



The Brickyard Collaborative

*- MakerSpace / Incubator / STEAM -*

P R O P O S A L

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## Overview

The Brickyard Collaborative is a unique three-faceted interpretation of the standard MakerSpace formula. By partnering a traditional MakerSpace with a business incubator and an academic community STEAM program, resources, inspiration and the power of collaboration are leveraged – not only to teach and inspire makers and inventors, but to start businesses and spark economic growth at a grassroots level.



### *What is a MakerSpace?*

The idea of a MakerSpace centers around group ownership and support of tooling and technology that is out of reach of the average individual. One of the very first MakerSpaces, the Artisan's Asylum, started between three friends in a dorm room at Olin College as a way to pool resources. (The Artisan's Asylum is now a self-sustaining, 40,000 square foot fully equipped facility in Somerville, MA and has inspired the formation of several other startup and shared resource facilities.)

The core of the MakerSpace model is to enroll members, for a monthly fee, who in turn have access to workspace as well as tools and technology available, after short introductory certification classes (depending on the complexity of the equipment). A member can rent storage space, as well as more permanent studio space at what is generally slightly less than market rates for similar spaces. Classes in technique and specific tool use are available to both members and non-members.

MakerSpace facilities mirror the needs and interests of the community. Most MakerSpaces feature fully equipped wood and metal shops, electronics labs and rapid prototyping shops with technology like 3D printing and molding. Often the spaces will host printing facilities, textile studios, traditional crafts and sculpture studios – even bicycle shops. Imaging, in the form of digital photography, traditional photography, scanning and output are also common offerings.

Beyond simply individuals who need shop or studio space and facilities, MakerSpaces are also populated by small, startup businesses that need extended facilities but need to keep their development overhead low. Corporate memberships, often offered in bulk and at a discount, allow larger companies to foster a “sandbox” culture among their design staff, as well as provide software and equipment the company doesn’t have to purchase. For any company trying to develop a prototype, the MakerSpace model allows a profound cost advantage over more traditional solutions – one example was of a startup developing what would become a successful product, able to prototype the design for \$2500. The original estimate for the same prototype through an outside vendor was \$250,000.



### *The Incubator/Accelerator*

Business incubators, or accelerators, are groups that, in the broadest terms, help startup companies to launch successfully. They range from simply providing resources to startups, often individuals, in the form of competitions, mentoring and information services, to offering full concept-to-market development to companies innovating new products.

Their services can include market testing, product design, prototype production, performance testing and research and the development of business, marketing and production plans.

To characterize incubator/accelerators and makers as operating in the same “space” is an understatement. By their very nature, members in MakerSpaces are innovators, and constantly challenging conventional solutions, products and processes. A significant percentage of them have a commercial application for their work in mind, yet no real plan to accomplish that. Incubators, for their part, are constantly searching for innovative projects that are headed for the marketplace. It’s a natural pairing of common interests.



### *STEAM: Science, Technology, Engineering, Arts and Math*

*“STEAM is an educational approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking. The end results are students who take thoughtful risks, engage in experiential learning, persist in problem-solving, embrace collaboration, and work through the creative process. These are the innovators, educators, leaders, and learners of the 21st century.”*

STEAM is an obvious, and very popular focus in current curricula in most schools trying to keep pace with technology development on the world stage. It’s a focus at the primary, secondary and collegiate levels. Incorporating STEAM into a community MakerSpace leverages resources, both physical and social.

Technology collaboration – the ability to share facilities across school borders, leverages the often-limited resources of any one school. While one school may offer traditional letterpress printing, for example, another may offer cutting edge digital imaging at the expense of more traditional techniques. By creating collaboration through a MakerSpace, and making it available to various student groups throughout the community, a student can take advantage of a broader range of technology resources. A MakerSpace has an advantage over an average school program – being independent and relatively uncomplicated, a MakerSpace can take

advantage of opportunities a school system has to pass on – making purchase of new equipment, accepting donations, courting investment and sponsorship. By teaming with a MakerSpace, a school can enjoy the benefits of a less restrictive environment.

Community collaboration – the creation of a community of makers across school, age, cultural and experiential boundaries allows a unique opportunity for mentorship, inspiration and collaboration. A student in a High School class can work on projects with retired professionals, young children, or peers from other schools. Students can collaborate with others in different disciplines – for example, a robotics student working on a particular problem may find solutions by collaborating with a retired machinist. A sculptor may find inspiration working with an electronics expert... the possibilities are virtually endless.

