

## TABLE OF CONTENTS

<i>Table of Contents</i>	<b>1</b>
<b>PART I - NEED FOR THE PROJECT</b>	<b>2-13</b>
<b>PART II - PROJECT DESIGN</b>	<b>14-15</b>
<b>PART III - PROJECT SERVICES</b>	<b>15-31</b>
<b>PART IV - KEY PROJECT PERSONNEL</b>	<b>31-35</b>
<b>PART V - ADEQUACY OF RESOURCES</b>	<b>35-36</b>
<b>PART VI - PROJECT MANAGEMENT PLAN</b>	<b>37-39</b>
<b>PART VII - PROJECT EVALUATION PLAN</b>	<b>40-49</b>

**PART I - NEED FOR THE PROJECT**

**INTRODUCTION TO LOS MEDANOS COLLEGE:** Los Medanos College (LMC), founded in 1974 in Pittsburg, California, is a comprehensive, public two-year community college located 45 miles East of San Francisco. Set in East Contra Costa County, the city of Pittsburg—like its namesake on the East coast—is filled with smokestacks for Dow Chemical Company and USS-POSCO. **It also has one of the fastest growing Hispanic populations in California – 42.4% of its population is Hispanic (2010 Census).** LMC, with its enrollment of 9,969 students (2011), has enjoyed an historical reputation as an excellent 2-year technical college with programs designed to prepare students for its regional job market. Besides its technical programs, LMC also has first-rate opportunities, from a statewide recognized Developmental Education program (DE) to a longstanding successful Honors Program. LMC recently established programs in Engineering, Environmental Science, Process Technology and Electrical/Electronic Technology housed in our newly built state of the art science and math buildings. **Yet the number of LMC students transferring to 4-year institutions as STEM majors has remained extremely low. There were 23 STEM majors who transferred in 2003 (3 Hispanic) and 45 STEM majors who transferred five years later in 2009, nine of whom are Hispanic. While our percentages are improving, our numbers are still very low and it continues to take an average of more than six years for students to transfer as STEM majors.**

**This project, *STEM Transfer Velocidad*, will shorten and strengthen LMC's now long and leaky STEM pipeline to increase the number of Hispanic and low-income students who transfer to four-year colleges/universities and attain degrees in STEM fields.**

***The application meets both absolute priorities and the additional competitive priority.***

LMC is proud to have a wealth of excellent and dedicated faculty and staff, along with of innovative and award-winning programs. Yet on average over the past three years, **of the 56% of all first-time students who enter LMC with an intent to transfer, only 3.2% actually do. Of the 59% of Hispanic students who enter with a transfer goal – only 2.9% achieve transfer.** In response to these low numbers, LMC implemented a collaborative planning process focused on building a strong transfer pipeline from outreach, to welcoming new students (and their families), to their successful transfer to four-year colleges and universities -- with particular attention to Hispanic and low-income underserved students. An outcome of that planning process was the identification of specific transfer-related problems involving our STEM-focused students. A STEM Transfer and Articulation Planning Team has dedicated significant time during the last year conducting research, reviewing LMC STEM student data, delving into academic studies of STEM education and degree completion, and meeting with STEM students, faculty, student services staff and local employers. This *STEM Transfer Velocidad* proposal, based on high-quality and timely data, not only identifies STEM-transfer problems, it promises to solve these problems by delivering improvements in STEM student enrollment, persistence and completion -- outcomes leading to successful futures for our STEM students.

#### **TRENDS INDICATE THAT JOBS AWAIT OUR STEM GRADUATES**

**National STEM Trends:** At a time when the number of STEM graduates is decreasing, the critical national need for STEM graduates is increasing in order for the nation to remain globally competitive.<sup>1</sup> At the same time, poor academic preparedness and low persistence rates in the STEM disciplines are working against transfer. Additionally, and alarming to note, is **the very low representation of ethnic minorities working in STEM fields (only 2% nationwide are Hispanic)**<sup>2</sup>; yet, according to the U.S. Census Bureau, the Hispanic population has grown by 43% in the last decade.

<sup>1</sup> Jim Ryan, “STEM Graduates Numbers Decrease,” *Central Penn Business Journal* (Aug. 2008).

<sup>2</sup> Mike Acosta, <http://www.prweb.com/releases/2009/09/prweb2844894.htm>.

**California STEM Trends:** California is not keeping pace with the increasing demand for skilled workers in STEM-related fields that fuel much of the state's economic growth and job creation, and this is having a devastating effect upon California's already distressed economy. During the next decade STEM-related occupations will grow faster in California (20%) than non-STEM occupations (14%). In fact, **between 2006 and 2016, approximately 46,100 job openings (requiring a postsecondary education) will be created in STEM occupations each year as a highly educated generation of baby boomers retire. California, particularly the San Francisco Bay Area, is among the nation's leaders in STEM-related employment.**

California, a national trendsetter in terms of demographic change, has an Hispanic workforce that is expected to continue to grow by 40% by 2020 and to become the majority by 2040.<sup>3</sup> Research shows that Hispanic enrollments in California's institutes of higher education have more than doubled over the last twenty years; however, Hispanics are not graduating in STEM fields with the same gains. In fact, only 8% of Hispanics earned bachelor's degrees in any major in 2006.<sup>4</sup>

**Local STEM Trends:** Business leaders in East Contra Costa County are also concerned about the lack of local STEM graduates. Jason Cox from USS-POSCO recently commented: "Although I am impressed with the way LMC works to meet the needs of industry when asked to provide STEM courses, we still need more STEM graduates if we want to prepare students to move into careers in bio-tech, green energy, and health care." This makes LMC's responsibility to take action even more imperative. In addition, the National Science Foundation reports that 55% of Latinos and 50% of African Americans who hold bachelors or masters degrees in STEM fields began their post-secondary education at a community college.<sup>5</sup> **East County's demographics (42.4%) and LMC's student population (27%) include high numbers of Hispanic and other underserved students (over 81% of our students receive BOG fee waivers) who are a potential pool for future entrants into our local and regional STEM workforce.**

### **ANALYSIS / DOCUMENTATION OF PROBLEMS TO BE ADDRESSED:**

**CORE PROBLEM: Despite high student aspirations, Hispanic and other traditionally underserved students are failing to transfer to four-year institutions in STEM-related**

**LMC STEM Transfers:** Los Medanos College (LMC) lacks a well-defined pipeline for training scientists, mathematicians and engineers from high school to transfer institutions. This is especially true for Hispanics, who would ideally graduate and return to serve their communities

<sup>3</sup> J.P. Cohn, *US Population Projections 2005-50* (Washington, DC: Pew Hispanic Center, 2008).

<sup>4</sup> Alicia Dowd, "Benchmarking the Success of Latina & Latino Students in STEM," *Equity Matters*, USC Center for Urban Education (December 2009).

