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The Tennessee Entrepreneurial Science and Technology Hub (TEST Hub) (aka the Garage) serves as the hub of innovative partnerships for economic and workforce development in rural northwest Tennessee between public and private entities and the educational institutions in the area.

Spearheaded by the University of Tennessee at Martin, the Garage is a national model for the central role public universities play in the revitalization of rural America. The Garage’s combination of educational facilities, entrepreneurial centers, manufacturing workshops surrounding a shared industrial maker space means it simultaneously trains and provides opportunity to the companies and community innovators (including UT Martin, TCAT, and DSCC students as well as community and industrial partners) who will create the next-gen industries to drive economic development in rural NW Tennessee. The Garage offers our partners the opportunity and support to turn ideas into products, and products into commercial and industrial successes.

“SPEARHEADED BY THE UNIVERSITY OF TENNESSEE AT MARTIN, THE GARAGE IS A NATIONAL MODEL FOR THE CENTRAL ROLE PUBLIC UNIVERSITIES PLAY IN THE REVITALIZATION OF RURAL AMERICA.”
PROJECT OVERVIEW

For the past three months our design team comprised of el dorado, Allen & Hoshall, and Acoustical Design Kubicki, has engaged a broad group of stakeholders in a Programming process for the new UT Martin Tennessee Entrepreneurial Science and Technology Hub (TEST Hub or Garage). The project is a unique collaboration between affiliated departments on the UT Martin campus, progressive higher educational institutions in West Tennessee, and innovative local industry leaders.

The Garage will promote economic development in Northwest Tennessee and will be a shared resource for the region. It will be used by local industries, start-up businesses, UTM academic departments, and faculty at the Tennessee Colleges of Applied Technology (TCAT). The facility / campus will offer machine tools, equipment, and space needed for start-ups and established companies to fabricate prototypes; laboratories to support the Manufacturing Engineering concentration; a central hub for high-level mechatronics certification in Northwest Tennessee; office and workspace for the Northwest Tennessee Entrepreneur Center (NTEC) and the Regional Entrepreneurship & Economic Development (REED) Center; work space for student competition teams from the College of Engineering and Natural Sciences (CENS) and the College of Agriculture and Applied Sciences (CAAS); support for adult certificate/diploma programs offered by the Tennessee Colleges of Applied Technology (TCAT).

Used by students, faculty, entrepreneurs, and local industry, the Garage is an industrial makerspace where learning and making are intertwined efforts. The facility / campus will simulate the environment in which many companies start: a garage used for experimentation, the development of product prototypes, and exploration of new manufacturing processes.
el dorado and Allen & Hoshall would like to recognize the valuable contribution of those who provided guidance, input, and feedback throughout the programming process.
THE UNIVERSITY OF TENNESSEE (UT)
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TENNESSEE COLLEGE OF APPLIED TECHNOLOGY, MACKENZIE (TCAT)
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NORTHWEST TENNESSEE DEVELOPMENT DISTRICT
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Tyler Hayes, Area Specialist

PLASTICS PRODUCTS COMPANY
Brad Biddle, Plant Manager

TLM ASSOCIATES
Terry Drumwright, Owner

WILLIAMS SAUSAGE COMPANY
Roger Williams, Owner
PROJECT TIMELINE

SEP 2019: Funding approval
DEC 2019: Design team selected
FEB 2020: Permit obtained
MAR 2020: Construction commences
OCT 2019: RFQ for design services issued
JAN 2020: Bid and permit documents issued
SEP 2021: Project completion
CAMPUS INTEGRATION

CAMPUS INTEGRATION PRINCIPLES

Currently, UTM students utilize shop space within the Joseph E. Johnson Engineering Physical Science (EPS) Building. The continued use of this shop space would significantly limit the renovation of the building for the future use of the College of Agriculture and Applied Science, as well as prevent use by local industry, businesses, area colleges, and other departments on campus. The space is barely sufficient for the basic needs required by the current engineering student groups, and is not adequate for additional, aspirational uses.

Efforts are continually underway to correct deficiencies and provide building system improvements within EPS through the UT Martin capital maintenance program; however, new facilities and additions will be needed to meet the needs of students based on the results of an assessment performed in 2008. The new STEM Classroom Building is currently included in the 2015 UT Martin Campus Master Plan. That new building will replace most of the space currently in the EPS building. However, shop and fabrication areas have not been taken into account in the new STEM Classroom Building primarily due to space and funding restraints. The Garage would complete the replacement of the critical space now located in EPS so that building could undergo the much needed improvements and make way for the ever expanding Agriculture and Applied Sciences College. In addition, it has been determined the program outlined for the Garage would not be best suited in a standard classroom building located on the Quadrangle.

The Garage directly addresses all four of the primary principles outlined in the 2015 Campus Master Plan; see specifically pages 3, 4, 9, and 20.
1. Creating a Robust on-Campus Community of Students
2. Improving the Campus Visual Experience
3. Reinforcing “Town & Gown” Relationships
4. Branding and Communicating the UT Martin Experience

The 2015 Campus Master Plan can be found at https://www.utm.edu/_pdfs/2015-UTM%20MP%20Refinement-final2.pdf
B.
SITE ANALYSIS
B. SITE ANALYSIS

B.1 West Tennessee
B.2 Local Industry Leaders
B.2 Martin, Tennessee
B.3 UTM Campus
B.4 The IPRF Site
Tennessee is a manufacturing state, ranked 13th in the nation in total number of manufacturing jobs and 12th in the nation in number of manufacturing jobs per 1000 people. Tennessee, like most of the other southern states, has no Bachelor of Science program for manufacturing engineering. Tennessee manufacturing has shown a need for manufacturing engineering jobs with an increasing number of positions available each year. There are insufficient numbers of students graduating with manufacturing engineering degrees, and the manufacturing jobs require that candidates with mechanical, electrical or industrial engineering be retrained to meet the manufacturing job requirements. Tennessee is not producing enough engineers to fill the open positions and are not developing the right skill mix for the available positions. The Garage will provide much-needed laboratory space for the manufacturing engineering concentration. It will provide a community workspace to foster innovation and collaboration through cross-disciplinary opportunities between industry and the university.

Not only will this facility promote and develop manufacturing talent in West Tennessee, the Garage will provide an expanded presence for the stakeholders, and broaden the network for student recruiting beyond West Tennessee’s boundaries.
INSTITUTIONAL PARTNERS AND LOCAL INDUSTRY LEADERS

Students and staff from the University of Tennessee, Martin, Tennessee College of Applied Technology, and Dyersburg State will all have the opportunity to partner with local industry leaders. The proposed facility will provide equipment and space that will support the new Manufacturing Engineering concentration within the Bachelor of Science in Engineering curriculum. This new educational path places an emphasis on optimizing manufacturing processes and machinery. Industry leaders participating in various programs within the facility are available to offer expertise, critique, and support to the benefit of the students. At the same time, industry leaders have the opportunity to evaluate and recruit potential new employees among the student population.
INDUSTRY PARTNER LOCATIONS

WILLIAMS SAUSAGE, UNION CITY, TN

USDA RURAL DEVELOPMENT, UNION CITY, TN

DYERSBURG STATE, DYERSBURG, TN

NW TENNESSEE DEVELOPMENT DISTRICT, MARTIN, TN

TCAT, MACKENZIE, TN

PLASTICS PRODUCTS COMPANY, GREENFIELD, TN

TLM ASSOCIATES, JACKSON, TN
Located in the north of West Tennessee, Martin is the home to the University of Tennessee, Martin.

This map shows which highways will likely be used by specific stakeholders to approach the site. The facility location is approximately 15 miles from Dyersburg State; 25 miles from TCAT McKenzie; 55 miles from the city of Jackson; 125 miles from Memphis; 150 miles from Nashville.
UTM CAMPUS

UT Martin’s main campus is located on the western edge of Martin, Tennessee.

The site is walking distance from the main campus and on the periphery of campus utility infrastructure.
RELEVANT FACILITIES FOR ENGINEERING STUDENTS

- Joseph E. Johnson EPS Building
- Paul Meek Library
- Boling University Center
- IPRF Site
- Student Recreation Center
1/4 MILE RADIUS, 5-MINUTE WALK

1/2 MILE RADIUS, 10-MINUTE WALK

3/4 MILE RADIUS, 15-MINUTE WALK

1/2 MILE, 10-MINUTE WALK FROM JOHNSON EPS BUILDING

WALKING DISTANCE
THE TEST Hub SITE

The site is UT Martin owned property to the southwest of campus, and offers a good location of the Garage to meet the campus integration principles previously stated in this book.

Currently used as a cornfield, the site falls approximately 20 feet in elevation from the northeast to the southwest. Features include a public jogging path that runs around the perimeter of the site, easy access to Hannings Lane and utilities within that street, and the potential for overflow parking at the Rec Center to the east. It is anticipated that the area of the site to the northwest (off of Skyhawk Parkway) will not be necessary for this project and can be set aside for another use in the future. The detention basin located in the southeast corner of the site is also used for student social activities during the school year, and is not to be disturbed when implementing this project.
C.
BUILDING PROGRAMMING
C. BUILDING PROGRAMMING

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The Haley Barbour Center for Manufacturing Excellence (CME) is located on the University of Mississippi’s Oxford campus right on the historic University Circle.

CME was established in June 2008 to provide unique opportunities for students interested in manufacturing. The opportunities developed are considered distinctive to the CME and are not available to undergraduate students at other universities in the United States. The CME is developing interdisciplinary educational opportunities within an innovative academic learning model that provides our students with the practical experiences, fundamental knowledge, and creative skill sets needed to lead the world of modern manufacturing. The CME is working with companies who express a strong desire to become industry leaders and who wish to work with CME staff and students. Together, the CME and these business partners are striving to serve their employees, improve business conditions, and promote economic growth.

LOCATION: Oxford, MS
CLIENT: University of Mississippi
COMPLETION: 2008
SIZE: 47,000 square feet

WHY IT’S IMPORTANT: The mission of the CME is similar to that of the IPRF - especially as it pertains to partnerships with industry partners. The facility provides both practical experience to students while also exposing them to potential employers.
ARKANSAS REGIONAL INNOVATION HUB

The Arkansas Regional Innovation Hub is comprised of three primary program elements: Art Connection, Launch Pad, & Silver Mine which are housed in an existing 1900’s building. This building is a sustainable solution for the Argenta Innovation Center’s needs; by that, an adaptive reuse of an existing building with great history and character.

Art Connection is an after school and summer visual arts work program for NLR High School students. The space features a gallery, studios, and supports spaces for the young becoming artists and their director in a 3,763 square feet section of facility. The Launch Pad is a “Maker Space” which occupies 5,956 square feet of the center. This space includes a carpentry & metal working shop and a technology shop. This section of the center also houses the “S.T.E.A.M. Lab” which serves as a computer lab and seminar space for all three programs. The Silver Mine is a co-working space which occupies 6,185 square feet on the ground floor of the center and features a 3,465 square feet loft. The Silver Mine is a place for co-working, entrepreneurialism, continuing education, and startup incubator events.

LOCATION: North Little Rock, AR
CLIENT: Argenta Innovation Center
ARCHITECT: Taggart Architects
COMPLETION: 2016
SIZE: 20,691 square feet
COST: $1,810,831

WHY IT’S IMPORTANT:
The Innovation Hub provides a home for an eclectic program with an array of quiet, focused spaces and open, collaborative zones - a good precedent for the less fabrication-focused areas of the IPRF. At about $90 per square foot, the facility provides a modern, yet approachable level of finishes.

> IMAGE
The Innovation Hub made use of the existing tall ceilings by inserting a mezzanine level for quieter, more focused working
TCAT — NISSAN TRAINING CENTER

The 162,000 square-foot technical training center is jointly occupied by the college and Nissan, representing a public-private partnership between Nissan and the College System of Tennessee to create educational opportunities that are closely aligned to current workforce needs in the region. The state-of-the-art campus offers high-quality programs to prepare students and Nissan employees for careers in advanced manufacturing and other fields.

Both public TCAT students and employees from the Nissan Smyrna plant are enrolled at the education and training facility. Through classes in fields such as Automotive Technology, Collision Repair Technology, Industrial Electrical Maintenance / Mechatronics, Machine Tool Technology and Welding Technology, current and prospective workers learn valuable skills that can be directly applied in Nissan’s facilities or with other employers in the region.

LOCATION: Smyrna, TN
CLIENT: Tennessee Board of Regents
ARCHITECT: Tuck-Hinton Architects
COMPLETION: 2016
SIZE: 154,000 square feet
COST: $32,900,000

WHY IT’S IMPORTANT: This facility represents the standard for public-private partnership in facilities like the IPRF. At just above $210 per square foot, it provides a high-quality, modern precedent that is roughly comparable to the IPRF’s proposed budget.

► IMAGE
The Nissan Training Center is a modern, clean facility located on the outskirts of Smyrna, adjacent to the Nissan Factory.
REGNIER HALL

The College of Architecture, Planning, and Design at Kansas State University has risen in stature and recognition among the nation’s design programs throughout the last decade, and the program’s home at Seaton Hall no longer supported the college’s needs. To fulfill these needs, a portion of Seaton Hall was demolished to make way for Regnier Hall while the remainder of Seaton was rehabilitated.

Working alongside ennead, BNIM and Confluence, el dorado was tasked with the development of 20,000 square feet on the ground floor of Regnier Hall into a modern, highly-functional fabrication lab. Equipment provided ranges from woodworking tools to welding equipment with a significant amount of digital fabrication mixed in.

LOCATION: Manhattan, KS
CLIENT: Kansas State University
ARCHITECT: el dorado inc (shop consultant)
COMPLETION: 2017
SIZE: 20,000 square feet (shop only)
COST: $332 / square foot (shop only)

WHY IT’S IMPORTANT:
As part of a multi-disciplinary college, the shop at Regnier Hall provides space and equipment for a diverse student body to realize their ideas. The equipment provided and logistics necessary to navigate various requirements is synonymous to those of the IPRF.

The fabrication lab opens up to a courtyard, available for loading and larger projects.
ART + DESIGN FACILITY

The new sculpture studio facility for the University of Arkansas Art Department is the first building in a new remote district of campus.

In a design partnership between el dorado inc and MODUS Studio, an existing warehouse structure was transformed and expanded into a stark and simple form, yet housing complex and technical programming for the art department. The existing frame is made efficient by introducing a second floor within the volume. The bright palette, purposeful use of natural daylight, and highly sophisticated spaces for the crafting of various media are underscored by the simple use of plan and section to interconnect students, faculty, and the public between studios, galleries, and exterior porches.

The project is a chance to connect with what is going on outside of the university, exposing students to a unique set of opportunities. Through a process of select renovation and careful addition, the result is architecture that transcends its humble origins, setting the tone for an ambitious new district beyond the traditional campus.

LOCATION: Fayetteville, AR
CLIENT: University of Arkansas
ARCHITECT: el dorado inc + MODUS Studio
COMPLETION: 2016
SIZE: 33,000 square feet
COST: $220 / square foot

WHY IT’S IMPORTANT: Located on the outskirts of campus, the IPRF finds itself in a similar context to the Art + Design Facility. Due to the physical disconnect from the campus proper, the facility is able to set its own tone as it relates to aesthetics and functionality.

► IMAGE
Shop spaces in the A+DF are allowed to spill out into the alleyway, offering a variety of environments for fabrication.
EMBODIED COMPUTATION LAB

The Embodied Computation Lab is a fabrication space for the School of Architecture at Princeton University, but it’s more than just a home for CNC milling machines and the like.