### *The Collaboration Model*

Mark Hatch, the CEO of TechShop, tells an interesting and compelling story about how collaboration works in a MakerSpace. A young team of engineers, just out of college, had an idea for what was essentially a sleeping bag for premature babies, warmed by a polymer pouch. This would allow hospitals to keep a two-week premature baby's body temperature stable while transporting them to an incubator.

While working on the project, another TechShop member saw what the chemical engineer was doing, and asked how much he knew about polymers. "Just what I learned in school", the young man replied. Apparently, the interested member had over 30 years' experience in developing polymers, and, working with the young engineer, was able to improve the performance of the heating pouch, to last nine times longer. The "sleeping bag" has saved, by Hatch's estimate, over 85,000 lives to date, simply because two members of a TechShop happened to be in the same space.

The MakerSpace model is one way that innovation happens today. Teamed with STEAM and incubator/accelerators, the Brickyard Collaborative is how economic growth through innovation comes to a community.

### *The Strategy for Building the Brickyard Collaborative*

The core strategy for founding The Brickyard Collaborative is to build resources within a facility in sufficient scale to attract membership, rentals, and income augmented by available grants and donations. The actual numbers for hardware are fairly modest – around the \$250,000 mark for a 10,000 square foot facility, even if purchased at retail prices. Leveraging surplus equipment sales, liquidation auctions and corporate donations can yield a far more modest number – almost half that.

The membership, space rental and class revenue model for a MakerSpace is, by now, time-tested and proven. Adding the synergy of a business incubator and STEAM partnership only adds viability – increasing attractiveness to investors and grant applications alike. While most MakerSpaces can apply for grants for equipment and program support, very few, if any, can claim their programs will directly help local economic stimulus programs as well as the local schools, from primary through the collegiate level.

The trajectory is to set a three to five-year profitability goal. The first months will require up-front investment in resources for staffing and equipment purchase, along with rent and operating expenses. As membership and rental income increases, and participation becomes more visible, additional funding through grants and loans can be sourced. With reasonable targets, the project has a break-even point into the third year of full operation under optimal conditions.

While it's a common refrain to hear “economic stimulus” ideas touted, the MakerSpace model has a proven track record of industry, manufacturing and employment creation. The Artisan's Asylum in Somerville moved into its current location around ten years ago, when the area was essentially an urban wasteland with cheap space. Today that neighborhood is a center of growth and innovation, called the Milk Row Creative Zone and the Innovation Village, hosting several resources that share a common thread:

- The country's largest cleantech incubator, Greentown Labs
- Canopy, a social impact co-working space
- Cambridge Hackspace, the DIY environmental science community
- The Public Laboratory
- Parts and Crafts, a makerspace/unschool for makers under 18
- Somerville Tool Library, a tool lending library
- The Somerville Media Center

Synergy - (from Greek sunergos 'working together'.)

*The interaction or cooperation of two or more organizations, substances, or other agents to produce a combined effect greater than the sum of their separate effects.*

“The whole is greater than the sum of its parts.” - Aristotle

## Characterizing the Space, Establishing Financial Benchmarks

### 1. Type of Space

Of the many models in place today, a relatively large community workshop featuring educational programs, membership access to shared tools/workspace, and storage or studio rental space fits the needs and vision of the Lynn maker community.

### 2. Size of Space

At least 8,000 – 20,000 square feet or larger is required to offer competitive facilities, attract membership and support continuously paid, full-time staff (Example: TechShop at 15,000 square feet on average, supporting 5-15 full-time staff per location.)

### 3. Space Distribution

- Fire Lanes. 25-35% of floor area for to-code fire lanes.
- Front desks, sign-in kiosks: 50-250 square feet.
- Social/Food Area: min. 15-40 square feet per person.
- Dedicated Classroom/Conference Rooms: 20-50 square feet per seated person.
- Workshops: 300-500 square feet each, and approximately 75-150 square feet per person working independently in a space.
- Rental Studios: private rental studios - 50 to 250 square feet.
- Storage Space: shelving (8-12 square feet per shelf unit), pallet-based storage (13 square feet per pallet)
- Gallery/Display Area
- Retail Area. Storage, display, sales station

*(Reference: The Engineering Toolbox - reference for architects and engineers, and the Grizzly Workshop Planner)*

### Expenses

#### 1. Rent

In this area, the market is \$8-14/sq. ft/year for 20-30 year old industrial property in a central location. (Typically rent will range at 25-30 percent of total expenses for a mature makerspace.)

#### 2. Building Maintenance / Property Tax

Estimates range from \$2.50-3/sq. ft/year in common area maintenance, with around \$1.20/sq. ft/year of that being property tax. (Note: operating as a Non Profit 501(c)3 would exempt the organization from property taxes.)