<sup>5</sup> Paul Bradley, "Colleges Strive to Supply Minority Grads in STEM Fields," *Community College Week* (February 2011).

in STEM fields. There is a genuine interest in STEM degrees on campus - in 2009, we had 560 students who had a stated goal of transfer in STEM. **In 2010, there were 342 individual STEM students;** (students enrolled in STEM courses, e.g., biology, chemistry, physics, engineering and math for STEM transfer majors). **Yet, in actuality, there were 45 students who achieved the goal of STEM transfer (only 9 were Hispanic and 2 African American). Clearly, a considerable divide exists between aspiration and outcome. The number of STEM transfers from LMC remains far too low.**

	All Students		Hispanic		African American	
	Transfers	STEM Transfers CSU/UC	Transfers	STEM Transfers	Transfers	STEM Transfers
2003	142	23	31	<b>3</b>	14	<b>1</b>
2006	190	25	50	<b>4</b>	19	<b>2</b>
2009	231	45	64	<b>9</b>	15	<b>2</b>

CPEC (California Post-Secondary Education Commission web-site)

For a college located in a community where 40% of the population is Hispanic, and where STEM jobs are increasing due to large numbers of baby boomer retirements, these numbers are unacceptable. The conclusion is inescapable: *despite the fact that East County is one of the fastest growing Hispanic areas in California, LMC is simply not transferring STEM-educated Hispanic students in significant numbers.* After over a year of study, the Planning Team has identified the four well-documented GAPS contributing to the CORE problem of low LMC’s STEM transfers. **Following is an overview and a response to each of the critical GAPS.**

**GAP 1: Undeveloped academic STEM pipeline (2+2+2) from high school to LMC to four-year colleges and universities.**

- **No Pipeline between LMC & feeder high schools**
- **Math Completion is an Enormous Barrier**
- **Math Course Content not Linked to STEM Majors**
- **No Science Lab in Brentwood; limited lab experience in Pittsburg**

*“Many of our students come to LMC wanting to transfer in STEM but it takes too long for them to transfer and they often give up. We have a huge gap between hope and achievement.”*

- Michael Norris, Faculty Senate President and Math Instructor

• **There is NO pipeline between LMC and our feeder high schools** to assist STEM students (and their families) in their preparations for college-level STEM curriculum. Our studies have found that attrition in STEM disciplines begins in high school, where students often take the wrong classes and bypass the right ones. This occurs because they lack sufficient information about potential STEM careers, and further lack a long-range academic plan for reaching their STEM goals. Consequently, our studies reinforce our assertion that **the STEM pipeline does not exist from LMC's six feeder high schools.**<sup>6</sup> Additionally, research shows that California high schools are producing too few graduates with the academic requisites for college level STEM classes, often because of a lack of understanding regarding the high school courses required for postsecondary STEM education and success.<sup>7</sup> For example, it is an established fact that the percentage of California students who were successful in obtaining STEM degrees was higher among students who took trigonometry, pre-calculus, or calculus in high school.<sup>8</sup> Yet many Hispanic and African-American students—independent of their test scores—are often assigned to lower-curriculum tracks than are White students; the message they too often receive is that “completing math” means taking only 2 years of lower-level high school courses.<sup>9</sup>

**According to LMC Office of Institutional Research, in 2009 only 11% of graduates at Pittsburg High School, one of LMC’s top feeder high schools (87% of students are Hispanic**

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<sup>6</sup> LMC MESA Student Focus Group, Fall 2010.

<sup>7</sup> Penny Edgert, *STEM Learning Opportunities Providing Equity* (Sacramento, CA: ARCHES, 2010).

<sup>8</sup> X. Chen, *Students Who Study STEM in Postsecondary Education* (Washington, DC: National Center for Education Statistics, 2009).

<sup>9</sup> Policy Evaluation & Research Center, *Latino Achievement and STEM* (Princeton, NJ: ETS, 2006).

**and African American), had completed all required classes for college preparation. This is in contrast to 35% state-wide and 37% within our county.** First-generation high school students often lack encouragement and support from parents who have insufficient experience and understanding of the rigors involved in pursuing a STEM degree. Without support from family and with dwindling counseling supports (due to budget constraints), Hispanic and African American high school students often have low academic confidence and perceive STEM studies as too difficult.<sup>10</sup> However, studies reveal that those who do complete the required high-level high school courses are as likely as White students to pursue STEM degrees.<sup>11</sup>

- **Math completion is an enormous barrier**, increasing the amount of time needed to graduate in STEM disciplines. Of LMC's Fall 2009 **incoming students who took the assessment test, 88% placed below college-level math, indicating only 12% had sufficient math skills to enroll in transfer-level STEM courses.** The average California math SAT score is 513, the average for Contra Costa County is 545 and the average for LMC's feeder high schools is a low 473. Bottom line, this means that the majority of our students must take one to two math courses to get to basic college level and pre-Calculus, before they can begin the advanced math levels needed for a STEM degree. One might argue that it is not viable for students who enter college at such low math levels to succeed in STEM courses; however, because of our exemplary DE Math program, research at LMC shows that in 2010, 40% of students (16% of whom were Hispanic or African American) in the calculus progression began at LMC taking math courses which were one or two courses below college level.<sup>12</sup> Yet, we still lose high numbers of students through too many "exit points" that exist along the traditional math

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<sup>10</sup> Nancy Nestor-Baker and Sandra Kerka, *Recruitment and Retention of Underrepresented Students in STEM Fields* (Ohio State University, 2009).

<sup>11</sup> Nancy Nestor-Baker and Sandra Kerka, 2009.

<sup>12</sup> LMC Office of Institutional Research, Datatel MIS, 2010.

sequence. It can take many DE students too many semesters to complete math pre-requisites for STEM. In order to enroll in the first level Physics course, STEM majors must complete Calculus II. This could take a student who places into Algebra **two years of math courses** to complete before starting STEM major courses – the same amount of time as it takes some students to complete an Associate’s degree!

- **Math Course Content not Linked to STEM Majors.** In the traditional math sequence, a STEM major is enrolled alongside students from all other majors. Although the curriculum is contextualized in the LMC DE math sequence, the contexts are general and not specific to STEM topics. As noted above, for a students interested in STEM, the path can often take at least two years before being able to enroll in classes with content specific to their major; this often discourages STEM-bound students and makes them to majors requiring less time to completion.

- **Inadequate Science Labs and Hands-On Experience in Brentwood and Pittsburg campuses.** LMC’s Brentwood Campus, which serves a rapidly growing Hispanic and low-income community, does not have a science laboratory. In response to the rapidly growing population to the east of our Pittsburg campus, LMC opened a center in Brentwood in Fall 2001. **The center has increased enrollments by 500%** during the past six years, from 493 to 2,563 in Fall 2010. **Hispanic enrollments have increased from 23% to 28%.** The 654 full-time equivalent enrollments (FTE) at the Brentwood Center comprise almost 16.5% of LMC’s total FTE, **yet there are NO science labs** at Brentwood. This is an obvious barrier to STEM transfer for those students who are unable to attend classes at the main Pittsburg campus.

**At LMC’s main campus,** as the **STEM Transfer Velocidad** Planning Team researched technological advances and the need for new and revised courses (to complete our STEM articulations), they discovered a corresponding equipment need. New STEM equipment and



technology is needed in order for our students to be competitive and gain comparable requisite lab skills to lower division lab experiences at top transfer colleges and universities.

**Response to GAP 1 in STEM Transfer Velocidad (see Part III for details):**

- **Early connections with high schools: Outreach Coach to work in high schools**
- **Math acceleration: Math-Path, STEM-Path, and MyMathLab**
- **Science Lab creation in Brentwood, equipment upgrades for Pittsburg, and smart studios/classrooms**

**GAP 2: LMC has a weak academic and support services STEM network, particularly for Hispanic and other STEM underserved students.**

- **Insufficient academic and student services for STEM students**

*“Before MESA, I went to class, went home and didn’t feel connected. I never knew there were other Latino women like me who were into science.”*

- MESA Student

- **STEM Academic and Student Supports Need to Be Expanded.** In Fall 2009, LMC STEM faculty and staff initiated a small pilot Math Engineering and Science Achievement (MESA) Program to meet the academic and networking needs of Hispanic and low-income STEM students. This pilot MESA program, funded by a small grant from an anonymous donor, allowed LMC to work with 100 low-income STEM students in a limited capacity. Even with the program’s limitations as a pilot, STEM students reported feeling more engaged and supported academically, socially and culturally. In Fall 2010, the **STEM Transfer Velocidad** Planning Team hosted a focus group of MESA students to learn about their experiences on campus both before and during MESA. **Common themes emerged:**

**Before MESA** – students attended classes, and unaware of campus services and activities, left campus immediately after class with feelings of ethnic and social isolation and confusion about navigating the system. This caused the erosion of motivation, performance and hopes of transfer.

**After MESA** – students feel more engaged with their peers, staff, faculty and counselor; become involved with STEM activities such as mentoring, academic excellence workshops, field trips to four-year universities; and take advantage of academic supports such as study groups as well as student services such as financial aid, scholarships, internships and work-study jobs on campus.

