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SECTION 1 | EXECUTIVE SUMMARY

The 2019 Five-Year Capital Outlay Plan for Michigan Technological University clearly identified the need for an H-STEM facility that will integrate educational programs to apply engineering and science to solve problems related to human health. The building will co-locate multi-disciplinary teams to work together in shared collaborative space to advance learning, develop new technologies and prepare a technologically skilled future workforce. In order to create a shared vision for the facility, a Project Directing Committee was formed with key campus leaders and a broad-based group of stakeholders in research, science, engineering, and health-related fields was invited to participate.

With the assistance of a consulting team, trends in state-of-the-art STEM facilities were reviewed and discussed. These trends included an emphasis on hands-on experiential learning, interactive and collaborative space to promote teamwork and community, shared research labs to enhance transdisciplinary collaboration, showcase facilities to recruit and retain students, faculty and staff, and governance structures to sustain successful operations.

A workshop was conducted with the Project Directing Team to develop the vision, goals and priorities for the complex. Participants were surveyed regarding the relationship of the project in supporting the institution’s strategic vision, mission and goals and asked to identify both opportunities and key issues or challenges that should be addressed prior to implementation. A two day workshop was conducted to discuss these topics, craft a vision statement and set of priorities for the project. The team drafted the following vision for this project:

- Create a showcase facility that has a positive impact on health-related research activity and the recruitment of faculty and students.
- Put research on display. Support research-based discovery learning.
- Encourage interdisciplinarity through thematic rather than departmental grouping.
- Reinforce the MTU culture of collaboration.
- Focus new construction on state-of-the art research and research support space.
- Renovate existing space for office and instructional space.

Informing this vision statement were priorities, which included, ranked by order of importance:

- Co-locating of Kinesiology and Integrative Physiology and Bio-Medical Engineering in renovated chemistry building space
- Provision of an ACF
- Renovating non-health related lab space in Chemical Sciences Building to modern standards
- Having “Health” integrated into the building
- Including a 60-80 seat multi-purpose space for public receptions, seminars, lectures, etc.
- Creating a “wow” factor
- Developing a “hub” or home base for H-STEM on campus (including hoteling for faculty)
- Constructing modern lab space with proper ventilation airflow, climate control and vibration dampening
- Creating research clusters/themed research neighborhoods
- Renovating inadequate existing space for offices and instruction
- Providing shared equipment (core facilities)

The full report and supporting documents provide additional details.
SECTION 2 | PROCESS OVERVIEW AND HIGHLIGHTS

A process was developed in close coordination with project leaders. This included the formation of an executive steering body, referred to as the Project Directing Committee, consisting of the Provost, VP for Research, Director of the Great Lakes Research Center Operations, the Director of Planning & Construction and the Assistant Director of Planning & Construction. The Project Directing Committee provided input and feedback in crafting the process. To create an engaging and inclusive process, a working group of stakeholders was then identified.

The process consisted of two phases of engagement. The first step was to solicit input via an electronic survey, and this was followed by an on-campus workshop.

Electronic Survey Overview

The survey asked how the project supports the University’s Vision and Mission. The participants were also asked how the project would contribute to specific University goals. The results confirmed excellent alignment between the H-STEM project and MTU’s published strategic vision, mission and goals.

The survey also helped identify some strong synergies between departments by asking about how likely the responding departments would be likely to collaborate with other departments. This identified the greatest synergies with K.I.P., Biomedical Engineering, Biology, and Cognitive Learning Sciences (in ranked order), as shown in the graph below.

It should be noted that these results likely reflect the strong interests of the survey participants, since responses were received from Biomedical Engineering, Biological Sciences, Chemical Engineering, Cognitive Learning Sciences, Kinesiology and Integrative Physiology, and the AVP for Research.
A list of issues and opportunities were summarized and formed the basis for discussion during the workshop. Strategic themes from the survey were noted to be as follows:

**STRATEGIC THEMES FROM SURVEY**

- **Experience**
  - Teaching Excellence, Academic Quality, Culture, New Pedagogies, New Ways of Thinking, Learning and Doing, Remove Physical and Practical Barriers, Schools/Colleges Visibly Working Together

- **Collaboration**
  - Fostering Interactions, Break-down Silos, Shared Spaces, Combined Research and Education, Cross-disciplinary Discussions, Faculty and Student Interactions

- **Impact**
  - Medical Advancements, Improve Human Health and Wellbeing, Results Disseminated all over the World, Reputation, Partnerships

- **Innovation**
  - Interdisciplinary Research, New Approaches, Recognition, Entrepreneurialism, Advancement of Knowledge

- **Operations**
  - State-of-the-Art Facility, Centralization, Process Improvement, Central Hub Spaces, New Technologies, Infrastructure Alignment, Space Accessibility

Survey responses are compiled and included in the Appendix.

**Workshop Overview**

A workshop held over two days constituted the second phase of engagement. Representatives from the following individuals were invited:

- Pradeep Agrawal - Chair, Chemical Engineering
- Janet Callahan - Dean, College of Engineering
- Jason Carter - Associate Vice President for Research Development
- Megan Frost - Interim Chair, Kinesiology and Integrative Physiology
- David Hemmer - Dean, College of Sciences and Arts
- John Jaszczak - Interim Chair, Chemistry
- Chandrashekhar (Shekhar) Joshi - Chair, Biological Sciences
- Sean Kirkpatrick - Chair, Biomedical Engineering
- Dr. Ye (Sarah) Sun - Professor of Mechanical Engineering

Other stakeholders included:

- Jackie Huntoon, Provost
- Dave Reed, Vice President of Research
- Kerri Sleeman, Facilities Management
- Jacob Guter, Assistant Director of Facilities Planning & Construction
- Mike Abbott, Director, Great Lakes Research Center Operations

The workshop consisted of two primary agenda items: a presentation of trends and case studies, and a working session to discuss opportunities and issues, which resulted in the formation of a draft vision and set of prioritized goals for the project.
**Trends**

Trends related to classrooms, instructional laboratories and thematic research space were discussed at the workshop. The idea of space assigned on a modular basis provides for flexible and adaptable space that can be converted and changed as the needs of students change. The modular concept is one that allows for space to be changed over time from instructional laboratory space to research space to office space as needs and requirements change. Trends in laboratory design are suggesting that a lab module of 11'-0" x 11'-0" is a good starting point for flexibility and convertibility in space that can be converted between wet and dry space.

The first trend relating to classrooms explored the idea of flexibility in learning types and the advantages of active learning pedagogies. While space specific to classrooms is very important, the group had discussed trends related to dry-ish space that could flex between a classroom and additional support spaces. Trends that relate to the dry-ish experiential learning space have multiple components that incorporate prep/equipment/storage space, write-up space and team-based mobile technology space. Flexible experiential learning spaces are becoming highly desired in today’s active learning environments.

Instructional laboratories for today’s students need to promote collaborative teamwork and hands-on learning. The trend in instructional labs is moving away from the traditional didactic experience to one that promotes students interacting in a team-based, hands-on experimental environment. A wet lab concept was explored for instructional laboratories, one that explores the opportunity of active lab environment. The active lab accommodates team-based mobile technology with flexible casework systems and provides a separate space for write-up experiment design and equipment storage prep space. A sample project was discussed at the University of Illinois Electrical and Computer Engineering building.

The University of Illinois project had instructional laboratories set up in thematic clusters with an instructional lab, small classroom and support space. This thematic cluster allowed for a separation of classroom and laboratory functions allowing for flexibility in scheduling.

**THEMATICALLY ORGANIZED - FLEXIBLE SPACES**

Thematic-based research space is a trend that the group had discussed at length during the workshop. The survey had expressed a desire for collaboration and innovation within interdisciplinary research spaces, enforcing the need for flexible and adaptable spaces able to accommodate many different sciences. A trend in Higher Education Research space suggests that space is no longer allocated to specific faculty, but to specific research funding needs for the faculty. This trend is suggesting that flexible space that can be changed over as funding streams change, is most desirable. We had discussed an example of a standard 2 module lab that had services on the exterior and corridor walls with overhead services on the separating walls. This concept would allow for separating walls to be removed or added as research needs change over time. This type of flexibility in research space is common within many Higher Education clients.

Environments for students and researchers are changing. Trends are suggesting space that can accommodate flexibility and adaptability are best suited for today’s learning environments.
**Case Studies**

During the workshop, the group had discussed a variety of similar case studies, most notable Oakland University Engineering Center and Virginia Technological University Institute for Critical Technology and Applied Science II. Both projects identify a flexible and interdisciplinary approach to instructional and research laboratories, viewed as useful and appropriate by the executive steering body.

The Oakland University Engineering Center has allowed the University to expand and grow enrollment and research funding through flexible and hands-on student opportunities. The new facility is 143,000 sqft of classroom, instructional labs, research labs and collaboration space, all working to enhance the students learning experience. The flexible research space provided follows a model that the executive steering body thought was useful for the H-STEM project. The research space in the Engineering Center is allocated to faculty who have active research funding. The laboratories have flexible casework systems and MEP infrastructure that allows for adaptability as funding may be increased or decrease.

The second case study was for Virginia Technological University, the Institute for Critical Technology and Applied Science II (ICTAS II). ICTAS II, as it is known on campus, is a 42,000 sqft interdisciplinary research building that is part of a 600,000 sqft interdisciplinary precinct on campus. The ICTAS II building supports science at the intersection of engineering and biology, providing advanced laboratories for cross-disciplinary research. Space within the ICTAS II building is assigned based on research funding and re-assigned as funding streams change.