### 3. Utilities

Electricity: \$0.10-\$0.20/sq. ft/month at \$0.15/kWhr

Natural Gas: Up to \$0.15/sq. ft/month at the peak of winter

Trash: \$100-\$300/month

Internet: \$75-\$150/month

### 4. Salaries

*Note: for reference, an example of an all-volunteer organization for a year at a size of 9,000 square feet- after a year, volunteers were exhausted, and programs were falling apart.*

#### Positions/Organizational Structure:

- Financial Controller: Head bookkeeper and accountant for the business.
- CEO/Executive Director: Primary point of contact and main organizer for the early life of the organization, head manager for the later life of the organization.
- Facilities Manager: Responsible for repair and maintenance of shop spaces and tools.
- Member Services: Answers phone calls, emails, and any in-person complaints, and makes sure the business runs smoothly.
- Development: Seek grants and partnerships with other organizations.
- Programs: Develops classes and programs as a source of income.
- Marketing: Markets the business and its programs to the public.
- Full-Time Trainer: Trains and tests new members on equipment.

5. Health Insurance & Benefits: \$350 to \$1,500/person/month. Membership and some rental space as a benefit to employees: Between \$150 and \$300 a month.

6. Tool Maintenance / Consumables: \$500 to \$1,000/month, shop consumables budget ranges from \$1,300 to \$1,700/month for a heavily-utilized 8,000 square feet of \$300,000 worth of shop equipment.

### 7. Contractors

Instructors: Example from the Artisan's Asylum (40,000 square feet) is 35-45 part-time instructors a month, spending between 2 and 10 hours a week on their classes, with relatively little oversight. Pay for AA is 50 percent of class proceeds. Other

options are fixed rates that vary between \$20 and \$75 per hour, depending on the class.

Accounting and legal: CPA ranges from \$2,500 - 7000, \$2,000 to \$3,000 in a year for legal services.

## 8. Insurance

- General Liability & Property: \$.020-\$0.40/sq. ft/year
- Umbrella Policy: 15-25 percent of the price of general liability & property insurance
- Worker's Compensation: .61 percent of total yearly salary for clerical and administrative work and 3.17 percent of total yearly salary for trade or vocational instruction
- Miscellaneous Insurance: 10-20 percent of our total insurance bill

9. Charges & Fees: 3-5 percent of total income for fees from banks, payment gateways, and credit card companies.

## 10. Other Expenses

- Advertising and marketing (graphical design work, print materials, etc.)
- Supplies for classes
- Volunteer food/beer/etc.
- Cost of any goods or services you sell
- Discounts off of memberships or classes (record these as an expense, so you know how much you're spending on them)
- Office supplies
- Telephone/cell phone plans
- Subscription websites (like SurveyMonkey)

11. Total Expenses: Reference: \$80,000 per month to run Artisan's Asylum right now at 40,000 square feet.

## *Income*

### 1. Memberships

Membership subscription examples range from \$40 per month for a 'starving hacker' membership at Noisebridge, to \$175 per month at TechShop. For a per-capita income of \$36,500, a median household income of \$61,700 a year in Somerville, the AA charges \$150 a month for 24/7 access membership.

Required space: 120-180 sq. ft/person

Examples:

- Makelt Labs in a 6,000 square foot space over 2-3 years is now at 60-100 sq. ft/person.
- TechShop 20-40 sq. ft/person after 5+ years of operation.

Corporate/Group membership is available at a discounted rate.

## 2. Rentals

Large-area flexible rentals offering more than 50 percent of available area as a rental studio or storage space for projects.

- 50, 100, 200, 250 sq/ft studios: \$2/sq. ft/month
- Pallet Storage (13sqft): \$30/month
- Shelf Storage (2'x2'x2' shelf space, stackable 4 high on a 2'x2' floorplan): \$10/month

## 3. Classes

Classes provided more than 60-75 percent of the income in early stages, and 25-35 percent of the income in a mature makerspace. Fees are typically \$10 to \$30/student-hour, and classes are generally 2-3 hours per session. Most classes are 4 sessions long (though some engineering, design, and project-based classes require 6-8 sessions, and most individual tool training and testing classes are simple one-shot sessions).

