

APPA

# Making Maker Space

Jason Smith, AIA LEED A.P.

SEAW 1919  
CELEBRATING 100  
YEARS 2019

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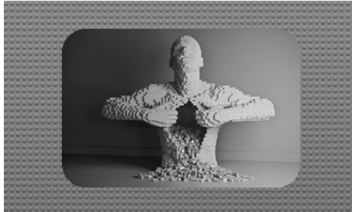
# maker space:

*"a place where students can gather to create, invent, tinker, explore and discover using a variety of tools and materials"*

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- There is a fundamental need to "make" / intervene in the environment hard-wired in human beings.



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## "MAKING" IS IN OUR DNA



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“

## Play is the highest form of research


Albert Einstein

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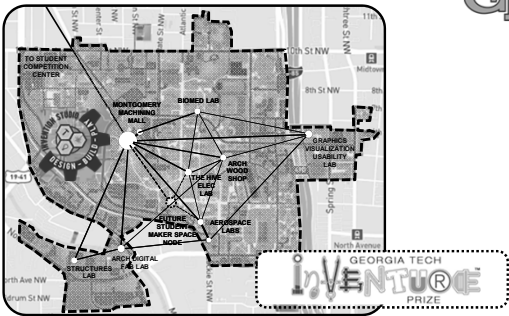
MAKER MOVEMENT - ORIGATION / DEVELOPMENT

- The "Maker Movement" migrated onto campuses at turn of the century from external DIY cultural influences
- The first university Maker Space dates back to ~2001 on the campus of MIT
- Campus Maker Spaces evolved from *Conceive-Design-Implement-Operate (CDIO)* initiatives reshaping Engineering curriculum with a focus on practice-based learning
- Focus on cross-disciplinary collaboration has encouraged the spread of Maker Spaces into other areas of study

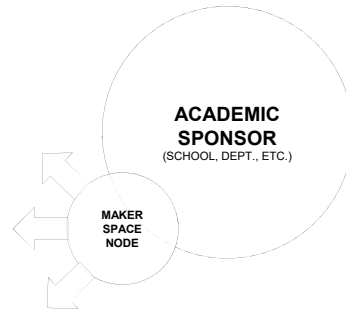


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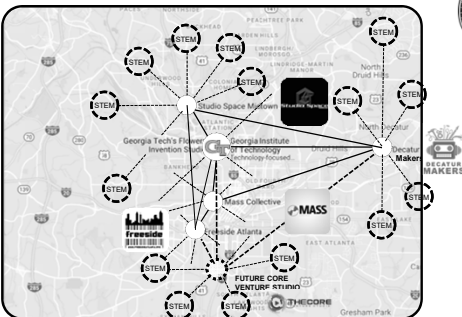
## MAKER SPACES – CAMPUS NETWORKS



**MAKER SPACE – COLLABORATIVE NODES:**

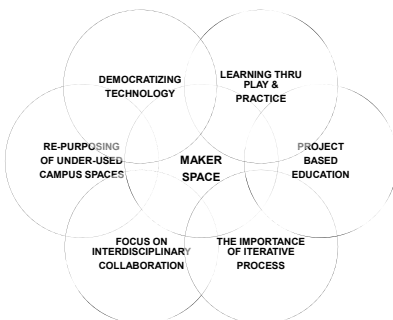


## MAKER SPACES – COMMUNITY NETWORKS



**NETWORK =  
COMMUNITY**

## MAKER SPACE – OVERLAPPING INTERESTS



MAKERSPACE LAB

INNOVATION PROTOTYPING

STUDIO CENTER

THINK GATHERING

RESEARCH MOBLEEXCITE

GUERILLA GEID

MAKING UNIFIED LABS

KITCHEN PROJECTS

INSTITUTE BOX

CREATE SPACE

TEAM IDEA

BOILERMAKER LABORATORY

MAKER CRAFT

HILL PROJECT LINKLAB

CINC INVENTION

CINCPROCODE

“

***Maker spaces have an opportunity to revolutionize current pedagogy by providing an extra-curricular means for students to engage in more hands-on learning***

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**① Survey of Maker Spaces**

