrance(s)

.4 Emergency exits (as required for code-conformance)

.5 Voice Communications

.1 A building-wide voice communication system will be provided to facilitate emergency operations procedures.

.2 Each lab will be equipped with an intercom to provide emergency voice communications to security staff who will in turn communicate necessary emergency measures.

.6 Security Devices

.1 The electronic security system will be comprised of electronic intrusion alarms, electronic door locks, motion detectors, and card readers (swipe and proximity readers). All controlled access points will be electronically connected to a central monitoring system, so that access to and from areas can both be programmed and recorded. All surveillance will be connected to a central CCTV/IP system and recorded.

.2 All controllers must be served from the electrical distribution circuits with emergency power backup and all access control systems must be supported with uninterruptible power supply.

.3 The central security control panel shall be located in the (controlled access) electrical room. This panel will be used to control the status of systems including security monitors, alarms, controlled access points, emergency communications systems.

.4 Security camera monitors will be located at the Security reception desk. The monitors will enable surveillance of threats and/or incidents and expedite immediate response time.

.7 Exterior Glazing

.1 Exterior window glazing in secure areas is required to be covered with security film.

.8 Keying

.1 All exterior locksets to be high security.

.1 All exterior locksets are to be protected against vandalism, freezing, and unauthorized entry.

.9 Access Control System

.1 Provide an electronic security system.

.1 The system will be comprised of electronic intrusion alarms, electronic door locks, motion detectors, and card readers (swipe and proximity readers).

.2 All controlled access points will be electronically connected to a central monitoring system, so that access to and from areas can be programmed and recorded.

.3 Investigate different methods of access control for security system (proximity card, biometrics, etc.), and ensure that methods are in accordance with AANDC/PWGSC security requirements.

.10 Intrusion Alarm System

.1 Provide a monitored intrusion alarm system for the building in accordance with AANDC/PWGSC security requirements.

.2 The central security control panel shall be located in the (controlled access) electrical room.

.3 This panel will be used to control the status of systems including security monitors, alarms, controlled access points, emergency communications systems.

.11 Video Surveillance System

.1 Provide a new video surveillance system for the building, complete with interior and exterior cameras as required.

.2 Security camera monitors will be located at the Security reception desk. The monitors will enable surveillance of threats and/or incidents and expedite immediate response time.

.3 All technical decisions are to be in accordance with AANDC/PWGSC security requirements.

3.3.3 Laboratory Security

.1 Security for lab areas is high.

.2 Staff shall have 24/7 access to all laboratory spaces.

.3 All lab area will be separated from public areas by locked doors and will be controlled via card access.

  .1 Access to a specific Containment lab suite within the lab area will be through lockable doors and controlled via card access.

  .2 An alarm system shall be provided.

3.4 SITE REQUIREMENTS

3.4.1 Site Planning Challenges

.1 Future development/expansion for the Station will be identified as part of the overall design of CHARS.

  .1 This will include immediate site planning options for extensions to the Station building(s) and the relationship of future extensions/renovations to Cambridge Bay community planning.

  .2 A formal expansion plan for the Station shall outline future planning opportunities and constraints, to ensure the capacity of CHARS to meet unexpected future S&T programming demands.

3.4.2 Landscaping

.1 The Station building(s) will consider the natural features of the site, including topography, wind patterns, and solar access.

  .1 Landscaping and site development will promote the natural environment through the use of indigenous materials and plants.

  .2 Consideration shall be given for building features and wind patterns causing snow build-up in inappropriate places. Snow removal is costly and build-up at entrances can cause safety issues. Refer to the RWDI report – *CHARS Site Comparison – Snow Drifting* for more information.

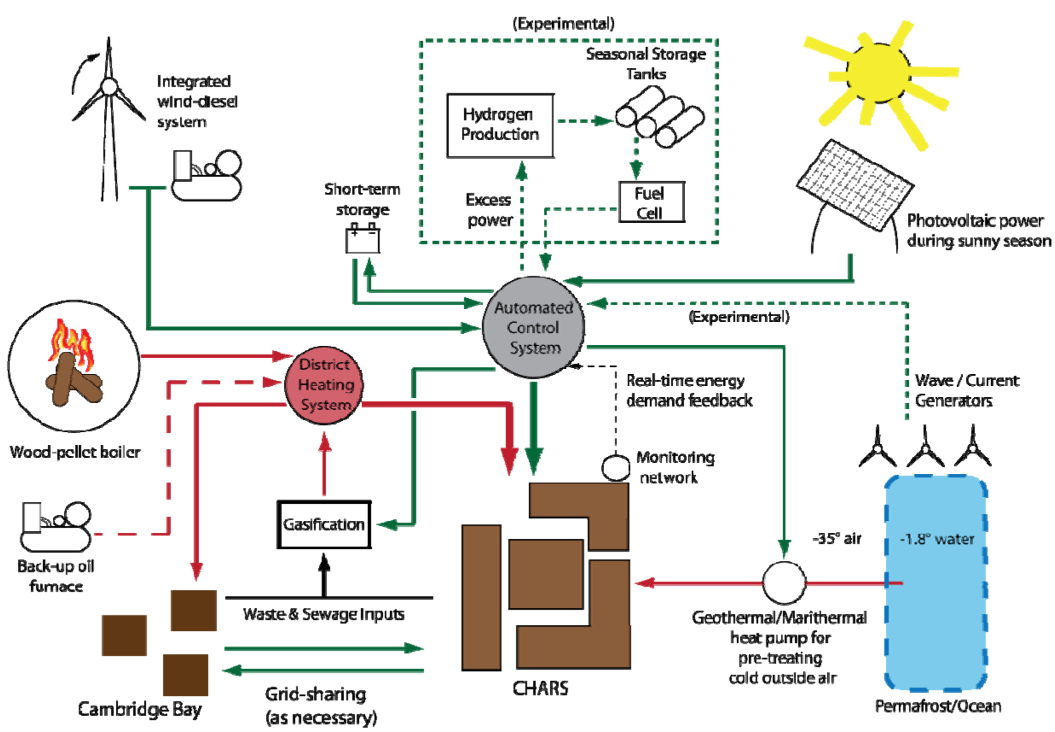
3.5 ENERGY

3.5.1 ENERGY COSTS

.1 Energy costs are exceptionally high in Arctic communities.

- .1 In terms of infrastructure, laboratories are considered highly energy intensive, often using four to six times more energy per area than a typical office building.
- .2 While CHARS will need to address this issue for its own operations, there is also a significant potential for developing and/or adapting technologies that would benefit all northern communities.
- .3 CHARS will therefore address this through the appropriate combination of:
  - .1 Employing efficiency-improving methods throughout the design, construction and operational phases; and,
  - .2 Exploring, testing and integrating alternative energy generating methods.
- .4 Decisions on specific building components should be made on the basis of a life cycle cost analysis.
- .5 The graphic below illustrates potential energy planning and integration approaches.

Integrated Energy Systems at the Canadian High Arctic Research Station



3.5.2 LABORATORIES

.1 The laboratories are expected to require the largest proportion of energy.

- .1 Within these spaces, the fume hoods are the element with the largest consumption.
- .2 Various industry estimates put the energy consumed by a single fume hood in a year to be 1 to 3.5 times the average residential home.
- .3 In most cases, the air required for the operation of the fume hood is totally exhausted outdoors (e.g. 100% outdoor air) due to potential high pollutant concentrations.

.4 100% outdoor air requires a considerable amount of energy to condition, particularly given Arctic climatic conditions.

.5 High energy consumption may also be driven by other process/plug loads, such as freezers.

3.5.3 STRATEGIES

.1 A number of strategies and measures have identified areas where efficiencies can be leveraged.

.1 The two examples below offer a number of practical recommendations that can be considered for CHARS.

.2 The first focuses on labs while the second addresses broader issues inherent to distributed facilities or campus settings.

.2 Energy consumption and cost of the facility must be modelled and a reasonable energy budget must be determined.

3.5.4 CLIMATE NEUTRAL RESEARCH CAMPUSES

.1 Source:

.1 National Renewable Research Laboratory, Climate Neutral Research Campuses, http://www.nrel.gov/applying_technologies/climate_neutral/

.2 The ***Climate Neutral Research Campuses*** highlights a number of actions that can be undertaken related to: people and policy; buildings; transportation; energy sources; and, offsets/certificates.

.1 Key recommendations that could be relevant to the CHARS context are included below.

.3 While significant energy savings can be supported through the building design and equipment choices, people (users and maintenance staff) and policies need to be incorporated into the overall strategy in order to be successful.

.4 Some estimates suggest energy management and maintenance programs can reduce energy use in individual buildings as much as 40%.

.1 The US Department of Energy published a rule of thumb that operations and maintenance (O&M) programs targeting energy efficiency can save 5-20% on energy bills with little capital investment.

.5 Actions such as turning lights off, closing blinds, and shutting a fume hood sash are necessary actions for low-energy performance.

.6 Additional methods can complement these actions:

.1 Make energy efficient building management the first step in energy efficiency;

.2 Engage building occupants in the mission of energy conservation;

.3 Educate building occupants about the building systems;

.4 Install energy consumption meters and display the results to provide real-time feedback to occupants;

.5 Focus efforts on the big energy users such as laboratories and data centres; and,

.6 Shut off or reduce HVAC service / lighting to unused spaces, on a seasonal, weekly, and/or diurnal schedule.

.7 Installing meters in buildings (and/or individual spaces) will allow users to see energy consumption rates in real-time, thereby potentially prompting reduction in energy use, and could also further the CHARS goal of being a testing and demonstration site for new technologies.

.8 These types of initiatives can be implemented inexpensively and can show immediate results.

.1 For some campus sites, these types of programs have represented the greatest and quickest returns on investment.

.9 Sharing of spaces and organizing usage schedules is one way to make better use of planned space and can often reduce the need for expansions due to organizational growth.

.10 Another energy efficiency act is setting goals for the building(s) which can guide decisions.

- .1 Whether this is done through benchmark goals, ratings and certificates (e.g. LEED), or standards, there are several strategies that can be used to help set and meet energy goals.
- .2 Designers and builders should use energy simulations to substantiate the energy performance goals through the design and construction phases. These simulations can be required as deliverables.

.11 Once the buildings are operational, a policy of continual maintenance and commissioning can help in several ways to keep performance within acceptable limits.

- .1 The use of diagnostic software in digital building automation systems can help prompt service and recalibration.
- .2 While the majority of CHARS will likely consist of new buildings with energy efficient systems, HVAC and control systems often start to drift toward lower efficiency and higher energy use.
- .3 After 5 years, a building will benefit from a thorough recalibration of its controls.
- .4 Planning for this, the maintenance budget can be appropriately applied to areas of greatest need and/or biggest payback.

.12 A consideration for the ongoing optimization of energy use at CHARS is to have an energy savings performance contract.

- .1 This can be structured so that the savings on energy bills pay for the upgrades. This may be particularly helpful in the cases where existing structures in the community are re-commissioned and/or expanded.

3.5.5 LABORATORIES FOR THE 21ST CENTURY

.1 Source:

- .1 Enermodal Engineering, Inc., National Renewable Energy Laboratory a DOE national laboratory (2003), Laboratories for the 21st Century: Energy Analysis, a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy – Office of Energy Efficiency and Renewable Energy Federal Energy Management Program.

.2 In 2003, ***Laboratories for the 21st Century*** conducted an analysis to find effective ways to reduce energy use and costs.

- .1 This analysis evaluated selected energy efficiency measures for a generic laboratory building in the areas of ventilating, cooling, heating, and considered the impacts of humidity controls and plug loads.

.3 The analysis focused on the effects of energy efficiency measures in a simplified laboratory model in four different climactic zones within the United States.

.4 The results show that the most efficient measures were the same for all climates but that energy savings differed from climate to climate. Based on the simulation results, the following was concluded:

- .1 A variable air volume (VAV) system, rather than a constant-volume system has the potential to reduce fan energy and energy for space cooling and heating.
  - .1 The choice of air distribution systems for CHARS must also take into account simplicity, maintainability, and reliability.
- .2 Energy recovery systems shall be considered for energy conservation and to be compatible with ASHRAE and NPFA Standards and Guidelines.

.3 The increase in fan energy from energy recovery ventilation systems is not offset by the reduction in space cooling. However, the lower heating energy use more than compensates for the increase in fan energy.

.4 Energy recovery can potentially reduce the size of the heating and cooling equipment and a VAV system has the potential to reduce the size of the heating system. The first-cost savings can cover a large portion of the cost of the energy efficiency strategy.

.5 Because of the high ventilation requirements in laboratory buildings, the air distribution system should be optimized to minimize pressure drop through the system and reduce energy use.

.6 Humidity control is energy intensive and should be carefully integrated into the control strategies to minimize reheat and sub cooling.

.7 Plug loads and internal gains from plug loads should be accurately assessed in order to design the mechanical system and determine power requirements. Significant increases in first costs and operating costs result from assuming too high a design load.

.5 This analysis, while instructive, should be considered carefully in the context of Arctic design. The climatic zones represented in the study are not indicative of an Arctic climate.

.6 In particular, decisions on HVAC design, such as constant-volume or variable air volume systems, should be made with an emphasis on simplicity, reliability, maintainability, expandability, and effectiveness, in addition to energy efficiency.

.7 VAV systems may encounter problems with overly complex controls and excess reheat causing poor efficiency. These issues should be addressed if a VAV system be specified.

3.5.6 THE 2030 CHALLENGE

.1 Another area to consider is the *2030 Challenge* which is endorsed by the *Royal Architectural Institute of Canada.*

.1 The challenge is to become carbon neutral by 2030.

.2 To accomplish this, Architecture 2030 has issued the 2030 Challenge asking the global architecture and building community to adopt the following targets:

.1 All new buildings, developments and major renovations shall be designed to meet a fossil fuel, greenhouse gas-emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type.

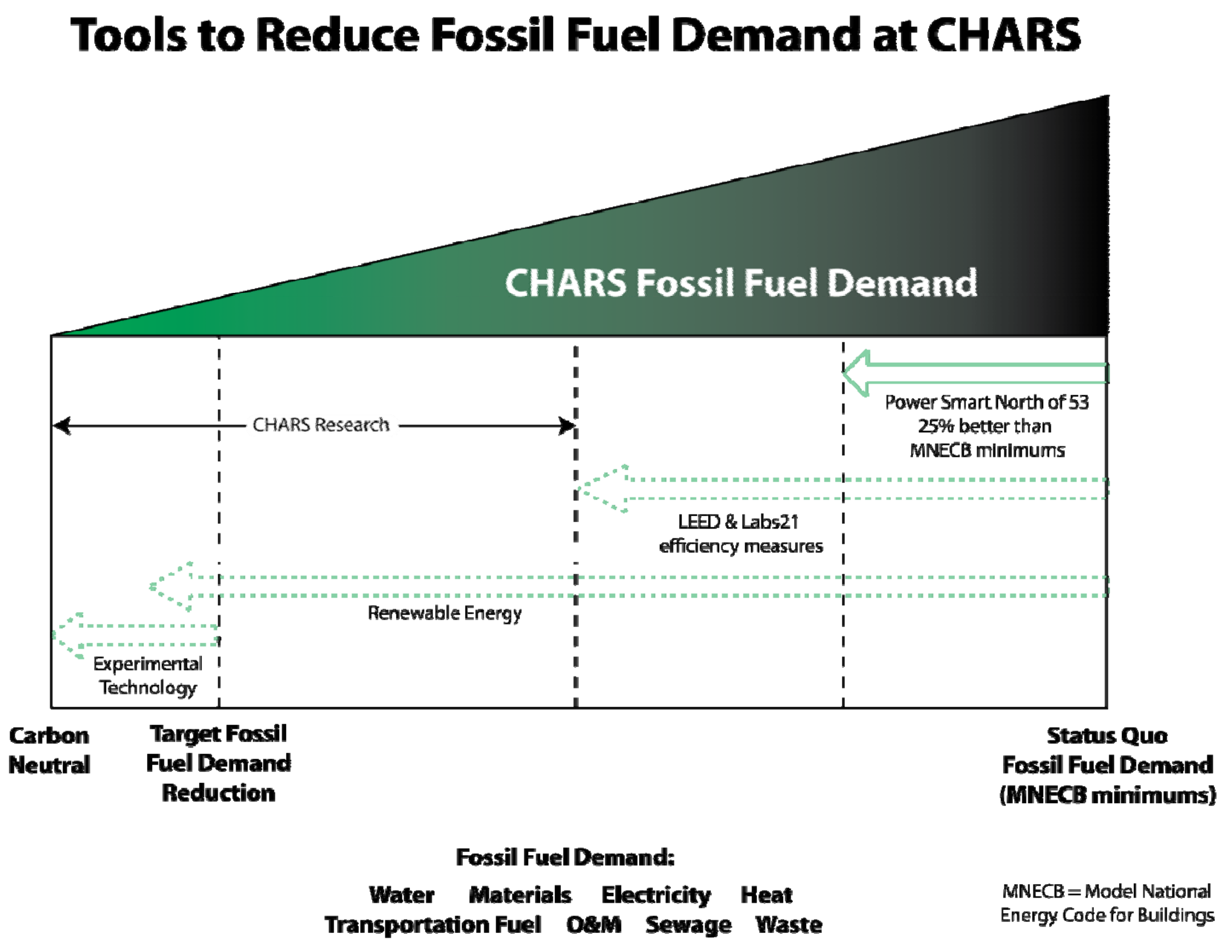
.3 At a minimum, an equal amount of existing building area shall be renovated annually to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type.

.1 A fossil fuel reduction standard for all new buildings and major renovations with the following targets:

.1 60% in 2010
.2 70% in 2015
.3 80% in 2020
.4 90% in 2025
.5 Carbon-neutral in 2030 (using no fossil fuel GHG emitting energy to operate)

.4 While some of these targets may be accomplished by purchasing (20% maximum) renewable energy and/or certified renewable energy credits, implementing innovative sustainable design strategies and generating on-site renewable power are seen to be the preferred approaches.

.1 In the context of a remote Arctic community, ‘on-site’ should be interpreted as referring to the local electrical grid.



.5 While the goal for CHARS is to achieve carbon neutrality in Station operations, incremental steps will be required to meet various targets.

.1 As illustrated in the figure above, adoption of the Model National Energy Code for Buildings (MNECB) will set the basic performance criteria for building construction and operation.

.2 The recognition and adoption of LEED and LABS 21 guidelines will further reduce energy consumption and push the usage targets beyond MNECB.

.3 The `gap' that remains between the achieved targets and carbon neutrality will form the basis of the CHARS research in building energy conservation.

.4 The Arctic location for this research will naturally focus the `gap' on buildings within polar regions.

3.6 COMMISSIONING

3.6.1 PROCESS

.1 Commissioning expertise shall be brought into the project early in project concept development and will follow the process established under the National Project Management System (NPMS) guidelines.

.1 There are a number of approaches for the commissioning on projects.

.2 It is recommended that the commissioning approach for CHARS be determined at the outset of the project, in order to mitigate potential impacts on project scope and to ensure the responsibilities of the client, Consultant team, and construction manager are well-defined.

.3 The Commissioning process must conform the PWGSC policy.

3.6.2 PROCEDURES

.1 The PWGSC Commissioning Manuals CP-1 through CP-13 will be provided to the Consultant team, who will adhere to the specific guidelines included in the manual to complete the commissioning testing procedures for components, systems and integrated systems.

.2 The commissioning documentation will include a description of:

- .1 Commissioning objectives
- .2 General description of commissioning by project stage
- .3 Roles and responsibilities
- .4 Occupancy requirements
- .5 Operational criteria
- .6 Life cycle costing criteria
- .7 Cooperation and coordination
- .8 Training
- .9 Correction of deficiencies
- .10 Facility maintenance policy, guidelines and requirements
- .11 Acceptance of the project
- .12 Commissioning documentation
- .13 Commissioning deliverables
- .14 Construction and Commissioning

3.7 ARCHITECTURAL REQUIREMENTS

3.7.1 ARCHITECTURAL CHALLENGES

.1 The architectural approach to CHARS provides opportunities and challenges which are not normally part of a design program.

- .1 As a world-class Canadian research station, the concept for the new facility must frame these buildings within the Arctic environment to convey the image of a federal presence that is strong and supportive without being dominating.
- .2 All designers will recognize opportunity, but the challenge is to recognize that the Arctic is rich in culture, resources and history, and requires considerable respect.
- .3 As evidenced by the early explorers, lack of respect for such fundamental issues as the Arctic climate has frustrated many non-Inuit explorers.
- .4 This research station represents another type of exploration of the Canadian Arctic by both native and non-native inhabitants.

Nunavut Legislature structure (under construction) evokes traditional Inuit building forms.

.2 The Station building(s) should provide a showcase for CHARS cultural, scientific and technological outputs, and foster community interest in the station's work.
  - .1 The Station facilities should be welcoming in scale, not more than two stories, so that the community is encouraged to interact with researchers.
  - .2 Station planning should allow youth, particularly school-aged children, to observe some operations at the Station, in order to develop their interests in science.
  - .3 The main public entry to the Station should be a bright and open space which welcomes visitors, incorporates displays about research at the Station and has material that relates to the Arctic environment.

.3 While CHARS will make an international statement on Canadian research in its Arctic, it will also project an architectural face onto the culture of the northern community and all northerners.
  - .1 The design of CHARS must therefore reflect an understanding of the scale, resources and other factors unique to Cambridge Bay, in a way that sets it as an example for ongoing development of other northern communities.

.4 CHARS should engage and intrigue the national and international research communities.
  - .1 As a campus of resources set within the existing Cambridge Bay community, the Station should engage researchers with the opportunity to deliver sound results, through the use of quality equipment and communications technologies.
  - .2 The Station should further intrigue the research community as an example of how the resources of Cambridge Bay have been directed to accommodate science and technology development.
  - .3 This will include the exploration of building form and construction methods for polar environments.

.4 As an example, Canada Mortgage and Housing Corporation may be engaged to help in the design of housing that will test building systems while serving as accommodation for researchers.

.5 Since the realities of the Arctic environment include long periods of darkness, the interiors of the Station should celebrate access to natural light and views of the landscape.

.1 Realizing that sustainability is a major objective for the Station, the designers will have to carefully and creatively weight the options for managing competing issues around the building interiors.

.2 Beyond the relationship of the Station to Cambridge Bay, the research community should feel a sense of community.

.3 The interior spaces should promote interaction and cross-discipline discussion.

.4 As much as possible, common areas such as hallways should be viewed as organic spaces which incorporate areas for reflection, study and discussion.

.5 While the lab areas require conformance with a variety of codes, regulations, and operational/servicing requirements that may imply greater design constraints, the interconnecting spaces provide important occasions to explore informal links within the research community.

.6 Informal interior streets should offer glimpses of both the exterior landscape and interior working areas to keep the Station tuned into the Arctic environment.

.6 In combination with the integration of some Station functions within the community, the organization of common spaces within the research areas will complement an overall view of Cambridge Bay as a research community.

.1 A careful consideration of the role of potential off site components such as storage, maintenance areas, and recreation facilities, will have to be completed to provide both the functional/operational priorities as well as the connection to the overall community planning structure.

.2 An area such as a coffee shop or restaurant, particularly in conjunction with Arctic College facilities, could act as a catalyst for discussions between younger local students, Elders, and veteran researchers.

.3 Resource planning and use, as well as human interaction, are important aspects in the conceptual approach and design development for a CHARS polar community.

.7 The description that best summarizes the approach to research is; `A world class research station in Canada's Arctic that is on the cutting edge of Arctic issues'.

.1 CHARS will have a relationship to the community that is informed by Inuit and northerners, and is based on principles that respect this unique environment.

.8 CHARS will be a place for inquiry and learning, where everyone has value to add – whether it be knowledge, experience, perspectives, or questions.

3.7.2 Accessibility

.1 With consideration for the Arctic environment, CHARS facilities are meant to be fully accessible.

.2 The PWGSC, Canadian Standards Association guidelines and Treasury Board policies will be relied on for achieving an accessible design.

.3 Some areas (e.g. mezzanines in maintenance areas and workshops) may not be accessible due to structures such as ramp limitations and potential safety concerns for non-able-bodied persons.

3.7.3 Exterior Enclosure

.1 The building envelope will be designed to allow easy reconfiguration of research areas, particularly the labs.

.1 The technology development areas may be used for testing and monitoring of building construction techniques as part of the Station envelope.

.2 Exterior Walls

.1 Design according to the rain screen principle, as defined by the National Research Council.

.2 Provide cladding that will ensure an efficient barrier against rain, water and snow penetration and that will also prevent ice build-up.

.3 Allow for pressure equalization and drainage of the cavity behind the cladding.

.4 Exceed the Model National Energy Code of Canada for Buildings.

.5 Maintain continuity of air and vapour seals, particularly at the intersections of walls, roofs and openings.

.6 Use materials that are capable of resisting arctic loads, building mechanical systems pressures and other loads acting either as a pressure or suction (positive or negative) without rupturing or breaking away from its support.

.3 Roofing

.1 Meet or exceed the applicable Canadian Roofing Contractors Association (CRCA) standards, including the use of materials, manufacturer's instructions and recommendations.

.2 Provide a CRCA 5-year guarantee and a 10-year roofing system guarantee from the manufacturer.

.3 Roof covering shall have a minimum Class A classification, in accordance with the 2005 NBC, subsection 3.1.15.2. (1).

.4 Allow for deflection of building structural systems and live loads.

.5 Allow for thermal contraction and expansion of roofing system components and any other building components that may potentially affect the performance of the roofing system.

.6 Ensure that the membrane is installed to slope to drain with a minimum slope of 1:50 (including valleys).

.1 Drainage slopes shall be achieved by sloping the structure accordingly.

.2 Sloped insulation is not allowed.

.7 Ensure the total absence of condensation on interior surfaces under the following minimum conditions:

.1 Interior at 22° C, 30% RH, still air;

.2 Exterior at -40° C, 60 Km/h winds

.4 Exterior Windows

.1 Shall be pre-finished, high performing, thermally broken, exterior glazed units, designed on rain screen principles with pressure equalization and drained glazing pockets/throats.

.2 Maintain continuity of air and vapour seals as part of wall construction.

.3 Extend 12 month Warranty as per the General Conditions to 24 months.

.4 Glazing pockets/throats to be able to mechanically accommodate air/vapour barrier membrane.

.5 Avoid joints at windowsills, heads, jams and intersections.

.6 Design windows to withstand:

.1 Dead and live loads caused by pressure and suction of wind acting normal to the plane of the system as calculated per the National Building Code.

.2 Expansion and contraction with respect to thermal and structural movement

.3 Water infiltration under design wind loads.

.1 No condensation on any interior surfaces of the framing before any exposed area of the sealed glazing unit reaches the dew point.

.5 Air tightness

.1 Air infiltration is recognized as a major driver of space conditioning costs in cold climates.

.2 The design of the building envelope should recognize the potential for air infiltration and strive to achieve a very high level of air-tightness.

.3 Air-tightness of the finished building(s) should be tested as part of the commissioning strategy.

3.7.4 INTERIOR FINISHES

.1 General

.1 Interior finishes shall meet or exceed international industry standards for high performing laboratories and shall be easy to clean and maintain.

.2 Finish materials indicated are the minimum standards acceptable for this project.

.1 Alternative finished of a higher performance standard may be considered, subject to cost, maintenance and availability considerations.

.2 As much as possible, finishes should be low volatile organic compound-emitting.

.2 Flooring

.1 Laboratories

.1 Characteristics: Hard, Resilient, Impervious to chemicals, Durable, Cleanable, Washable, Seamless, Static free, Non-Slip with integral base

.2 Offices and Meeting Rooms

.1 Characteristics: Durable, Acoustic absorption, Cleanable, Static free, Replaceable with minimal disruption

.3 Circulation and Public Corridors

.1 Characteristics: Hard, Resilient, Impervious to chemical spills, Durable, Cleanable, Washable, Seamless, Static free

.4 Public Gathering Spaces

.1 Characteristics: Hard, Resilient, Durable, Cleanable, Non-Slip, High Traffic Resistant, Static free

.5 Service and Mechanical Areas

.1 Characteristics: Hard, Resilient, Impervious to chemical spills, Durable, Cleanable, Washable, Seamless

.6 Kitchen / Food Services

.1 Characteristics: Hard, Resilient, Impervious to chemicals, Durable, Steam Cleanable, Washable, Can be hosed down, Seamless, Non-slip finish with integral base

.7 Accommodation Areas

.1 Characteristics: Standard Residential Finishes, Durable, Cleanable, Static free

.3 Walls

.1 Laboratories

.1 Characteristics: Durable, Cleanable, Washable, Paintable,

.2 Wall Protection: Provide wall & corner guards along high traffic circulation routes where materials are delivered and equipment is moved and where required

.2 Offices and Meeting Rooms

.1 Characteristics: Durable, Cleanable, Washable, Paintable

.3 Circulation and Public Corridors

.1 Characteristics: Durable, Cleanable.

.2 Protection: Wall & Corner guards,

.4 Public Gathering Spaces

.1 Characteristics: Durable, Cleanable. Feature areas where applicable

- .5 Service and Mechanical Areas
  - .1 Characteristics: Durable, Cleanable, Impervious, can be hosed down.
  - .2 Protection: Wall & Corner guards,
  - .3 Shielding: selected on the basis of suitability.
- .6 Kitchen / Food Services
  - .1 Characteristics: Durable, Cleanable, Washable, Scrubable, Spray resistant, Insulated (for coolers & freezers), Impervious, can be washed down and hosed down.
  - .2 Protection: Wall & Corner guards,
- .7 Accommodation Areas
  - .1 Characteristics: Standard Residential Finishes, Durable, Cleanable, Static free

.4 Ceilings

- .1 Laboratories
  - .1 Characteristics: Acoustical treatment, Cleanable, Washable
  - .2 Acceptable products: Lay-in acoustic panel ceilings throughout the labs and lab support rooms. Gypsum board equipped with access panels in rooms where potential moisture exists, such as autoclave rooms and glassware washing rooms.
- .2 Offices and Meeting Rooms
  - .1 Characteristics: Durable, Cleanable, Sound absorption
- .3 Circulation and Public Corridors
  - .1 Characteristics: Durable, Cleanable, Sound absorption
- .4 Public Gathering Spaces
  - .1 Characteristics: Durable, Cleanable, Sound absorption
- .5 Service and Mechanical Areas
  - .1 May be open to painted structure
- .6 Kitchen / Food Services
  - .1 Characteristics: Durable, Cleanable, Washable, Spray resistant, Impervious
- .7 Accommodation Areas
  - .1 Characteristics: Standard Residential Finishes, Durable, Cleanable, Static free

3.7.5 DOORS/EXITS

.I Exits shall be located in protected areas where blowing snow cannot build up to impede the opening of exit doors during an emergency condition.

.2 Consideration must also be given to avoid infiltration of blowing snow.

.3 Exit Doors

- .1 Exterior exit doors to be insulated with full weather stripping, using high performance insulated glass panels for sidelights or where glazing is required.
- .2 All hinges on exterior doors will be security hinges with non-removable pins pinned and with a security stud that locks the hinge plates together when the door is closed.

.4 Laboratory Doors

- .1 Characteristics
  - .1 Durable, Cleanable, Washable, Paintable, with metal frames
  - .2 Comply with NFPA for doors in laboratories.

.5 Hardware

- .1 Prepare hardware based on operational, health and safety, code requirements and DHI best practices.
- .2 Provide door hardware complying with ANSI/BHMA standards of heavy duty institutional grade I rating, corrosion resistant.

3.8 STRUCTURAL REQUIREMENTS

3.8.1 SUPER STRUCTURE

.1 A typical steel frame structure will likely be the basis for the building(s).

.2 Where applicable the structure could be exposed to reinforce the relationship between the buildings and practical nature of research.

.3 Some areas, such as main entry lobbies, conference areas, and common hallways, may also benefit from the juxtaposition of wood and concrete structural elements.

3.8.2 SUBSTRUCTURE

.1 Due to the variety of terrain and station functions, the building(s) could incorporate a number of foundation systems, including pilings for structures elevated above the permafrost and thermosyphons for large concrete slabs at grade.

.2 The level of building rigidity and stiffness will depend on the functions within the building.

- .1 While the lab and research areas will require a high floor stiffness level to support the operation of sensitive equipment such as optical microscopes to 1000X, the other areas will not have to be designed to the same standards.
- .2 In order to forecast future research work, at least one lab module should be designed to even higher vibration resistance levels.
- .3 This may require independent foundations possibly located on bedrock.

.3 All large, fixed equipment areas should be located so that minimum structural or building alterations are required in order to replace the equipment.

.4 Design for use of ad-freeze piles or concrete slab-on-grade with thermosyphons must consider potential issues relating to climate change-induced permafrost instability.

3.9 MECHANICAL REQUIREMENTS

3.9.1 MECHANICAL CHALLENGES

.1 The preference for mechanical design is to preference capital spending as a means of reducing downstream operations & maintenance costs. Systems shall be determined by life cycle cost analysis.

.2 Methods to improve efficiency and comfort are a cost-effective way of increasing productivity and reducing fuel consumption.

- .1 The HVAC systems of CHARS must be part of an integrated holistic design.
  - .1 As noted in Labs21 Environmental Performance Criteria (EPC), these systems are integral to the efficient operation of a building.
  - .2 Failure to properly size and place HVAC equipment will result in excess fuel use, user discomfort, and premature wear.

.3 A preliminary report by FSC Architects & Engineers, entitled *Mechanical & Electrical Supplementary Program Information – High Arctic Research Station*, recommends a decoupled air/water system using a discrete heating plant and traditional ventilation.

- .1 Heat recovery measures must be employed to reduce heating requirements.
- .2 Generally in the North, heat is provided through oil-fired burners

.1 Electric heating through resistive heaters is not recommended due to the high cost of electricity.

.3 Furthermore, biomass is not commercially available in the High Arctic.

.1 However, in other Northern facilities such as the North Slave Correctional Facility, wood-pellet boilers for heating have been very successful.

.2 The main issue with this option is supply chain management and logistics.

.4 Free cooling, solar shading and operable windows might be sufficient to maintain user comfort during the summer for areas other than labs.

.1 However, CHARS will contain a high amount of heat-generating process loads, such as computers, other electronic and lab equipment, and freezers.

.2 Efforts should be made to cool these loads passively when required, and utilize heat recovery.

.3 Waste heat could also be utilized for domestic hot water, process heat, or space heating.

.5 Demand control ventilation is common in the Arctic and is a good way for CHARS to ensure energy efficiency and user comfort.

.1 There will likely be a wide range in occupancy, particularly on an hourly and seasonal basis, and so it is important to adjust ventilation requirements accordingly. CO_2 sensors combined with a set seasonal schedule could be used for this purpose.

.6 A digital control network for building mechanical systems will ensure high system reliability and energy efficiency.

.1 These systems have become quite common, even in the High Arctic, and should be incorporated into CHARS.

.1 The system should be simple enough for proper operation by maintenance staff, with a minimum of training.

.2 Real-time monitoring of building and system performance will help to optimize the mechanical systems of the facility.

.3 Critical safety systems will be alarmed to notify users and building operators of potential hazards and conditions that require attention.

.4 Controls system will provide monitoring and control via a dedicated Operator Work Station located in the Mechanical Room.

.7 Training to be provided by the General Contractor to all building operation and maintenance staff.

.8 Fuel, lab gases, and the storage of all consumables must be designed to accommodate the remote site conditions.

3.9.2 General Goals

.I Achieve:

.1 Safety through directional airflow, dilution and source control of contaminants with fail-safe systems.

