



UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Divisional Space Review and Development of a Master Plan

**Abbreviated Report:
Executive Summary, Recommendations,
Observations, Recommended Actions**

June 2009

“Today as we approach our second centennial, the University of Toronto is respected as one of the foremost research-intensive universities in the world ... Even as a publicly supported institution with constrained resources, we have been able to rival both the great private universities of the United States and the ancient public universities of Britain in the quantity and quality of our research and scholarship.

- President David Naylor, U of T Magazine, Winter 2009

EXECUTIVE SUMMARY

The Space Review Committee was established by Dean Cristina Amon in September, 2008.

The report is intentionally presented in three distinct and cohesive sections, namely Sections A, B and C, to include specific observations from the undergraduate and graduate representatives respectively serving on the Committee. Both representatives sought out input through discussion and interaction with their respective peer groups in the preparation of these representative observations. It should be noted however that no formal student town-hall meetings were held and that both reports received the full support of the Committee for the Divisional Space Review and Development of a Master Plan.

Section A provides valuable insight of the needs of the undergraduate student body which have been assembled with input from student colleagues by Mr. Jimmy Lu. Section B provides a companion paper from the graduate student perspective which is a trifle more philosophical but contains a bold message of the value of passive, active and facilitating stimuli that serve to emphasize the importance of both the research facilities and the surrounding environments that will attract the very best students. Mr. Dan Sellan is the author of Section B.

Section C provides a compendium of space data, information on the quality of space within defined space categories, the shortfall and a listing of the challenging issues with sixteen companion recommendations pertaining to space requirements. It is important that this information data base effectively serve to facilitate the alignment of the space planning requirements with the evolving academic vision, strategies and enrolments to realize these objectives.

The Existing Space Envelope: The Faculty of Applied Science and Engineering is presently operating within a space envelope of 62,500 nasm on the St. George and Downsview Campuses. The collective activities of the Faculty with respect to COU guidelines indicate a shortfall of 5,000 nasm which is increased to 11,500 nasm based on the needs of a leading edge research intensive University and calibrated with respect to space requirements expected by the Faculty and 2008/09 enrolments:

Comment: Space shortfall is 5,000 nasm, but realistically 11,500 nasm of additional space is required. The real impact of this quantitative shortfall is misleading since many of the older buildings, and the rooms within these buildings, used by the Faculty are ill-sized and do not allow for efficient space usage without expensive remodeling.

Space Quality & Configuration: A uniform assessment of every room, within all sixteen buildings occupied by the Faculty, of the space quality was undertaken. Only 27% of all space occupied is assessed as satisfactory for the current purpose, with 4% being of poor quality and the significant balance [69%] needing attention. A companion calibration of each of the sixteen building is also provided with respect to nine metrics that address: Accessibility, Asbestos, Building Exterior, Elevators, Fire Protection, Electrical Service, HVAC systems, Security Access and Washrooms. Furthermore as a result of the historic nature of many of our buildings, most of which pre-date the emergence of computer technology, the space is poorly configured for current needs so that space is used inefficiently which further compounds the space shortfall.

Comment: 69% of all space used *needs attention*; either the room, the building or a combination of both.

New Space Requirements, Academic Expansion and Strategic Issues: Three specific issues are highlighted under the umbrella of new space requirements to provide some quantitative measure to more clearly interpret these future requirements.

1. Any proposed expansion in graduate enrolment will require the expansion of research laboratory facilities and office accommodations. An increase of some 355 graduate students and 30 new faculty members is estimated to require an additional and conservatively estimated 9,342 nasm. This reflects an enrolment increase of 25% over the 2008/09 numbers and would increase the graduate student to faculty ratio from the current 6.3 to 7.

2. There is a need to acquire and consolidate more shared research support facilities which can service and support researchers across all engineering units. The ECTI facility, within ECE, is a good illustration of such shared research facilities that boost collaboration and provide the users with expensive research tools that simply cannot be accommodated and afforded in individual laboratories. Such research support space needs to be targeted within any strategic expansion. An allowance of some 4,000 nasm is not an excessive objective to accommodate such facilities and is consistent with the thrust of the CET [Centre for Enabling Technologies] initiative.

3. Strategic consideration needs to be given to the possible need and value of relocating UTIAS to the St George Campus. In time, facilities at Downsview will need to be upgraded and the question is whether or not such upgrades are best done at Downsview or within a relocation of UTIAS to the downtown campus. Without delving into the pros and cons of such a proposal it is important to realize that such a relocation would require that a further 5,500 nasm of space be provided for on the St. George campus.