This simple but forward-thinking lab will host research on the future of buildings. Designed to evolve over time, the project features components and systems that can be swapped and upgraded—students and faculty will continually rewrite and adapt the structure. The Princeton University Embodied Computation Lab is a model for new sustainability and low-carbon features, including extremely low embodied energy through a glulam structure and envelope made of local timber. It is the first engineered wood building in North America with a five-ton gantry crane. The radiant floor uses waste condensate from the building next door, with no additional energy required. The building envelope is made of reclaimed New York City scaffolding boards that otherwise would have ended up in a landfill. The facade involves the use of custom algorithms trained to detect knots in wood—bringing the power of machine-learning technology to the physical world.

LOCATION:
Princeton, NJ

CLIENT:
Princeton University

ARCHITECT:
The Living

COMPLETION:
2017

SIZE:
8,500 square feet

WHY IT’S IMPORTANT:
The lab sets an aspirational precedent for what a collegiate fabrication space can look like and how it functions. Utilizing an open-source, kit-of-parts approach, the building is able to adapt to ever-changing curricula and technologies.

► IMAGE
The fabrication floor opens to the outside through a pair of oversized overhead doors. The gantry is allowed to slip out the back door, simplifying loading and unloading.
WEWORK

WeWork provides shared workspaces for established enterprises and growing startups alike along with providing services for entrepreneurs and freelancers.

While some go to WeWork to simply work, others use WeWork as an incubator for their ideas - a powerful tool that fosters engagement, inspires innovation, and drives productivity. The individual spaces at a WeWork range from standard desk-based workstations to “escape pods” that allow each individual to choose their own style of working and collaboration. Common spaces exist as collision areas to share ideas as a result of unexpected encounters.

WeWork designs their spaces to be both adaptive and intuitive, ready to change to meet the needs of whoever may need the space.

LOCATION: numerous

CLIENT: WeWork

WHY IT’S IMPORTANT: WeWork’s shared workspaces have disrupted office culture in cities internationally through redefine the design of space, the intersection of experience, technology and collaborative models. Innovative thinking like this about how to create a space where ideas are nurtured is vital to the success of the IPRF.

A variety of spaces at WeWork cater toward every type of working.
Do what you can’t
SALK INSTITUTE

Located on a picturesque site in La Jolla along the Pacific coast, the Salk Institute is a biological research center lauded for both its functionality and its striking aesthetics — and the manner in which each supports the other.

The laboratories are, by design, spaces of shared enterprise and spontaneous collaboration; those seeking privacy must cross the bridges into one of the ten towers which line the central square. The towers contain small studies, with their west-facing windows directing views toward the square and the Pacific Ocean beyond.

The laboratories to be easily upgraded. Support beams are restricted to the edges of each lab, allowing for greater flexibility in reconfiguring the equipment and spaces within. Mechanical systems are not sealed away behind concrete, instead, they are easy to access for maintenance and renovations. Laboratory windows are able to be temporarily removed so that large equipment can be moved in and out of the building without requiring any of the structure to be demolished. The building is able to “guess tomorrow.”

LOCATION:
San Diego, CA

CLIENT:
Jonas Salk

ARCHITECT:
Louis Kahn

COMPLETION:
1965

WHY IT’S IMPORTANT:
As a key example of what a research institution can be, the Salk Institute championed the corridor as a space not just for circulation, but for unexpected encounters and collaboration. This rich, interdisciplinary atmosphere has matured over the years and reinforced the goals of the project.
MIT MEDIA LAB

The MIT Media Lab is a resource that supports more than 25 research groups, academic initiatives and more than 450 projects world-wide. The six-floor studio-style building is a showplace for new concepts in design, communication systems and collaborative research. It features conference and supporting catering areas, a theater, lecture hall, laboratories and offices designed around a central atrium. Its collaborative environment supports leading edge research including synthetic neurobiology, digital currencies, extended intelligence, wellbeing, affective computing, innovative interfaces and sociable robots.

It is a home for product designers, nanotechnologists and pioneers of computer interfaces within an open office environment that provides the flexibility needed to respond to emerging research opportunities.

LOCATION: Cambridge, MA
CLIENT: Massachusetts Institute of Technology
ARCHITECT: Fumijiko Maki
COMPLETION: 2009
WHY IT’S IMPORTANT: The Media Lab is an interdisciplinary research lab that encourages the unconventional mixing and matching of seemingly disparate research areas. This mixing has lead to numerous life-changing inventions in what has been dubbed the “Future Factory.”

IMAGE
A multi-disciplinary studio in the Media Lab, strewn with a barrage of prototypes.
PROGRAM SPACE INVENTORY

The required program spaces on the adjacent page originated through an inventory of the spaces currently utilized by the proposed TEST Hub occupants on the UTM campus.

This list grew to meet the ambition and needs that arose during a series of interviews between the programming team and all entities involved in the project. It is anticipated that this list of program spaces will continue to be revised as a greater understanding of the overall vision and program mix of the TEST Hub evolves. Thus, all programming activities were intended to be as flexible as possible to account for the unknowns that will arise as the project progresses.

The latter portion of this chapter will identify an acceptable square footage per space, equipment and furniture found within the space, its relationship to other spaces within the facility, and all other necessary requirements.
PROPOSED INTERIOR SPACES

THE LOBBY
BOARDROOM
PITCH ROOMS (2)
COMPUTER LAB
OFFICE (UTM ENG)
OFFICE (UTM AG)
OFFICE (REED ADMIN)
OFFICE (REED CTR.)
OFFICE (TCAT)
OFFICE (DYERSBURG)
OFFICE (LAB MANAGER)
LARGE CLASSROOM
SMALL CLASSROOM
ENTREPRENEUR CENTER
PHONE ROOM (2)
FABRICATION LAB
TEAM LAB (BRIDGE)
TEAM LAB (CONC. CANOE)
TEAM LAB (GLIDER)
TEAM LAB (ROCKET)
TEAM LAB (TRACTOR)
TEAM LAB (BAJA)
TEAM LAB (2, RENTABLE)
OBSERVATION MEZZANINE
FOUNDRY
COLD ROOM
UTILITY / JAN / IT ROOMS AS NECESSARY
RESTROOMS AS NECESSARY
STORAGE AS NECESSARY

PROPOSED EXTERIOR SPACES

PARKING
ENTRANCE
COURTYARD
TRASH / RECYCLING
TRAILER STORAGE
OUTDOOR WORK AREA
TEST TRACK
ROCKET TESTING
MATERIAL STORAGE
The required program spaces of the TEST Hub can be easily grouped into three categories:

**CLEAN + QUIET SPACES**
- OUTDOOR SPACE
- DIRTY + LOUD SPACES

Another key assumption made for the following studies is that these spaces are to have a distinct separation from one another due to numerous reasons, a few of which include acoustic concerns, thermal comfort and systems differences. The last key assumption made is that the facility is to be located on a single level. Considering that there is little concern about the site being large enough for the facility, keeping the facility on a single level negates the need for costly elevators and additional accessibility elements.

As the program blocks are arranged and studied, four metrics are considered:

1. CLEAR SEPARATION
   Clear Separation means programmatic aggregations around clean activities and dirty activities. The associated benefits are organizational, addressing thermal comfort needs, air quality management, and maintenance considerations.

2. CROSS VENTILATION
   Cross Ventilation speaks to building proportions and dimensions, associations with cardinal orientation and prevailing breezes, all in the spirit of considering natural ventilation as an important consideration.

3. OUTDOOR SPACE
   Outdoor Space looks at the ability to position and shape the building to take advantage of positive, usable outdoor space. Achieving this creates the opportunity to elegantly expand the program.

4. PROGRAM FLEXIBILITY
   Program Flexibility positions the overall square footage within the physical site parameters, and considers the ease of expanding each of the two primary organizational massings – clean and dirty. In all options, a simple system of (+) and (-) is meant to create a quick assessment over overall benefit for each arrangement consideration.
POSSIBLE PROGRAM RELATIONSHIPS

This piece of the Programming Document is meant to flesh out a value system by which stakeholders can understand what is most important, a kind of applied value system for this facility and program.

Using the simple programmatic separation strategy of Clean/Dirty, a number of overall arrangements have been examined and evaluated around a grouping of relevant beneficial considerations. While a broad number of arrangements have been examined, this is by no means an exhaustive number of options.
OPTION A

1. CLEAR SEPARATION
If joined in the middle, this option makes acoustic separation between the incompatible uses difficult. Sounds and vibrations are likely to travel between the two blocks unless significant effort is undertaken to isolate them from one another.

2. CROSS VENTILATION
By elongating on the east-west axis, the massing allows each space to have equitable access to fresh air. Cross ventilation strategies would be easy to develop to ensure unconditioned areas always have a cooling breeze.

3. OUTDOOR SPACE
Any outdoor space in this option would be loosely-organized about the front and back of the building. The addition of required parking areas would encroach on this already loosely-defined outdoor space, making for a poor outdoor environment. However, this option does tuck the potentially messy outdoor work areas behind the building.

4. PROGRAM FLEXIBILITY
When located on the southern edge of the site, this option would have little room to grow east or west to accommodate program changes that may arise. It is limited in this direction by the existing detention basin and the likelihood that it would need to have driveways on either side.
**OPTION B**

1. **CLEAR SEPARATION**

Similar to option A, this option is joined in the middle, which makes acoustic separation between the incompatible uses difficult. Sounds and vibrations are likely to travel between the two blocks unless significant effort is undertaken to isolate them from one another.

2. **CROSS VENTILATION**

Similar to option A, this option would provide a straightforward ventilation strategy for all areas in the building. By having both broad sides of the "dirty" program exposed and ventilated, it may be able to be unconditioned and still be comfortable during the warmer months.

3. **OUTDOOR SPACE**

Similar to option A, any outdoor space in this option would be loosely-organized about the sides of the building. The addition of required parking areas would encroach on this already loosely-defined outdoor space, making for a poor outdoor environment. In addition, most of the outdoor space will always be visible from the street, displaying the messy outdoor work areas to the passerby.

4. **PROGRAM FLEXIBILITY**

Considering the length of this massing option, it would likely take the majority of the north-south space on site. This leaves little room to accommodate additions to the building both during the design process and later on in its life.
1. CLEAR SEPARATION
Because the two program blocks are joined on the long edge, this option is the least successful in creating a clear separation between the two incompatible uses. This level of adjacency would require significant investment in strategies to attenuate noise and vibration transfer between the two.

2. CROSS VENTILATION
Because of the compact nature of the massing option, it would likely be difficult to naturally get fresh air deep into the facility. It is also likely that this option would require a number of spaces to be located in an area with no access to an operable window or fresh air.

3. OUTDOOR SPACE
Similar to previous options, any outdoor space in this option would be loosely-organized about the sides of the building. In addition, most of the outdoor space will always be visible from the street, displaying the messy outdoor work areas to the passerby.

4. PROGRAM FLEXIBILITY
Because the massing option is so compact, it has the possibility to leave a significant amount of the site undeveloped. This leaves room for the building to grow both now and over time.
1. CLEAR SEPARATION
The drawbacks of this option are similar to that of option C. Careful attention would need to be paid to noise and vibration attenuation between the two masses. It should be noted that this option is the most similar to the original “Garage” floor plan supplied in the economic impact report. A primary concern with said floor plan is concerned with the lack of separation between incompatible uses.

2. CROSS VENTILATION
Similar to option C, the wide nature of this massing option would make ventilating spaces deep inside the facility difficult. These spaces would need to rely on otherwise unnecessary mechanical means of delivering fresh air.

3. OUTDOOR SPACE
Similar to all three previous options, there is little possibility for defined outdoor space without additional building elements. However, this option is an improvement on option C as it tucks the potentially messy outdoor work area behind the building and away from the road.

4. PROGRAM FLEXIBILITY
Similar to option C, this massing option is very compact. Thus it has the possibility to leave a significant amount of the site undeveloped, leaving room for the building to grow both now and over time. However, option C would be more preferable with respect to this metric as there is more room to grow north than there is east-west.
OPTION E

1. CLEAR SEPARATION
The two program chunks are physically separated from one another, negating the need for any special sound or vibration attenuation. It is also worth noting that the physical separation of the masses is also likely to keep the “clean” program areas clean while letting the “dirty” program areas stay dirty.

2. CROSS VENTILATION
By separating the two program blocks and maximizing exterior wall area, it maximizes opportunities for both cross ventilation through the building and individual space access to fresh air. This could allow the “dirty” areas to be unconditioned but still remain comfortable during the warmer months.

3. OUTDOOR SPACE
By separating the program into two distinct chunks and orienting them in this way, an outdoor space is strongly defined on two edges by the massing. This outdoor space is sheltered from harsh western light during the warmer months and invites in warm southern light during the winter months, extending the amount of time it is able to be comfortably used throughout the year.

4. PROGRAM FLEXIBILITY
With more room to expand to the north, this option allows for easy manipulation during the design process and straightforward additions if necessary down the road.
OPTION F

1. CLEAR SEPARATION
As established in option E, the physical separation of the masses negates any need for special sound or vibration attenuation while also keeping incompatible program uses separated.

2. CROSS VENTILATION
Similar to option E, this massing option maximizes opportunities for natural ventilation, thus increasing the thermal comfort in the building throughout the year.

3. OUTDOOR SPACE
As established in option E, orienting the program chunks parallel to each other creates a very defined, functional outdoor space. However, other than early in the morning or late in the afternoon, this outdoor space could very likely be entirely in shadow throughout the cooler months. In addition, during the warmer months, this outdoor space could possibly receive little winds from the southwest.

4. PROGRAM FLEXIBILITY
As established in previous options, when bound by drives, parking and the existing detention basin on the east and west, that leaves little room for the massing to account for unknowns.
**OPTION G**

1. CLEAR SEPARATION

While shifted, this option is still unsuccessful in creating a clear separation between the two incompatible uses. However, if the masses were to shift more, the area that they are joined can be minimized, in turn minimizing the amount of effort necessary to attenuate noise and vibration between the two.

2. CROSS VENTILATION

Similar to options B and C, the wide nature of this massing option would make ventilating spaces deep inside the facility difficult. These spaces would need to rely on otherwise unnecessary mechanical means of delivering fresh air. However, the more that this option is able to be shifted, the better the potential for natural ventilation, in theory, gets.

3. OUTDOOR SPACE

While modest, this option creates two distinct outdoor spaces. Considering that there is little benefit to wind protection of outdoor spaces in this climate, the outdoor space located away from the prevailing winds is likely to be more uncomfortable during the warmer months.

4. PROGRAM FLEXIBILITY

Due to the compact nature of this massing option, it takes up significantly less area on the site than most other options. This means that there is likely plenty of room for manipulation and adjustments when unknowns are encountered.
1. CLEAR SEPARATION
As established in option A, any joining of the masses makes acoustic separation between the incompatible uses difficult. Sounds and vibrations are likely to travel between the two blocks unless significant effort is undertaken to isolate them from one another.

2. CROSS VENTILATION
While this massing option has more opportunities for natural ventilation than options A, B and G, it does not maximize the cross ventilation potential of the building. The portion of the “clean” massing tucked behind is unlikely to receive any prevailing breezes from the southwest.