The Oakland University and Virginia Tech case studies as explored, have flexible and adaptable space that provides and interdisciplinary approach to research. The research space for both projects is provided with a modular approach allowing for flexibility in dry and wet research, the executive committee found value in this approach.

**Governance**

Two case studies were presented regarding governance. The first involved CU Boulder’s Jennie Smoly Caruthers Systems Biotechnology Building, which was re-programmed, designed and constructed when Paul Leef was the campus architect at CU-Boulder. This building was the vision of Nobel Laureate and former director of the Howard Hughes Medical Institute, Dr. Tom Cech. It was original constructed to house researchers from Department of Biochemistry, Department of Chemical Engineering, the BioFrontiers Institute and private industry partners. It was designed around thematic research “neighborhoods,” “productive collision” space and lab flexibility. In fact, the labs were designed according to a standard lab module rather than individual occupants, and space assignments were not decided until after design was complete. Space decisions are made by an executive committee consisting of the chair of Biochemistry, the chair of Chemical Engineering and the Director of the BioFrontiers Institute.
The second study in governance structure involved the Bond Life Sciences Building at the University of Missouri Columbia. The facility was studied by Paulien & Associates as part of a campus wide utilization analysis and assessment of space needs and found to have the highest productivity of research expenditures on campus. The building is operated by a director and staff funded by Indirect Cost Recovery (ICR) with responsibility for event scheduling, fiscal matters, grant administration, IT, facilities coordination and general administration. A unique aspect of this facility is that a Memorandum of Understanding (MOU) has bee developed to articulate mutual expectations. In particular, principal investigators are expected to:

- To develop and maintain a vigorous and externally research program
- To cultivate collaborative interactions with other investigators both within and beyond the LSC
- Provide and annual report
- Participate in governance and meetings
- Participate in evaluating the director

These are designed to create a behavioral culture of collaboration. The requirements for engagement also provide more opportunities for relationship-building. Faculty committees for policy, personnel, facilities and lab operations, and space and equipment serve the dual purpose of governance and development of collaborative culture. The Space and Equipment Committee was developed to help address the use of “flex” or “surge” lab space in the building, and to reinforce the shared nature of equipment.

**Discussion**

The trends presented resonated with the stakeholder group, particularly as related to collaboration areas and thematic research. One issue which garnered significant attention and discussion was that of governance. The case studies offered two models for funding and operational oversight. It was observed that the governance model for the H-STEM building would be important, since the vision is for it to be a non-departmental building, with academic home departments located in the existing Chemical Sciences Building. However, the existing Great Lakes Research Center provides an operational prototype for the new building. However, with an institutional goal of increasing research expenditures, one key issue to be addressed is the process and terms for space allocation in the new facility.
Vision Statement
The team drafted the following vision for this project:

- Create a showcase facility that has a positive impact on health-related research activity and the recruitment of faculty and students.
- Put research on display. Support research-based discovery learning.
- Encourage interdisciplinarity through thematic rather than departmental grouping.
- Reinforce the MTU culture of collaboration.
- Focus new construction on state-of-the-art research and research support space.
- Renovate existing space for office and instructional space.

Goals
Through facilitated discussion, the stakeholder team developed and then voted on the following goals, listed in priority order by voting:

1. Facilitate meaningful tours
2. Display/exhibit space for campus-wide health research
3. Makes visible ‘enterprise’ program
4. Informal gathering and collision space
5. Combined research and teaching space
6. Increase student recruitment and retention
7. Public access and patient privacy (parking, etc.)
8. Adequate emergency power for freezer and lab backup power
9. Governance structure
10. Café (chem sci?)
11. Co-locating graduate students
12. “Wow” factor
13. “HUB” or home base for H-STEM on campus (incl. hoteling for faculty)
14. Health integrated into building
15. 60-80 seat multi-purpose space for public receptions, seminars, etc.
16. Renovate inadequate existing space for office and instruction
17. Modern lab space with ventilation airflow, climate control, and vibration dampening
18. Research clusters/neighborhoods
20. Animal Care Facility (hidden)
21. Non-health related lab space (chem sci) to be renewed to modern standards
22. Governance structure
23. Café (chem sci?)
24. Adequate emergency power for freezer and lab backup power
25. Public access and patient privacy (parking, etc.)
26. Conference rooms meeting space
27. Increase student recruitment and retention
28. Co-locating graduate students
29. “Wow” factor
30. “HUB” or home base for H-STEM on campus (incl. hoteling for faculty)
## Survey Responses

### Q1 1. What is the name of your department or unit?

Answered: 11   Skipped: 0

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<tbody>
<tr>
<td>1</td>
<td>Chemical Engineering</td>
<td>3/22/2019 10:30 AM</td>
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<tr>
<td>2</td>
<td>Department of Cognitive and Learning Sciences, and Department of Kinesiology and Integrative Physiology</td>
<td>3/21/2019 6:25 AM</td>
</tr>
<tr>
<td>3</td>
<td>Biological Sciences</td>
<td>3/20/2019 3:23 PM</td>
</tr>
<tr>
<td>4</td>
<td>AVPRD</td>
<td>3/19/2019 9:11 AM</td>
</tr>
<tr>
<td>5</td>
<td>Biomedical Engineering</td>
<td>3/19/2019 8:07 AM</td>
</tr>
<tr>
<td>6</td>
<td>Biomedical Engineering</td>
<td>3/18/2019 2:11 PM</td>
</tr>
<tr>
<td>7</td>
<td>College of Sciences and Arts</td>
<td>3/18/2019 12:48 PM</td>
</tr>
<tr>
<td>8</td>
<td>Chemistry</td>
<td>3/18/2019 12:43 PM</td>
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<tr>
<td>9</td>
<td>MEEM</td>
<td>3/18/2019 12:27 PM</td>
</tr>
<tr>
<td>10</td>
<td>Kinesiology and Integrative Physiology</td>
<td>3/18/2019 12:10 PM</td>
</tr>
<tr>
<td>11</td>
<td>Biomedical Engineering</td>
<td>3/18/2019 11:55 AM</td>
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</table>
Q2 2. Describe how the H-STEM Complex supports the University’s Vision.

Answered: 6   Skipped: 5

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<tr>
<th>#</th>
<th>RESPONSES</th>
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<tbody>
<tr>
<td>1</td>
<td>In the most direct way, H-STEM complex provides support for improving quality of life through community- and health-focussed initiatives in research, education.</td>
<td>3/22/2019 12:17 PM</td>
</tr>
<tr>
<td>2</td>
<td>There are a number of ways: 1) the H-STEM complex will serve to break down traditional silos, bringing together research and education from numerous departments, across multiple colleges/schools. This will allow for innovative education and research as it can bring together MTU's strength in engineering and technology with its strengths in traditional health research disciplines (e.g., biology, kinesiology, chemistry, and psychology/human factors). 2) through strategic planning we are positioned to create innovative and shared spaces that move beyond the antiquated model of the isolated, stand-alone lab, allowing for better cross-disciplinary discussions about teaching and research for both students and faculty. 3) by bringing together multiple disciplines into a single space it removes practical barriers to interdisciplinary work in the form of the scattering of those stakeholders across campus, as is the case currently.</td>
<td>3/21/2019 7:22 AM</td>
</tr>
<tr>
<td>3</td>
<td>By providing state-of-the art facilities for collaborative and interdisciplinary work in human health and STEM subjects that will be disseminated all over the world.</td>
<td>3/20/2019 3:34 PM</td>
</tr>
<tr>
<td>4</td>
<td>The infrastructure of H-STEM will advance research and educational capacities in a manner that will support education of students, advancement of knowledge, and improvement of quality of life.</td>
<td>3/19/2019 9:22 AM</td>
</tr>
<tr>
<td>5</td>
<td>By providing an academic home for the Department of Kinesiology &amp; Integrative Physiology and the Department of Biomedical Engineering, along with research space for other health-related researchers, the H-STEM complex provides for a central hub for health technologies research and development, fostering interactions and innovation in the applied health sector.</td>
<td>3/19/2019 8:26 AM</td>
</tr>
<tr>
<td>6</td>
<td>creates a hub to focus and support health related research on campus and encourages interdisciplinary fertilization of ideas and approaches from different fields to improve human health and well being</td>
<td>3/18/2019 12:37 PM</td>
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</tbody>
</table>
### Q3. Describe how the H-STEM Complex can best align with the University’s Mission.

**Answered: 6**  **Skipped: 5**

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<tbody>
<tr>
<td>1</td>
<td>Health, environment, and responsible utilization of resources are intricately linked to the well-being of the society at large. An inter-disciplinary effort requires not only education at the undergraduate and graduate level, but also working together to develop innovative solutions to the complex challenges the society faces.</td>
<td>3/22/2019 12:17 PM</td>
</tr>
<tr>
<td>2</td>
<td>By ensuring that all health-related researchers/disciplines on campus have a seat at the table. Also by ensuring that the H-STEM complex is accessible to students, faculty, staff, and importantly, the community. As the number of students and faculty on campus that do human-subjects research grows, it is imperative the lab spaces and the general infrastructure of the complex are accessible to community partners who contribute to that work, including participant populations (both clinical populations and healthy controls), community organizations, local hospitals, etc. As an example, MTU must ensure that there is accessible and readily available parking for participants, especially special populations, and community partners that is close to the complex. We also need to ensure that there is a inviting and comfortable public space (e.g., lobby) inside the complex that makes community partners feel welcome and appreciated.</td>
<td>3/21/2019 7:22 AM</td>
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<tr>
<td>3</td>
<td>increase opportunities for collaborative work in H-STEM involving students, faculty and staff</td>
<td>3/20/2019 3:34 PM</td>
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<tr>
<td>4</td>
<td>The H-STEM complex can best align with University mission by advancing departments/units with proven track-record of health-related grad/UG education, research, and innovation.</td>
<td>3/19/2019 9:22 AM</td>
</tr>
<tr>
<td>5</td>
<td>By bringing together scientists and engineers who are directly and primarily engaged in health-related research and technology development, the H-STEM complex will provide an active environment with a singular focus on solving health related challenges.</td>
<td>3/19/2019 8:26 AM</td>
</tr>
<tr>
<td>6</td>
<td>The new complex will provide physical infrastructure to bring people and research together in a space for the growth of innovative ideas and solutions to human health</td>
<td>3/18/2019 12:37 PM</td>
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</table>
Q4 Goals

Specific University strategic goals have been developed around Education, Scholarship, and People. Describe how you see the H-STEM project contributing towards each of the following goals. Student Learning: Integrate instruction, research, and innovation to achieve the student learning goals for undergraduate and graduate program.