.2 Occupant comfort by providing space conditions according to referenced Standards,

.3 Regulatory compliance by meeting or exceeding all reference Standards,

.4 Protection of the research program by maintaining required space conditions and directional airflows with reliable systems.

.5 Value through optimum balance of capital expenditure and operating expenses. Flexibility of systems by providing redundancy and excess capacity, as required for a northern isolated community.

3.9.3 Fire Protection Systems

.1 Passive and active fire suppression systems are critical as piped water service may not be available at CHARS and fire fighting services are limited.

- .1 Passive systems include fire stopping measures, fire dampers, and non-combustible materials and finishes.
- .2 Active measures include hand held fire extinguishers, tank-supplied sprinkler system, and proper ventilation systems.
- .3 The incorporation of a sprinkler system will require construction of a substantial cistern for holding the system water supply.
- .4 This cistern will require easy exterior filling stations as well as hatches for inspection, cleaning and general maintenance.
- .5 Water supplies for fire protection must conform to the Labour Canada Standard FC-403 – Chapter 8, Water Supplies.

.2 The system will require water pressurization through mechanical pumping, which must be connected to an emergency power system.

.3 Laboratory Fire Protection systems shall be designed according to National Fire and Building Codes, Chapter 3 of Fire Protection Services of Treasury Board of Canada Secretariat and Labour Code of Canada.

.4 Fire detection and alarm systems shall not be interlocked to automatically shut down laboratory hood exhaust fans.

.5 Suitable multi-purpose portable fire extinguishers of a size easily handled by laboratory workers and to be easily accessible wherever flammable materials are used or stored.

.6 The fire protection installation shall meet seismic code requirements.

3.9.4 Plumbing & Water Services

.1 Cambridge Bay is dependent on trucked freshwater services supplied from a lake just outside the community. Although the hardness increases in the winter, the water is suitable for human consumption. The water is chlorinated with no further treatment by the purveyor.

.2 CHARS freshwater will likely come from the same source as the community. Depending on the location of the Station, water could be either piped or delivered by truck.

.3 Other research water systems, such as saltwater from the sea, will likely be plumbed from the neighbouring inlet and either delivered directly to the Station or trucked.

.4 Small desalination / water treatment plants are technically, financially and maintenance intensive and may not be feasible.

.5 There will be a need for freshwater storage to supply the operational needs of the Station and for the fire protection system.

- .1 Typically in Arctic communities, water is stored in large tanks within a building crawlspace or as an insulated tank sitting on the ground outside of the building.
- .2 The quantity of water required to meet the station demands will challenge the station designers to incorporate large cisterns within the station building structure.
- .3 Stagnation of water in a large cistern is a concern. There must be a strategy to economically maintain high quality potable water supply for the facility.
- .4 The volumes of water required for fire protection represent a potential for use as a thermal reservoir. The feasibility of using this water as thermal storage for waste heat or solar thermal energy could be explored, although this must be balanced against safety and code compliance considerations.

.6 Every effort should be made to reduce water consumption at the facility, especially in light of potentially limited water infrastructure in Cambridge Bay.

.1 Easily implemented measures to reduce water use include low-flow showers and faucets with automatic shut-off, low-flow toilets utilizing grey-water re-use, waterless urinals, and composting toilets.

.2 Solar domestic hot water heating should be considered.

.7 There are limited requirements for storm water systems and roof drainage due to low precipitation levels; similarly, storm water harvesting is limited.

3.9.5 SEWAGE

.1 Sewage treatment is a significant environmental challenge faced by all Arctic communities.

.1 Most communities simply dump sewage into ponds on the tundra with no treatment before collection or after dumping.

.2 These ponds remain on the landscape and, with climate change and melting permafrost, may pose future problems if waste migrates into adjacent watercourses.

.2 Sewage handling for the Station will be particularly challenging as it may include chemicals and substances which should not be released into a normal Arctic sewage lagoon.

.1 Station sewage also provides an opportunity for innovation in disposal methods and other uses such as waste heat or methane harvesting.

.3 Presently, Cambridge Bay pumps sewage out by truck and hauls it to lagoons, located on the tundra outside the community.

.1 In light of the commitment to sustainable development, measures should be undertaken to, at a minimum, reduce the amount of sewage outputs from the Station.

.2 Separation and containment of laboratory chemicals from the main sewage stream is critical at CHARS to avoid environmental damage.

.3 Furthermore, sewage costs can be reduced by using double drain systems in laboratories, grey water reuse, and possible on-site sewage treatment solutions such as the Waterloo Bio-Filter.

.4 The treatment of sewage also offers interaction possibilities with the private sectors involved in mining and exploration and since Cambridge Bay is located adjacent to the Arctic resource exploration and development areas, technology development and testing of small scale waste water treatment systems may benefit CHARS, the private sector as well as the broader list of Arctic communities.

3.9.6 PLUMBING REQUIREMENTS FOR LABORATORIES

.1 Introduction:

.1 Laboratory zones shall be provided with water services, piped independently of non-laboratory spaces. The laboratory water systems shall be isolated from the remainder of the building with reduced pressure backflow prevention devices.

.2 Plumbing installation shall be as per National Plumbing Code of Canada.

.3 System diversity factors shall be considered for the respective systems and these diversity factors must be substantiated with calculations, observation and survey from the users for the peak demand.

.4 Future expansion shall be considered in the sizing of equipment and distribution systems.

.2 Design Principle:

.1 The design of the plumbing systems in the Section shall be based on a modular layout.

.2 Distribution shall consist of vertical risers located in chases, horizontal mains, and individual room runouts to accommodate the architectural layout and achieve repetitive and standardized grid arrangement of risers, mains, branches, and runouts.

.3 The primary goal for vertical distribution is to minimize floor penetrations in lab areas.

.4 Ideally, piped services, except waste and vent systems, should be distributed in a double-ended horizontal loop that may be sectionalized for alternations and repair.

.5 Size piping on acceptable diversity factors, minimum and maximum velocity limitations, minimizing pressure drops, and future expansion requirements.

.6 Piping and valve arrangements shall allow easy shutdown of individual laboratories, floors, and zones of the system without affecting adjacent areas for modifications and maintenance to systems.

.7 All equipment that must be serviced, operated, or maintained should be located in fully accessible positions or through access doors

.8 Backflow preventers shall be installed to protect domestic potable water systems from industrial non-potable systems and miscellaneous equipment.

.9 Pipe sleeves should be provided and extend at least 50 mm above the floor and 25 mm below the floor and should include a built-in water stop and appropriate seal and be fire/smoke stopped, if floor penetration is unavoidable.

.3 Plumbing fixtures and controls:

.1 Consideration should be given for water conserving fixtures to reduce impact on potable water consumption.

.2 Provide emergency power for those faucets operating on an automation control principle.

.3 High quality commercial grade plumbing fixtures will be provided. Laboratory sinks will be 316 stainless steel and equipped with heavy duty brass designed specifically for laboratory applications.

.4 Laboratory Potable Water:

.1 The laboratory potable water connection is to be connected to the water distribution system downstream of the main building domestic water service backflow preventer, to eliminate any potential backflow to the incoming supply.

.2 Adequate pressure is needed.

.1 Water booster pump systems shall be of not less than triplex design.

.2 A minimum flowing (residual) water pressure of 276 kPa at the hydraulically remote fixture or equipment shall be provided.

.3 Booster pump system shall be sized to provide for both minimum flow requirements and maximum peak flow, with at least one redundant pump on standby.

.4 All pumps shall alternate in lead-lag sequence and include a pump exerciser function and all controls and alarms.

.5 Minimum supply pressure is critical to proper fixture and equipment operation.

.6 It also minimizes the potential for a backflow condition.

.5 Laboratory Process Water:

.1 A separate laboratory process water piping system shall be provided for the laboratory equipment and processes.

.1 Back flow preventers shall be provided and installed to separate the process water from the laboratory potable water system.

.6 Laboratory Water System:

.1 If economically feasible, the laboratory water system shall be a centralized system with duplex circulation distribution pumps capable of producing ISO 3696 Type II quality water system at the most remote point-of-use.

- .2 It consists of packaged central generation unit complete with pre-filter, reverse osmosis membranes, 950 litres storage tank, distribution pumps, and distribution loop, after-filter and UV lamp, vents, overflow, conductivity meter, high level alarm and automatic fill.
- .3 The purified water system should include a clean distribution loop using thermoplastic piping that is compatible with the water quality without compromising it quality at the point of use.

.7 Emergency Showers and Eyewash:

- .1 The number and location to be determined based on detailed functional requirements, and installation as mandated by Code and ANSI Standard Z358.1-2004.
- .2 Emergency eyewash and emergency shower fixtures shall be connected to building potable water system.
- .3 Steps must be taken to prevent the stagnation of the systems that can occur from infrequent use.
- .4 Piping loop shall be arranged to minimize the length of dead legs to individual fixtures.
- .5 Piping loop shall be constructed only of copper materials.
- .6 Emergency showers minimum water volume of spray shall be 75.7 litres/min. Water supply valve shall be activated in less than 1 second and remains operational uninterrupted without any change of water flow rate.
- .7 Eyewash stations shall deliver water to both eyes simultaneously at a water flow rate of not less than 1.5 litres for 15 minutes and water flow velocity shall be low enough not to injure the eyes.
- .8 All eyewash and emergency shower water supply temperature shall be tempered with ULC approved and to be tamper-resistant temperature adjustment control water valves to provide a nominal temperature of 21°C for eyewashes and safety showers.
  - .1 Temperature gauges shall be installed for both the hot- and cold-water intake piping.
- .9 Water flow devices shall be complete with emergency equipment to ensure smooth and low velocity flow from the heads.

.8 Piping Materials:

- .1 Materials must be compatible with the respective media conveyed and shall meet the National Fire Code of Canada and local and National Building Codes.

.9 Floor Flooding:

- .1 Floor penetrations shall be avoided wherever possible, to prevent water damage to floor below.
  - .1 For those situations where floor penetrations are unavoidable, sleeves and watertight seals and caulking shall be provided.

.10 Plumbing Drainage:

- .1 Each fixture shall be individually trapped and vented.
- .2 Laboratory drainage and vent system shall be separate from all other systems until the effluent is adequately treated before combining with the rest of the building drainage systems.

.11 Laboratory Vacuum System:

- .1 A central vacuum system shall be provided and installed.
- .2 It shall consist of two or more vacuum pumps and a receiver and system to be sized for 100% of the system peak load to remain upon failure of any one pump, controls and instrumentation for operation and maintenance.
- .3 All pumps shall alternate in the lead-lag sequence and include a pump exerciser function.
- .4 Pumps should be single-stage, fully re-circulating, liquid ring type. A float or level switch shall be provided to limit seal water makeup to only the flow actually required.

.5 A single stage rotary-vane type may also be used, but shall include a post-cycle purge and be constructed of materials suitable for laboratory chemicals.

.6 Exhaust from vacuum systems should be discharged outdoors and remote from air intakes or other openings in the building, and be protected from entry of insects or debris.

.7 Drip pockets are also required at the foot of exhaust risers.

.8 Vacuum systems are to be protected with appropriate filtration to minimize potential contamination of vacuum pumps.

.9 For radioactive, biological, and toxic chemicals, dedicated local filters are to be located as close as possible to the laboratory in order to minimize potential contamination of vacuum lines.

.10 Some mechanism for decontamination of filters shall be incorporated in the design of the vacuum system to minimize the disruption of the whole system.

.11 Receiver to have automatic drain traps to remove moisture.

.12 System shall be capable of maintaining a vacuum of 6561 kg/m^2 of mercury at the inlet terminal farthest from the central vacuum source.

.13 Vacuum system to be selected for an operational range of 7587 to 8287 kg/m^2.

.14 Each vacuum inlet to be sized for 0.235 standard L/s.

.12 Laboratory Compressed Air System:

.1 The laboratory compressed air system shall be capable of 100% redundancy to meet the demand with one compressor is out of operation.

.1 It will feed a distribution loop for the respective spaces and the local nitrogen generator.

.2 The laboratory compressed air system will provide 100% oil-free air according to ISO 8573.1 Class 0 for laboratory air.

.3 The system will consist of single package of heavy duty, water or air-cooled, two-stage, oil-free rotary tooth air compressor complete with 100% oil-free compressor elements and integrated refrigeration dryer.

.4 Package supplied built-in coolers, moisture separators, no loss auto-drain to save energy, full load/no load controls for energy efficient regulations and energy savings, control system and panel, filters, line pressure regulator and epoxy coated air receiver.

.5 The compressed air distribution piping shall be medical-grade copper piping with valves at the points-of-use and on main branches for isolation for maintenance.

3.9.7 HVAC Systems

.1 Design Conditions

.1 Outdoor Design Conditions

.1 The laboratory ventilation systems, which employ 100% outdoor air, shall have adequate capacity to meet the design conditions.

.2 For other spaces, refer to ASHRAE Handbook of Fundamentals and relevant Standards.

.2 Indoor Design Condition of Laboratories

.1 Except as indicated, all laboratories shall be maintained at the conditions as shown below at all times, regardless of occupied or unoccupied modes.

.2 Summer temperature: 21°C +/- 2°C and RH %: 30 +/- 5

.3 Winter temperature: 23°C +/- 2°C and RH %: 30 +/- 5

.4 Background sound levels to conform to ASHRAE Applications Handbook.

.2 Thermal Comfort

.1 Design for human thermal comfort conditions to meet all requirements of ASHRAE 55.

.2 A separate HVAC zone shall be provided for each unique thermal zone.

.3 Each laboratory suite shall have a separate HVAC zone.

.3 Central Systems

.1 Systems shall be centralized to facilitate ease of maintenance.

.2 Adequate redundancy of the heat source, suitable for a remote northern climate, shall be provided.

.3 HVAC system main handling units shall be 100% outdoor air and to be filtered at a minimum to meet;

.1 MERV 6 pre-filtration to ASHRAE 52.2

.2 MERV 13 final filtration to ASHRAE 52.2

.3 Extended surface area filters shall be considered for lower pressure drops and longer service life.

.4 Filtration systems will need to accommodate very fine dust in the summer and 'talc' snow in the winter.

.4 The main air-handling units and their associated heating and cooling coils shall be capable of meeting the current design conditions and shall have adequate 20% standby capacity of the current design conditions to meet the needs of the future ventilation, heating and cooling loads.

.1 Standby capacity means the excess ventilation, heating and cooling capacities installed to the ventilation, heating and cooling main air-handling units to meet the ventilation, heating and cooling loads.

.5 Normal occupied mode and unoccupied mode are the control strategies.

.1 Occupied mode is when the fume hood(s) running with a face velocity of 0.5 m/s and unoccupied mode is when the fume hood(s) face velocity at 0.25 m/s.

.2 Regardless of the mode of operation, the space temperature, minimum number of air changes and equipment make-up air requirements must be maintained.

.3 Minimum number of air changes for laboratories shall be determined in consultation with the User Group.

.4 Access to Mechanical Equipment and Components

.1 Provide space around all equipment as recommended by the manufacturers to facilitate routine maintenance without undue difficulties.

.2 Access to elevated major equipment, such as cooling towers, air handling units, boilers, chillers, large pumps, compressors and others, must be by means compliant with the Canada Labour Code.

.5 Wet and Dry Laboratories

.1 Laboratory ventilation systems shall be arranged such that failure of the supply system will not compromise safety of the occupants or cause damage to the building envelope. Adequate make-up air must be provided to the building at all times to ensure proper operation of hoods and exhaust systems. Control strategies are to be provided to reduce air flows under failure scenarios while still maintaining safety.

.2 Systems shall be arranged such that ventilation/make-up air is delivered directly to each laboratory space.

.1 Fume hoods are a driving factor of air exchange rates.

.2 Systems shall be designed to supply 100% outside air at all times.

.3 The minimum air change rate to be maintained at all times will be determined in consultation with the User Group.

.3 Fume hood locations shall be as per recommendations from CSA Z316.5-94, Fume Hoods and Associated Exhaust Systems and as per MD 15128.

.4 Air distribution to laboratory spaces shall be such that unwanted air currents or drafts are eliminated.
  .1 Air distribution shall be designed to avoid noticeable air currents at lab benches and shall be such that the operation of fume hoods is not impacted.
  .2 Design shall employ laminar or radial flow diffusers.
.5 Airflow will provide the directional flow of air from areas of least contamination to those of greatest contamination.
.6 Directional air flow shall be based on the principle that there is more exhaust airflow rate than the supply airflow rate within the same laboratory space.
  .1 Interlock the total supply and exhaust to maintain a minimum and constant airflow offset.
.7 When exhaust fans are mounted on the same plenum, fan isolation and bypass dampers shall be of high quality and of industry grade to ensure the damper leakage rate shall be minimized and their integrity shall be maintained for the duration of the facility.
.8 Dedicated localized exhaust system in the forms of canopies, snorkels, enclosures, slot hoods, and others to capture the airborne contaminants from equipment and process.
  .1 Interlocks are to be provided for the localized exhaust devices with the external exhaust fans.
.9 Provide dedicated exhaust and supply air systems for chemical storage rooms as per NFPA 30 and National Fire Code of Canada.
  .1 Monitoring alarms shall be provided to the central building automation system to indicate the failure of the exhaust systems.
.10 Flammable storage cabinets, if vented, shall be in compliance of NFPA 30.
.11 Toxic material storage cabinets, when used to store highly toxic materials, shall be vented with a dedicated exhaust system.
.12 Storage of toxic and highly toxic compressed gas cylinders shall be within exhaust-ventilated gas storage cabinets or exhausted enclosures.
.13 Exhaust air ductwork shall be in compliance with SMACNA and shall be stainless steel.

.6 Acoustic Requirements and Vibration Control
.1 Vibration and noise isolations and controls for all mechanical systems shall be recommended by an agent, who is specialized in this field.
.2 Mechanical vibration and its induced noise potentially interfere with the proper operation of the laboratory equipment and instrumentation.
.3 Use of vibration and shock isolators to reduce magnitude of the force transmitted to supports for equipment.
  .1 All equipment mounted on vibration isolators shall be provided with seismic restraints capable of resisting the horizontal force as per the local regulations and codes.
.4 Design criteria for human comfort and equipment vibration shall be as per 2011 ASHRAE Handbook HVAC Applications.
.5 Noise levels within the laboratory shall be minimized.
  .1 This can be achieved by the proper selection of diffuser, the number of diffusers and the corresponding flow rates, together with the avoidance of cross talk arrangement.
.6 For the modular laboratory the acceptable criteria in midpoint of room shall be in the range of 45 – 55 RC as per ARI 885-90 with fume hood or fume hoods running and sash or sashes opened halfway.
.7 Refer to ASHRAE Handbooks for other acceptable criteria for other spaces.

.8 Internal ductwork acoustic insulation is not acceptable for both the supply and exhaust system.

.7 Fume Hoods

.1 Fumehood shall be designed and constructed in accordance with UL18105, CAN/CSA standard C22.2, ANSI-Z9.5, SEFA.

.2 Fume hood performance and testing shall meet the minimum requirements of the PWGSC document MD 15128, Minimum Guidelines for Laboratory Fume Hoods.

.3 Performance tests shall be conducted by the manufacturer and to be verified by an independent agent.

.4 All fume hoods are to be complete with digital displays of the face velocities, together with alarms, set point resets for occupied and unoccupied face velocities, silencer switches, and testers.

.1 All alarms shall be connected to central building computerized monitoring system.

.8 Office and Administration and Other Spaces

.1 Office and administrative areas will be provided with heating and cooling to maintain the required conditions.

.1 Ventilation will be provided to meet the requirements of the NBC and Canada Labour Code.

.2 Systems shall be selected and designed on the basis of best value and life cycle cost. Sustainable and emerging technologies shall be considered and implemented where viable.

.1 The design shall consider the use of operable windows.

.9 Hazardous Gas Systems

.1 A hazardous gas is a gas that is compressed or liquefied with an NFPA 704 rating of Health 3 or 5, or Instability of 3 or 4.

.1 A gas detection system shall be installed to detect, alarm and monitor its presence.

.2 The gas detection shall be equipped with an uninterruptible power supply and with audible and visual alarms both locally and near the potential release point where the gas is located or stored.

.3 Alarms shall also be monitored remotely from the centrally monitored station.

.4 Detection system shall be capable of detecting concentrations at or below ½ of the permissible exposure limits and/or threshold limit value.

3.9.8 Heating and Cooling

.1 Heating and cooling capability shall be provided at each air handling unit to condition supply air before it enters the space, as appropriate to each system or zone.

.2 The laboratory area shall be served by a separate air handling unit.

.3 Heating shall be provided as required to offset envelope losses, maintain space temperature and humidity control and address comfort by controlling drafts and radiant effects at the building perimeter.

.1 For non-laboratory spaces, systems shall be designed to maintain winter design temperatures during the unoccupied season without the use of the air handling systems.

.4 Occupied spaces must be provided with minimum 25 % RH. Building envelope must be designed to accommodate.

.5 High efficiency heating and cooling sources shall be employed.

3.9.9 Air Intakes and Exhausts

.1 Design shall meet requirements as outlined in ASHRAE 62.1 Section 5.

.2 Fume Dispersion Modeling

.1 All fume exhaust systems (fume hoods, chemical storages, loading and receiving docks, emergency generators, kitchen, garage and other exhaust systems) and their exit velocities and air intake locations shall be determined by wind tunnel modeling.

.1 Through the evaluation of exhaust and intake location, stack height and stack exit velocity, the minimum exhaust ventilation rates required to maintain acceptable air quality levels at the air intakes and other receptors will be determined.

.2 Modelling of snow accumulations shall also be provided.

.2 Dispersion modeling shall be done by a firm which specialize in this area and have more than 10 years experiences in wind tunnel modeling.

.3 Exhaust Systems

.1 The laboratory shall have its own dedicated exhaust air units.

.2 Design for high plume, high dilution.

.3 In addition to meeting the current design demand loads, the main exhaust systems shall be designed and selected to provide a standby capacity of 20% of the current design demands to meet future needs.

.4 Exhaust systems serving hood shall be arranged to permit use of variable volume hoods as well as high performance, low volume hoods. Design for adequate redundancy to ensure that failure does not compromise safety.

.5 To provide flexibility, maintainability, and redundancy, a separate central manifold exhaust air system shall be dedicated for fume hoods and other local exhaust.

.1 Another separate central manifolded system exhaust system will be dedicated for the laboratory general exhaust and the supporting areas.

.2 Each centralized manifolded exhaust system shall consist of at least three exhaust fans.

.3 Each system shall operate in such a manner that two fans shall be in operation for occupied mode to meet the design flow rate and one fan in operation for unoccupied mode, while the third fan is used as backup fan to be ready to run when failure happens to either other two.

3.9.10 Building Automation Systems

.1 Controls and operator interfaces will be kept as simple as practical for high reliability and ease of operation and maintenance.

.2 The building automation system shall be a direct digital control (DDC) system.

.1 It shall be capable of control, monitor, log, alarm, graphic interact, of all the control elements to maintain the indoor environmental conditions, pressure differential, equipment conditions, status report to meet current needs and shall have enough built-in capacity (5 analog inputs and 5 digital inputs and 5 analog outputs and 5 digital outputs) in each current panel for future expansion.

.3 The control system shall consist of a number of stand-alone programmable control panels connected to a common network in order to allow sharing of specific data and information.

.1 All control points and control logic (PID) software for each laboratory module shall reside in the same panel for speed of response and coordination.

.2 The control system shall have the capacity to communicate with other DDC systems (BACnet or other communication standards as required).

.4 All sensing elements, outputs and actuators shall be of electronic. Pneumatic systems are allowed.

.5 The network type configuration shall allow a maintenance operator to supervise and/or control all points connected to any control panel from a single location.

.6 Control schematics with dynamic interactive input and output data shall be shown graphically on computer workstations.
  .1 There shall be an operator workstation at each site.
  .2 Each workstation shall consist of 500mm horizontal panel monitor, colour printer, 40 GB hard drive, CD/DVD read and writer.
.7 The pressurization of each area is to be maintained by using an air flow tracking control strategy.
.8 The temperature level in each room is individually controlled. The temperature is maintained to its set point.

3.10 ELECTRICAL REQUIREMENTS

3.10.1 Electrical Challenges

.1 Cambridge Bay, like all Nunavut communities, is not part of a larger electrical grid; consequently, there may be more issues with power quality and reliability than are found in central-grid locations.
  .1 To comply with code requirements, as well as meet the needs of some precision research equipment requiring high quality, uninterrupted power, CHARS will need to be outfitted with proper emergency power supplies and regulators.
.2 The Consultant, working with project stakeholders, shall conduct a study of options to determine the most effective, efficient and economical means of providing clean, reliable power to meet operational and other specific needs of CHARS.
  .1 The study should explore the possibility of implementing creative and innovative strategies such as development of on-site power generation or upgrades to existing community infrastructure (undertaken to augment CHARS' operations).
.3 An option analysis to determine technical feasibility and economic viability is recommended for the following systems before the design of the project:
  .1 Cogeneration/ three generation multi-unit system providing power, heat, cooling, and other specific power needs of the site.
  .2 Use of electrical power from existing utilities.
  .3 Combination of both options noted above.
  .4 Alternate energy systems.
  .5 Centralized UPS versus localized UPS system.
.4 The outcomes of the studies / option analysis may have impacts on the project's electrical, mechanical, structural and architectural systems.
.5 Electrical services tend to be supplied by overhead distribution lines from existing utilities.
  .1 As a research facility with significant power requirements, CHARS will likely require augmentation to the local utilities.
  .2 This can take the form of either on-site power generation or upgrades to the community infrastructure.
  .3 The use of alternate energy sources, such as wind or solar, may be applicable for supplying additional electrical power to both the station and the community.
    .1 Alternative energy initiatives to be proposed for CHARS must account for operational challenges emanating from the Arctic location.
  .4 These alternate energy sources must be carefully integrated to ensure grid stability is not compromised.
  .5 Training will be required for the operation and maintenance of novel energy technologies installed on the project.
.6 There is a preference in many Nunavut communities for 208V power supply (not 220V), due to the lack of trained electrical workers with experience in higher voltages.

   .1 This reinforces the need for CHARS to have trained in-house electrical staff to maintain research and industrial equipment that has higher or non-standard power requirements.
   .2 This may represent a good training opportunity for the local labour pool.
   .3 It is also important to have the electrical services to research and technology areas organized so that changes and future fit-ups accommodate non-standard equipment electrical needs.

.7 Confirmation will be required regarding the availability of power from the local power utility in Cambridge Bay. Generators may have to be provided with sufficient capacity to supplement the needs of the facility and ensure continuous operation during peak demand times.
   .1 It may be desirable to have an independent diesel generator, capable of supplying power for CHARS directly, for research into power systems.

.8 The power corporation will have to be consulted in the event that energy-generating resources at CHARS feed in to the community grid.
   .1 Issues to be resolved include, but may not be limited to, the feed-in rate/credit and consideration for grid stability/power quality.

.9 There should be some form of real-time feedback of energy consumption at the Station. This could be for individual spaces and/or at the lobby and could take the form of a display panel or interesting architectural element.
   .1 The intent is to encourage users to conserve energy, e.g. by turning off lights, and also to educate users and visitors and showcase energy use at the Station.
   .2 To ensure users can see the effect of their own actions, it may be necessary to show the power consumption of individual spaces rather than the whole Station.
      .1 For example, individual lab areas could be 'sub-metered', such that closing fume hood sashes, powering down equipment, etc., has an obvious effect on the power demand of that space.

3.10.2 Power

.1 Provide new normal and emergency power distribution systems to service all facilities.
   .1 Power supply in laboratory spaces shall be supplied using a modular wire mould system.

.2 Detailed design will determine the scale of power requirements, including spare capacity for future growth.

.3 Emergency Power and Distribution
   .1 Provide diesel powered emergency generator complete with Automatic Transfer Switch conforming to CSA-282-05, for required interruptible power to essential equipment and services in the building.

.4 Uninterruptible Power Supply
   .1 UPS systems are mandatory for certain research requirements, as well as for emergency lighting and firefighting equipment such as fire pumps and alarms. Surge suppression is also necessary for sensitive equipment.
   .2 Provide a UPS system to accommodate equipment requirements, complete with new batteries, racks, annunciator panels and all related equipment to provide power to essential systems including, but not limited to, specialized lab equipment, CCTV/IP cameras, access control systems, and critical ventilation systems. Indentify the load to be provided for client's operational needs.
   .3 The UPS system is to be expandable with new modules for future growth requirements.

3.10.3 Main Electrical and Distribution, Power and Control Wiring

.1 Distribution system shall be equipped with transient voltage surge suppression (TVSS) units with the proper overcurrent protection device (OCPD).

.2 Where practical, provide additional empty conduits extending to ceiling spaces from recessed panelboards to accommodate the panel circuit capacity for future use.

.3 All wires to be copper.

3.10.4 Coordination Study

.1 Provide Coordination Study, Short Circuit Study and Arc Flash Study.

3.10.5 Grounding and Lightening Protection System

.1 Provide lightening protection system in accordance with NFPA780.

.2 Provide proper grounding protection system including, but not limited to, electrodes, conductors, connectors, and accessories as required and in accordance with applicable reference standards and code.

.3 Soil type and environment condition shall be considered to provide proper grounding protection. Provide grounding connections to typical equipment including, but not necessarily limited, lighting fixtures, ballasts and controls, conduits, switches, supports of the light fixtures, service equipment, transformers, distribution panels, duct system, frames and motors, motor control centers, starters, building steel work, generator, and outdoor lighting.

3.10.6 Lighting

.1 Lighting systems will be designed as an energy efficient, quality artificial lighting system satisfying aesthetic, safety, security and operational requirements at a minimal life-cycle cost determined through a cost analysis of capital cost and ongoing operating and maintenance costs.

  .1 This analysis should take into account the impacts of heat gain on space conditioning loads, and the physiological and psychological impacts of different lighting options, with consideration for 24-hour darkness.

.2 Illumination levels will be in conformance with IES, PWGSC and Labour Canada, except where AANDC has specific illumination level requirements.

.3 Manual control may consist of line switches, low voltage switches, time switches, photo-controls and contactors and other switches.

.4 Utilize direct or direct-indirect fluorescent luminaries with pure virgin acrylic lenses, or parabolic louvers.

.5 Occupancy sensors and/or centralized scheduling should be utilized to reduce energy usage.

.6 Manual control may consist of line switches, low voltage switches, time switches, photo-controls and contactors and other switches.

.7 LED outdoor lighting complete with built in photocell is to be considered as an energy saving option.

.8 Areas monitored by CCTV/IP equipment should be illuminated adequately.

.9 An emergency lighting system with light units will be provided in the following locations:

  .1 Locations required by the National Building Code and FCC standard No. 501;

  .2 Emergency generator rooms - one lamp directed on the generator and one lamp directed on the generator control panel;

  .3 Rooms containing primary and secondary distribution switchgear and unit substations - lamps directed on switchgear and instruments;

  .4 Electrical panel rooms containing branch circuit panel boards, dry type transformers, etc - lamp directed on the electrical equipment

.10 Emergency lighting could consist of centralized inverter, individual battery banks, or fluorescent fixtures with integral emergency lighting ballasts. Illumination levels of emergency lighting system will be in accordance with the National building Code.

.11 Provide a new exit lighting system throughout the building.
 .1 All exit lights are to conform to CSA C860-01.
 .2 Exit signs should be in English, French, Inuktitut, and Inuinnaqtun.

3.10.7 Fire Alarm System

.1 Provide fire alarm system with an addressable building fire alarm system in accordance with the National Building Code and Treasury Board Fire Protection Standards.
.2 The fire alarm system power supply equipment, including all power sources, shall
.3 be capable of performing its intended function at any supply voltage between 85% and 110% of the rated voltage
.4 System is to be designed and installed to CAN/ULC S524-06 and verified to CAN/ULC S537-04.
.5 Inspection and Testing of the completed system, is to be as per CAN/ULC 536-.

3.10.8 Telecommunications and Information Technologies

.1 Telecommunications is critical to CHARS' function as a world-class research facility. In addition to research requirements, it is expected that that the facility will operate year-round, and some of the staff will bring their families.
 .1 Therefore, ensuring adequate personal internet access will be important to attracting and retaining key personnel.
.2 It is important that the telecom requirements are sized properly, as excess capacity could prove extremely expensive; this must be balanced against the need for expansion of capacity if and when the facility grows.
.3 Currently all telecommunications access is provided via satellite.
 .1 CHARS must be able to adapt to future evolution of the northern telecommunications infrastructure, including possible implementation of an underwater fibre optic network or microwave towers.
.4 There are two main service providers in Nunavut, SSi Micro (which runs the QINIQ network) and Northwestel (which runs the NetKaster network). QINIQ is the larger network, connecting 56 communities in the North as well as Ottawa.
.5 A custom solution could require a VSAT satellite dish installed as part of the facility, a spares package ensuring minimal downtime in the event of hardware failure, an on-site support package, and a service agreement with one of the two main service providers.
 .1 The service agreement will enable the facility to purchase a base amount of bandwidth for core operations, with the option to burst at higher speeds as required for special projects or as part of facility expansion.
.6 It is important to establish what constitutes an acceptable capacity for the Station, given budgetary requirements.
 .1 Videoconferencing, for example, requires at least 384 kbps for 'talking heads', with 768 kbps if more movement is involved.
 .2 The Polar Continental Shelf Program (PCSP) recently had an upgrade to their telecommunications package; for commercial use, the facility has 512 kbps with burst speeds of up to 1.5 Mbps.
  .1 However, the end users at PCSP are likely quite different from those at CHARS, who are mainly not transient and are at the facility year-round.
.7 PWGSC compiled a preliminary estimate of CHARS bandwidth requirements. Minimum sizing assumptions include:
 .1 50 to 75 users

.2 Applications involving video conferencing at 384 kbps/user and internet access at 512 kbps / user

.3 Concurrent user activity of 20%

.4 Therefore the bandwidth requirement ranges are:

.1 Low-end: 50 users x 384 kbps x .20 user activity = 3840 kbps total.

.2 High-end: 75 users x 512 kbps x .20 user activity = 7680 kbps total.

.8 These bandwidth requirements do not account for large data transmission requirements and should be confirmed, based on expected science programming and ongoing costs.

.1 Initial estimates of science bandwidth requirements are 1-10 Gbps, to be competitive with 'Southern' institutions on the North American fibre-optic grid.

.9 Provide a new structured fibre optic system complete with new telecommunications rooms throughout the building.

.1 Access to rooms to be controlled with proximity cards

.2 Provide an infrastructure of telecommunications rooms, "closets", and pathways meeting the requirements of TIA-569-B "Commercial Building Standard for Telecommunications Pathways and Spaces".

.3 The system is to be designed in accordance with latest version of all applicable standards.

.4 Investigate zoned conduit system or cable trays for telecommunications pathways.

.5 The structured wiring system shall utilize Category 6 wiring.

.10 The entire facility should have wireless network access.

.11 Government buildings in Cambridge Bay are connected via a fibre optic local area network. CHARS should be part of this network, which should be extended to other buildings that communicate with the Station but are not already on the local area network.

.12 Voice Communications System

.1 Provide a public address (PA) system for the building.

.1 Investigate an integrated telephone/public address system.

.2 Voice Communications System is to be a fully digital bus structure that distributes uncompressed digital audio data from one or many main PA systems to an unlimited number of remote amplifier modules. The system should be able to:

.1 Create zones of PA systems that are completely flexible and independent from speaker runs.

.2 Change the zones any time without rewiring.

.3 Adjust volume for every speaker in the system independently.