Comment: Each of the above requires additional nasm counts of 9,342, 4,000 and 5,500 nasm respectively for a total of 18,842, which is in addition to the established space shortfall identified previously

Building Sites & Swing Space: To begin to improve the magnitude and quality of space requires an expansion of space and a sufficiently large multi-purpose swing space, estimated to be 2,000 nasm minimum, to allow for the systematic renovation of existing space in large enough chunks to be cost effective for HVAC, asbestos removal improvements etc. Ideally, any new building should incorporate multi-purpose swing space that will facilitate the renovation of space which will ultimately also permit the orderly growth of units that are located within that building. Off-campus swing space simply not available and is neither an attractive nor cost effective option.

Unfortunately there are only two potential building sites within the Engineering Precinct; the Engineering Annex site and the Haultain/Heat Engines/Rosebrugh site that could conceivably generate a maximum of 12,000 nasm and 18,000 nasm respectively. In more realistic terms the numbers are more likely to be closer to 7,000 and 11,500 nasm respectively with a net gain which is considerably less [estimated to be 15,000nasm [5,500 & 9,500] since the demolished space will be lost from the space inventory. Regrettably, both sites are also in difficult building locations and costs per new square metre are consequently very high.

Comment: It is estimated that the magnitude of new space that can be added within the Engineering Precinct is unlikely to exceed 15,000 nasm which is considerably less than what is required. This presents a very serious challenge for the University and the Faculty.

A macro overview of the tentative space requirements identified is summarized and expressed in terms of the net assignable square metre [nasm] requirements. The total value of some 32,342 nasm is equivalent to approximately 650,000 gross square feet

Shortfall [range between COU and FASE]	4,700 [COU]	11,500 [FASE]
Swing Space, minimum:		2,000
25% Graduate Expansion [Expanded Research]		9,342
Shared Research Support Facilities		4,000
Relocation Strategies, UTIAS		5,500
		<hr/>
		32,342

It is immediately obvious that this total requirement on the St George Campus well exceeds the 15,000 nasm that might be created within the Engineering Precinct. This situation needs to be immediately clarified in discussion with the central administration of the University. Clearly the strategy needs to allow for the acquisition and consolidation of properties that might include CAMH as well as properties on College Street that extend from University Avenue to as far east as Bathurst Street. Alternate sites, off campus, need to be defined so that improved long term planning might be possible on these sites as well as the relocation of activities within the Engineering Precinct Buildings. To illustrate

- i) a site in close proximity to the Engineering Precinct Buildings, possibly on College Street, could potentially be used to erect meaningful multi-purpose swing space [laboratories and offices] to facilitate a systematic renovation of existing space within the Faculty to be initiated. Alternately, such space could be incorporated into an independent commercial project and leased to the University.
- ii) it would be appropriate, given the shortage of building sites plus the extensive infrastructure clean-up costs for adjacent buildings within the Engineering Precinct that alternate building footprints, either within or outside the Engineering Precinct, be carefully considered to evaluate and assess i) the significantly increased cost of the space per unit areas and ii) the need to continuously upgrade and renew deteriorating space and surroundings within the Engineering Precinct. An illustrative example would be to assess the preferred footprint for the proposed Centre for Enabling Technologies CET, currently targeted for the Engineering Annex site with a site outside, but adjacent to, the Engineering Precinct. A key consideration and constraint is obviously the need to identify and secure these external sites. Similarly, a new UTIAS building could conceivably be located on a possible College Street site, but each of these twin options needs to be fully investigated. It is however critical in all these undertakings that well defined space plans for any potential new building be developed with cost estimates for different footprints and locations so that we are prepared to move with speed when the funding opportunity arises; identifying potential sites is therefore of critical importance to address these opportunities.

The Centre for Enabling Technologies, CET: During the current space review a User Committee was established to address the requirements of a proposed CET. The intent of this building, defined outside of the current Space Review Committee, was to develop shared research support space targeted at enabling technologies, specifically nano- & micro-fabrication, optics, and materials characterization infrastructure etc. The proposed space envelop is 6,000 nasm and allows some 20% of the total space to be used for offices and supporting accommodation for researchers. The space lost to accommodate the new building on the site of the Engineering Annex is 1,432 nasm, so the net gain will be 4,568 nasm. Funding for this project has unfortunately not materialized as of June 1st 2009. However, the need for these research facilities has not dissipated and it is important to continue to develop the enabling technologies concept and prepare a revised and comprehensive space plan for CET on the Engineering Annex Site as

well to explore the possibility for alternate sites¹ in readiness for when potential Government funding opportunities arise. The CET User Committee will finalize a User Report for approval by Governing Council in the fall of 2009 consistent with the overall space requirements of the Faculty.