Answered: 6    Skipped: 5

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<tbody>
<tr>
<td>1</td>
<td>Solving complex societal problems requires an inter-disciplinary effort to develop, translate, and implement solutions. Both undergraduate and graduate education needs to recognize the role of each individual component within a larger context.</td>
<td>3/22/2019 12:17 PM</td>
</tr>
<tr>
<td>2</td>
<td>Bringing multiple health-related disciplines together under one roof, and breaking down traditional silos, will facilitate the creating of a more multidisciplinary curricula that can be offered more broadly across undergraduate and graduate programs.</td>
<td>3/21/2019 7:22 AM</td>
</tr>
<tr>
<td>3</td>
<td>The research performed in H-STEM building will help student learning, knowledge creation and promote innovation.</td>
<td>3/20/2019 3:34 PM</td>
</tr>
<tr>
<td>4</td>
<td>1. State-of-the-art teaching laboratories for key undergraduate courses (particularly in KIP and BME, which are currently poorly met) 2. Collaborative and flexible spaces for researchers to interact with students and other researchers.</td>
<td>3/19/2019 9:22 AM</td>
</tr>
<tr>
<td>5</td>
<td>The H-STEM complex will provide a centrally located, very research active environment for students to become engaged in basic and applied research related to human health challenges</td>
<td>3/19/2019 8:26 AM</td>
</tr>
<tr>
<td>6</td>
<td>It will provide hands-on learning and interaction space for students and faculty to work together in research and development - learning by doing and solving real problems in a guided, mentored environment</td>
<td>3/18/2019 12:37 PM</td>
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Q5 Transformative Education: Provide a technologically-rich education grounded in a residential and experiential learning environment.

Answered: 6  Skipped: 5

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<tbody>
<tr>
<td>1</td>
<td>MTU is known for hand-on learning approach in its education model, which is further augmented by internships/co-op program as well as building partnerships with the government (both local and national) and industry. This would prepare the students best to treat societal need as the main driver for education and innovation.</td>
<td>3/22/2019 12:17 PM</td>
</tr>
<tr>
<td>2</td>
<td>By ensuring that the H-STEM complex also includes dedicated research and teaching laboratories, we will also ensure that the students are provided with a top-notch, innovative, hands-on, and skills-based learning environment, while minimizing disruption to ongoing research activities.</td>
<td>3/21/2019 7:22 AM</td>
</tr>
<tr>
<td>3</td>
<td>state-of the art labs for research performed by world-class faculty and staff in collaboration with students</td>
<td>3/20/2019 3:34 PM</td>
</tr>
<tr>
<td>4</td>
<td>1. Discovery-based teaching laboratories 2. Spaces and infrastructure for more undergraduate and graduate research opportunities.</td>
<td>3/19/2019 9:22 AM</td>
</tr>
<tr>
<td>5</td>
<td>Both BME and KIP actively encourage undergraduate students to become aggressively engaged in high-tech health care research. This complex will expand those opportunities.</td>
<td>3/19/2019 8:26 AM</td>
</tr>
<tr>
<td>6</td>
<td>Provide the framework for shared resources and approaches in a psychical location to bring together cutting edge research and multiple perspectives to add energy to creative problem solving</td>
<td>3/18/2019 12:37 PM</td>
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</table>
Q6 Educational Programs: Expand programs in response to social and economic needs and challenges.

Answered: 6  Skipped: 5

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<tr>
<td>1</td>
<td>The well-being of the society requires a systems-based understanding of the entire complex field. With so many moving parts, changing one parameter impacts other parts in ways that are not well understood. Many more people will become aware of the need to train in systems-wide thinking.</td>
<td>3/22/2019 12:17 PM</td>
</tr>
<tr>
<td>2</td>
<td>By ensuring the accessibility of the H-STEM complex to community partners, we will be positioned to appreciate local social and economic needs/challenges that will complement our understanding of national and international social and economic challenges through our research endeavors.</td>
<td>3/21/2019 7:22 AM</td>
</tr>
<tr>
<td>3</td>
<td>topics like preserving and improving human health, global climate change, and feeding world's hungry population, and bioenergy could be studied</td>
<td>3/20/2019 3:34 PM</td>
</tr>
<tr>
<td>4</td>
<td>1. Strengthen existing degrees and programs that are deeply engaged and committed to health, particularly BME, KIP, and Biological Sciences pre-health. 2. Create an intersect with these three major programs and some of the others that are more peripherally focused on health.</td>
<td>3/19/2019 9:22 AM</td>
</tr>
<tr>
<td>5</td>
<td>This complex will help to foster inter- and trans-disciplinary research which is critical to solving challenging issues in human health. It will provide a rich educational environment allowing students to actively participate in this research and more easily cross traditional departmental boundaries.</td>
<td>3/19/2019 8:26 AM</td>
</tr>
<tr>
<td>6</td>
<td>create interdepartmental educational programs to tailor to student needs and interests</td>
<td>3/18/2019 12:37 PM</td>
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</tbody>
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## Q7 Scholarly Activity: Grow research, scholarship, and creativity.

**Answered:** 6  **Skipped:** 5

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<tr>
<td>1</td>
<td>Both graduate and undergraduate research activities will flourish in the H-STEM complex since that is one of the main themes for this initiative.</td>
<td>3/22/2019 12:17 PM</td>
</tr>
<tr>
<td>2</td>
<td>Primarily by bridging existing gaps between disciplines across multiple colleges. The H-STEM complex has the real potential, if planned appropriately, to launch novel and innovative collaborative research projects by bring together students and faculty from those separate disciplines. With buy in from the upper administration, and incentive structures put in place, the H-STEM complex would facilitate the development of novel, large-scale research programs and funding applications.</td>
<td>3/21/2019 7:22 AM</td>
</tr>
<tr>
<td>3</td>
<td>more research by more students and faculty more publications and more research funding more information, knowledge and wisdom</td>
<td>3/20/2019 3:34 PM</td>
</tr>
<tr>
<td>4</td>
<td>1. State-of-the-art facilities to attract more (and larger) NIH grants. 2. Upgraded facilities will lead to better scholarship and publications.</td>
<td>3/19/2019 9:22 AM</td>
</tr>
<tr>
<td>5</td>
<td>By co-locating the primary departments involved in health research along with other researchers who are engaged in health-related research, the complex will promote interdisciplinary research activity, which is the most fertile ground for solving human health challenges. It will promote the authoring of larger grant proposals consisting on multi-disciplinary teams.</td>
<td>3/19/2019 8:26 AM</td>
</tr>
<tr>
<td>6</td>
<td>Provide the pooling of resources to positively build the health research community on campus</td>
<td>3/18/2019 12:37 PM</td>
</tr>
<tr>
<td>#</td>
<td>RESPONSES</td>
<td>DATE</td>
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<td>----</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>1</td>
<td>The facility would likely act as an incubator for venture capital firms, in addition to generating human resources. Both will contribute towards the economic growth.</td>
<td>3/22/2019 12:17 PM</td>
</tr>
<tr>
<td>2</td>
<td>Innovative and forward-thinking design of the H-STEM space, with an eye to well-being and quality of life of students, staff, and faculty, and to opportunities for entrepreneurship, we would be positioned to make significant contributions to the local, state, and national economy, and to lead health-related community outreach that would foster social progress.</td>
<td>3/21/2019 7:22 AM</td>
</tr>
<tr>
<td>3</td>
<td>more patents and publications more faculty and students more high paying jobs and economic stability</td>
<td>3/20/2019 3:34 PM</td>
</tr>
<tr>
<td>4</td>
<td>1. Opportunities exist for technological innovations in health, and are happening in BME, Chem, and Chem Eng. 2. Opportunity to expand to other departments.</td>
<td>3/19/2019 9:22 AM</td>
</tr>
<tr>
<td>5</td>
<td>Human health research demands a multi-disciplinary approach. The translation of medical technology (i.e., 'bench-to-bedside' research) must involve basic scientists and engineers with a focus on human health. Co-locating these scientists and engineers can promote invention and innovation in a manner that just does not happen currently.</td>
<td>3/19/2019 8:26 AM</td>
</tr>
<tr>
<td>6</td>
<td>The intellectual environment focused on human health helps MTU faculty and students, the local health care community and the people in the Copper Country by educating citizens and students and adding energy to the entire community of health care providers and patients.</td>
<td>3/18/2019 12:37 PM</td>
</tr>
</tbody>
</table>
### Q9 Community: Cultivate an exceptional academic and professional community.