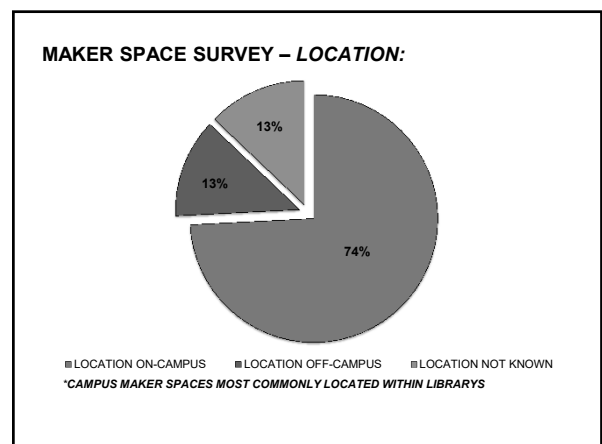
*White paper presented as a part of the 2015 ASEE Annual Conference & Exhibition*

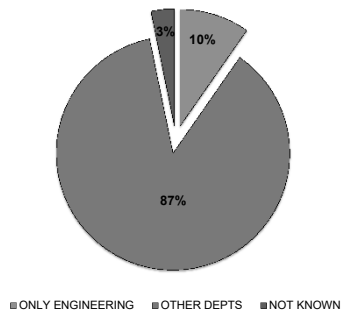
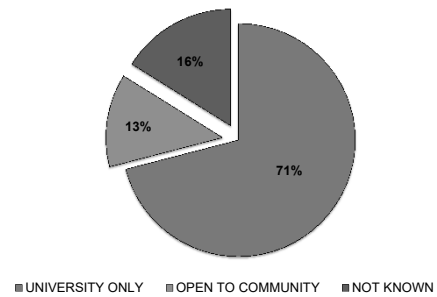
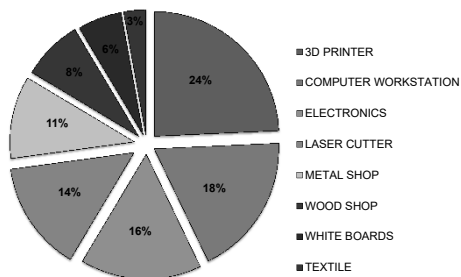
**CAMPUS MAKERSPACES SURVEYED**

**BRANDED MAKER SPACE COMMUNITIES**

**MAKER SPACE - OPERATIONAL MODELS**

<b>Student Run</b>		
Boston University Harvard University Columbia University University of Illinois Georgia Tech		
Boise State Cal Berkeley Cal Davis U of Michigan U of Illinois		
<b>Faculty Run</b>		<b>Specific Staff</b>
Case Western Reserve University	University of South Florida Colorado-Boulder (ITL) Dartmouth Princeton Rice University Texas - Austin	Arizona State UC San Diego Colorado State Lehigh Northwestern



**MAKER SPACE SURVEY – ACADEMIC DEPARTMENT:****MAKER SPACE SURVEY – MEMBERSHIP:****MAKER SPACE SURVEY – EQUIPMENT INVENTORY:**

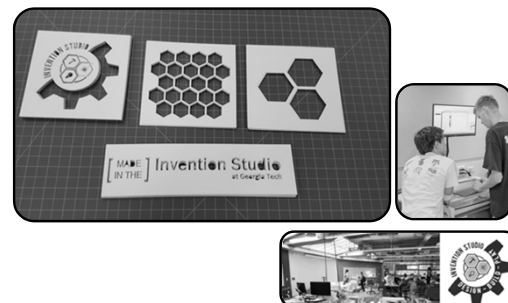
## ② Programming & Equipping Maker Spaces

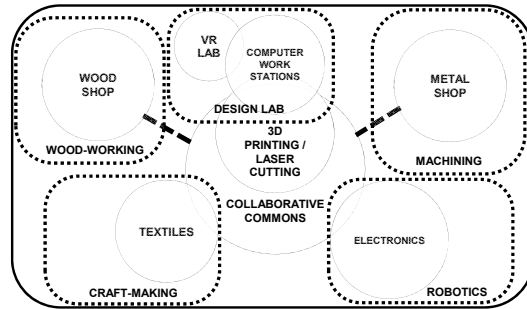
**AUTODESK - BUILD SPACE**

- **Private Maker Studios** (Boston, San Francisco, Toronto)
- **Lessons learned on Programming & Equipping Maker Spaces**

**GEORGIA TECH – INVENTION STUDIO**

- <https://inventionstudio.gatech.edu/tools-equipment/>

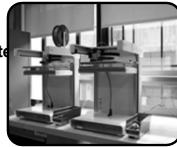


**MAKER SPACE – PROGRAMMING MODEL****EQUIPMENT – VR / AR COLLABORATION:**

- **VR-in-a-Box Motion Capture System** (HTC Vive or eq.)