Construction & Renovation Costs: It is always useful to provide a brief quantitative assessment of the replacement costs of all facilities: An estimate of the construction replacement cost for the 62,333 nasm of space presently occupied by the Faculty when using an average building cost of \$11,000 per nasm would amount to \$700 million. Comparative costs that provide some measure of context are: the BCIT at a cost of \$112 million for 19,000 nasm constructed in 2000, and the CET now estimated at \$100 million for 6,000 nasm in 2010.

Within the Faculty some 4% of all space [2,590 nasm] is classified as poor. 69% of all space [42,980 nasm] needs attention with the remaining 27% [16,800 nasm] assessed as adequate. A reasonable estimate of the cost to elevate the 73% of inadequate space, based on a moderate average cost of \$5.500 per nasm, would require \$250 million which is indeed significant and excludes the additional costs for temporary relocation and the rental of swing space. The magnitude of this capital investment required serves to demonstrate the challenge and is certainly consistent with established levels of deferred maintenance that exist within the University.

Recommendations: Sixteen recommendations are provided throughout Section C of the Report. The complete set of recommendations are presented in this abbreviated Report, followed by key observations and recommended actions.

¹ Sites yet to be identified on College Street or possibly other sites on the St. George Campus such as the parking lot immediately north of the Galbraith Building.

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MANDATE OF THE COMMITTEE

The availability of space in support of teaching, research, and administration is of critical importance to the Faculty. This review is being initiated to evaluate the quality and quantity of existing space within APSE, and to determine the current and projected space needs of the Faculty. This review will identify space deficiencies (including underutilization), *inform* on allocations of any available space and possible reallocations of existing space, and provide the basis for new space plans. In turn, the project will help promote the need to value space appropriately and use space efficiently. The resulting new space plans will be incorporated into the Faculty's strategic plan and guide fundraising efforts.

Membership of the Committee

Stewart Aitchison, Vice-Dean, Research, APSE
Vanessa Abaya, Executive Director, Advancement, APSE
Grant Allen, Vice Dean, Undergraduate Studies, APSE
Gloria Bryan (secretary), Operations Manager, APSE
Chris Damaren, Vice Dean, Graduate Studies, APSE
Jimmy Lu, Vice-President, Student Life, Engineering Society, APSE. Elected President: 2009.
Gail Milgrom, Managing Director, Campus & Facilities Planning
Steve Miszuk, Director Planning & Infrastructure, APSE
Tom Nault, Associate Registrar & Director of Academic Scheduling, APSE
Dan Sellan, Graduate Student, Department of Mechanical & Industrial Engineering, APSE
Elizabeth Sisam, Assistant Vice-President, Campus & Facilities Planning
Ron Venter (Chair), Professor Emeritus, APSE

Terms of Reference

After verifying the complete divisional inventory of space, including local classrooms, the working group will:

- Determine the occupancy and utilization as compared to the Council of Ontario Universities' (COU) and the University's space standards.
- Evaluate the quality of the space and identify space that requires renewal for high service or low service activities, and space that has such significant deficiencies as to make renewal impractical.
- Determine an estimated cost of renewal for space identified as requiring improvement.
- Recommend occupancy changes to improve efficient use of existing space.
- Create a comprehensive master plan that identifies the short, medium, and long-term renovations and building upgrades required, based on departmental input and academic plans.
- Identify potential development sites for capital projects, both within and adjacent to the Engineering precinct.

Initial Draft Report

Submitted to:

Dean Cristina Amon on March 25th, 2009.

Draft for Faculty Input

Submitted to:

Dean Cristina Amon on June 9th, 2009.

7 RECOMMENDATIONS FOR CONSIDERATION

A compilation of all recommendations, previously presented and dispersed within the Report is provided below.

This listing of recommendation plus the Executive Summary have been produced as an abbreviated Divisional Space Review and Development of Master Plan Report

RECOMMENDATION 1ON UNIT LOCATIONS

The fact that Departments are dispersed across numerous buildings is viewed by the Space Committee as a positive outcome for future planning. Departments have been historically structured to develop and deliver discipline-specific, accredited, undergraduate programs. For the undergraduate student, the optics and delivery of each specific undergraduate program is an important cornerstone; for this reason it is important that each Department continue to have a defined undergraduate home in a particular building, which would typically house the Chair's office, undergraduate studies offices and personnel, student common rooms, club space etc., to provide a very visible departmental home for the undergraduate to foster a sense of belonging. In contrast, at the graduate level the department focus, while still significant, is considerably reduced, and, while it is necessary to provide an administrative focus with respect to graduate admissions, scholarships, and graduate accommodations, the growing research thrusts are towards research integration and the use of shared research facilities. It is this need for integration and the establishment of focused research groups and costly facilities that increasingly cuts across all Departments and will enable [and facilitate] the outreach by Departments into different building locations to be used to advantage. Nevertheless, it should be recognized that Departments, Institutes and Centres as well as interdisciplinary research groups do foster a collaborative sense of participation and team spirit which needs to be nurtured and sustained and which is difficult to more duplicate as entities increase in size

The recommendation is not to attempt to consolidate each Department at a single location, but rather to maintain a visible core location in support of the undergraduate program identification and delivery, but with effective research tentacles to promote interactions across building and departmental boundaries.