3. OUTDOOR SPACE
This option retains all the benefits and drawbacks of option G, but provides more generous areas of outdoor space. Providing ample outdoor space on both broad sides of the “dirty” program block is likely beneficial with respect to loading, unloading, daylighting and ventilation.

4. PROGRAM FLEXIBILITY
As established earlier, there is little room to expand on the site east-west once all the required site development items are included. Extending the “clean” program block to the north is likely the only manipulation that can be made.
**OPTION I**

1. **CLEAR SEPARATION**
   As established in option E, the physical separation of the masses negates any need for special sound or vibration attenuation while also keeping incompatible program uses separated. This option also has the benefit of potentially separating incompatible outdoor spaces instead of consolidating them into a single courtyard.

2. **CROSS VENTILATION**
   This option retains all the benefits of both options E and F. Additionally, by not placing the masses parallel to one another, there may be an opportunity to funnel prevailing winds into the building. Other orientations of this option may be studied to capitalize on this phenomenon.

3. **OUTDOOR SPACE**
   While not as defined as options E or F, this option has the potential to create a small network of defined outdoor spaces. As stated earlier, these outdoor spaces also have access to the prevailing breezes, keeping them more comfortable during the warmer months.

4. **PROGRAM FLEXIBILITY**
   If smartly located on the site, this option may allow each program block to be easily manipulated. When tucked behind the existing detention basin, the “dirty” program block can extend toward the east while “clean” program block can extend toward the north.
OPTION J

1. CLEAR SEPARATION
As established in option A, any joining of the masses makes acoustic and vibration separation between the incompatible uses difficult. In addition, this option could have the drawback of requiring one to cross through “dirty” space to get from one “clean” space to another.

2. CROSS VENTILATION
Similar to option H, this option has more cross ventilation opportunities than some options, but there is still portions of the building that may or may not have access to natural ventilation in the intersection area.

3. OUTDOOR SPACE
Though modest when compared to other options, this massing option has the potential to create four distinct outdoor spaces. The variety of these spaces is likely to be beneficial to the eclectic program mix of the facility.

4. PROGRAM FLEXIBILITY
Similar to previous options, the compact nature of this option takes up little area on the site, making future manipulation and expansion easy.
OPTION K

1. CLEAR SEPARATION

Similar to option J, this option not only requires careful attention to be paid to noise and sound attenuation, but also could require one to cross through an incompatible program space to get to another.

2. CROSS VENTILATION

This option has similar drawbacks to option J. While better than some, a long narrow building massing helps maximize cross ventilation in a climate like Martin’s.

3. OUTDOOR SPACE

The outdoor spaces in this option are similarly defined as the spaces in option J. As with all options creating more than one defined outdoor space, there is the opportunity to further define these spaces as “clean” and “dirty,” mirroring the straightforward program separation already set forth.

4. PROGRAM FLEXIBILITY

Similar to previous options, the compact nature of this option takes up little area on the site, making future manipulation and expansion easy.
OPTION L

1. CLEAR SEPARATION
Because the two program blocks are joined on the long edge, this option is the least successful in creating a clear separation between the two incompatible uses. This level of adjacency would require significant investment in strategies to attenuate noise and vibration transfer between the two.

2. CROSS VENTILATION
Considering that this massing option is effectively a long narrow option, it could likely have abundant cross ventilation opportunities. However, note that if reversed (see option I), the courtyard area could be improved and utilized to funnel the prevailing southwest winds into the outdoor spaces and building.

3. OUTDOOR SPACE
While the outdoor space in this option is clearly defined on two sides by the program massing, it also has two significant drawbacks. Other than early in the morning, this outdoor space could very likely be entirely in shadow throughout the cooler months. In addition, during the warmer months, this outdoor space receives little of the prevailing breezes from the southwest.

4. PROGRAM FLEXIBILITY
If located on site so that the “dirty” program block can tuck behind the existing detention basin, then there is little room for the “clean” program block to expand to the north. Conversely, if located on the southern edge of the site, there is little room for the “dirty” program block to expand once all necessary site elements are included.
SPACE SQUARE FOOTAGES

The square footages shown are the result of stakeholder interviews, room diagrams shown on the following pages, and THEC requirements. Square footages are subject to change during Schematic Design based on further design study, additional feedback, cost estimating, and prioritization of programming requests.
ADJACENCY DIAGRAM

As established on prior spreads, the programmatic spaces for the TEST Hub can be roughly grouped into three classifications:

**CLEAN + QUIET SPACES**
- OUTDOOR SPACES
- DIRTY + LOUD SPACES

The adjacency diagram on the opposite page not only brings together spaces that would functionally benefit from being near each other, but also separates functionally incompatible spaces.

This exercise leads to two key conclusions. First of all, it demonstrates the ability of common outdoor space to act as a functional buffer between two seemingly incompatible programmatic uses. Second, it shows the vital role that the fabrication lab, lobby, and entrepreneur center have in the facility not only as functional spaces, but also as a gateway into the more programatically-specific areas of the building.
A multi-programmed, flexible space, the Lobby is the first impression interior space for the TEST Hub. The space is used for collaboration (student–student, student–instructor, student–industry partner), social gatherings, informal presentations, industry partner and donor recognition, a first stop on a facility tour, a lounge, a pre-function space for the classrooms, display of past student work and achievements, vending, coffee. The space is visually connected to the covered Entrance the Courtyard, and the Fabrication Lab. This space is to be available for all users at the facility. Equipment provided in this space includes vending machine(s), coffee maker(s), and microwave(s). Furniture is to include a variety of benches both movable and built-in, lounge chairs, tables, fixed display casework, kitchenette casework, (80–100) stackable chairs to be stored in Furniture Storage when not in use.
**A101 — BOARD ROOM**

The Board Room is a large conference room for formal meetings and presentations, available to all building users.

Equipment provided in this space should include a flat screen TV and a computer that allows laptop connections. Furniture provided in this space should include a conference table, conference chairs, and a built-in credenza.

<table>
<thead>
<tr>
<th>OCCUPANTS:</th>
<th>20 persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF:</td>
<td>550 sf</td>
</tr>
<tr>
<td>HVAC:</td>
<td>Typical with dedicated VAV box</td>
</tr>
<tr>
<td>ILLUMINATION:</td>
<td>LED lighting</td>
</tr>
<tr>
<td>ELECTRICAL:</td>
<td>Electrical outlets per currently enforced codes</td>
</tr>
<tr>
<td>PLUMBING:</td>
<td>N/A</td>
</tr>
<tr>
<td>FUME HOOD:</td>
<td>N/A</td>
</tr>
<tr>
<td>VIBRATION:</td>
<td>N/A</td>
</tr>
<tr>
<td>ACOUSTICAL:</td>
<td>Partitions to have a Sound Transmission Class rating of STC-55</td>
</tr>
<tr>
<td>GAS USE:</td>
<td>N/A</td>
</tr>
<tr>
<td>COMMUNICATION:</td>
<td>WiFi and data, conference phone</td>
</tr>
<tr>
<td>SECURITY / FIRE:</td>
<td>Fire alarm notification devices and initiation devices per currently enforced codes</td>
</tr>
<tr>
<td>FLOOR:</td>
<td>Carpet tile</td>
</tr>
<tr>
<td>WALLS:</td>
<td>Painted GWB with rubber base</td>
</tr>
<tr>
<td>CEILINGS:</td>
<td>Painted GWB</td>
</tr>
<tr>
<td>DOORS:</td>
<td>Interior storefront entrance</td>
</tr>
<tr>
<td>WINDOWS:</td>
<td>Interior glazing at wall next to lobby, exterior windows</td>
</tr>
</tbody>
</table>
FULL-GLAZED DOOR
STOREFRONT GLAZING

BUILT-IN CREDENZA
CONFERENCE CHAIRS (20)
CONFERENCE TABLE
A102, 103 — PITCH ROOMS

The Pitch Rooms are small, informal rooms for meetings and product pitches.

Equipment provided in the Pitch Rooms should include a flat screen TV and a computer to allow for laptop connection. Furniture in these rooms should include a built-in credenza, marker boards, a conference table, and conference chairs.

| OCCUPANTS:          | 8-10 persons |
| NASF:              | 360 sf       |
| HVAC:              | Typical with dedicated VAV box |
| ILLUMINATION:      | LED lighting |
| ELECTRICAL:        | Electrical outlets per currently enforced codes |
| PLUMBING:          | N/A          |
| FUME HOOD:         | N/A          |
| VIBRATION:         | N/A          |
| ACOUSTICAL:        | Partitions to have a Sound Transmission Class rating of STC-50 |
| GAS USE:           | N/A          |
| COMMUNICATION:     | WiFi and data, conference phone |
| SECURITY / FIRE:   | Fire alarm notification devices and initiation devices per currently enforced codes |
| FLOOR:             | Carpet tile  |
| WALLS:             | Painted GWB with rubber base |
| CEILINGS:          | Painted GWB  |
| DOORS:             | Interior storefront entrance, interior overhead door that opens to lobby |
| WINDOWS:           | Interior glazing at wall next to lobby, exterior windows |
A104-107 — OFFICES

The Offices act as temporary “landing spots” for various instructors and staff members.

Equipment provided in the Offices should include copiers and printers alongside any additional equipment shown on the opposite page for any specific office.

Furniture provided should include office workstations, office chairs, storage cabinets or shelving, lounge chairs, and a coffee table along with any additional furniture shown on the opposite page for any specific office.

<table>
<thead>
<tr>
<th>OCCUPANTS:</th>
<th>4 instructors / staff per office</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF:</td>
<td>540 sf (UTM Engineering), 420 sf (UTM Agriculture, TCAT, Dyersburg State)</td>
</tr>
<tr>
<td>HVAC:</td>
<td>Typical with dedicated VAV box</td>
</tr>
<tr>
<td>ILLUMINATION:</td>
<td>LED lighting</td>
</tr>
<tr>
<td>ELECTRICAL:</td>
<td>Electrical outlets per currently enforced codes</td>
</tr>
<tr>
<td>PLUMBING:</td>
<td>N/A</td>
</tr>
<tr>
<td>FUME HOOD:</td>
<td>N/A</td>
</tr>
<tr>
<td>VIBRATION:</td>
<td>N/A</td>
</tr>
<tr>
<td>ACOUSTICAL:</td>
<td>Partitions to have a Sound Transmission Class rating of STC-45</td>
</tr>
<tr>
<td>GAS USE:</td>
<td>N/A</td>
</tr>
<tr>
<td>COMMUNICATION:</td>
<td>WiFi and data</td>
</tr>
<tr>
<td>SECURITY / FIRE:</td>
<td>Fire alarm notification devices and initiation devices per currently enforced codes</td>
</tr>
<tr>
<td>FLOOR:</td>
<td>Carpet tile</td>
</tr>
<tr>
<td>WALLS:</td>
<td>Painted GWB with rubber base</td>
</tr>
<tr>
<td>CEILINGS:</td>
<td>Painted GWB</td>
</tr>
<tr>
<td>DOORS:</td>
<td>Interior storefront entrance</td>
</tr>
<tr>
<td>WINDOWS:</td>
<td>Interior glazing to borrow daylight and provide views, exterior windows coordinated to control building entrance and minimize glare</td>
</tr>
</tbody>
</table>
A104-107 — OFFICES

LOUNGE AREA

PRINTING/STORAGE

VIEW TOWARD COVERED ENTRY

WORKSTATIONS

PRINTING/STORAGE

A104

A105-107
A108-109 — RESTROOMS

The Restrooms should be located in a convenient location and open to all users of the building. Equipment provided in the Restrooms is limited to the necessary bathroom fixtures and accessories. Furnishings include steel toilet compartments.

| OCCUPANTS: | N/A |
| NASF: | 330 sf each |
| HVAC: | Typical with dedicated VAV box for both rooms, code required exhaust, space pressure should be negative to adjacent |
| ILLUMINATION: | LED lighting |
| ELECTRICAL: | Electrical outlets per currently enforced codes |
| PLUMBING: | Water closets, urinals, lavatories, and drinking fountains adjacent |
| FUME HOOD: | N/A |
| VIBRATION: | Vibration isolation on exhaust fan |
| ACOUSTICAL: | Partitions to have a Sound Transmission Class rating of STC-40 |
| GAS USE: | N/A |
| COMMUNICATION: | N/A |
| SECURITY / FIRE: | Fire alarm notification devices and initiation devices per currently enforced codes |
| FLOOR: | Polished concrete |
| WALLS: | Painted GWB (scrubbable) with rubber base |
| CEILINGS: | Acoustical tile |
| DOORS: | Steel doors |
| WINDOWS: | N/A |
A110 — UTILITY / JANITOR

This Utility room is the primary utility room for the TEST Hub "campus". Equipment inside of this space includes AHU’s, chilled water pumps, steam to water heat exchanger and hot water pumps. No furniture is necessary in this space. Site-wise, this space is fed chilled water and steam from the campus loop. The water for both domestic use and fire suppression also enter into this space.

OCCUPANTS: N/A
NASF: 450 sf

HVAC: Unit heater
ILLUMINATION: LED lighting
ELECTRICAL: Electrical outlets per currently enforced codes and power for equipment
PLUMBING: Floor drains and condensate drains, mop sink and utility faucet
FUME HOOD: N/A
VIBRATION: Vibration isolation on AHU fan and inertia bases on pumps
ACOUSTICAL: Sound-attenuation insulation within wall cavities and above ceiling
GAS USE: N/A
COMMUNICATION: Fire alarm notification devices and initiation devices per currently enforced codes
SECURITY / FIRE: N/A

FLOOR: Concrete slab
WALLS: GWB with rubber base
CEILINGS: Exposed structure
DOORS: Steel doors
WINDOWS: N/A
A111 — FURNITURE STORAGE

The Furniture Storage is used specifically for furniture used within the Lobby.

- **OCCUPANTS:** N/A
- **NASF:** 340 sf
- **HVAC:** Unit heater
- **ILLUMINATION:** LED lighting
- **ELECTRICAL:** Electrical outlets per currently enforced codes
- **PLUMBING:** N/A
- **FUME HOOD:** N/A
- **VIBRATION:** N/A
- **ACOUSTICAL:** N/A
- **GAS USE:** N/A
- **COMMUNICATION:** N/A
- **SECURITY / FIRE:** Fire alarm notification devices and initiation devices per currently enforced codes
- **FLOOR:** Concrete slab
- **WALLS:** GWB with rubber base
- **CEILINGS:** Exposed structure
- **DOORS:** Steel doors
- **WINDOWS:** N/A
A112 — IT CLOSET

The IT Closet should meet all UT Martin General Specification requirements.

- **OCCUPANTS:** N/A
- **NASF:** 160 sf
- **HVAC:** Typical with dedicated VAV box for both rooms, code required exhaust
- **ILLUMINATION:** LED lighting
- **ELECTRICAL:** Electrical outlets per currently enforced codes and as necessary, power to be connected to generator, racks to be appropriately grounded
- **PLUMBING:** N/A
- **FUME HOOD:** N/A
- **VIBRATION:** N/A
- **ACOUSTICAL:** N/A
- **GAS USE:** N/A
- **COMMUNICATION:** N/A
- **SECURITY / FIRE:** Fire alarm notification devices and initiation devices per currently enforced codes
- **FLOOR:** Concrete slab
- **WALLS:** GWB with rubber base
- **CEILINGS:** Exposed structure
- **DOORS:** Steel doors
- **WINDOWS:** N/A
A113 — COMPUTER LAB

The Computer Lab is a category C lab per THEC standards (75 NASF per station). The room is used for the instruction of computer-based course work. The lab is an open lab per THEC; unscheduled and available for use throughout the day and evening.