Examples:

- Woodworking: \$10-\$25/sq. ft/month, mostly due to the space requirements of moving large raw material around
- Machining: \$15-\$30/sq. ft/month, due to small space requirements. but relatively low demand
- Welding: \$40-\$60/sq. ft/month, typically very popular
- Quiet Classroom: \$35-\$55/sq. ft/month, due to the sheer variety of classes that can be taught
- Electronics: \$20-\$35/sq. ft/month, due to significant demand and modest space requirements
- Jewelry and Glassworking: \$40-\$55/sq. ft/month, due to high demand and small space requirements

## 4. Grants and Donations

Fundraising events can generate \$25-\$40/person at large-scale, once-or-twice-a-year events, and in the case of fundraising drives for specific items can hit averages as high as \$100-\$200/person.

Several established spaces (including sprout and The Crucible) run many of their programs by writing and receiving grants as non-profit 501(c)3 organizations.

## 5. Other Income

Other proven sources of income include:

- Selling raw materials and kits from Sparkfun and Adafruit at a markup (this can create conflict with a 501(c)3 structure).
- Vending services (for food and drinks) to their members
- Design, engineering, and fabrication consultation for a fee
- Commissions from the community at large, paying members to develop responses to those commissions
- Flexible studio space without walls, and fees by the day and by the square foot to use it for time-sensitive projects
- Monthly parties in the space, and rental of large-scale works of art

## 6. Total Income

Income vs. Expense: (Target) 5-20 percent, retaining a buffer of 3 months of total operating expenses at all times.

### *References:*

*Making Makerspaces: Creating a Business Model:*

<https://makezine.com/2013/06/04/making-makerspaces-creating-a-business-model/>

*TechShops:* <http://www.techshop.ws/>

*The Artisan's Asylum:* <https://artisansasylum.com/>

*The Engineering Toolbox:* <https://www.engineeringtoolbox.com/>

*The Grizzly Workshop Planner:* <http://www.grizzly.com/workshopplanner>

*Makerspace Worksheet:*

<http://artisansasylum.com/wp-content/uploads/2015/01/Make-a-Makerspace-Worksheet-2014-05-07.pdf>

## **Launch, Growth and Trajectory**

### *Year 1: Foundation*

The first steps of building the Brickyard Collaborative MakerSpace / Incubator / STEAM project is to contract a full-time Director tasked with the following:

- Establish a business model and build partnerships with incubator and academic partners.
- Establish a location and form a buildout plan.
- Acquire launch funding through development of grants, loans, investment, partnerships and donations.
- Establish Insurance coverage.
- Source equipment through retail and discount vendors.
- Make basic staff hires and augment with volunteers.
- Attract first membership.
- Establish corporate partnerships.
- Form Non Profit 501(c)3.

This contracted position would be for either a 6 month term at \$40,000, renewed by performance review, or a year term at \$75,000. After a year term, the position would be folded into the main organization structure of the non-profit corporation.

### *Years 2-3: Momentum*

Once the core services are established with all the support that is required, The Collaborative can evaluate offerings, consider expansion of space and services, leverage successes to obtain higher funding levels, and increase profitability.

Equipment and supplies require constant upgrading to be able to offer market-level resources that will attract more members of higher caliber – i.e., corporate, academic and industrial applications.

Goals for years 2-3:

- Evaluate offerings and needs of membership.
- Review equipment condition and age, and research upgrades.
- Expand outreach and marketing to grow the membership base and offerings.
- Expand funding outreach to attract more substantial funding and investment.
- Eliminate unprofitable or unpopular programs and facilities.

**Equipment List (10,000 square foot average, basic list, new and salvage/used pricing)**

	Retail	Used
<b>Core Facilities</b>		
Facilities		
Forklift	\$30,000.00	\$6,000.00
Compressor (60gal)	\$800.00	\$400.00
Abrasives		
Disk sander, large, pedestal mounted	x	
Sand blasting cabinet	\$300.00	\$150.00
Wire wheel, bench mounted	x	
Vibratory polisher	\$3,000.00	\$1,200.00
Arts & Crafts		
Vinyl cutter, computer controlled	\$1,200.00	\$500.00
Glass cutters, stained glass	x	
Soldering irons, stained glass	x	
Automotive		
Floor jack and jack stands	x	
Motorcycle lift	x	
Transmission jack	x	
Engine hoist	\$500.00	\$150.00
Battery charger	x	
Pneumatic tools	x	
Electronics		
Multimeter	x	
Oscilloscope	\$600.00	\$100.00
Soldering station	x	
Power supply, DC	x	
Signal generator	\$1,000.00	\$250.00
Frequency counter	\$600.00	\$150.00
Variable transformer, variac	x	
Fabrication		
Cold saw	\$3,000.00	\$1,200.00
Drill press	x	
Horizontal band saw	\$1,000.00	\$500.00
Vertical band saw	x	
Tubing bender	\$100.00	\$50.00