RECOMMENDATION 2ON MAINTAINING OUR BUILDINGS

The facilities available to support the academic mission of the Faculty require systematic attention and a schedule for planned renovation, upgrade, and relocation. The nine metrics listed become the essential building blocks around which the required educational, research, and scholarship requirements must be addressed. The infrastructure is outdated and a visit through the back-lanes immediately north of the Mining Building, interfacing onto the Rosebrugh, Mechanical, and Haultain Buildings, will confirm the need for a major redevelopment, starting with a comprehensive plan for the provision of adequate services.

The recommendation is to define the beginnings of an ambitious plan to:

- 2.1 improved maintenance of all Engineering Buildings but particularly the quality buildings [Bahen and Pratt] to ensure that good buildings are maintained as such.***
- 2.2 target an existing, but structurally sound [core] building [Sandford Fleming, Galbraith or Wallberg] as a first priority for renovation, with a view to extensive reorganization, and***
- 2.3 identify those buildings that should best be demolished to allow for redevelopment at an increased density on the cleared footprint, as well as with improved interfaces with existing, adjacent buildings [Engineering Annex, Electro Metallurgy Lab, Haultain, Old***

The choice and possible reorganizations as it relates to Recommendations 2.2 and 2.3 will be subsequently clarified once the space requirements of the Faculty, as distinct from what presently exists, have been presented in a later section of this Report. It is simply impractical to assess each individual space and to recommend on specific action for improvement; instead, a list of general recommendations is provided to serve as guidelines for the consolidation of space and subsequent renewal:

RECOMMENDATION 3ON SPACE PROCEDURES TO ASSIST
Units are responsible for the effective use of the space assigned to them by the Faculty consistent with the strategic research and educational objectives of the Faculty. The Faculty Guidelines documented in Appendix 4 provide a useful guide in the implementation thereof, but the effective use and interpretation thereof falls to the leadership of the respective Unit. This report strongly recommends however that all space, whenever possible and practical should be used to benefit the activities of the Faculty as a whole. Accordingly, subsequent recommendations in addition to those *On Space Procedures* contained within Recommendation 3 will highlight the specific needs to plan and reconfigure shared undergraduate laboratories in support numerous undergraduate programs to intentionally increase the hourly usage per week of such facilities and release space for other needed functions. Sharing of facilities to include the use of conference rooms and graduate classrooms etc. with the necessary protective protocols can all be implemented to assist us all.

The current Space Review undertaking has made it abundantly clear that greater attention and commitment be given to matters of space, its potential availability and utilization. All Units are encouraged to direct increased attention to improved monitoring and utilization of space. As noted, the guidelines on space allocation is an important cornerstone and personnel need to be well informed of the real cost of space and the metrics that monitor space assignment for undergraduate labs, research labs and all accommodations. Increasingly, space will emerge as line item in budgets. Therefore it is important that Units ensure the elevation and knowledge of space and space costs plus an understanding of the inherent inefficiencies when using ill-configured space. All space inventory needs to be correctly categorized and all changes approved and recorded in the University Space Inventory². Smaller units may consider sharing personnel [Space Reps] to ensure a quality operation.

Two interrelated recommendations are identified for consideration on procedures:

3.1 The recommendation is to address the increasing relevance of space in the strategic planning and financial management of the Faculty. Accordingly, consideration should be given to the establishment of a Standing Committee on Space Planning in which the Chairs and Directors represent their respective Units. The Dean, Chief Administrative Officer and Director of Planning & Infrastructure would also be members of the Standing Committee. The proposed membership structure would allow meetings of this Standing Committee to be conveniently orchestrated under a C&D Committee umbrella. The Dean could also report matters to Faculty Council.

² All approvals for the re-reassignment of space and/or renovations/upgrades (value in excess of \$50,000 are made by AFD. The Space Inventory is maintained by Mr. Brian Armstrong, Office of Campus & Facilities Planning.