Equipment provided in the Computer Lab should include a smartboard, whiteboard, flat panel TV screens, printers, computers, and AV equipment.

Furniture should include storage cabinets, computer desks / workstations, and office chairs.

**OCCUPANTS:** 24 students, 1 instructor  
**NASF:** 1,020 sf  
**HVAC:** Typical with dedicated VAV box  
**ILLUMINATION:** LED lighting  
**ELECTRICAL:** Electrical outlets per currently enforced codes plus additional circuits for computers and other equipment  
**PLUMBING:** N/A  
**FUME HOOD:** N/A  
**VIBRATION:** N/A  
**ACOUSTICAL:** Partitions to have a Sound Transmission Class rating of STC-50  
**GAS USE:** N/A  
**COMMUNICATION:** WiFi and data  
**SECURITY / FIRE:** Fire alarm notification devices and initiation devices per currently enforced codes  
**FLOOR:** Carpet tile  
**WALLS:** Painted GWB with rubber base  
**CEILINGS:** Acoustical tile  
**DOORS:** Interior storefront entrance  
**WINDOWS:** Interior glazing at entry wall to borrow daylight and provide views, exterior windows coordinated to minimize glare on screens
A114 — LARGE CLASSROOM

The Large Classroom is a space primarily used for teaching curriculum, but also available as a large pitch room, large meeting room, or K-12 STEM instruction. Movable partitions should allow the room to be divided into two, smaller classrooms.

Equipment within the space should include a smartboard, whiteboards, projector(s), projection screen(s), an A/V cabinet or closet, and a storage cabinet or closet.

Furniture within the space should include fixed tables with power, molded plastic chairs, and a lectern with power.

| OCCUPANTS: | 105 students, 1 instructor (when divided: 63 students, 1 instructor and 42 students, 1 instructor) |
| NASF: | 1,020 sf |
| HVAC: | Typical with dedicated VAV box |
| ILLUMINATION: | LED lighting |
| ELECTRICAL: | Electrical outlets per currently enforced codes plus additional circuits for computers and other equipment |
| PLUMBING: | N/A |
| FUME HOOD: | N/A |
| VIBRATION: | N/A |
| ACOUSTICAL: | Partitions to have a Sound Transmission Class rating of STC-50 |
| GAS USE: | N/A |
| COMMUNICATION: | WiFi and data |
| SECURITY / FIRE: | Fire alarm notification devices and initiation devices per currently enforced codes |
| FLOOR: | Carpet tile |
| WALLS: | Painted GWB with rubber base |
| CEILINGS: | Acoustical tile |
| DOORS: | Interior storefront entrance |
| WINDOWS: | Interior glazing at entry wall to borrow daylight and provide views, exterior windows coordinated to minimize glare on screens |
A114 — LARGE CLASSROOM
The Small Classroom is a space primarily used for teaching curriculum, but also available as a large pitch room, large meeting room, or K-12 STEM instruction.

Equipment within the space should include a smartboard, whiteboards, projector(s), projection screen(s), an A/V cabinet or closet, and a storage cabinet or closet.

Furniture within the space should include fixed tables with power, molded plastic chairs, and a lectern with power.

**OCCUPANTS:** 48 students, 1 instructor

**NASF:** 1,780 sf

**HVAC:** Typical HVAC with dedicated VAV box

**ILLUMINATION:** LED lighting

**ELECTRICAL:** Electrical outlets per currently enforced codes and power for equipment

**PLUMBING:** N/A

**FUME HOOD:** N/A

**VIBRATION:** N/A

**ACOUSTICAL:** Partitions are to have a Sound Transmission Class rating of STC-50

**GAS USE:** N/A

**COMMUNICATION:** WiFi

**SECURITY / FIRE:** Fire Alarm notification devices per currently enforced codes

**FLOOR:** Carpet tile

**WALLS:** Painted GWB with rubber base

**CEILINGS:** Acoustical tile

**DOORS:** Interior storefront entrance

**WINDOWS:** Interior glazing at entry wall to allow view; exterior windows
A115 — SMALL CLASSROOM

STORAGE

SMARTBOARD / DISPLAY
B100 — ENTREPRENEUR CENTER

The Entrepreneur Center is a flexible, open office to be used by local entrepreneurs with workstations to be rented on a monthly basis. The space is to have a separate entrance to allow for hours of operation separate from other programs, and to allow for a greater level of privacy from other spaces. The space is to have equal access to a walkway adjoining the Fabrication Lab.

Equipment within the space should include a copier / printer.

Furniture within the space should include workstations (24) with power/data and lockable storage components, office chairs on casters (24), lounge furniture, and storage shelving or casework.

| OCCUPANTS: | 24 persons |
| NASF: | 2,800 sf |
| HVAC: | Typical HVAC with dedicated VAV box(es) |
| ILLUMINATION: | LED lighting |
| ELECTRICAL: | Electrical outlets per currently enforced codes and power for workstations |
| PLUMBING: | N/A |
| FUME HOOD: | N/A |
| VIBRATION: | N/A |
| ACOUSTICAL: | Sound-absorbing panels located within exposed structure above |
| GAS USE: | N/A |
| COMMUNICATION: | WiFi |
| SECURITY / FIRE: | Fire Alarm notification devices per currently enforced codes |
| FLOOR: | Polished concrete |
| WALLS: | Painted GWB with rubber base |
| CEILINGS: | Exposed structure above |
| DOORS: | Storefront entrances and overhead doors |
| WINDOWS: | North-facing clerestory, storefront, overhead doors |
B101-102 — REED CENTER OFFICES

Administrative office and corporate office for REED Center.

Equipment within the space should include a copier / printer.

Furniture should include a workstation, an office chair, storage shelving, and (2) waiting chairs.

OCCUPANTS: 1 administrative employee; 1 REED Center employee

NASF: 150 sf

HVAC: Typical HVAC with dedicated VAV box

ILLUMINATION: LED lighting

ELECTRICAL: Electrical outlets per currently enforced codes

PLUMBING: N/A

FUME HOOD: N/A

VIBRATION: N/A

ACOUSTICAL: Partitions are to have a Sound Transmission Class rating of ST-45

GAS USE: N/A

COMMUNICATION: WiFi and data

SECURITY / FIRE: Fire Alarm notification devices per currently enforced codes

FLOOR: Carpet tile

WALLS: Painted GWB with rubber base

CEILINGS: Painted GWB

DOORS: Interior storefront entrance

WINDOWS: Interior glazing at entry wall to borrow daylight into the building and provide views into the office; exterior windows, coordinated with room layout to minimize glare on screens and provide visual control of building entrance
**B103-104 — PHONE ROOMS**

Small room for two-person meeting or private phone conversations.

Furniture within the space should include a 48in round table and (4) chairs.

<table>
<thead>
<tr>
<th>OCCUPANTS:</th>
<th>1 to 4 persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF:</td>
<td>80 sf</td>
</tr>
<tr>
<td>HVAC:</td>
<td>Typical HVAC with shared VAV box</td>
</tr>
<tr>
<td>ILLUMINATION:</td>
<td>LED lighting</td>
</tr>
<tr>
<td>ELECTRICAL:</td>
<td>Electrical outlets per currently enforced codes</td>
</tr>
<tr>
<td>PLUMBING:</td>
<td>N/A</td>
</tr>
<tr>
<td>FUME HOOD:</td>
<td>N/A</td>
</tr>
<tr>
<td>VIBRATION:</td>
<td>N/A</td>
</tr>
<tr>
<td>ACOUSTICAL:</td>
<td>Partitions are to have a Sound Transmission Class rating of ST-50</td>
</tr>
<tr>
<td>GAS USE:</td>
<td>N/A</td>
</tr>
<tr>
<td>COMMUNICATION:</td>
<td>WiFi</td>
</tr>
<tr>
<td>SECURITY / FIRE:</td>
<td>Fire Alarm notification devices per currently enforced codes</td>
</tr>
<tr>
<td>FLOOR:</td>
<td>Carpet tile</td>
</tr>
<tr>
<td>WALLS:</td>
<td>Painted GWB with rubber base</td>
</tr>
<tr>
<td>CEILINGS:</td>
<td>Painted GWB</td>
</tr>
<tr>
<td>DOORS:</td>
<td>Interior storefront</td>
</tr>
<tr>
<td>WINDOWS:</td>
<td>N/A</td>
</tr>
</tbody>
</table>
INTERIOR WINDOWS TO BORROW LIGHT

SMALL CONFERENCE TABLE
### B105 — STORAGE

Storage room for Entrepreneur Center.

<table>
<thead>
<tr>
<th>OCCUPANTS:</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF:</td>
<td>80 sf</td>
</tr>
<tr>
<td>HVAC:</td>
<td>Typical HVAC with served by Phone room's VAV box</td>
</tr>
<tr>
<td>ILLUMINATION:</td>
<td>LED lighting</td>
</tr>
<tr>
<td>ELECTRICAL:</td>
<td>Electrical outlets per currently enforced codes</td>
</tr>
<tr>
<td>PLUMBING:</td>
<td>N/A</td>
</tr>
<tr>
<td>FUME HOOD:</td>
<td>N/A</td>
</tr>
<tr>
<td>VIBRATION:</td>
<td>N/A</td>
</tr>
<tr>
<td>ACOUSTICAL:</td>
<td>N/A</td>
</tr>
<tr>
<td>GAS USE:</td>
<td>N/A</td>
</tr>
<tr>
<td>COMMUNICATION:</td>
<td>N/A</td>
</tr>
<tr>
<td>SECURITY / FIRE:</td>
<td>Fire Alarm detection devices per currently enforced codes</td>
</tr>
<tr>
<td>FLOOR:</td>
<td>Concrete slab</td>
</tr>
<tr>
<td>WALLS:</td>
<td>Painted GWB with rubber base</td>
</tr>
<tr>
<td>CEILINGS:</td>
<td>Exposed structure</td>
</tr>
<tr>
<td>DOORS:</td>
<td>Steel door</td>
</tr>
<tr>
<td>WINDOWS:</td>
<td>N/A</td>
</tr>
</tbody>
</table>
B106-107 — RESTROOMS

Single fixture restroom, dedicated to Entrepreneur Center users.

| OCCUPANTS: | N/A |
| NASF: | 40 sf each |
| HVAC: | Typical HVAC with shared VAV box for both rooms. Code required exhaust. Space pressure should be negative to adjacent. |
| ILLUMINATION: | LED lighting |
| ELECTRICAL: | Electrical outlets per currently enforced codes |
| PLUMBING: | Water closets, lavatories, and drinking fountains adjacent |
| FUME HOOD: | N/A |
| VIBRATION: | Vibration isolation on exhaust fan |
| ACOUSTICAL: | Partitions to have a Sound Transmission Class rating of STC-40 |
| GAS USE: | N/A |
| COMMUNICATION: | N/A |
| SECURITY / FIRE: | Fire Alarm notification devices per currently enforced codes |
| FLOOR: | Polished concrete |
| WALLS: | Painted GWB (scrubbable) with rubber base |
| CEILINGS: | Acoustical tile |
| DOORS: | Steel doors |
| WINDOWS: | N/A |
B108 — UTILITY

Utility room dedicated to Entrepreneur Center with AHU.

| OCCUPANTS: | N/A |
| NASF: | 80 sf |
| HVAC: | Unit heater |
| ILLUMINATION: | LED lighting |
| ELECTRICAL: | Electrical outlets per currently enforced codes |
| PLUMBING: | Floor drains and condensate drains |
| FUME HOOD: | N/A |
| VIBRATION: | Vibration isolation on AHU fan |
| ACOUSTICAL: | N/A |
| GAS USE: | N/A |
| COMMUNICATION: | N/A |
| SECURITY / FIRE: | Fire Alarm detection devices per currently enforced codes |
| FLOOR: | Concrete slab |
| WALLS: | GWB with rubber base |
| CEILINGS: | Exposed structure |
| DOORS: | Steel door |
| WINDOWS: | N/A |
C100 — FABRICATION LAB

Large open fabrication space used by students, instructors, and entrepreneurs. Space is organized into zones, with dirtier, spark-throwing equipment located near Loading / Unloading, transitioning to digital, computerized equipment located on the opposite end. Space is to include zones dedicated gantry structure. Longitudinal circulation is sized to allow for smaller trucks to drive the length of the building. A zone dedicated to first-aid and eye-wash stations is located between circulation and the specific fabrication zones.

The space is equipped with a permanent 10-ton gantry, running the length of the room. For other equipment, see list specific to each zone.

OCCUPANTS: +/- 145 persons based on Lab and Studio Multipliers found in THEC Space Allocation Guidelines, Table 18

NASF: 14,560 sf (including all fabrication zones subsequently listed)

HVAC: Heating only makeup air, high volume low speed fans, unit or infrared heaters, and summer ventilation

ILLUMINATION: Pendant mounted LED lighting, located above gantry

ELECTRICAL: Flexible power distribution; Power and equipment shutoff switches to be on unistrut frame running behind rows of equipment

PLUMBING: Water to eye wash stations

FUME HOOD: N/A

VIBRATION: Vibration isolation on fans

ACoustical: Sound absorbing panels within roof structure above

GAS USE: Unit or infrared heaters

COMMUNICATION: WiFi and data

SECURITY / FIRE: Fire Alarm notification devices per currently enforced code

FLOOR: Polished concrete slab

WALLS: Painted GWB (impact resistant) with rubber base

CEILINGS: Exposed structure

DOORS: Overhead doors

WINDOWS: North-facing clerestory, glazing within overhead doors
FABRICATION ZONE 01 (STAGING)
- NASF: 760 sf
  1A Material Storage
  1B Fork Lift

FABRICATION ZONE 02 (FORMING)
- NASF: 800 sf
  2A Box Brake
  2B Flywheel Single Stroke Press
  2C Baleigh BP-7098 CNC Hydraulic Press Brake
  2D Mobile Work Table

FABRICATION ZONE 03 (CUTTING / BURNING)
- NASF: 140 sf
  3A 4X4 Plasma Cutter
  3B Horizontal Band Saw
  3C Vertical Band Saw
  3D Waterjet Cutting Machine
  3E Mobile Work Table

This diagram is conceptual in nature and shows equipment layout for verification of available square footage only. Equipment layout is to be coordinated with stakeholders’ input during Schematic Design.
This diagram is conceptual in nature and shows equipment layout for verification of available square footage only. Equipment layout is to be coordinated with stakeholders’ input during Schematic Design.
FABRICATION ZONE 05 (MACHINING)

NASF: 2880 sf
5A Haas Toolroom Lathe & Mill
5B Manual Mill
5C Drill Press
5D Mitsubishi MD+ Pro III Wire EDM
5E Thermwood Model 70 5-Axis Router
5F Haas VF-3 CNC
5G Haas ST-10 CNC
5H Lucifer Series 8000 AM Heat Treat Furnace
5I Sharpe Engine Lathe
5J Sharpe Manual Knee Style Mill
5K Mobile Work Table

FABRICATION ZONE 06 (DIGITAL)

NASF: 1200 sf
6A Next Engine 3D Laser Scanner
6B Matsuura Lumex Laser Sintering
FABRICATION ZONE 07 (TCAT DEDICATED)

