

# **Proposal for a Tri-Valley STEM Center & Aviation Makerspace at LVK**

TriValleySTEM.net

Submitted by:

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This is a preliminary document that is subject to review and modification.  
Copies can be downloaded - <http://trivalleystem.weebly.com/docs.html>  
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## A SPECIAL THANK YOU

I wish to extend a special thank you to Trystyn Clark, the youth leader for Aviation Explorer Post #997. Without him this project would have made little forward progress.

Trystyn has been a regular at Livermore Municipal Airport (LVK) ever since he turned seven years old. He has grown up spending much of his time there. From the start, the airport community took him under their collective wing and helped him pursue his interests in aviation. Trystyn has earned the trust and admiration of the pilot and business communities at LVK and beyond.

When we started the Aviation Explorer Post in late 2016, Trystyn always knew exactly who to contact when something needed to be done or questions needed to be asked. He would unlock his cell phone, make a call, and move our efforts forward.

When the first version of this document was made public, Trystyn was only fifteen years old. Call it reverse age description if you want, but I purposely did not include him as a co-author on this document. He did not help directly with the compilation of this document, but he has had a significant impact on this project overall – both through action and ideas.

Trystyn exhibits the poise of someone significantly older than himself. And, he exhibits a depth and breadth of aviation knowledge of someone significantly older than himself. But, in terms of enthusiasm, passion, and sheer joy in all things related to aviation, he is still a kid at heart. I hope he continues in this mold.

Since the first version of this document was distributed, Trystyn has turned sixteen and has completed his first solo flight. We look forward to his continued participation in the Explorer Post, and the Tri-Valley STEM Center. He is sure to compile many more aviation and personal accomplishments.

-- Tom Manger

## MISSION & GOALS

Provide 24x7x365 meeting and project space for informal STEM learning activities outside of established classroom time. Provide dedicated space for afterschool, evening, weekend, holiday, and summer programs in STEM.

Build and maintain hangar space at Livermore Municipal Airport suitable for low cost informal STEM learning programs for youth.

Use the wonder and awe of aviation and aerospace to engage youth in relevant topics to inspire, motivate, guide and train them to pursue educational and career paths in these industries.

Use age appropriate hands-on informal STEM learning activities to advance real world understanding of numerous STEM topics.

Bring together volunteers from local youth, STEM and hobby groups to collaborate and offer a combination of both free and moderate cost classes, activities, camps and project based STEM learning opportunities with outcomes moving them closer to high paying STEM careers.

Engage the local pilot and plane building communities to provide youth with opportunities to learn about all manufacturing, construction and maintenance aspects of aviation and aerospace.

Coordinate with local Boy Scout, Girl Scout and 4H groups to better facilitate their STEM programs and subsequent outcomes.

Provide a community workspace with advanced manufacturing tools so that individuals and groups can learn new technical skills specific to the equipment as well as to work on projects that combine skill sets.

Increase awareness and value of the airport to the surrounding community. Promote the airport as a hub for informal STEM education and innovation.

## EXECUTIVE SUMMARY

This proposal details efforts to build a new publicly accessible hangar for youth-oriented informal STEM learning programs run by local nonprofits. Five Rivers Aviation, Robot Garden, and Aviation Explorer Post #997 are working with additional groups and individuals to execute this.

The current plan is for a 15,000sf hangar, but the lot would accommodate up to 25,000sf for a single story hangar. Including a second story to the hangar would add significantly more square footage. The completed hangar will include meeting, classroom, project and storage space. It will include a makerspace where advanced manufacturing tools such as 3D printers; CNC routers; laser, waterjet and plasma cutters are available for training purposes as well as for personal/group building projects.

The new hangar space will be used by dozens of local STEM hobby groups and local aviation groups for meetings, classes, collaborative building projects, and public outreach programs. Multiple groups and activities will be able to use the facility at the same time. This will provide numerous opportunities for social interactions between normally disparate groups. This will lead to collaboration between groups.

The current list of groups has an estimated active membership of over 1100 individuals. Through their extensive volunteer efforts and ongoing activities, these groups will provide a steady schedule of activities and learning opportunities.

There will be a primary emphasis on aviation and aerospace career training, but experience and technical skills learned will be useable in many career fields outside of aviation and aerospace.

Youth are naturally drawn to the wonders of aviation and aerospace. Activities at the new hangar will be geared to motivate, energize and guide youth towards careers in STEM. This hangar will be a focal point for numerous informal STEM learning opportunities in the Tri-Valley.

Pete Sandhu, president of Five Rivers Aviation, recently constructed new private hangars at LVK and is helping to spearhead the building efforts.

## A COLLABORATIVE APPROACH

There are numerous aviation, aerospace, youth, hobby & STEM groups in the Tri-Valley area. The members of these groups are some of the most passionate, dedicated, motivated, connected and knowledgeable in each of their respective areas. They are known for their youth programs, public outreach and volunteer efforts. These groups are also known for their capable retiree members who are motivated to help train a new generation of enthusiasts and innovators.

Bringing these groups together into a single collaborative environment will allow them to share space, tools, resources, skill sets and expertise. Joining efforts and sharing common resources will greatly increase their reach and effectiveness.

These groups provide hands-on informal learning opportunities at a low cost. They provide area youth with opportunities to put newly learned knowledge into practice and explore career options through hands-on activities. These groups give youth real world experience.

With a shared space these many groups will be able to offer and grow their existing programs without having to make significant changes to their core missions, their budgets or to their primary operating procedures. They will be able to expand their program reach through increased visibility, increased efficiencies and leveraging common assets.

All groups that have been approached have expressed an interest in using the planned space, collaborating on projects, and pooling resources to expand youth programs and public outreach. These groups include local hobby clubs for RC planes, drone racing, youth aviation, indoor skydiving, rocketry, geology, astronomy, Mars exploration, general science, robotics, amateur radio, and software programing.

Local Boy Scout and Girls Scout councils have also expressed interest in using the facility as a focal point for STEM related merit badge programs. With a physical & logistical focal point, many more youth are expected to pursue STEM related merit badges and patches.

## INVITED GROUPS

Below is the current list of local hobby & STEM groups being invited to use the space. Most have expressed a clear desire to do so.

### **Aviation Related STEM & Hobby Groups**

- Aviation Explorer Club #997 (age 10-13) - ~30 members
- Aviation Explorer Post #997 (age 14-20) - ~10 members
- Livermore Flying Electrons - RC Plane Club - ~200 members
- East Bay Radio Controllers - RC Plane Club - ~85 members
- Aerial Sports League - drone racing - ~50 members
- iFly SF Bay - STEM using indoor skydiving
- EAA Young Eagles – free introductory flights for youth age 8-17
- Robot Garden – aviation focused makerspace

### **Aerospace Related STEM & Hobby Groups**

- Livermore Unit National Association of Rocketry - ~300 members
- Livermore Valley Lithophiles – geology /earth science - ~30 members
- Tri-Valley Stargazers - astronomy - ~50 members
- Mars Society - ~25 members

### **Electronics Related STEM & Hobby Groups**

- Robotics Explorer Post #6059 - ~20 members
- Livermore Amateur Radio Klub - ~200 members
- Robot Garden makerspace – robotics - ~45 members
- TriValley CoderDojo - ~25 mentors
- Girls Who Code - ~25 mentors

### **Youth & STEM Programs**

- Boy Scout SF Bay Area Council – STEM merit badges
- Boy Scout Engineering Explorer Post - coming fall 2017
- Boy Scout Science Explorer Post - coming fall 2017
- Girl Scout NorCal District – STEM related activities
- Girl Scout Troop # 30226 - Livermore Robotics Team
- Abbie 4H – focus on STEM related activities
- Del Arroyo 4H – STEM related projects

### **Other Local Programs**

- Spectrum of Science Foundation - ~20 instructors
- TriValley Explorers – informal homeschooling group
- TV30 – STEM programming via student-run field reporting

Below is the list of local pilot & aviation groups that will be invited to use the space for meetings and public outreach programs.

### **Pilot & Aviation Groups**

- Experimental Aircraft Association #663 - ~85 members
- Flying Particles - flying club - ~150 members
- Sierra Rotorcraft Club
- Women In Aviation International, SF Chapter
- The 99's (women's flying club)
- Livermore Valley Airman's Association
- Women Love Taildraggers
- NorCal Soaring Association
- International Aerobatic Club (IAC) Chapter

Once the STEM Center construction is complete, several government run aviation programs will be contacted to see if their programs are appropriate to be run from the STEM Center. These programs include the Air Force's Civil Air Patrol, Alameda County Sheriff's Air Squadron, and the USCG Auxillary Squadron.

### **Scouting Badges & Merit Badges**

Below is a list of STEM related merit badges offered by the Boy Scouts. The Girl Scouts offer a similar range of badges. For STEM activities, 4H youth participate in individual "projects" which can be any preferred topic.

With the Community STEM Center scouts throughout the area will be able to show up at a prescheduled time to work on their badges together. It is expected that this simple collaboration will significantly increase the number of STEM related badges awarded.

Aviation	Astronomy	Electricity	Space Exploration
Robotics	Engineering	Programming	Digital Technology
Radio	Electricity	Chemistry	Energy
Geology	Composites	Welding	Nuclear Science

### **STEM Competitions**

Where appropriate the STEM Center will be made available to STEM competitions and the teams that compete. The Tri-Valley has numerous Lego, robotics, rocketry, coding and other STEM teams that compete.



## **Businesses & Business Groups**

Relationships with local businesses and business groups have not yet been fully established. These contacts and relationships will be developed as organizational and fundraising efforts get underway. In an effort to increase opportunities for youth – via sponsorships, scholarships, internships, and coops - these relationships will be pursued as an ongoing effort.