**EQUIPMENT – 3D PRINTING:**

- **8"x6"x6" Format 3d Printer**
  - o ABSplus, Dissolvable Support Material
- **10"x10"x12" Format 3d Printer**
  - o ABSplus, Dissolvable Support Material
- **12"x12"x12" Format 3d Printer**
  - o PLA, Nylon & PC-Plus
- **Amber Stereolithography Format 3d Printer**
  - o 64x40x134 mm Bed
  - o DLP Stereolithography
  - o XY Res.: 50 mic., Z Res.: 10-100 mic.
- **Ultimaker 3 3d Printer Extended**
  - o 215x215x300 mm Bed
  - o Nylon, PLA, ABS, CPE, CPE+, PVA, PC, TPU 95A, PP, Break-Away
- **Markforged 3d Printer**
  - o 320x132x154 mm Bed
  - o Onyx, Carbon Fiber, Fiberglass, Kevlar, HS/HT Fiberglass

**EQUIPMENT – 3D PRINTING:**

**Authority Resource on 3D Printing:**

- **PART 1 – Comprehensive Overview of 3D Printing Technologies**
- **Actionable Design Advice for each 3D Printing Technology**
- **Introduction to Computer Aided Design (CAD) Software**

**EQUIPMENT – LASER CUTTING:**

- **Laser Cutter (Trotec Speedy 400 or eq.)**
  - o CO2 120 Watt Laser, 40"x28"x13.25", Air Assist
- **Vinyl Printer / Cutter (Roland SP-300i VersaCAMM or eq.)**
  - o 7"-29" Media
  - o 4-Color CMYK Piezo Inkjet
  - o Integrated Software
  - o Max. 1440 DPI

**EQUIPMENT – WOOD SHOP:**

- Miter Saw
- 18" Vertical Band Saw
- 15" Planer
- 8" Joiner
- Belt / Disc Sanders
- 42" Manual Lathe
- 2 HP Gearhead Drill Press
- 42" x 24" Powermatic Wood Lathe
- Heavy Duty Spindle Sander
- Industrial Downdraft Table
- CNC Routers (Various Sizes)
- Programmable Powered Fence System



**EQUIPMENT – METAL FABRICATION:**

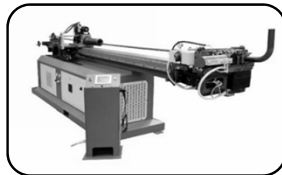
- 5'x8' Welding Table
- Media Blast Cabinet, 46"W x 36"D x 35"H
- 48" Finger Brake, 12 ga. Capacity
- Vertical Knee Mill
- 20" Vertical Band Saw
- 400W Laser Cutter / Engraver, 52" x 11"
- Cold Cutoff Saw
- Handheld Plasma Cutter, 1 1/4" Capacity
- 350 amp TIG Welder
- 350 amp MIG Welder
- Cutting Torch Kit
- 12"x18" Horizontal Band Saw

**EQUIPMENT – STEEL FRAMING:**

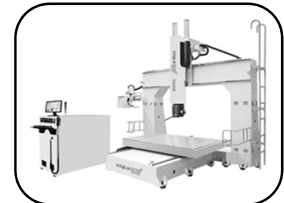
- **Howick FRAMA 3200**
  - Produces light-gauge framing from steel coil (0.75mm – 1.2mm thick)
  - End Product Size: 65mm -150mm

**EQUIPMENT – TUBE BENDING:**

- **3-Axis CNC**
- Mild Steel Tube Capacity 3" (.079 Wall),  
Stainless Steel Tube Capacity 3" (.065 Wall),  
Square Tube Capacity 2" (.065 Wall)
- Programs YBC
- Materials:
  - Steel
  - Stainless Steel
  - Aluminum
  - Titanium
  - Brass

**EQUIPMENT – CNC MILLING:**

- 5-Axis CNC Router
- XYZ: 60"x120"x41"
- 17,000 RPM Spindle
- Vacuum Table
- Dedicated Dust Collection

**EQUIPMENT – WATERJET CUTTING:**

- 5-Axis Water Jet Cutter (OMAX Maxiém 1515 or eq)
- XYZ: 120"x72"x7"
- 87,000 PSI
- Closed Loop Water Filtration System
- Integrated Software