While there is a growing demand, because of limited funding, there are currently only five hours per week of MESA Counseling allocated, one Biology instructor managing the program, and limited capacity for STEM student participants and growth of the program's interventions. The program would also like to offer off-campus research opportunities that are so critical for STEM students, as studies show that those students who participate in internships and student research are the most successful. **Research shows that while underrepresented minority students are more likely to enroll in STEM majors than White students; they are also less likely to complete a STEM degree. However, those underrepresented students who did complete their degrees were more likely to have made effective use of academic and support services.**<sup>13</sup> LMC needs the five years of this grant to double the size the MESA program (from 100 to 200 students) and to implement a plan of institutionalization to sustain the program, moving it from soft funds to college allocated funds.

**Response to Gap 2 in STEM Transfer Velocidad (see Part III for details):**

- **Expand and institutionalize MESA program support and services for STEM students, with particular attention to Hispanic and other traditionally underserved students.**
  - Increase opportunities for internships and student research
  - Expand MESA Center and hours
  - Increase Academic Counseling hours
  - Institutionalize MESA Coordinator and Counselor

**GAP 3: Missing courses and program articulation with LMC's top transfer universities are causing students to bypass LMC as a choice for science or engineering majors.**

- **Articulation gaps in identified STEM courses and majors are barriers to STEM transfers**
- **Insufficient staffing to focus on STEM articulations**

*"I thought I was taking all the right Engineering classes but then I realized that the class I took wasn't accepted at Berkeley. I thought I could transfer next year, but now I have to go somewhere else first to take a class that LMC doesn't offer."*

- STEM student in 2010 MESA Focus Group

<sup>13</sup> L. Tsui, "Effective Strategies to Increase Diversity in STEM Fields," *BNET.com* (2007).

- **Articulation gaps in identified STEM courses and majors are barriers to STEM**

**transfers:** LMC's individual lower-division STEM courses are generally well articulated with our top ten transfer universities.<sup>14</sup> However, each four-year university expects transfer students to complete a unique set of lower-division classes before transferring in their particular STEM major. When the LMC STEM Planning Committee conducted a sample inventory of LMC's STEM articulation, it became evident that STEM major articulations with our top transfer universities are inadequate. For example, **LMC falls far short of articulation in most STEM majors as compared to Diablo Valley College (DVC)**, the closest local community college to LMC. This is illustrated the chart below, which delineates examples of the large gaps in LMC's major articulation to feeder colleges in comparison to DVC.

University	STEM Major	Lower-division Requirements Articulated for Transfer	
		LMC	DVC
UC Berkeley	Civil Engineering	10/16	13/16
Sonoma State	Engineering Science	No classes articulated	9/16
CSU East Bay	Computer Science B.S.	5/8	8/8
San Francisco State	Chemistry B.S.	11/16	16/16
San Jose State	Electrical Engineering	8/13	13/13
CSU Sacramento	Engineering	12/19	16/19

STEM students report **LMC is missing essential classes needed to complete their lower-division STEM curriculum, resulting in their being less competitive transfer applicants.** For example, we lack a calculus supplement required at some University of California campuses to fulfill the physics requirement for biology students. While LMC students could take LMC's calculus-based physics series to satisfy UC Berkeley, this series is not articulated at other top transfer universities such as UC Davis or CSU East Bay, who prefer the general physics series.

<sup>14</sup> Top 8 STEM Transfer Universities as identified through CPEC, 2011: University of California – Berkeley, Davis, and Los Angeles; and California State Universities – Polytechnic/San Luis Obispo, East Bay, Sacramento, San Francisco and San Jose.

Since most students prepare to apply to multiple universities due to the competitiveness of transfer, the calculus supplement class is an important curricular gap to fill.

In addition, within the last four years, LMC has established two new Career Technical Education (CTE) certificate and programs - Electronic Instrumentation (Etec) and Process Technology programs (PTEC). A number of students in these programs who had never before considered pursuing bachelors degree and other higher degrees in STEM are now “hooked on science” and want to continue their studies through transfer. These programs fill an important gap in STEM because they are more hands-on than “pure” science and also linked to the possibility of immediate local employment. They offer students flexibility either to enter the workforce as technicians upon certification, or to transfer and continue in related bachelors degree programs. However, in order to offer the transfer option, many of the Etec and PTEC courses will have to be articulated with our transfer universities.

- **Insufficient staffing to focus on STEM articulations:** While most colleges with high transfer cultures<sup>15</sup> employ full-time articulation officers, LMC has only a part time (50%) Articulation Officer. Clearly, additional support is necessary to help with the backlog of STEM major course articulations and to stay current into the future.

**Response to Gap 3 in STEM Transfer Velocidad (see Part III for details):**

- **Hire a STEM Articulation Specialist**
- **Form STEM Articulation Committee**
- **Articulate and complete major pathways for STEM transfers**

**GAP 4: Weak data, research and assessment analyses for improving the myriad of factors impacting enrollments, retentions and transfer of LMC STEM students.**

- **Lack of Research agenda and team to improve Science and Engineering programs**

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<sup>15</sup> The Research & Planning Group for California Community Colleges, *Transfer Velocity Project: Key Findings on Student Transfer in California Community Colleges* (March 2010).

*“The culture of LMC is becoming one of evidence. The next step for STEM is learning to regularly collect and interpret data and to make continuous improvements to move students through the transfer pipeline.”* - Gil Rodriguez, Dean of Liberal Arts and Sciences

• **Lack of Research Agenda to Study and Improve Science and Engineering Programs:**

As community colleges in general have become increasingly knowledgeable and diligent about using data evidence to improve educational practices to better serve students,<sup>16</sup> our Science and Engineering programs have lagged behind. In an effort to create a more wide-spread and consistent culture of evidence on campus, LMC has recently engaged with the Center of Urban Education (CUE) to encourage and support college-wide conversations regarding data-based inquiry to inform LMC about our effectiveness, and to produce equitable outcomes for students of color. It is critical to design our STEM research in comparable ways within the context of LMC’s emerging culture of evidence – by collecting, understanding and analyzing high-quality and timely data to help us to design our programs to improve LMC’s STEM student outcomes. Research shows interventions for the improvement of student success are most effective when programs and professional development are driven by the institution’s assessment process.<sup>17</sup>

**Response to Gap 4 in STEM Transfer Velocidad (see Part III for details):**

- **Create a STEM Evidence Team to lead an ongoing cycle of research and assessment to inform our planning and professional development programs**
- **Create a STEM Incubator to identify solutions from Evidence Team findings, support and assess pilots, and institutionalize what works**
- **Design professional development for faculty and staff as informed by our research**

<sup>16</sup> Center for Community College Student Engagement, *Benchmarking & Benchmarks, Effective Practice with Entering Students* (The University of Texas at Austin: Community College Leadership Program, 2009).

<sup>17</sup> Lee Schulman, “Counting and Recounting: Assessment and the Quest for Accountability,” *Change*, 39-1 (2007).