Answered: 6    Skipped: 5

<table>
<thead>
<tr>
<th>#</th>
<th>RESPONSES</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H-STEM facility would certainly create a critical mass of academics and professionals, by the very essence of it being an interdisciplinary field.</td>
<td>3/22/2019 12:17 PM</td>
</tr>
<tr>
<td>2</td>
<td>Again, by dissolving barriers between existing disciplines to encourage interdisciplinary initiatives. This would surely need to include the design of a reasonably large lecture hall that could be used to bring in world leaders in health-related fields to give plenary talks to all stake-holders in the H-STEM complex.</td>
<td>3/21/2019 7:22 AM</td>
</tr>
<tr>
<td>3</td>
<td>those who come here would contribute to build a better world for us and the future generations!</td>
<td>3/20/2019 3:34 PM</td>
</tr>
<tr>
<td>4</td>
<td>1. With nearly 1 in 5 faculty somehow connected to health research or education, there is an opportunity for this building to serve as a community hub for health research and education (even for those that are not main occupants).</td>
<td>3/19/2019 9:22 AM</td>
</tr>
<tr>
<td>5</td>
<td>Co-locating KIP and BME along with appropriate other faculty will lead to an increase in sharing ideas and research concepts that is not cultivated currently on campus due to the dispersed locations of health-related faculty. This will lead to a richer and more diverse academic and professional community.</td>
<td>3/19/2019 8:26 AM</td>
</tr>
<tr>
<td>6</td>
<td>Creating a physical location to be the focus of health research in the region brings together students, faculty and staff to facilitate the growth and development of the health research community that supports excellence in education and excellence in research</td>
<td>3/18/2019 12:37 PM</td>
</tr>
</tbody>
</table>
Q10 Quality of Life: Ensure a supportive environment for all members of the University community.

Answered: 6   Skipped: 5

<table>
<thead>
<tr>
<th>#</th>
<th>RESPONSES</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It is a collaborative effort, involving people from so many parts of the university. It has to be supportive environment to be successful.</td>
<td>3/22/2019 12:17 PM</td>
</tr>
<tr>
<td>2</td>
<td>By ensuring the allocation of common spaces that can be shared by all students, faculty, and staff to decompress, relieve stress, and engage with each other socially throughout the day.</td>
<td>3/21/2019 7:22 AM</td>
</tr>
<tr>
<td>3</td>
<td>happy and successful community</td>
<td>3/20/2019 3:34 PM</td>
</tr>
<tr>
<td>4</td>
<td>1. Research in several areas are addressing quality of life issues.</td>
<td>3/19/2019 9:22 AM</td>
</tr>
<tr>
<td>5</td>
<td>Current health-related research and teaching facilities on campus are sub-par for an institution such as MTU. The new facility will improve the work environment for faculty, staff and students involved in human health research.</td>
<td>3/19/2019 8:26 AM</td>
</tr>
<tr>
<td>6</td>
<td>The complex will bring together and co-locate the KIP department that has no common location for graduate students and faculty to interact with one another. The physical proximity of graduate students and faculty allows a stronger sense of identity and community to develop and increases the likelihood of student-student and student-faculty interactions</td>
<td>3/18/2019 12:37 PM</td>
</tr>
</tbody>
</table>
### Q11 Infrastructure: Provide exceptional services and infrastructure.

**Answered:** 6  **Skipped:** 5

<table>
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<tr>
<th>#</th>
<th>RESPONSES</th>
<th>DATE</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>State-of-art research infrastructure would catalyze new research projects, including the ability to attract top talent form all over the country.</td>
<td>3/22/2019 12:17 PM</td>
</tr>
<tr>
<td>2</td>
<td>I have highlighted numerous examples above, including common spaces, inviting lobby space, dedicated teaching and research lab space, accessible parking for community partners, state-of-the-art classrooms and a lecture hall, etc.</td>
<td>3/21/2019 7:22 AM</td>
</tr>
<tr>
<td>3</td>
<td>H-STEM will play a significant role in this goal</td>
<td>3/20/2019 3:34 PM</td>
</tr>
<tr>
<td>4</td>
<td>1. This health-oriented infrastructure is overdue. We have reached our capacity to grow, and need state-of-the-art facilities (particularly research facilities).</td>
<td>3/19/2019 9:22 AM</td>
</tr>
<tr>
<td>5</td>
<td>Current infrastructure for human health research at MTU is in very poor shape. It consists of space that was designed for distinctly different purposes, which leads to infrastructure challenges that are hard to overcome. The new facility, particularly when the animal care facility is included in it's design will help to overcome the distractions and challenges associated with the current extremely poor infrastructure.</td>
<td>3/19/2019 8:26 AM</td>
</tr>
<tr>
<td>6</td>
<td>There is a desperate need for research space designed for health research that has appropriate air handling, environmental control, vibration control, etc. for completing human health research.</td>
<td>3/18/2019 12:37 PM</td>
</tr>
</tbody>
</table>
Q12 5. Are there additional ideas or concepts that you envision for this project?

Answered: 5    Skipped: 6

<table>
<thead>
<tr>
<th>#</th>
<th>RESPONSES</th>
<th>DATE</th>
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<tbody>
<tr>
<td>1</td>
<td>None specifically</td>
<td>3/22/2019 12:39 PM</td>
</tr>
<tr>
<td>2</td>
<td>STEM involves more than just Engineering and Health which seems to have been highlighted</td>
<td>3/20/2019 3:39 PM</td>
</tr>
<tr>
<td>3</td>
<td>No, I think if anything this needs to be scaled down. For example, name a faculty in ECE that is really engaged in health? We can build a collaborative environment, but need to scope with areas that have track-record.</td>
<td>3/19/2019 9:27 AM</td>
</tr>
<tr>
<td>4</td>
<td>The animal care facility (ACF) must be located in this new structure as well. This is much more than a convenience issue. As health-related research grows on campus, the need for animal studies will grow as well. We can not be transporting these animals across campus to the new labs. Not co-locating the ACF will serve as just another barrier to effective and efficient research in health at MTU.</td>
<td>3/19/2019 8:35 AM</td>
</tr>
<tr>
<td>5</td>
<td>space where graduate students from different departments and labs co-mingle</td>
<td>3/18/2019 12:54 PM</td>
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</tbody>
</table>
**Q13 6. How do you see your department or research program contributing resources (talent, funding, space) to support this project?**

**Answered:** 6  **Skipped:** 5

<table>
<thead>
<tr>
<th>#</th>
<th>RESPONSES</th>
<th>DATE</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>The Department of Chemical Engineering would be a critical player in this initiative by leveraging human resources (faculty, graduate and undergraduate students).</td>
<td>3/22/2019 12:39 PM</td>
</tr>
<tr>
<td>2</td>
<td>One of my departments (KIP) is a critical contributor to this project. As one of the primary human health-related departments on campus, and one of the top departments for NIH funding, we are in a unique position to contribute research talent from our students and faculty. Our success rate for securing external funding also means that we are well positioned to write grants that could allocate a portion of the budget for personnel that could be shared across the H-STEM complex (e.g., research grant support specialist, administrative support for centralized human subjects databases, community partnership liaison, etc.). KIP also has a strong record of developing hands-on learning environments for students using research equipment. Our goal is to develop dedicated teaching lab space to expand and improve the efficiency and effectiveness of this approach. My other department (CLS) could make substantial contributions related to health and technology because our graduate program and research focus on human factors. Technological advances related to health and the healthcare system are only useful insofar as they benefit humans. As such it is critical to consider the human part of the equation. Health human factors focuses on principles of human-centered that need to be considered when designing novel health technologies. CLS can provide that critical component of research on health technologies for the new H-STEM complex.</td>
<td>3/21/2019 10:26 AM</td>
</tr>
<tr>
<td>3</td>
<td>outstanding faculty, staff and students obtaining funding (new and existing)</td>
<td>3/20/2019 3:39 PM</td>
</tr>
<tr>
<td>4</td>
<td>N/A</td>
<td>3/19/2019 9:27 AM</td>
</tr>
<tr>
<td>5</td>
<td>Ideally, BME will move in it's entirety to the new facility. That is all faculty research labs and offices, graduate students, front office, and teaching space (in the renovated area) will relocate to the facility. The same for KIP. Both of these moves will free up currently occupied space that is better suited for non-health related research.</td>
<td>3/19/2019 8:35 AM</td>
</tr>
<tr>
<td>6</td>
<td>we will maintain high standards for admissions into our graduate programs, seek collaborative, interdisciplinary projects and allow appropriate shared use of equipment our department owns</td>
<td>3/18/2019 12:54 PM</td>
</tr>
</tbody>
</table>
Q14 7. How do you think the project will enhance your department or research program's ability to serve students and conduct research?

Answered: 6  Skipped: 5

<table>
<thead>
<tr>
<th>#</th>
<th>RESPONSES</th>
<th>DATE</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>This project will help attract and retain the faculty members engaged in research in this field. In addition, it will help recruit high caliber graduate students, post-doctoral fellows. These are the key elements needed to sustain and grow top notch research program.</td>
<td>3/22/2019 12:39 PM</td>
</tr>
<tr>
<td>2</td>
<td>Breaking down barriers and silos by bring multiple disciplines together in the H-STEM complex will foster interdisciplinary research and education providing new opportunities for faculty and students in both of my departments.</td>
<td>3/21/2019 10:26 AM</td>
</tr>
<tr>
<td>3</td>
<td>shared faculty labs and offices shared infrastructure space for collaborations</td>
<td>3/20/2019 3:39 PM</td>
</tr>
<tr>
<td>4</td>
<td>N/A</td>
<td>3/19/2019 9:27 AM</td>
</tr>
<tr>
<td>5</td>
<td>BMEs research and teaching laboratories are currently in-appropriate for the type of research we do. We can not provide new researchers with modern lab space. Graduate students are not educated in modern laboratory facilities. The new facility, if done properly, will help to alleviate some of these issues.</td>
<td>3/19/2019 8:35 AM</td>
</tr>
<tr>
<td>6</td>
<td>the co-location of our department and laboratory space designed for health research (air filtering, environmental controls, pure water, clean air/nitrogen systems, etc.) are transformative in the ability of our department's research productivity and the student experience on campus</td>
<td>3/18/2019 12:54 PM</td>
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</tbody>
</table>
Q15 8. What are three key issues or challenges that should be addressed prior to implementation?