3.2 It is also recommended that the Director of Planning & Infrastructure continue to advance the Faculty's space planning by ensuring that all user committees, renovation projects and space exchanges within the Faculty are planned and implemented consistent with the Standing Committee on Space Planning, the established Accommodation & Facilities Directorate, and the Faculty's Master Space Plans and Space Guidelines. Informed Space Representatives from each unit will meet regularly with the Director, Planning & Infrastructure. The purpose of these meetings would be:

- i) to promote awareness of all planned renovations within APSE and how such changes could impact and potentially benefit sister units,***
- ii) to enhance working knowledge of the AFD approval process through which all approvals are secured,***
- iii) to provide a forum to discuss potential space exchanges,***
- iv) identification and promotion of jointly managed facilities with clear lines of responsibility,***
- v) improved coordination and shared use of undergraduate laboratories,***
- vi) to share information on infrastructure, facilities management, and policy issues, with emphasis on relationships with Facilities & Services, Real Estate Operations [Capital Projects], and Environmental Health & Safety, facilitating dialogue between the respective groups.***

RECOMMENDATION 4.....ON UNDERGRADUATE LABORATORIES

The Faculty should consider the establishment of selected undergraduate generic laboratories that support two or more engineering programs. A useful start could be made with Fluids, Heat Engineering, Controls, Materials and/or Electronic Circuits Laboratories. This could result in the consolidation and improved utilization levels of undergraduate laboratory facilities and release space to support other undergraduate student activities. The planning of such laboratories would benefit from the fact that projected undergraduate enrolment numbers are currently at or near peak levels. In undertaking this initiative it is important to focus on the essential principles that are being conveyed by the laboratory experiment and as such are discipline independent. When a more discipline specific laboratory experiment has to be introduced there is considerable value to having this experiment available to students in sister disciplines.

Sharing of in-faculty workshop facilities and or services also offers advantages, as does the use of inter-Faculty undergraduate laboratories i.e. Chemical Engineering's use of modern Chemistry laboratories within the conveniently located Lash Miller/Davenport Building, or inter-College/University initiatives such as MIE's use of the George Brown workshop as an external student training facility.

RECOMMENDATION 5ON CENTRAL CLASSROOMS

The Registrar's Office in the Faculty of Applied Science and Engineering has developed a good working rapport with the OSM on matters related to the scheduling of all undergraduate classes and tutorial rooms. The centralization of classrooms works reasonably and OSM is currently upgrading projection facilities in classrooms and streamlining server access. The Faculty is supportive of these updates as it significantly serves to enhance the educational experience. With current increases in class size, classrooms that seat 125 students are at a premium and represent

the most visible pressure point at this time. Any opportunity for OSM to acquire additional 125 seat capacity classrooms in the vicinity of the Engineering Precinct Buildings would be well received. Since this is unlikely to occur, the solution will most likely be found within the scheduling exercise.

It must be noted however that the majority of lecture hall space assigned to the Faculty is used at or near the COU guideline of 34 hours per week. This high usage leads to wear and tear on the classroom components such as seating, writing surfaces and floors. Further, with the exception of the Bahen Centre, most of the classrooms primarily used by the Faculty appear dated and are prone to the same problems as the building they occupy as outlined elsewhere in this report. As noted above OSM has a renewal and replacement program in place for all central classrooms; it is important that this program is properly funded and managed to maintain and improve the learning environment of all classrooms. Ultimately, our classroom facilities should reflect the faculty's status as a global leader in engineering education. The Faculty strongly endorses this OSM undertaking for classroom renewal; it will require sustained central support and hopefully will impact all classrooms including those where no improvements have been made in twenty years and more.

RECOMMENDATION 6ON IMPROVING THE ON-CAMPUS EXPERIENCE

It is noted that different units within the Faculty provide their undergraduates with very different services for example, common room space, reading rooms, club space etc. This is inevitable given the combination and assignment of old and new facilities, yet given the make-up of our buildings there are significant pluses to using the older buildings to accommodate those items that are not high tech, leaving the new facilities to accommodate labs as we move forward. The recommendation is simply to invite all units to endeavour to improve the quality and appearance of support space that might be available to undergraduate student students, such as club offices and Eng Soc space. Similarly all undergraduates are invited to leave space as they would like to find it so that it will be inviting to others.

What we should not see are broken beer bottles in the Galbraith Courtyard when Advancement Officers are working to raise funds in the Barratt Room and observing the state of affairs. Real positive impacts include the glass doors which produce a welcoming feel to the ECE graduate and administrative offices when entering Sanford Fleming; the flat screen information carriers that have been installed in the Mechanical Building and work; the transparency [using glass] into numerous work areas that Civil Engineering has been able to introduce with their building projects; the cleaning up of bench surfaces in the Sanford Fleming lobby to name but a few.

A high priority should be to improve on the access to meeting rooms that would facilitate and support student activities. Students often need to reserve rooms for planning meetings with some 20-25 participants on relatively short notice; OSM is the normal vehicle, and if the lead time for making such reservation is excessive then it is recommended that OSM, having the largest meeting room resources, be contacted to seek suitable alternatives. All units should work to understand this student need and on occasion, should facilities be available, to provide access to existing Conference and Meeting Rooms when such emergency situations arise.