.4 Play different audio in any of the zones at the same time.

.5 Know the status of every single speaker.

.6 Provide every zone with individual information in case of an evacuation.

.3 Investigate provision and implementation of an integrated fire alarm voice communication system.

.13 Clock System

.1 Provide a new central clock system throughout the building.

3.10.9 VIDEO SECURITY SYSTEM

.1 Provide a complete video security system for the building in close coordination with AANDC and PWGSC Departmental Representative.

.2 The security system shall:

.1 Be suitable for monitoring the building's exterior and interior spaces as required.

.2 Ensure the safety of staff, scientist, & other personnel, and prevent damage to the building property.

.3 Be Vandal Resistant Fixed Dome Network Camera and Weather Resistant Day-Night Dome Network Camera suitable for outdoor installation.

.4 Be high sensitivity design, 2D/3D , and electronic sensitivity enhancement functionality enable the capture of color images even in low light. If the scene is too dark, the Day/Night Switching feature should be a able to automatically switches from color to B/W while maintaining the correct focus.

.5 Be complete with management software that offers instant visual alarm verification capability.

3.11 CASEWORK AND EQUIPMENT

3.11.1 Lab Casework

.1 Lab casework shall be a modular steel frame system with high quality, durable, heavy duty laboratory type counters, cupboards, shelving, drawers and lab support components such as drip boards, splash guards, etc.

.2 Casework must be capable of supporting heavy loads, easy to maintain and repair and must be provided by a highly reputable company who can provide assurance that replacement parts and components will be available in the future.

3.11.2 Lab Equipment

.1 Fume hoods, autoclaves, glass washers, refrigerators, freezers, etc. shall all be high quality laboratory equipment provided by highly reputable companies who can provide assurance that replacement parts and components will be available in the future.

3.11.3 Kitchen Equipment

.1 Provide high quality commercial kitchen equipment, with stainless steel finish.

APPENDICES

A OVERVIEW OF AANDC'S ROLE IN CHARS

A 1.1 ABORIGINAL AFFAIRS AND NORTHERN DEVELOPMENT CANADA

1. Aboriginal Affairs and Northern Development Canada (AANDC) is the lead department on the Government's Northern Strategy.
   .1 The Department has the federal mandate for fostering northern science and technology.
   .2 AANDC, therefore, was selected as the lead federal department for the CHARS initiative on behalf of the Government of Canada.

.2 AANDC is the client user department on the CHARS project.

.3 Although not typically identified as a science-based department, AANDC has developed significant expertise in the conduct of northern S&T.
   .1 AANDC's Northern Contaminants Program, in particular, has honed an approach to research over its 20 years of operation that engages stakeholders, especially Northerners, to ensure the relevance and applicability of the science while also contributing substantively to international management and regulatory efforts.
   .2 The Department's leadership of Canada's International Polar Year (IPY) activities also will contribute to its capacity to develop the Station, which will be part of Canada's ongoing legacy of its significant investment in polar science during IPY.

.4 The team within AANDC managing the development of the Station has built specific expertise and experience in northern research infrastructure by administering the Arctic Research Infrastructure Fund (ARIF).
   .1 ARIF was an initiative under Canada's Economic Action Plan to upgrade the existing network of research infrastructure across Canada's North.
   .2 The 20 funded projects extended across the whole of Canada's Arctic and range from small cabins that provide shelter in remote field locations to large, sophisticated research stations.
   .3 Lessons learned from these projects were factored into the development of the new Station, including green approaches to building design and operation in the North, the limits and strengths of northern construction capacity and their impact on building costs, and the positive effects of new research infrastructure on the overall northern research enterprise.
   .4 ARIF also helped build strong relationships between the CHARS project team and key players in Canadian Arctic science and technology.

.5 At present, it is anticipated that AANDC will champion the development of the Station from the initial planning stages, through design and construction, and into the operations phase on behalf of the Government of Canada.
   .1 However, AANDC is evaluating governance options for the Station, and the delivery of CHARS could be transferred to another entity in the future, particularly once the S&T program is established.

B PRELIMINARY ACCOMMODATION SURVEY

CHARS Preliminary Accommodation Survey - July, 2012

		PHASE 1a Offsite in Community		PHASE 1b Main Facility		PHASE 2 (Future) NOTIONAL - still in development		
		Total # of spaces	Total m2	Total # of spaces	Total m2	Total # of spaces	Total m2	PHASE 2 - Guidance to designers
A. SCIENCE & TECHNOLOGY SPACE								
1. Wet Labs General	1. Soils & Geology			1	100.0	**Program Expansions - TBD**		15 CHARS staff are currently assigned to these spaces (as well as an office each). This leaves at least 10 spaces (based on a 16.5 m2 per person allocation) to visiting scientists or students or pay-per-use clients (transient or medium to longer-term). The labs are where we expect to see the bulk of partnership opportunities - both domestically and internationally. Some partners may seek only lab space, others are likely to want "suites" for longer term use - labs and offices. International organizations have already contacted us about using the facility. Domestically, we've had conversations about using CHARS as a northern node for southern universities to run courses and do distance learning. Experience from PCSP in Resolute is that their lab space was oversubscribed by transient users (there are no resident staff) in the first year of use. Southern scientists almost have to see the labs in the North to rethink how they will adjust their routines to take advantage of them.
	2. Modular/Flexible			1				
	3. Microbiology and Environmental Toxicology			1				
	4. Teaching Lab @ NAC (ARIF lab)	1	60.1					
	5. E-Health and Exam Rooms @ Health Centre	1	25.0					
2. Wet Labs Dirty and Cold	1. Animals			1	65.0			
	2. Rough lab/Vestibule			1				
	3. Prep Samples - Snow and Ice			1				
3. Wet Labs Clean and Cold	1. Analysis - Snow and Ice			1	25.0			
4. Dry Labs Clean	1. Atmospheric			1	75.0			
	2. Calibration			1				
	3. Radioisotope			1				
5. Dry Labs General	1. Analytic			1	100.0			
	2. Computer / GIS			1				
6. Marine	1. Aquaria			1	50.0			
	Subtotal	2	**85.1**	13	**415.0**		**200.0**	
7. Non-lab science space and Lab Support	1. Greenhouse			1	16.0	1	16.0	Some of these spaces will have to grow in concert with expansion of the lab spaces. The Social sciences workshop/classroom might be an opportunity for partnership for Phase 2 growth depending on domestic and international interest in using CHARS as a base for workshops or conferences.
	2. Growth Chamber			1	16.0	1	16.0	
	3. Chemical Storage			1	16.0			
	4. Gas Storage			1	16.0			
	5. Digital imaging & Microscope Room			1	16.0			
	6. Balance Room			1	10.0			
	7. Diving Facility			1	16.0			
	8. Rock Prep			1	16.0			
	9. Sample Archives			3	48.0			
	10. IT/Telecom/Server Room			1	8.0			
	11. Interview Room			3	36.0	1.0	12.0	
	12. Social Science Workshop/ Classroom			1	40.0			
	13. Display area			1	20.0	1	20.0	
	14. Media Centre/Broadcast Room			1	32.0			
	15. Glass wash, autoclave & storage			1	25.0			
	16. Freezers & Refrigerators			1	30.0	1	20.0	
	17. Liquid nitrogen generating unit			2	20.0			
	18. Science stores			2	32.0			
	19. Traditional knowledge centre			1	25.0			
	Subtotal			25	**438.0**	6	**94.0**	

		PHASE 1a Offsite in Community		PHASE 1b Main Facility		PHASE 2 (Future) NOTIONAL - still in development		
		Total # of spaces	Total m2	Total # of spaces	Total m2	Total # of spaces	Total m2	PHASE 2 - Guidance to designers
8. Technology Centre	1. Mechanical			1	51.0			Currently, 3 staff programmed into these workshops. Partnerships with industry or academic institutions could see these areas grow. CHARS could serve as a base for testing under Arctic conditions.
	2. Electrical			1	32.0			
	Subtotal			2	**83.0**			
9. Library		1	40.0					
10. Logistics	1. Logistics & Operations Office	1	32.0			1	60.0	Equipment storage is key demand from transients. Expansion will depend on pay-per-use income. International partnerships may play here if CHARS becomes a significant hub for international research.
	2. Plug-and-play dock for seatainers			1	10.0			
	3. Small-boat dock(s) - at water	1	20.0					
	4. Equipment and Vessel Storage	1	500.0	1	120.0	1	600.0	
	Subtotal	3	**552.0**	2	**130.0**	2	**660.0**	
11. Field Cabins		3	48.0					
12. Meeting Space	1. Six-person			4	48.0			
	2. Twelve-person			2	44.0	1	22.0	Additional TK meeting room
	3. Multi-purpose Auditorium Conference			1	100.0	1	50.0	Phase 1 can serve as a **DINING AREA** + Future addition. Growth will depend on whether CHARS becomes a destination for meetings and workshops. This will affect how we approach the dining room in Phase 2.
	4. Coffee Break Areas			3	30.0			
	Subtotal			10	**222.0**	2	**72.0**	
13. Office Space	1. One-person			18	144.0	11	88.0	Additional TK office and 10 S&T offices
	2. Two-person			16	160.0	3	30.0	Additional S&T Offices
	3. Four-person			4	60.0	2	30.0	Additional S&T Offices
	4. Modular Offices (up to 20 people)			1	40.0	1	40.0	
	5. Business Incubation (for SMEs - offices, shared meeting rooms, reception)			1	60.0	1	60.0	We will approach CanNor, IRAP, and HRSDC to assess business incubation requirements and partnerships for Phase1 and Phase2.
	Subtotal			40	**464.0**	18	**248.0**	
			725.1		**1752.0**		**1274.0**	

		PHASE 1a Offsite in Community		PHASE 1b Main Facility		PHASE 2 (Future) NOTIONAL - still in development		
		Total # of spaces	Total m2	Total # of spaces	Total m2	Total # of spaces	Total m2	PHASE 2 - Guidance to designers
B. COMMON SPACE								
1. General	1. Entry/Vestibule			1	6.0			
	2. Commercial Space			1	20.0			
	3. Reception Atrium			1	39.0			
	4. Staff Locker Room			1	40.0	1	10.0	
	Subtotal			4	**105.0**	1	**10.0**	
2. Storage	1. General					1	10.0	
	2. Clerical					1	10.0	
	3. Admin			1	15.0			
	4. Photocopy/Printers			1	7.0			
	5. Secure			1	5.0			
	6. Coats / Boots storage			1	15.0			
	Subtotal			4	**42.0**	2	20.0	
3. Recreation	1. Exercise Room					1	60.0	Community based - update an existing space
	2. Entertainment Room							
4. Kitchen	1. Kitchen - includes Dry, cool, cold, perishable storage Pantry			1	110.0	1	50.0	
5. Dining	1. Dining Room/Multipurpose					1	50.0	
	Subtotal			1	**110.0**	3	**160.0**	
			0.0		**257.0**		**170.0**	
C. MECHANICAL & MAINTENANCE SPACE								
1. Offices	1. Maint. Services - Operations Office			1	40.0	1	**20.0**	
2. Mechanical & Electrical Equipment	1. Mechanical Room, includes all below			1	700.0			
	2. Ventilation / HR							
	3. Main Electrical							
	4. Local Electrical							
	5. Water Storage							
	6. Water Recycling							
	7. Fire Protection / Water Storage							
	8. Energy Generation							
	9. Mechanical Areas					1	170.0	
3. Operations & Maintenance Services	1. Composting / Incinerator	1	25.0	1	10.0			
	2. Garbage	1	20.0					
	3. Recycling	1	20.0					
	4. Janitorial Storage			1	16.0			
	5. Maintenance Garage			1	100.0	1	50.0	
	6. Loading/receiving Dock			1	16.0			
	Subtotal	3	**65.0**	5	**842.0**	2	**220.0**	
			65.0		**882.0**		**240.0**	

		PHASE 1a Offsite in Community		PHASE 1b Main Facility		PHASE 2 (Future) NOTIONAL - still in development		
		Total # of spaces	Total m2	Total # of spaces	Total m2	Total # of spaces	Total m2	PHASE 2 - Guidance to designers
D. ACCOMMODATIONS SPACE								
1. Detached Housing	Single Family Dwelling	5	500.0					Build for start up staff, remaining Built by Local Developer
2. Row Housing	Apartments	4	160.0					Build for start up staff, remaining Built by Local Developer
	1. One-Bed Dorms							
	2. Two-Bed Dorms							
	3. Four-Bed Dorms							
	5. Laundry Facility							
	6. Lounge							
	7. Personal Storage							
	Subtotal	9	**660**				480.0	
			660.0		**0.0**		**480.0**	

COMPONENT	Phase 1a	Phase 1b	Phase 2	
S&T Space	725.1	1752.0	1274.0	
Common Space	0.0	257.0	170.0	
Mechanical Space	65.0	882.0	240.0	
Subtotal	790.1	2891.0	1684.0	
Grossing Factor (~1:1.345)	272.6	997.4	581.0	
Subtotal Program Area	**1062.7**	**3888.4**	2265.0	
Accommodation	660.0	0.0	480.0	
Grossing Factor (~1:1.293)	193.4	0.0		
Subtotal Accommodation	**853.4**	**0.0**	480.0	
GRAND TOTAL	1916.1	3888.4	2745.0	**8549.4**

CHARS Preliminary In-House Staffing Plan

STAFF		Long Term Offices CHARS Staff								Nominal Lab Spaces allocation to CHARS Staff		
Title	Classifi-cation	1-person	2-person	4-person	Operations Office	Lockers	Total	SPACES S&T Common Mechanical Accomodation	DETAILS	# of Associated Spaces	Type of Assoc. Space	DETAILS
SCIENCE & TECHNOLOGY												
Executive Director	EX-02	1					1	S&T	Moved from R.S. Common - Included in Admin Office	1	Cold Wet Labs	Prep (Dirty),
Chief Scientist	EX-01	1					1	S&T		1	Cold Wet Labs	Analysis (Clean)
Admin assistant	AS-02		1				1	S&T				
							3			2		
Research (Assuming 3 of 4 Themes TBD)												
Research manager	REM-02	3					3	S&T		3	Wet Lab General Dry Lab Clean	- Atmospheric - Analytic - Radioisotope
Junior Researcher	RES-01		3				3	S&T		3	Wet Lab General Wet Lab Dirty	- Marine/Aquaria - Marine Rough Lab - Microbiology and Environmental Toxicology
							6			6		
Traditional Knowledge												
Research manager	REM-02	1					1	S&T		1	Wet Lab General	Health and Exam Rooms
Junior Researcher	RES-01		1				1	S&T		1	Wet Lab Dirty	Animals
							2			2		
Tech. Dev. and Application Theme												
Research manager	REM-02	1					1	S&T		1	Electrical workshop	Modular/Flexible
Junior Researcher	RES-01		1				1	S&T		1	Mechanical workshop	Modular/Flexible
							2			2		
Monitoring												
Manager	REM-01	1					1	S&T		1	Wet Labs General	Soils and Geology
							1			1		
Computational analysis and support												
Research manager	REM-01	1					1	S&T		1	Dry Lab Clean	Computer/GIS Lab
Computer Technician	CS-02		1				1	S&T		1	Dry Lab Clean	Computer/GIS Lab
Junior Researcher	RES-01		1				1	S&T		1	Dry Lab Clean	Computer/GIS Lab
							3			3		

STAFF		Long Term Offices CHARS Staff								Nominal Lab Spaces allocation to CHARS Staff		
Title	Classifi-cation	1-person	2-person	4-person	Operations Office	Lockers	**Total**	**SPACES** S&T Common Mechanical Accomodation	**DETAILS**	**# of Associated Spaces**	**Type of Assoc. Space**	**DETAILS**
Knowledge Application												
Manager	REM-01	1					1	S&T		1	Wet Lab General	Teaching Lab
Analyst/broker	EC-05		2				2	S&T		2	Support Space	Interview Rooms
Information manager/librarian	IS-04	1					1	S&T		1	Library	
							4			4		
Education and outreach												
Manager	REM-01	1					1	S&T		1	Support Space	Class Room
Outreach coordinator	EC-05	1					1	S&T		1	Support Space	Media Centre
							2			2		
S&T Program Support												
Manager - Lab/Tech centre	REM-01	1					1	S&T		1	Technology Centre	Oversees all labs/workshops Mechanical Workshop Electrical Workshop
Technician - Lab, Tech centre, monitoring/ reference sites	EG-06		2				2	S&T		2	Field cabins	Also supports all labs/workshops
Administrative staff	AS-01		1				1	S&T	Moved from R.S. Common - Included in Admin Office			
Admin assistants	AS-02		2				2	S&T				
Finance officer	AS-03		1				1	S&T	Moved from R.S. Common - Included in Admin Office			
HR officer	PE-03		1				1	S&T	Moved from R.S. Common - Included in Admin Office			
							8			3		
Logistics												
Logistics manager (PCSP)	AS-05				1		1	S&T	In Logistics Admin Office			
Assets Manager Field Accommodations	AS-04				1		1	S&T	In Logistics Admin Office			
							2					
		14	17	0	2	0	**33.0**					

STAFF		Long Term Offices CHARS Staff								Nominal Lab Spaces allocation to CHARS Staff		
Title	Classifi-cation	1-person	2-person	4-person	Operations Office	Lockers	**Total**	**SPACES** S&T Common Mechanical Accomodation	**DETAILS**	**# of Associated Spaces**	**Type of Assoc. Space**	**DETAILS**
CORPORATE / ADMINISTRATION												
Reception	GS-02	1					1	Common	Desk in main Reception Area			
Security officers, night watchman	GS-03					2	2	Common	Counter in main Reception Area/locker			
		1	0	0	0	2	**3**					
FACILITIES MANAGEMENT (covered in PWGSC estimate)												
Facility and fleet manager	ENG-06				*	1	1	Mechanical/Common	Desk in Maintenance Garage/Locker in Staff Room			
Shipping and receiving officer	CR- 04				*	1	1	Mechanical/Common	Desk in Maintenance Garage/Locker in Staff Room			
Custodian/Janitor	GS-02					3	3	Mechanical	Locker in Staff Room			
Mechanics, plumbers, electricians, technicians	GL- VHE-11				*	3	3	Mechanical/Common	Desk in Maintenance Garage/Locker in Staff Room			
	Total					8	**8**					
ACCOMMODATIONS AND OPERATIONS												
Accommodations manager	GS-09	1					1	S&T	Included in Admin Office			
Cook	GS-05					2	2	Common	Office in Kitchen/Locker			
Kitchen assistant	GS-02					1	0.5	Common	Staff Locker Room			
Heavy equipment operator	GL-VHE-09				*	1	0.5	Mechanical	Desk in Maintenance Garage			
		1	0	0	0	3	**4**					
	GRAND TOTAL	16	17	0	2	13	**48**			**25**		

C SPACE DATA SHEETS

INTRODUCTION

- High-level requirements are included in the Preliminary Functional Program.
- Where a discrepancy exists between the Preliminary Functional Program and the datasheets, the information on the datasheet should be confirmed as accurate.
- Space datasheets are for Phase 1a, 1b, and 2. Unless otherwise noted, it should be assumed the datasheet refers to new construction in Phase 1b. Some spaces refer in the space description to expansion in Phase 2.
- Floor layouts are generally for indicative purposes only, and should not inappropriately constrain architectural design.
- Consideration should be made for 'common areas' to consolidate different functions, e.g. fume hoods in a central location to facilitate.

TABLE OF CONTENTS

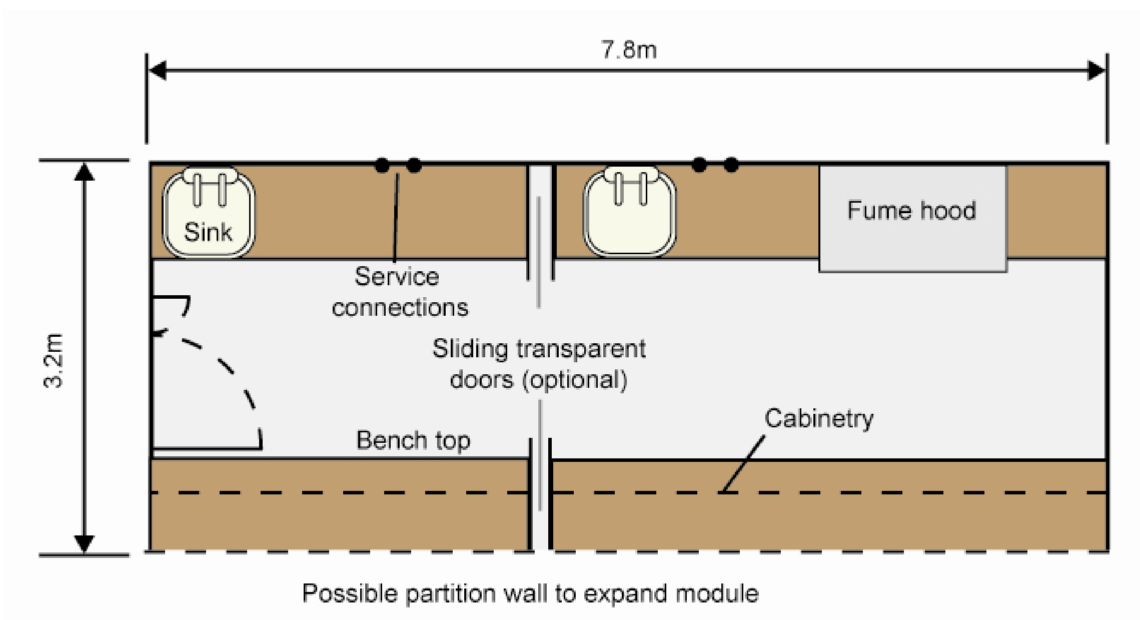
CONTENTS

A. SCIENCE & TECHNOLOGY PROGRAM

1. WET LAB GENERAL

0. GENERIC

Science &Technology Program			No.	A 1 0	
Functional Group		Component Group		Space Name	
A Science & Technology		1 Wet Lab General		0 Generic	
Total Area	# of Spaces	Area	Length	Width	Height
100.00 m²	4	25.00 m²	7.80 m	3.20 m	3.00 m



Function	Facilitates testing and analysis of chemicals, drugs, and other biological matter requiring specialized utilities, such as water, direct ventilation, and gases.
Space Description	Generic, flexible, adaptable bench-top research laboratory. May require two areas connected by sliding transparent doors to separate 'wet' and 'dry' areas (microscopes, etc. from potentially dusty analytical work.)
Primary Users	
Max Occupant Load	2 - 4
Adjacencies	Potential adjacency to other lab modules to expand size of space. Proximity to central Freezer/Refrigerator, Glasswash/Autoclave area, other lab support areas.
Relationship to Building Complex	

Environment	**Clean Factor**: normal dry lab on one side and wet lab on the other
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: medium
Natural daylight	**Natural Daylight**: Desirable **Light Quality**: High quality, controlled **Interior view to space**: Required for safety & security
Vibration	**Generation**: Low **Protection**: For microscopes, balances, and sensitive instrumentation
Structural	To be verified with building standards
Floors	**Characteristics**: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free **Materials**: **Base**:
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static free **Materials**: **Finish**:
Ceilings	**Characteristics**: Acoustical, cleanable **Materials**: **Finish**:

Doors	**To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
	Internal	Sliding	1.0 M	2.1 M	Metal/Glass	Pre-finished	Metal

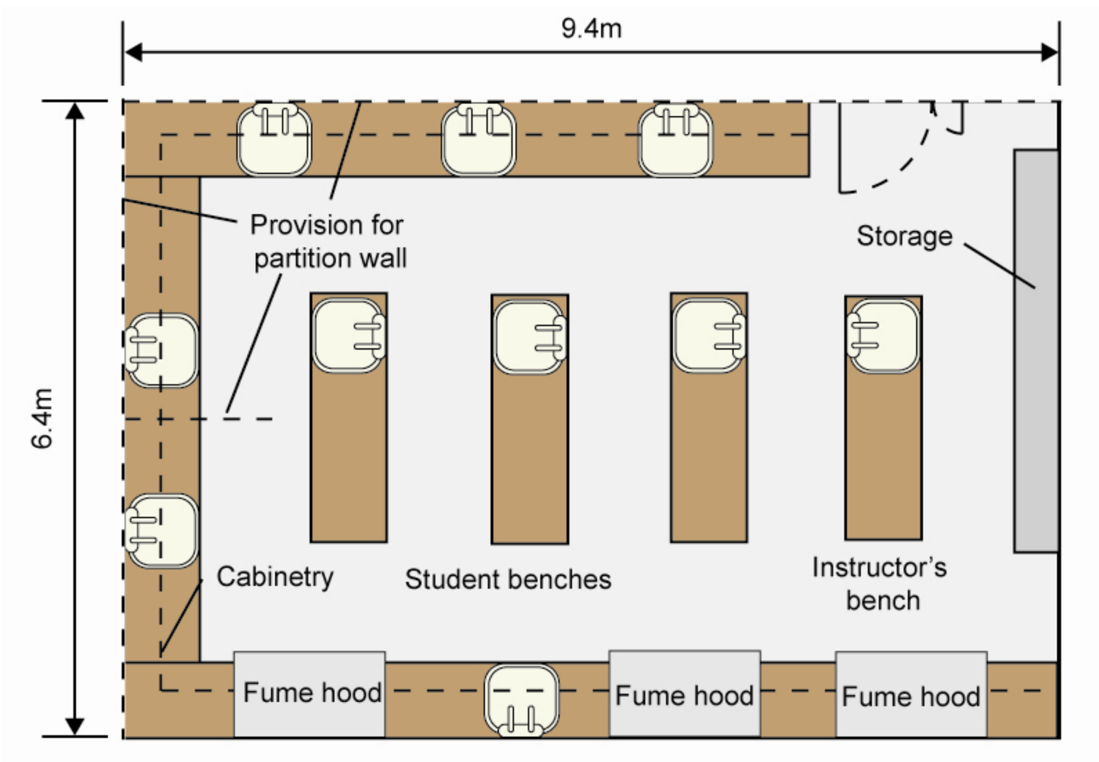
Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers
Plumbing	**Fixtures:** Lab sink **Water**: Domestic hot, domestic cold, purified water **Laboratory Gases**: Propane, compressed air, vacuum Close proximity to eye wash and shower station
HVAC	Negative pressure electronic control UPS for ventilation system Dust extraction system if required
Temp Control	As per design range Controllable for occupant comfort / specific laboratory experiments Night time set-back provision

Humidity Control	As per design range		
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as	**LUX**	As per IES

	general lamps above.					
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.					
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Fume Hood	For use with acids and solvents	Power, Gas	1	1.6	1	2.3
Freezer/Fridge	Local units if necessary; proximity to central freezer/fridge area preferred	Emergency Power				
Dishwasher / Autoclave	Local units if necessary; proximity to central dishwashing/autoclave area preferred					
Sink						
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.762	
Upper Casework	Metal	Paint				
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**
Waste Drum	One for solid and two for liquid waste	chlorinated & non-chlorinated	3			
Potential Space types	1. – Soils & Geology 2. – Modular/Flexible 3. – Microbiology & Environmental Toxicology					
Comments	Modular/Flexible lab space requires adjacency to workshops and dry labs, as well as other wet lab spaces.					

4. TEACHING LAB

Science &Technology Program			No.	A 1 4	
Functional Group		**Component Group**		**Space Name**	
A Science & Technology		1 Wet Lab General		4 Teaching Lab	
Total Area	**# of Spaces**	**Area**	**Length**	**Width**	**Height**
60.10 m^2	1	60.10 m^2	9.40 m	6.40 m	3.00 m



Function	Space for teaching science and laboratory techniques
Space Description	Generic, flexible, adaptable bench-top research laboratory. Adaptable for teacher-led instruction and independent/group work
Primary Users	
Max Occupant Load	
Adjacencies	Possibly located at NRI facilities
Relationship to Building Complex	This may be an off-site space/function.
Environment	**Clean Factor**: wet
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: medium

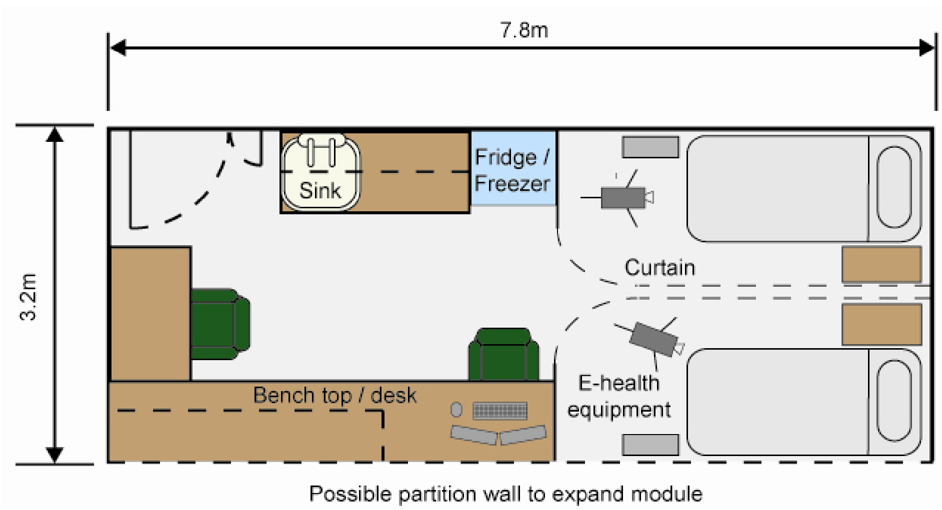
<table>
<tr><td colspan="2">Natural daylight</td><td colspan="6">Natural Daylight: Desirable
Light Quality: High quality, controlled
Interior view to space: Required for safety & security</td></tr>
<tr><td colspan="2">Vibration</td><td colspan="6">Generation: Low
Protection: For microscopes, balances, and sensitive instrumentation</td></tr>
<tr><td colspan="2">Structural</td><td colspan="6">To be verified with building standards</td></tr>
<tr><td colspan="2">Floors</td><td colspan="6">Characteristics: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free
Materials: Base:</td></tr>
<tr><td colspan="2">Walls</td><td colspan="6">Characteristics: Durable, cleanable, washable, paintable, static free
Materials: Finish:</td></tr>
<tr><td colspan="2">Ceilings</td><td colspan="6">Characteristics: Acoustical, cleanable
Materials: Finish:</td></tr>
<tr><td rowspan="3">Doors</td><td>To:</td><td>Type</td><td>Width</td><td>Height</td><td>Materials</td><td>Finish</td><td>Frame</td></tr>
<tr><td rowspan="2">Lab</td><td>Main Door</td><td>0.92 M</td><td>2.1 M</td><td>Hollow Metal/Gl.</td><td>Pre-finished</td><td>Metal</td></tr>
<tr><td>Side leaf</td><td>0.31 M</td><td>2.1 M</td><td>Hollow Metal/Gl.</td><td>Pre-finished</td><td>Metal</td></tr>
<tr><td colspan="2">Hardware</td><td colspan="6">Hinges: NRP; High Security Lockset: Lever
Closer: Frame Mounted Locks: Card Access; Flush Bolts
Hold open; O/H; Manual Stop: O/H
Specialties: Kick Plates, Astragal</td></tr>
<tr><td colspan="2">Interior Glazing</td><td colspan="6">Glass: Single, tempered Window Coverings: Blinds
Frames: Metal</td></tr>
<tr><td colspan="2">Exterior Glazing</td><td colspan="6">Glass: Double or triple-paned, low-e, argon gas fill
Window Coverings: Blinds/blackout shutters
Frames: Metal with insulated spacers</td></tr>
<tr><td colspan="2">Plumbing</td><td colspan="6">Fixtures: Lab sink
Water: Domestic hot, domestic cold, purified water
Laboratory Gases: Propane, compressed air, vacuum
Close proximity to eye wash and shower station</td></tr>
<tr><td colspan="2">HVAC</td><td colspan="6"></td></tr>
<tr><td colspan="2">Temp Control</td><td colspan="6">As per design range
Controllable for occupant comfort / specific laboratory experiments
Night time set-back provision</td></tr>
<tr><td colspan="2">Humidity Control</td><td colspan="4">As per design range</td><td></td><td></td></tr>
<tr><td colspan="2">Lighting</td><td colspan="4">Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.</td><td>LUX</td><td>As per IES</td></tr>
<tr><td colspan="2">Power</td><td colspan="6">Normal Power – 120 volt duplex receptacles, GFCI
Emergency Power – one 120 volt 15 amp duplex receptacle
UPS – as design and required for specific functions</td></tr>
<tr><td colspan="2">Mechanical Life Safety</td><td colspan="6">Sprinklers, smoke control, fire safety equipment</td></tr>
<tr><td colspan="2">Electrical</td><td colspan="6">Alarms, emergency lighting, addressable fire alarm devices, detection (CO,</td></tr>
</table>

Life Safety	smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Fume Hood	For use with acids and solvents	Power, Gas	1	1.6	1	2.3
Freezer/Fridge	Local units if necessary; proximity to central freezer/fridge area preferred	Emergeny Power				
Dishwasher / Autoclave	Local units if necessary; proximity to central dishwashing/autoclave area preferred					
Sink						
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.76 2	
Upper Casework	Metal	Paint				
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**
Waste Drum	One for solid and two for liquid waste	chlorinated & non-chlorinated	3			
Comments						

5. E-HEALTH & EXAMINATION

Science &Technology Program		No.	A 1 5
Functional Group	Component Group	Space Name	
1 Science & Technology	A Wet Lab General	5 E-Health & Examination	

Total Area	# of Spaces	Area	Length	Width	Height
25.00 m^2	1	25.00 m^2	7.80 m	3.20 m	3.00 m



Function	Space to support health research and e-health
Space Description	Examination rooms with appropriate telecommunications equipment
Primary Users	
Max Occupant Load	2 - 4
Adjacencies	Possibly located at the community Health Centre
Relationship to Building Complex	This may be an off-site space/function.
Environment	**Clean Factor**: dry, clean
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: medium
Natural daylight	**Natural Daylight**: Desirable **Light Quality**: High quality, controlled **Interior view to space**: Required for safety & security
Vibration	**Generation**: Low
Structural	To be verified with building standards

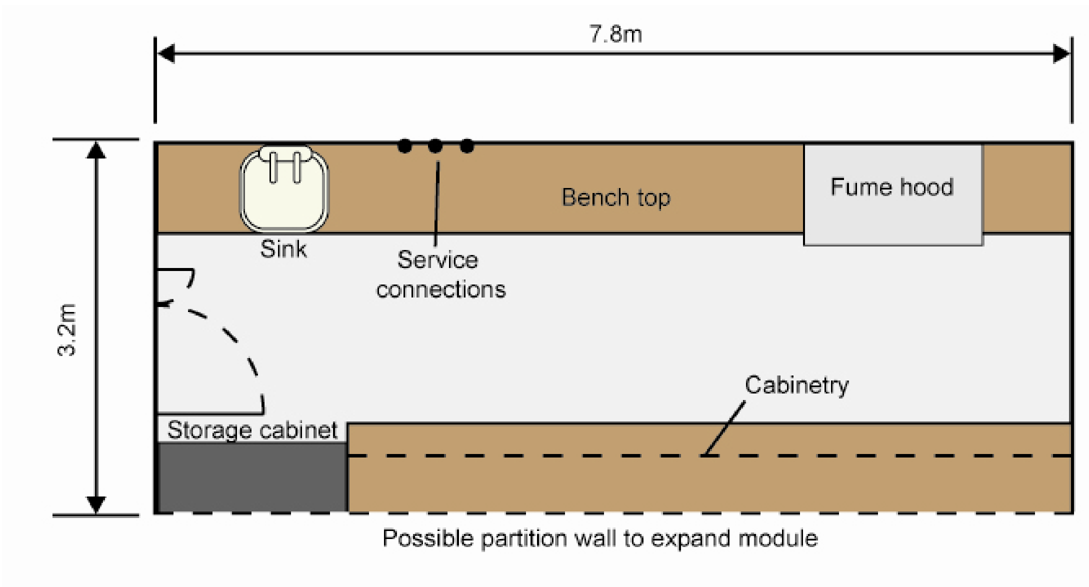
Floors	**Characteristics**: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free **Materials**: **Base**:					
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static free **Materials**: **Finish**:					
Ceilings	**Characteristics**: Acoustical, cleanable **Materials**: **Finish**:					
Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal					
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal					
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers					
Plumbing	**Fixtures:** Sink **Water**: Domestic hot, domestic cold, purified water **Laboratory Gases**: Close proximity to eye wash and shower station					
HVAC						
Temp Control	As per design range Controllable for occupant comfort Night time set-back provision					
Humidity Control	As per design range					
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.					
Power	Normal Power – 120 volt duplex receptacles, GFCI Emergency Power – one 120 volt 15 amp duplex receptacle UPS – as design and required for specific functions					
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Freezer/Fridge	Local units if necessary; proximity to central freezer/fridge area preferred	Emergency Power				
Sink						
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9