Answered: 6  Skipped: 5

<table>
<thead>
<tr>
<th>ANSWER CHOICES</th>
<th>RESPONSES</th>
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<td>#3</td>
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<th>DATE</th>
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<tbody>
<tr>
<td>1</td>
<td>facilities should not be starved of cash for initial build out.</td>
<td>3/22/2019 12:39 PM</td>
</tr>
<tr>
<td>2</td>
<td>Dedicated separate research and teaching lab space.</td>
<td>3/21/2019 10:26 AM</td>
</tr>
<tr>
<td>3</td>
<td>space utilization</td>
<td>3/20/2019 3:39 PM</td>
</tr>
<tr>
<td>4</td>
<td>Scope of the new and renovated building, with priority to depts with proven track record</td>
<td>3/19/2019 9:27 AM</td>
</tr>
<tr>
<td>5</td>
<td>How to move KIP and BME in their entirety to the new complex</td>
<td>3/19/2019 8:35 AM</td>
</tr>
<tr>
<td>6</td>
<td>maintenance of shared equipment</td>
<td>3/18/2019 12:54 PM</td>
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<tr>
<td>#</td>
<td>#2</td>
<td>DATE</td>
</tr>
<tr>
<td>1</td>
<td>space feuds will naturally arise within the different units. A mechanism to prevent this is needed.</td>
<td>3/22/2019 12:39 PM</td>
</tr>
<tr>
<td>2</td>
<td>Facilitating the integration of the new H-STEM complex with local community partners.</td>
<td>3/21/2019 10:26 AM</td>
</tr>
<tr>
<td>3</td>
<td>infrastructure development</td>
<td>3/20/2019 3:39 PM</td>
</tr>
<tr>
<td>4</td>
<td>Who will control the space, and what will be the role of the new Health Research Institute?</td>
<td>3/19/2019 9:27 AM</td>
</tr>
<tr>
<td>5</td>
<td>How to incorporate the ACF into the plan</td>
<td>3/19/2019 8:35 AM</td>
</tr>
<tr>
<td>6</td>
<td>accounting for individual research projects (community gloves vs gloves purchased for this project)</td>
<td>3/18/2019 12:54 PM</td>
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<td>#3</td>
<td>DATE</td>
</tr>
<tr>
<td>1</td>
<td>keep a 10-year horizon focus in developing a strategic plan for adding faculty and staff.</td>
<td>3/22/2019 12:39 PM</td>
</tr>
<tr>
<td>2</td>
<td>Navigating optimal plans for shared laboratory spaces.</td>
<td>3/21/2019 10:26 AM</td>
</tr>
<tr>
<td>3</td>
<td>collaboration and innovation</td>
<td>3/20/2019 3:39 PM</td>
</tr>
<tr>
<td>4</td>
<td>What are funding level expectations for space (and scaling if new resources become available)? This won't work if we can't have some flexibility to respond to needs and funding.</td>
<td>3/19/2019 9:27 AM</td>
</tr>
<tr>
<td>5</td>
<td>Where do we draw the (albeit, fuzzy) line as to what goes into this new building and what does not.</td>
<td>3/19/2019 8:35 AM</td>
</tr>
<tr>
<td>6</td>
<td>maintenance of purity of samples/equipment (means to keep chemicals pure, spatulas and pipettes pure, etc.)</td>
<td>3/18/2019 12:54 PM</td>
</tr>
</tbody>
</table>
Q16 9. On a scale of 1-5, where 5 is most likely and 1 is least likely, how likely is your department or unit to collaborate with the following other departments (Answer NA for your unit; if you do not represent an academic department, still indicate your expectations)

<table>
<thead>
<tr>
<th>Department</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>N/A</th>
<th>TOTAL</th>
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<tr>
<td>a. Biology</td>
<td>0.00%</td>
<td>0.00%</td>
<td>16.67%</td>
<td>50.00%</td>
<td>16.67%</td>
<td>16.67%</td>
<td>6</td>
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</tr>
<tr>
<td>b. Biomedical Engineering</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>33.33%</td>
<td>50.00%</td>
<td>16.67%</td>
<td>6</td>
<td>4.60</td>
</tr>
<tr>
<td>c. Chemistry</td>
<td>0.00%</td>
<td>33.33%</td>
<td>33.33%</td>
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<td>0.00%</td>
<td>0</td>
<td>6</td>
<td>3.33</td>
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<tr>
<td>d. Chemical Engineering</td>
<td>16.67%</td>
<td>16.67%</td>
<td>0.00%</td>
<td>33.33%</td>
<td>16.67%</td>
<td>16.67%</td>
<td>6</td>
<td>3.20</td>
</tr>
<tr>
<td>e. Cognitive and Learning Sciences</td>
<td>0.00%</td>
<td>16.67%</td>
<td>16.67%</td>
<td>33.33%</td>
<td>16.67%</td>
<td>16.67%</td>
<td>6</td>
<td>3.60</td>
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<tr>
<td>f. Computer Science</td>
<td>16.67%</td>
<td>33.33%</td>
<td>0.00%</td>
<td>50.00%</td>
<td>0.00%</td>
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### Appendix

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<th>Count</th>
<th>Average</th>
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</thead>
<tbody>
<tr>
<td>g. Electrical and Computer Engineering</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>0</td>
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<td>0</td>
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<td>2.17</td>
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<tr>
<td>h. Kinesiology and Integrative Physiology</td>
<td>0.00%</td>
<td>0.00%</td>
<td>14.29%</td>
<td>0.00%</td>
<td>42.86%</td>
<td>42.86%</td>
<td>7</td>
<td>4.50</td>
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<tr>
<td>i. Material Science and Engineering</td>
<td>0.00%</td>
<td>16.67%</td>
<td>33.33%</td>
<td>16.67%</td>
<td>33.33%</td>
<td>0.00%</td>
<td>6</td>
<td>3.67</td>
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<tr>
<td>j. Mechanical Engineering-Engineering Mechanics</td>
<td>0.00%</td>
<td>16.67%</td>
<td>33.33%</td>
<td>33.33%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>6</td>
<td>3.50</td>
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1. INTRODUCTIONS
PROJECT TEAM: PAULIEN & ASSOCIATES

ABOUT PAULIEN

- Understanding of the academy from the inside
- Breadth & depth of higher education experience
- Expertise in data management and visualization
- Space Needs Assessments and Analytics
- Benchmarking
- Capital Planning
- Process and Policy Recommendations

700 Campuses
49 States
10+ State Systems
38 Years in Higher Education Planning

PROJECT TEAM: PAULIEN & ASSOCIATES

MEET OUR TEAM

Paul A. Leef
Project Manager

Steve Schonberger
Space Needs Specialist

Frank A. Markley
Strategic Planning & Visioning Specialist

Chris Vanneste
Laboratory Planner

LEED Platinum / R&D Magazine’s 2014 Lab of the Year
National Renewable Energy Laboratory Energy Systems Integration Facility
PROJECT TEAM: SMITHGROUP
INTEGRATED, MULTIDISCIPLINARY, RECOGNIZED.

SmithGroup has been honored with 7 Lab of the Year recognitions from R&D Magazine

LEED Platinum / R&D Magazine's 2014 Lab of the Year
National Renewable Energy Laboratory Energy Systems Integration Facility

PROJECT TEAM: SMITHGROUP
YOU'RE IN GOOD COMPANY

SmithGroup has worked with 9 of the 30 Best Engineering Schools in the Country

Colorado School of Mines, Brown Hall Renovation/Addition | Duke University, Pratt School of Engineering, Home Depot Smart Home | Michigan State University, Biophysical Sciences Building | Michigan Technological University, Dow Environmental Sciences and Engineering Building | National Renewable Energy Laboratory, Energy Systems Integration Facility, Science and Technology Facility | Northern Arizona University, College of Engineering and Natural Sciences | North Carolina State University, Engineering IV | Oakland University, Engineering Center | The Ohio State University, Koffolt-Fontana Feasibility Study, Advanced Materials Corridor | Oregon State University, Kelley School of Engineering Sciences | South Dakota School of Mines and Technology, Chemistry and Chemical Engineering | Temple University, College of Engineering Expansion | University of Arizona, Engineering Innovation Building | University of California, Berkeley, Energy Biosciences Building, Sutardja Dai Hall | University of California, Merced, Science and Engineering II | University of Georgia, Driftmier Engineering Center | University of Illinois at Urbana Champaign, Electrical and Computer Engineering Building | University of Maryland, Joong H. Kim Engineering Building | University of Michigan, Bagnoud Aerospace Engineering, Lurie Nanofabrication Facility | University of Texas at Dallas, Engineering and Computer Science Complex, Mechanical Engineering Building | Virginia Tech, Institute for Critical Technology and Applied Science II
1. TRENDS IN EDUCATION & RESEARCH