Full collaboration with businesses and business groups will ramp up as the new hangar is incrementally built and made operational.

Basic communications have been established with the groups listed above. Their interest in participating is premised on the completion of the new hangar.

As of September 2017, several of the groups listed have plans to immediately start offering scaled down activities at the airport. The hangar for the new Community STEM Center is at least a year from being available, so they will use existing space made available to them. The goal is to get their programs integrated into and affiliated with current airport operations prior to completion of construction for the new hangar.

Most have been invited to participate in the annual Livermore Airport Open House & Airshow taking place in October. Their presence at the Open House is to showcase STEM at the airport; and to give the leaders of these groups an opportunity to meet and to start dialogs amongst themselves.

## **MAKING GOOD NEIGHBORS – CONTRACTS, MOU’S & SYNERGIES**

### **ECONOMIC DEVELOPMENT**

As much as funding will allow, the Tri-Valley STEM Center will install high end advanced manufacturing equipment in its makerspace. A Memorandum of Understanding and/or contract will be developed with local business incubators in Tri-Valley to allow their startup businesses to use the manufacturing equipment for product prototyping.

Where appropriate, students will be paired with startups and prototyping projects to gain real world product development experience.

### **WORKFORCE DEVELOPMENT**

The Tri-Valley STEM Center will work with the community college district to provide equipment and training appropriate for local workforce development.

As much as funding will allow, the Tri-Valley STEM Center will install equipment not currently available at Los Positas Community College. A Memorandum of Understanding and/or contract will be developed with LPCC such that classes can be offered at the STEM Center via LPCC instructors. These classes will be either for credit or non-credit as LPCC deems appropriate for their offerings.

### **CURRICULUM AUGMENTATION**

Over time, the Tri-Valley STEM Center will work with local high school and middle school STEM teachers to coordinate curriculum with STEM Center activities and offerings.

For example, if the local high school science classes are teaching about force vectors, the STEM Center will offer a class or activity about the forces of flight. If a local science class teaches about light and radio frequency spectrum, the STEM Center will offer a class or activity about radio communications.

These hands-on activities would provide additional insight to topics covered in the classrooms.

## LEGAL

A new nonprofit corporation called LVK Land Holdings (or some other agreed upon name) will be formed to hold property for use as an educational facility in the Tri-Valley. This new nonprofit will build the physical hangar; hold the ground lease for the lot located on airport property; and hold title to the physical hangar once it is completed.

This additional nonprofit, LVK Land Holdings, holding title to the hangar is being put in place to minimize liability to the City of Livermore which owns the land used by the airport.

Any capital fund donations made to Robot Garden for the construction of the hangar would be passed through to LVK Land Holdings. Only funds sufficient to complete the unimproved hangar would be passed on to LVK Land Holdings.

Once LVK Land Holdings completes construction of the hangar, Robot Garden makerspace will obtain a \$1/year lease for use of the hangar and associated amenities. As part of the lease agreement, Robot Garden will be responsible for maintaining the building, utilities and for any leasehold improvements.

Robot Garden will continue its charter to provide a community workspace focused on STEM and advanced manufacturing techniques. It will set up and maintain the classroom, meeting, and work spaces. It will be responsible for the scheduling of activities, meeting spaces and other resources. And, it will control access to the building and its resources using individually assigned badges.

## **OPERATIONS**

The Community STEM Center will be open 24/7/365 for paying Robot Garden members. Access will be allowed and monitored using a card key system and numerous video cameras throughout the facility. Robot Garden will manage the card key access system.

### **GROUP ACCESS**

Each nonprofit STEM and hobby club will be provided with 2 free photo badges that will provide unlimited access to the meeting and classroom space within the hangar. These badges will be provided to specific club members who can provide scheduled access to other club members as needed. This badge will not allow access to the makerspace or the tools within. This arrangement will allow each club to work independently, reserve meeting space and other resources, and schedule group activities for their members and for the public.

Boy Scout and Girl Scout “merit badge counselors” will likewise be provided with badges that provide limited access. They will also be able to reserve meeting space and schedule resources needed for youth to pursue their badges.

Local home school families have expressed interest in using the facility. Robot Garden is in discussions to create a separate membership tier for homeschoolers that would allow access only during normal school hours when public and private school students are not available to use the space.

### **PROJECT TEAMS**

In addition to the youth, hobby and STEM groups that will have access to the facility, self-identified project teams will be provided access to specific resources as needed. These project teams will be small groups (up to 10 people) working on a specific educational or build project.

Project teams can be STEM contest teams, home school groups, special interest groups, a subgroup within a hobby club, school clubs, teams working to build a STEM related project, or small teams with other goals or purposes. They could be small hobby club classes working through a hands-on curriculum.

These groups will operate similar to the Boy Scout or Girl Scout patrol model. Each team requires two adult leaders, two youth leaders, and up to six youth participants. Individuals can belong to multiple teams. Project teams will be allowed to only access meeting and classroom areas of the facility. Access to the makerspace will require an adult with a Robot Garden membership.

Project teams will be either temporary or ongoing entities. Groups that endure year to year can change their membership. Project teams will be able to reserve tools, workspace and workbenches.

### **RESERVING WORKBENCHES**

Approximately twelve moveable workbenches will be purchased or built. The top work surface of these workbenches will be 4'x8' in dimension. The entire unit will be on lockable wheels so that they can be moved about the facility. These workbenches will be listed on the facility schedule and can be reserved for use.

Most workbenches will be generic in their amenities but several will be set up to house specific tools and features. A small number of special function workbenches will be developed over time. Examples are workbenches dedicated to small electronic projects & soldering; small craft projects & glue guns; or light duty building projects & small power tools.

Project teams and hobby clubs can reserve the workbenches to work on their projects. To facilitate long term projects, team competitions, and after other school programs, teams will be able to reserve workbenches for repeat visits.

When the main STEM Center space is needed for large groups, the workbenches can be moved to storage areas.

### **ROBOT GARDEN MEMBERSHIPS**

Each hobby, youth and STEM group will continue to operate under its own membership. Groups will use the STEM Center side by side. Participants will be encouraged to join specific clubs in which they wish to further participate. This will add to the total list of available STEM Center volunteers without unnecessarily restricting members.

The Community STEM Center will be a busy location. With numerous meetings, classes, activities, and projects taking place concurrently. Every opportunity will be taken to encourage participants to become Robot Garden members, use the makerspace and financially support the center.

In addition to providing benefits to individuals and families, Robot Garden memberships will be promoted as an act of goodwill and a way to support the larger STEM community.

### **ROBOT GARDEN SPECIAL INTEREST GROUPS (SIG's)**

Robot Garden currently facilitates a number of informal SIG's. These are groups of individuals focused on a specific topic or project. Robot Garden will continue to facilitate SIG's. These will be separate from Project Teams that will not have access to the Robot Garden makerspace. The type and quantity of SIG's can change over time. The current list of SIG's is:

Robotics	Ham Radio Projects
Aquaponics	Minecraft Modding
Youth LEGO League	Udacity Robotics Nanodegree
Microcontrollers & Electronics	

### **MAKERSPACE SPONSORS**

Only Robot Garden members will have access to the tools in the enclosed makerspace. But, any Robot Garden member can sponsor an individual, group or Project Team and provide them with in-person access to specific resources.

The Robot Garden member will be responsible for ensuring the safety of any individuals or groups while using the makerspace equipment. They will be primary operators responsible for the equipment. But, they will be encouraged to provide instruction to the individuals and groups being sponsored.

They will also encourage sponsored individuals to sign up for their own Robot Garden membership.

### **MAKERSPACE EQUIPMENT TRAINING**

Two substantial challenges facing a makerspace are training members to safely use the equipment, and keeping the equipment fully operational.

Keeping equipment running requires a pool of people who are trained and experienced with the intricacies of each piece of equipment. Many of the larger tools have specific safety and usage requirements. This knowledge takes time to relay to users. And, it takes people who are motivated to learn the equipment and keep it running.

For a number of years Robot Garden has been offering monthly Safety & Basic Use classes (SBU's) for each piece of equipment. To date, these classes have been run in person and are individualized to attendees. Going forward, Robot Garden will create self-paced online curricula for each piece of equipment. This will streamline the training process.

Google Classroom or a similar tool will be used to provide the material. Quizzes and tests will be used to ensure that each student thoroughly understands the material. This will also be used to document the pool of people who have completed training.

After online requirements have been completed, each student will be required to complete at least one project using the equipment. A previously trained member will oversee these efforts. This last step will be a demonstration of skills learned.

The curricula will include the do's and don't's of the equipment; major specifications; and safety issues. It will also include maintenance and calibration steps.

### **MAKERSPACE EQUIPMENT MENTORS**

Once properly trained, high school students will be encouraged to participate as equipment mentors. They will work under the tutelage of a Robot Garden member. But, they will be provided opportunities to work with the public in using the equipment. In this role they will be liaisons that can help people make "one-off" creations. This provides the high school students with experience designing and building using advanced manufacturing equipment.

High school students will also be asked to keep the equipment in operational condition. They won't be responsible for maintenance or calibration tasks. But, they will be encouraged to use the equipment on a regular basis to create their own projects. These will serve as tests of the

equipment. So, when others need to use the equipment it will be in a known working state.

### **MAKER PORTFOLIOS**

Engineering colleges sometimes now ask for “maker portfolios” during the admissions process. These portfolios illustrate projects completed by the student and detail the technical skill sets and creativity they have demonstrated throughout high school.

High school students who volunteer as Makerspace Equipment Mentors will be provided with documentation of the projects on which they have worked.