2. WET LAB DIRTY & COLD

1. ANIMALS

Science &Technology Program			No.	A 2 1	
Functional Group		Component Group		Space Name	
A	Science & Technology	2	Wet Lab Dirty & Cold	1	Animals

Total Area	# of Spaces	Area	Length	Width	Height
25.0 m^2	1	25.0 m^2	7.80 m	3.20 m	3.00 m



Function	Facilitates testing and analysis of live animals and specimens.
Space Description	Generic, flexible, adaptable bench-top research laboratory. May require two areas connected by sliding transparent doors to separate 'wet' and 'dry' areas (microscopes, etc. from potentially dusty analytical work.) Provision for messy/dirty bench work and climate control.
Primary Users	
Max Occupant Load	2 - 4
Adjacencies	Potential adjacency to other lab modules to expand size of space. Proximity to central Freezer/Refrigerator, Glasswash/Autoclave area, other lab support areas. Adjacent to Rough Lab.
Relationship to Building Complex	
Environment	**Clean Factor**: normal dry lab on one side and wet/dirty lab on the other
Security	**Operations Zone** **Doors:** Card access

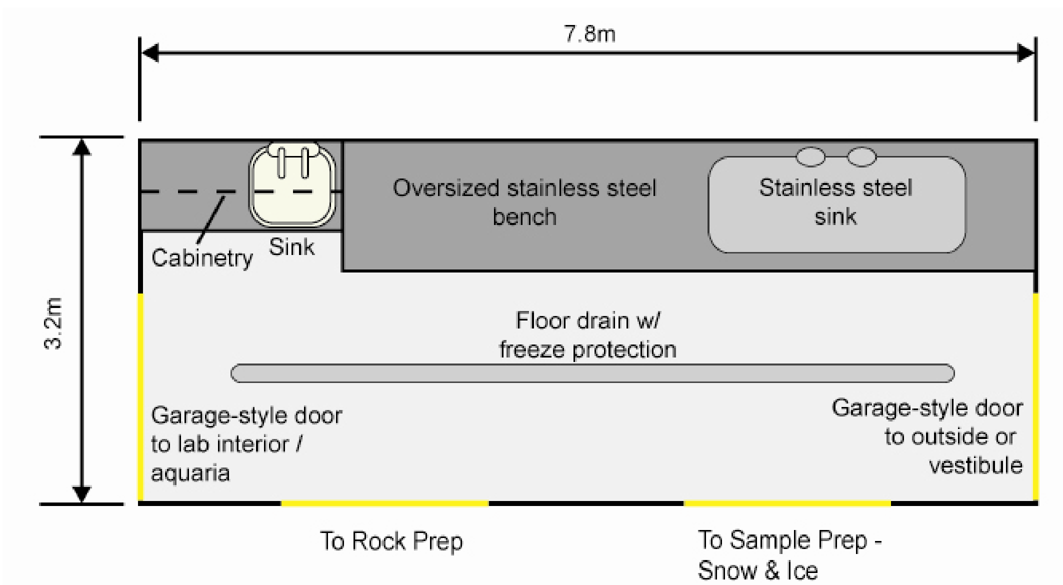
Acoustics	**Ambient Noise Generation**: medium
Natural daylight	**Natural Daylight**: Desirable **Light Quality**: High quality, controlled **Interior view to space**: Required for safety & security
Vibration	**Generation**: Low **Protection**: For microscopes, balances, and sensitive instrumentation
Structural	To be verified with building standards
Floors	**Characteristics**: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free **Materials**: **Base**:
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static free **Materials**: **Finish**:
Ceilings	**Characteristics**: Acoustical, cleanable **Materials**: **Finish**:
Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers
Plumbing	**Fixtures:** Lab sink – potentially large stainless steel with hose assembly. **Water**: Domestic hot, domestic cold, purified water **Laboratory Gases**: Propane, compressed air, vacuum Close proximity to eye wash and shower station Potential floor drains, with consideration for chemical spills
HVAC	Negative pressure electronic control UPS for ventilation system Dust extraction system if required
Temp Control	As per design range – wide range of control Controllable for occupant comfort / specific laboratory experiments Night time set-back provision
Humidity Control	As per design range
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above. **LUX**: As per IES
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.

Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Fume Hood	For use with acids and solvents	Power, Gas	1	1.6	1	2.3
Freezer/Fridge	Local units if necessary; proximity to central freezer/fridge area preferred	Emergency Power				
Dishwasher / Autoclave	Local units if necessary; proximity to central dishwashing/autoclave area preferred					
Sink						
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.762	
Upper Casework	Metal	Paint				
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Waste Drum	One for solid and two for liquid waste	chlorinated & non-chlorinated	3			
Comments	.					

2. ROUGH LAB / VESTIBULE

Science &Technology Program		No.	A 2 2
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	2 Wet Lab Dirty	2 Rough Lab / Vestibule	

Total Area	# of Spaces	Area	Length	Width	Height
25.00 m^2	1	25.00 m^2	7.80 m	3.20 m	3.00 m



Function	Wet space for importing fields samples from outdoors and preparing them for further laboratory analysis, e.g. through sample wash-down.
Space Description	Sample receiving and preparation space with provision for messy/dirty bench work and large doors leading to the outside.
Primary Users	
Max Occupant Load	2 - 4
Adjacencies	Potential adjacency to other lab modules to expand size of space. Proximity to central Freezer/Refrigerator, Glasswash/Autoclave area, other lab support areas. Adjacent to Aquaria, Animal lab, other 'dirty' labs that may require a preparation space.
Relationship to Building Complex	
Environment	**Clean Factor**: wet, dirty
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: medium

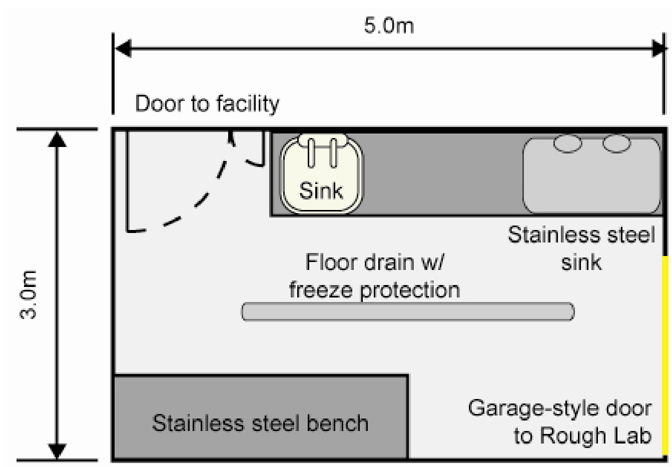
<table>
<tr><td colspan="2">Natural daylight</td><td colspan="6">Natural Daylight: Desirable
Light Quality: High quality, controlled
Interior view to space: Required for safety & security</td></tr>
<tr><td colspan="2">Vibration</td><td colspan="6">Generation: Low/medium
Protection:</td></tr>
<tr><td colspan="2">Structural</td><td colspan="6">To be verified with building standards</td></tr>
<tr><td colspan="2">Floors</td><td colspan="6">Characteristics: Non-slip protection, protection against frost accumulation. Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free
Materials: Interlocking, removable, heavy-duty fibreglass or rubber grating over depressed floor area. Base: Integral w/floor
Safety: Design to prevent slipping on wet floor.</td></tr>
<tr><td colspan="2">Walls</td><td colspan="6">Characteristics: Durable, cleanable, washable, paintable, static free
Materials: Prefinished fibreglass or other durable plastic wall panels, sealed at joints. Finish: Water-proof.</td></tr>
<tr><td colspan="2">Ceilings</td><td colspan="6">Characteristics: Interior ceiling exposed and painted.
Materials: Finish:</td></tr>
<tr><td rowspan="3">Doors</td><td>To:</td><td>Type</td><td>Width</td><td>Height</td><td>Materials</td><td>Finish</td><td>Frame</td></tr>
<tr><td rowspan="2">Outdoors
Aquaria</td><td>Large door</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Large door</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td colspan="6"></td></tr>
<tr><td colspan="2">Hardware</td><td colspan="6">Hinges: NRP; High Security Lockset: Lever
Closer: Frame Mounted Locks: Card Access; Flush Bolts
Hold open; O/H; Manual Stop: O/H
Specialties: Kick Plates, Astragal</td></tr>
<tr><td colspan="2">Interior Glazing</td><td colspan="6">Glass: Single, tempered Window Coverings: Blinds
Frames: Metal</td></tr>
<tr><td colspan="2">Exterior Glazing</td><td colspan="6">Glass: Double or triple-paned, low-e, argon gas fill
Window Coverings: Blinds/blackout shutters
Frames: Metal with insulated spacers</td></tr>
<tr><td colspan="2">Plumbing</td><td colspan="6">Fixtures: Lab sink – potentially large stainless steel with hose assembly.
Water: Domestic hot, domestic cold, purified water
Laboratory Gases: Propane, compressed air, vacuum
Close proximity to eye wash and shower station</td></tr>
<tr><td colspan="2">HVAC</td><td colspan="6">Negative pressure electronic control
UPS for ventilation system
Dust extraction system if required
Services may have to come from ceiling</td></tr>
<tr><td colspan="2">Temp Control</td><td colspan="6">As per design range – wide range of control
Controllable for occupant comfort / specific laboratory experiments
Night time set-back provision</td></tr>
<tr><td colspan="2">Humidity Control</td><td colspan="6">As per design range</td></tr>
<tr><td colspan="2">Lighting</td><td colspan="4">Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).</td><td>LUX</td><td>As per IES</td></tr>
</table>

	Task lights under cabinets to have similar attributes as general lamps above.					
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.					
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.) Waterproof fixtures					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Sink	Standard lab sink					
S/S Sink	Large stainless steel sink					
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.76 2	
Upper Casework	Metal	Paint				
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Waste Drum	One for solid and two for liquid waste	chlorinated & non-chlorinated	3			
Comments						

3. SAMPLE PREP – SNOW & ICE

Science &Technology Program		No.	A 2 3
Functional Group	**Component Group**		**Space Name**
A Science & Technology	2 Wet Lab Dirty & Cold		3 Sample Prep - Snow & Ice

Total Area	# of Spaces	Area	Length	Width	Height
15.00 m^2	1	15.00 m^2	5.00 m	3.00 m	3.00 m



Function	Facilitates preparation of snow and ice samples for further analysis
Space Description	Generic, flexible, adaptable bench-top research laboratory. Provision for messy/dirty bench work and cold environment.
Primary Users	
Max Occupant Load	2-3
Adjacencies	Potential adjacency to other lab modules to expand size of space. Proximity to central Freezer/Refrigerator, Glasswash/Autoclave area, other lab support areas. Adjacent to Analysis – Snow & Ice lab Access to outdoors through Rough Lab
Relationship to Building Complex	
Environment	**Clean Factor**: wet/dirty
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: medium

Natural daylight	**Natural Daylight**: Desirable **Light Quality**: High quality, controlled **Interior view to space**: Required for safety & security						
Vibration	**Generation**: Low **Protection**: For microscopes, balances, and sensitive instrumentation						
Structural	To be verified with building standards						
Floors	**Characteristics**: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free **Materials**: **Base**:						
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static free **Materials**: **Finish**:						
Ceilings	**Characteristics**: Acoustical, cleanable **Materials**: **Finish**:						
Doors	**To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
	Internal	Sliding	1.0 M	2.1 M	Metal/Glass	Pre-finished	Metal
Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal						
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal						
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers						
Plumbing	**Fixtures:** Lab sink – potentially large stainless steel with hose assembly. **Water**: Domestic hot, domestic cold, purified water **Laboratory Gases**: Propane, compressed air, vacuum Close proximity to eye wash and shower station Potential floor drains, with consideration for chemical spills						
HVAC	Negative pressure electronic control UPS for ventilation system Dust extraction if required						
Temp Control	As per design range – wide range of control Controllable for occupant comfort / specific laboratory experiments Night time set-back provision						
Humidity Control	As per design range						
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.					**LUX**	As per IES
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of						

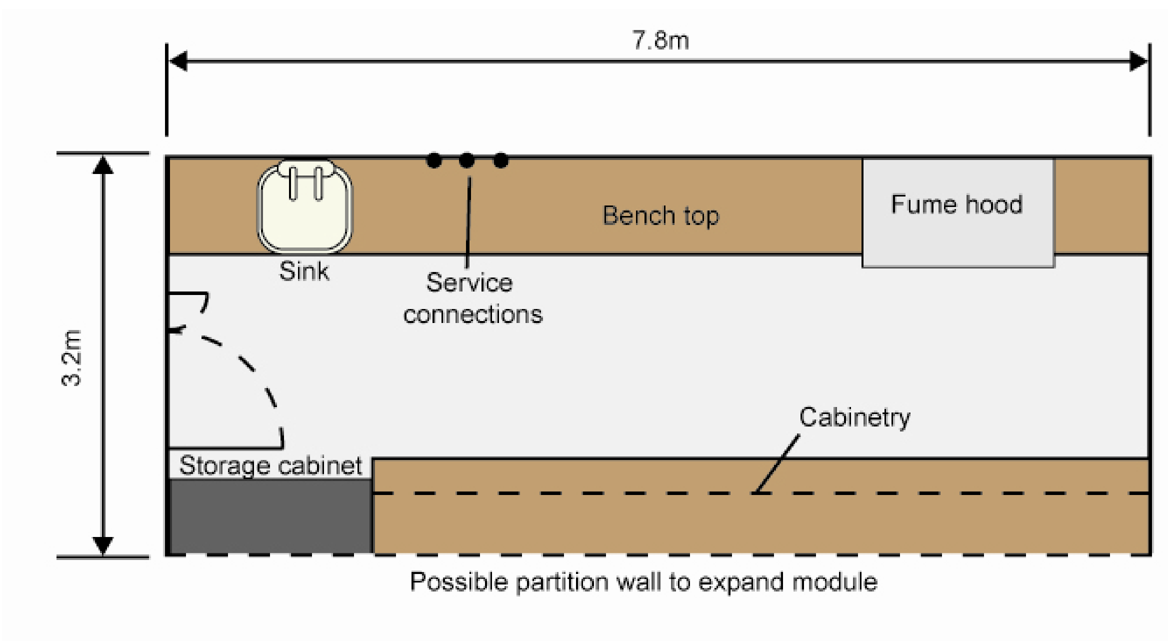
	counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.					
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Freezer/Fridge	Local units if necessary; proximity to central freezer/fridge area preferred					
Dishwasher / Autoclave	Local units if necessary; proximity to central dishwashing/autoclave area preferred					
Sink	Standard lab sink					
S/S Sink	Large stainless steel sink					
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.76 2	
Upper Casework	Metal	Paint				
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Waste Drum	One for solid and two for liquid waste	chlorinated & non-chlorinated	3			
Comments						

3. WET LAB CLEAN & COLD

1. ANALYSIS – SNOW & ICE

Science &Technology Program			No.	A 3 1	
Functional Group		Component Group		Space Name	
A	Science & Technology	3	Wet Lab Dirty & Cold	1	Analysis - Snow & Ice

Total Area	# of Spaces	Area	Length	Width	Height
25.00 m^2	1	25.00 m^2	7.80 m	3.20 m	3.00 m



Function	Facilitates testing and analysis of snow and ice samples.
Space Description	Generic, flexible, adaptable bench-top research laboratory.
Primary Users	
Max Occupant Load	2 - 4
Adjacencies	Potential adjacency to other lab modules to expand size of space. Proximity to central Freezer/Refrigerator, Glasswash/Autoclave area, other lab support areas. Adjacent to Sample Prep – Snow & Ice lab
Relationship to Building Complex	
Environment	**Clean Factor**: wet/dirty
Security	**Operations Zone**

	Doors: Card access
Acoustics	**Ambient Noise Generation**: medium
Natural daylight	**Natural Daylight**: Desirable **Light Quality**: High quality, controlled **Interior view to space**: Required for safety & security
Vibration	**Generation**: Low **Protection**: For microscopes, balances, and sensitive instrumentation
Structural	To be verified with building standards
Floors	**Characteristics**: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free **Materials**: **Base**:
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static free **Materials**: **Finish**:
Ceilings	**Characteristics**: Acoustical, cleanable **Materials**: **Finish**:

Doors	**To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
	Sample Prep	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal

Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers
Plumbing	**Fixtures:** Lab sink – potentially large stainless steel with hose assembly. **Water**: Domestic hot, domestic cold, purified water **Laboratory Gases**: Propane, compressed air, vacuum Close proximity to eye wash and shower station
HVAC	Negative pressure electronic control UPS for ventilation system Dust extraction system if required
Temp Control	As per design range – wide range of control Controllable for occupant comfort / specific laboratory experiments Night time set-back provision
Humidity Control	As per design range

Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.	**LUX**	As per IES

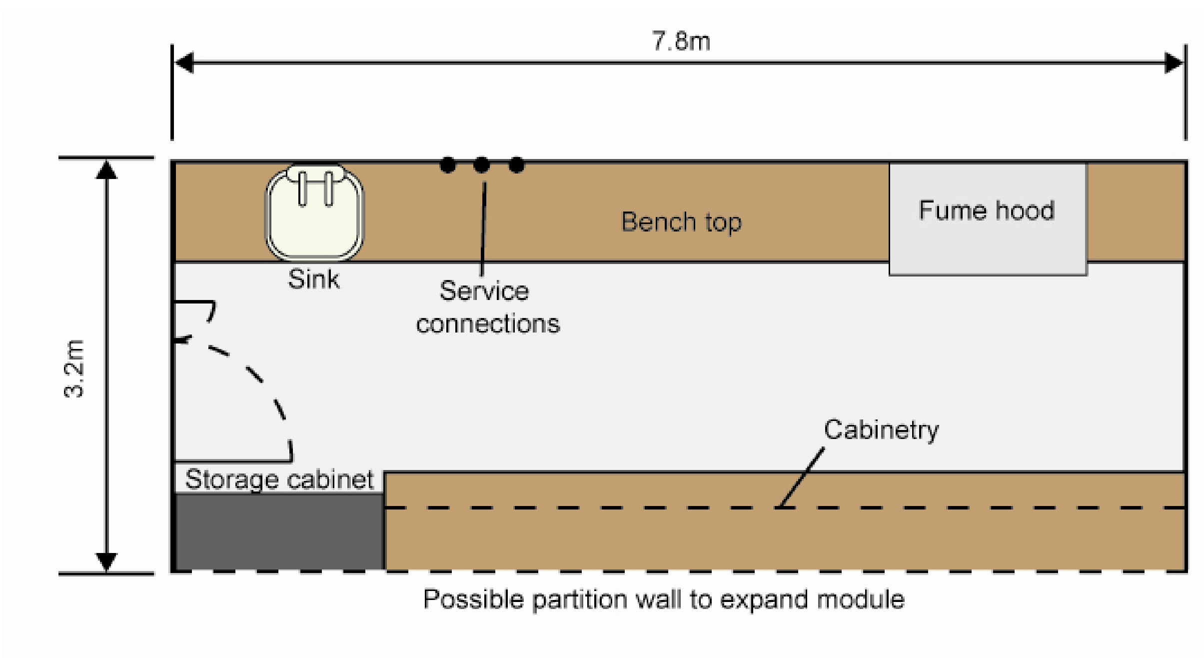
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.					
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Freezer/Fridge	Local units if necessary; proximity to central freezer/fridge area preferred					
Dishwasher / Autoclave	Local units if necessary; proximity to central dishwashing/autoclave area preferred					
Sink	Standard lab sink					
S/S Sink	Large stainless steel sink					
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.76 2	
Upper Casework	Metal	Paint				
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**
Waste Drum	One for solid and two for liquid waste	chlorinated & non-chlorinated	3			
Comments						

4. DRY LAB CLEAN

1. ATMOSPHERIC

Science &Technology Program			No.	A 4 1
Functional Group	**Component Group**		**Space Name**	
A Science & Technology	4 Dry Lab Clean		1 Atmospheric	

Total Area	# of Spaces	Area	Length	Width	Height
25.00 m^2	1	25.00 m^2	7.80 m	3.20 m	3.00 m



Function	Dry lab to facilitate atmospheric sensing and analysis.
Space Description	Generic, flexible, adaptable bench-top dry research laboratory
Primary Users	
Max Occupant Load	2 – 4
Adjacencies	Potential adjacency to other lab modules to expand size of space. Proximity to central Freezer/Refrigerator, Glasswash/Autoclave area, other lab support areas.
Relationship to Building Complex	
Environment	**Clean Factor**: clean
Security	**Operations Zone** **Doors:** Card access

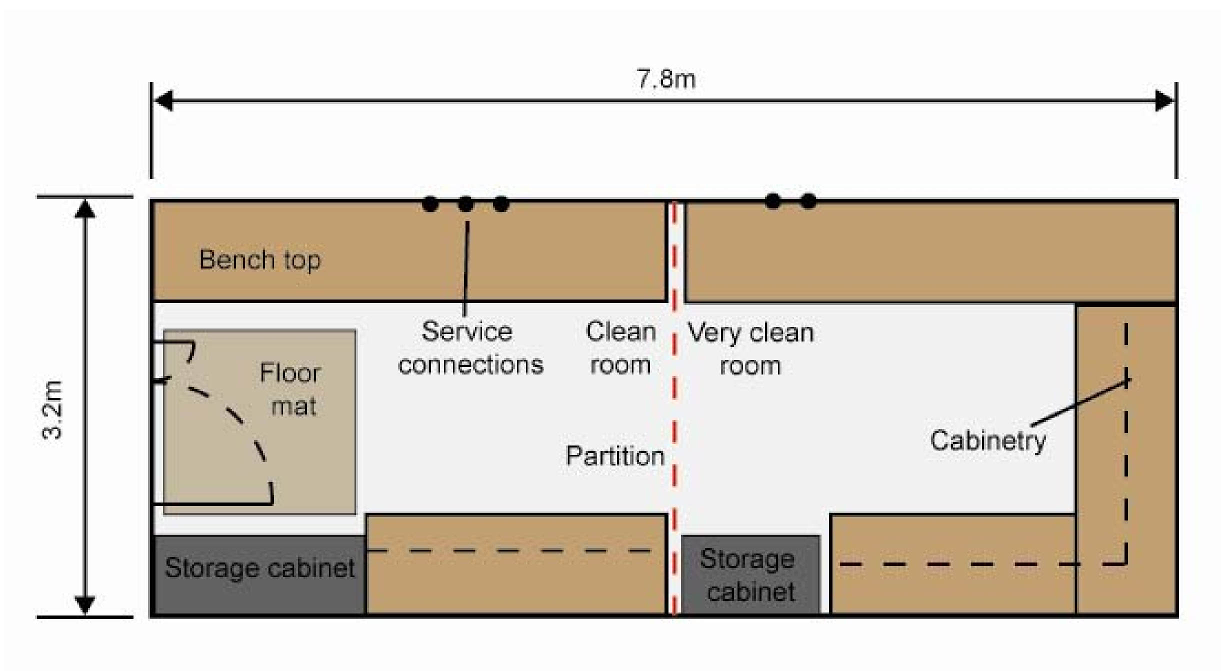
<table>
<tr><td>Acoustics</td><td colspan="7">Ambient Noise Generation: medium</td></tr>
<tr><td>Natural daylight</td><td colspan="7">Natural Daylight: Desirable
Light Quality: High quality, controlled
Interior view to space: Required for safety & security</td></tr>
<tr><td>Vibration</td><td colspan="7">Generation: Low
Protection: For microscopes, balances, and sensitive instrumentation</td></tr>
<tr><td>Structural</td><td colspan="7">To be verified with building standards</td></tr>
<tr><td>Floors</td><td colspan="7">Characteristics: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free
Materials: Base:</td></tr>
<tr><td>Walls</td><td colspan="7">Characteristics: Durable, cleanable, washable, paintable, static free
Materials: Finish:</td></tr>
<tr><td>Ceilings</td><td colspan="7">Characteristics: Acoustical, cleanable
Materials: Finish:</td></tr>
<tr><td rowspan="3">Doors</td><td>To:</td><td>Type</td><td>Width</td><td>Height</td><td>Materials</td><td>Finish</td><td>Frame</td></tr>
<tr><td rowspan="2">Lab</td><td>Main Door</td><td>0.92 M</td><td>2.1 M</td><td>Hollow Metal/Gl.</td><td>Pre-finished</td><td>Metal</td></tr>
<tr><td>Side leaf</td><td>0.31 M</td><td>2.1 M</td><td>Hollow Metal/Gl.</td><td>Pre-finished</td><td>Metal</td></tr>
<tr><td>Hardware</td><td colspan="7">Hinges: NRP; High Security Lockset: Lever
Closer: Frame Mounted Locks: Card Access; Flush Bolts
Hold open; O/H; Manual Stop: O/H
Specialties: Kick Plates, Astragal</td></tr>
<tr><td>Interior Glazing</td><td colspan="7">Glass: Single, tempered Window Coverings: Blinds
Frames: Metal</td></tr>
<tr><td>Exterior Glazing</td><td colspan="7">Glass: Double or triple-paned, low-e, argon gas fill
Window Coverings: Blinds/blackout shutters
Frames: Metal with insulated spacers</td></tr>
<tr><td>Plumbing</td><td colspan="7">Fixtures: Sink
Water: Domestic hot, domestic cold, purified water
Laboratory Gases: Propane, compressed air, vacuum
Close proximity to eye wash and shower station</td></tr>
<tr><td>HVAC</td><td colspan="7">UPS for ventilation system</td></tr>
<tr><td>Temp Control</td><td colspan="7">As per design range
Controllable for occupant comfort / specific laboratory experiments
Night time set-back provision</td></tr>
<tr><td>Humidity Control</td><td colspan="7">As per design range</td></tr>
<tr><td>Lighting</td><td colspan="5">Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.</td><td>LUX</td><td>As per IES</td></tr>
<tr><td>Power</td><td colspan="7">Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water).
Emergency Power – one 120 volt 15 amp duplex receptacle.</td></tr>
</table>

	UPS – as designed and required for specific functions.					
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Fume Hood	For use with acids and solvents	Power, Gas	1	1.6	1	2.3
Freezer/Fridge	Local units if necessary; proximity to central freezer/fridge area preferred					
Dishwasher / Autoclave	Local units if necessary; proximity to central dishwashing/autoclave area preferred					
Sink						
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.762	
Upper Casework	Metal	Paint				
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**
Waste Drum	One for solid and two for liquid waste	chlorinated & non-chlorinated	3			
Comments	Consideration for outfitting lab with wet services to ensure future flexibility.					

2. CALIBRATION

Science &Technology Program	No.	A 4 2
Functional Group	**Component Group**	**Space Name**
A Science & Technology	4 Dry Lab Clean	2 Calibration

Total Area	# of Spaces	Area	Length	Width	Height
25.00 m^2	1	25.00 m^2	7.80 m	3.20 m	3.00 m



Function	Facilitates precision workshop functions such as mechanical and electronic calibration
Space Description	Generic, flexible, adaptable bench-top research laboratory with graduated clean environments.
Primary Users	
Max Occupant Load	2 - 4
Adjacencies	Potential adjacency to other lab modules to expand size of space. Proximity/adjacency to workshops, modular/flexible lab
Relationship to Building Complex	
Environment	**Clean Factor**: clean, very clean
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: low

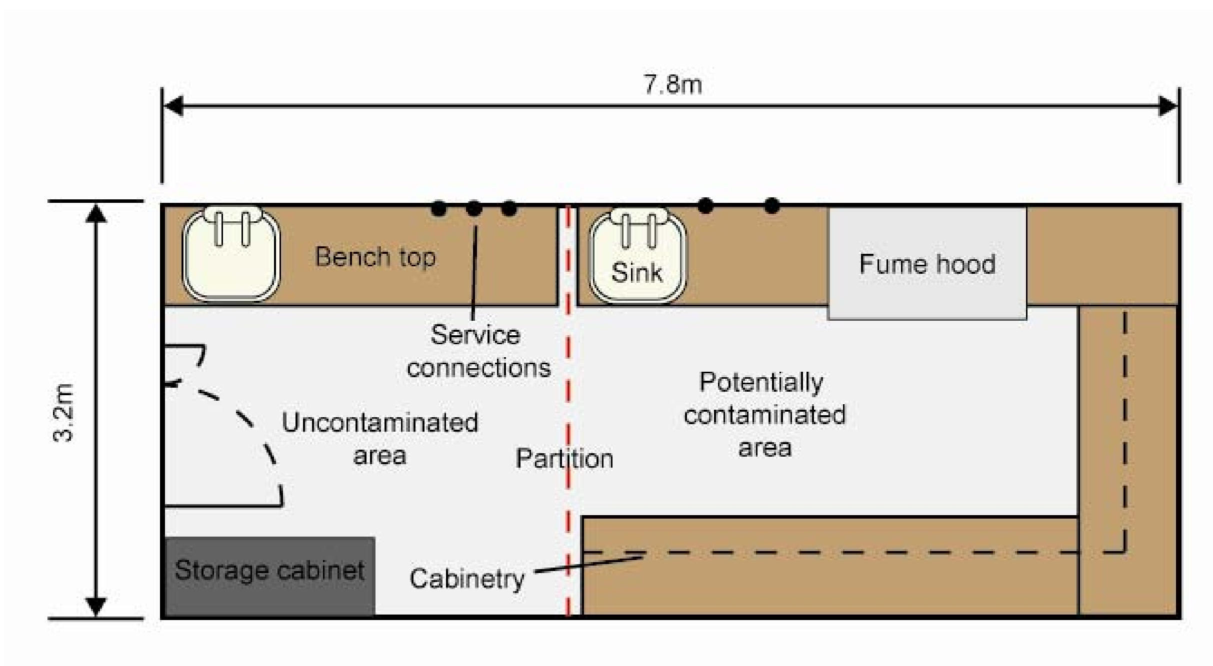
Natural daylight	**Natural Daylight**: Desirable **Light Quality**: High quality, controlled **Interior view to space**: Required for safety & security						
Vibration	**Generation**: Low **Protection**: High						
Structural	To be verified with building standards						
Floors	**Characteristics**: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free, clean **Materials**: **Base**:						
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static free, clean **Materials**: **Finish**:						
Ceilings	**Characteristics**: Acoustical, cleanable **Materials**: **Finish**:						
Doors	**To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal						
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal						
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers						
Plumbing	**Fixtures:** **Water**: **Laboratory Gases**: Propane, compressed air, vacuum Close proximity to eye wash and shower station						
HVAC	Positive pressure electronic control UPS for ventilation system High efficiency filtration						
Temp Control	As per design range – wide range of control Controllable for occupant comfort / specific laboratory experiments Night time set-back provision						
Humidity Control	As per design range						
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.					**LUX**	As per IES
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610 mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle.						

	UPS – as designed and required for specific functions. Access to 600 volt power supplies may be required for future needs.					
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.762	
Upper Casework	Metal	Paint				
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**
Comments	Consideration for outfitting lab with wet services to ensure future flexibility.					