EDUCATION NOW

- boundary-busting
  - interdisciplinary
  - nano-bio-geo-chem-eomics

- highly collaborative
  - instructional – research
  - technology transfer – business partners

- flexible / adaptable
  - modular
  - accessible pathways

- sustainable / energy efficient
  - pleasant work environment
  - net zero energy

- showcase
  - transparent / celebratory
  - learning tool
TRENDS IN EDUCATION

Provide hands-on experimental learning
Provide a broad education:
• Develop communication and problem-solving skills
• Stimulate creativity and develop critical thinking skills
Integrate technology into the curricula
Provide appropriate experiential (evidence-based) environments
Promote team work, interaction and collaboration
Celebratory / Showcase
Attract and retain students, faculty and staff

THEMATICALLY ORGANIZED – FLEXIBLE SPACES

University of Illinois, ECE Building

Pod A - Electronic Circuits
Pod B - Optical Imaging
Pod C - Signal Processing and Power
Pod D - Communications
Pod E - Robotics and Controls

Pod F - Senior Design
Pod G - Intro Lab (ECE 110)
Pod H - Digital Projects
Pod I - Integrated Circuits (Clean Room)
Pod J - Computer Systems

Space Assignment on Modular Basis

OFFICE
COMPUTATIONAL / SEMINAR / CLASSROOMS
COLLABORATION
LABS

Convert-ability from dry to wet space
RESEARCH – MTU R&D EXPENDITURES

2017 R&D EXPENDITURES

National science Foundation center for Science and Engineering States Higher Ed R & D Funding

NIH FUNDING TRENDS

NIH FY 2017 BUDGET SUMMARY
CLASSROOM TRENDS

ACTIVE LEARNING
- Present aka Didactic or Lecture
- Collaborative
- Active Learning
- Cafe

DISTANCE LEARNING / TELECONFERENCING

COLLABORATIVE STUDY OUTSIDE THE CLASSROOM

MULTIPLE CLASSROOM PEDAGOGIES

TRENDS
EXPERIENTIAL LEARNING

TEAMING
- Problem-Based
- Write-Up
- Experiment Design

WET
SCIENCE / ENG LABS

SUPPORT LAB
- Prep
- Equipment
- Storage

ACTIVE LAB
- Team-based
- Mobile Technology

RESEARCH
- Student
- Faculty
- Demonstration Lab “Stations”
TRENDS
EXPERIENTIAL LEARNING

SUPPORT LAB 1
- Prep Equipment
- Storage

ACTIVE LAB
- Team-based
- Mobile Technology

SUPPORT LAB 2
- Dedicated Equipment

TINY TEAMING
- Write-Up
- Experiment Design

DRY-ISH
GENERAL SCIENCES / ENG

BIG WINDOW
ON SCIENCE

INTERPROFESSIONAL EXPERIENCES
LEARNING TOGETHER IN TEAMS
PROFESSIONAL IDENTITY AND LEADERSHIP
STUDENT ORGANIZATIONS, ADVISING, OUTREACH

TECHNOLOGY
CHANGING THE WAY STUDENTS LEARN...AND THE WAY THEY WILL ENGAGE WITH PATIENTS
EXTERNAL PARTNERSHIPS
CAMPUS, COMMUNITY AND REGIONAL ENGAGEMENT AND RESEARCH OPPORTUNITIES

COLLABORATIVE WORKPLACE
CHANGING FACULTY DEMOGRAPHICS DRIVING FLEXIBLE WORKPLACE ENVIRONMENTS
ENGINEERING IS NOT JUST FOR ENGINEERING STUDENTS

ENGINEERING EDUCATION IS ABOUT EXPERIENTIAL, HANDS-ON LEARNING
AND COLLABORATIVE TEAMWORK

CREATING A SENSE OF WONDER, ATTRACTING STUDENTS TO ENGINEERING
FLEXIBLE, CROSS-FUNCTIONAL, UNBREAKABLE LABS

STUDENT–FACULTY INTERACTION AND...SHOWING OFF!
IT IS ABOUT PERSONAL INQUIRY

PERSONAL SPACE
SPACE FOR COOL STUFF

2. BENCHMARKING + METRICS
### PROGRAM MIX
Typical Range for Program Categories for Building Type

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**Collab Space**
- Social Hub

**Clinic**
- Interprofessional

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### INTERACTIVE LECTURE
BY THE NUMBERS

**INTERACTIVE LECTURE HALL**
- **18–22 Assignable Square Feet**
- **150–200 Seats**
- **24–32 Weekly Room Hours**

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**Michigan Technological University**
FLEXIBLE FLAT FLOOR

Flexible Space for Teaching, Community Outreach

- assignable square feet: 25-30
- seats: 100-120
- weekly room hours: 24-32

SMALL GROUP ACTIVE LEARNING

Small Group Active Learning

- assignable square feet: 25-30
- seats: 40-60
- weekly room hours: 24-32
GROUP STUDY / PBL

GRADUATE PROGRAMS

SMALL GROUP COLLABORATION
AND PROJECT WORK

30–50
Assignable
Square Feet

6–10
Seats

24–32
Weekly
Room Hours

UNDERGRADUATE CLASS LABS & RESEARCH LABS

EARLY EXPOSURE TO BASIC TECHNICAL AND COMMUNICATION SKILL DEVELOPMENT

CLASS AND RESEARCH LABS

35–75
Assignable
Square Feet
Per person
600-1200
sqft per lab

16–24
4–10
Seats

24–32
Weekly
Room Hours
CASE STUDIES

1. OAKLAND U HUMAN HEALTH BUILDING
2. UNIVERSITY OF MICHIGAN BIOLOGICAL SCIENCE BUILDING
3. UNIVERSITY OF PENNSYLVANIA NEURAL & BEHAVIORAL SCIENCE
4. VIRGINIA TECH INS FOR CRITICAL TECH & APPLIED SCIENCE II
5. OAKLAND UNIVERSITY ENGINEERING CENTER
6. UNIVERSITY OF MICHIGAN DEARBORN ENGINEERING LAB BLDG.
7. CU BOULDER, SYSTEMS BIOTECHNOLOGY BUILDING
8. UNIVERSITY OF MISSOURI, COLUMBIA BOND LIFE SCIENCES BLDG.
Appendix

FLEXIBILITY

COMFORT
1. OAKLAND U HUMAN HEALTH BUILDING
2. UNIVERSITY OF MICHIGAN BIOLOGICAL SCIENCE BUILDING
3. UNIVERSITY OF PENNSYLVANIA NEURAL & BEHAVIORAL SCIENCE
4. VIRGINIA TECH INS FOR CRITICAL TECH & APPLIED SCIENCE II
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THE UNIVERSITY OF MICHIGAN
BIOLOGICAL SCIENCE BUILDING

The new Biological Science Building (BSB) represents the culmination of the College of Literature, Science and Arts’ (LSA) long-term vision and initiative to consolidate the Biological Sciences in one area of campus. The 300,000 gsf building, houses classrooms, a 200-seat Active-Learning Hall, and research space for the departments of Molecular, Cellular, and Developmental Biology (MCDB) and Ecology and Evolutionary Biology (EEB). Included in the program is a new home for the re-envisioned University of Michigan Museum of Natural History, which will serve as a resource to the University community and region.

SPACE ALLOCATION:
LAB + LAB SUPPORT
1,100 NASF / PI (MCDB)
900 NASF / PI (EEB)
LINEAR EQUIPMENT ROOM (LER)
40 – 50 NASF / PI
CORES
Imaging, Molecular, Vivarium
UNIVERSITY OF PENNSYLVANIA
STEPHEN A. LEVIN NEURAL AND BEHAVIORAL SCIENCES LABORATORY

BIOLOGY

To investigate the biological basis of behavior, the University of Pennsylvania assembled psychology, biology and behavioral sciences programs in an interdisciplinary facility. Connected to adjacent building below grade, the Levin Neural and Behavioral Sciences Lab is both an icon and crossroads in this area of campus.

The research labs are a mix of dry computational, behavioral, and wet bench.

SPACE ALLOCATION:

LAB + LAB SUPPORT
1,200 NASF / PI (Behavioral)
900 NASF / PI (Wet Bench)
600 NASF / PI (Computational)

CORES
In adjacent buildings—vivarium
1. OAKLAND U HUMAN HEALTH BUILDING
2. UNIVERSITY OF MICHIGAN BIOLOGICAL SCIENCE BUILDING
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VIRGINIA TECH INS FOR CRITICAL TECH & APPLIED SCIENCE II

CHEMISTRY
SmithGroup provided precinct planning for more than 600,000 gsf of interdisciplinary research at VT. The plan established preliminary building footprints and massing, relocated parking and proposed onsite, storm water management and a new all-campus path dubbed "Research Walk."

As the first building in the precinct, ICTAS II provides an interdisciplinary setting for Virginia Tech’s Institute for Critical Technology and Applied Science. Supporting science at the intersection of engineering and biology this new 42,000 gsf facility provides advanced laboratories for cross-disciplinary investigation, dedicated collaboration areas, and touchdown faculty offices.

SPACE ALLOCATION:
LAB + LAB SUPPORT
640 NASF / PI (Nano / Bio)
750 NASF / P (Sensors / Engin.)
960 NASF / P (Chem / Physical)
Cores
Analytical Equipment, Tissue Culture
1. OAKLAND U HUMAN HEALTH BUILDING
2. UNIVERSITY OF MICHIGAN BIOLOGICAL SCIENCE BUILDING
3. UNIVERSITY OF PENNSYLVANIA NEURAL & BEHAVIORAL SCIENCE
4. VIRGINIA TECH INS FOR CRITICAL TECH & APPLIED SCIENCE II
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OAKLAND UNIVERSITY ENGINEERING CENTER

Instructional and Research Facility for Four Departments and Two Focus Areas.