**NASF:** 960 sf  
**EQUIPMENT INCLUDES:**  
Siemens Trainer  
Robotics  
Mech Drive  
Hydraulics  
Motor Controls  
CNC Trainers  
Electrical Wiring Trainer

FABRICATION ZONE 08 (DYERSBURG STATE DEDICATED)

**NASF:** 2880 sf  
**EQUIPMENT INCLUDES:**  
Virtual Welders  
PLC Trainer & Table  
CPU'S on Versa Tables  
Piping Fabrication Trainer  
Mechanical Drive 1-3 Trainers  
Pneumatic Control System  
Hydraulic Control System  
Power Distribution System  
Electric Control Wiring Station  
Electric Motor Control System  
Programming Controller System  
Process Control System  
LR Mate 200IC Robot

This diagram is conceptual in nature and shows equipment layout for verification of available square footage only. Equipment layout is to be coordinated with stakeholders’ input during Schematic Design.
FABRICATION ZONE 09 (FUTURE EXPANSION)

NASF: 1760 sf

This diagram is conceptual in nature and shows equipment layout for verification of available square footage only. Equipment layout is to be coordinated with stakeholders’ input during Schematic Design.
C101 — LOADING / UNLOADING

Large open bay sized to accommodate a 53 foot trailer. This space includes access to the permanent 10-ton gantry which runs the length of the room.

| OCCUPANTS: | N/A |
| NASF: | 1,920 sf |
| HVAC: | Heating only makeup air, high volume low speed fans, unit or infrared heaters, and summer ventilation |
| ILLUMINATION: | Pendant mounted LED lighting, located above gantry |
| ELECTRICAL: | Flexible power distribution to accommodate equipment locations |
| PLUMBING: | Water to eye wash stations |
| FUME HOOD: | N/A |
| VIBRATION: | Vibration isolation on fans |
| ACOUSTICAL: | Sound absorbing panels within roof structure above |
| GAS USE: | Unit or infrared heaters |
| COMMUNICATION: | WiFi and data |
| SECURITY / FIRE: | Fire Alarm notification devices per currently enforced code |
| FLOOR: | Polished concrete slab |
| WALLS: | Painted GWB (impact-resistant) |
| CEILINGS: | Exposed structure |
| DOORS: | Overhead doors |
| WINDOWS: | North-facing clerestory, glazing within overhead doors |
C102 — UTM STORAGE

This storage room dedicated to UT Martin include utility shelving and fire-rated storage cabinets.

<table>
<thead>
<tr>
<th>OCCUPANTS:</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF:</td>
<td>1500 sf</td>
</tr>
<tr>
<td>HVAC:</td>
<td>Unit heaters</td>
</tr>
<tr>
<td>ILLUMINATION:</td>
<td>LED lighting</td>
</tr>
<tr>
<td>ELECTRICAL:</td>
<td>Electrical outlets per currently enforced codes</td>
</tr>
<tr>
<td>PLUMBING:</td>
<td>N/A</td>
</tr>
<tr>
<td>FUME HOOD:</td>
<td>N/A</td>
</tr>
<tr>
<td>VIBRATION:</td>
<td>N/A</td>
</tr>
<tr>
<td>ACOUSTICAL:</td>
<td>N/A</td>
</tr>
<tr>
<td>GAS USE:</td>
<td>Heaters</td>
</tr>
<tr>
<td>COMMUNICATION:</td>
<td>WiFi</td>
</tr>
<tr>
<td>SECURITY / FIRE:</td>
<td>Fire Alarm notification devices per currently enforced code</td>
</tr>
<tr>
<td>FLOOR:</td>
<td>Polished concrete slab</td>
</tr>
<tr>
<td>WALLS:</td>
<td>Painted GWB (impact-resistant)</td>
</tr>
<tr>
<td>CEILINGS:</td>
<td>Exposed structure</td>
</tr>
<tr>
<td>DOORS:</td>
<td>Steel doors</td>
</tr>
<tr>
<td>WINDOWS:</td>
<td>N/A</td>
</tr>
</tbody>
</table>
C103 — COLD ROOM

Open area at 45°F set aside for the fabrication and use of equipment in lower temperatures. Space is to have dedicated loading connected to exterior.

Space includes storage cabinetry, mobile benches, and condensing unit for refrigeration equipment.

**OCCUPANTS:** 25 persons

**NASF:** 1,800 sf

**HVAC:** Dedicated refrigeration equipment to maintain 45°F

**ILLUMINATION:** LED lighting

**ELECTRICAL:** Electrical outlets per currently enforced codes

**PLUMBING:** Condensate drains

**FUME HOOD:** N/A

**VIBRATION:** N/A

**ACOUSTICAL:** N/A

**GAS USE:** N/A

**COMMUNICATION:** N/A

**SECURITY / FIRE:** Fire Alarm notification devices per currently enforced code

**FLOOR:** Polished concrete slab (insulated)

**WALLS:** Painted GWB (impact-resistant)

**CEILINGS:** Acoustical tile (scrubbable)

**DOORS:** Insulated steel and overhead doors

**WINDOWS:** N/A
## C104-111 — TEAM LABS

Work area dedicated to specific student team. The Fabrication Lab and Outdoor Work space is accessed thru overhead doors.

<table>
<thead>
<tr>
<th>OCCUPANTS:</th>
<th>20 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF:</td>
<td>480 sf</td>
</tr>
<tr>
<td>HVAC:</td>
<td>Heating only makeup air, high volume low speed fans, unit or infrared heaters, and summer ventilation</td>
</tr>
<tr>
<td>ILLUMINATION:</td>
<td>LED lighting</td>
</tr>
<tr>
<td>ELECTRICAL:</td>
<td>Electrical outlets per currently enforced codes</td>
</tr>
<tr>
<td>PLUMBING:</td>
<td>N/A</td>
</tr>
<tr>
<td>FUME HOOD:</td>
<td>N/A</td>
</tr>
<tr>
<td>VIBRATION:</td>
<td>Vibration isolation on fans</td>
</tr>
<tr>
<td>ACOUSTICAL:</td>
<td>Sound absorbing panels in structure above</td>
</tr>
<tr>
<td>GAS USE:</td>
<td>Unit or infrared heaters</td>
</tr>
<tr>
<td>COMMUNICATION:</td>
<td>WiFi</td>
</tr>
<tr>
<td>SECURITY / FIRE:</td>
<td>Fire Alarm notification devices per currently enforced code</td>
</tr>
<tr>
<td>FLOOR:</td>
<td>Polished concrete</td>
</tr>
<tr>
<td>WALLS:</td>
<td>Painted GWB (impact-resistant)</td>
</tr>
<tr>
<td>CEILINGS:</td>
<td>Exposed structure</td>
</tr>
<tr>
<td>DOORS:</td>
<td>Overhead doors</td>
</tr>
<tr>
<td>WINDOWS:</td>
<td>North-facing clerestory, glazing within overhead doors</td>
</tr>
</tbody>
</table>
C112 — UTILITY / JANITOR

Utility room dedicated to Fabrication Lab. This space includes makeup air unit and an air compressor for the foundry and shop.

| OCCUPANTS: | N/A |
| NASF:      | 480 sf |
| HVAC:      | Unit heater |
| ILLUMINATION: | LED lighting |
| ELECTRICAL: | Electrical outlets per currently enforced codes and power for equipment |
| PLUMBING:  | Floor drains and condensate drains; mop sink and utility faucet |
| FUME HOOD: | N/A |
| VIBRATION: | N/A |
| ACOUSTICAL: | N/A |
| GAS USE:   | N/A |
| COMMUNICATION: | N/A |
| SECURITY / FIRE: | Fire Alarm detection devices per currently enforced code |

| FLOOR: | Concrete slab |
| WALLS: | Painted GWB with rubber base |
| CEILINGS: | Exposed to structure |
| DOORS: | Steel doors |
| WINDOWS: | N/A |
C113-114 — RESTROOMS

Restroom space serving Fabrication Lab.

- **OCCUPANTS:** N/A
- **NASF:** 360 sf, each
- **HVAC:** Code required exhaust. Conditioned air supplied from lab managers fan coil unit. Space pressure should be negative to adjacent spaces.
- **ILLUMINATION:** LED lighting
- **ELECTRICAL:** Electrical outlets per currently enforced codes
- **PLUMBING:** Water closets, urinals, lavatories, and drinking fountains adjacent
- **FUME HOOD:** N/A
- **VIBRATION:** Vibration isolation on exhaust fan
- **ACOUSTICAL:** Partitions to have Sound Transmission Class rating of STC-40
- **GAS USE:** N/A
- **COMMUNICATION:** N/A
- **SECURITY / FIRE:** Fire Alarm notification devices per currently enforced codes
- **FLOOR:** Polished concrete
- **WALLS:** Painted GWB (scrubbable) with rubber base
- **CEILINGS:** Acoustical tile
- **DOORS:** Steel doors
- **WINDOWS:** N/A
C115 — FINISHING

Fabrication space dedicated to painting and finishing. Fire suppression system layout is to have increased concentration. This space includes a paint oven and medium-sized paint booth.

**OCCUPANTS:** N/A
**NASF:** 1,380 sf
**HVAC:** Exhaust for paint booth, heating only makeup air, unit heater, and summer ventilation. Room shall be negative to adjacent spaces at all times.
**ILLUMINATION:** LED lighting
**ELECTRICAL:** Flexible power distribution to accommodate equipment locations
**PLUMBING:** N/A
**FUME HOOD:** N/A
**VIBRATION:** N/A
**ACOUSTICAL:** N/A
**GAS USE:** Unit or infrared heaters
**COMMUNICATION:** WiFi
**SECURITY / FIRE:** Fire Alarm notification devices per currently enforced code
**FLOOR:** Polished concrete slab
**WALLS:** Painted GWB (impact-resistant)
**CEILINGS:** Exposed structure
**DOORS:** Steel; overhead door connected to Fabrication Lab
**WINDOWS:** Exterior windows
C116 — PLASTICS

Fabrication space dedicated to plastics, physically separate from other spaces. Fire suppression system layout is to have increased concentration.

<table>
<thead>
<tr>
<th>OCCUPANTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
</tr>
<tr>
<td>NASF:</td>
</tr>
<tr>
<td>480 sf</td>
</tr>
<tr>
<td>HVAC:</td>
</tr>
<tr>
<td>Exhaust for space pressurization, heating only makeup air, unit heater, and summer ventilation. Room shall be negative to adjacent spaces at all times.</td>
</tr>
<tr>
<td>ILLUMINATION:</td>
</tr>
<tr>
<td>LED lighting</td>
</tr>
<tr>
<td>ELECTRICAL:</td>
</tr>
<tr>
<td>Flexible power distribution to accommodate equipment locations</td>
</tr>
<tr>
<td>PLUMBING:</td>
</tr>
<tr>
<td>N/A</td>
</tr>
<tr>
<td>FUME HOOD:</td>
</tr>
<tr>
<td>N/A</td>
</tr>
<tr>
<td>VIBRATION:</td>
</tr>
<tr>
<td>N/A</td>
</tr>
<tr>
<td>ACOUSTICAL:</td>
</tr>
<tr>
<td>N/A</td>
</tr>
<tr>
<td>GAS USE:</td>
</tr>
<tr>
<td>Unit or infrared heaters</td>
</tr>
<tr>
<td>COMMUNICATION:</td>
</tr>
<tr>
<td>WiFi</td>
</tr>
<tr>
<td>SECURITY / FIRE:</td>
</tr>
<tr>
<td>Fire Alarm notification devices per currently enforced code</td>
</tr>
<tr>
<td>FLOOR:</td>
</tr>
<tr>
<td>Polished concrete slab</td>
</tr>
<tr>
<td>WALLS:</td>
</tr>
<tr>
<td>Painted GWB (impact-resistant)</td>
</tr>
<tr>
<td>CEILINGS:</td>
</tr>
<tr>
<td>Exposed structure</td>
</tr>
<tr>
<td>DOORS:</td>
</tr>
<tr>
<td>Steel door</td>
</tr>
<tr>
<td>WINDOWS:</td>
</tr>
<tr>
<td>Exterior windows</td>
</tr>
</tbody>
</table>
C117-118 — STORAGE

Storage rooms dedicated to TCAT and Dyersburg State. This space includes utility shelving and fire-rated storage cabinets

**OCCUPANTS:** N/A
**NASF:** 360 sf

**HVAC:** Unit heaters
**ILLUMINATION:** LED lighting
**ELECTRICAL:** Electrical outlets per currently enforced codes
**PLUMBING:** N/A
**FUME HOOD:** N/A
**VIBRATION:** N/A
**ACOUSTICAL:** N/A
**GAS USE:** Unit or infrared heaters
**COMMUNICATION:** WiFi
**SECURITY / FIRE:** Fire Alarm notification devices per currently enforced code

**FLOOR:** Polished concrete slab
**WALLS:** Painted GWB (impact-resistant)
**CEILINGS:** Exposed structure
**DOORS:** Steel doors
**WINDOWS:** N/A
C200 — MEZZANINE

Mezzanine offering views of entire C100 Fabrication Lab to the inside, outdoor team lab spaces to the outside.

**OCCUPANTS:** 50-100 persons during tours

**NASF:** 4,400 sf

**HVAC:** Heating only makeup air, high volume low speed fans, unit or infrared heaters, and summer ventilation

**ILLUMINATION:** Pendant mounted LED lighting, located above gantry

**ELECTRICAL:** Electrical outlets per currently enforced codes

**PLUMBING:** N/A

**FUME HOOD:** N/A

**VIBRATION:** Vibration isolation on fans

**ACOUSTICAL:** Sound absorbing panels within roof structure above

**GAS USE:** Unit or infrared heaters

**COMMUNICATION:** WiFi and data

**SECURITY / FIRE:** Fire Alarm notification devices per currently enforced code

**FLOOR:** Painted steel decking

**WALLS:** Painted GWB (impact-resistant)

**CEILINGS:** Exposed structure

**DOORS:** Overhead doors

**WINDOWS:** North-facing clerestory, exterior windows
C201 — LAB MANAGER

Office and meeting space for Lab Manager, offering views of entire C100 Fabrication Lab.