Recommend that the Director of Planning & Infrastructure establish an active working group in consultation with the Vice-Deans of Undergraduate Studies and Graduate Studies to assemble a membership of elected undergraduate students from the Engineering Society and discipline specific student clubs [graduate and undergraduate] to develop selected ideas addressed from within Sections A and B of this Report. This Working Group is to establish a realistic set of priorities and the respective locations, i.e. to identify the number of lockers

required and the potential locations thereof, or formulating the request to expand the wireless services provided through CNS Funding for these opportunities and other initiatives could then be directed to the Dean through a suitable proposal with the support of the student body.

RECOMMENDATION 7ON UNDERGRADUATE COMPUTING
ECF has managed to provide an excellent service in support of computing services for students. While there is no urgent need to dramatically increase the seat count in the ECF computer rooms, there are times when assignments are due on simultaneous dates that introduce all sorts of pressures in ECF. It would be helpful if selected course offerings [that are major users] working with ECF could coordinate different completion dates for major assignments to reduce these pressures.

On the seat count issue, it is noted that ECF has recently implemented systems to provide students with convenient remote access to increasing amounts of software from anywhere, including home. With students being able to access from home, demand for seating is unlikely to increase as these initiatives gain popularity, as they will.

Students are also requesting more widespread access to wireless networks within all Engineering Precinct Buildings. Of particular interest is the need for wireless access within existing computer laboratories since many students are using laptop computers within these laboratories. Since wireless access is implemented centrally, it is important for the Faculty to work with the central administration to provide extensive wireless access. Furthermore, as new buildings and renovations are undertaken it is important to include ECF representation in these plans to possibly site computer access points at strategic locations within these new constructions.

RECOMMENDATION 8ON RESEARCH COMPUTING
Most units presently have computer rooms that house research equipment in support of on-going research within the Department /Institute. These rooms sometimes include undergraduate servers/racks [outside of ECF] or even administrative servers/racks. Some units have separate computer room/closets for this activity. Each of these rooms has required extensive power and cooling to be installed, one room at a time; this is expensive and these individual rooms provide little scope, if any, to effectively use the waste heat. All Units appear to be at capacity at present, but at capacity in the ability to adequately cool as distinct from the footprint for servers/racks.

It is recommended that Faculty consider a central computing facility, with the necessary levels of cooling and physical infrastructure to house and to network these servers/racks to each respective Unit. Currently, this possibility is being investigated and discussed for inclusion within the CET Building; the proposal is strictly to provide the appropriate housing environment and security in which the independent units can operate independently.

Where appropriate, it is also recommended to plan and construct central facilities such as the current ECTI facility to address the needs of the faculty as distinct from smaller repetitive facilities being constructed that are dispersed within each Unit. Economies of scale can work to advantage as noted for the centralized server facility.

RECOMMEDATION 9ON GRADUATE CLASSROOMS
Collectively Units within the Faculty each control a limited number of graduate teaching classrooms that could be available across the Faculty in support of the graduate teaching requirements of all Units; we need to collectively improve on the coordinated use of these classrooms to increase the weekly hours of usage across the Faculty. We also need to consider

using the early morning time-slots for graduate course offerings to potentially attract young professionals; courses could commence at 7:30am and be mutually advantageous to the schedule of all.

Other possibilities are to offer concentrated graduate courses that start in the second week of April, once OSM classrooms are not being used by undergraduates and technically available. This approach could be used to advantage throughout the summer and again in the brief interval in December when OSM has is available. Encourage thinking and planning options outside of the box to use space when it is available rather than at those times when it is in excessive demand.

Consistent with the OSM operation identified within Recommendation 5, consideration should be given to the introduction of an intelligent reservation system, such as RRS Lite currently being used for meeting room reservations within the Faculty, which will allow for all graduate classrooms, conference rooms and meeting rooms within each unit to be more effectively used across the Faculty; the negotiated arrangement would require the appropriate protocols and penalties to ensure that the rooms are adequately maintained by all approved users.

RECOMMENDATION 10IMPROVING THE GRADUATE EXPERIENCE

Any new building within the Engineering Precinct, such as the proposed CET, [or indeed reclaimed space within existing, older buildings] should endeavour to incorporate within the space plan suitable space for graduate students to meet and discuss issues or to establish the appropriate office hoteling services in support of part-time professional Masters Students. The graduate student experience needs to be enriched and it would be logical to include in a facility such as the CET, which is distinctly research intensive, to provide an appealing and comfortable meeting place for graduate students to talk research, industry and societal issues. In the same context it is important to provide professional part-time Masters students with professional hoteling suites equipped with email and telephone access when they are on campus to attend lectures, meetings etc.