**EQUIPMENT – PRECISION MACHINING:**

- Vertical Manual / CNC Knee Mill w/ Fagor Controller
- Vertical Manual Knee Mill
- Drill Sharpener
- 30" Vertical Bandsaw
- 20" Drill Press
- 50 Ton Shop Press
- 3 Ton Arbor Press
- 3-Axis Vert. Manual Machining Ctr.
- CNC Lathe w/ Y Axis
- Engine Lathe
- Carbide Tool Grinder

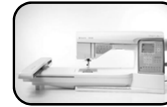


**EQUIPMENT – MICROELECTRONICS:**

- Digital Multimeter (Fluke or eq.)
- Soldering Station (Weller WESD51 or eq.)
- Digital Storage Oscilloscopes (Instek or eq.)
- Waveform Generator (Keysight Tech or eq.)
- Triple Linear DC Power Supply

**EQUIPMENT – TEXTILES & CRAFTS:**

- Industrial Sewing Machine (JUKI or eq.)
- Embroidery Arm
- Rotary Engraver

**EQUIPMENT – COMPOSITES:**

- 2'x4' Bel-O-Vac Vacuum Former
- Elec. Walk-in Comp. Curing Oven
- Filter Wall
- HEPA Dust Collector
- Gear Head Drill Press
- Heavy Duty Spindle Sander
- 24" Band Saw
- Environmental Test Chamber, -85°F to +200°F, 20% - 98% RH
- Belt / Disc Sander
- LAP Ceiling-Mounted Laser Projector
- 6000 CFM Mobile Air Filtration Units

**EQUIPMENT – GLASS + CERAMICS:**

- 2'x4'x4' Skutt Ceramic Kiln, 2350°F
- 54" x 42" x 18" Wet Dog Glass Fusing / Slumping Kiln, 1550°F

**EQUIPMENT – MATERIAL HANDLING:**

- 5-Ton Bridge Crane

**EQUIPMENT – SOFTWARE:**

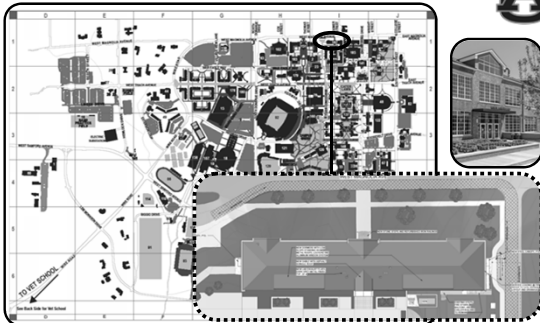
- **Water Jet**
  - *OMAX Layout* – 2D CAD software import / editing compatible with waterjet projects
  - *OMAX Make* – Executes waterjet jobs prepared in OMAX Layout
- **Laser Cutting**
  - *Inkscape* – Vector graphics editor to create / edit files for laser cutting
  - *JobControl X* – Interfaces directly with the laser cutter
- **3d Printing**
  - *Cura 3* – 3d slicer software
- **Embroidery / Vinyl Cutting**
  - *Inkscape* – Vector graphics editor to create / edit files for embroidering / vinyl cutting
  - *Embird* – Embroidery & stitch digitizing software