3. RADIOISOTOPE

Science &Technology Program				No.	A 4 3
Functional Group		**Component Group**		**Space Name**	
A	Science & Technology	4	Dry Lab Clean	3	Radioisotpe

Total Area	# of Spaces	Area	Length	Width	Height
25.00 m^2	1	25.00 m^2	7.80 m	3.20 m	3.00 m



Function	Dry lab to facilitate work with radioactive materials.
Space Description	Generic, flexible, adaptable bench-top dry research laboratory. Space divided into 'hot' and 'clean' areas
Primary Users	
Max Occupant Load	2 – 4
Adjacencies	Potential adjacency to other lab modules to expand size of space. Proximity to central Freezer/Refrigerator, Glasswash/Autoclave area, other lab support areas.
Relationship to Building Complex	
Environment	**Clean Factor**: clean
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: medium

<table>
<tr><td colspan="2">Natural daylight</td><td colspan="6">Natural Daylight: Desirable
Light Quality: High quality, controlled
Interior view to space: Required for safety & security</td></tr>
<tr><td colspan="2">Vibration</td><td colspan="6">Generation: Low
Protection: For microscopes, balances, and sensitive instrumentation</td></tr>
<tr><td colspan="2">Structural</td><td colspan="6">To be verified with building standards</td></tr>
<tr><td colspan="2">Floors</td><td colspan="6">Characteristics: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free
Materials: Base:</td></tr>
<tr><td colspan="2">Walls</td><td colspan="6">Characteristics: Durable, cleanable, washable, paintable, static free
Materials: Finish:</td></tr>
<tr><td colspan="2">Ceilings</td><td colspan="6">Characteristics: Acoustical, cleanable
Materials: Finish:</td></tr>
<tr><td rowspan="3">Doors</td><td>To:</td><td>Type</td><td>Width</td><td>Height</td><td>Materials</td><td>Finish</td><td>Frame</td></tr>
<tr><td rowspan="2">Lab</td><td>Main Door</td><td>0.92 M</td><td>2.1 M</td><td>Hollow Metal/Gl.</td><td>Pre-finished</td><td>Metal</td></tr>
<tr><td>Side leaf</td><td>0.31 M</td><td>2.1 M</td><td>Hollow Metal/Gl.</td><td>Pre-finished</td><td>Metal</td></tr>
<tr><td colspan="2">Hardware</td><td colspan="6">Hinges: NRP; High Security Lockset: Lever
Closer: Frame Mounted Locks: Card Access; Flush Bolts
Hold open; O/H; Manual Stop: O/H
Specialties: Kick Plates, Astragal</td></tr>
<tr><td colspan="2">Interior Glazing</td><td colspan="6">Glass: Single, tempered Window Coverings: Blinds
Frames: Metal</td></tr>
<tr><td colspan="2">Exterior Glazing</td><td colspan="6">Glass: Double or triple-paned, low-e, argon gas fill
Window Coverings: Blinds/blackout shutters
Frames: Metal with insulated spacers</td></tr>
<tr><td colspan="2">Plumbing</td><td colspan="6">Fixtures: Sink
Water: Domestic hot, domestic cold, purified water
Laboratory Gases: Propane, compressed air, vacuum
Close proximity to eye wash and shower station</td></tr>
<tr><td colspan="2">HVAC</td><td colspan="6">UPS for ventilation system</td></tr>
<tr><td colspan="2">Temp Control</td><td colspan="6">As per design range
Controllable for occupant comfort / specific laboratory experiments
Night time set-back provision</td></tr>
<tr><td colspan="2">Humidity Control</td><td colspan="6">As per design range</td></tr>
<tr><td colspan="2">Lighting</td><td colspan="4">Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.</td><td>LUX</td><td>As per IES</td></tr>
<tr><td colspan="2">Power</td><td colspan="6">Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 601mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water).
Emergency Power – one 120 volt 15 amp duplex receptacle.
UPS – as designed and required for specific functions.</td></tr>
</table>

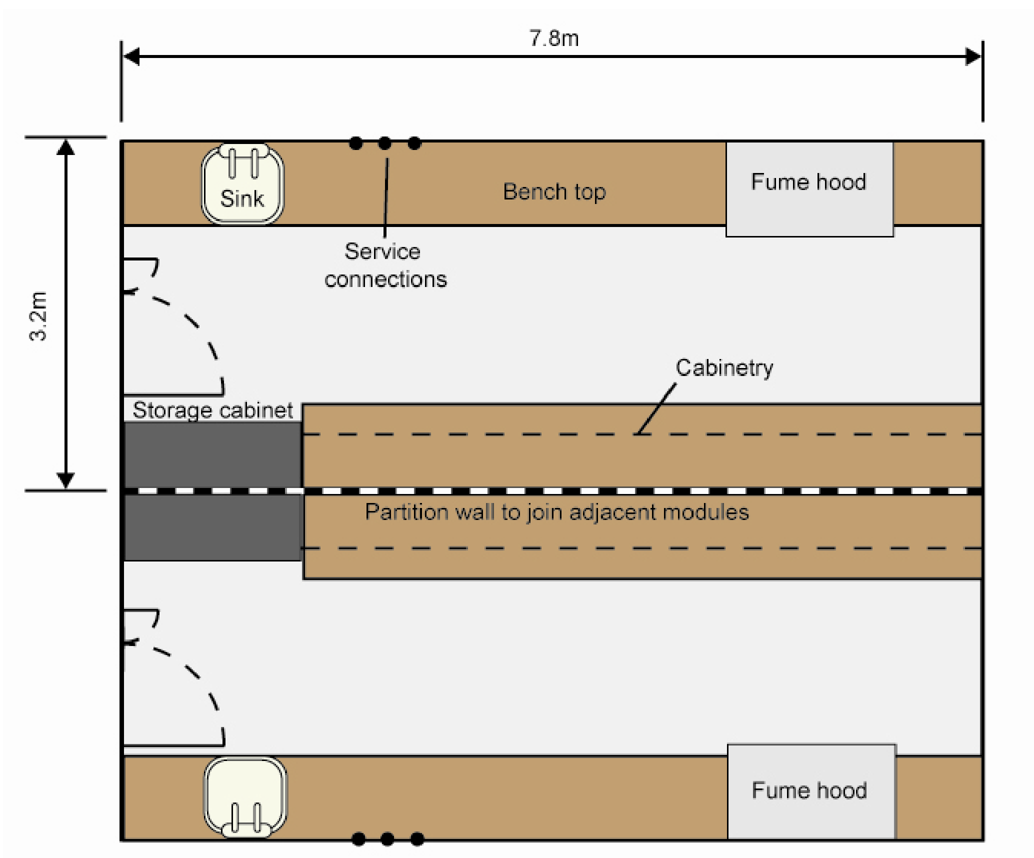
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Fume Hood	For use with acids and solvents	Power, Gas	1	1.6	1	2.3
Dishwasher / Autoclave	Local units if necessary; proximity to central dishwashing/autoclave area preferred					
Sink						
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.762	
Upper Casework	Metal	Paint				
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**
Comments	Consideration for outfitting lab with wet services to ensure future flexibility.					

CONTENTS

5. DRY LAB GENERAL

1. ANALYTIC

Science &Technology Program			No.	A 5 1	
Functional Group		Component Group		Space Name	
A Science & Technology		1 Dry Lab General		1 Analytic	
Total Area	# of Spaces	Area	Length	Width	Height
50.00 m^2	2	25.00 m^2	7.80 m	3.20 m	3.00 m



Function	Dry lab to support analytical functions
Space Description	Generic, flexible, adaptable, research laboratory
Primary Users	
Max Occupant Load	2 – 4
Adjacencies	Potential adjacency to other dry lab modules to expand size of space. Proximity to central Freezer/Refrigerator, Glasswash/Autoclave area, other lab support areas.
Relationship to	

Building Complex	
Environment	**Clean Factor**: normal
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: medium
Natural daylight	**Natural Daylight**: Desirable **Light Quality**: High quality, controlled **Interior view to space**: Required for safety & security
Vibration	**Generation**: Low **Protection**:
Structural	To be verified with building standards
Floors	**Characteristics**: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free **Materials**: **Base**:
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static free **Materials**: **Finish**:
Ceilings	**Characteristics**: Acoustical, cleanable **Materials**: **Finish**:

Doors	**To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal

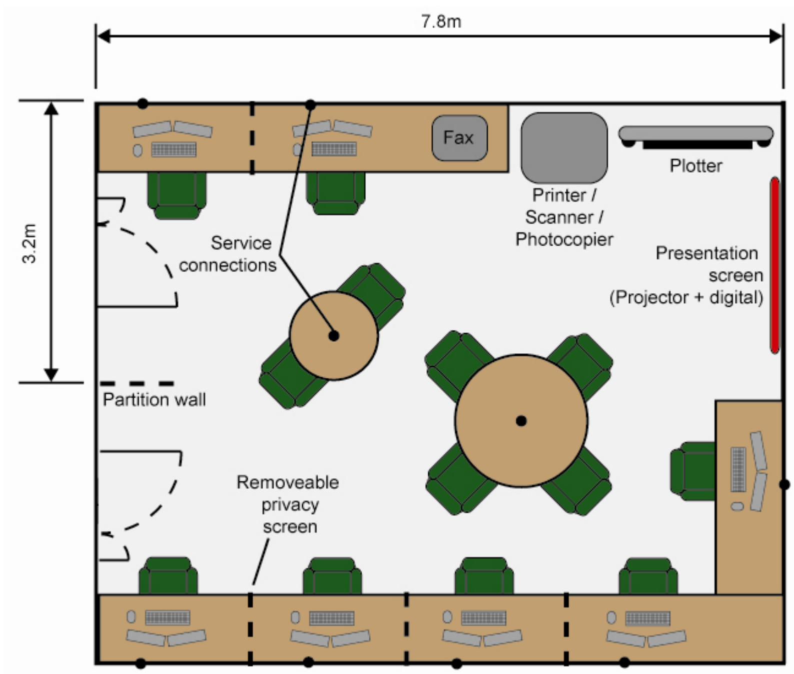
Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal		
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal		
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers		
Plumbing	**Fixtures:** Sink **Water**: Domestic hot, domestic cold, purified water **Laboratory Gases**: Propane, compressed air, vacuum Close proximity to eye wash and shower station		
HVAC	UPS for ventilation system		
Temp Control	As per design range Controllable for occupant comfort / specific laboratory experiments Night time set-back provision		
Humidity Control	As per design range		
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.	**LUX**	As per IES

Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, pus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.					
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Fume Hood	For use with acids and solvents	Power, Gas	1	1.6	1	2.3
Freezer/Fridge	Local units if necessary; proximity to central freezer/fridge area preferred					
Dishwasher / Autoclave	Local units if necessary; proximity to central dishwashing/autoclave area preferred					
Sink						
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.76 2	
Upper Casework	Metal	Paint				
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**
Waste Drum	One for solid and two for liquid waste	chlorinated & non-chlorinated	3			
Comments	Consideration for outfitting lab with wet services to ensure future flexibility.					

2. COMPUTER / GIS

Science &Technology Program		No.	A 5 2		
Functional Group		Component Group		Space Name	
A	Science & Technology	5	Dry Lab General	2	Computer / GIS

Total Area	# of Spaces	Area	Length	Width	Height
60.10 m^2	2	25.00 m^2	7.80 m	3.20 m	3.00 m



Function	Dry lab to support computing functions, including GIS mapping & plotting and computation-intensive analysis
Space Description	Generic, flexible, adaptable, computer laboratory with multiple work stations that can be used independently or for group work.
Primary Users	
Max Occupant Load	4-6
Adjacencies	Potential adjacency to other dry lab modules to expand size of space. Potential adjacency to offices
Relationship to Building Complex	
Environment	**Clean Factor**: normal
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: medium
Natural daylight	**Natural Daylight**: Desirable

	Light Quality: High quality, controlled **Interior view to space**: Required for safety & security
Vibration	**Generation**: Low **Protection**: For microscopes, balances, and sensitive instrumentation
Structural	To be verified with building standards
Floors	**Characteristics**: Soft, resilient, durable, cleanable, washable, static free **Materials**: Carpet **Base**:
Walls	**Characteristics**: Cleanable, washable, paintable, static free **Materials**: **Finish**:
Ceilings	**Characteristics**: Acoustical, cleanable **Materials**: **Finish**:

Doors	**To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal

Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal		
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal		
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers		
Plumbing	No special plumbing		
HVAC			
Temp Control	As per design range Controllable for occupant comfort Night time set-back provision		
Humidity Control	As per design range		
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.	**LUX**	As per IES
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, pus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.		
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment		
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)		
Communications	Telephone, public address, security video, security, LAN access, broadband		

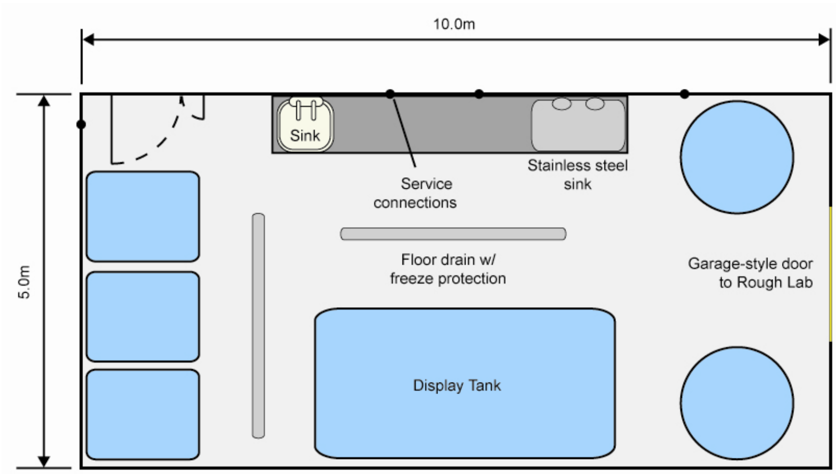
	wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Computer stations						
Work tables						
GIS Plotter	Consideration for using NIRB/NPC plotters (off-site)					
Lab. Casework	**Description**	**Finishes**	**Qty**			
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**
Comments						

6. MARINE

1. AQUARIA

Science &Technology Program		No.	A 6 1
Functional Group	**Component Group**		**Space Name**
A Science & Technology	6 Marine		1 Aquaria

Total Area	# of Spaces	Area	Length	Width	Height
50.00 m^2	1	50.00 m^2	10.0 m	5.00 m	4.00 m



Function	Area for research involving collected marine animals
Space Description	Marine biology research lab
Primary Users	
Max Occupant Load	
Adjacencies	Large, double doors to Rough Lab. Access to outside through adjacent Rough Lab. Potential adjacency to other lab modules to expand size of space. Proximity to central Freezer/Refrigerator, Glasswash/Autoclave area, other lab support spaces
Relationship to Building Complex	
Environment	Wet
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: medium

Natural daylight	**Natural Daylight**: Desirable **Light Quality**: High quality, controlled **Interior view to space**: Required for safety & security
Vibration	**Generation**: Medium
Structural	To be determined – provision for heavy water tanks
Floors	**Characteristics**: Non-slip protection, protection against frost accumulation. Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free **Materials**: Interlocking, removable, heavy-duty fibreglass or rubber grating over depressed floor area. **Base**: Integral w/floor **Safety:** Design to prevent slipping on wet floor.
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static free **Materials**: Prefinished fibreglass or other durable plastic wall panels, sealed at joints. **Finish**: Water-proof.
Ceilings	**Characteristics**: Interior ceiling exposed and painted. **Materials**: **Finish**:
Doors	Double doors to Rough Lab. Door to interior of Station.

Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Rough lab	Large double doors					
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal

Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal		
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers		
Plumbing	**Fixtures:** Lab sink **Water**: Domestic hot, domestic cold, purified/distilled water, seawater **Laboratory Gases**: Compressed air, vacuum **Drain**: Central floor drain with freeze protection. Consideration for chemical spills into floor drain. Close proximity to eye wash and shower station,		
HVAC	Negative pressure electronic control UPS for ventilation system Capture devices at aquariums Services may have to come from ceiling		
Temp Control	As per design range. Controllable for occupant comfort / specific laboratory experiments within safe parameters for marine life. Wide range of allowable temperature conditions.		
Humidity Control	As per design range. Consideration for higher humidity levels.		
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).	**LUX**	As per IES

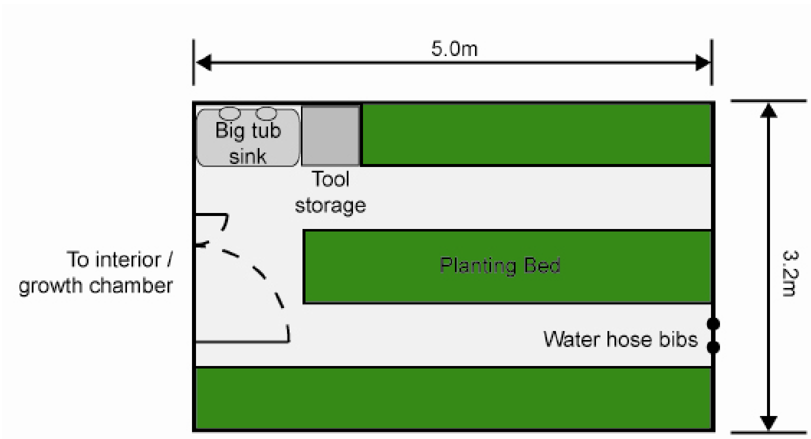
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, pus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near tanks). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.					
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications	Telephone, public address, security video, security, LAN access, broadband wireless					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Various tanks & aquaria	As per research program.	Power, Gas	1	1.6	1	2.3
Stainless steel lab benches	Possibly stainless steel casework as well.					
Comments	Special provisions for safety issues relating to water on floors in potentially sub-zero conditions.					

7. LAB SUPPORT

1. GREENHOUSE

Science &Technology Program		No.	A 7 1
Functional Group	**Component Group**		**Space Name**
A Science & Technology	7 Lab Support		1 Greenhouse

Total Area	# of Spaces	Area	Length	Width	Height
16.0 m^2 (Phase 1b)	1	16.0 m^2	5.00 m	3.20 m	4.00 m
16.0 m^2 (Phase 2)	1	16.0 m^2	5.00 m	3.20 m	4.00 m



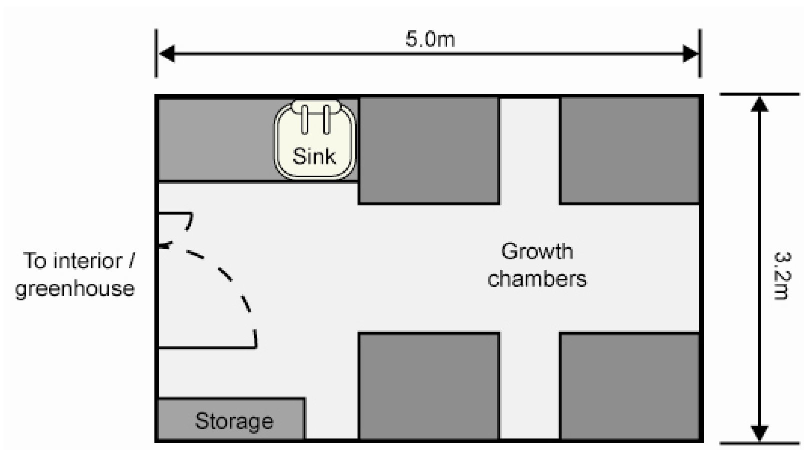
Function	For growth and study of various types of vegetation
Space Description	Greenhouse
Primary Users	
Max Occupant Load	2-4
Adjacencies	Growth chambers
Relationship to Building Complex	
Environment	Wet/humid **Clean factor:** normal greenhouse
Security	**Operations Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: low
Natural daylight	**Natural Daylight**: Yes **Light Quality**: Natural and controlled **Interior view to space**: Required for safety & security

<table>
<tr><td></td><td colspan="6">Shading system with automatic controls</td></tr>
<tr><td>Vibration</td><td colspan="6">Generation: Low
Protection: For microscopes, balances, and sensitive instrumentation</td></tr>
<tr><td>Structural</td><td colspan="6">To be verified with building standards</td></tr>
<tr><td>Floors</td><td colspan="6">Characteristics: Hard, non-slip, water resistant
Materials: Base:
Possibly utilize removable grated fibreglass or rubber greenhouse floor matting for increased safety</td></tr>
<tr><td>Walls</td><td colspan="6">Characteristics: Washable
Materials: Glass Finish:</td></tr>
<tr><td>Ceilings</td><td colspan="6">Characteristics: Exposed
Materials: Glass Finish:</td></tr>
<tr><td>Interior Glazing</td><td colspan="6">Glass: Single, tempered Window Coverings: Blinds
Frames: Metal</td></tr>
<tr><td>Exterior Glazing</td><td colspan="6">Glass:
Window Coverings:
Frames:</td></tr>
<tr><td>Plumbing</td><td colspan="6">Greenhouse plumbing system</td></tr>
<tr><td>HVAC</td><td colspan="6">Greenhouse HVAC to control greenhouse temperature, potentially 1:50 year design temperatures. Greenhouse control system
Heat recovery</td></tr>
<tr><td>Temp Control</td><td colspan="6">As per design range. Controllable.</td></tr>
<tr><td>Humidity Control</td><td colspan="6">As per design range. Controllable.</td></tr>
<tr><td>Lighting</td><td colspan="3">Area requires illumination to meet Greenhouse lighting standards, complete with independent variable intensity switching or controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).</td><td>LUX</td><td colspan="2">As per IES</td></tr>
<tr><td>Power</td><td colspan="6">Normal Power – independent 120/208 receptacles, ground fault GFCI and entire installation to be compatible with damp location.
Emergency Power – one 120 volt 15 amp duplex receptacle.
UPS – as designed and required for specific functions.</td></tr>
<tr><td>Mechanical Life Safety</td><td colspan="6">Sprinklers, smoke control, fire safety equipment</td></tr>
<tr><td>Electrical Life Safety</td><td colspan="6">Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)</td></tr>
<tr><td>Communications</td><td colspan="6">Telephone, public address, security video, security, LAN access, broadband wireless</td></tr>
<tr><td rowspan="2">Equipment</td><td rowspan="2">Description</td><td rowspan="2">Notes</td><td rowspan="2">Qty</td><td colspan="3">(Meters)</td></tr>
<tr><td>L</td><td>W</td><td>H</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Comments</td><td colspan="6"></td></tr>
</table>

2. GROWTH CHAMBER

Science &Technology Program		No.	A 7 2
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	7 Lab Support	2 Growth Chamber	

Total Area	# of Spaces	Area	Length	Width	Height
16.0 m^2 (Phase 1b)	1	16.0 m^2	5.00 m	3.20 m	4.00 m
16.0 m^2 (Phase 2)	1	16.0 m^2	5.00 m	3.20 m	4.00 m



Function	For growth and study of various types of vegetation
Space Description	Custom designed or pre-manufactured growth chamber
Primary Users	
Max Occupant Load	2-4
Adjacencies	Greenhouse. Expandable to 32 m^2 in Phase 2.
Relationship to Building Complex	
Environment	Wet/humid **Clean factor:** normal greenhouse
Security	**Operations Zone** **Doors:** Card access Alarm system
Acoustics	**Ambient Noise Generation**: low
Natural daylight	**Natural Daylight**: Not required

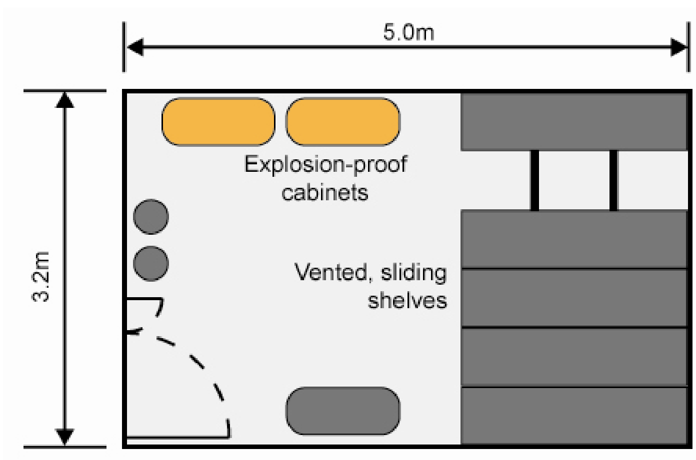
	Light Quality: Controlled						
Vibration	**Generation**: Low						
Structural	To be verified with building standards						
Floors	**Characteristics**: Hard, non-slip, water resistant, impervious to chemicals, durable, cleanable, washable, seamless **Materials**: **Base**:						
Walls	**Characteristics**: Durable, washable **Materials**: **Finish**:						
Ceilings	**Characteristics**: Durable, washable **Materials**: **Finish**:						
Doors	**To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**
Interior Glazing							
Exterior Glazing							
Plumbing							
HVAC							
Temp Control	As per design range						
Humidity Control	As per design range						
Lighting	Area requires illumination to meet Greenhouse lighting standards, complete with independent variable intensity switching or controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).	**LUX**	As per IES				
Power	Normal Power – independent 120/208 receptacles, ground fault GFCI and entire installation to be compatible with damp location. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.						
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment						
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)						
Communications	Telephone, public address, security video, security, LAN access, broadband wireless						

Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Lab. Casework	**Description**	**Finishes**	**Qty**			
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Comments						

3. CHEMICAL STORAGE

Science &Technology Program		No.	A 7 3
Functional Group	**Component Group**		**Space Name**
A Science & Technology	7 Lab Support		3 Chemical Storage

Total Area	# of Spaces	Area	Length	Width	Height
16.00 m^2	1	16.00 m^2	5.00 m	3.20 m	4.00 m



Function	Storage of lab-related chemical materials
Space Description	Storage space
Primary Users	
Max Occupant Load	2-4
Adjacencies	Lab areas
Relationship to Building Complex	
Environment	Dry **Clean factor:**
Security	**Operations Zone** **Doors:** Card access Alarm system
Acoustics	**Ambient Noise Generation**: low
Natural daylight	**Natural Daylight**: Not required **Light Quality**: Controlled
Vibration	**Generation**: Low
Structural	To be verified with building standards

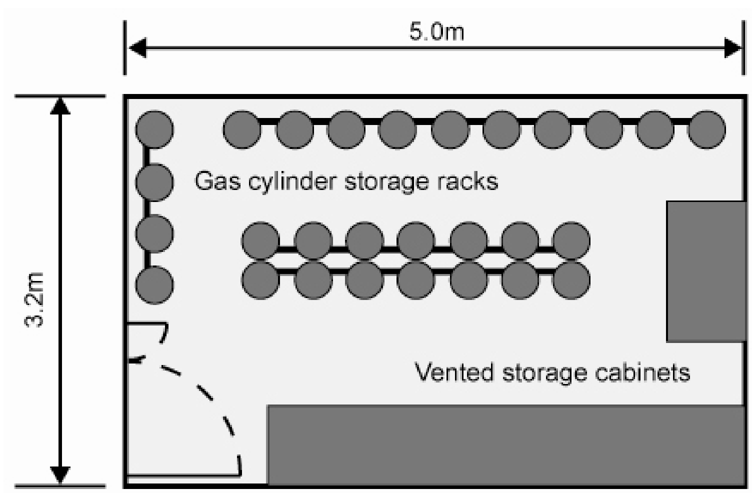
Floors	**Characteristics**: Hard, non-slip, water resistant, impervious to chemicals, durable, cleanable, washable, seamless **Materials**: **Base**:					
Walls	**Characteristics**: Durable, washable **Materials**: **Finish**:					
Ceilings	**Characteristics**: Durable, washable **Materials**: **Finish**:					
Doors **To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**
Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
	Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
Interior Glazing	N/A					
Exterior Glazing	N/A					
Plumbing						
HVAC	As per chemical storage requirements					
Temp Control	As per design range					
Humidity Control	As per design range					
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).	**LUX**	As per IES			
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus receptacles of rating and configuration to suit equipment.(GFCI throughout). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.					
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment. Additional chemical storage requirements as specified. Proximity to eye wash and emergency shower station Explosion-proofing as required.Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.) Additional chemical storage requirements as specified.					
Communications	Public address, security video, security, broadband wireless					

Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Lab. Casework	**Description**	**Finishes**	**Qty**			
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Comments						

4. GAS STORAGE

Science &Technology Program			No.	A 7 4	
Functional Group		**Component Group**		**Space Name**	
A	Science & Technology	7	Lab Support	4	Gas Storage

Total Area	# of Spaces	Area	Length	Width	Height
16.00 m^2	1	16.00 m^2	5.00 m	3.20 m	3.00 m

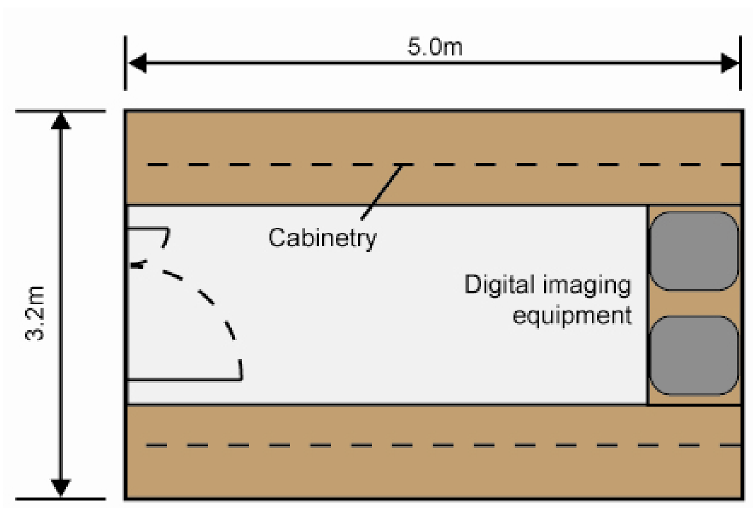


Function	Storage of lab-related gases.
Space Description	Storage space
Primary Users	
Max Occupant Load	2-4
Adjacencies	Lab areas
Relationship to Building Complex	
HVAC	As per gas storage area requirements
Mechanical Life Safety	As per gas storage area requirements
Electrical Life Safety	As per gas storage area requirements
Space details	Similar to A.7.3. Explosion-proofing as necessary.
Comments	Special considerations for safe storage of gases remain to be specified.

5. DIGITAL IMAGING / MICROSCOPY

Science &Technology Program		No.	A 7 5
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	7 Lab Support	5 Digital Imaging / Microscopy	

Total Area	# of Spaces	Area	Length	Width	Height
16.00 m^2	1	16.00 m^2	5.00 m	3.20 m	3.00 m



Function	Central location for digital imaging and microscope work
Space Description	Space with dedicated vibration protection for delicate imaging work.
Primary Users	
Max Occupant Load	4-5
Adjacencies	Labs
Relationship to Building Complex	
Environment	Dry **Clean factor:** Clean room
Security	**Operations zone** **Doors:** Card access Alarm system
Acoustics	**Ambient Noise Generation**: low
Natural daylight	**Natural Daylight**: Not required **Light Quality**: Controlled **Interior view to space**: Required for safety & security
Vibration	**Generation**: Low High protection for sensitive instrumentation

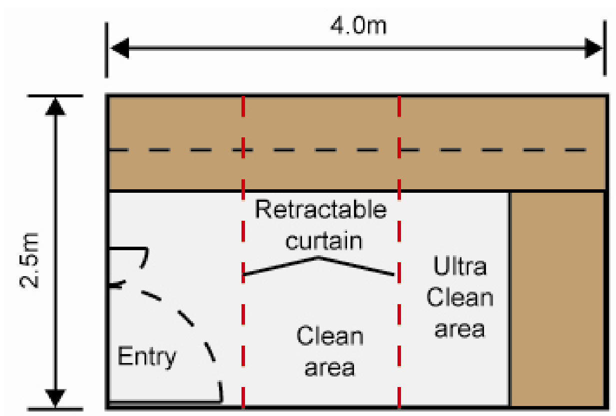
Structural		To be verified with building standards. Vibration isolation to be confirmed						
Floors		**Characteristics**: Hard, resilient, non-slip, impervious to chemicals, durable, washable, seamless, static-free **Materials**: **Base**:						
Walls		**Characteristics**: Durable, cleanable, washable, paintable, static-free **Materials**: **Finish**:						
Ceilings		**Characteristics**: Cleanable **Materials**: **Finish**:						
Doors	**To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**	
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal	
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal	
Interior Glazing		**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal						
Exterior Glazing		N/A						
Plumbing								
HVAC		Positive pressure, high efficiency filters Care taken to avoid drafts, particularly on lab benches						
Temp Control		As per design range. Controllable for occupant comfort. Provision for night time set-back						
Humidity Control		As per design range						
Lighting		Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.					**LUX**	As per IES
Power		Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.						
Mechanical Life Safety		Sprinklers, smoke control, fire safety equipment						
Electrical Life Safety		Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)						
Communications		Telephone, public address, security video, security, LAN access, broadband wireless						

Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Lab. Casework	**Description**	**Finishes**	**Qty**			
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**

6. BALANCE ROOM

Science &Technology Program			No.	A 7 6	
Functional Group		Component Group		Space Name	
A	Science & Technology	7	Lab Support	6	Balance Room

Total Area	# of Spaces	Area	Length	Width	Height
10.00 m^2	1	10.00 m^2	4.00 m	2.50 m	3.00 m



Function	Supports precision balance activities.
Space Description	Ultra clean, positive pressure space with graduated clean environments.
Primary Users	
Max Occupant Load	2-4
Adjacencies	Labs
Relationship to Building Complex	
Environment	Dry **Clean factor:** Ultra clean room
Security	**Operations zone** **Doors:** Card access Alarm system
Acoustics	**Ambient Noise Generation**: low
Natural daylight	**Natural Daylight**: Not required **Light Quality**: Controlled **Interior view to space**: Required for safety & security
Vibration	**Generation**: Low High protection for sensitive instrumentation **Generation**: Low

	Protection: High
Structural	To be verified with building standards, vibration isolation to be confirmed
Floors	**Characteristics**: Hard, resilient, non-slip, impervious to chemicals, durable, washable, seamless, static-free **Materials**: **Base**:
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static-free **Materials**: **Finish**:
Ceilings	**Characteristics**: Cleanable **Materials**: **Finish**:

Doors	**To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal

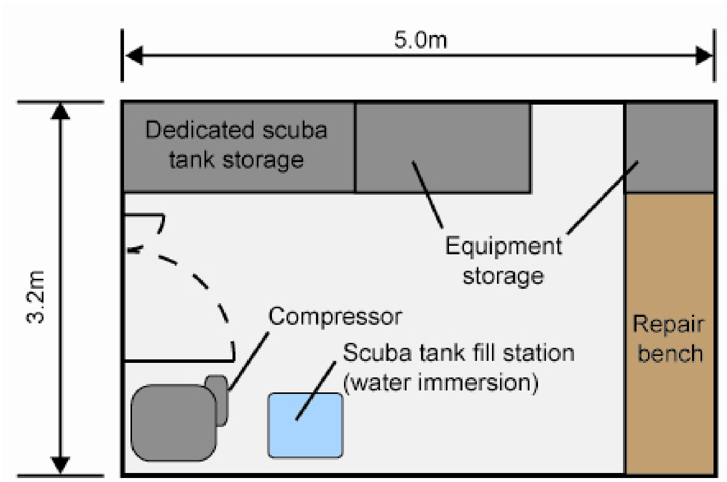
Exterior Glazing	N/A		
Plumbing			
HVAC	Positive pressure, high efficiency filters Care taken to avoid drafts, particularly on lab benches		
Temp Control	As per design range. Controllable for occupant comfort. Provision for night time set-back		
Humidity Control	As per design range		
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.	**LUX**	As per IES
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.		
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment		
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)		
Communications	Telephone, public address, security video, security, LAN access, broadband wireless		

Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Lab. Casework	**Description**	**Finishes**	**Qty**			
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**

CONTENTS

7. DIVING FACILITY

Science &Technology Program		No.	A 7 7		
Functional Group		**Component Group**		**Space Name**	
A Science & Technology		7 Lab Support		7 Diving Facility	
Total Area	**# of Spaces**	**Area**	**Length**	**Width**	**Height**
16.00 m^2	1	16.00 m^2	5.00 m	3.20 m	3.00 m



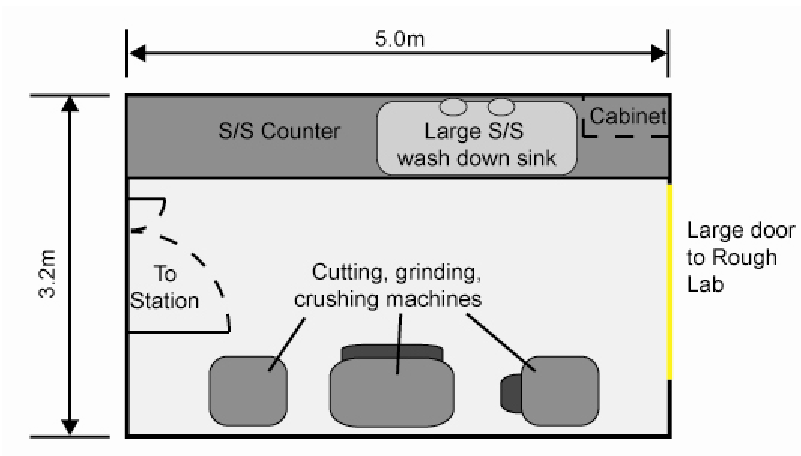
Function	Storage and repair of diving equipment
Space Description	Diving facility
Primary Users	
Max Occupant Load	2-4
Adjacencies	Dock, water
Relationship to Building Complex	
Environment	Humid/Wet **Clean Factor**: Often dirty
Security	**Operations Zone** **Doors:** Card access Alarm system
Acoustics	**Ambient Noise Generation**: high Sound isolation around compressor
Natural daylight	**Natural Daylight**: Not required **Light Quality**: High quality, controlled
Vibration	**Generation**: Low

Structural	To be verified with building standards						
Floors	**Characteristics**: Hard, resilient, impervious to chemicals, durable, cleanable, washable, seamless, static free **Materials**: **Base**:						
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static free **Materials**: **Finish**:						
Ceilings	**Characteristics**: Acoustical, cleanable **Materials**: **Finish**:						
Doors	**To:**	**Type**	**Width**	**Height**	Materials	**Finish**	**Frame**
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal						
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal						
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers						
Plumbing	**Fixtures:** Sink **Water**: Domestic hot, domestic cold, purified water **Laboratory Gases**: Propane, compressed air, vacuum Close proximity to eye wash and shower station						
HVAC	UPS for ventilation system						
Temp Control	As per design range Controllable for occupant comfort / specific laboratory experiments Night time set-back provision						
Humidity Control	As per design range						
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).	**LUX**	As per IES				
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.						
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment						
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)						
Communications	Telephone, public address, security video, security, LAN access, broadband wireless						
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**			

				L	W	H
Fume Hood	For use with acids and solvents	Power, Gas	1	1.6	1	2.3
Freezer/Fridge	Local units if necessary; proximity to central freezer/fridge area preferred					
Dishwasher / Autoclave	Local units if necessary; proximity to central dishwashing/autoclave area preferred					
Sink						
Lab. Casework	**Description**	**Finishes**	**Qty**			
Lower Casework:	Metal	Paint			.75	.9
Bench Tops	Plastic Laminate or stainless steel as required	Chem. resistant			.762	
Upper Casework	Metal	Paint				
Loose Furniture	**Description**	**Finishes**	**Qty**	**L**	**W**	**H**
Waste Drum	One for solid and two for liquid waste	chlorinated & non-chlorinated	3			
Comments	Consideration for outfitting lab with wet services to ensure future flexibility.					