### **INTERNAL PROJECT FUNDING (ala Kickstarter program)**

If funding allows, the STEM Center will solicit makerspace project team proposals seeking funding – typically to purchase materials and parts for building and completing the project. On a quarterly basis the project proposals will be reviewed and scored on a number of factors. Projects that score highest will receive funding.

Any funded projects will receive internal support until completed. The youth on the project team will receive important real world experience. Once the project is completed, youth leaders on the team will have to give a presentation about their project during a future STEM Center event. So, youth will also get public speaking experience.

Exposure for these projects will be sought through local newspapers and other media outlets. They will be highlighted on the STEM Center website as well. These projects will be used to inspire and motivate other youth who might be considering similar projects.

### **STEM TEACHER SUPPORT TEAMS**

Teachers will be encouraged to use the STEM Center as a resource for making equipment for classroom demonstrations, visual aids, and posters highlighting STEM concepts.

In order to build and strengthen community relationships, schools and individual STEM teachers will be encouraged to develop volunteer teams of students and parents who can act as program supporters. If a teacher has an item they would like designed and built to support their



curriculum, their support team could use STEM Center resources to complete the project.

If a teacher or school does not have a designated support team, they can alternately submit a verbal or written request to the STEM Center. A Project Team will then be identified to provide support to the teacher. In this manner support can then be provided on an ad hoc basis. Teachers who only need occasional assistance won't need to recruit their own support team.

It is preferred that a teacher's project have students & parents from the school at which the teacher works. But, if none are available, there will likely be STEM Center students looking for projects on which to work.

### **VOLUNTEER TUTOR CENTER**

Volunteer tutors will be able to schedule space at specific times so that students needing help with STEM topics can receive assistance. This would be a completely volunteer program that targets underprivileged youth.

### **ONLINE SELF HELP SYSTEMS**

Online scheduling and payment tools will be used to facilitate orderly access to STEM Center resources and programs. The online tools to be used have not yet been selected. But, there is a multitude of pre-built Software-As-A-Service (SAAS) options. Options will be reviewed and implemented prior to opening of the facility.

### **BADGE THE WORLD**

Robot Garden members and regular attendees of the STEM Center – both adults and youth – will be provided with badges. Badges will have the participant's name and photo. This will help to facilitate contacts between people. By making people more recognizable it will also help to build community.

Youth badges will grant access to the front foyer of the building. Youth will be required to "badge in" and "badge out" when entering or leaving the building. The badging process will help facilitate accountability amongst the youth.

Adults will receive badges whether they are group leaders or regular attendees. Group leaders will be able to grant access to the building.

Visitors will not. This will help to foster accountability amongst the entire membership.

### **THE BENEFITS OF BADGES**

The badging process will confirm that participants have reviewed and accepted the liability waiver for facility use. It will allow documentation of emergency contacts. And, for youth, it will allow contact with their parents if needed.

Anyone without a visible badge will need to “check in” at a designated kiosk within the facility. This check in process will include signing of the waiver.

An additional benefit to the badging process is that it will allow Robot Garden to document and track how the facility is used. By associating an individual’s presence during a specific time period, the most popular programs can be identified and better managed.

Robot Garden can also identify individuals who show up infrequently or stop showing up after a few visits. These people can then be contacted and surveyed to identify which elements did or didn’t work for them.

With a standardized tracking system, Robot Garden would be in a better position to seek grants from the National Science Foundation (NSF). NSF does research on the effectiveness of science education and student outcomes. They have a subgroup called Advancing Informal STEM Learning (AISL) that would be most interested in the working outcome of the Community STEM Center.

### **GREETERS**

All Robot Garden members will act as greeters and docents to welcome individuals to the facility and to orient them to resources and operations. Providing greeter and docent services will be a required part of Robot Garden membership.

During events and activities each youth, STEM and hobby group will be required to designate specific individuals to act as greeters. These greeters will be “on duty” for each event or activity scheduled by the group.

Greeters will be tasked with identifying visitors in their groups. (Typically someone without a badge or otherwise looks disoriented.) Greeters will provide visitors with handouts and a brief orientation. They will ensure the visitor has signed the online liability waiver and their contact info is added to the online system. If time is available, a brief facility tour would be warranted. If the visitor plans to return, instructions for obtaining a badge will be provided.

The greeters will also introduce visitors to other group members, including the leadership team. Research clearly shows that the more contacts a new member has within a given group, the more likely they are to retain their membership and involvement.

Having a designated pool of greeters and docents will help ensure a good experience for all. It will help ensure facilities are used correctly and safely. It will also help to build cohesiveness with people who use the facility.

Additional aspects of STEM Center operations will be documented as the hangar is built and programs start being offered to the public. The preceding is an outline and is subject to change.

## **FINANCIALS - FUNDING THE INITIAL BUILDOUT**

The initial fundraising goal is \$4.0M. This is for an estimated \$1.2M-1.5M for the construction of the hangar(s); an estimated \$1M to outfit the interior of the hangar with furniture, signage, computers, software, and training aids; \$0.5M for makerspace supplies, safety equipment, tools and advanced manufacturing equipment; and an additional \$1M to be held in reserve for possible cost overruns, unplanned building needs, unexpected expenses, and future operations.

If needed, the reserves will be used to smooth out actual expenses against income projections as operations are ramped up over the first three years. Membership and fee income is expected to grow rapidly over the first three years. But, reserves will be used to cover any shortfalls as actuals are compared to projections.

Amounts needed for initial build out will vary as the design and interior layout of the hangar space is finalized. In order to eliminate cost overruns proposed features, amenities, purchases and significant upgrades will be postponed as needed. They will be considered for future inclusion when additional revenue or fundraising can be secured.

A capital fundraising plan will be finalized after the building plan has been agreed upon and finalized with the City of Livermore and the Airport Commission.

### **DONATIONS & IN-KIND SERVICES**

The City of Livermore will be petitioned to waive all construction and development fees for this project.

The electrical contractor who has been contacted regarding construction of the new hangar (Tucknott Electrical) has offered to provide labor and materials for free. (Bob Tucknott is on the board of directors of the local Boy Scout council.) The plumbing contractor (Bonetti Plumbing) has made the same offer. This will provide a significant cost savings to this project. These are the same contractors who built Five Rivers Aviation so they are familiar with airport operations and construction intricacies at the airport.

## FINANCIALS – EXPENSES FOR ONGOING OPERATIONS

### MAJOR EXPENSES

Operations are being planned so that there will be a low overhead cost structure for monthly operations. Once the hangar is built, the largest mandatory monthly expenses will be:

- Insurance
- Ground Lease
- Utilities
- Online SAAS Utilities
- Accounting Services

There will be elective operational costs for building and equipment supplies. But, these can be kept to a monthly minimum until a steady income stream is established.

### STAFFING

Approximately six months after start up, there are plans to hire onsite full time staff to help run operations. Salaries have been budgeted. But, specifics of the positions will be decided as the hire date nears. The goal is to have the building staffed from 9-to-5 seven days each week. Volunteers will be recruited for additional support.

Initial operations will be run by volunteers. But, at least one full time staffer may be hired sooner depending upon funding and future events.

See attached expenses spreadsheet for projections.

## **FINANCIALS – EXPENSES FOR ONGOING OPERATIONS**

### **ANNUAL EXPENSES – 5 YEAR PROJECTION (2018 partial year)**

	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
Ground Rent	11500	11500	11500	11500	11500	11500
Liability Insurance	5000	5200	5400	5600	5800	6000
<b>SUBTOTAL</b>	<b>16500</b>	<b>16700</b>	<b>16900</b>	<b>17100</b>	<b>17300</b>	<b>17500</b>
PG&E	15000	18000	21000	24000	27000	30000
Water & Sewer	1800	2100	2400	2700	3000	3300
Garbage Pickup	2400	2700	3000	3300	3600	3900
Internet	1800	2100	2400	2700	3000	3300
Phone	600	720	840	960	1080	1200
Accounting Services	12000	13200	14400	15600	16800	18000
<b>SUBTOTAL</b>	<b>33600</b>	<b>38820</b>	<b>44040</b>	<b>49260</b>	<b>54480</b>	<b>59700</b>
Cost of Goods Sold	1000	2000	2500	2500	2500	2500
Building Supplies	2400	2700	3000	3300	3600	3900
Equipment Supplies	3000	3600	4200	4800	5400	6000
<b>SUBTOTAL</b>	<b>5400</b>	<b>6300</b>	<b>7200</b>	<b>8100</b>	<b>9000</b>	<b>9900</b>
<b>TOTAL SANS SALARIES</b>	<b>55500</b>	<b>61820</b>	<b>68140</b>	<b>74460</b>	<b>80780</b>	<b>87100</b>
Salaries	0	175,000	185,000	195,000	205,000	215,000
<b>TOTAL</b>	<b>55,500</b>	<b>236,820</b>	<b>253,140</b>	<b>269,460</b>	<b>285,780</b>	<b>302,100</b>

## FINANCIALS – INCOME FOR ONGOING OPERATIONS

### **ROBOT GARDEN MEMBERSHIPS**

The overarching financial goal for operations is to have fee income from Robot Garden memberships be sufficient to pay for basic operations - “keep the lights on; doors open; equipment running”. So, monthly RG memberships will be heavily promoted on an ongoing basis. Membership benefits will include access to the advanced manufacturing tools and a fee waiver or discount on paid classes and activities offered.

There are several tiers of membership, each with its commensurate fee. A tier for retirees is intended to help create a significant pool of volunteers who have the time and expertise to help run operations and run various classes and programs. Other changes to tiers are being considered and will likely change before the STEM Center opens its doors to the public.

### **ADDITIONAL INCOME**

Additional income from fees, fundraising, and product sales will be used to purchase equipment and supplies to grow programs. When income warrants, full time staff will be hired to ensure smooth operations of the programs and equipment.