### ③ Case Studies

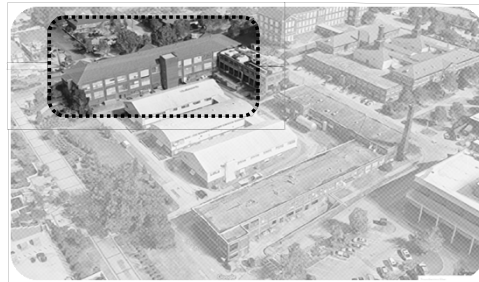
#### GAVIN ENGINEERING RESEARCH LAB



#### SITE – PROJECT LOCATION



#### SITE - AERIAL PHOTO



#### MAKING = RE-MAKING:



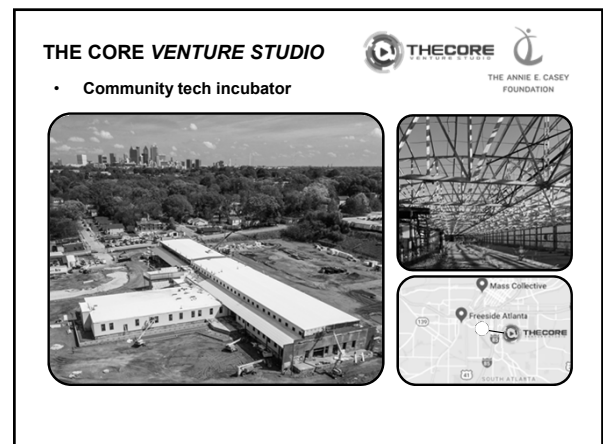
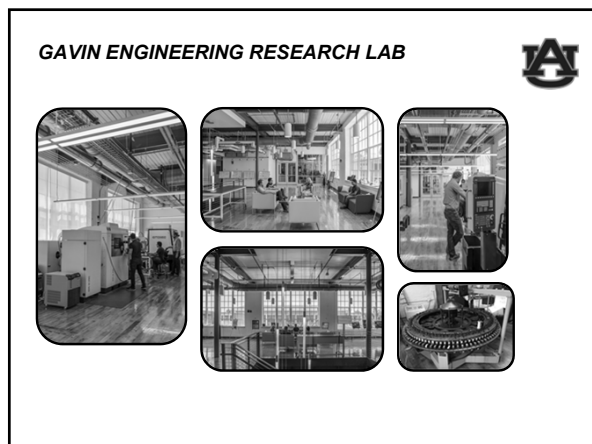
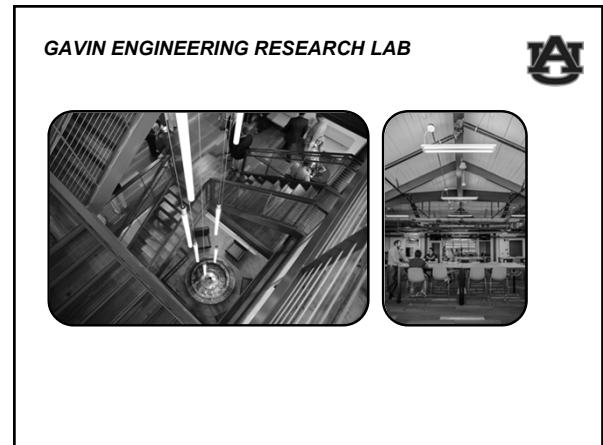
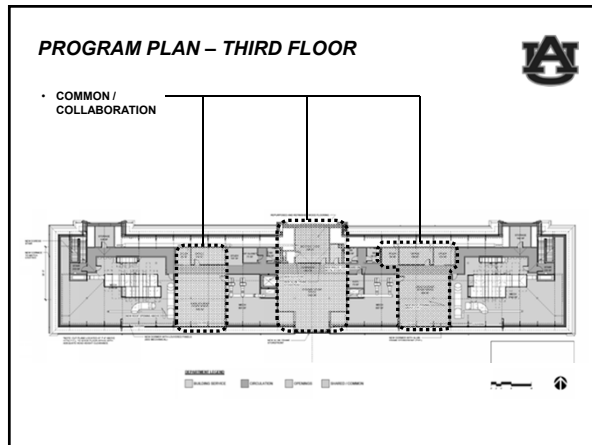
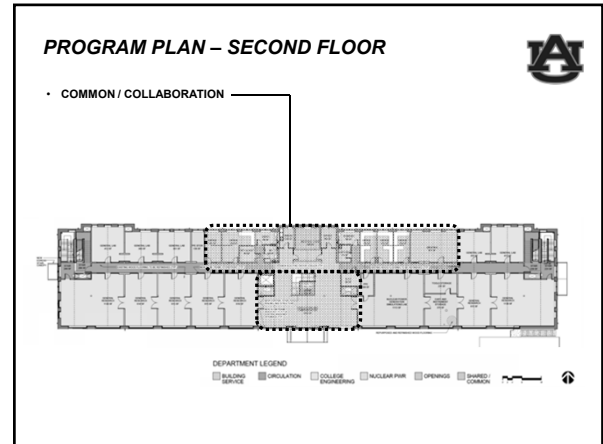
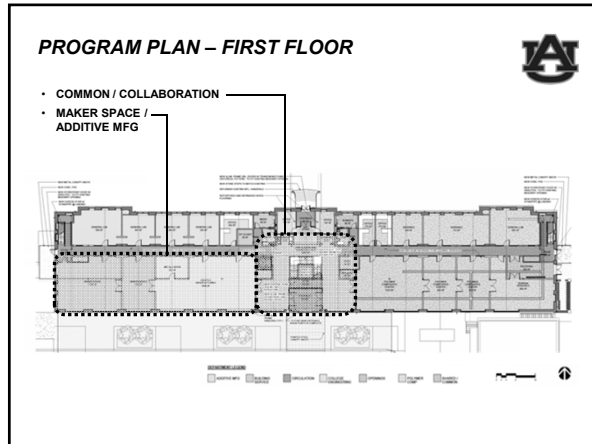
- Project focused on restoring / renovating c. 1928 ~61,000 SF Textile Engineering Building
- Project to repurpose what had become a campus "garage" of sorts of the past 15 years to an open campus resource managed by the School of Engineering
- Project funded in part through a gift from Charles & Carol Ann Gavin, Charles an alumni and former student manager of the original facility.
- Project to attract in-coming research interest as well as campus-wide student collaboration
- Project interest sparked sufficient additional donations to fund an adjacent new building focused on undergraduate Engineering achievement.