<table>
<thead>
<tr>
<th>OCCUPANTS:</th>
<th>4 persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF:</td>
<td>360 sf</td>
</tr>
<tr>
<td>HVAC:</td>
<td>Chilled water and hot water fan coil unit. Space pressure should be positive to adjacent spaces</td>
</tr>
<tr>
<td>ILLUMINATION:</td>
<td>LED lighting</td>
</tr>
<tr>
<td>ELECTRICAL:</td>
<td>Electrical outlets per currently enforced codes</td>
</tr>
<tr>
<td>PLUMBING:</td>
<td>N/A</td>
</tr>
<tr>
<td>FUME HOOD:</td>
<td>N/A</td>
</tr>
<tr>
<td>VIBRATION:</td>
<td>Vibration: Vibration isolation on AHU fan</td>
</tr>
<tr>
<td>ACOUSTICAL:</td>
<td>Acoustical: Partitions to have Sound Transmission Class rating of STC-45</td>
</tr>
<tr>
<td>GAS USE:</td>
<td>N/A</td>
</tr>
<tr>
<td>COMMUNICATION:</td>
<td>WiFi and data</td>
</tr>
<tr>
<td>SECURITY / FIRE:</td>
<td>Fire Alarm notification devices per currently enforced code</td>
</tr>
<tr>
<td>FLOOR:</td>
<td>Rubber tile</td>
</tr>
<tr>
<td>WALLS:</td>
<td>Painted GWB with rubber base</td>
</tr>
<tr>
<td>CEILINGS:</td>
<td>Painted GWB</td>
</tr>
<tr>
<td>DOORS:</td>
<td>Steel door</td>
</tr>
<tr>
<td>WINDOWS:</td>
<td>Interior storefront</td>
</tr>
</tbody>
</table>
D100 — FOUNDRY

Foundry and adjacent outdoor yard. Note that water-based fire suppression system

| OCCUPANTS: | 30 students |
| NASF: | 1,760 sf |
| HVAC: | Heating only makeup air unit and unit heaters, and general exhaust and hood exhaust; Foundry should remain negative to any adjacent spaces |
| ILLUMINATION: | LED lighting |
| ELECTRICAL: | Electrical outlets per currently enforced codes and dedicated outlets for foundry equipment; 120V AC power for sanding molding station(s) |
| PLUMBING: | Compressed air up to 100psi; conditioned water, filtered for minerals or closed loop water cooling system |
| FUME HOOD: | Provide hood for foundry |
| VIBRATION: | N/A |
| ACOUSTICAL: | N/A |
| GAS USE: | Unit or infrared heaters |
| COMMUNICATION: | N/A |
| SECURITY / FIRE: | Fire Alarm notification devices per currently enforced code |
| FLOOR: | Anhydrous brick, completely absent of concrete at pouring floor; Concrete slab elsewhere |
| WALLS: | Anhydrous brick lining interior face of walls |
| CEILINGS: | Exposed structure |
| DOORS: | Steel doors; overhead doors to dedicated loading and adjacent outdoor yard |
| WINDOWS: | N/A |
(1) SAND RAMMER AFS
(2) TUBE FILLER ACCESSORY
(3) ELECTRONIC UNIVERSAL SAND STRENGTH MACHINE
(4) DIGITAL ABSOLUTE PERMMETER
(5) LABORATORY SIFTER
(6) TESTING SIEVE
(7) METHYLENE BLUE CLAY TESTER
(8) LABORATORY MULLER
(9) LABORATORY CORE SAND MIXER
(10) ELECTRONIC MOLD HARDNESS TESTER
**OUTDOOR — PARKING**

Concrete paved parking lot for use by students, staff, and guests; 50 spaces (48 standard, 2 ADA). City-required landscaping will be included.

<table>
<thead>
<tr>
<th>OCCUPANTS:</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF:</td>
<td>16,200 sf</td>
</tr>
<tr>
<td>HVAC:</td>
<td>N/A</td>
</tr>
<tr>
<td>ILLUMINATION:</td>
<td>Pole mounted, LED Area Lighting</td>
</tr>
<tr>
<td>ELECTRICAL:</td>
<td>Electrical outlets per currently enforced codes</td>
</tr>
<tr>
<td>PLUMBING:</td>
<td>N/A</td>
</tr>
<tr>
<td>FUME HOOD:</td>
<td>N/A</td>
</tr>
<tr>
<td>VIBRATION:</td>
<td>N/A</td>
</tr>
<tr>
<td>ACOUSTICAL:</td>
<td>N/A</td>
</tr>
<tr>
<td>GAS USE:</td>
<td>N/A</td>
</tr>
<tr>
<td>COMMUNICATION:</td>
<td>N/A</td>
</tr>
<tr>
<td>SECURITY / FIRE:</td>
<td>Security and Fire Alarm: security cameras</td>
</tr>
<tr>
<td>FLOOR:</td>
<td>Concrete paving</td>
</tr>
<tr>
<td>WALLS:</td>
<td>N/A</td>
</tr>
<tr>
<td>CEILINGS:</td>
<td>N/A</td>
</tr>
<tr>
<td>DOORS:</td>
<td>N/A</td>
</tr>
<tr>
<td>WINDOWS:</td>
<td>N/A</td>
</tr>
</tbody>
</table>
OUTDOOR — ENTRANCE

Covered, exterior area with visual connection to Lobby, Courtyard, Fabrication Lab, Entrepreneur Center. This area is for communicating the “brand” of the facility, wayfinding, and social interactions.

| OCCUPANTS: | N/A |
| NASF:      | 2,160 sf |
| HVAC:      | High volume low speed fans |
| ILLUMINATION: | Illumination: LED Lighting |
| ELECTRICAL: | Electrical: Electrical outlets for convenience |
| PLUMBING:  | N/A |
| FUME HOOD: | N/A |
| VIBRATION: | N/A |
| ACOUSTICAL: | N/A |
| GAS USE:   | N/A |
| COMMUNICATION: | N/A |
| SECURITY / FIRE: | Security and Fire Alarm: Security cameras and fire Alarm detection devices per currently enforced code |
| FLOOR:     | Concrete slab and landscaping |
| WALLS:     | N/A |
| CEILINGS:  | Roof structure |
| DOORS:     | N/A |
| WINDOWS:   | N/A |
OUTDOOR — COURTYARD

Open, exterior area between Lounge and Fabrication Lab. Landscaped portion used for student social interaction. Space is available for formal or informal display of student work.

- OCCUPANTS: N/A
- NASF: 16,600 sf
- HVAC: N/A
- ILLUMINATION: LED landscape lighting
- ELECTRICAL: Electrical outlets per currently enforced codes
- PLUMBING: Hose bibs
- FUME HOOD: N/A
- VIBRATION: N/A
- ACOUSTICAL: N/A
- GAS USE: N/A
- COMMUNICATION: N/A
- SECURITY / FIRE: Security cameras
- FLOOR: Concrete paving and landscaping
- WALLS: N/A
- CEILINGS: N/A
- DOORS: N/A
- WINDOWS: N/A
OUTDOOR — TRASH / RECYCLING

Covered, concrete paved area for trash and recycling dumpsters, and for steel scraps. The area is to be fenced-in, with gates accessing the Loading / Unloading area.

OCCUPANTS: N/A
NASF: 960 sf

HVAC: N/A
ILLUMINATION: LED lighting
ELECTRICAL: Electrical outlets per currently enforced codes
PLUMBING: Hose bib
FUME HOOD: N/A
VIBRATION: N/A
ACOUSTICAL: N/A
GAS USE: N/A
COMMUNICATION: N/A
SECURITY / FIRE: Fire Alarm detection devices per currently enforced code

FLOOR: Concrete paving
WALLS: N/A
CEILINGS: Roof structure
DOORS: N/A
WINDOWS: N/A
OUTDOOR — TRAILER STORAGE

Covered, concrete paved area for the storage of UT Martin tractor and trailers. The area is to be accessed from the Loading / Unloading area.

<table>
<thead>
<tr>
<th>OCCUPANTS:</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF:</td>
<td>1,950 sf</td>
</tr>
<tr>
<td>HVAC:</td>
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</tr>
<tr>
<td>ILLUMINATION:</td>
<td>LED Lighting</td>
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<tr>
<td>ELECTRICAL:</td>
<td>Electrical: Electrical outlets per currently enforced codes</td>
</tr>
<tr>
<td>PLUMBING:</td>
<td>Hose bib</td>
</tr>
<tr>
<td>FUME HOOD:</td>
<td>N/A</td>
</tr>
<tr>
<td>VIBRATION:</td>
<td>N/A</td>
</tr>
<tr>
<td>ACOUSTICAL:</td>
<td>N/A</td>
</tr>
<tr>
<td>GAS USE:</td>
<td>N/A</td>
</tr>
<tr>
<td>COMMUNICATION:</td>
<td>N/A</td>
</tr>
<tr>
<td>SECURITY / FIRE:</td>
<td>Security and Fire Alarm: Fire Alarm detection devices per currently enforced code</td>
</tr>
<tr>
<td>FLOOR:</td>
<td>Concrete paving</td>
</tr>
<tr>
<td>WALLS:</td>
<td>N/A</td>
</tr>
<tr>
<td>CEILINGS:</td>
<td>Roof structure</td>
</tr>
<tr>
<td>DOORS:</td>
<td>N/A</td>
</tr>
<tr>
<td>WINDOWS:</td>
<td>N/A</td>
</tr>
</tbody>
</table>
**OUTDOOR — WORK AREAS**

Covered, concrete paved work area, each dedicated to adjacent student Team Lab. Students access the space from the Team Lab via overhead door. Area is enclosed with fencing with gate located at the end of space to allow access to Test Track and Rocket Testing.

| OCCUPANTS: | 20 (the same 20 students from the adjacent Engineering Lab) |
| NASF: | 720 sf |
| HVAC: | High volume low speed fans |
| ILLUMINATION: | LED Lighting |
| ELECTRICAL: | Electrical outlets per currently enforced codes |
| PLUMBING: | Hose bib |
| FUME HOOD: | N/A |
| VIBRATION: | N/A |
| ACOUSTICAL: | N/A |
| GAS USE: | N/A |
| COMMUNICATION: | N/A |
| SECURITY / FIRE: | Fire Alarm detection devices per currently enforced code |
| FLOOR: | Concrete paving |
| WALLS: | Roof structure |
| CEILINGS: | N/A |
| DOORS: | N/A |
| WINDOWS: | N/A |
**OUTDOOR — TEST TRACK**

Outdoor field available for students’ use.

| OCCUPANTS: | 20 (the same 20 students from the adjacent Engineering Lab) |
| NASF: | Outdoor field |
| HVAC: | N/A |
| ILLUMINATION: | Pole mounted LED area lighting |
| ELECTRICAL: | N/A |
| PLUMBING: | N/A |
| FUME HOOD: | N/A |
| VIBRATION: | N/A |
| ACOUSTICAL: | N/A |
| GAS USE: | N/A |
| COMMUNICATION: | N/A |
| SECURITY / FIRE: | Security cameras |
| FLOOR: | N/A |
| WALLS: | N/A |
| CEILINGS: | N/A |
| DOORS: | N/A |
| WINDOWS: | N/A |
OUTDOOR — ROCKET TEST

Outdoor field available for students’ use.

**OCCUPANTS:** 20 (the same 20 students from the adjacent Engineering Lab)

**NASF:** Outdoor field

**HVAC:** N/A

**ILLUMINATION:** Pole mounted LED area lighting

**ELECTRICAL:** N/A

**PLUMBING:** N/A

**FUME HOOD:** N/A

**VIBRATION:** N/A

**ACOUSTICAL:** N/A

**GAS USE:** N/A

**COMMUNICATION:** N/A

**SECURITY / FIRE:** Security cameras

**FLOOR:** N/A

**WALLS:** N/A

**CEILINGS:** N/A

**DOORS:** N/A

**WINDOWS:** N/A
## OUTDOOR — MATERIAL STORAGE

Covered, outdoor material storage

| OCCUPANTS:  | N/A |
| NASF:       | 1,580 sf |
| HVAC:       | N/A |
| ILLUMINATION: | Pole mounted LED area lighting |
| ELECTRICAL: | N/A |
| PLUMBING:   | N/A |
| FUME HOOD:  | N/A |
| VIBRATION:  | N/A |
| ACOUSTICAL: | N/A |
| GAS USE:    | N/A |
| COMMUNICATION: | N/A |
| SECURITY / FIRE: | Security cameras |
| FLOOR:      | N/A |
| WALLS:      | N/A |
| CEILINGS:   | N/A |
| DOORS:      | N/A |
| WINDOWS:    | N/A |
BEST VALUE PROPOSITION

SELECTED OPTIONS

Using the quick check system for evaluating a range of Possible Program Relationship options, the two most beneficial options (“E” and “I”) have been highlighted as offering the greatest potential to meet the criteria (Clear Separation, Cross Ventilation, Outdoor Space, Program Flexibility) and the aspirational goals of the project established at the beginning of this book. Option “E” was selected for further examination as a Test Fit shown on the following pages.
TEST FIT PLAN

While it may look like a Schematic Design floor plan, it isn’t meant to be. The Test Fit verifies adjacencies, confirms core project values and goals, and provides just one idea of where Schematic Design may begin. As witnessed during stakeholder meetings, the Test Fit conjures more valuable feedback and debate than a bubble program diagram alone.

This Test Fit exhibits the potential to meet the criteria previously established (Clear Separation, Cross Ventilation, Outdoor Space, Program Flexibility). The program is arranged as a makerspace “campus”, with dirty/loud and clean/quiet having equal prominence when viewed from the street and connected by a covered walk. The courtyard is a cloister providing flexible outdoor space arranged around shop (making), socializing / selling ideas (communicating), classroom (thinking). These core assets are visually connected, providing a complete picture of all the Garage’s benefits.

Other Test Fits may also inform Schematic Design per the Program Relationships exercise earlier in this book. The design team selected for this project must work with the stakeholders to study multiple strategies.
VEHICULAR CIRCULATION OPTIONS

The Test Fit previously shown sparked a productive conversation concerning how a large truck might interact with the facility / campus. The following diagrams show three primary delivery methods based on the Test Fit that Schematic Design might explore. Ultimately, the Test Fit can accommodate any of the following options.

The diagrams on the adjacent page are based on a 53 foot, flat-bed truck. During programming interviews, it was noted that a delivery of this size would be “rare”, however the project should be designed to accommodate the occurrence. The Test Fit includes a 12 foot wide circulation aisle scaled for small truck use, which can be loaded / unloaded from the rear.

Option 01: As shown in the Test Fit and the Preliminary Budget Analysis.

Option 02: Large truck drives through the width of the facility. The longitudinal circulation width remains 12 feet wide, thus there is no square footage increase. This requires the large truck to navigate through the parking lot. This option would add approximately $60,000 to Preliminary Budget Analysis for additional paving and curbs.

Option 03: Large truck drives the length of the facility. The circulation aisle widened to 24 feet to accommodate side loading / unloading of flat bed truck. This option adds approximately 8,500 square feet to the Test Fit. This also requires the large truck to navigate through the parking lot. This option adds approximately $690,000 to Preliminary Budget Analysis for additional paving, curbs, thickened interior slab, structure, siding, roofing, HVAC, and fire suppression.
POSSIBLE ROOF TYPES

- GABLE
- ARCH
- SHED
- LANTERN
GABLE

Sierra House
Steyn Studio

ARCH

Warehouse & Office
B+O Architectuur en Interieur

SHED

Villacelama Multisport Centre
Quirós Presa
This pairing utilizes two variations of the gabled sawtooth roof type. The varying scales of sawtooth roof allow for varied control of the passive systems such as roof glazing consistency and operability.

GABLE SAWTOOTH

This pairing utilizes two variations of the gabled sawtooth roof type though perpendicular in orientation. With the courtyard in between the two buildings, the long bar sawtooth roof is able to act as a billboard while also allowing for visual variation from the street.

GABLE SAWTOOTH MIX

This pairing utilizes two variations of the arch sawtooth roof type. With the same scale of sawtooth, the building is able to be seen as a singular gesture meeting multiple programming needs.

ARCH SAWTOOTH

This pairing utilizes the same North facing sawtooth for each lantern. This minimizes the amount of glazing and separates the building into 3 programmable structural bays. With the same scale of sawtooth, the building is able to be seen as two identical buildings meeting different programatic needs.

LANTERN SAWTOOTH
This pairing utilizes two variations of the shed type roof, one sawtooth and the other alternating. The pairing allows for visual variety from the street as well as the approach by foot. Despite the variety in pitch, the roofs blend into each other visually at their perceived junction.