**PART II – PROJECT DESIGN**

*The Outcomes, Objectives and Goals for the STEM Transfer Velocidad are Clearly Stated and Measurable.*

**OUTCOME OBJECTIVES IN RESPONSE TO CORE NEED OF TARGET POPULATION AND GAPS:**

<b>OBJECTIVE 1:</b> Through development of a strong STEM pipeline, increase by 5% per year over the duration of the grant the numbers of LMC students seeking degrees in STEM fields, compared to the 2009 baselines.						
STEM Degree Seeking Students	2010 Baseline	Annual Targets				
		2011-12	2012-13	2013-14	2014-15	2015-16
All Students	342	359	377	396	415	436
Hispanic Student	82	86	90	94	100	105
<b>OBJECTIVE 2:</b> Beginning grant year two, increase the number of LMC students who attain STEM degrees by 15% per year.						
STEM DEGREES	2009 Baseline	Annual Targets				
		2011-2012	2012-13	2013-14	2014-15	2015-16
Total Students Awarded STEM DEGREES	10	19	24	30	38	45
Hispanic Students Awarded STEM Degrees	6	8	11	14	19	25
<b>OBJECTIVE 3:</b> By 2015, double the number of LMC student who transfer to the University of California or the California State University systems in STEM; and more than triple the number of Hispanic STEM.						
STEM TRANSFERS	2009 Baseline	Annual Targets				
		2011-12	2012-13	2013-14	2014-15	2015-16
All Students	45	50	55	61	66	73
Hispanic Student	9	11	14	18	23	29
<b>OBJECTIVE 4:</b> By 2016, LMC will have made significant progress in overcoming the gaps in articulation deficiencies documented in the NEED section of the proposal by completing a minimum of 35 new STEM course articulations with four-year universities, including the courses targeted below.						
		<i>Baseline Articulation</i>		<i>2016 Target</i>		
UC Berkeley	Civil Engineering	10/16		+3 course articulations		
Sonoma State	Engineering Science	No classes articulated		+4 course articulations		
CSU East Bay	Computer Science B.S.	5/8		+3 course articulations		
San Francisco State	Chemistry B.S.	11/16		+3 course articulations		
San Jose State	Electrical Engineering	8/13		+ 3 course articulations		
CSU Sacramento	Engineering	12/19		+ 4 courses articulations		

**The Outcome Objectives and the Project Goals support achievement of both *Absolute Priorities*: (1) increased STEM degrees, (2) STEM transfer and articulation agreements and the *Competitive Priority*: “Enabling more data-based decision-making.”**

Project Goals	Strategy Responses
1. Partner with 4 high Hispanic enrolled feeder high schools to implement programs to achieve STEM-student college readiness.	<ul style="list-style-type: none"> <li>• Establish MESA-like STEM Programs at Antioch, Deer Valley, Liberty and Pittsburg High Schools to prepare students for college-level STEM to serve 200+ students per year. (p.19)</li> <li>• Provide concurrent enrollment math classes for 50+ Hispanic and low-income HS students to serve 50+ students per year. (p.20)</li> </ul>
2. Shorten the time it takes students to complete the development of college level math sequences.	<ul style="list-style-type: none"> <li>• Pilot and institutionalize accelerated Math Path/STEM Path programs to serve 110+ students per year. (p.21)</li> <li>• Utilize technology to accelerate math learning. (p.22)</li> </ul>
3. Upgrade Science lab instrumentation/experimentation to parallel lower division courses at four-year transfer schools.	<ul style="list-style-type: none"> <li>• Establish first multi-disciplinary science lab equipped with state-of-the-art equipment at the LMC Brentwood Center to serve students per year. (p.23)</li> <li>• Upgrade quality of Biology, Chemistry, Physics and Engineering lab experiences with new state-of-the-art equipment and revised lab curriculum to serve students per year. (p.23)</li> </ul>
4. Significantly expand academic and student support services and experiences for Hispanic and low-income STEM students.	<ul style="list-style-type: none"> <li>• Expand/ institutionalize MESA Support Program to serve 200+ students per year. (p.24)</li> <li>• Increase number of Academic Excellence Workshops in Algebra, Calculus, Chemistry and Physics to serve xx students per year. (p.25)</li> <li>• Increase internship experiences for hands-on research. (p.26)</li> </ul>
5. Overcome significant gaps in STEM course and program articulation.	<ul style="list-style-type: none"> <li>• Identify all gaps in STEM major articulations and develop articulation agreements for at least 85% of these gaps. (p.28)</li> <li>• LMC STEM faculty will meet with top feeder university faculty to understand articulation needs to develop and revise new STEM courses and lab experiences as necessary. (p.28)</li> </ul>
6. Create dynamic professional development that promotes a vibrant learning environment that enhances student learning.	<ul style="list-style-type: none"> <li>• Provide professional development opportunities for STEM faculty and staff, including technology in the classroom, and use of new lab equipment. (p.31)</li> <li>• STEM faculty and staff will attend professional conferences and workshops. (p.31)</li> </ul>
7. Enable more data-based decision-making.	<ul style="list-style-type: none"> <li>• Establish a STEM Incubator to research and study innovations to address identified barriers, with an eye toward equity. (p.30)</li> <li>• All grant strategies will collect, analyze and use high-quality/timely data to improve STEM student outcomes relating to enrolment, persistence and STEM completion. (p.31)</li> </ul>

### PART III - PROJECT SERVICES “STEM TRANSFER VELOCIDAD”

#### Before STEM: *Eduardo's Story*

Eduardo wanted to become a doctor. No one in his family had ever finished college, primarily because they needed to work. Eduardo was filled with hope and purpose when he started LMC in fall 2010. Almost immediately he was faced with hurdles: he assessed in a lower level of math due to lack of adequate preparation and counseling in high school; the biology course he needed was offered only at the main campus and not in Brentwood where he lived, and gas was very expensive. When he found that in order to take the Calculus course he would need for his major he would have to take two more semesters of pre-college math, he was upset. Because he went to school and came right home afterwards, he didn't know where to go to or who to talk to about his situation. At first he thought he would just switch to psychology, since another student told him it didn't require as much math. But when his family had money troubles, he decided to fill out the application for the local Starbucks, whose close proximity to LMC allowed Eduardo to preserve the hope he might sometime return to college.

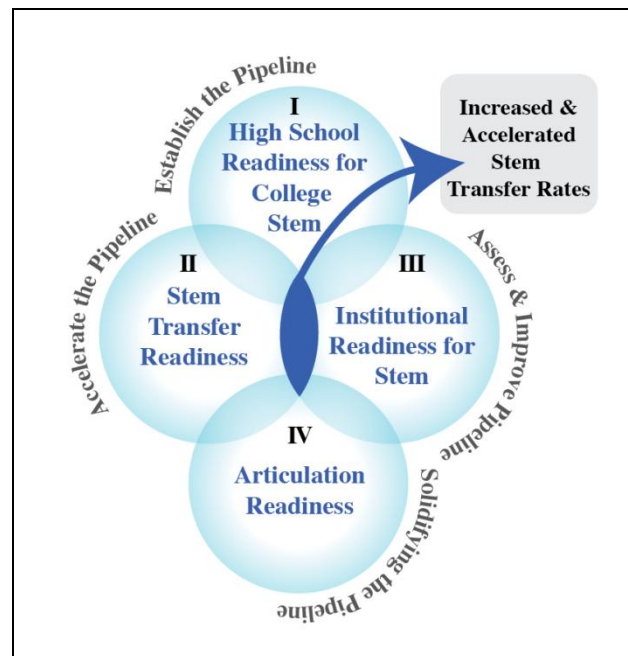
#### A. Activity Overview

Many of our students live in Pittsburg where **less than 25% of the population has gone to college and only 11% have taken college preparatory classes in high school.**

These community conditions

(underprepared for college, frequently first-generation, 81% low-income, going to school part time, and taking over 6 years to transfer) would seem daunting if it were not

for the STEM Planning Team's year-long research. The Team studied effective acceleration practices to increase retention, acceleration and success of Hispanic and underrepresented students in the STEM fields and in transfer. Using the 2010 Transfer Velocity Project (TVP)<sup>18</sup> as framework for our **STEM Transfer Velocidad** Project planning, this proposal was designed to



<sup>18</sup> The Research & Planning Group for California Community Colleges, “Key Findings on Student Transfer in California Community Colleges,” *Transfer Velocity Project* (March 2010).



meet the identified needs of the target population by selecting the most appropriate and effective strategies. The TVP distinguished three key factors at colleges enjoying elevated transfer rates:

- 1) implementation of “a culture of transfer”;
- 2) integration of instructional and student support services;
- and 3) partnerships and articulations with high schools and universities”<sup>19</sup>