Angle iron bender/notcher	\$1,000.00	\$600.00
Fabrics & Sewing		
Sewing machine, industrial	\$500.00	\$300.00
Sewing machine, standard	\$300.00	\$150.00
Overlock machine, serger	\$200.00	\$100.00
Embroidery machine, computer controlled	\$600.00	\$250.00
Tools		
Assorted hand and power tools	x	
Instruction		
Camera, digital SLR	\$1,200.00	\$300.00
Projector	\$1,200.00	\$400.00
Layout		
Granite surface plate	\$150.00	\$75.00
Height gauges, digital	\$400.00	\$200.00
Machining		
Lathe, large metal, with digital readout and tooling	\$10,000.00	\$6,000.00
Milling machine, large, with digital readout and tooling	\$10,000.00	\$6,000.00
Milling machine, 4-axis, CNC (Tormach)	\$10,000.00	\$6,000.00
Measurement		
Calipers, digital and dial	x	
Micrometer, digital	x	
Plastics		
Vacuum forming station, 24" x 24"	\$500.00	\$300.00
Heat strip bender	\$600.00	\$300.00
Router table	\$200.00	\$100.00
Prototyping		
3D FDM printer, ABS	\$3,000.00	\$1,500.00
Laser cutter, 60 watt	\$2,000.00	\$1,600.00
3D scanner (NextEngine)	\$6,000.00	\$2,500.00
Sheet Metal		
Box and pan brake	\$2,500.00	\$1,200.00
English wheel	\$1,200.00	\$600.00

Planishing hammer, air powered	\$1,200.00	\$500.00
Sheet metal shear, power, 48" wide	\$3,000.00	\$1,500.00
Slip roll, power, 48" wide	\$5,000.00	\$2,500.00
Throatless shear, bench mounted	\$250.00	\$100.00
Corner notcher	\$600.00	\$250.00

#### Surface & Finishing

Powder coating station and oven	\$5,000.00	\$2,500.00
Spray painting area, ventilation hood	\$2,500.00	\$2,000.00

#### Welding

Plasma cutter, CNC, 4' x 8' (Torchmate)	\$10,000.00	\$8,000.00
Welder, TIG	\$5,000.00	\$2,500.00
Welder, MIG	\$1,200.00	\$800.00
Welder, spot	\$1,200.00	\$600.00
Plasma cutter, hand held	\$1,200.00	\$600.00

#### Woodworking

Wood router, CNC (ShopBot)	\$5,000.00	\$3,000.00
Table saw (SawStop)	x	
Compound miter saw, sliding	\$500.00	\$250.00
Table router	\$500.00	\$250.00
Band saw	x	
Belt/disc sander, free standing	x	
Lathe, 24", 3HP	\$1,600.00	\$1,000.00
Scroll saw	x	
Drill press, free standing	x	

#### Imaging

44" photo-quality printer	\$6,000.00	\$2,000.00
High resolution digital camera	\$4,000.00	\$1,500.00
Photo scanner	\$1,500.00	\$500.00
Darkroom (wet)	\$500.00	\$500.00
Stands, support, grip	x	
Holography starter kit	\$500.00	\$500.00

#### **Expansion**

##### Commercial Kitchen

Hood	\$5,000.00	\$1,200.00
Ovens	\$5,000.00	\$2,000.00
Cooktops	\$3,000.00	\$1,200.00

Refrigerator	\$2,000.00	\$1,000.00
Freezer	\$2,000.00	\$1,000.00
Dishwasher	\$2,000.00	\$1,000.00
BioTech		
Refrigerator	\$2,000.00	\$1,000.00
Freezer	\$2,000.00	\$1,000.00
Incubator	\$3,000.00	\$1,500.00
Shaker	\$1,000.00	\$500.00
Centrifuge	\$15,000.00	\$10,000.00
PCR machine	\$1,500.00	\$1,000.00
Confocal/Epifluorescent Microscope	\$6,000.00	\$4,000.00
X-Ray diffraction machine	\$50,000.00	\$40,000.00
Totals	\$218,600.00	\$130,475.00

(Items marked with "x" are already owned)

Furniture, storage

50 Workbenches	\$200.00	\$10,000.00
25 Workstations	\$1,000.00	\$25,000.00
30 Storage Units	\$150.00	\$4,500.00
30 Cages (secure)	\$300.00	\$9,000.00
20 Shelving Units	\$150.00	\$3,000.00
		\$51,500.00

Buildout (Partially developed standard commercial space as example)

10,000 square feet, electrical and plumbing	\$50,000.00
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