For fee income, the goal is to extract 10% (with a minimum of \$5 or \$10) for all paid classes, projects, merit badges and other activities. The hobby clubs providing the content will determine pricing for their offerings. With numerous programs running each month, a high volume of participants is expected to bring in needed revenue.

With sufficient interest and volunteer availability, various camps will be offered to generate larger amounts of fee income from a smaller number of participants. These will be high dollar and high value offerings.

Fundraising efforts will be a year round activity. Periodic fundraising events will be used to promote programs, bring cohesion to volunteer teams, and to target potential donors who do not typically fund STEM programs.

Grants will be sought on a regular basis for both operations, equipment and for new program support. Corporate sponsorships will be sought as a means to support ongoing operations. With a high density of high tech employers in the Bay Area, there are many sources from which to seek sponsorships.

Additional income will come from sales of a select line of equipment, parts, supplies and kits of popular usage. And, when sufficient volunteers are available, after school programs will allow additional fee income.

See attached income spreadsheet for projections.



## **FINANCIALS – INCOME FOR ONGOING OPERATIONS**

### **ANNUAL REVENUE – 5 YEAR PROJECTION (2018 partial year)**

	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
Membership - Retiree - \$20/mo	3,600	7,200	14,400	14,400	14,400	14,400
Membership - Club Mem - \$40/mo	14,400	28,800	57,600	57,600	57,600	57,600
Membership - Individual - \$50/mo	18,000	36,000	72,000	72,000	72,000	72,000
Membership - Family - \$80/mo	9,600	19,200	38,400	38,400	38,400	38,400
Membership - Business - \$150/mo	3,600	7,200	14,400	14,400	14,400	14,400
<b>MEMBERSHIP SUBTOTAL</b>	<b>49,200</b>	<b>98,400</b>	<b>196,800</b>	<b>196,800</b>	<b>196,800</b>	<b>196,800</b>
Scout Merit Badges	1,000	2,000	3,000	3,500	3,500	3,500
Aviation Summer Camps	0	12,500	17,500	20,000	20,000	20,000
STEM Summer Camps	7,500	12,500	17,500	20,000	20,000	20,000
Facility Use Fee (from hobby groups)	5,000	20,000	30,000	35,000	35,000	35,000
Class fee (from Robot Garden)	2,500	5,000	7,500	10,000	10,000	10,000
Facility Rental	1,000	2,000	3,000	4,000	5,000	6,000
Annual Fundraiser - dinner	6,250	7,500	8,750	10,000	11,250	12,500
Annual Fundraiser - golf tournament	0	0	0	12,500	12,500	12,500
Grants	30,000	50,000	75,000	100,000	100,000	100,000
Donations for Operations	20,000	30,000	40,000	50,000	50,000	50,000
Corporate Sponsorships	50,000	75,000	100,000	125,000	125,000	125,000
Sales from Mini-Museum	1,000	2,000	2,500	2,500	2,500	2,500
Sales from STEM Supplies	1,000	2,000	2,500	2,500	2,500	2,500
<b>STEM ACTIVITIES SUBTOTAL</b>	<b>125,250</b>	<b>220,500</b>	<b>307,250</b>	<b>395,000</b>	<b>397,250</b>	<b>399,500</b>
Tech Toy Drop Off - \$5/hr	1,000	2,500	3,000	3,500	4,000	4,500
After School Programs	0	1,500	2,000	2,500	3,000	3,500
<b>YOUTH ACTIVITIES SUBTOTAL</b>	<b>1,000</b>	<b>4,000</b>	<b>5,000</b>	<b>6,000</b>	<b>7,000</b>	<b>8,000</b>
<b>ANNUAL TOTALS</b>	<b>175,450</b>	<b>322,900</b>	<b>509,050</b>	<b>597,800</b>	<b>601,050</b>	<b>604,300</b>

## SITE SELECTION – THE PREFERRED BAY AREA AIRPORT

The Livermore Municipal Airport is an ideal location because of its size, location and proximity to amenities and knowledge workers. It is a very popular airport for the reasons outlined below.

- Planes at LVK are typically able to get airborne several hours earlier in the day while airports to the west are still socked in with fog. The Pleasanton Ridge – west of the airport – keeps fog at bay.
- Nearby GA airports have between 60 and 150 hangars supporting local general aviation pilot communities. Livermore has 400 hangars and a very active pilot community.
- LVK is home to a very active builder community. Over 15% of registered airplanes (78 in total) are experimental class. This includes homebuilt kits, refurbished planes, and vintage warbirds. Although confirmation is not available, numerous individuals have stated that LVK is the third most active airport in the US in terms of homebuilts.
- There are an estimated 15 homebuilt planes being built at LVK right now. These range from kits, to plans, to original designs. There are also older planes being refurbished. This is an indicator of a healthy building community at LVK.
- Airspace to the west of Livermore is highly restricted because of airspace around San Francisco, Oakland, and San Jose International Airports surrounding San Francisco Bay. Airspace surrounding and to the east of LVK is less restricted. This gives pilots easier access.
- LVK is home to five pilot training programs to provide a variety of options for new pilots. (ATP, Attitude Aviation, Flying Particles, JATO, Red Sky Aviation)
- The pilot community at LVK is very receptive to having more youth at the airport. They recognize that pursuing interests and careers in aviation and aerospace is not a straightforward task. So, they've expressed interest in making the Community STEM Center a success.

## SITE SELECTION – PREFERRED SITING ON LVK PREMISES

The location surrounding the old Dan Lee Terminal Building is preferred for the new Community STEM Center because of several factors.

- **Utility Hookups** – Utility hookups are already available at this location. Using the existing utility connections will save tens and possibly hundreds of thousands of dollars in construction costs.
- **Parking** – Parking is already available. Between the roadway and the existing parking lot, approximately 130 cars can be accommodated for attendees.
- **Overflow Parking** – If needed for large events, overflow parking is available in the grass area behind the existing paved parking area along Terminal Circle.
- **Impervious Surfaces** – This location will minimize new impervious surface areas by using existing parking areas and the existing allotment from the old Dan Lee Terminal Building.
- **Dining & Other Amenities** – Restaurants and other resellers are within walking distance to this site. This makes it easier for youth who don't drive to participate on site. And, it eliminates the need to drive to obtain needed services.
- **Increased Restaurant Revenue** – The restaurant planned for the new admin building will likely receive additional customers from people visiting the Community STEM Center. After parents drop off their children, a percentage will make use of local restaurants.
- **Nearby Airport Resources** – There are a number of other nearby airport resources – the control tower, admin building and FBO. The close proximity of these resources will increase opportunities to interact, build community, and show the value of the airport to the larger Tri-Valley area.
- **Mini-Museum** – The Community STEM Center will have a mini-museum with hands-on exhibits designed to engage young children. Proximity to the planned park and public viewing platform near the admin building is ideal for maximizing visitor traffic and engagement.
- **The View** – The view onto the tarmac and runway is enviable. We seek to introduce thousands of youth to careers in aviation and aerospace. Providing them a window into the workings of a small airport is an exceptional way to inspire and motivate them.

For these reasons, the location of the old Dan Lee Terminal Building is the ideal location for this project.

## SITE SELECTION – REJECTED LOCATIONS

Other airport sites have been discussed, but rejected as implausible for this project.

**“MD80 Ramp”** – The MD80 Ramp between the American Aircraft Sales building and the fire station was considered. But, this location would require all new utility hook ups at great expense. New parking areas would need to be constructed at additional expense. Additional ground area would be removed from natural seepage during rains requiring an additional fee. And, the exterior fence line would need to be significantly modified as an additional expense.

**South Side of Airport** – The south side of the airport was also considered. In addition to the same issues inherent to building at the “MD80 Ramp”, there are no amenities within walking distance. This would make the location significantly less convenient.

**Existing Hangar Space** – There is a 9-12 month waiting list for even the smallest T-hangar at LVK. The waiting list for the larger hangars is estimated to be even longer since there are fewer of these large hangars. This wait is an estimate for the individuals and businesses at the top of the list. New sign ups will have to wait even longer.

But, even if the new STEM Center would get a lease on a city owned hangar, these hangars are inside the secure fenced area of the airport. So, problems with safety, security, parking and other logistics would remain.

**Offsite Locations** – Several sites located off of the airport grounds were considered. These were considered inferior since they would not easily allow airplane building and maintenance activities. They would not allow regular interactions with pilots and personnel at the airport. And, since they were all privately owned, they would be significantly more expensive to rent – as opposed to obtaining a ground lease from the City of Livermore.

## **SITE SELECTION - TRANSPORTATION**

### **FREEWAY ACCESS**

The proposed hangars are less than one half mile from the “Airport Way” freeway exit on Interstate 580 in Livermore. Attendees have easy on/off access to the airport.

The airport has State Route 84 (aka Isabel Ave) bordering the east edge of the airport. This route provides easy access from the San Francisco “South Bay” to Livermore.

### **WHEELS BUS SERVICE**

Wheels Bus Service has been contacted regarding the proposed STEM Center. With the expected number of youth attending on a regular basis, Wheels has stated that it would be a straightforward effort for them to modify routes from local cities to provide drop off and pick up at the new STEM Center at the airport.

This would provide bus service from Dublin, Pleasanton and Livermore. With this in place, youth could attend after school programs with an estimated 4pm start time. Programs and policies would be put in place to allow parents to pick up their children as part of their commute home from work.

### **SCHOOL TRIPS**

It is hoped that resources and activities will be developed and offered for local schools as field trip programs. There is significant cost to transport youth to such activities. So, the STEM Center will seek out contracts with local transportation companies to establish low cost rates to the airport.