<b>CREATING A ROBUST STEM TRANSFER CULTURE AT LMC</b>
<p><b>STEM Transfer Velocidad</b> is a single activity that will <b>create systemic change at LMC and will increase the number of Hispanic and other low-income students who attain STEM degrees and who transfer as STEM majors.</b> The following principles weave through the four project components to create a sustainable STEM transfer pipeline:</p> <ul style="list-style-type: none"> <li>• High expectations and aspirations that STEM transfer is an attainable goal for all students</li> <li>• High quality, rigorously articulated programs and instruction based on proven models of excellence and acceleration</li> <li>• High levels of student, faculty and staff engagement and support</li> <li>• High levels of professional development based on effective assessment</li> </ul>
<p><b><u>COMPONENT 1: COLLEGE READINESS FOR HIGH SCHOOL STEM STUDENTS – ESTABLISHING THE PIPELINE:</u></b> Connections with Hispanic STEM-focused Students, their Families, and their Preparation in High Schools.</p>
<p><b><u>COMPONENT 2: TRANSFER READINESS – ACCELERATING THE PIPELINE;</u></b> Provide Hispanic and other Under-represented Students with Programs that Support and Accelerate their STEM Transfer.</p>
<p><b><u>COMPONENT 3: ARTICULATION READINESS – SOLIDIFYING THE PIPELINE:</u></b> Articulate, Complete, and Monitor Major Pathways for STEM Transfers w/transfer universities.</p>
<p><b><u>COMPONENT 4: INSTITUTIONAL READINESS – ASSESSING &amp; IMPROVING THE PIPELINE:</u></b> Create and sustain a STEM-focused Assessment and Transfer Culture that makes informed, data-driven and equity-focused decisions.</p>

<p><b><u>COMPONENT 1: STRATEGIES:</u></b> <b><i>COLLEGE READINESS FOR HIGH SCHOOL STEM STUDENTS – ESTABLISHING THE PIPELINE</i></b> <b>Partner with high schools to work with Hispanic and other STEM-Focused Students.</b></p> <ul style="list-style-type: none"> <li>• <b>Hire an Outreach STEM Coach to work with high school faculty, staff, students (and their families) to prepare academically for post-secondary STEM</b></li> <li>• <b>Establish MESA programs at feeder high schools</b></li> <li>• <b>Develop Summer Math Program for high school students</b></li> </ul>
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<sup>19</sup> The Research & Planning Group for California Community Colleges, “Key Findings on Student Transfer in California Community Colleges,” *Transfer Velocity Project* (March 2010).

Studies show that an intentionally designed high-school-to-college pipeline delivers a more culturally diverse and academically prepared group of first year students to campus.<sup>20</sup> As first-generation college students, many Hispanic and underserved students lack role models and often believe STEM fields are not for them. The decision to attend college is shaped primarily by prior academic and social experiences; therefore, opportunities for college success begin long before students are ready to make their transition to college.<sup>21</sup>

To begin to fill in the gap of an undeveloped STEM Academic pipeline from high school to LMC, we need to make sure that Hispanic and underserved students have the consistent academic STEM planning and preparation needed. To ensure this we will do the following:

- **Hire an Outreach STEM Coach to work in high Hispanic-enrolled local high schools:**

One of the key benchmarks noted in the study of the Survey of Entering Student Engagement (SENSE) is the importance of early connections with students **before** college.<sup>22</sup> Both the TVP and SENSE studies emphasize the importance of an effective track to college readiness, and as the SENSE benchmark phrases it, “a clear academic plan and pathway” from high school to transfer.

Disproportionally, more Hispanics graduate from high school lacking advanced math courses such as Intermediate Algebra, Trigonometry, Pre-Calculus and Calculus. Such underrepresentation in the advanced math curriculum has serious implications for Hispanics’ postsecondary opportunities and employment aspirations in STEM fields. Interventions and partnerships designed to increase college awareness and focus on STEM fields, combined with

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<sup>20</sup> Rendon, Garcia & Pederson, eds., *Transforming the First Year of College for Students of Color* (Columbia SC: University of South Carolina, 2004).

<sup>21</sup> R. Jalomo & L. Rendon, *Moving to a New Culture, Transforming the First Year of College for Students of Color* (Columbia, SC: University of South Carolina, 2007).

<sup>22</sup> Center for Community College Student Engagement, *Benchmarking & Benchmarks: Effective Practice with Entering Students* (Austin, TX: The University of Texas at Austin, 2009).

strategies to increase awareness in minority families about how best to prepare their children for postsecondary STEM success, enlarge the pool of college bound STEM students.<sup>23</sup> A study of over 8,000 high school students enrolled in introductory science courses indicates that students with the most coursework in high school math performed strikingly better in their biology, physics and chemistry courses in college than those with less math preparation.<sup>24</sup>

Based on these studies, **LMC will hire an Outreach STEM Coach to work in four high Hispanic enrolled East County feeder high schools** to create a strong and sustainable launching pad for our STEM transfer pipeline. This Outreach Coach will work at each of the high schools for at least one day each week, working with high-school faculty, staff, students and parents to help them be more prepared and informed of coursework needed for transfer at college-level.

Exelencia in Education's 2008 *Modeling HSIs Report* shares examples of colleges successfully partnering with high school students and their families in preparation for college and persistence through transfer institutions. LMC will include common elements of these successful programs, such as consistent opportunities for early college awareness, relationship building with students and families, educational plan development encouraging more college prep courses, test preparation and bilingual financial aid workshops.<sup>25</sup>

- **Establish MESA programs at high schools.** Create and sustain MESA programs at each of these high schools (Antioch, Deer Valley, Liberty and Pittsburg) to assist students who are interested in STEM majors to prepare for college.

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<sup>23</sup> Nancy Nestor-Baker and Sandra Kerka, 2009.

<sup>24</sup> Philip M. Sadler and Robert H. Tai, "The Two High School Pillars Supporting College Science," *Science Magazine*, July 27, 2007, 317.

<sup>25</sup> DeAnza, Irvine Valley, San Diego City, Skyline Colleges in CA.

<b>Highlights of High School MESA Programs will include:</b>	
• Individual academic plans	• Summer programs
• HS MESA Study Skills workshops	• Science Careers workshops
• STEM study groups	• LMC MESA Earth Day curriculum
• STEM-ing Future Day: High school students visit LMC & shadow our MESA students	
• Hands-on STEM experiences at the high schools, LMC and at local industry	
• Workshops for parents in understanding STEM education and careers and how to become effective advocates for their children’s academic success	

The Outreach Coach will also work with Antioch High School’s **Project Lead the Way (PLTW)**, a sequence of courses in which students develop critical thinking skills through hands-on project-based learning, preparing students for an Engineering pathway. The Coach will also work with administrators and faculty at the other three high schools (with the highest number of Hispanic and low-income students) to establish PLTW activities designed for high school students interested in STEM-related fields. Over the last several years, numerous academic institutions have confirmed PLTW’s effectiveness in increasing student success.

- **Develop Summer Math Program for high school students:** The Outreach Coach will work with LMC faculty and the high schools to create summer math programs at the college for high school students in which they can earn college units. In 2008 and 2009, LMC ran two similar pilot programs for students at Pittsburg High. At the conclusion of the project, 90% of all of the participants were able to progress to the next level of math the following fall. Project ExCEL will work with 50 Hispanic and low-income high school students who have taken the LMC required assessment and who qualify for enrollment in college-level algebra and geometry classes. In addition to attending classes four days a week, these students will spend study-group time with math tutors from LMC. Students who successfully complete a course will receive concurrent high school and LMC credit, and accelerate to the next math level in the fall.