This pairing utilizes two variations of the gabled sawtooth roof type. With the same scale and orientation of sawtooth, the building is able to be seen as a singular gesture meeting multiple programming needs.

This pairing utilizes two variations of the arch sawtooth roof type. With the same scale and orientation of sawtooth, the building is able to be seen as a singular gesture meeting multiple programming needs. Using a slightly smaller sawtooth profile allows for more program flexibility within the elongated sawtooth building.

This pairing utilizes two variations of the lantern roof type. Using both sawtooth and a long lifted roof profile, the light is able to always come from the North.
OPTION E1

GABLE SAWTOOTH

This pairing utilizes two variations of the gabled sawtooth roof type. The varying scales of sawtooth roof allow for varied control of the passive systems such as roof glazing consistency and operability.

1. NORTH LIGHT FROM ABOVE

Using two different scales of North facing sawtooth roof, the separate structures are able to achieve different qualities and levels of light from above.

2. COLUMN FREE SPACE

Both the East & West buildings are oriented the same way with the trusses spaning the short distance of the building. Depending on loading and overall span, this should allow the buildings to remain largely column free.

3. CROSS VENTILATION EFFICIENCY

Relying on the sawtooth glazing to be operable, the building has natural cross ventilation. Prevailing winds during the cooling months show that the building is ideally oriented for natural ventilation not only around the building but within.
OPTON E2

GABLE SAWTOOTH MIX

This pairing utilizes two variations of the gabled sawtooth roof type though perpendicular in orientation. With the courtyard in between the two buildings, the long bar sawtooth roof is able to act as a billboard while also allowing for visual variation from the street.

1. NORTH LIGHT FROM ABOVE

Using two different orientations of sawtooth roof, the separate structures are able to achieve different qualities and levels of light from above at different times of the day. The lighting in the West building becomes less consistent.

2. COLUMN FREE SPACE

With the shift in orientation for the West building, providing a column free space becomes more difficult, though possible. The East building is able to easily remain column free.

3. CROSS VENTILATION EFFICIENCY

Using two different orientations of sawtooth roof, the separate structures’ ability to naturally ventilate become less consistent with each other. The east building remains ideally oriented to the prevailing winds in the months requiring cooling. This may not be an issue if one of the buildings does not require natural ventilation.
OPTION E3

ARCH SAWTOOTH
This pairing utilizes two variations of the arch sawtooth roof type. With the same scale of sawtooth, the building is able to be seen as a singular gesture meeting multiple programming needs.

1. NORTH LIGHT FROM ABOVE
Using the same sawtooth profile across both East & West buildings allows for ultimate flexibility between buildings lighting wise. Both will receive the same amount of light at similar quality.

2. COLUMN FREE SPACE
Both the East & West buildings are oriented the same way with the trusses spanning the short distance of the building. Depending on loading and overall span, this should allow the buildings to remain largely column free.

3. CROSS VENTILATION EFFICIENCY
Relying on the sawtooth glazing to be operable, the building has natural cross ventilation. Prevailing winds during the cooling months show that the building is ideally oriented for natural ventilation not only around the building but within.
OPTION E4

LANTERN SAWTOOTH

This pairing utilizes the same North facing sawtooth for each lantern. This minimizes the amount of glazing and separates the building into 3 programmable structural bays. With the same scale of sawtooth, the building is able to be seen as two identical buildings meeting different programatic needs.

1. NORTH LIGHT FROM ABOVE

Using the same sawtooth profile across both East & West buildings allows for ultimate flexibility between buildings lighting wise. Both will receive the same amount of light at similar quality.

2. COLUMN FREE SPACE

Both the East & West buildings are oriented the same way with the trusses spanning the short distance of the building. However, the lantern will likely need additional support by way of 2 rows of interior columns.

3. CROSS VENTILATION EFFICIENCY

Relying on the sawtooth glazing to be operable, the building has natural cross ventilation. Prevailing winds during the cooling months show that the building is ideally oriented for natural ventilation not only around the building but within.
**OPTION I1**

**SHED MIX**
This pairing utilizes two variations of the shed type roof, one sawtooth and the other alternating. The pairing allows for visual variety from the street as well as the approach by foot. Despite the variety in pitch, the roofs blend into each other visually at their perceived junction.

**1. NORTH LIGHT FROM ABOVE**
While having an interesting variation of roof line, this shed roof design will provide an inconsistent level of North light from above where available at all.

**2. COLUMN FREE SPACE**
Though not similar, structurally, both the East & West buildings’ trusses are oriented toward the short span of the building. Depending on loading and overall width of the building, this should allow the buildings to remain largely column free.

**3. CROSS VENTILATION EFFICIENCY**
The outdoor spaces in this option are similarly defined as the spaces in option J. As with all options creating more than one defined outdoor space, there is the opportunity to further define these spaces as “clean” and “dirty,” mirroring the straightforward program separation already set forth.
OPTION I2

GABLE SAWTOOTH

This pairing utilizes two variations of the gabled sawtooth roof type. With the same scale and orientation of sawtooth, the building is able to be seen as a singular gesture meeting multiple programming needs.

1. NORTH LIGHT FROM ABOVE

Similar to option J, this option not only requires careful attention to be paid to noise and sound attenuation, but also could require one to cross through an incompatible program space to get to another.

2. COLUMN FREE SPACE

This option has similar drawbacks to option J. While better than some, a long narrow building massing helps maximize cross ventilation in a climate like Martin’s.

3. CROSS VENTILATION EFFICIENCY

The outdoor spaces in this option are similarly defined as the spaces in option J. As with all options creating more than one defined outdoor space, there is the opportunity to further define these spaces as “clean” and “dirty,” mirroring the straightforward program separation already set forth.
OPTION I3

ARCH SAWTOOTH

This pairing utilizes two variations of the arch sawtooth roof type. With the same scale and orientation of sawtooth, the building is able to be seen as a singular gesture meeting multiple programming needs. Using a slightly smaller sawtooth profile allows for more program flexibility within the elongated sawtooth building.

1. NORTH LIGHT FROM ABOVE

Similar to option J, this option not only requires careful attention to be paid to noise and sound attenuation, but also could require one to cross through an incompatible program space to get to another.

2. COLUMN FREE SPACE

This option has similar drawbacks to option J. While better than some, a long narrow building massing helps maximize cross ventilation in a climate like Martin’s.

3. CROSS VENTILATION EFFICIENCY

The outdoor spaces in this option are similarly defined as the spaces in option J. As with all options creating more than one defined outdoor space, there is the opportunity to further define these spaces as “clean” and “dirty,” mirroring the straightforward program separation already set forth.
OPTION I4

**LANTERN MIX**

This pairing utilizes two variations of the lantern roof type. Using both sawtooth and a long lifted roof profile, the light is able to always come from the North.

**1. NORTH LIGHT FROM ABOVE**

Similar to option J, this option not only requires careful attention to be paid to noise and sound attenuation, but also could require one to cross through an incompatible program space to get to another.

**2. COLUMN FREE SPACE**

This option has similar drawbacks to option J. While better than some, a long narrow building massing helps maximize cross ventilation in a climate like Martin’s.

**3. CROSS VENTILATION EFFICIENCY**

The outdoor spaces in this option are similarly defined as the spaces in option J. As with all options creating more than one defined outdoor space, there is the opportunity to further define these spaces as “clean” and “dirty,” mirroring the straightforward program separation already set forth.
ROOF TYPE PROPOSITION

SELECTED OPTIONS

A preliminary study of roof styles and composition is important to include in a Programming Document to help explore and evaluate the performative impact of various approaches to a highly repetitive roof form. This study may positively inform the facility’s identity, economic construction strategies, the potential to passively cross ventilate the Fabrication Lab, and the potential to allow desirable natural light from the north.
PRELIMINARY BUDGET ANALYSIS

The preliminary budget analysis presented on the following page is based on RS Means data for New Construction, third quarter of 2019, in West Tennessee. The budget is based on the 66,000 gross square feet Test Fit. Note that the Test Fit is just one possible result of the effort to fulfill all programmatic goals requested by the stakeholder group. As Schematic Design commences, the design team and the stakeholder group may need to prioritize programmatic goals if decreasing gross square footage proves necessary.
DIVISION 03 - CONCRETE: $376,000  
DIVISION 04 - MASONRY: $25,000  
DIVISION 05 - METALS: $1,778,000  
DIVISION 06 - WOOD / PLASTIC: $50,000  
DIVISION 07 - THERMAL / MOISTURE PROTECTION: $1,153,000  
DIVISION 08 - OPENINGS: $771,000  
DIVISION 09 - FINISHES: $431,000  
DIVISION 10 - SPECIALITIES: $34,000  
DIVISION 11 - APPLIANCES: $7,000  
DIVISION 12 - FURNISHINGS: $91,000  
DIVISION 13 - SPECIAL CONSTRUCTION: $150,000  
DIVISION 14 - CONVEYING EQUIPMENT: $10,000  
DIVISION 21 - FIRE SUPPRESSION: $198,000  
DIVISION 22 - PLUMBING: $561,000  
DIVISION 23 - HVAC: $1,584,000  
DIVISION 26 - ELECTRICAL: $1,584,000  
DIVISION 31 - EARTHWORK: $127,000  
DIVISION 32 - EXTERIOR IMPROVEMENTS: $550,000  
DIVISION 33 - UTILITIES: $509,000  

**TOTAL COST OF WORK (COW):** $9,989,000  

**GENERAL CONDITIONS AND FEE (16% OF COW):** $1,598,240  

**CONTINGENCY (10% OF COW AND GENERAL CONDITIONS):** $1,158,724  

**ESCALATION (1.5 YEARS AT 5% EACH YEAR):** $955,947  

**TOTAL CONSTRUCTION COSTS:** $13,701,911  
(MACC TARGET IS $13,860,000)
D. REGULATIONS + BUILDING SYSTEMS
D. REGULATIONS + BUILDING SYSTEMS

160  D.1 General Codes + Requirements
164  D.2 Tennessee Higher Education Commission Space Guidelines
166  D.3 Tennessee High Performance Building Requirements
168  D.4 LEED Scorecard
170  D.5 Mechanical Systems
174  D.6 Electrical Systems
GENERAL CODES + REQUIREMENTS

ASSUMPTIONS

a. Gross Area:
   Interior:
   - Clean / Quiet: 17,400 GSF
   - Dirty / Loud: 32,900 GSF
   Interior + Exterior Covered:
   - Clean / Quiet: 21,600 GSF
   - Dirty / Loud: 46,900 GSF
b. All new construction.
c. Project is located in Martin, Tennessee.
d. Martin, Tennessee, is located in IECC Climate Zone 4.
e. Site is zoned ‘U’ University per map prepared by Northwest Tennessee Development District, updated November 19, 2013, although local zoning ordinances do not apply to State of Tennessee owned facilities.
f. Projects with State Commission Numbers are required to be reviewed by the Tennessee State Fire Marshall Office.

APPLICABLE CODES

1. 2006 International Building Code, with adopted local amendments
2. 2006 International Fire Code
4. 1991 Standard Mechanical Code
6. 2017 National Electrical Code
8. 2010 ADA Standards for Accessible Design
9. NFPA 10 Standard for Portable Fire Extinguishers
10. NFPA 13 Standard for Installation of Sprinkler Systems
11. NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals
12. NFPA 51B Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
15. Locally adopted amendments to items 2-14.
USE AND OCCUPANCY CLASSIFICATION
(IBC CHAPTER 3)

Assembly 'A-1' *(classrooms with occupancy 50 or greater and fixed seating)*
Assembly 'A-3'
Business 'B'
Factory Industrial ‘F-1’
Factory Industrial ‘F-2’
Storage ‘S-2’

GENERAL BUILDING HEIGHTS AND AREAS

a. Table 503 IBC provides the following available areas per floor based on construction type and maximum height allowed for each construction type.

Clean / Quiet
- Type IA: Unlimited Height; Unlimited Area.
- Type IB: 11 Stories Height; Unlimited Area.
- Type IIA: 3 Stories Height; 15,500 GSF per story.
- Type IIB: 2 Stories Height; 9,500 GSF per story.

Dirty / Loud
- Type IA: Unlimited Height; Unlimited Area.
- Type IB: 11 Stories Height; Unlimited Area.
- Type IIA: 4 Stories Height; 25,000 GSF per story.
- Type IIB: 2 Stories Height; 15,500 GSF per story.

b. It is anticipated that building is to be fully sprinkled, allowing an increase of one story (Section 504.2) and 200% of floor area (300% for a single story building) (Section 506.3). The available floor areas and maximum height can be increased as follows:

Clean / Quiet
- Type IA: Unlimited Height; Unlimited Area.
- Type IB: 12 Stories Height; Unlimited Area.
- Type IIA: 4 Stories Height; 31,000 GSF per story (46,500 GSF if one story).
- Type IIB: 3 Stories Height; 19,000 GSF per story (28,500 GSF if one story).
Dirty / Loud
Type IA: Unlimited Height; Unlimited Area.
Type IB: 11 Stories Height; Unlimited Area
Type IIA: 5 Stories Height; 50,000 GSF per story (75,000 GSF if one story).
Type IIB: 3 Stories Height; 31,000 GSF per story (46,500 GSF if one story).

Area increase allowed by building frontage (Section 506.2) has not been calculated, but is available if necessary. An increase of 25% could be conservatively anticipated.

Section 507.3 allows a one-story, Group F building of other than Type V construction to have unlimited area provided the building has an automatic sprinkler system and is surrounded by public ways or yards not less than 60 feet in width.

MIXED USE AND OCCUPANCY

It is anticipated that incidental uses will not require fire separation due to automatic sprinkler system (Table 508.2).

It is anticipated that occupancies can be nonseparated (Section 580.3.2).

TYPES OF CONSTRUCTION

It is recommended that construction Type IIB be used as the basis of design for Schematic Design. Fire-resistance rating requirements per Table 601:
- Structural Frame: 0 hours.
- Bearing Walls (Exterior and Interior): 0 hours.
- Non-Bearing Walls (Exterior and Interior): 0 hours.
- Floor Construction: 0 hours.
- Roof Construction: 0 hours.
FIRE PROTECTION

A fully automatic sprinkler system is anticipated. Discharge of automatic fire extinguishing system shall activate an audible fire alarm system on the premises.

Fire department access roads shall be provided such that any portion of the building is not more than 150 feet from the fire department access roads as measured by an approved route around the exterior of the facility. Fire department access roads shall extend to within 50 feet of at least one exterior door that can be opened from the outside and provides access to the interior of the building. When the facility is fully sprinkled, this distance can be extended to 450 feet. Fire department access road lane width is 15'-0" for one-way traffic and 20'-0" for two-way traffic. A clear height of 13'-6" must be maintained for the access roads.
TENNESSEE HIGHER EDUCATION COMMISSION SPACE GUIDELINES

The programming of specific spaces and the preliminary room data shown in this book has included requirements per the Tennessee Higher Education Commission (THEC) Space Allocation Guidelines, 2013. These guidelines are to be referenced throughout the upcoming design phases of the project.
TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS

It is the University’s intent that this project be designed and constructed in accordance with Tennessee High Performance Building Requirements (HPBr) Manual and current “best practice” standards of sustainable design. Consideration is to be given to those elements of sustainable design which result in the most efficient and cost-effective operation and maintenance of the facility. Sustainable design strategies should be achieved within the first cost constraints of the design and construction budget.