#### PROGRAM PLAN – GROUND FLOOR








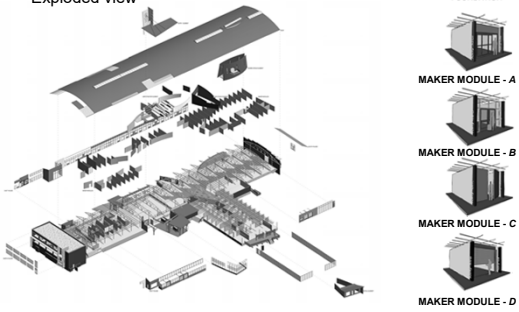
**THE CORE VENTURE STUDIO**  THE ANNIE E. CASEY FOUNDATION


- Life-cycle progression of the studio...




**THE CORE VENTURE STUDIO**  THE ANNIE E. CASEY FOUNDATION

- Exploded view




**THE CORE VENTURE STUDIO**  THE ANNIE E. CASEY FOUNDATION


- Maker modules flexible for a diversity of users / uses



MAKER MODULE - A  
MAKER MODULE - B  
MAKER MODULE - C  
MAKER MODULE - D

**THE CORE VENTURE STUDIO**  THE ANNIE E. CASEY FOUNDATION

- Public markets & cafes integrated for local sale of studio goods & services



**THE CORE VENTURE STUDIO**  THE ANNIE E. CASEY FOUNDATION

**WOOD STUDIO**

- FURNITURE MAKER
- FURNITURE REFINISHER
- BOWL TURNER
- SALVAGER / REPURPOSED GOODS
- WOOD SCULPTOR





**THE CORE VENTURE STUDIO**  THE ANNIE E. CASEY FOUNDATION

**WOOD STUDIO**


- FURNITURE MAKER
- FURNITURE REFINISHER
- BOWL TURNER
- SALVAGER / REPURPOSED GOODS
- WOOD SCULPTOR





**THE CORE VENTURE STUDIO**  

**MIXED MEDIA**


- PAINTER
- PAPERMAKING
- BASKET WEAVING
- PHOTOGRAPHER
- POTTER
- BOOKBINDER
- TYPE-SETTER / PRINTER
- GLASS BLOWER
- ART CLASSES



**THE CORE VENTURE STUDIO**  

**FOOD STUDIO**

- FOOD TRUCK SUPPORT
- CATERER
- BUTCHER
- BAKER
- CHEESE MONGER
- BREWER / DISTILLER
- PRESERVER / PICKLER
- MEAT CURING



**THE CORE VENTURE STUDIO**  

**MAKER SPACE...COMMUNITY**



**Cultivating a culture of "making" will prepare us to accomplish our most ambitious goals** 



 **1919**  
CELEBRATING **100**  
YEARS **2019**

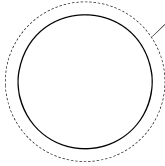
**THANK YOU**

**Jason Smith, AIA LEED A.P.**  
*jsmith@stevens-wilkinson.com*

 **1919**  
CELEBRATING **100**  
YEARS **2019**  Leadership in Educational Facilities

**Big concept**

Bring the attention of your audience over a key concept using icons or illustrations



A picture is worth a thousand words

A complex idea can be conveyed with just a single still image, namely making it possible to absorb large amounts of data quickly.