Improving the graduate space experience also requires better office accommodation in smaller offices preferably outside of labs, a defined network of lounges and hoteling suites for part-time students within Units and Centres. It is proposed that in all new buildings that academic offices, and indeed all offices, are constructed to the *standard 13 nasm requirement with adequate communication and computer jacks installed at the time of construction* so that these *standard offices* can also readily accommodate three graduate students and as such provide Units with increased flexibility to accommodate faculty, visitors, researchers and graduate students.

RECOMMENDATION 11ON SUPPORTING COLLABORATIVE SEED RESEARCH

Certain Units are providing research laboratory space and or office space to support the research endeavours of individuals who are neither former employees of the Unit nor currently being paid from any budget administered by that Unit. For the present this activity will be identified as *Collaborative Seed Research*; the individuals using this space might typically have been employed or associated with another Faculty, most likely at the University of Toronto or a spin-off company. It is recommended that should such seed research be formally institutionalized that the space allocation be fully transparent, and that the research needs to be of short term interest to the Unit [as distinct from a specific researcher] and that space so assigned be reported at regular intervals to the Dean and approved by AFD. In the collection of data that has been undertaken, Collaborative Seed Research has been identified within Chart 3B. At present the magnitude of this allocation is of order of 400 nasm. This is not an insignificant amount space given that space is currently being rented elsewhere to accommodate activities as important as the PEY Program.

RECOMMENDATION 12.....ON MAXIMIZING NEW SPACE
Given the very limited number of sites available within the Engineering Precinct, it is highly recommended that every effort be made to maximize the building envelop available within each site. This will require that larger amounts of funding are required to build the larger footprint and space envelope.

RECOMMENDATION 13CENTRE for ENABLILING TECHNOLOGIES [CET]
It is recommended that the CET development on the Engineering Annex site proceed as planned and that every effort be made, consistent with Recommendation 12, that additional floors be added on whatever footprint that can be economically established to maximize the amount of space that can be constructed with the budgetary envelope. Consideration should be given to an expansion of the footprint, currently estimated to be 1200 gross square metres [gsm] by an additional 450 gsm; this would require the demolition of a protruding section of the Wallberg Building. Such a possibility will require the lost space to be re-established, but it could result in a better overall design with improved access from College Street, through the Wallberg Building into the CET.

It is also to be noted that proposed shared research facilities in optics, nano & micro fabrication and materials characterization are perceived to be an expansion of critical facilities in these areas of enabling technologies. It is anticipated that in addition to the establishment of these shared facilities that additional research space will be provided that would be sufficiently flexible and that might be used to provide for limited swing space opportunities.

RECOMMENDATION 14ON SITES EXTERNAL
Given that the net maximum amount of new space that could be constructed on both building sites [Engineering Annex + Haultain/ Heat Engines] is unlikely to exceed 18,500 nasm, it is recommended that the Dean initiate discussions with the University Administration to identify additional sites in close proximity to the Engineering Precinct Buildings for future development. It will take considerable time to acquire and consolidate such space, but this action is required and needs to be promoted well in advance of the actual construction.

RECOMMENDATION 15UTIAS RELOCATION?
Given the limited expansion of space that can be contemplated in the near term, it is not possible to consider the relocation of UTIAS to the St. George campus without the acquisition of new building sites in the vicinity of the Engineering Precinct Buildings. Were such sites to materialize the UTIAS entity could be more conveniently relocated without the difficulty of shoehorning the unit into ill-suited pockets of space. This recommendation links directly to Recommendation 13, since if no suitable sites can be identified there will be increasing pressure to plan for building upgrades on the Downsview campus.

RECOMMENDATION 16SWING SPACE
To advance any renovation program of significance within the Faculty to systematically upgrade space requires that some 2,000 nasm of swing space be available, preferably within the Engineering Precinct Buildings or within the immediate vicinity, to temporarily relocate activities

to such swing space during the typically 12-18 month renovation cycle. It is recommended that such space be identified and acquired either through rental or as a result of new construction.

8. OBSERVATIONS.

While each of the first 16 recommendations address important issues that would enhance the stature of the facilities available within the Faculty, the pivotal recommendation is that conveyed in Recommendation 14. This particular recommendation will ultimately define the long term critical path for the Faculty; it will require both extensive consideration and planning within the University and time to realize the objectives within an unpredictable market place. The benefits to establishing this pathway are considerable; additional building sites need to be identified within the St George Campus or in close proximity to the campus with the most likely possibilities existing along the College Street corridor. With some measure of clarity as to where affordable expansion might occur, the planning process could be considerably enhanced.