Ambassador Limo currently has a ground lease at the airport and parks their vehicles on the south side along Jack London Blvd. They will be approached as one such candidate. It is hoped that their proximity to the airport should allow for cost effective transportation for local schools.

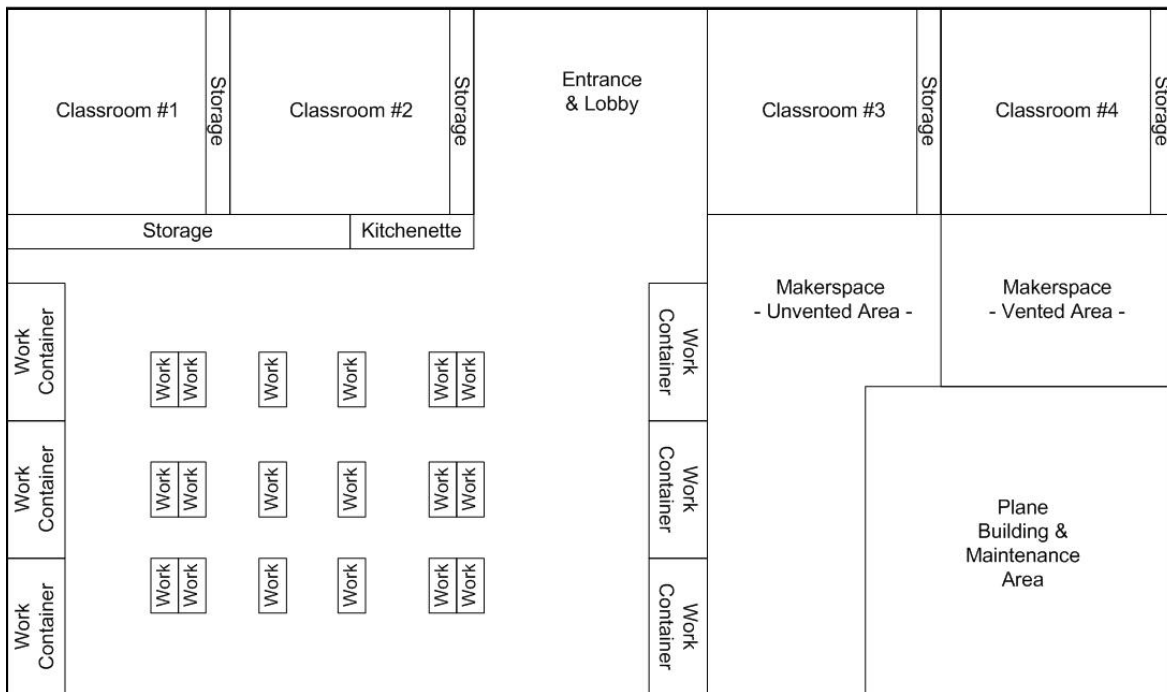
## BUILDING CONSTRUCTION

The final size, layout and siting of the STEM Center has not been finalized. These decisions will depend upon FAA and city requirement. They will also depend upon attaining fundraising goals. So, there is a range of proposed sizes and layouts.

### SMALLEST PROPOSED LAYOUT

The smallest proposed building size is 100'D x 150'W. The schematic below shows one such layout.

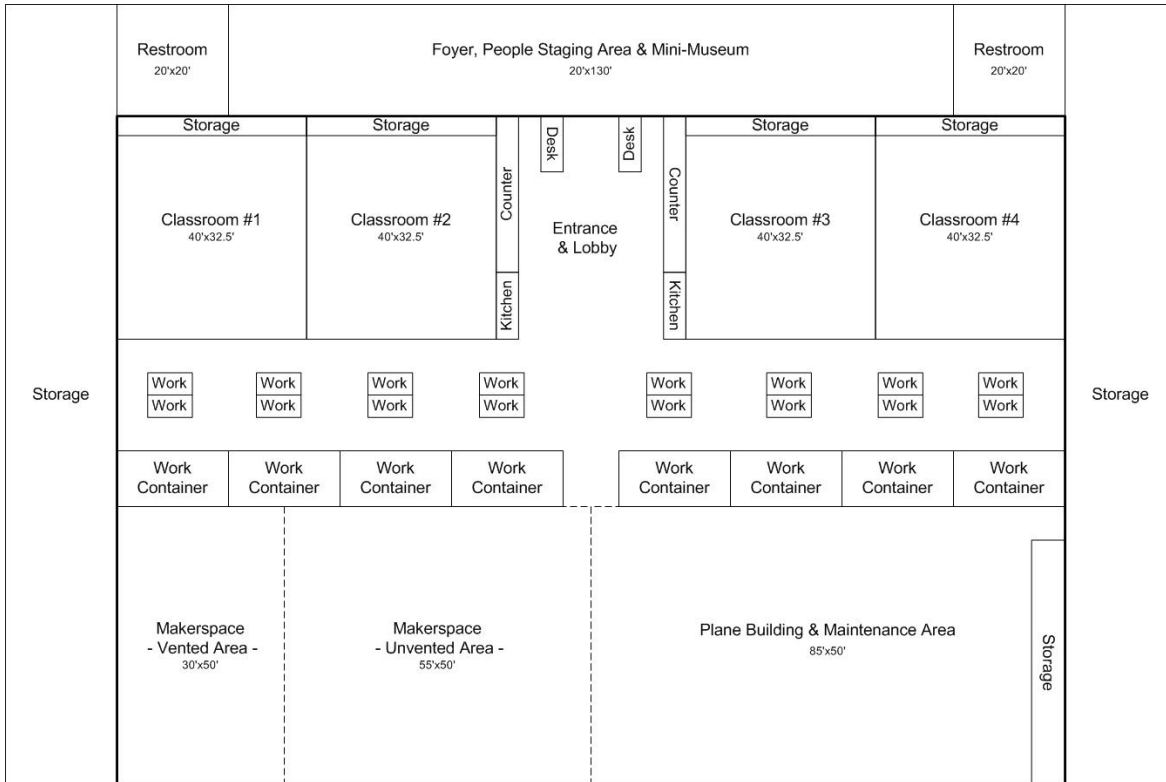
Tri-Valley STEM Center  
Conceptual Layout – Smallest Layout - 100' x 150'



The classrooms will be either traditional metal studs with drywall, or modular office space similar to what is available through PanelBuilt.com. The work containers will either be traditional metal studs with drywall, or they will be modified shipping containers outfitted for specific functions. The workbenches will be movable 4'x8' work surfaces with storage underneath.

## MID-SIZE LAYOUT - WITH ADDITIONAL STORAGE

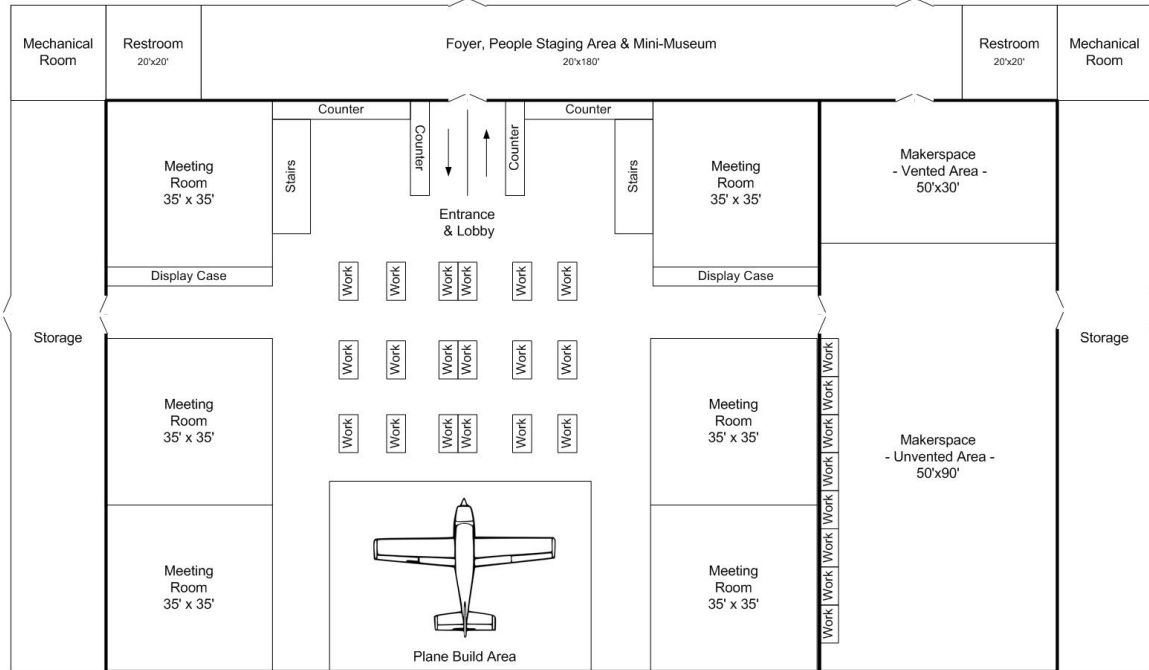
If funding allows, an upgrade from the smallest layout increases the hangar depth from 100' to 120'. It also adds a front foyer and side storage areas on both sides of the building. The foyer and storage areas are 20' deep and run the length of each side, respectively.