**COMPONENT 2 STRATEGIES:  
TRANSFER READINESS – ACCELERATING THE PIPELINE**

- **Implement Instructional Acceleration Strategies**
- **Establish Brentwood Science Lab; Upgrade and Innovate Pittsburg Labs**
- **Expand and institutionalize the MESA support program and services for STEM students**

One of the key gaps in the transfer pipeline that the STEM Planning Team uncovered in their year-long study was that our STEM students are taking, on average, more than six years to transfer to four-year institutions. Numerous academic, support service and equity barriers slow the progress of our Hispanic and underserved STEM students. A central issue is the length of time it takes our students to progress from Developmental Math to Calculus. Currently, 88% of students who take the math assessment test enter LMC scoring below college-level math. These students must successfully complete Elementary and Intermediate Algebra before enrolling in college-level math courses, yet of those students who enter Elementary Algebra, the majority never reaching their intended goals. To begin to fill in this gap of an undeveloped STEM Transfer pipeline from LMC to our four-year transfer institutions, we need to create programs that support and accelerate Hispanic and underserved students' progress.

• **To do this we will implement the following three Instructional Acceleration Strategies:**

(1) **Establish Innovative Math Path:** In response to these low success rates, two fulltime LMC math Faculty have created Math Path, which pairs a 5-unit Elementary Algebra course and a 4-unit Intermediate Algebra course with a 3-unit support course (which includes: strategies for reading math texts, taking notes in class, methods for problem solving, time management, study habits and educational planning), creating a full-time 12-unit semester course load. **This combination of high support with high expectations will enable below college level students with career goals in STEM to quickly move through the DE math pipeline (in one semester)**

**and into Calculus transfer-level courses.** This accelerated program integrates components of a successful Pasadena City College course and Acceleration principles discussed in the 2010 Report, *Exponential Attrition and the Promise of Acceleration in Developmental English and Math*,<sup>26</sup> by LMC Math instructor Myra Snell. Thirty-three students began the program in August, 2010 and twenty-five (76%) of these students successfully completed the two-class accelerated sequence. **The Math Path cohort demonstrated a 40% higher success rate than the conventional two-semester course sequence.** LMC will implement and assess two sections of Math Path each semester for two years and institutionalize the program in the third year.

*“LMC administrators are very interested in Math Path because it directly addresses the barrier that math courses pose for not only LMC students, but for community college STEM students nationally. Math Path can be the much needed catalyst for students to complete these often difficult prerequisites, opening the pipeline to transfer level STEM courses.”*  
- Julie von Bergen, Basic Skills Math Lead

**(2) Establish a Summer to Fall Stem Path:** Additionally, Math faculty will develop a twelve-week summer Math Path Program (pairing Elementary and Intermediate Algebra with the support class) followed in the fall by an accelerated pairing of a science-contextualized Pre-Calculus Class with a science course to be determined. This project will begin in Year Two of the grant, after its full development in the interdisciplinary STEM Velocidad Incubator (p.29).

**(3) Integrate Technology into Math Courses:** Research shows that interactive technology increases the engagement of minority students.<sup>27</sup> LMC will increase the use of technology at our Brentwood Center by creating a new 40-computer classroom for Elementary and Intermediate Algebra using MyMathLab<sup>28</sup> software as an accelerated computer alternative to Math Path and

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<sup>26</sup> Myra Snell & Katie Hern, *Exponential Attrition and the Promise of Acceleration in Developmental English and Math* (Chabot College, 2010).

<sup>27</sup> Mary Helen Miller, “How Interactive Technology Can Help Minority Students Learn,” *The Chronicle of Higher Education* (April 24, 2011).

<sup>28</sup> <http://mymathlab.com/>

the conventional Algebra classroom sequence. Our Brentwood Math faculty will model the use of this program after Xavier University in Chicago's Algebra program, where success rates increased from 55% to 74% in Elementary Algebra and from 45% to 64% in Intermediate Algebra, with enrollment rates of 74% and success rates of 88% in subsequent math courses.

- Establishment of Brentwood Science Lab; Upgrades and Innovations in Pittsburg Labs: In response to the need for science lab classes at LMC's rapidly growing and heavily Hispanic Brentwood Center, a multi-disciplinary wet-lab will be established. **A space for this lab has been identified at the Center, and cost and time estimates have been established. Once funding is secured, work on establishing the lab will immediately begin. A part-time Lab Technician will be hired at the end of Year 2 to assist with the set-up and operation of this lab, which will begin to accommodate lab sections of Biology in Fall, 2013. Lab sections in Physics & Engineering will be offered beginning in Spring 2014.**

**In addition to establishing the Brentwood Lab, innovations at our Pittsburg campus will be accomplished by upgrading lab equipment.** It is important to advance our laboratory experiences in order for our students to gain requisite lab skills comparable to those available in lower-division lab experiences at our top four-year colleges and universities. With the upgrades, students will conduct more hands-on inquiry-based experiments and design research projects. Studies find that hands-on research broadens students' understanding of what science is and provides a "passport" to the scientific community. Undergraduates who participate in laboratory inquiry-based experiments and research are significantly more likely to complete their bachelor degrees and pursue advanced degrees in STEM.<sup>29</sup> Articulation of course content and skills

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<sup>29</sup> Siri Carpenter, "Community Colleges Fuel Science Workforce," *Science Careers Magazine* (June 2008).

cannot be separated from access to facilities and equipment. Successful articulations address hands-on lab skills as well as mastery of content.<sup>30</sup>

New lab courses LMC will offer such experiences as Molecular biosciences, Thermo/Saves and Electricity/Magnetism, and Forensics. These labs will not only parallel the undergraduate lab experiences of our top transfer universities, they will also help to prepare students for real life work environments. The establishment of the new Brentwood lab and modern upgrades at the Pittsburg campus will bring both labs to the level necessary to succeed and be competitive with other colleges, universities and industry.

- **The expansion and institutionalization of the MESA support programs and services for STEM students** is perhaps one of the most crucial ways of accelerating and sustaining a strong transfer pipeline within Los Medanos itself. In 2008 LMC met with representatives of MESA's community college programs throughout the state to study the results of increased student retention, persistence and transfer success. MESA, a program of the University of California Office of the President, is an academic and support service program for low-income and other first-generation students. **Of the MESA students who transfer to 4-year institutions, 98% major in STEM fields** (<http://www.ucop.edu/mesa/direct>). A case study of successful STEM transfer programs found these similar characteristics: a presence in high schools, summer bridge programs, peer support systems, opportunities to learn about STEM professions, opportunities for research, mentoring, student facilities, tutoring services and social activities.<sup>31</sup> All of these characteristics define what makes a MESA program so successful.

In November, 2009 an anonymous donor, hearing of LMC's enthusiasm for MESA, donated \$35,000 to LMC as startup funds; since that time we have established a successful pilot MESA

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<sup>30</sup> *Increasing and Strengthening the Next Generation of Leaders in STEM* (Paine College, 2007).

<sup>31</sup> Ruta Sevo, "The Talent Crisis in Science and Engineering," *SWE-AWE* (2009).



program at LMC that serves 100 underserved STEM students. However, the pilot is funded only by soft funds. With *STEM Transfer Velocidad*, LMC plans to expand and institutionalize the MESA Program providing more support to low-income, first-generation STEM transfer-bound students and implementing enrichment and support strategies for non-MESA STEM students. In this way, we can continue to build a strong transfer culture by integrating support services with academics and partnering with high schools and four-year colleges and universities.

***MESA will include the following programmatic elements:***

**a. Expansion of MESA Center:** Designated space helps academic programs to gain identity and permanence.<sup>32</sup> Therefore, the MESA team procured space in the Science Building which includes computers and work stations for group work, soft space to encourage student bonding, a library with core STEM texts, graphing calculators, references and other tools difficult for students to afford. We will expand this space and its hours so we can accommodate more MESA and non-MESA STEM students.

**b. STEM Counseling and Educational Planning:** STEM classes are particularly complicated to navigate because of overlapping sequential course requirements. Choosing the wrong course can set students back an entire year; therefore, a 50% **STEM Counselor** will be hired to work closely with MESA students, assisting them in developing educational plans to guide them efficiently through the STEM pipeline.

**c. Co-curricular Student Activities:** Studies have long shown the importance of student communities and social bonding as factors in retention and success,<sup>33</sup> especially for first-generation college students. MESA students will organize social and family activities, STEM field trips, a yearly retreat, and science and math related events at LMC. STEM students will also attend State workshops and conferences.