- Mechanical Engineering
- Computer Science and Engineering
- Industrial and Systems Engineering
- Biomedical Engineering (new focus area)
- Power and Energy Systems (new focus area)

Support Research Centers

- Fastening and Joining Research Institute (FAJRI)
- Clean Energy Research Center
- Automotive Tribology Center
- Stephen and Rita SHARF Robotics Lab
- Center for Robotics and Advanced Automation

First Floor Plan  Second Floor Plan  Third - Fifth Floor Plan
1. OAKLAND U HUMAN HEALTH BUILDING
2. UNIVERSITY OF MICHIGAN BIOLOGICAL SCIENCE BUILDING
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Systems Biotechnology Building, CU Boulder

- 330,00 GSF (grew to 400,000 GSF)
- General Fund Building—No ICR Support
  - Supplementary revenue
- Occupants:
  - Dept of Biochemistry
  - Dept of Chemical Engineering
  - BioFrontiers Institute
  - Private Industry Partners
- Administrative Responsibilities
  - Security, Keys, Parking, Loading Dock
  - Facilities Liaison, DI Water Contract
  - Scheduling Events, CR, TL, Conf Rms
  - IT and Classroom AV
  - Landlord to Private Industry Leasees

Systems Biotechnology Building, CU Boulder

- Designed for “Productive Collisions”
  - Thematic Neighborhoods
- Space decisions made by Exec Comm:
  - Chair, Dept of Biochemistry
  - Chair, Dept of Chemical Engineering
  - Director, BioFrontiers Institute
- Core Facilities are fee for service
  - Tissue Culture (Biochem)
  - MRI, NMR (Biochem)
  - Mass Spectrometry (Biochem)
  - X-Ray Diffraction (Biochem)

For more information:
Lee Silbert,
Lee.Silbert@Colorado.EDU
1. OAKLAND U HUMAN HEALTH BUILDING
2. UNIVERSITY OF MICHIGAN BIOLOGICAL SCIENCE BUILDING
3. UNIVERSITY OF PENNSYLVANIA NEURAL & BEHAVIORAL SCIENCE
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Bond Life Sciences Building, University of Missouri Columbia

ADMINISTRATIVE STRUCTURE

- 230,000 GSF Building
- Funding: ICR/F&A Capture
- Director, appointed by VCR
  - Facilities
  - Event Scheduling
  - IT
  - Fiscal
  - Grant Admin
  - General Admin
MOU -- PI EXPECTATIONS

- To develop and maintain a vigorous and externally research program
- To cultivate collaborative interactions with other investigators both within and beyond the LSC
- Provide and annual report
- Participate in governance and meetings
- Participate in evaluating the director
Bond Life Sciences Building, University of Missouri Columbia

ADMINISTRATIVE STRUCTURE

• Faculty Committees:
  • Policy
  • Personnel
  • Facilities/Lab Operations Group
  • Space and Equipment

• Space

• Equipment

• For more information:

  Karla Carter, Exec Assistant to the director
  Email: carterka@missouri.edu

3. VISIONING
H-STEM Strategic Themes, Visioning, Goal Setting

1. Strategic Visioning Themes from Survey
2. Visioning Exercise
3. Draft Vision
4. Tomorrow – Goal Setting

MTU VISION STATEMENT DRIVERS FOR H-STEM

Vision

Michigan Tech is a (globally recognized) technological university that (educates students), (advances knowledge), and (innovates) to (improve the quality of life) and to promote mutual respect and equity for all people within the state, the nation, and the (global community).
STRATEGIC THEMES FROM SURVEY

**Experience**
- Teaching Excellence, Academic Quality, Culture, New Pedagogies, New Ways of Thinking, Learning and Doing, Remove Physical and Practical Barriers, Schools/Colleges Visibly Working Together

**Collaboration**
- Fostering Interactions, Break-down Silos, Shared Spaces, Combined Research and Education, Cross-disciplinary Discussions, Faculty and Student Interactions

**Impact**
- Medical Advancements, Improve Human Health and Wellbeing, Results Disseminated all over the World, Reputation, Partnerships

**Innovation**
- Interdisciplinary Research, New Approaches, Recognition, Entrepreneurialism, Advancement of Knowledge

**Operations**
- State-of-the-Art Facility, Centralization, Process Improvement, Central Hub Spaces, New Technologies, Infrastructure Alignment, Space Accessibility

VISIONING EXERCISE

This activity will help us reach consensus about H-Stems ideal future. By envisioning the ideal or best-case scenario, a vision statement can be developed.

**Step One:** Review the strategic visioning themes.

**Step Two:** Image five to seven years from now.
1) What is the best-case scenario regarding interactions and/or relationships between stakeholders? - What are the outcomes?
2) Which strategic themes are most critical to building the desired future?

**Step Three:** Report outcomes. We will begin to develop a collective vision about the ideal future. It is this ideal vision that will guide our thinking when we set goals and priorities.
STRATEGIC THEMES FROM SURVEY

- **Experience**
  - Teaching Excellence, Academic Quality, Culture, New Pedagogies, New Ways of Thinking, Learning and Doing, Remove Physical and Practical Barriers, Schools/Colleges Visibly Working Together

- **Collaboration**
  - Fostering Interactions, Break-down Silos, Shared Spaces, Combined Research and Education, Cross-disciplinary Discussions, Faculty and Student Interactions

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- **Operations**
  - State-of-the-Art Facility, Centralization, Process Improvement, Central Hub Spaces, New Technologies, Infrastructure Alignment, Space Accessibility

SAMPLE VISION STATEMENT (USING VISIONING THEMES)

To create a state-of-the-art-facility with centralized operations that will foster internal and external collaborations as a means to increase intellectual output, enhance the student experience, and provide an innovative research environment that creates a shared sense of identity that impacts human health and wellbeing locally and globally.
GOAL SETTING

The next step is to translate the H-Stem project vision into clear achievable goals.

Not every business or university treats goals the same way. In order for us to work together and create H-STEM goals, everybody needs to know where the goal line is. In other words, when you set goals, are you setting goals that are:

1. **Moonshots** (aka, almost impossible to hit)
2. **Challenging** (You’ll hit them 70% of the time)
3. **Focused Effort** (80-95% chance you’ll hit them)
4. **Walk in the Park** (you’ll hit them with ease)

It might not seem important to know this right now, but goals need to be realistic.

---

GOAL SETTING

Each goal needs to support the H-STEM Vision

Know what type of goal you’re setting (Moonshots to Walks in the Park)

First popularized by Intel CEO Andy Grove, this approach has been used by major tech companies like Google, Amazon, Adobe, Dropbox, Slack, and other to align their vision higher-level company goals.

In Grove’s famous manual *High Output Management*, he introduces goal setting by asking 3 questions:

1. **Where do we want to go?** *(What end we want to reach based on identified needs)*
2. **What Challenges do we need to overcome?**
3. **How will I know when we are getting there?** *(what does success looks like)*
GOAL SETTING

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1. Where do we want to go? (What end do we want to reach based on identified needs)
2. What Challenges do we need to overcome?
3. How will I know when we are getting there? (what does success look like)

Before engaging in our goal setting exercise, let’s review how survey participants noted the H-STEM project contributing towards each of the following goals.
Student Learning: Integrate instruction, research, and innovation to achieve the student learning goals for undergraduate and graduate programs

- It will provide hands-on learning and interaction space for students and faculty to work together in research and development - learning by doing and solving real problems in a guided, mentored environment
- The H-STEM complex will provide a centrally located, very research active environment for students to become engaged in basic and applied research related to human health challenges
- State-of-the-art teaching laboratories for key undergraduate courses (particularly in KIP and BME, which are currently poorly met)
- Collaborative and flexible spaces for researchers to interact with students and other researchers.
- The research performed in H-STEM building will help student learning, knowledge creation and promote innovation.
- Bringing multiple health-related disciplines together under one roof, and breaking down traditional silos, will facilitate the creating of a more multidisciplinary curricula that can be offered more broadly across undergraduate and graduate programs.
- Solving complex societal problems requires an inter-disciplinary effort to develop, translate, and implement solutions. Both undergraduate and graduate education needs to recognize the role of each individual component within a larger context.

Transformative Education: Provide a technologically-rich education grounded in a residential and experiential learning environment

- Provide the framework for shared resources and approaches in a psychical location to bring together cutting-edge research and multiple perspectives to add energy to creative problem solving
- Both BME and KIP actively encourage undergraduate students to become aggressively engaged in high-tech health care research. This complex will expand those opportunities.
- Discovery-based teaching laboratories
- Spaces and infrastructure for more undergraduate and graduate research opportunities.
- state-of the art labs for research performed by world-class faculty and staff in collaboration with students
- By ensuring that the H-STEM complex also includes dedicated research and teaching laboratories, we will also ensure that the students are provided with a top-notch, innovative, hands-on, and skills-based learning environment, while minimizing disruption to ongoing research activities.
- MTU is known for hand-on learning approach in its education model, which is further augmented by internships/co-op program as well as building partnerships with the government (both local and national) and industry. This would prepare the students best to treat societal need as the main driver for education and innovation.
Educational Programs: Expand programs in response to social and economic needs and challenges

- Create interdepartmental educational programs to tailor to student needs and interests
- This complex will help to foster inter- and trans-disciplinary research which is critical to solving challenging issues in human health.
- It will provide a rich educational environment allowing students to actively participate in this research and more easily cross traditional departmental boundaries.
- Strengthen existing degrees and programs that are deeply engaged and committed to health, particularly BME, KIP, and Biological Sciences pre-health.
- Create an intersect with these three major programs and some of the others that are more peripherally focused on health.
- topics like preserving and improving human health, global climate change, and feeding world's hungry population, and bioenergy could be studied
- By ensuring the accessibility of the H-STEM complex to community partners, we will be positioned to appreciate local social and economic needs/challenges that will complement our understanding of national and international social and economic challenges through our research endeavors.
- The well-being of the society requires a systems-based understanding of the entire complex field. With so many moving parts, changing one parameter impacts other parts in ways that are not well understood. Many more people will become aware of the need to train in systems-wide thinking.