8. ROCK PREP

Science & Technology Program			No.	A 7 8	
Functional Group		Component Group		Space Name	
A Science & Technology		7 Lab Support		8 Rock Prep	
Total Area (m2)	# of Spaces	Area	Length	Width	Height
16.0 m^2	1	16.0 m^2	5.0 m	3.2 m	4.00 m



Function	Preparation of rock samples, including cleaning, cutting, grinding, sorting, etc.
Space Description	Rock prep
Primary Users	
Max Occupant Load	2-4
Adjacencies	Rough work areas such as Rough Lab
Relationship to Building Complex	
Environment	Dry, dusty **Clean Factor**: Dirty
Security	**Operations Zone** **Doors:** Card access Alarm system
Acoustics	**Ambient Noise Generation**: high. Sound isolation required
Natural daylight	**Natural Daylight**: Not required **Light Quality**: High quality, controlled
Vibration	**Generation**: medium
Structural	To be verified with building standards
Floors	**Characteristics**: Hard, resilient, impervious to moisture, durable, cleanable, washable, seamless

	Materials: **Base**:
Walls	**Characteristics**: Durable, cleanable, washable, paintable, static free, seamless **Materials**: **Finish**:
Ceilings	**Characteristics**: Washable, cleanable **Materials**: **Finish**:

Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
	Exterior	Door	1.0 M	2.1 M	Metal/Glass	Pre-finished	Metal

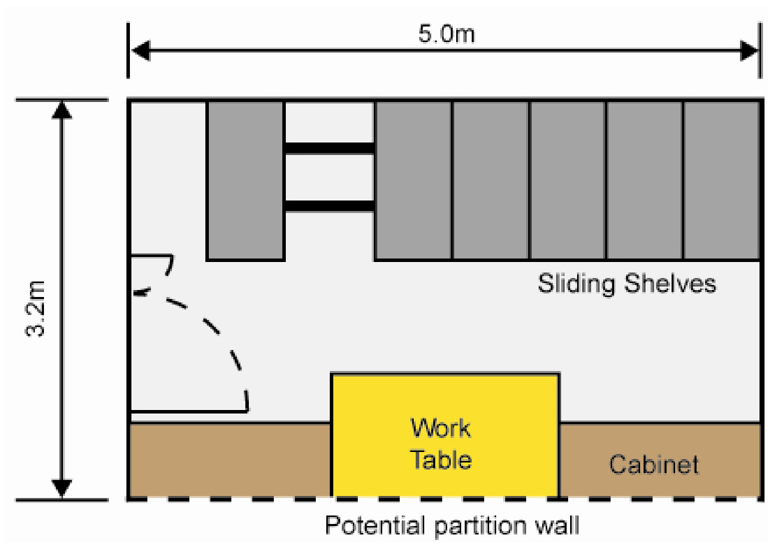
Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal
Exterior Glazing	N/A
Plumbing	**Fixtures:** Large stainless steel sink **Water**: Domestic hot, domestic cold, purified water **Laboratory Gases**: Propane, compressed air
HVAC	Extraction hood for dusty areas
Temp Control	As per design range. Controllable for occupant comfort. Night time set-back provision.
Humidity Control	As per design range
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). — **LUX**: As per IES
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)
Communications	Telephone, public address, security video, security, LAN access, broadband wireless

Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Comments						

9. SAMPLE ARCHIVES

Science &Technology Program			No.	A 7 9	
Functional Group		Component Group		Space Name	
A	Science & Technology	5	Lab Support	9	Sample Archives

Total Area	# of Spaces	Area	Length	Width	Height
48.0 m^2	3	16.0 m^2	5.0 m	3.20 m	4.00 m



Function	Storage of smaller samples brought in from field research
Space Description	Several discrete areas containing the appropriate equipment, chemicals, etc. for preserving sample specimens.
Primary Users	
Max Occupant Load	2-4
Adjacencies	Close or adjacent to Rough Lab, potentially Loading Dock.
Relationship to Building Complex	
Environment	Dry **Clean Factor**:
Security	**Operations Zone** **Doors:** Card access Alarm system
Acoustics	**Ambient Noise Generation**: low
Natural daylight	**Natural Daylight**: Not required **Light Quality**: High quality, controlled
Vibration	**Generation**: low

Structural	To be verified with building standards
Floors	**Characteristics**: Impervious to chemicals, durable, cleanable, washable, seamless **Materials**: **Base**:
Walls	**Characteristics**: Washable, cleanable **Materials**: **Finish**:
Ceilings	**Characteristics**: Washable, cleanable **Materials**: **Finish**:

Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal

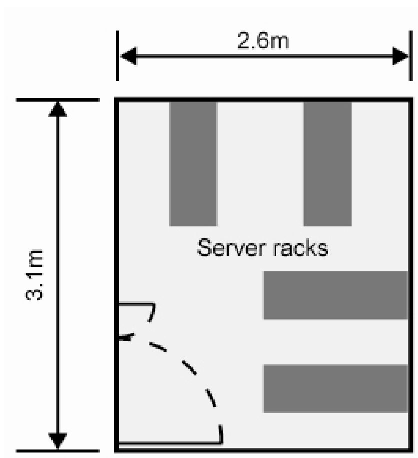
Hardware	**Hinges**: NRP; High Security **Lockset:** Lever **Closer**: Frame Mounted **Locks**: Card Access; Flush Bolts **Hold open**; O/H; Manual **Stop**: O/H **Specialties**: Kick Plates, Astragal
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal
Exterior Glazing	N/A
Plumbing	
HVAC	
Temp Control	As per design range. Controllable for occupant comfort. Night time set-back provision.
Humidity Control	As per design range
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above. **LUX**: As per IES
Power	Normal Power – 120 volt duplex receptacles, ground fault GFCI. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)
Communications	Telephone, public address, security video, security, LAN access, broadband wireless

Equipment	**Description**	**Notes**	**Qty**	**(Meters) L**	**W**	**H**

Comments	Specific area requirements to be developed.

10. SERVER ROOM

Science &Technology Program			No.	A 7 10	
Functional Group		Component Group		Space Name	
A Science & Technology		7 Lab Support		10 Server Room	
Total Area	# of Spaces	Area	Length	Width	Height
8.00 m^2	1	8.00 m^2	3.1 m	2.6 m	3.00 m



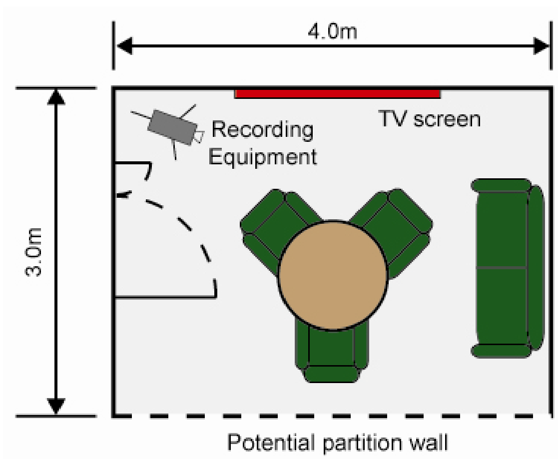
Function	Space for storage of Station network servers.
Space Description	Size to be confirmed based on Station data and network requirements.
Primary Users	
Max Occupant Load	2-3
Adjacencies	Adjacent to data archive, central telecommunications, other computer labs (if necessary)
Relationship to Building Complex	
Environment	Very clean, static-free
Security	**Security Zone** **Doors:** Card access Alarm system
Acoustics	**Ambient Noise Generation**: low
Natural daylight	**Natural Daylight**: Not required **Light Quality**: High quality, controlled **Interior view to space**: Required for safety & security

<table>
<tr><td colspan="2">Vibration</td><td colspan="7">Generation: Low</td></tr>
<tr><td colspan="2">Structural</td><td colspan="7">To be verified with building standards</td></tr>
<tr><td colspan="2">Floors</td><td colspan="7">Characteristics: Static-free
Materials: Base:</td></tr>
<tr><td colspan="2">Walls</td><td colspan="7">Characteristics: Static-free
Materials: Finish:</td></tr>
<tr><td colspan="2">Ceilings</td><td colspan="7">Characteristics: Acoustical, cleanable
Materials: Finish:</td></tr>
<tr><td rowspan="3">Doors</td><td>To:</td><td>Type</td><td>Width</td><td>Height</td><td>Materials</td><td>Finish</td><td colspan="2">Frame</td></tr>
<tr><td rowspan="2">Room</td><td>Main Door</td><td>0.92 M</td><td>2.1 M</td><td>Hollow Metal/Gl.</td><td>Pre-finished</td><td colspan="2">Metal</td></tr>
<tr><td>Side leaf</td><td>0.31 M</td><td>2.1 M</td><td>Hollow Metal/Gl.</td><td>Pre-finished</td><td colspan="2">Metal</td></tr>
<tr><td colspan="2">Interior Glazing</td><td colspan="7">Glass: Single, tempered Window Coverings: Blinds
Frames: Metal</td></tr>
<tr><td colspan="2">Exterior Glazing</td><td colspan="7">None</td></tr>
<tr><td colspan="2">Plumbing</td><td colspan="7">No special plumbing.</td></tr>
<tr><td colspan="2">HVAC</td><td colspan="7">Design for potentially high equipment heat gain.
Consideration for free cooling to reduce air conditioning costs.</td></tr>
<tr><td colspan="2">Temp Control</td><td colspan="7">As per design range</td></tr>
<tr><td colspan="2">Humidity Control</td><td colspan="7">As per design range. Special humidity controls may be necessary.</td></tr>
<tr><td colspan="2">Lighting</td><td colspan="5">Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).</td><td>LUX</td><td>As per IES</td></tr>
<tr><td colspan="2">Power</td><td colspan="7">Normal Power – 120 volt duplex receptacles, ground fault GFCI.
Emergency Power – one 120 volt 15 amp duplex receptacle.
UPS – as designed and required for specific functions.</td></tr>
<tr><td colspan="2">Mechanical Life Safety</td><td colspan="7">Sprinklers, smoke control, fire safety equipment.
Specialized fire suppression equipment may be required to prevent damage to electronic equipment.</td></tr>
<tr><td colspan="2">Electrical Life Safety</td><td colspan="7">Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)</td></tr>
<tr><td colspan="2">Communications</td><td colspan="7">Telephone, public address, security video, security, LAN access, broadband wireless</td></tr>
<tr><td colspan="2" rowspan="2">Equipment</td><td colspan="2" rowspan="2">Description</td><td rowspan="2">Notes</td><td rowspan="2">Qty</td><td colspan="3">(Meters)</td></tr>
<tr><td>L</td><td>W</td><td>H</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Comments</td><td colspan="7"></td></tr>
</table>

11. INTERVIEW ROOM

Science &Technology Program		No.	A 7 11
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	7 Lab Support	11 Interview Room	

Total Area	# of Spaces	Area	Length	Width	Height
36.0 m^2 (Phase 1b)	3	12.0 m^2	4.00 m	3.00 m	3.00 m
12.0 m^2 (Phase 2)	1	12.0 m^2	4.00 m	3.00 m	3.00 m

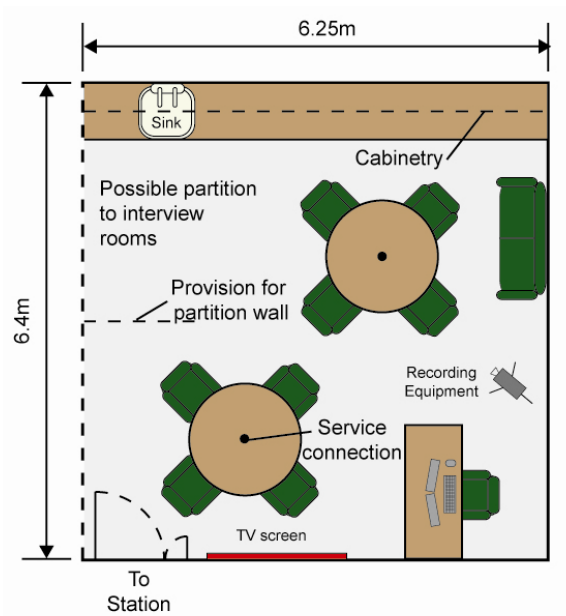


Function	Used for interview or related purposes, small meetings
Space Description	Comfortable area designed to make occupants feel welcome and at ease.
Primary Users	
Max Occupant Load	3-5
Adjacencies	In proximity to Social Science room, E-Health, main area if possible.
Relationship to Building Complex	
Environment	Normal
Security	Operations Zone Doors: Card access
Acoustics	Ambient Noise Generation: low Sound insulation to prevent voice transmission
Natural daylight	Natural Daylight: Desirable Light Quality: High quality, controlled View to interior for occupant safety
Vibration	Generation: Low

Structural	To be verified with building standards							
Floors	Characteristics: Materials: Base:							
Walls	Characteristics: Materials: Finish:							
Ceilings	Characteristics: Materials: Finish:							
Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**	
	Room	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal	
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal	
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal							
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers							
Plumbing	No special plumbing.							
HVAC								
Temp Control	As per design range. Controllable for occupant comfort. Provision for night time set-back							
Humidity Control	As per design range							
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.	**LUX**	As per IES					
Power	Normal Power – 120 volt duplex receptacles, ground fault GFCI. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.							
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment.							
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)							
Communications	Telephone, public address, security video, security, LAN access, broadband wireless							
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**				
				L	**W**	**H**		
Comments								

12. SOCIAL SCIENCE WORKSHOP/CLASSROOM

Science &Technology Program			No.	A 7 12	
Functional Group		Component Group		Space Name	
A Science & Technology		7 Lab Support		2 Social Science Workshop / Classroom	
Total Area	# of Spaces	Area	Length	Width	Height
40.0 m^2	1	40.0 m^2	6.40 m	6.25 m	3.00 m



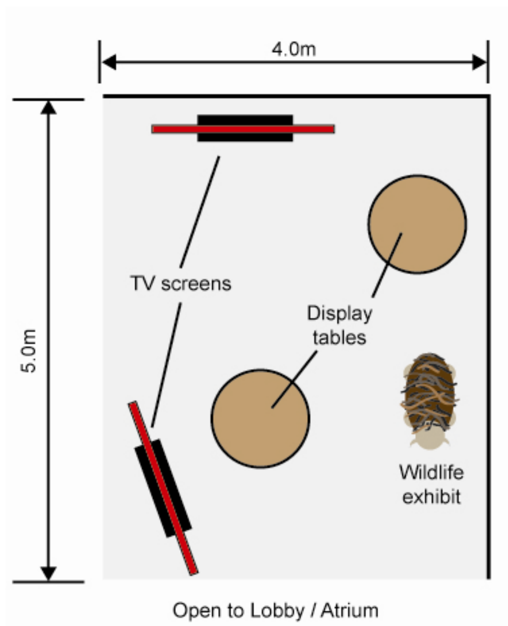
Function	Used for social science research, focus/discussion groups, traditional knowledge, teaching
Space Description	Comfortable, adaptable space that can be configured for both workshops and classroom-style settings
Primary Users	
Max Occupant Load	
Adjacencies	Coffee/kitchen area, interview rooms
Relationship to Building Complex	
Environment	Dry
Security	Operations Zone Doors: Card access
Acoustics	Ambient Noise Generation: low Soundproof

Natural daylight	Natural Daylight: Desirable Light Quality: High quality, controlled Interior view to space: Required for safety and security						
Vibration	Generation: Low						
Structural	To be verified with building standards						
Floors	Characteristics: **Materials:** **Base:**						
Walls	Characteristics: Materials: Finish:						
Ceilings	Characteristics: **Materials:** **Finish**:						
Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Room	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal						
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers						
Plumbing							
HVAC							
Temp Control	As per design range. Controllable for occupant comfort. Provision for night time set-back						
Humidity Control	As per design range						
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.	**LUX**	As per IES				
Power	Normal Power – 120 volt duplex receptacles, ground fault GFCI. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.						
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment.						
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)						
Communications	Telephone, public address, security video, security, LAN access, broadband wireless						
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**			
				L	**W**	**H**	
Comments							

13. DISPLAY AREA

Science &Technology Program			No.	A 7 13	
Functional Group		Component Group		Space Name	
A	Science & Technology	7	Lab Support	13	Display Area

Total Area	# of Spaces	Area	Length	Width	Height
20.00 m^2 (Phase 1b)	1	20.00 m^2	5.00 m	4.0 m	3.00 m
20.00 m^2 (Phase 2)	1	20.00 m^2	5.00 m	4.0 m	3.00 m



Function	For display of items of scientific interest to visitors
Space Description	
Primary Users	
Max Occupant Load	2-4
Adjacencies	Adjacent to reception
Relationship to Building Complex	
Environment	Normal
Security	Reception Zone Doors:

Acoustics	Ambient Noise Generation: low
Natural daylight	Natural Daylight: Desirable Light Quality: High quality, controlled
Vibration	Generation: Low
Structural	To be verified with building standards
Floors	Characteristics: Materials: Base:
Walls	Characteristics: Materials: Finish: Type and orientation depends on relation to lobby
Ceilings	Characteristics: Materials: Finish:

Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**

Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers
Plumbing	No special plumbing.
HVAC	
Temp Control	As per design range. Controllable for occupant comfort. Provision for night time set-back
Humidity Control	As per design range

Lighting	Illumination to enhance displays, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).	**LUX**	As per IES

Power	Normal Power – 120 volt duplex receptacles for display power connection.
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment.
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)
Communications	Telephone, public address, security video, security, LAN access, broadband wireless

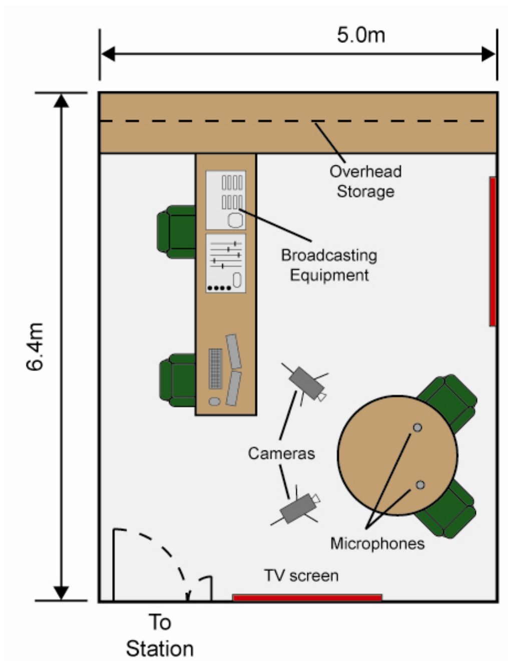
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**

Comments	Flexible space to accommodate multiple different displays

14. MEDIA CENTRE / BROADCAST ROOM

Science &Technology Program		No.	A 7 14
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	7 Lab Support	14 Media Centre / Broadcast Room	

Total Area	# of Spaces	Area	Length	Width	Height
32.00 m^2	1	32.00 m^2	5.00 m	6.40 m	3.00 m



Function	Used for broadcasting messages to Station and/or radio/internet programs. Also can be used for holding small interviews or discussions for broadcast/webcast, recording of video and audio. Allow for incorporation of portable translation equipment.
Space Description	
Primary Users	
Max Occupant Load	4-6
Adjacencies	Auditorium/conference areas
Relationship to Building Complex	
Environment	Dry, static-free
Security	**Operations Zone**

	Doors: Card access Alarm system
Acoustics	**Ambient Noise Generation**: low Soundproof
Natural daylight	**Natural Daylight**: Not required **Light Quality**: High quality, controlled **Interior view to space:** Required for safety and security
Vibration	**Generation**: Low
Structural	To be verified with building standards
Floors	**Characteristics**: **Materials**: **Base**:
Walls	**Characteristics**: **Materials**: **Finish**:
Ceilings	**Characteristics**: **Materials**: **Finish**:

Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Room	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal

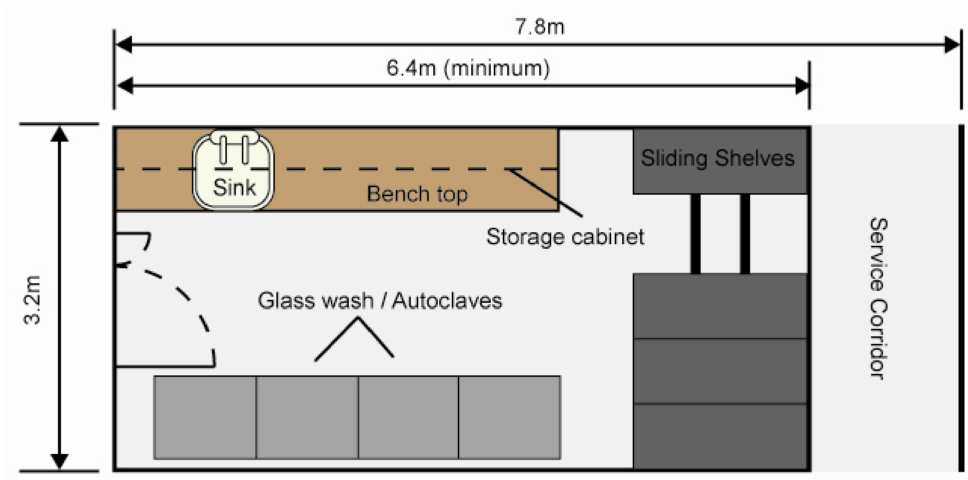
Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal		
Exterior Glazing	**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers		
Plumbing	No special plumbing.		
HVAC			
Temp Control	As per design range. Controllable for occupant comfort. Provision for night time set-back		
Humidity Control	As per design range		
Lighting	Area requires illumination to coordinate with functional needs, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights on local desks and cabinets to have similar attributes as general lamps above.	**LUX**	As per IES
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, with 120 volt 15/20 amp duplex receptacle required. Special power connection to suit equipment. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.		
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment.		
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)		
Communications	Telephone, public address, security video, security, LAN access, broadband		

	wireless Specialized broadcast equipment as per program requirements					
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Comments						

15. GLASS WASH / AUTOCLAVE / STORAGE

Science &Technology Program		No.	A 7 15
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	7 Lab Support	15 Glass Wash / Autoclave / Storage	

Total Area	# of Spaces	Area	Length	Width	Height
25.00 m^2	1	25.00 m^2	7.80 m	3.20 m	3.00 m



Function	Central glass washing, autoclave, and glass storage
Space Description	Space with stations/equipment for washing and storage of assorted glassware.
Primary Users	
Max Occupant Load	4 – 6
Adjacencies	Labs
Relationship to Building Complex	
Environment	Humid Clean factor: normal wet lab
Security	Operations zone Doors: Card access Alarm system
Acoustics	Ambient Noise Generation: high
Natural daylight	Natural Daylight: Not required Light Quality: Controlled Interior view to space: Required for safety & security
Vibration	Generation: medium

Structural	To be verified with building standards
Floors	Characteristics: Hard, resilient, non-slip, impervious to chemicals, durable, washable, seamless **Materials:** **Base:**
Walls	Characteristics: Durable, washable, paintable, static-free **Materials:** **Finish:**
Ceilings	Characteristics: Washable, cleanable **Materials:** **Finish:**

Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Room	Main Door	0.92 M	2.1 M	Hollow Metal/GI.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/GI.	Pre-finished	Metal

Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal		
Exterior Glazing	N/A		
Plumbing	As per wet lab		
HVAC	Heat extraction hoods		
Temp Control	As per design range. Potentially controllable for occupant comfort. Provision for night time set-back		
Humidity Control	As per design range		
Lighting	Area requires illumination to meet IES standards, complete with independent controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).	**LUX**	As per IES
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, plus two single phase 208 volt and two three phase 208 volt outlets. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.		
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment.		
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)		
Communications	Telephone, public address, security video, security, broadband wireless, LAN access		

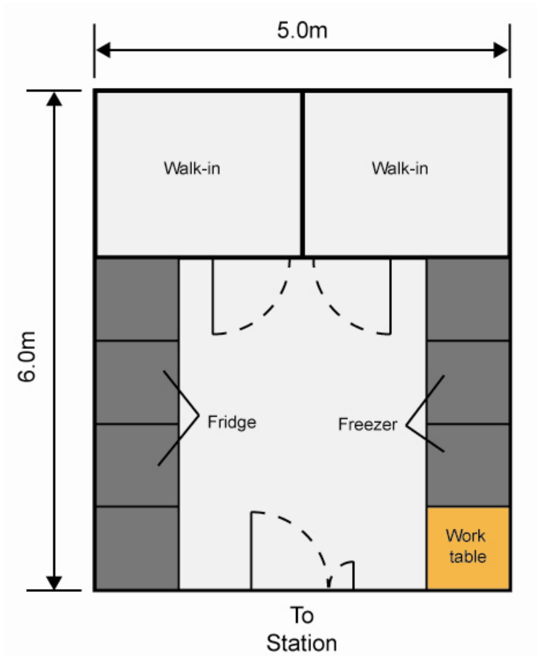
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Glass washer						
Autoclave						
Storage cabinets						
Dolleys						

Comments	This space is a central glassware storage area. Consideration should be given for small, immediate-use glassware storage areas within/adjacent to each lab.

16. FREEZERS & REFRIGERATORS

Science &Technology Program		No.	A 7 16
Functional Group	Component Group	Space Name	
A Science & Technology	7 Lab Support	16 Freezers & Refrigerators	

Total Area	# of Spaces	Area	Length	Width	Height
30.00 m^2	1	30.00 m^2	6.00 m	5.00 m	3.00 m



Function	Central area provided consolidation of freezers and refrigerators.
Space Description	Area containing small and walk-in equipment.
Primary Users	
Max Occupant Load	4-6
Adjacencies	Labs
Relationship to Building Complex	
Environment	Dry
Security	Operations Zone Doors: Card access
Acoustics	Ambient Noise Generation: low
Natural daylight	Natural Daylight: Not required

		Light Quality: High quality, controlled Interior view to space: Required for safety and security					
Vibration		Generation: Low					
Structural		To be verified with building standards					
Floors		Characteristics: Cleanable, washable, hard, resilient, impervious to chemicals, durable, seamless **Materials:** **Base:**					
Walls		Characteristics: Durable, cleanable, washable, paintable, static-free **Materials:** **Finish:**					
Ceilings		Characteristics: Washable, cleanable **Materials:** **Finish:**					
Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Room	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
Interior Glazing		**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal					
Exterior Glazing		N/A					
Plumbing		As per wet lab					
HVAC		Freezer temperatures to be determined. Consideration for utilizing outdoor air / permafrost to reduce energy loads					
Temp Control		As per design range. Controllable for occupant comfort.					
Humidity Control		As per design range					
Lighting		Area requires illumination to meet IES standards, complete with independent controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).				**LUX**	As per IES
Power		Normal Power – independent 120/208 volt 3 phase 4 wire panel board, with receptacles of rating and configuration to suit equipment. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.					
Mechanical Life Safety		Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety		Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications		Telephone, public address, security video, security, LAN access, broadband wireless					

Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Comments	Provide walk-in freezer and emergency power for all equipment					

17. LIQUID NITROGEN GENERATION

Science &Technology Program		No.	A 7 17
Functional Group	Component Group		Space Name
A Science & Technology	7 Lab Support		17 Liquid Nitrogen Generation

Total Area	# of Spaces	Area	Length	Width	Height
20.00 m^2	2	10.00 m^2			3.00 m

Function	Generation of liquid nitrogen to support research functions
Space Description	Area containing equipment for liquid nitrogen generation. Total area requirements to be confirmed.
Primary Users	
Max Occupant Load	1-2
Adjacencies	Labs
Relationship to Building Complex	
Environment	Normal **Clean factor:**
Security	**Operations zone** **Doors:** Card access Alarm system
Acoustics	**Ambient Noise Generation**:
Natural daylight	**Natural Daylight**: Not required **Light Quality**: Controlled **Interior view to space**: Required for safety & security
Vibration	**Generation**:
Structural	To be verified with building standards
Floors	**Characteristics**: Hard, resilient, non-slip, impervious to chemicals, durable, washable, seamless **Materials**: **Base**:
Walls	**Characteristics**: Durable, washable, paintable, static-free **Materials**: **Finish**:

Ceilings	**Characteristics**: Washable, cleanable **Materials**: **Finish**:

Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Room	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal

Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal
Exterior Glazing	N/A
Plumbing	
HVAC	
Temp Control	As per design range. Potentially controllable for occupant comfort. Provision for night time set-back
Humidity Control	As per design range

Lighting	Area requires illumination to meet IES standards, complete with independent controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).	**LUX**	As per IES

Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, with receptacles of rating and configuration to suit equipment. To be confirmed once space needs/equipment confirmed. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment.
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)
Communications	Telephone, public address, security video, security, broadband wireless, LAN access

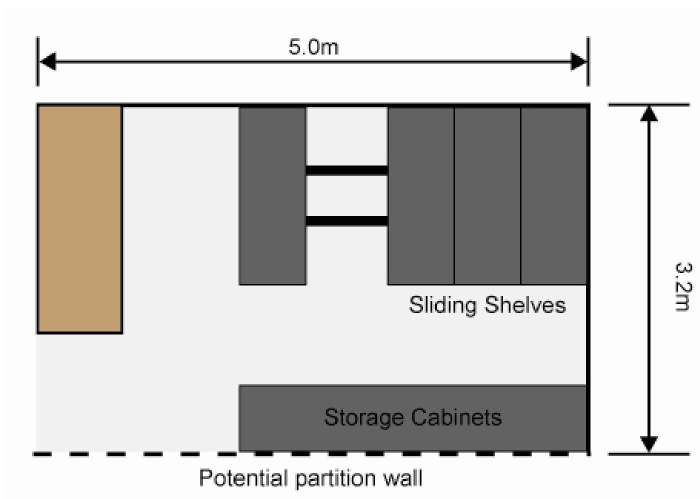
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**

Comments	

18. SCIENCE STORES

Science &Technology Program		No.	A 7 18
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	7 Lab Support	18 Science Stores	

Total Area	# of Spaces	Area	Length	Width	Height
32.00 m^2	2	16.00 m^2	5.00 m	3.20 m	3.00 m



Function	Distribution of various scientific equipment and substances to researchers
Space Description	
Primary Users	
Max Occupant Load	4 – 6
Adjacencies	Labs, storage
Relationship to Building Complex	
Environment	Normal Clean factor:
Security	Operations zone Doors: Card access Alarm system
Acoustics	Ambient Noise Generation: low
Natural daylight	Natural Daylight: Not required Light Quality: Controlled Interior view to space: Required for safety & security
Vibration	Generation:

Structural	To be verified with building standards
Floors	Characteristics: Hard, resilient, non-slip, impervious to chemicals, durable, washable, seamless Materials: Base:
Walls	Characteristics: Durable, washable, paintable, static-free Materials: Finish:
Ceilings	Characteristics: Washable, cleanable Materials: Finish:

Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Room	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal

Interior Glazing	**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal		
Exterior Glazing	N/A		
Plumbing			
HVAC			
Temp Control	As per design range. Controllable for occupant comfort. Provision for night time set-back		
Humidity Control	As per design range		
Lighting	Area requires illumination to meet IES standards, complete with independent controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).	**LUX**	As per IES
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, with receptacles of rating and configuration to suit equipment. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.		
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment		
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)		
Communications	Telephone, public address, security video, security, broadband wireless, LAN access		

Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Comments						

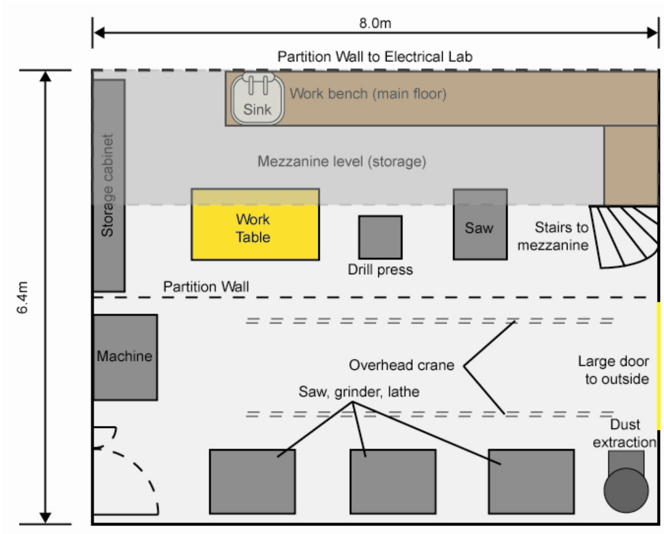
CONTENTS

8. WORKSHOP

1. MECHANICAL

Science &Technology Program		No.	A 8 1
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	8 Workshop	1 Mechanical	

Total Area	# of Spaces	Area	Length	Width	Height
51.00 m2	1	51.00 m2	8.00 m	6.40 m	6.00 m



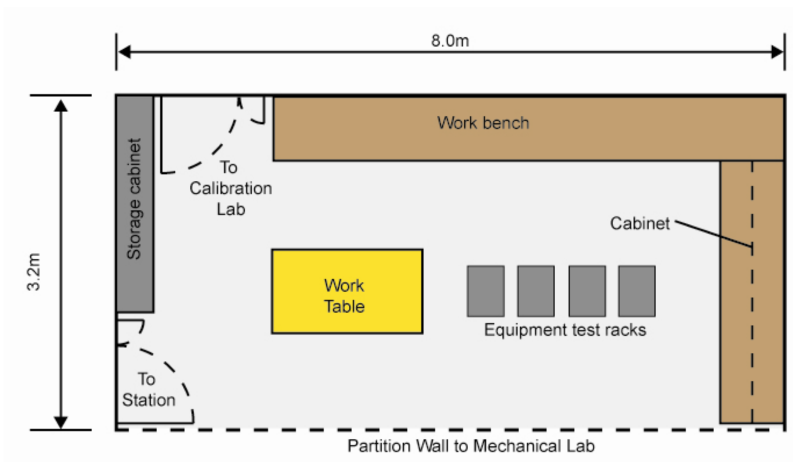
Function	Supports technology functions of the S&T program
Space Description	Open engineering lab with reconfigurable work benches, machinery, etc. for testing and construction of equipment (primarily mechanical)
Primary Users	
Max Occupant Load	4-8
Adjacencies	Electrical Workshop, Calibration Lab, Modular Lab, loading dock (potentially)
Relationship to Building Complex	
Environment	Dry, dusty
Security	Operations zone Doors: Card access, Alarm system
Acoustics	Ambient Noise Generation: medium/high
Natural daylight	Natural Daylight: Desirable Light Quality: High quality, controlled Interior view to space: Required for safety & security
Vibration	Generation: Medium – high Some equipment may require vibration protection