**d. Mentoring Networks and Campus/Industry Partnerships:** LMC's strong business and industry relationships present numerous mentoring opportunities for MESA students. MESA students will link with local professionals who can introduce them to STEM career options, facilitate job-shadow/intern opportunities and support students through college. MESA will also affiliate with other STEM organizations such as the East Bay Chapter of the National Society of Hispanic Engineers.

**e. Expanded Academic Excellence Workshops:** Focusing on key "bottleneck" courses, these workshops—based on the work of Uri Treisman at UC Berkeley, in

<sup>32</sup> Brian Holton & George Horton, *The Rutgers Physics Learning Center: Reforming the Physics Course for First-Year Engineering & Science Students*, Rutgers State University of New Jersey.

<sup>33</sup> Sharon Silverman & Martha Casazza, *Learning and Development: Making Connections to Enhance Teaching* (San Francisco, CA: Josse Bass, 2000).

which African American and Latino participants outperformed non-workshop White and Asian classmates—facilitate group study techniques for MESA students. LMC has identified such courses as Algebra, Intermediate Algebra, Calculus, Organic Chemistry and Physics as primary candidate courses for the formation of study groups.

**f. Expanded MESA Students Participation in Research and Internships:** These activities will be undertaken with faculty at LMC, universities and local industry. Using the Community as a Classroom, students may choose to participate in local field-work experiences, such as Watershed issues in the Delta or environmental problems and toxic waste from factories. Studies reveal that participation in undergraduate research has increased the retention of underrepresented groups in the STEM disciplines.

**g. Create LMC MESA Café:** The Café will host biweekly/monthly, informal seminars for STEM students to present their research projects, discuss science journal articles, and listen to outside speakers and LMC faculty discuss their research.

**h. Establish MESA Interactive Website:** A central website will be created and updated regularly. On the site, each STEM department can host its own section containing web links, societies of interests, conferences and STEM events in the area.

In addition to these interventions and external connections, the LMC MESA will also initiate the following strategies:

(1) **Join a network of learning communities and student programs on campus** committed to building a robust transfer culture at LMC that includes AVID (academic boot camp for students interested in transferring), Honors Program, Puente (learning community for Hispanic students in English), Umoja Scholars (learning community for African American students in English and Math) and the new Transfer Academy. This network plans joint orientations, leadership retreats and social activities and encourages cross-program interactions. The Honors Program has made a pledge to identify advanced STEM students to mentor and tutor MESA students, while MESA students will become ambassadors to our local high schools and middle schools.

(2) **Establish a MESA Summer Boot Camp.** Hispanic students are usually the first in their families to attend college and often feel alienation, culture shock, and isolation upon entering

college.<sup>34</sup> Summer Bridge programs, particularly at community colleges, offer an effective approach to engaging students early. **MESA Summer Boot Camp** will provide a series of seminars to help prepare incoming students for the rigors of STEM majors.

**COMPONENT 3 STRATEGIES:****ARTICULATION READINESS – SOLIDIFYING THE PIPELINE**

- **Hire a STEM Counselor/Articulation Specialist**
- **Form a STEM Articulation Committee to conduct a thorough analysis and monitoring of the model articulation pathways being developed Articulate and complete major pathways for STEM transfer majors**
- **Develop roadmaps for STEM majors for top transfer institutions.**

To solidify the transfer pipeline, it is crucial that LMC provide key STEM courses that are articulated with top transfer universities for student success. Research from The National Institute for Health - Bridges to the Future Program (which facilitates transfer of underrepresented minority students in STEM fields) stresses the importance of articulation agreements that address both course content and lab skills.<sup>35</sup> An inventory of our articulation, conducted by STEM Planning Team members, shows major gaps in LMC's articulation agreements, particularly in Engineering and Physics. Currently, a number of students cannot complete even half of their lower-division engineering requirements at LMC. In some cases we offer the courses, but they are inadequately articulated; in other cases new courses must be developed. To accomplish these goals, we will implement the following strategies:

- **Hire a STEM Counselor/Articulation Specialist** in Year One who will **Form a STEM Articulation Committee** to include: LMC's 50% Articulation Officer; faculty, administrators, staff, STEM students; and representatives from CSU and UC. The committee will conduct a

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<sup>34</sup> David Conley, *College Knowledge: What it Really Takes for Students to Succeed and What We Can Do to Get Them Ready* (San Francisco, CA: Josse Bass, 2005).

<sup>35</sup> [www.nigms.nih.gov](http://www.nigms.nih.gov)

thorough analysis of the model articulation pathways. STEM faculty members will be carefully selected to work directly with STEM faculty from our top ten transfer institutions (California State University East Bay, San Francisco, Sacramento, San Jose, Chico, Sonoma, Humboldt and UC Davis, Berkeley, Santa Cruz) **to develop or revise courses as necessary for majors articulation.** The STEM Counselor /Articulation Specialist will become a member of LMC's Curriculum Committee, coordinate articulation with the Transfer Center, and develop a systemic plan to continue to our STEM articulations. In addition to articulation for our traditional STEM majors, agreements will be developed for our popular PTEC and ETEC applied science courses and majors, which can now be articulated with many of our CSU transfer universities.

***Timely, Accountable, Complete - New STEM Articulation Process:*** One of the key gaps in our articulation, as discussed in our Need Section, is a Calculus supplement for general Physics classes needed by Biology students to fulfill the physics requirement at UC Davis. In the New STEM Articulation Process, the STEM Articulation Specialist, Marie Karp, will meet with Biology and Math faculty to coach them as they revise the Physics course, adding the Calculus supplement. The ***STEM Velocidad*** Project will pay LMC faculty to meet with faculty from Davis to discuss the requirements. Marie will then work in conjunction with the LMC Articulation Officer to ensure approval by UC Davis. If any requirements are missing, Marie will work directly with faculty to coach them to revise it. Above all, Marie will monitor the STEM articulation process making sure it is completed. A designated STEM articulation specialist will be able to focus, monitor and fill the significant articulation gaps currently existing at LMC. As an additional benefit, relationships will be formed between faculty at LMC and our transfer institutions.

- **Articulate, Complete and Continually Monitor Major Pathways for STEM Transfer**

**Majors:** In addition to ensuring that key STEM courses are monitored, the STEM Counselor/Articulation Specialist will work with faculty to satisfy SB1440, the California Student Transfer Achievement Reform Act. This act was adopted in Fall 2010 to simplify and streamline the process for California community college students transferring to schools within the California State University (CSU) system. The STEM Articulation Specialist will work on streamlining and simplifying the LMC STEM transfer requirements to follow the spirit and the letter of SB1440.

- **Develop roadmaps for STEM majors for top transfer institutions.** Many first-generation students start at LMC uninformed about what classes to take. They pick classes blindly, or follow a general education program, and fail to realize the need to start on their STEM major classes in their first semester. This results in their delaying their time to transfer and/or lack of competitive preparation for transfer to a four-year university. Students need a roadmap for their major so that they can pick the correct classes and transfer in a timely manner.

The STEM Counselor/Articulation will develop roadmaps for STEM majors at the top transfer institutions. The STEM Counselor will meet with all of the STEM students and provide them with the roadmap for their major and help students plan their classes for the 2-3 years that they will be at LMC. An education plan will be required for all STEM students, so that these students are choosing the correct classes.

**COMPONENT 4 STRATEGIES:*****INSTITUTIONAL READINESS – ASSESSING AND IMPROVING THE PIPELINE***

- **Establish a STEM Incubator based on a Culture of Evidence, Assessment and Innovation**
- **Increase Professional Development opportunities, based on effective practices**

As identified in the Need for Project section of this grant, the CORE problem is that despite high aspirations, Hispanic and other underserved students are failing to transfer in STEM-related fields. As the grant planners studied this problem and our students' experiences, they recognized the need to understand the STEM data, have meaningful discussions about what the data means and to make changes that will increase and accelerate the success of our STEM students. As the Planning Team analyzed and discussed the data, they agreed that we will never significantly increase completion rates of STEM students unless we reduce the length time it takes to complete STEM major requirements, eliminating the "exit points" where students are get lost.