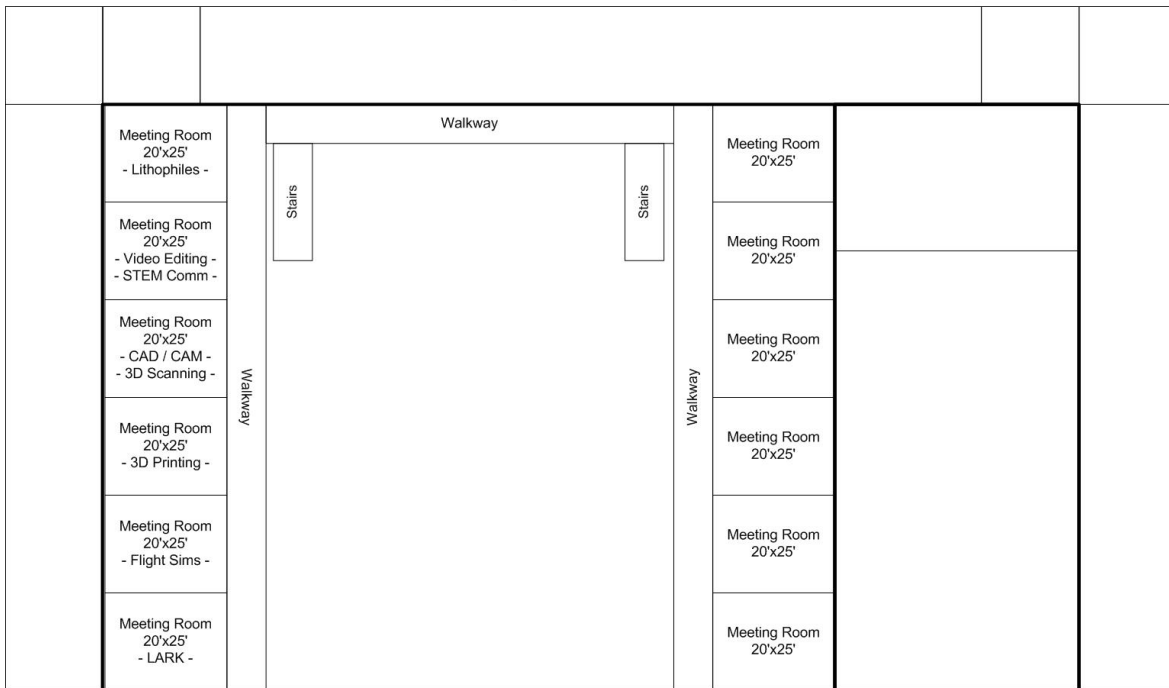
## LARGEST PROPOSED LAYOUT

If sufficient funding can be secured, a separate adjacent hangar would be built and dedicated for the makerspace and larger tools. This would allow better noise abatement between classroom areas and work areas with power tools. Also, the interior would be built with two-story classrooms and meeting rooms to increase the number of activities that could take place simultaneously. (Diagram on next page.)

Tri-Valley STEM Center  
Conceptual Layout – First Floor Interior



Tri-Valley STEM Center  
Conceptual Layout – Second Floor Interior





## BUILDING LAYOUT - CONSTRUCTION PHASES

This is a project that has few parallels in function or in the way it will be funded or operated at this scale. There are many unknowns regarding initial fundraising efforts. So, construction efforts will be initiated based upon reaching specific funding goals. These phases are:

Phase 1 – Build initial building/hangar shell with concrete pad, main electrical service and complete restrooms and plumbing to plan. Install fire suppression system. Install card key access system and basic internet connectivity. Add interior and exterior video monitoring systems.

Phase 2 – Build out interior with classrooms, meeting rooms, workbenches and public amenities. Include basic heating/cooling duct work for later hook up to rooms. Add electrical for additional rooms. And workspaces.

Phase 3 – Heating & cooling systems for enclosed rooms and for larger open hangar area.

Phase 3 – Build out the makerspace area with tools, dust collection, venting and other items needed for a public workspace.

An empty hangar with minimal amenities can be put to substantial use by the many youth, hobby, STEM, aviation and aerospace groups that have already been invited to offer their programs in this space. The interior rooms can be added at a later date based upon funding and volunteer efforts.

## **BUILDING LAYOUT - FEATURES**

If built to full size, this project will use the majority of space surrounding the old Dan Lee Terminal Building. This lot – between the FAA tower and the new administration building - is approximately 300' x 150'. The full use of this space includes both indoor and outdoor elements.

### **EXTERIOR FEATURES**

A small park and transition area will be built between the new administration building and the new STEM Center. This small park would provide a place for families to enjoy the airport. It would also serve as a lead entryway into the reception area of the new hangar(s).

A glass walled foyer along Terminal Circle is being considered for the front of the hangar. This would be a staging area for groups before entering the main hangar or the classrooms. It would also provide space for a mini-museum and instructional materials along the walls.

The entire building would be situated along the current fence line abutting the tarmac. FAA tower needs will be fully vetted before construction start.

### **INTERIOR FEATURES**

The smallest building design is for an open 100' deep by 150' wide hangar with a 20' tall interior. Additional hangar space is being considered for storage along both sides for equipment and supplies. This additional storage area will be used for storing tables, chairs, workbenches, hobby club supplies and infrequently used tools. This will help to keep the main hangar clear and safe. This will allow the primary work and meeting spaces to be free of clutter yet still highly adaptable.

Meeting and classroom space will be built in the interior of the hangar. This enclosed space is needed to minimize noise interference during instructional time. It will also be used to create physical barriers between different areas of the Community STEM Center.

For example, a physical barrier is needed between the planned work areas and the Aviation Makerspace which contains potentially dangerous tools. Access to these different areas will be controlled by door readers and individually assigned badges.

Rolling/sliding doors will be installed on the south side facing the tarmac. When opened it will provide an unimpeded view onto the airfield.

If possible, solar panels will be installed to offset energy usage required to cool the hangar and keep it comfortable during summer months.

The STEM Center will be divided into different zones using either signage or physical barriers such as walls or dividers. The designated areas will be:

- Reception Area & Mini-Museum (greeting area)
- Meeting & Classroom Space (3-6 rooms of 900-1200 sqft each)
- Moveable Workbenches (for light duty projects requiring tools)
- Aviation Makerspace (advanced manufacturing tools)
- Airplane Hangar (build area, maintenance area, flight simulator)
- Outdoor Lounge (picnic benches, outdoor seating, covered seating)
- Storage Area (supplies regularly needed by various groups)

The siting, design and layout have not been finalized. Discussions with stakeholders will continue until these phases are completed.

## BUILDING LAYOUT – USE CASES

Discussions have already been started with the invited groups. These discussions include interviews where use cases for the STEM Center are developed. Below are outlines of several use cases.

**Aviation Explorer Post #997** will make the Community STEM Center its home. It will be their base of operations at the airport. From RC planes, rocketry, robotics, geology, and the many activities based at the hangar, these youth will be introduced to career options in aviation and aerospace. – and the STEM requirements central to each.

They will work with local pilots to build or refurbish airplanes in the hangar. They will also work with local pilots to learn about basic maintenance tasks needed for small aircraft. Over time, they'll learn airport operations and start on the path to earning pilot certificates.

Flight simulators will be available for practicing maneuvers, and for introductions to instrument flight. Members of the Aviation Explorer Post will work with other hobby clubs to pursue aviation related interests. Since Robot Garden is the sponsor of the explorer post, youth members will be taught to use advanced manufacturing equipment and how it relates to the manufacturing of modern aircraft.

The **Livermore Valley Lithophiles** is a geology and lapidary club. They provide classes about earth science and need regular access to various stone cutting and grinding tools. Grinding can take place for hours at a time. Because of noise levels associated with this equipment, the Lithophiles will have their equipment set up in a separate space to prevent the noise from interfering with other parts of the hangar. The Lithophiles currently have about 800sf of storage space at The Barn in Livermore. They will need equivalent work and storage space at the STEM Center.

The **Livermore Amateur Radio Klub** will have equipment set up for demonstration purposes as well as for emergency use. Amateur radio communications can involve intermittent static, warbles and other signal processing sound affects. This equipment will be set up in its own space so that it does not interfere with other uses of the hangar.

The **Livermore Flying Electronics** RC plane club has its own flying field in north Livermore. There they keep two shipping containers with their needed supplies. They have a base of operations, but it doesn't serve all of their needs. They will use the STEM Center for their monthly meetings, for occasional classes and for building projects with youth. They also expect to use the makerspace tools for various building projects.

**Tri-Valley CoderDojo** members meet on a weekly basis. This is a nonprofit organization that introduces youth to careers in software programming. There are 60-80 youth who attend each week. They are divided based upon the various programming languages being taught. Youth, parents and mentors all attend these events.

Currently, CoderDojo meetings rotate weekly between five different locations that are offered to them for free. (i.e. The spaces are available once each month.) They use meeting rooms at Oracle, Veeva, Caledous Cloud, and the Dublin Public Library. This variability causes logistical problems for some families, so they attend some meetings but not others.

If provided weekly classroom space at the new STEM Center, leaders of CoderDojo are confident that they will be able to enlarge their program and provide more services to their youth. They do not expect to use any space other than the classrooms. But, they do anticipate expanding their offerings to include programming of autonomous aerial vehicles, and robotic systems.

**Young Eagles** is a program offered by the local chapter of the Experimental Aircraft Association. They provide free introductory flights to youth age 8-17. This is a well established activity at the Livermore Airport. But, they regularly experience logistical and space problems on the weekends at LVK when they operate.

There are dozens of families who mill about from 9am to 2pm while waiting for their children to take flight. The new administration building is not open to the public on weekends. And, while Five Rivers Aviation has offered their space, it is not large enough for the 50-100 individuals.

With the new STEM Center, these families will have a space in which to wait. During their wait they will be introduced to programs at the airport, but especially programs at the STEM Center.