Per the HPBr Project Applicability Tree, the project is to follow path ‘A’ (New Construction, greater than $3M). The required HPBr credits are:

- LM 2.1 Site Disturbance - Erosion Control
- LM 4.2 Landscape Design
- LM 6.4 Stormwater Design
- WE 1.1 Water Efficient Landscaping
- WE 3.1 Water Use Reduction
- EE 1.2 Advanced Commissioning
- EE 3.1 Schematic Design Energy Modeling
- EE 3.3 Minimum Energy Performance
- EE 5.1 Building Level Metering
- EE 6.1 Long-Term Energy Reporting
- EE 7.1 Renewable Energy
- MR 1.1 Recycling Storage and Collection
- MR 3.1 Sustainable Materials
- EQ 1.1 Tobacco Smoke Control
- EQ 2.1 Minimum Ventilation
- EQ 6.1 thru EQ 6.5 Material VOC Limits
- EQ 7.2 Pollutant Control - Hazardous material storage
- EQ 8.1 Thermal Comfort
Based on building site and scope, the project team will evaluate all applicable “elective” credits to achieve all credits required by the Owner and as many as budgetary and other constraints allow. To comply with HPBr, the project team will achieve 50% of all elective points applicable to the project. Determination for credit achievement will be made by the Owner.

The commissioning process should verify the installation, functional performance, and integration of the following building systems:

1. Heating, Ventilation, Air Conditioning and Refrigeration systems.
2. HVAC controls including BAS graphic display points and data trending capability.
4. Distribution Panels
5. Branch Circuit Panel Boards
6. Emergency Power Equipment, including generator and switchgear
7. UPS System
8. Lighting Control System
9. Renewable Energy Systems
10. Additional systems as determined by the Owner.

The design team should adopt the following approach measures to achieve sustainable design goals:

1. Embrace sustainable design goals towards an integrated design approach early in the project.
2. Develop partnering strategies to include all design team members, UT Martin staff, and project users.
3. Take advantage of passive solar strategies, using the building’s form and siting to minimize heat gain and provide shade for outdoor program.
# LEED CHECKLIST

**LEED v4 for BD+C: NEW CONSTRUCTION & MAJOR RENOVATION**

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**LOCATION & TRANSPORTATION**

- LEED for Neighborhood Development Location
- Sensitive Land Protection
- High Priority Site
- Surrounding Density
- Access to Quality Transit
- Bicycle Facilities
- Reduced Parking Footprint
- Green Vehicles

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**SUSTAINABLE SITES -- 10**

- Construction Activity Pollution Prevention
- Site Assessment
- Site Development - Protect
- Open Space
- Rainwater Management
- Heat Island Reduction
- Light Pollution Reduction

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**WATER EFFICIENCY -- 11**

- Outdoor Water Use Reduction
- Indoor Water Use Reduction
- Building-Level Water
- Outdoor Water Use Reduction
- Indoor Water Use Reduction
- Cooling Tower Water Use
- Water Metering

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### 13 **5 3 5** MATERIALS & RESOURCES
- **Y** - - Storage and Collection of Recyclables
- **Y** - - Construction and
- **-** - 5 Building Life-Cycle Impact Reduction
- **1** - - Building Product Disclosure and Optimization-Environmental Product
- **1** - - Building Product Disclosure and Optimization-Sourcing of Raw Materials
- **1** - - Building Product Disclosure and Optimization-Material Ingredients
- **2** - - Construction and Demolition

### 6 **3 3 0** INNOVATION
- **2** 3 - Innovation
- **-** - - LEED Accredited Professional

### 4 **2 0 2** REGIONAL PRIORITY
- **1** - - Regional Priority: Enhanced
- **1** - - Indoor Air Quality Strategies
- **-** - 1 Regional Priority: Rainwater Management
- **-** - 1 Regional Priority: Specific Credit

### 16 **9 7 0** INDOOR ENVIRONMENTAL QUALITY
- **Y** - - Minimum Indoor Air Quality
- **Y** - - Environmental Tobacco Smoke Control
- **1** 1 - Enhanced Indoor Air Quality Strategies
- **1** 2 - Low-Emitting Materials
- **1** 1 - Construction Indoor Air Quality Management Plan
- **1** 1 - Indoor Air Quality Assessment
- **2** - - Thermal Comfort
- **3** - - Interior Lighting
- **-** - 1 Daylight
- **-** - 1 Quality Views
- **-** - 1 Acoustic Performance

### 126 **46 40 40** TOTALS -- 126 POSSIBLE
- Certified: 40 to 49 points
- Silver: 50 to 59 points
- Gold: 60 to 79 points
- Platinum: 80 to 110 and Verification

* **Required Credit**
MECHANICAL SYSTEMS

HVAC


The air pressurization shall be maintained at a slight positive pressure to minimize infiltration. Janitor closets, restrooms, etc shall be maintained with a negative pressure relative to the adjacent spaces. Central Plant. Space and domestic water heating and building chilled water are to be provided from the campus steam system and chilled water distribution systems that have been extended to the adjacent Student Recreation Center. Capacity of the central plant and existing distribution pumps at the central plant must be verified. Steam condensate shall be collected and returned to the central plant by duplex 3500 rpm pumps.

Flow meters and temperature sensors shall be provided to monitor the flow and energy into the building.

Overall System Concept. For the clean and quiet areas air handling units shall be located in mechanical rooms. Units shall have MERV 8 pre-filters with MERV 13 final filters, hot water and chilled water coils, and ducted return air. Air handling units for the building shall not be located at grade outside the building. These units shall typically provide air to variable air volume boxes (with reheat if necessary) to distribute conditioned air to the various zones within the space.

The dirty and loud shop spaces shall be heated and ventilated. Ventilation air will be provided by a heating only makeup air unit. The space heating shall be provided by gas fired low-intensity
infrared tube heaters. This will warm not only the occupants but also all of the metals, tools, etc. that normally remain cold in forced air only heating systems. This approach also allows for better heating when large outside doors must be opened as it warms the people and objects in the building instead of just the air the will exfiltrate out open doors. High volume low speed fans shall be provided in shop spaces to de-stratify the air in the summer and provide additional air movement in the summer. Exhaust fans and makeup air louvers will be provided for ventilation during the cooling season. Close coordination will be required to clear the gantry crane.

Heating and cooling piping shall be a 4 pipe system throughout the building. Steam is the preferred energy source for AHU preheat coils but it is expected that a steam coil will be too much capacity. A steam coil will likely be acceptable for the heating only makeup air unit. A steam to water heat exchanger shall be provided for VAV box reheat and AHU heating coils. If required, pumps for the chilled water shall be set up as a primary-secondary-tertiary pump system. The primary and secondary pumps are in the central chiller plant and the tertiary pumps will be installed in the building if required. Separate pumps will be provided for the heating hot water system. This system design allows for flexibility with diverse load patterns. Pumps shall be selected at best efficiency point.

Thermostats (with integral humidistats for cooled spaces) shall be provided for each HVAC zoned space. Thermostats shall be DDC, capable of setpoint adjustability, and able to be connected to the existing campus energy management system. Wire thermostat guards shall be provided in spaces where prone to accidental damage. Thermostats shall have occupancy override selection.

The majority of the building shall have heating and cooling energy provided by the central plant, with the exception of specialized spaces such as, but not limited to:
• Data closets and IDF rooms shall be conditioned by cooling only VRF (variable refrigerant flow) systems.
• Cold room will require specialized refrigeration system meeting temperature requirements.
• Lab manager’s office will have a small split system as it’s the only air conditioned space in the lab building.

Acoustics. Systems within the building will be designed with sound levels that acceptable to the various spaces.

Testing and Balancing. The HVAC system (airside and waterside) shall be designed in a manner that allows a certified contractor (AABC or NEBB certified) to balance the systems according to design documents.

The mechanical system shall be reviewed by a registered commissioning authority (CxA) to ensure that the facility and systems meet the project requirements.

Climate Controls. HVAC systems shall operate with direct digital control (DDC). Control system is to be open protocol and compatible with the existing energy management system.

PLUMBING

General. All plumbing design shall abide by 2012 International Plumbing Code as well as exceed the Energy Policy Act of 2005 fixture flow rate by at least 20%.

Fixtures. Plumbing fixtures are to be vitreous china material.

Toilet plumbing fixtures shall be wall mounted with battery powered automatic flush valves and shall be supported with flour mounted fixture carrier. Lavatories and urinals are to have low flow, automatic type flush valves. Pipes, faucets, and pipe fittings shall abide by the Safe Drinking Water Act section 1417 as lead free materials.

Service Piping. Domestic water shall enter the building by use of dual reduced pressure...
backflow preventers. Calculations shall be performed in order to determine if a booster pump is needed to maintain adequate pressure throughout the domestic water system.

Building water usage shall be independently metered.

Domestic Hot Water Systems. The campus standard for domestic hot water supply is to be provided using steam instantaneous hot water generator. The domestic hot water system shall have a circulation pump to ensure fast hot water delivery times to hot water outlets. Due to the minimal domestic hot water load for this facility smaller tank and electric instantaneous water heaters should be considered for cost, redundancy, and temperature control considerations.

Sanitary and Storm Drainage Systems. New sanitary and storm drainage piping shall be provided to connect to existing site utility mains. Building sanitary and storm drainage shall use cast iron pipes and fittings within the footprint of the building.

Building shall utilize internal roof drainage as well as scuppers and downspouts matching the architectural design.

**FIRE PROTECTION**

The building shall be fully sprinkled with an automatic wet sprinkler system and designed in accordance with NFPA 13 and 14. Sprinkler heads located in areas with lay-in ceiling tiles shall be placed in the center of the tiles and be fully recessed with matching colored cover plates. Areas with exposed structure shall have brass upright sprinkler heads. The incoming water supply for fire protection shall be connected to the existing site water service. Hydraulic calculations shall be provided to ensure adequate pressure and flow is available to the building. A fire pump shall be determined based on the results of the hydraulic calculations.
ELECTRICAL SYSTEMS

LIGHTING

Lighting design shall meet UT design standards as well as the State of Tennessee Sustainable Design Guidelines and High Performance Building Requirements. Lighting levels shall be per the Illuminating engineering Society recommended standards.

Light fixtures shall consist of LED sources. Lighting fixtures shall be selected to minimize building energy required while maximizing functional illumination. Typically fixtures shall utilize 3500K LED sources.

Exterior lighting shall be LED and controlled by photocell, digital time clock, and/or low voltage controls. The exterior lighting design shall avoid sky glow, light trespass and glare as much as possible, while still showcasing the new design.

Emergency egress lighting fixtures and exit signs shall be provided per code. All “emergency” fixtures shall be connected to a new emergency power system.

POWER DISTRIBUTION

A low voltage lighting control system shall be employed that meets the 2012 IECC energy code adopted by the UT design standards. Typical elements shall include: local occupancy (motion) switching, programmable dimming, daylighting and programmed control of lighting circuits for after-hours shutdown. The system shall be designed to maximize the use of available natural light.

New utility service and a new generator shall be provided, as well as new electrical equipment for both normal and emergency power. A 480Y/277V switchboard shall be provided in the electrical room. The switchboard shall have full feature, electronic breakers for coordination and ground fault protection, a surge protection device, and electronic metering equipment that can be connected to an energy management system.

Multiple 480V:208V panels along with stepdown transformers and 208Y/120V distribution panelboards shall be provided. The panelboards
shall have full feature, electronic breakers for coordination and ground fault protection.

Branch circuit panels shall have a minimum of 25 percent spare breakers and 25 percent spare provisions for future breakers. Since all of the panels shall have main breakers, the feeders to the panels shall be sized for the main breaker and not the size of the load on the panel or the bus rating of the panel. Panels shall not have isolated grounds or oversized neutrals.

Power shall be distributed throughout the building to serve lighting, mechanical and large user equipment loads.

Emergency power shall be provided from a new emergency distribution system. This system shall consist of one generator located on the site in a weatherproof enclosure. There shall also be automatic transfer switches, transformers, and emergency panels. The distribution system within the building shall be divided into two branches. One shall be the emergency branch which consists of egress lighting, exit lighting and the fire alarm system. Another shall be the standby power branch which shall the cold room. All wiring devices, conduit and wiring shall be provided per the UT criteria.

**GROUNDING**

Equipment grounding conductors shall be run in each panelboard and equipment feeder and branch circuit. There shall be no isolated grounded receptacles; therefore there shall be no isolated ground buses in the panelboards or isolated ground conductors in the feeders to the panels.

**LIGHTING & SURGE PROTECTION**

A lightning protection system for the structure consisting of a terminal and cable system on the roof, with down conductors to ground rods at the base of the building addition shall be provided. There shall be a surge protection device in the main switchboard. The electrical services are connected to an underground
network with paralleled transformers with network protectors. The quality of power for this area is considered good and stable. Surge protection outlets shall not be provided. If there is equipment that the user wishes to have protected, plug-in type surge protectors can be used for those pieces of equipment.

TELEPHONE & DATA WIRING

Outlet boxes, backboards, conduits and sleeves shall be provided for telephone and data wiring. A 1” conduit shall be provided from each outlet box to the accessible ceiling space. All outlet devices, cable trays, “J” hook hangers, bridle rings, wiring and equipment shall be furnished and installed as directed by the user.

The building shall be served from main backbone cables and conduits that enter the building. The phone and data systems shall be housed in separate MDF/IDF rooms. The main incoming communications services shall be coordinated with UT’s Information Technology (IT) Department.

ADDITIONAL IT REQUIREMENTS

It is anticipated the information technology systems will be designed to campus IT standards and policies as well as all applicable ANSI/EAI/TIA, BICSI, ICS, and IEE standards. The intent is that all clinical spaces and offices will be hardwired for use with computers and thin clients.

FIRE ALARM SYSTEM

A digitally addressable, voice evacuation style, fire alarm system shall be provided throughout the building. The system shall comply with applicable codes and requirements. The system shall be connected to the campus monitoring system and UT central station monitoring service.

ACCESS CONTROL/SECURITY SYSTEMS

Conduits, boxes, select 120v power connections and/or other provisions for these systems shall be included as defined by UT’s users and/or IT departments. The associated equipment, devices, wiring, installation, and commissioning
of these systems, if required, shall be provided separately by UT or their vendor. The design engineer shall coordinate with the UT departments governing these systems and/or their vendors to determine the project requirements.

**PAGING SYSTEM**

A network of speakers that is inter-tied with the phone system will be provided for a complete public address system.

**PUBLIC ADDRESS SYSTEM**

There shall be no provisions for this system.

**TV ANTENNA SYSTEM**

There shall be no provisions for this system.

**ELECTRONIC SECURITY**

Electronic security may consist of an access control system, video surveillance system, intrusion detection system, near field communication (NFC), and emergency phones. Final electronic system requirements will need to be discussed with the stakeholders to determine final components or combination of components appropriate for this building.

The access control system will provide card access at certain non-public entry and exit points of the building or departmental perimeters or at any other area or space deemed a priority by the College. It is likely that the only traditional keys given to faculty would be for their individual offices and any storage rooms that are under their control.

Architecturally-specified door hardware configurations detailed in the Architect’s Door Hardware Schedule require close integration with the access control system to ensure proper operation for normal and alarmed conditions. The door hardware schedule should include not only standard door hardware devices such as locksets and closers, but that it also detail electronic security devices and components to create a more comprehensive schedule.
E.

APPENDIX
E. APPENDIX

E.1 Meeting Minutes