Scholarly Activity: Grow research, scholarship, and creativity

- Provide the pooling of resources to positively build the health research community on campus
- By co-locating the primary departments involved in health research along with other researchers who are engaged in health-related research, the complex will promote interdisciplinary research activity, which is the most fertile ground for solving human health challenges. It will promote the authoring of larger grant proposals consisting on multi-disciplinary teams.
- State-of-the-art facilities to attract more (and larger) NIH grants.
- Upgraded facilities will lead to better scholarship and publications.
- more research by more students and faculty more publications and more research funding more information, knowledge and wisdom
- Primarily by bridging existing gaps between disciplines across multiple colleges. The H-STEM complex has the real potential, if planned appropriately, to launch novel and innovative collaborative research projects by bring together students and faculty from those separate disciplines. With buy in from the upper administration, and incentive structures put in place, the H-STEM complex would facilitate the development of novel, large-scale research programs and funding applications.
- Both graduate and undergraduate research activities will flourish in the H-STEM complex since that is one of the main themes for this initiative.
Economic and Social Development: Promote innovation and development for economic and social progress.

- The intellectual environment focused on human health helps MTU faculty and students, the local health care community and the people in the Copper Country by educating citizens and students and adding energy to the entire community of health care providers and patients.
- Human health research demands a multi-disciplinary approach. The translation of medical technology (i.e., 'bench-to-bedside' research) must involve basic scientists and engineers with a focus on human health. Co-locating these scientists and engineers can promote invention and innovation in a manner that just does not happen currently.
- Opportunities exist for technological innovations in health, and are happening in BME, Chem, and Chem Eng.
- Opportunity to expand to other departments.
- more patents and publications more faculty and students
- more high paying jobs and economic stability
- Innovative and forward-thinking design of the H-STEM space, with an eye to well-being and quality of life of students, staff, and faculty, and to opportunities for entrepreneurship, we would be positioned to make significant contributions to the local, state, and national economy, and to lead health-related community outreach that would foster social progress.
- The facility would likely act as an incubator for venture capital firms, in addition to generating human resources. Both will contribute towards the economic growth.

Community: Cultivate an exceptional academic and professional community

- Creating a physical location to be the focus of health research in the region brings together students, faculty and staff to facilitate the growth and development of the health research community that supports excellence in education and excellence in research.
- Co-locating KIP and BME along with appropriate other faculty will lead to an increase in sharing ideas and research concepts that is not cultivated currently on campus due to the dispersed locations of health-related faculty. This will lead to a richer and more diverse academic and professional community.
- With nearly 1 in 5 faculty somehow connected to health research or education, there is an opportunity for this building to serve as a community hub for health research and education (even for those that are not main occupants).
- Those who come here would contribute to build a better world for us and the future generations!
- Again, by dissolving barriers between existing disciplines to encourage interdisciplinary initiatives. This would surely need to include the design of a reasonably large lecture hall that could be used to bring in world leaders in health-related fields to give plenary talks to all stake-holders in the H-STEM complex.
- H-STEM facility would certainly create a critical mass of academics and professionals, by the very essence of it being an interdisciplinary field.
Quality of Life: Ensure a supportive environment for all members of the University community.

- The complex will bring together and co-locate the KIP department that has no common location for graduate students and faculty to interact with one another. The physical proximity of graduate students and faculty allows a stronger sense of identity and community to develop and increases the likelihood of student-student and student-faculty interactions.
- Current health-related research and teaching facilities on campus are sub-par for an institution such as MTU. The new facility will improve the work environment for faculty, staff and students involved in human health research.
- Research in several areas are addressing quality of life issues.
- Happy and successful community
- By ensuring the allocation of common spaces that can be shared by all students, faculty, and staff to decompress, relieve stress, and engage with each other socially throughout the day.
- It is a collaborative effort, involving people from so many parts of the university. It has to be supportive environment to be successful.

Infrastructure: Provide exceptional services and infrastructure

- There is a desperate need for research space designed for health research that has appropriate air handling, environmental control, vibration control, etc. for completing human health research.
- Current infrastructure for human health research at MTU is in very poor shape. It consists of space that was designed for distinctly different purposes, which leads to infrastructure challenges that are hard to overcome. The new facility, particularly when the animal care facility is included in its design will help to overcome the distractions and challenges associated with the current extremely poor infrastructure.
- This health-oriented infrastructure is overdue. We have reached our capacity to grow and need state-of-the-art facilities (particularly research facilities).
- H-STEM will play a significant role in this goal
- I have highlighted numerous examples above, including common spaces, inviting lobby space, dedicated teaching and research lab space, accessible parking for community partners, state-of-the-art classrooms and a lecture hall, etc.
- State-of-art research infrastructure would catalyze new research projects, including the ability to attract top talent form all over the country.
NEEDS IDENTIFICATION

In two groups, using the survey responses, the trends presented at this workshop and your knowledge of the H-STEM project, record on flip chart paper identified needs. Try to reach consensus in your group on these needs.

EXAMPLE

Student Learning: Integrate instruction, research, and innovation to achieve the student learning goals for undergraduate and graduate programs

- It will provide hands-on learning and interaction space for students and faculty to work together in research and development - learning by doing and solving real problems in a guided, mentored environment
- The H-STEM complex will provide a centrally located, very research active environment for students to become engaged in basic and applied research related to human health challenges

KEY CHALLENGES – SURVEY RESPONSES

Survey responses – Are there other challenges that need to be addressed and noted?

What are three key issues or challenges that should be addressed prior to implementation?
- Maintenance of shared equipment
- Accounting for individual research projects (community gloves vs gloves purchased for this project)
- Maintenance of purity of samples/equipment (means to keep chemicals pure, spatulas and pipettes pure, etc.)
- How to move KIP and BME in their entirety to the new complex
- How to incorporate the ACF into the plan
- Where do we draw the (albeit, fuzzy) line as to what goes into this new building and what does not.
- Scope of the new and renovated building, with priority to depts with proven track record
- Who will control the space, and what will be the role of the new Health Research Institute?
- What are funding level expectations for space (and scaling if new resources become available)? This won’t work if we can’t have some flexibility to respond to needs and funding.
- Space utilization
- Infrastructure development
- Collaboration and innovation
- Dedicated separate research and teaching lab space.
- Facilitating the integration of the new H-STEM complex with local community partners.
- Navigating optimal plans for shared laboratory spaces.
- Facilities should not be starved of cash for initial build out.
- Space feuds will naturally arise within the different units. A mechanism to prevent this is needed.
- Keep a 10-year horizon focus in developing a strategic plan for adding faculty and staff.
WE KNOW WE’VE BEEN SUCCESSFUL WHEN...

Goal Factor 3: How will we know when we are getting there? (what does success looks like)

Possible Factors Include:

- Our student quality, retention, & completion improves
- We see growth in graduate programs
- Academic units are able to enhance learning & research outcomes
- Centralized shared core services provide overarching strategy, policy & operational frameworks
- Embedded administrative units engage in integrated strategy & dedicated solutions coordination across units
- Students graduate with a diverse range of knowledge & skills in H-STEM programs
- Students flow freely across themed spaces as needed for their research and studies
- Faculty readily share, learn, & adopt new interdisciplinary practices, with a focus on constant improvement
- Increase efficiency & utilization by aligning size, research activity & pedagogical needs
- Increase in study & collaborative space builds project based and research based learning
- University receives increased income from new revenue sources
- Brainstorm others factors for the H-STEM complex and record on flip chart pa

GOAL EXERCISE

In two small groups:

Using flip chart paper, write five to six H-STEM goals using the following taxonomy:

Review the H-STEM Vision
1. Where do we want to go? (What end do you want to reach based upon identified needs)
2. What Challenges do we need to overcome?
3. How will we know when we are getting there? (what does success looks like)

After 45-60 minutes, share your responses with the larger group. Look for similarities and difference among the two groups and try to reach consensus one combined set of goals.
GOAL EXAMPLE

To accommodate student learning and scholarly activity, the goal is to develop multi-modal space where learning and research takes place simultaneously. Interdisciplinary space provides resources to perform health and engineering research through implementation. Nodes of themed core equipment which can be easily accessed by all research teams and disciplines and are available for contract research. Faculty & students are supported to incubate and develop their ideas into reality and there is an increase in not just the productivity of research, but also the diversity of projects.

VISION STATEMENT

Create a showcase facility that has a positive impact on health-related research activity and the recruitment of faculty and students.

Put research on display. Support research-based discovery learning. Encourage interdisciplinarity through thematic rather than departmental grouping.

Reinforce the MTU culture of collaboration.

Focus new construction on state-of-the-art research & research support space.

Renovate existing space for office & instructional space.