## SWOT ANALYSIS

### STRENGTHS

- Significant community support
- Low cost operating structure once hangar is built
- Nearby parking, amenities and freeway onramp
- Depth and breadth of volunteer skill sets and backgrounds
- Outside the fence access / minimal security or on-field safety issues
- Larger hobby groups have been in existence for 20-50 years
- Large number of skilled volunteers from numerous STEM groups
- Large number of classes and activities available upon opening
- Programs can grow organically based upon interests of volunteers
- Robot Garden has been running local makerspaces since 2012

### WEAKNESSES

- Limited earned income
- Uncommon model bringing nonprofits together into a shared space
- Space needs to be highly adaptable for large variety of activities

### OPPORTUNITIES

- New model brings together hundreds of motivated volunteers
- Large number of tech retirees provides huge knowledgebase
- Youth oriented programs motivate parents to volunteer
- Preferred site already has utilities at curb
- Unique program design should help attract funding
- Large number of activities to drive up makerspace memberships
- Repeat visitations due to breadth and depth of planned activities
- Direct involvement of Boy Scout, Girl Scout and 4H councils
- Direct involvement with home school groups
- Direct connection to parents as school budgets get tighter
- Can work with local STEM teachers to align STEM Center activities with ongoing classroom curriculum

### THREAT

- Capital funding is uncertain.
- Low staffing levels with opportunities for staff burnout
- Ongoing safety and liability risk management
- Ongoing corporate sponsorships are uncertain.
- Number of makerspace memberships to be attained is uncertain.

## AREA STEM PROGRAMS

The following companies and organizations advertise and offer educational services in the Tri-Valley area. Most of these organizations are for profit entities that charge full market rates for their educational activities.

[A STEM Plus](#) – SAT/ACT Tutoring - nonprofit

[Ace Academy](#) - Dublin

[Bricks For Kids](#) - Livermore

[Catalyst Prep](#) – Santa Monica – Online\*

[CEI Tutoring](#) – Dublin

[Coder School](#) - Pleasanton

[Common Core Solutions](#) – Pleasanton

[Dublin Robotics Club](#) - Dublin

[Education Enrichment Center](#) – Pleasanton

[Genius Kids Club](#) - Livermore

[Goods Of The Mind](#) - Dublin

[Mad Science of Mount Diablo](#) – Concord

[Ohlone College Coding For Kids](#) - Fremont

[The Gaussian School](#) - Pleasanton

[Revolution Prep](#) – Santa Monica – Online\*

\* Online & out of area services that advertise in Tri-Valley

The success of these programs demonstrates that there is a ready market for supplemental educational programs. However, the high costs of these programs leave a significant portion of local families unable to access extracurricular programs for their children.

The Community STEM Center will not directly compete with these programs. They will not be academic programs for specific tests or study areas. Rather, the new STEM Center will provide hands-on learning opportunities that allow youth to put their new knowledge into practice.

Programs at the Community STEM Center will be run mostly by volunteers. So, the costs to participate will be significantly less than these for profit commercial programs. This will allow more youth to explore options with STEM careers.

## **FALL BACK PLAN - ALTERNATE USES FOR THE SPACE**

In the event that the Community STEM Center and Aviation Makerspace are not successful enterprises, the city of Livermore or other entities would ultimately take over ownership of the building. So, the building is being designed to ensure it can be leased or sold for alternate purposes.

Ideally it would be used as a hangar for storing airplanes. In the event that the Community STEM Center is not successful, Pete Sandhu from Five Rivers Aviation has already stated that he would be willing to lease the hangar for such purposes. He indicates that there is sufficient need for hangar space that it would be profitable to sublease.

Additional interior walls could be built to segment the interior space of the hangar and lease it out to multiple tenants. The segmented space could be used by new or existing aviation related businesses.



## PLANNED ACTIVITIES

The meetings, classes, activities and projects hosted at the new STEM Center will be initiated and run by the local STEM, hobby, youth and aviation groups that will have access to the hangar.

Most all of the programs listed below already exist. They are already being offered to the community – but in limited ways. Some activities are offered on a regular basis and are fairly well attended. Others are offered on a limited or sporadic basis.

The variability of offerings is due to limited budgets, volunteer availability, marketing outreach – and availability of low cost space.

The STEM Center will be able to provide low cost meeting and work space. It will make it easy for volunteers to organize and run programs. And, just as importantly, it will provide additional marketing and outreach so that the public knows how and when to join in and get involved.

Working together, a full and stable schedule of activities will be available to keep youth engaged at the STEM Center.

The following pages provide a sampling of events that will be available at the STEM Center.

## **PLANNED ACTIVITIES – Livermore Municipal Airport**

Numerous events take place at the airport each year. Some are open to the public. Others are private. To join in and enhance some of these events, the Community STEM Center will open its doors to the public.

This will be an opportunity to showcase and market the activities taking place at the STEM Center. It will also be an opportunity to illustrate the value provided by the airport to the local community.

### **ANNUAL AIRPORT OPEN HOUSE DAY**

On the second Saturday of October each year, the airport opens its doors to the public. Local aviation groups and businesses set up booths to inform and engage the public. Many activities are provided including an air show and static displays of local airplanes that are normally hangared. We will open our hangar for public tours during this event. There are between 7500 and 10,000 attendees at this event each year.

### **ANNUAL WOMEN IN AVIATION WEEK EVENT**

Each year in March, in conjunction with Women In Aviation International (WAI), the airport opens its doors for a select group of young women who have previously expressed interest in a STEM career. They are treated to presentations and activities by female pilots and other female mentors who work within the aviation industry. We will participate in this event and make our hangar available for tours and activities. Approximately 60 girls attend this event each year. The STEM Center might allow this program to grow and reach more young women.

### **EAA YOUNG EAGLES**

The local EAA chapter has a very active Young Eagles program where they provide free 15-20 minute introductory flights to youth aged 8-17. Nationally, the EAA has provided over 2,000,000 free flights to youth. Locally, these events take place once a month from April through September.

### **AIRPORT TOURS**

Airport management as well as other groups offer both formal and informal tours of the airport. In order to showcase the value provided to the local community, the STEM Center would be added as a regular stop on these tours.

## PLANNED ACTIVITIES – Youth Programs

Local Boy Scout, Girl Scout and 4H groups have been apprised of the plans around the new Community STEM Program. They have all expressed interest in engaging their youth in programs there.

With the Community STEM Center as a focal point, Merit Badge Counselors will be able to better organize and offer regularly scheduled sessions so that more scouts can pursue STEM related merit badges.

The Community STEM Center will charge a small fee (\$5-\$10 estimated) for each scout working towards a STEM merit badge. Providing low cost meeting and storage space is a simple change with a big impact - and positive outcomes. Some of the STEM merit badges are:

Aviation	Astronomy	Electricity	Space Exploration
Robotics	Engineering	Programming	Digital Technology
Radio	Electricity	Chemistry	Energy
Geology	Composites	Welding	Nuclear Science

Each year youth in 4H programs select topics and projects on which they want to work. Common topics are rocketry, RC planes, aviation, robotics, electronics, and programming. By simplifying access to resources through the new STEM Center, more 4H youth will be able to pursue STEM interests. Again, a small fee will be charged for using the STEM Center.

The Girl Scouts also encourage the pursuit of STEM interests through badges and hands-on learning activities. But, they also allow troops to have a primary activity. In Livermore there is a Girl Scout troop that focuses on robotics. They are one of our use cases for the STEM Center.

## **PLANNED ACTIVITIES - GIRL SCOUT TROOP # 30226 - Robotics**

### **GIRL SCOUT TROOP #30226 - ROBOTICS**

This Livermore based troop is singularly focused on robotics. They follow a specific curriculum and also engage in national robotics competitions. Throughout the school year they meet weekly for 2 hours. This is an active troop that does presentations at local educational events in an effort to encourage more girls to pursue STEM.

They have received donations and grants over the years and now have a noteworthy collection of equipment from both Lego Mindstorm and Vex Robotics. But, they struggle with both meeting space and storage space.

They currently meet in the basement of one of their mentors. Unfortunately, this particular mentor travels a fair amount for work. So, the troops weekly meetings often have to be cancelled for these travel dates.

Moving their meetings to the new STEM Center and providing a nominal amount of storage space will allow this troop to stabilize their program. Their current meeting space is small. So, a move to the STEM Center will also allow them to expand the program to more young women.

## **PLANNED ACTIVITIES – Hobby Clubs**

The hobby clubs in the Tri-Valley are hidden gems. The volunteers running them are knowledgeable, motivated, energetic and enthusiastic when it comes to their favorite activities. Unfortunately, these groups are not well advertised. So, participation is largely word of mouth.

All of the local hobby groups have youth and public outreach programs. The STEM Center has started interviews with the various groups to understand their offerings and determine how to best work together.

The following pages detail some offerings and additional use cases.

## **PLANNED ACTIVITIES – Robot Garden**

Most of the activities listed below are events that Robot Garden or groups at the Livermore Airport have already successfully run. Historically, a large focus has been on adult hobby interests and career transition training. But, youth specific programs are offered as well.

## **PERIODIC & REGULARLY SCHEDULED CLASSES**

Robot Garden holds classes and meetings on a multitude of topics. These range from equipment specific classes (3D printer, laser cutter, etc.) to classes about programming languages, CAD software, Minecraft modding, etc. These classes are offered by volunteers and are driven by a desire to help grow a local community of makers, builders, programmers and roboticists.

Below is a list of classes and activities that Robot Garden has directly offered or participated in over the past four years.