<table>
<tr><td colspan="2">Structural</td><td colspan="6">To be verified with building standards – higher structural strength may be required to accommodate heavy equipment.</td></tr>
<tr><td colspan="2">Floors</td><td colspan="6">Characteristics: Hardened, sealed concrete</td></tr>
<tr><td colspan="2">Walls</td><td colspan="6">Characteristics: Durable, cleanable, washable, paintable</td></tr>
<tr><td colspan="2">Ceilings</td><td colspan="6">Characteristics:</td></tr>
<tr><td rowspan="4">Doors</td><td>To:</td><td>Type</td><td>Width</td><td>Height</td><td>Materials</td><td>Finish</td><td>Frame</td></tr>
<tr><td rowspan="2">Internal</td><td>Main Door</td><td>0.92 M</td><td>2.1 M</td><td>Hollow Metal/Gl.</td><td>Pre-finished</td><td>Metal</td></tr>
<tr><td>Side leaf</td><td>0.31 M</td><td>2.1 M</td><td>Hollow Metal/Gl.</td><td>Pre-finished</td><td>Metal</td></tr>
<tr><td>External</td><td>O/H</td><td>4.0 M</td><td>3.0 M</td><td>Insulated Metal</td><td>Pre-finished</td><td>Metal</td></tr>
<tr><td colspan="2">Plumbing</td><td colspan="6">Fixtures: Lab sink
Water: Domestic hot, domestic cold, purified/distilled water
Waste: Floor drain if appropriate
Laboratory gas: Propane, compressed air, oxygen (cutting torches)
Proximity to eye washer, shower</td></tr>
<tr><td colspan="2">HVAC</td><td colspan="6">Consideration for heat recovery, dependant on pollutant control requirements
Design for potentially high equipment heat gain.
Dust extraction hoods
Design to allow for varying levels of air quality and exhaust of work-related odours and fumes.</td></tr>
<tr><td colspan="2">Temp Control</td><td colspan="6">As per design range. Controllable for occupant comfort. Consideration for night-time set back.</td></tr>
<tr><td colspan="2">Humidity Control</td><td colspan="6">As per design range</td></tr>
<tr><td colspan="2">Lighting</td><td colspan="4">Area requires illumination to meet IES standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.</td><td>LUX</td><td>As per IES</td></tr>
<tr><td colspan="2">Power</td><td colspan="6">Normal Power – independent 120/208 volt 3 phase 4 wire panel board, with 120 volt 15/20 amp duplex receptacle required. Special power connection to suit equipment. (GFCI near sinks or any other source of water).
Emergency Power – one 120 volt 15 amp duplex receptacle.
UPS – as designed and required for specific functions.</td></tr>
<tr><td colspan="2">Mechanical Life Safety</td><td colspan="6">Sprinklers, smoke control, fire safety equipment</td></tr>
<tr><td colspan="2">Electrical Life Safety</td><td colspan="6">Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)</td></tr>
<tr><td colspan="2">Communications</td><td colspan="6">Telephone, public address, security video, security, LAN access, broadband wireless</td></tr>
<tr><td colspan="2" rowspan="2">Equipment</td><td rowspan="2">Description</td><td rowspan="2">Notes</td><td rowspan="2">Qty</td><td colspan="3">(Meters)</td></tr>
<tr><td>L</td><td>W</td><td>H</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Comments</td><td colspan="6"></td></tr>
</table>

2. ELECTRICAL

Science & Technology Program		No.	A 8 2
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	8 Workshop	2 Electrical	

Total Area (m2)	# of Spaces	Area	Length	Width	Height
32.00 m^2	1	32.00 m^2	8.00 m	3.20 m	6.00 m



Function	Supports technology functions of the S&T program
Space Description	Open engineering lab with reconfigurable work benches, machinery, etc. for testing and construction of equipment (primarily electrical)
Primary Users	
Max Occupant Load	4-8
Adjacencies	Mechanical Workshop, Calibration Lab, Modular Lab, loading dock (potentially)
Relationship to Building Complex	
Environment	Clean, static-free
Security	Operations zone Doors: Card access Alarm system
Acoustics	Ambient Noise Generation: medium/high
Natural daylight	Natural Daylight: Desirable Light Quality: High quality, controlled Interior view to space: Required for safety & security
Vibration	Generation: Medium Vibration protection required
Structural	To be verified with building standards – higher structural strength may be

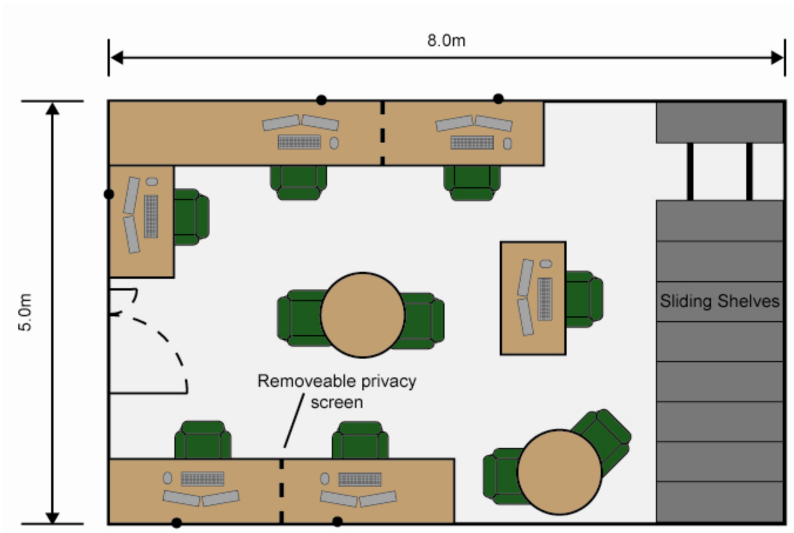
		required to accommodate heavy equipment.					
Floors		Characteristics: Hardened, sealed concrete					
Walls		Characteristics: Durable, cleanable, washable, paintable					
Ceilings		Characteristics:					
Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Calibration Lab	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
	Internal	Main Door	0.92 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
		Side leaf	0.31 M	2.1 M	Hollow Metal/Gl.	Pre-finished	Metal
Plumbing		**Fixtures:** **Water:** Domestic hot, domestic cold, purified/distilled water **Waste**: Floor drain if appropriate **Laboratory gas:** Propane, compressed air, oxygen (cutting torches) Proximity to eye washer, shower					
HVAC		Consideration for heat recovery, dependant on pollutant control requirements Design for potentially high equipment heat gain. Design to allow for varying levels of air quality and exhaust of work-related odours and fumes, e.g. soldering irons					
Temp Control		As per design range. Controllable for occupant comfort. Consideration for night-time set back.					
Humidity Control		As per design range					
Lighting		Area requires illumination to meet IES standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.				**LUX**	As per IES
Power		Normal Power – independent 120/208 volt 3 phase 4 wire panel board, with 120 volt 15/20 amp duplex receptacle required. Special power connection to suit equipment. (GFCI near sinks or any other source of water). Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.					
Mechanical Life Safety		Sprinklers, smoke control, fire safety equipment					
Electrical Life Safety		Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications		Telephone, public address, security video, security, LAN access, broadband wireless					

Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Comments						

9. LIBRARY

Science &Technology Program		No.	A 9 1
Functional Group	Component Group	Space Name	
A Science & Technology	9 Library	1 Library	

Total Area	# of Spaces	Area	Length	Width	Height
40.0 m^2	1	40.0 m^2	8.0 m	5.00 m	4.0



Function	Storage of written & electronic materials, reading/discussion space
Space Description	Culturally sensitive space for storage of archival material, including video and audio records, books and written materials in physical and electronic format, and artifacts
Primary Users	
Max Occupant Load	12
Adjacencies	Phase 1a – potentially located in high school
Relationship to Building Complex	
Environment	Dry, normal
Security	**Reception Zone** **Doors:** Card access
Acoustics	**Ambient Noise Generation**: low
Natural daylight	**Natural Daylight**: Preferred **Light Quality**: High quality, controlled **Interior view to space:** Required for safety and security
Vibration	**Generation**: Low
Structural	To be verified with building standards

Floors		**Characteristics**: **Materials**: **Base**:					
Walls		**Characteristics**: **Materials**: **Finish**:					
Ceilings		**Characteristics**: **Materials**: **Finish**:					
Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
Interior Glazing		**Glass**: Single, tempered **Window Coverings**: Blinds **Frames**: Metal					
Exterior Glazing		**Glass**: Double or triple-paned, low-e, argon gas fill **Window Coverings**: Blinds/blackout shutters **Frames**: Metal with insulated spacers					
Plumbing		No special plumbing.					
HVAC							
Temp Control		As per design range. Controllable for occupant comfort. Provision for night time set-back					
Humidity Control		As per design range					
Lighting		Area requires illumination to meet IES standards, and coordinate with book shelving equipment complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.				**LUX**	As per IES
Power		Normal Power – 120 volt duplex receptacles. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.					
Mechanical Life Safety		Sprinklers, smoke control, fire safety equipment. Special fire suppression for records storage spaces may be required.					
Electrical Life Safety		Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)					
Communications		Telephone, public address, security video, security, LAN access, broadband wireless					

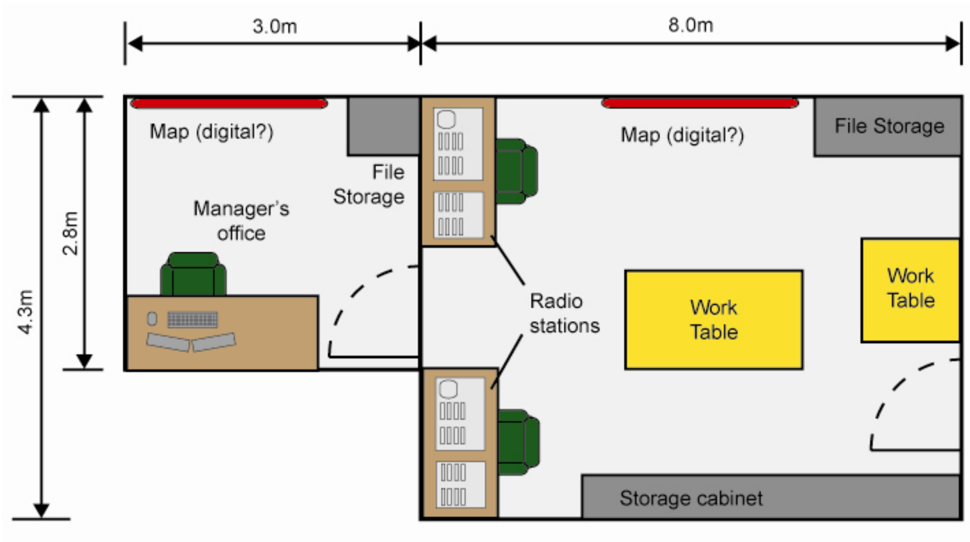
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**		
				L	**W**	**H**
Comments	Sliding rail system for bookshelves.					

10. LOGISTICS

1. OPERATIONS OFFICE

Science &Technology Program		No.	A 10 1
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	10 Logistics	1 Operations Office	

Total Area	# of Spaces	Area	Length	Width	Height
32.00 m^2	1	23.60 m^2	4.30 m	5.50 m	3.00 m
	1	8.40	2.80 m	3.00 m	3.00 m



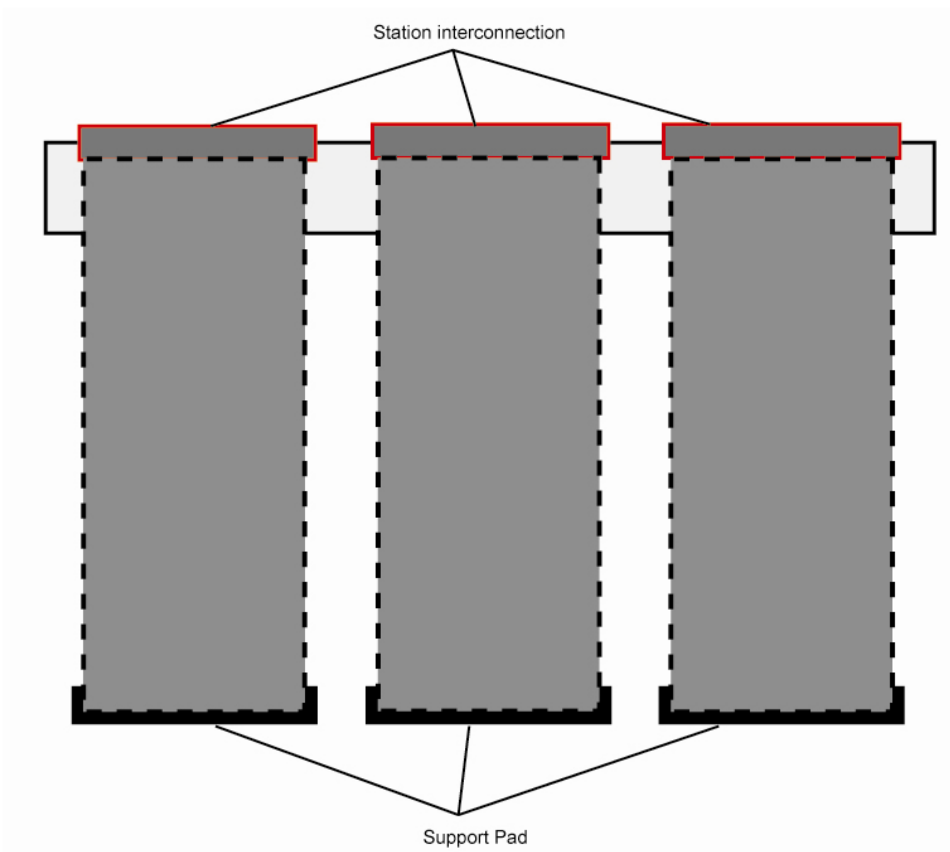
Function	Support field researchers, including daily communications for safety purposes
Space Description	Open area with radio and other communication equipment, maps, work tables, file storage, small office attached
Primary Users	
Max Occupant Load	2-4
Adjacencies	Potentially located at airport.
Relationship to Building Complex	
Environment	Dry
Security	Operations Zone Doors: Card access
Acoustics	Ambient Noise Generation: low
Natural daylight	Natural Daylight: Desirable

	Light Quality: High quality, controlled Interior view to space: Required for safety & security						
Vibration	Generation: low						
Structural	To be verified with building standards						
Floors	Characteristics: Soft, durable, cleanable, static-free Materials: Base:						
Walls	Characteristics: Durable, cleanable, washable, paintable, static-free Materials: Finish:						
Ceilings	Characteristics: Acoustical, cleanable Materials: Finish:						
Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
	Internal	Main Door					
	Office	Office Door					
Plumbing							
HVAC							
Temp Control	As per design range. Occupant control. Consideration for night-time set back.						
Humidity Control	As per design range						
Lighting	Area requires illumination to meet Lab standards, complete with independent variable intensity controls. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum). Task lights under cabinets to have similar attributes as general lamps above.	**LUX**	As per IES				
Power	Normal Power – independent 120/208 volt 3 phase 4 wire panel board, wire mold raceway with two 120 volt 15/20 amp duplex receptacle per 610mm of counter, pus two single phase 208 volt and two three phase 208 volt outlets. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.						
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment						
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)						
Communications	Telephone, public address, security video, security, LAN access, broadband wireless						
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**			
				L	**W**	**H**	
Comments							

2. SEATAINER PLUG-AND-PLAY DOCK

Science &Technology Program			No.	A 10 2	
Functional Group		**Component Group**		**Space Name**	
A	Science & Technology	10	Logistics	2	Seatainer Plug-and-Play Dock

Total Area	# of Spaces	Area	Length	Width	Height
10.0 m^2	1	10.0 m^2			



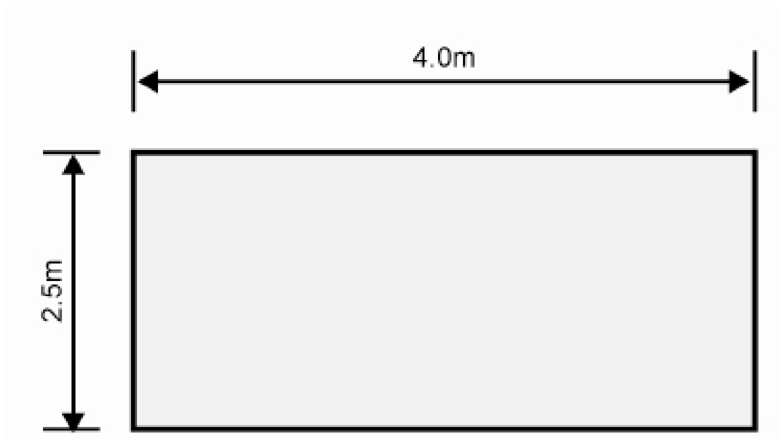
Function	Facilitate incorporation of seatainer labs into main facility.
Space Description	
Primary Users	
Max Occupant Load	
Adjacencies	
Relationship to Building Complex	

Environment	Dry								
Security	Operations Zone Doors: Card access								
Acoustics	Ambient Noise Generation: high								
Natural daylight	Natural Daylight: Not required Light Quality: High quality Interior view to space:								
Vibration	Generation:								
Structural	To be verified with building standards – higher structural strength may be required to accommodate heavy equipment and seatainers								
Floors	Characteristics: Materials: Base:								
Walls	Characteristics: Materials: Finish:								
Ceilings	Characteristics: Materials: Finish:								
Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**		
Plumbing									
HVAC									
Temp Control	As per design range								
Humidity Control	As per design range								
Lighting	Area required illumination to meet IES standards.	**LUX**	As per IES						
Power									
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment, spill control equipment.								
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, exit signs, detection (CO, smoke, heat, etc.)								
Communications	Telephone, public address, closed circuit / IP video, security, LAN access, broadband wireless								
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**					
				L	**W**	**H**			
Comments									

3. DOCK

Science &Technology Program		No.	A 10 3
Functional Group	**Component Group**	**Space Name**	
A Science & Technology	10 Logistics	3 Dock	

Total Area	# of Spaces	Area	Length	Width	Height
10.0 m^2	1	10.0 m^2			



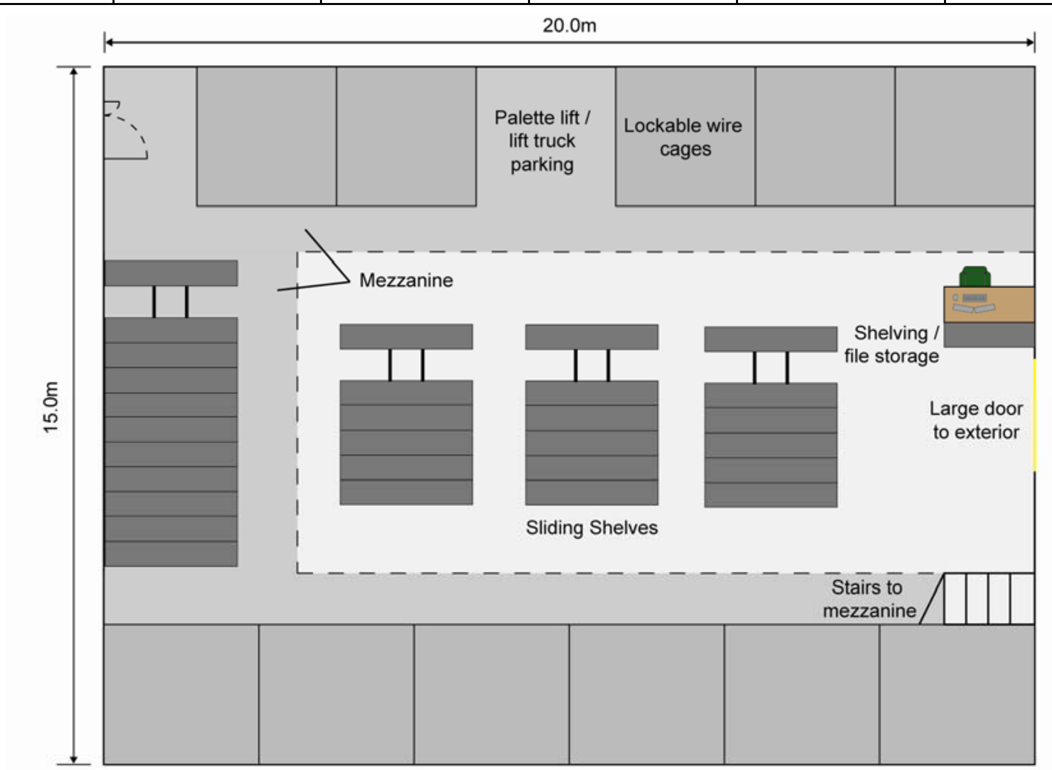
Function	Support aquatic functions such as the launching of boats and robotic submersibles
Space Description	It's a dock. Floating for ease of removal in the winter.
Primary Users	
Max Occupant Load	
Adjacencies	
Relationship to Building Complex	
Environment	Outdoors
Security	
Acoustics	Ambient Noise Generation: medium
Natural daylight	Yes
Vibration	Generation: Medium
Structural	
Floors	Characteristics: Materials: Base:

Walls		N/A						
Ceilings		N/A						
Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**	
	N/A							
Plumbing								
HVAC								
Temp Control								
Humidity Control								
Lighting		Area requires illumination to meet IES standards, complete with independent control. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).				**LUX**	As per IES	
Power		Normal Power – 120 volt duplex receptacles, ground fault GFCI. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.						
Mechanical Life Safety								
Electrical Life Safety								
Communications								
Equipment		**Description**	**Notes**	**Qty**	**(Meters)**			
					L	**W**	**H**	
Comments								

4. EQUIPMENT STORAGE

Science &Technology Program		No.	A 10 4
Functional Group	**Component Group**		**Space Name**
A Science & Technology	10 Logistics		4 Equipment Storage

Total Area	# of Spaces	Area	Length	Width	Height
300.00 m^2 (Phase 1a)	1	300.00 m^2			6.00 m
120.00 m^2 (Phase 1b)	1	120.00 m^2			6.00 m
600.00 m^2 (Phase 2)	1	600.00 m^2			6.00 m



Function	Storage of S&T equipment in a controlled environment
Space Description	Central, interior, conditioned, warehouse-type space. Final areas to be determined.
Primary Users	
Max Occupant Load	Varies

Adjacencies	Other storage, loading dock						
Relationship to Building Complex	Some spaces potentially located at the airport or in the community.						
Environment	Dry, normal						
Security	Security zone Doors: Card access, Alarm system						
Acoustics	Ambient Noise Generation: low						
Natural daylight	Natural Daylight: Not required Light Quality: Controlled Interior view to space: Required for safety & security						
Vibration	Generation: Low						
Structural	To be verified with building standards – may require higher structural strength						
Floors	Characteristics: Hard, resilient, non-slip, impervious to chemicals, durable, washable, seamless, static-free						
Walls	Characteristics: Durable, cleanable, washable, paintable, static-free						
Ceilings	Characteristics: Cleanable						
Doors	**To:**	**Type**	**Width**	**Height**	**Materials**	**Finish**	**Frame**
Interior Glazing	**Glass**: Single, tempered **Frames**: Metal	**Window Coverings**: Blinds					
Exterior Glazing	N/A						
Plumbing							
HVAC							
Temp Control	As per design range. Controllable for occupant comfort. Provision for night time set-back						
Humidity Control	As per design range						
Lighting	Area requires illumination to meet IES standards, complete with independent control. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).	**LUX**	As per IES				
Power	Normal Power – 120 volt duplex receptacles. Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.						
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment						
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)						
Communications	Telephone, public address, security video, security, broadband wireless, LAN access						
Equipment	**Description**	**Notes**	**Qty**	**(Meters)**			
				L	**W**	**H**	
Comments							

5. VESSEL STORAGE

Science &Technology Program		No.	A 10 5
Functional Group	**Component Group**		**Space Name**
A Science & Technology	10 Logistics		5 Vessel Storage

Total Area	# of Spaces	Area	Length	Width	Height
300.00 m^2	1				

Function	Large space to hold vessels for repair, outfitting, and seasonal storage
Space Description	Open, unconditioned or semi-conditioned space
Primary Users	
Max Occupant Load	Varies
Adjacencies	Other storage, loading dock
Relationship to Building Complex	
Environment	Unconditioned or semi-conditioned
Security	Security zone Doors: Card access Alarm system
Acoustics	Ambient Noise Generation: low
Natural daylight	Natural Daylight: Not required Light Quality: Controlled Interior view to space: Required for safety & security
Vibration	Generation: Low
Structural	To be verified with building standards
Floors	Characteristics: Hard, resilient, non-slip, impervious to chemicals, durable, washable, seamless, static-free Materials: Base:
Walls	Characteristics: Durable, cleanable, washable, paintable, static-free Materials: Finish:
Ceilings	Characteristics: Cleanable Materials: Finish:

Doors	To:	Type	Width	Height	Materials	Finish	Frame

Interior Glazing	**Glass**: Single, tempered **Frames**: Metal	**Window Coverings**: Blinds						
Exterior Glazing	N/A							
Plumbing								
HVAC								
Temp Control	As per design range.							
Humidity Control	As per design range							
Lighting	Area requires illumination to meet IES standards, complete with independent control. Luminaires to use high efficacy lamps, with lumen colour quality of 5000K and CRI greater than 90 (Full Spectrum).					**LUX**	As per IES	
Power	Normal Power – 120 volt duplex receptacles. (GFCI near water sources) Emergency Power – one 120 volt 15 amp duplex receptacle. UPS – as designed and required for specific functions.							
Mechanical Life Safety	Sprinklers, smoke control, fire safety equipment							
Electrical Life Safety	Alarms, emergency lighting, addressable fire alarm devices, detection (CO, smoke, heat, etc.)							
Communications	Telephone, public address, security video, security, broadband wireless, LAN access							
Equipment	**Description**		**Notes**		**Qty**	**(Meters)**		
						L	**W**	**H**
Comments								

11. FIELD CABINS

Science &Technology Program			No.	A 11 1	
Functional Group		Component Group		Space Name	
A Science & Technology		11 Field Cabins		1 Field Cabins	
Total Area	# of Spaces	Area	Length	Width	Height
48.00 m^2	3	16.00 m^2	5.0 m	3.20 m	2.7 m

Function	Space for support of research activities in the field, at remote sites.
Space Description	Refer to separate specification – APPENDIX E
Comments	

D CANADIAN COAST GUARD MODULAR MISSION PAYLOAD

Appendix D – Program Container Specification

The purpose of this document is to provide a Program Container Specification that ensures interchangeability of program containers on board the Polar Icebreaker through the standardization of details such as size, access locations, egress locations, and locations and quantities of required ship services. The primary advantage of standardized program containers is the ability to accommodate program containers from Canadian users as well as International users without requiring modifications to the Polar Icebreaker.

This specification is primarily based on information contained in the UNOLS Portable Scientific Vans Manual (version produced in January 2003)[1]. However, this Program Container Specification does not include the construction standardization of the program containers (e.g., construction materials, structural details, outfitting details, and certification).

<u>Program Container Details</u>

All program containers will conform to the dimensions of the International Organization for Standardization (ISO) portable twenty foot equivalent unit (TEU) containers listed in Table 1 (see Figure 1).

Table 1 - ISO TEU Container Dimensions

	Length	Width	Height	Deck Footprint
Full Height	6.06 m (19.9 ft)	2.44 m (8 ft)	2.60 m (8.5 ft)	14.8 m^2 (159.2 ft^2)
Half Height	6.1 m (19.9 ft)	2.44 m (8 ft)	1.3 m (4.3 ft)	14.8 m^2 (159.2 ft^2)

Each program container will be equipped with a minimum of one (1) means of access and two (2) means of egress (with the exception of storage containers which are generally not equipped with a second means of egress). The locations and configurations of the means of access and egress for the program containers that are anticipated to be stowed on board the Polar Icebreaker are as follows:

1. <u>Stand-Alone Arrangement</u>: This arrangement (Figure 2) is intended for program containers such as containerized laboratories, and refrigeration containers. Program containers that conform to the stand-alone arrangement are fitted with:

   a. a maximum of two (2) access doors (i.e., personnel doors). One (1) personnel door is located on the forward end of the program container and measures a maximum of 0.71 m (28 inches) in width and 1.8 m in height (70 inches). The other personnel door is located on the opposite end of the program container and

[1] Reference: http://www.unols.org/committees/rvoc/vanspecs2002/UNOLSVanManualv2.pdf

measures a maximum of 0.71 m (28 inches) in width and 1.8 m in height (70 inches).

Refrigeration containers are only fitted with one (1) personnel door on the aft end of the program container. The forward end of the container contains the refrigeration equipment.

b. one (1) escape hatch. The escape hatch is located on the top of the program container and measures a maximum of 0.51 m (20 inches) in width and 0.5 m in length (20 inches).

c. a maximum of two (2) cargo doors. The cargo doors are located on the aft end of the program container and measure a maximum of 1.15 m (45.3 inches) in width and 2.3 m in height (90.6 inches).

2. <u>UNOLS AGOR Arrangement</u>: This arrangement (Figure 3) is intended for program containers that are used on board Auxiliary General Oceanographic Research (AGOR) vessels in the United States, and may be brought on board the Polar Icebreaker. Program containers that conform to the UNOLS AGOR arrangement are fitted with:

a. a maximum of two (2) access doors (i.e., personnel doors). One (1) personnel door is located on the forward end of the program container and measures a maximum of 0.71 m (28 inches) in width and 1.83 m in height (72 inches). The other personnel door is located on the opposite end of the program container and measures a maximum of 0.91 m (36 inches) in width and 1.83 m in height (72 inches).

b. one (1) escape hatch. The escape hatch is located on the top of the program container and measures a maximum of 0.51 m (20 inches) in width and 0.5 m in length (20 inches).

The main difference between the AGOR arrangement and the stand-alone arrangement is that the AGOR arrangement contains a smooth forward face (Face F), a different location for the ship service connections, and does not contain cargo doors.

3. <u>Storage Container Arrangement</u>: This arrangement is intended for program containers that are used to store equipment and supplies. Program containers that conform to the storage container arrangement are fitted with two (2) cargo doors. The cargo doors are located on the aft end of the program container and each door measures a maximum of 1.15 m (45.3 inches) in width and 2.3 m in height (90.6 inches).

4. <u>Workshop Container Arrangement</u>: This arrangement (Figure 4) is typically found in workshop containers that house worktables, spare parts, tools, and machinery that are used by personnel on board to repair program equipment. This arrangement is also found in program containers that are used to house electronic equipment, and work stations to

allow personnel to control program equipment, and/or monitor, and record data. Program containers that conform to the workshop container arrangement are fitted with:

a. one (1) access door (i.e., personnel door). The personnel door is located on one of the sides of the program container and measures a maximum of 0.71 m (28 inches) in width and 1.8 m in height (70 inches).

b. one (1) escape hatch. The escape hatch is located on the top of the program container and measures a maximum of 0.51 m (20 inches) in width and 0.5 m in length (20 inches).

c. a maximum of two (2) cargo doors. The cargo doors are located on the aft end of the program container and each door measures a maximum of 1.15 m (45.3 inches) in width and 2.3 m in height (90.6 inches).

5. Coring Container Arrangement: This container (Figures 5 to 7) is used to store the individual components of the piston corer. The coring container is also used to separate the core liner and sediment samples from the core barrels, and to prepare the samples and equipment for storage. The coring container is a half height ISO TEU container that does not have an enclosed top and is equipped with a crane which is used to remove the core barrels from the container. Program containers that conform to the coring container arrangement are fitted with two (2) cargo doors. The cargo doors are located on the aft end of the program container and each door measures a maximum of 1.15 m (45.3 inches) in width and 2.3 m in height (90.6 inches).

Program Container Stowage Locations

Program containers stowed on board the Polar Icebreaker will include, but not be limited to coring containers, containerized laboratories, refrigeration containers, storage containers, and workshop containers. A maximum of five (5) program containers will be stowed in the program container stowage area. The program container stowage area is located adjacent to the after working deck, below the helicopter deck, and in close proximity to the laboratories. These containers will primarily be used to support program missions that are conducted on the after working deck, and the ocean sampling room. The maximum mass of each program container stowed in the program container stowage area will not be greater than 12,000 kg.

Program containers stowed in the program container stowage area will be single stacked, and will be arranged such that there is:

a. a minimum unobstructed clearance of 0.9 m on each side of the container along the entire length of each container in order to allow personnel to enter and exit the containers;

b. a minimum unobstructed clearance of 2 m aft of each container along the entire width of each container and a minimum unobstructed clearance of 6 m aft of three

(3) of the containers along the entire width of each container in order to allow equipment to be removed from the container;

c. a minimum unobstructed clearance of 1.5 m forward of each container along the entire width of each container in order to allow personnel to enter and exit the containers; and

d. a minimum unobstructed clearance of 1.2 m above the program containers (assuming a full height container which is mounted on its securing devices) along the entire length of each container to allow personnel to exit from the escape hatches, and to allow for the protrusion of program container intake and exhaust vents.

A maximum of five (5) program containers will be stowed on the open deck cargo area. These containers will primarily be stowed on the open deck cargo area during program missions for which they are not required. These containers will then be relocated to the program container stowage area when required to support a specific program mission(s). However, there may be program missions during which time the containers will remain in the open deck cargo area for use by personnel (primarily storage containers in support of mooring deployment and recovery missions). The maximum mass of each program container stowed on the open deck cargo area will not be greater than the maximum rated gross weight of an ISO TEU container (i.e. 30,480 kg for a "heavy tested" ISO TEU container[2]).

Program containers stowed in the program container stowage area may be double stacked, and will be arranged such that there is:

a. a minimum unobstructed clearance of 0.9 m on each side of the container along the entire length of each container in order to allow personnel to enter and exit the containers; and

b. a minimum unobstructed clearance of 6 m aft of each container along the entire width of each container in order to allow equipment to be removed from the container.

Ship Services:

The following ship services are required for a maximum of five (5) program containers stowed in the program container stowage area:

1. electrical power;
2. connections to the vessel general alarm system;
3. connections to the vessel internal phone system;
4. connections to the vessel science LAN;
5. connections to the vessel fire detection system;

[2] Reference: http://www.interfreight.co.za/container_information.html

6. hot and cold fresh water supply;
7. uncontaminated seawater supply;
8. grey water drainage; and
9. ship service compressed air supply.

The following ship services are required for a maximum of five (5) program containers on the open deck cargo area:

1. electrical power;
2. connections to the vessel general alarm system; and
3. connections to the vessel fire detection system.

Electrical Power:

The program containers will be equipped with either of the following electrical connections to the vessel's power system (this is not meant to replace or limit the program container's shore based electrical connections):

1. Three-Phase Power: 600V, three phase, 60A, 60Hz ungrounded connection to the vessel's power system.

2. Single-Phase Power: 220V or 120V, single phase, 60A, 60Hz ungrounded connection to the vessel's power system

The program containers will be equipped with one (1) male-end power supply plug (see Figure 2 and Figure 3) for connection to the ungrounded vessel's power supply system. This power supply plug is separate from the shore based power supply connection. Plugs shall be indicated for the type of connection they are intended for (shore or vessel's power supply, voltage, phase and current rating).

Alarm, Detection, and Communications Systems:

The program containers will require temporary connections to the following vessel fitted systems:

1. general alarm system;
2. internal phone system;
3. science LAN; and
4. fire detection system.

The program containers will be equipped with a minimum of one (1) and a maximum of six (6) wire passes/vents (see Figure 8). The wire passes/vents vary from 101.6 mm (4 inches) to 152.4 mm (6 inches) in size. These penetrations may be used for cable passes, exhaust vents, and/or air supplies.