To illustrate the advantages:

- i) The existing building sites within the Engineering Precinct are complex sites on which to build and construction costs, as a result, are very high. Might it not be preferable to locate selected activities on say, College Street or elsewhere in the immediate vicinity?
- ii) No swing space exists to vacate the existing building sites needed for construction; we also need to acquire quality swing space for laboratories to allow for upgrading of existing facilities when such funding are available from all sources including CFI. It could be cost effective to construct suitable swing space within a new building on say, College Street or elsewhere in the immediate vicinity.
- iii) It could be advantageous to thoroughly investigate the feasibility to relocate UTIAS close to the St George Campus. The College Street corridor could offer such possibilities and could potentially allow for the relocation of the entire entity as distinct from shoe-horning these activities into constrained space within the existing Engineering Precinct.
- iv) Administrative operations such as the very successful Professional Experience Year [PEY] program are currently renting space in New College Residence and could benefit from having a more permanent home³. Such entities could preferably be located within any of the opportunities cited above in preference to the current ad-hoc approaches.

The Space Review Committee puts forward these observations with the full understanding that it is costly to erect new buildings and that it will all take time to do so. We also understand that these options need to be fully explored and understood to facilitate constructive space planning within the Faculty.

Finally, an interim alternate approach might be to consider inviting external developers to work in possible partnership with the University to build *swing space* for offices and laboratories that could be rented by the University for defined periods. This is not unlike the concept, proposed with the recent leasing of 245 College Street to developers, to build residences that could be used by U of T students. Building of such facilities could also be applicable to PEY offices and other non residential activities that could be compatible with a residence. To include laboratory and

³ This rental is a stop-gap plan, following the targeted purchase of 245 College Street, and temporarily stalled renovation of the 5th floor of McCaul Street at a cost in excess of \$1 million. It is important to note that these options followed an extensive search to identify suitable rental space on College Street and elsewhere that might be adaptable for University needs.

office swung space could also be an attractive outlet for spin-off companies and MaRS type activities.

9 RECOMMENDED ACTIONS

A brief listing of recommended actions are identified below that are currently on-gong or should be initiated in the very near term to ensure that the required information would be available when required.

1. **User Committee for the CET.** This Committee has been formally established and is anticipated to table a final report in the early fall of 2009. The report will provide for a detailed space plan for the building on the Engineering Annex site. It is also proposed to include options that could expand the space envelope and to investigate the pricing of each option on speculative sites that would have reduced construction complexities. The proposed footprint for this project, once funding is secured, will be the Engineering Annex site.
2. **Bio-Zone Project [Bioengineering Research Facility for Energy, Environmental & Economic Sustainability].** An internal Working Committee is actively identifying the space requirements for the CFI supported Bio-Zone project which is to be located on the upper floors (with a roof expansion) of the Wallberg Building. Formal approval of the User Committee and the Project Report will be required through University governance in the fall.
3. **UTIAS.** It is recommended to convene an internal User Committee that could be formally established with University governance in the fall. The Committee is to define the detailed space requirements required by the Institute of Aerospace Studies. The intent is to define the required space plan irrespective of any specific site location which could conceivably be within the College Street corridor or the Downsview campus. It would be a useful and timely step in the process to precisely define these requirements since the information could impact decisions pertaining to either a new building and or the staged upgrading of facilities at Downsview.
4. **Working Group for Generic Undergraduate Laboratories:** It is recommended to establish a Working Committee to identify and investigate all undergraduate laboratories within the Faculty with the objective to define the optimum subset that could be reconfigured to accommodate the laboratory component of similar course offerings within the Faculty. The courses and number of experiments offered within each course are to be identified for each laboratory and a brief description of each experiment and the supporting facilities provided. Experiments that could be common to two or more course should also be identified. Once this preliminary information is assembled, Working Groups for each targeted generic laboratory will be required to define the experiments that will be incorporated into the new entity. The driving force behind this initiative is to more intensive use our undergraduate laboratory space so that some of the existing laboratory space can be redirected to support other activities which could even include the creation of swing space to assist in renovations throughout the Faculty.
5. **Working Group on the Student Experience.** Recommend that the Director of Planning & Infrastructure, in consultation with the Vice-Deans of Undergraduate Studies and Graduate Studies, establish an internal Working Group comprising elected undergraduate students from the Engineering Society and discipline specific student clubs [graduate and undergraduate] to develop selected ideas identified within Sections A & B of this Report. Specifically this Working Group could define a realistic set of objectives, with the appropriate justification, for implementation when suitable funding opportunities might become available. Illustrative examples could include: i) locations

for wireless networking; ii) identify the number of lockers required and the potential locations thereof; and iii) how and where to expand facilities for the outside parking of bicycles.