### **STEM Training For Youth**

- Curiosity Hacked (aka Hacker Scouts)
- Intro to Microprocessors Class
- Intro To Programming
- Sister Science (girls leading other girls in science)
- Lego Robotics Club for Kids
- Lego Robotics Club for Parents
- LARK Amateur Radio Activities for Kids
- Tech Toy Night (building toys for kids)
- Minecraft Modding Special Interest Group
- Electronics Teardown Day
- Cardboard Build Day

### **Community Outreach Activities**

- Art On The Green (Livermore)
- Alameda County Fair (Pleasanton)
- Maker Faire (Bay Area)
- Open Access (weekly open house - free)
- Robot Block Party (Palo Alto)
- Innovation Day (Bankhead Theater)
- Pleasanton Ignite! (STEM at the Firehouse Theater)
- Arduino Day Party
- Robot Nightlife @ CA Academy of Science (SF)
- Robotics/Electronics Swap Meet

## **Maker Activities + Retraining for Professionals**

- Open Access (weekly open house - free)
- Programming Robots Study Group (open source robotics)
- Open Source Robot Arm Study Group
- Beer & Wine Making Interest Group
- Building Automation Interest Group
- Aquaponics Interest Group
- JAMS COSplay Circle
- LARK Amateur Radio Weekly Meetups
- Git + GitHub Version Control Class
- Android + Firmata Class
- Intro to Slack Bots
- FreeCAD Class
- OpenSCAD Class
- Microcontroller & Motor Basics Class
- Intellectual Property Seminar
- Intro to 3D Printing
- Equipment SBU's (Safety & Basic Use Classes):
  - 3D Printers
  - Laser Cutter
  - Vacuum Former
  - Digital Soldering Workstations
  - Reflow Solder Oven
  - CNC Router (Nomad 883)
  - Woodshop / Toolshop
  - Robot Garden Robots (10 different programmable robots available)
- One Time & Periodic Events:
  - Space Robotics Seminar (by Silicon Valley Robotics)
  - High Powered Drones Seminar (by Pure Rockets, Inc)
  - TEDx - Women in Technology

## **Social & Networking Events**

- Monthly Potluck Lunches (during Saturday Open Access period)
- Movie Night
- Idea Brew
- Tri-Valley Teen Entrepreneur Meetup

## **PLANNED ACTIVITIES – Livermore Amateur Radio Klub (LARK)**

LARK was established in 1959. Over the years it has maintained a roster of close to 200 paying members. This illustrates how hobby activities can draw people together to build a community. They have regularly provided youth and public outreach programs.

Pilots, astronauts, police, fire, construction crews and many other professionals are dependent upon radio communications for their livelihood and for their safety. By bringing LARK to the airport, we expect LARK's membership to gradually rise. Below are some of the activities LARK will host at the STEM Center.

### **LARK PROJECT NIGHT**

Participants work on both individual and group projects related to electronics and radio communications. Robot Garden has been hosting these ongoing weekly meetings for almost two years.

### **HAM CRAM – Get A Ham Radio License**

LARK hosts regular classes where individuals can get help learning the necessary science and regulations needed to get an amateur radio license. For older and more knowledgeable audiences, these classes are offered as one-day “ham crams” where the necessary FCC test is given at the end of the day. Younger audiences get multi-day classes over several weekends.

### **FIELD DAY**

Once a year LARK participates in a national test of emergency field operations. Members set up and test their equipment usage in “off the grid” conditions.

### **AMATEUR RADIO ON THE INTERNATIONAL SPACE STATION (ARISS)**

ARISS is a prescheduled voice-only communication between Amateur Radio operators on the ground and the International Space Station (ISS) crew. These ARISS contacts allow education audiences to learn firsthand from astronauts what it is like to work and live in space. Participation involves multiple public contacts with school districts and local communities. This program is jointly managed by the American Radio Relay League (ARRL) and the National Aeronautics and Space Administration (NASA).



## PLANNED ACTIVITIES – New Events

By bringing a focus to local volunteers the new STEM Center will be able to offer programs not currently offered.

### **WRIGHT BROTHERS BICYCLE REPAIR DAY**

We will be setting up periodic bicycle repair days at the airport. Community members can get simple repairs done - flat tires fixed, brake pads replaced, other simple adjustments. We want youth to make the historical connection between the Wright Brothers, who were bicycle builders, and the building of small planes at LVK. With its active builder community, Livermore Airport offers a unique venue to help youth imagine themselves working around airplanes.

### **SUNDAY SCIENCE**

Weekly social gatherings will be scheduled where volunteers and the larger public can discuss local activities as well as the larger world of STEM. Short lectures will be presented about both the history of science and the challenges leading to new discoveries. Reviews of ongoing STEM Center activities and projects will be highlighted. Families will be encouraged to attend and smaller children will be kept occupied with the many building and learning toys available.

### **ELECTRONICS REPAIR DAY**

At these events community members stop by with various household items in need of repair. Volunteers assist them in diagnosing the problem, determining the cost to fix it (based on needed replacement parts) and implementing the actual repair. We involve our youth in the troubleshooting and repair processes so that they gain experience.

### **ELECTRONICS TEAR DOWN DAY**

We believe that youth learn by doing. We stockpile unrepairable items from our Electronics Repair Day events then provide our youth the opportunity to completely dismantle various items from cell phones, to printers to dishwashers. It is an excellent opportunity to better understand how things work.

### **CARDBOARD BUILD DAY**

For younger children we provide them the opportunity to design, engineer and build their own cardboard creations. These can be artistic creations (such as flowers or simple cutouts) or they can be engineered items (such as bridges, towers and forts). This is a low cost way to move from an idea to an actual object that they created.

### **TECH TOY PLAY TIME**

For younger children we will open our doors and provide time to play with various building toys while under adult supervision. We have access to an array of toys such as Lego, Lego Mindstorm, Knex, Zoob, Lincoln Logs, Magformers, Erector Set, Zometool, Chaos Tower, Snap Circuits, Brio Builder, etc. Many of these toy collections include dozens of sets so many children can play simultaneously. We will charge a small hourly fee to attend these events.

There are established STEM curricula available for Lego Mindstorm, KNEX, Chaos Tower, and Snap Circuits. Over time we will look into using these educational toys for ongoing afterschool and weekend programs.

## PLANNED ACTIVITIES – Collaborative Projects

After groups get settled in the space, there will be regular meetings to foster collaborative projects that require multiple disciplines and skill sets. Following are a few examples of possible projects:

### **RC Planes + Robotics**

There have been discussions about designing, building and testing small robotic systems that can be attached to RC planes. Examples are telemetry equipment for tracking, and payload delivery systems.

### **Robotic Quadcopters + Programmable Missions**

There are several models of quadcopters that can be programmed using javascript modules. The youth programming clubs will be taught to program these devices then configure them for specific missions.

### **Rockets + Telemetry Systems**

The Rocketry Club will work with Amateur Radio Club to design, build and test various telemetry systems to track metrics of the rocket's flight. Other robotics projects can be placed in the payloads of rockets.

### **Young Eagles + Amateur Radio**

APRS is an amateur radio system that allows GPS tracking of multiple entities at a time. The Radio Club can configure a system that allows easy tracking of Young Eagle flights so that more youth can get in the air on these event dates.

### **Gizmos + Makerspaces**

With the tools available in the Aviation Makerspace parts can be created in short order. The RC plane club can use the laser cutter to create glider parts out of balsa wood or foam. The astronomy club can create holders and mounts needed to attach parts to their tripods and telescopes. The Mars Society can cut parts needed for the Rover mock ups they use for classroom and public presentations.

Working with youth who've been trained on the makerspace equipment will allow many different groups to move forward on a multitude of projects. This will also allow youth to receive real world experience.

## IN SUMMARY

Communities already spend large sums of money to support youth programs. Sports fields are a common – and expensive – asset. Community arts centers are a cornerstone of any well established town. Museums are homes for various special interest groups. The new Community STEM Center is just a new way to invest in our youth.

It will move STEM activities out of the classroom and beyond the occasional summer camp. It will provide a focused community of STEM learners. It will provide multiple pathways for youth to build character, learn their strengths and weaknesses, and see where they fit.

After many conversations with many different people & groups, a common response is that this project will be transformational for Tri-Valley families.

It is expected that this new STEM Center will bring cohesiveness to a community of people that enjoy similar interests but don't often have opportunities to interact. Consolidating many disparate youth, hobby and STEM groups into one building makes it easier for the public to find and participate with these fun hands-on educational resources. It is also seen as an opportunity to bring a social aspect to these many activities.

Bringing youth together for enjoyable activities allows more positive interactions. Successful peer interactions should lead to more youth following the path to a STEM career. This is seen as a critical component when encouraging girls and minorities to pursue these career interests.

Whereas these many groups have worked independently – and many unbeknownst to the larger Tri-Valley population – this new STEM Center will provide a high profile gateway. This will be used to increase participation and outcomes.

A hangar, a basic steel building, is one of the least expensive building types available. When done properly, it is durable and adaptable. After completing construction, local STEM communities can further adapt it to meet their individual needs.

## NEXT STEPS

This document and associated website serve as introductions to the planned Tri-Valley STEM Center. We ask that all who read this document take these additional steps:

- 1) provide your feedback to help us design a better program;
- 2) invite potential partners and stakeholders to download and review these documents;
- 3) contact us if you or your group wish to be involved or can otherwise contribute;
- 4) assist us in identifying and aligning with potential funding sources.

A board of directors, advisory board, and management team are all being assembled. Nominees interested in serving are asked to come forward.

Many additional tasks are underway to ensure a successful launch. In the following weeks and months a complete business plan and subcomponents will be finalized and posted to the website.

### Business Plan

- Financial Plan
- Marketing Plan
- Operations Plan
- Fundraising Plan

With the assistance of planned participants, additional use cases are being compiled to identify the ways in which the STEM Center will be used. This information will be added to existing documentation.

Please, revisit the website periodically to download and review these additional documents. Additionally, participant and stakeholder meetings will be scheduled in the near future. These will be announced via our website and through available mailing lists.

Tri-ValleySTEM.net