Drainage, Water, and Compressed Air Services:

The program containers will require the following ship services:

1. hot fresh water with similar flow rate, pressure, and temperature as supplied to the vessel fitted laboratories;

2. cold fresh water with similar flow rate, pressure, and temperature as supplied to the vessel fitted laboratories; and

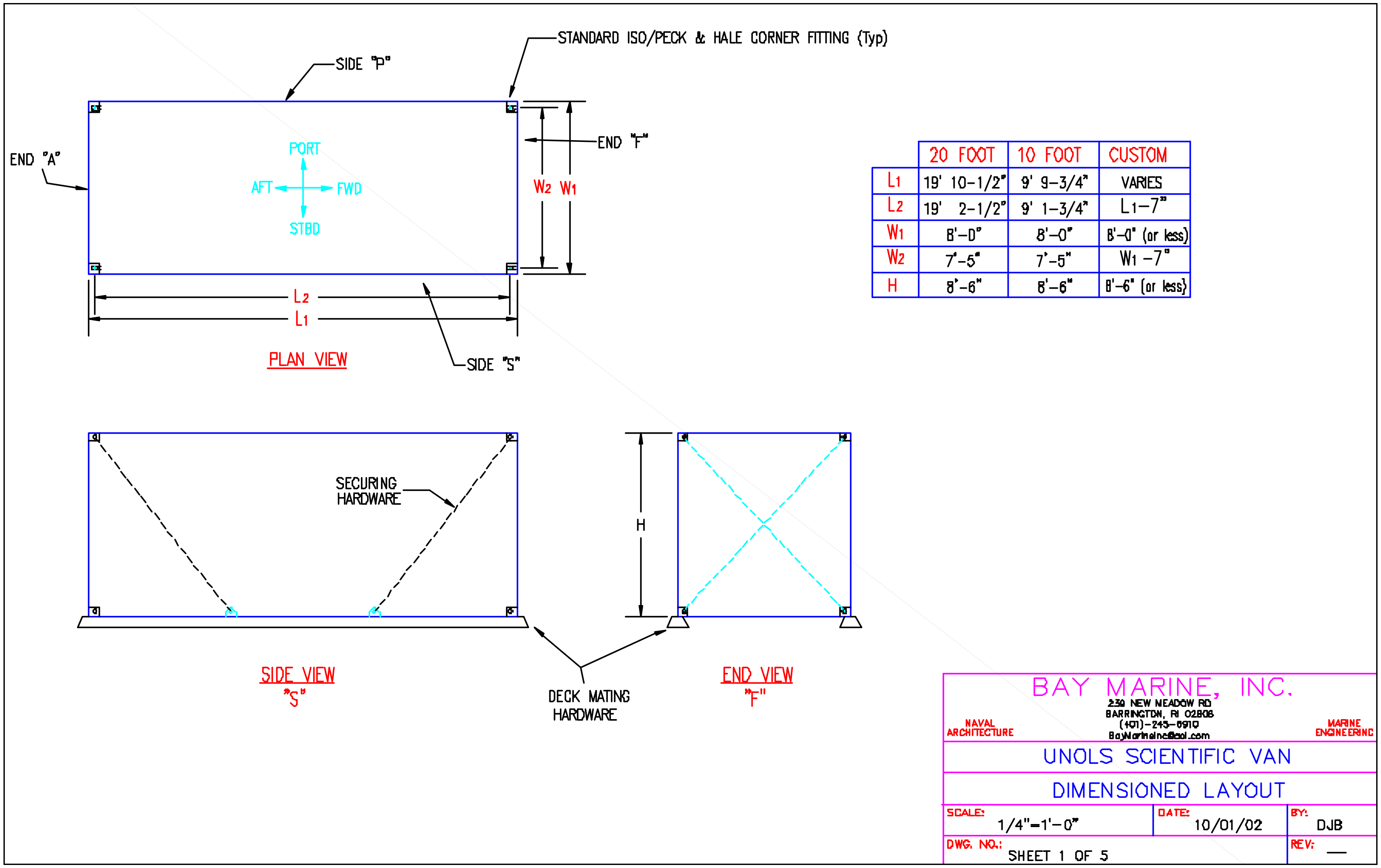
3. uncontaminated seawater with similar flow rate, pressure, and temperature as supplied to the vessel fitted laboratories.

4. compressed air from the ship fitted system. The flow rate, and pressure shall be similar to that supplied to the vessel fitted laboratories.

The program containers will be equipped with the following plumbing fittings:

1. Two (2) 38.10 mm (1.5 inch) plastic cam-and-groove drain fittings (see Figure 8); and

2. Four (4) 19.05 mm (0.75 inch) plastic cam-and-groove supply fittings (see Figure 8).



	20 FOOT	10 FOOT	CUSTOM
L1	19' 10-1/2"	9' 9-3/4"	VARIES
L2	19' 2-1/2"	9' 1-3/4"	L1-7"
W1	8'-0"	8'-0"	8'-0" (or less)
W2	7'-5"	7'-5"	W1 -7"
H	8'-6"	8'-6"	8'-6" (or less)

Figure 1 – ISO TEU Container Dimensions[3]

[3] Reference: http://www.unols.org/committees/rvoc/vanspecs2002/UNOLSVanManualv2.pdf

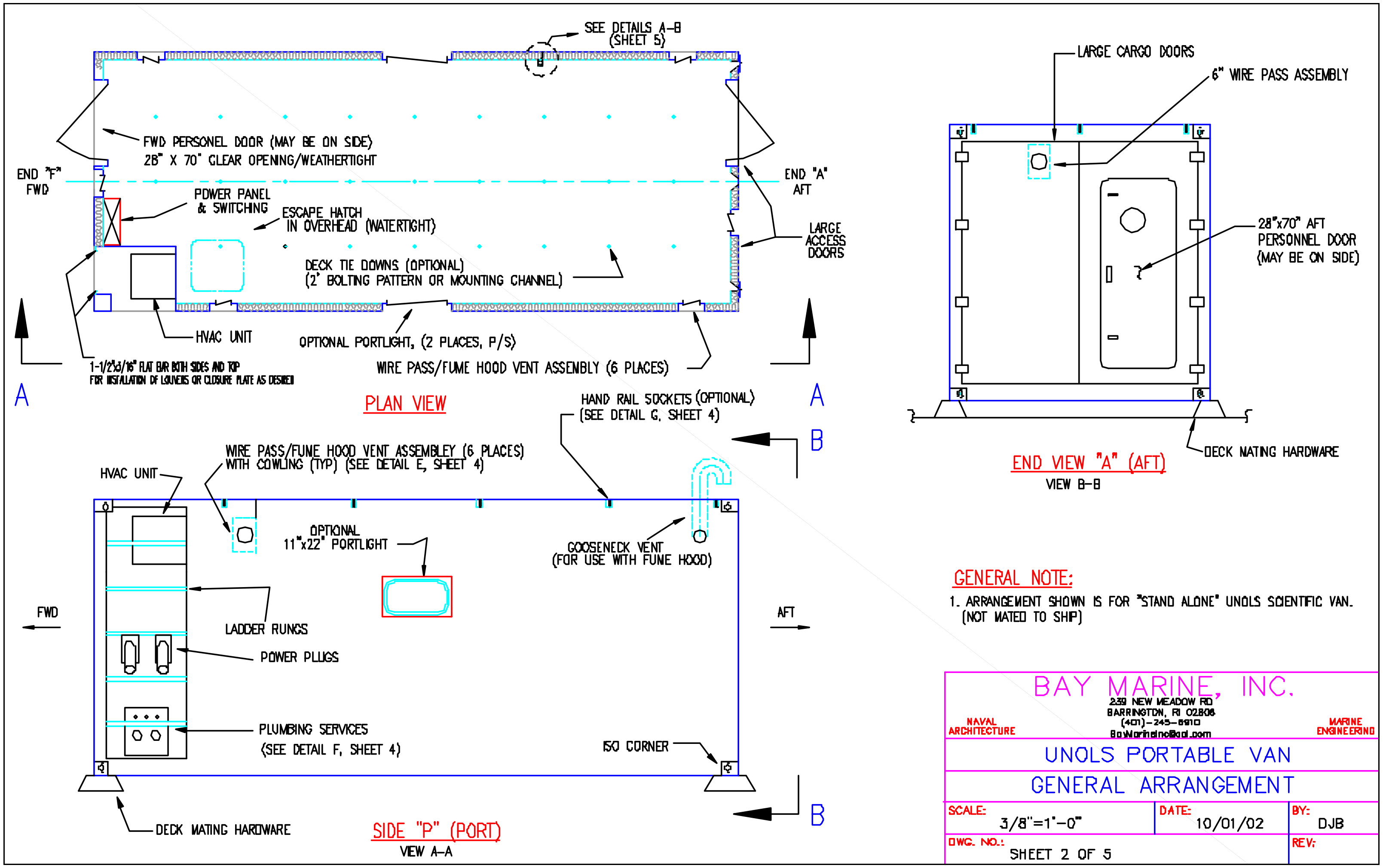


Figure 2 – Program Container Stand-Alone Arrangement[4]

[4] Reference: http://www.unols.org/committees/rvoc/vanspecs2002/UNOLSVanManualv2.pdf

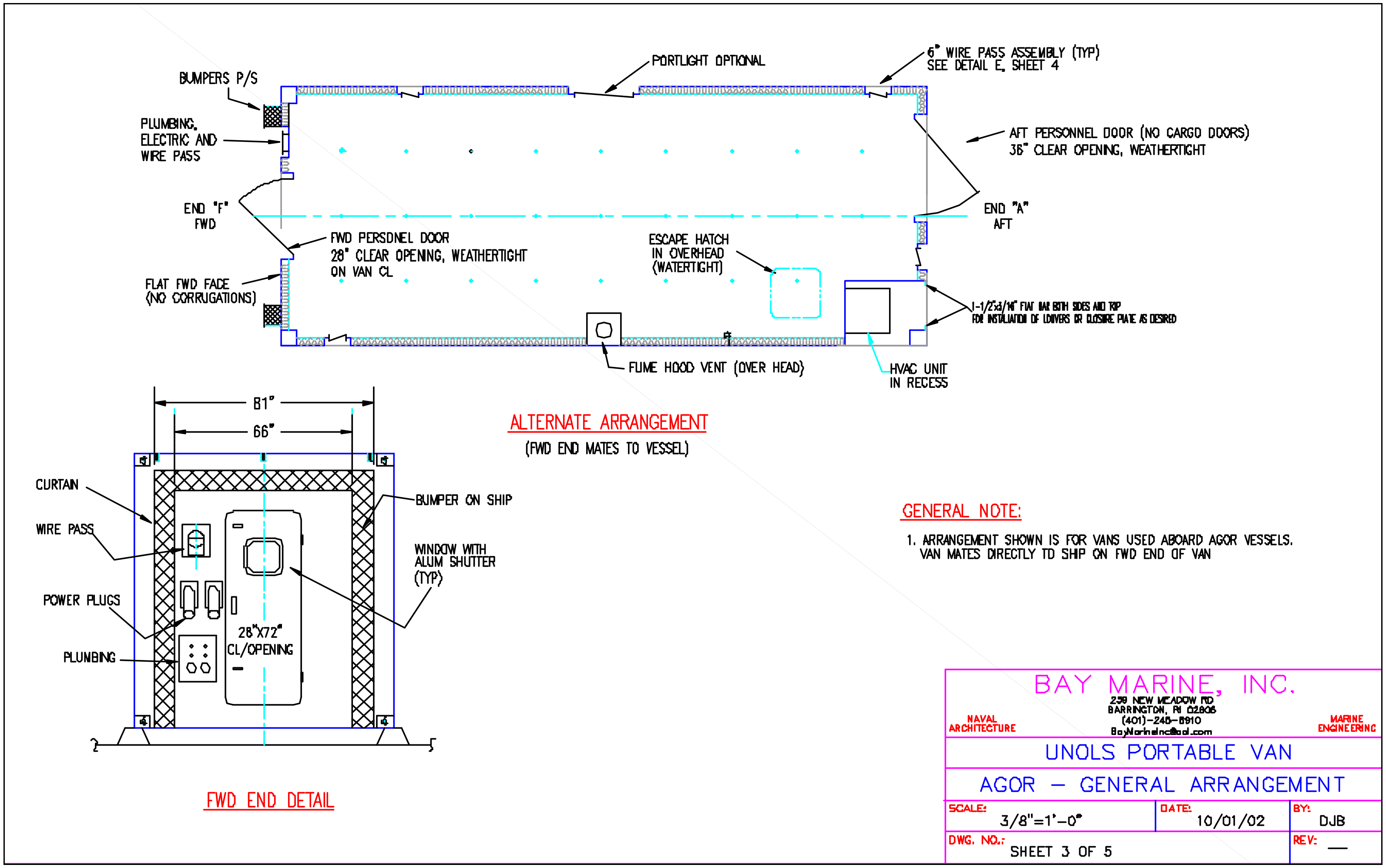


Figure 3 – Program Container AGOR Arrangement[5]

[5] Reference: http://www.unols.org/committees/rvoc/vanspecs2002/UNOLSVanManualv2.pdf

Figure 4 – Workshop Container Arrangement[6]

6 Reference: http://www.container-marittimi.it/en/marittimi-iso.html

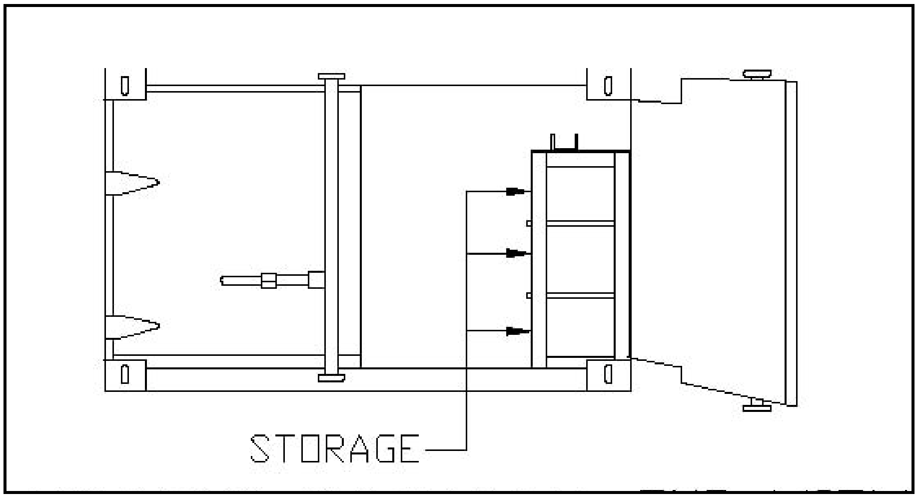


Figure 5 – Coring Container Aft End[7]

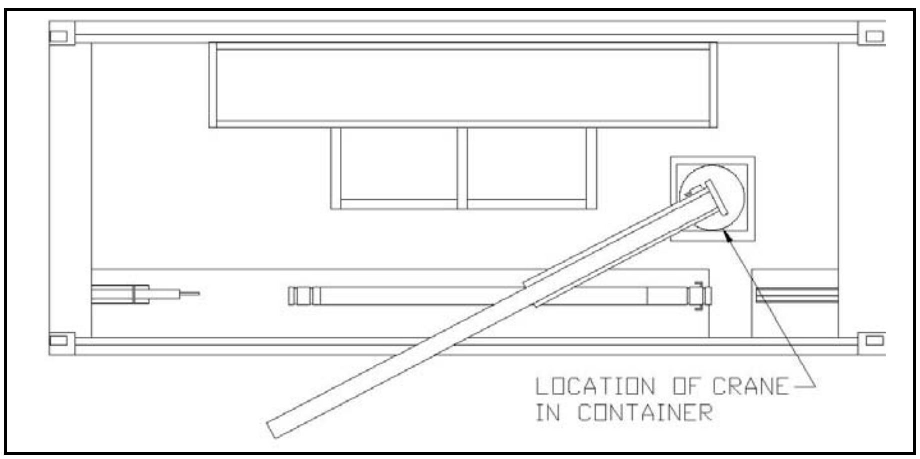


Figure 6 – Coring Container Plan View[8]

[7] Reference: NRCAN Piston Core Manual
[8] Ibid

Figure 7 – Coring Container On Board CCGS Hudson[9]

[9] Ibid

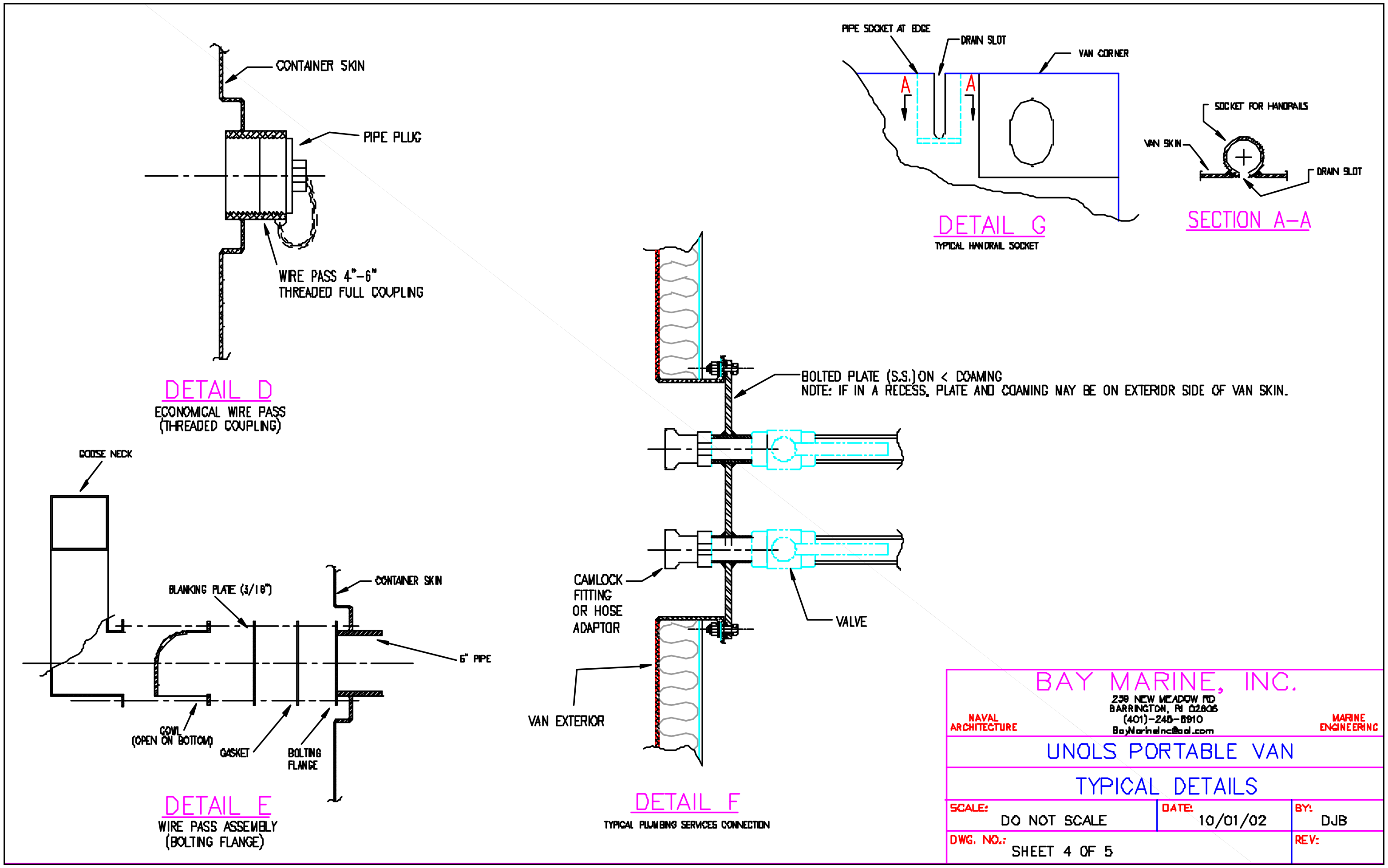


Figure 8 – Program Container Fittings[10]

[10] Reference: http://www.unols.org/committees/rvoc/vanspecs2002/UNOLSVanManualv2.pdf

E FIELD CABIN INFORMATION

E 1.1 PRELIMINARY FIELD CABIN SPECIFICATION

1. This document was originally developed as a design exercise. Some of the information may not be required at this point, but it does provide a performance specification (based on documents from another similar structure) for review and discussion.

   Other options as well as the purchase of off-the-shelf units to be considered.

2. The requirement for field cabins is a valid part of Phase 1a, and a part of the overall m2 for the project

Semi Permanent Field Station

Table of Contents

Semi-Permanent Field Cabin (minimum standards)

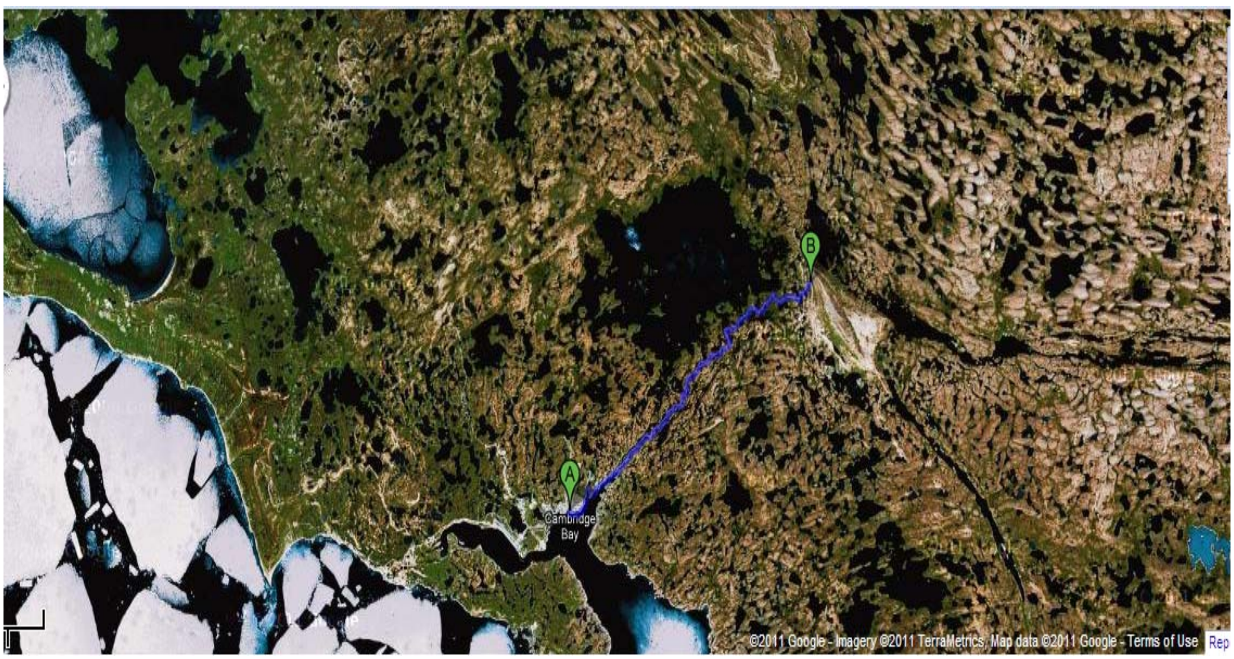
Introduction

As part of the CHARS field research and monitoring programs it will be necessary for staff to spend varying amounts of time `on the land'.

The specific use of the Field Camp will vary from collecting flora and fauna samples, monitoring the activities of migratory and other animal species, banding birds, inventory efforts for birds, fish and arthropods, snowpack sampling, atmospheric research and possibly some park management work.

The research will require staff to spend varying amounts of time at remote locations, which may or may not be accessible through the use of aircraft.

In the case of this exercise, the field station site is identified somewhere within Mount Pelly Territorial Park, an 18 km distance by truck or snow mobile from Cambridge Bay. The site is assumed to be close to either a stream or lake.



The Field Station will be most used during the May – October research season, but as CHARS programming expands there may also be a need to use the Field Station during the dark winter months.

Logistically, as part of the procedural safety measures, the field staff will be required to make daily radio contact via satellite cell phone with the Cambridge Bay home base to confirm that all are well and that there are no emergencies. This procedure is most important for the more remote sites which may require specialized coordination and delivery of emergency services.

Once established, the Field Station, will remain in place for an extended period, possibly a number of seasons, but it must be capable of being dismantled and moved as described in the attached Operational Specification.

Objectives

To design for the Field Station functional requirements, which also incorporates other priorities into an Arctic Project, such as:

- Sustainability, including energy production, management and conservation
- Waste management planning
- Adaptability and flexibility to meet changing research program objectives
- Site selection and building development approaches
- Working with and incorporating client inputs
- Construction in an Arctic environment
- Scheduling of construction
- Understanding and relating to Inuit values and traditional knowledge

Post Concept Acceptance

.1 Submit shop drawings for fabrication of components

.2 Shop drawings to indicate layout, principal dimensions, placement of doors, windows and vents, anchoring methods, etc. Materials descriptions and any appropriate test data.

Operational Specification

1.0 General

.1 Design for one (1) Semi-Permanent Insulated Structure as described below. Structure will be pre-engineered, easy to erect with 4 people within a 72-hour period and demountable without damage by 4 people in a 72-hour period. Structures may include wood framing, fabric-covered metal-framed, modular glass fibre reinforced plastic or other materials which meet the Operational Requirements.

.2 While easily demountable for relocation, the overall planning and design should provide protection from predators such as polar bears (if required).

.3 Final design will include a description of the kit of components necessary for assembly on a 4.8m x 7.3m (16’x24’) platform, including general assembly instructions.

.4 Materials and design to be acceptable for site conditions at Mount Pelly Territorial Park, Cambridge, Nunavut

1.1 Functional Requirements

.1 Semi-permanent Field Cabin/Unit used by field staff for data collection and analysis related to a variety of field projects
.2 4.8m wide x 7.3m (16'x24') long overall, with one minimum exterior door
.3 Eight feet of benching or a work table as a work surface
.4 Accommodations for up to 4 researchers at one time
.5 Kitchen, dining and bathroom facilities
.6 Appropriately designed food storage
.7 Some limited interior storage for sensitive equipment, firearms, etc

1.2 Design Standards

.1 Design of structure(s) to conform to the requirements of the National Building Code of Canada 2005 and the National Fire Code of Canada 2005.
.2 Design structures to withstand wind and snow loads calculated according to the National Building Code of Canada.
.3 Fabrics and combustible materials to conform to requirements for relevant CAN-ULC combustibility and flame spread ratings.
.4 Dimensions are based on a 4.8m x 7.3m (16' x 24') footprint and must be met.
.5 Overall design to be adaptable for conditions where Polar Bears or other predators may be present.

1.3 Planning, Storage & Delivery

.1 Outline planning for shipment and deliver of any components not available in Cambridge Bay via sealift, from a southern Canadian port to Cambridge Bay.
.2 Outline planning for packaging of materials to protect components during delivery and storage at site.
.3 Each package must be no more than 100 kg to support transport and handling without heavy equipment.

2.0 Components & Materials

2.1 Fabric-Covered Shelters shall have the following minimum standards

.1 Insulated coverings to conform to:.

Outer ply to CAN-ULC-S109-03 Flame Tests of Flame Resistant Fabrics and Films.

Centre ply Flame spread rating of 25 when tested to ASTM E84 - 09a Standard Test Method for Surface Burning Characteristics of Building Materials.

Inner ply (liners) to at least CAN-ULC-S109-03 Flame Tests of Flame Resistant Fabrics and Films.

.2 Exterior surfaces will include ultra violet inhibitors.

2.2 Structured Shelters shall have the following minimum standards:

.1 Wall and Roof Components
Components to include all required structured stiffeners and flanges as required for structural integrity.

.2 All framing requires base sections to be secured (ie, strap cleats, etc).

.3 Fasteners and Anchoring will be zinc plated steel for interior use and 304 stainless steel for exterior use.

.4 If Insulated wall and roof sandwich assembly panels are proposed, a total insulation core thermal resistance of R20 is required.

.5 Insulation is not to be exposed, and to have low VOC properties.

.6 Exterior surfaces to be coated with ultra violet inhibitors and fire retardant fillers.

2.3 Doors:

.1 Exterior door – minimum of 914mm x 2030mm insulated and thermally broken door and frame, including double glazing, screening and operable window

2.4 Windows:

.1 Operable, double insulated Low-E clear glazing windows with insect screen

.2 Windows dimensions to meet egress requirements in National Building Code.

2.5 Heating:

.1 Space heating with appropriate capability for maintaining comfortable year round indoor temperature year.

2.6 Water Supply

.1 Access to -----litres of potable water per person per day to be identified.

.2 Filtration and storage strategies and equipment to be outlined if applicable

2.7 Power

.1 Power for computers and battery charging required

.2 Lighting strategies to be outlined

.3 Storage strategies and equipment to be outlined if applicable

2.8 Sewage Treatment

.1 Sewage management strategies and technologies required for 6 people for up to a month residence at the cabin.

Appendix A

1. Field Cabin – Functional Programming

information submitted by :__Nunavut Field Unit, Parks Canada Agency______
date: Jan. 20, 2011_______

As part of the Functional Programming for the Canadian High Arctic Research Station (CHARS), we are looking at defining the operational requirements for a Field Camp/Cabin.
We would like to gather background data on what an ideal operational requirement would be for one of these units.

Presently the Field Camp is seen as easy demountable and moveable, but strong enough to provide protection against predators such as polar bears. Your assistance is requested to help us in further defining specific operational needs. It's also recognized that operational needs depend on the specific work being carried out at the cabin, so it's requested that your information be in relation to your particular program requirements.

Research Program: Quttinirpaaq National Park	Cabin used for: We use Weahterhaven-style structures for a variety of uses in support of our park operations and research programs on Ellesmere Island including research labs, accommodations, kitchens, latrines, and storage shelters.	
Approx. size – floor area (m2 or sq. ft) Varies from 64 sq ft to 900 sq ft.	Approx. Dimension (L x W) (metres or feet) Various, usually 8' or 16' wide by four foot lengths eg. 20' or 24' etc.	Approx. Height (metres or feet) 10 or 12 ft
Is lab benching required? If yes, describe function and related equipment. In our research lab buildings there is usually some form of lab bench or table. In one building there is a small fume hood.		
Is cabin used for accommodations? If yes, for how many people? Some of the structures are. In general they are either 2 bedroom units which sleep 2 people and give good privacy or they are bulk houses which are open and sleep 4 people.		
Is cabin used by multiple research groups during research season? – Describe. Most of our cabins support park operations and multiple research teams in the field season. Some are for exclusive use by parks staff.		
How are supplies brought in and stored at the cabin? – Describe All supplies brought in by Twin Otter. Storage is usually in cupboards or durable containers. Winter storage is in durable containers.		
What services are provided at cabin (water, power, etc) – If provided, describe how it's done & capacities. Most cabins have solar power. Only kitchen have running water with filtration systems. Solar systems are made up of 8 panels usually on a solar tracking array. Battery banks have at least 8 high capacity batteries. Two inverter/charge controllers at 24 V converted to 120 VAC. Water systems consist of 200 gallon tank connected to a pump and filter system. Hot water not currently available.		
How is sewage handled? – Capacities? All camps have 2 incinerating toilets in a latrine. Toilets are alternated so that only one is burning at a time. We can accommodate up to 15 people on site, but usually we ask people to urinate elsewhere if possible.	How is general waste handled? – Capacities? General waste is separated into burnable and non-burnable. Burnable is either incinerated or burned in a drum. Non burnable is cleaned and flown out.	

How is cabin transported to site and regular maintenance done? – Describe Once erected our buildings are largely permanent. They could be disassembled and moved by Twin Otter, but we have not have a reason to do this. Regular maintenance is done by park staff and/or park carpenters depending on the size of task at hand.	
How often is cabin moved? – Describe Never.	
What happens to cabin at end of research season? – Describe All equipment is packed up and stored. Buildings are secured and locked.	
List any communications equipment in the cabin? Each camp has satellite phone antenna and SSBx radios with permanent or temporary antennae.	Describe the use of any communications equipment. SSBx used for checking into PCSP and between camps. Satellite phones used when SSBx is not working or when secure line required. Satellite phones used to call home .
If cabin planning requirements or plans are available, please forward copies to: **Rein Soosalu,** **Senior Project Coordinator, CHARS Infrastructure,** **INAC Arctic Science Policy** **10th Floor, 360 Albert St., Ottawa K1A 0H4** **Phone 613 995-6802 Fax 613 995-7029 Email Rein.Soosalu@ainc-inac.gc.ca**	

2 . Field Cabin – Functional Programming

information submitted by:_– Parks Canada_________**date**:_February 10, 2011_________

As part of the Functional Programming for the Canadian High Arctic Research Station (CHARS), we are looking at defining the operational requirements for a Field Camp/Cabin.
We would like to gather background data on what an ideal operational requirement would be for one of these units.

Presently the Field Camp is seen as easy demountable and moveable, but strong enough to provide protection against predators such as polar bears. Your assistance is requested to help us in further defining specific operational needs. It's also recognized that operational needs depend on the specific work being carried out at the cabin, so it's requested that your information be in relation to your particular program requirements.

Research Program: Used by various researchers on various projects	Cabin used for: Provides living accommodation for up to 4 people. Bunk beds in addition to common area used for food preparation, eating and relaxing etc.	
Approx. size – floor area (m2 or sq. ft) 320 sq. ft There is a 100' x 200' fence	Approx. Dimension (L x W) (metres or feet) 16' x 20'	Approx. Height (metres or feet) 8' walls with a sloped roof

surrounding the buildings.		
Is lab benching required? If yes, describe function and related equipment. Not at this time, however there is a shed (12 x 16) as each location (Owl and Broad River) that can be converted to provide this space if necessary.		
Is cabin used for accommodations. If yes, for how many people? Yes. Four people. There is also room for others to set up tents inside the fenced compound which protects people from polar bears. A washroom that is 8' x 12' is also located on site that has a shower, sink and toilet.		
Is cabin used by multiple research groups during research season? – Describe. Yes. Canada goose banding, inventory efforts for birds, fish and arthropods, snowpack sampling, caribou genetic program, effluent sampling, Arctic fox, vegetation sampling and other park management purposes.		
How are supplies brought in and stored at the cabin? – Describe By oversnow vehicle whenever possible for dry goods and for camp supplies like propane. Some goods are flown in by helicopter, however we try to keep this to a minimum. Supplies are stored in the cabin, shed or fenced compound as necessary.		
What services are provided at cabin (water, power, etc) – If provided, describe how it's done & capacities. At Broad River, there is a water / wastewater treatment and power generation unit. All water used and wastewater produced are treated to acceptable standards and power is supplied by a solar / gasoline generator.		
How is sewage handled? – Capacities? Treated by a wastewater treatment system on site. Can treat approximately 1,500 litres / day	How is general waste handled? – Capacities? Recyclables and household garbage are transported back to town. Items that can be burnt are done so on site.	
How is cabin transported to site and regular maintenance done? – Describe The materials to construct the cabin were hauled in during the winter and maintenance is done in the winter generally by snowmobile and in the summer by heliocopter.		
How often is cabin moved? – Describe The cabin is permanently built on site and is not moved.		
What happens to cabin at end of research season? – Describe The doors and windows are boarded up to prevent polar bears from entering and the site is shut down until required by the next researchers.		
List any communications equipment in the cabin? None specifically, however people staying at the camp have satellite phones.	Describe the use of any communications equipment. Satellite phones are used to check in on a daily basis.	

If cabin planning requirements or plans are available, please forward copies to:

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