Increasing the completion rates of STEM students is a priority need of Hispanic and low-income students, evidenced by the fact that only 9 Hispanic STEM majors transferred in 2009.

Math faculty have shown that it is possible to increase persistence and completion rates by 40% in the Math Path Pilot, the accelerated combination of two Math courses in one semester. As part of this pilot, faculty collected entrance data from students, conducted exit interviews, and tracked student enrollment in subsequent semesters.

- **Establish a STEM Incubator based on a Culture of Evidence, Assessment and Innovation.** Building on the momentum of this pilot data, we will engage additional faculty, staff and administrators as we continue to focus on research and innovations to address the identified barriers to our STEM students' success. Expanding on the Math Path model, the team will create similar accelerated pairings across STEM disciplines.

The STEM Incubator will be the venue to assess and link data to the story conveyed and ignite the next cycle of revisions and innovative programmatic change. This evolving team will invite high school, university and industry partners to the table. The Incubator Team will continually create opportunities to understand and interpret disaggregated data (with an eye toward equity), to revise and continue pilot efforts, and to initiate change in the college culture. Incubator team members will explore pertinent studies and literature, conduct qualitative and quantitative research about LMC program participants (in accordance with privacy requirements), and visit effective high school, community college, and university STEM programs. Incubator team members will become STEM Innovators who – informed by our campus data, students' stories, and their own desire to improve our STEM outcomes – will ultimately enhance student learning through a strong and accelerated STEM pipeline.

**•To close the loop on what we research, initiate and study we will create STEM-**

**Transfer Focused Professional Development** so that we can learn from what we have done.

Assessment will then become a source of inspiration and learning for our STEM departments. In this way, assessment itself will become the foundation of on-going STEM professional development, using data to learn together how to change programs, curriculum, and teaching – inside and outside of the classroom. Below is a list a partial list of professional development activities to be implemented through this grant. Additional opportunities will be designed using what we learn through the work of the STEM Incubator.

<b>Acceleration Workshops:</b> Professional development supporting new faculty in teaching the newly designed accelerated math programs
<b>Contextualizing Curriculum:</b> Learning about, and working together to contextualize math and English course to be STEM specific.
<b>The Role of Faculty in STEM Technology:</b> Particularly in regard to working with technology savvy students whose learning styles have transformed along with changes in technology and new lab equipment
<b>Curricular Innovation and Collaboration along the 2+2+2 STEM Pipeline:</b> Professional development collaboration among high school, community college and university instructors for increasing high-quality educational opportunities for Hispanics in all STEM fields.
<b>Conference Participation:</b> STEM faculty and staff will attend professional STEM conferences and workshops, including Acceleration, Contextualization, Technology, Professional Conferences and others.

As the Incubator recommends changes in programs, curriculum and teaching – Professional Development will be approached as an ongoing and reflective practice for all faculty and staff, at all stages of their careers. Above all, Professional Development integrated with assessment and evaluation will bring increasing numbers of Hispanic and underserved students, like Anna, through the STEM transfer pipeline.

**Anna’s Triumph:** Anna had always dreamed of being an engineer but no one in her family had ever finished college, nor did she know any Hispanic scientists. So she was happy when she was able to join Project Lead the Way Antioch High as a junior. Along with two of her guy friends, she helped put on an Engineering day at the high school, working with students from LMC and two engineers who worked at Dow and POSCO. She especially felt hopeful after she was invited to shadow a female college MESA student. As she sat in on the LMC Mesa Café listening to LMC students presenting the research they did on the Delta Watersheds, she imagined herself presenting her latest engineering solution. After that, Anna felt very good about majoring in Engineering at the college. Her Outreach STEM Coach suggested that Anna join the Math Path Summer Bridge at LMC when she graduated from high school. Because this is an accelerated program, her participation gained her entry into pre-calculus in the Fall. Once she got into calculus, she joined an Academic Excellence group, which offered additional assistance. Then, at LMC, she immediately joined MESA where she already knew many of the students. The best part was not only hanging out with other MESA students at the MESA Center but working with the amazing faculty in the new Brentwood lab. Most of all, she loved being a STEM Student Ambassador to Antioch High to inspire other girls to come to LMC and transfer to UC just like her: ”Yes, there are other Hispanic girls who want to be engineers!”

**PART IV – KEY PROJECT PERSONNEL**

The LMC President is pleased that Jennifer Saito, who has proven leadership and grant directing experience, has agreed to accept the position of Grant Director.

<b>STEM Transfer Velocidad Project Director: (75%) Ms. Jennifer Saito</b>
<p><b><u>Grant Leadership Role:</u></b> The Grant Director has primary leadership responsibility for the STEM Transfer Velocidad Project and serves as the primary contact with the Department of Education. The LMC President has delegated appropriate authority to carry out the duties and responsibilities of the position.</p>
<p><b><u>Reporting Lines:</u></b> Ms. Saito will report to LMC President Richard Livingston, and work closely with Gil Rodriguez, Dean of Liberal Arts and Sciences. She will have direct access to academic and student services managers, faculty and staff. Ms. Saito will be hired in this capacity for the five years of the grant term only.</p>
<p><b><u>STEM Grant Management Duties:</u></b> Establish/maintain oversight of the Grant Steering Committee; serve as chief spokesperson for the goals and objectives of the project to internal and external constituencies; authorize all expenditures and maintain control over budget; perform regular interface and ongoing communications with faculty and administration with partnering high schools; ensure the development and implementation of an effective and objective system of evaluation (including collection and analysis of high quality and timely data on program participant outcomes) for all components of the project; facilitate and monitor communications and development to maximize sustainable institutionalization of new practices, strategies and partnerships; submit required annual reports to Dept. of ED; and ensure that the project operates in compliance with EDGAR throughout the grant period.</p>



<p><b><u>Activities Leadership Role:</u></b> Ms. Saito played a key role in the planning, development, and writing of this <i>STEM Transfer Velocidad</i> application, and can therefore lead a strong implementation with an accelerated start. She will oversee all components of the grant and will work closely in supervising the work of the <i>Velocidad</i> Assistant, the MESA Director, the STEM Counselor/Articulation Specialist, the STEM Outreach Coach, the Facilities Project Manager and the Incubator Lead. She will work closely with the campus research and PD staff, will be the interface between the grant and STEM and other staff/departments and community, and will represent the <i>STEM Transfer Velocidad</i> and various committees on campus to support the goals of the grant. Ms. Saito will also chair the <i>STEM Velocidad Steering Committee</i>.</p>
<p><b><u>Education &amp; Related Experience:</u></b> Ms. Saito has federal grants experience as Coordinator for a Title III grant at LMC, as well as extensive experience in leadership positions, both as Chair of the Math Department and Coordinator of the Honors Program at LMC. <b>Ms. Saito earned her BA and MA in Theoretical Mathematics from UC Berkeley. As a minority woman in the graduate program she was recruited to teach in the Professional Development Program, an innovative math retention program founded by noted math retention expert Uri Treisman.</b> Ms. Saito has spent her LMC teaching career focused on math. Twelve years ago, she started LMC’s enormously successful Honors Program, tripling its participants within 8 years. Ms. Saito enjoys being on the ‘front lines’ with students, working with faculty on innovative curriculum design, and delights in the idea of more math and science majors and transfers.</p>

<p><b>ACTIVITY COMPONENT 1: College Readiness for High School Students</b></p>
<p><b>High School STEM Outreach Coach (100%) – to be hired</b></p>
<p><b><u>Job Responsibilities:</u></b> Direct and oversee implementation and operation of the Early Connections component as outlined in the in the Project Services section of the grant narrative and work plan including: high school readiness for STEM prep, STEM coaching for students, parents, and high school faculty, initiation of high school MESA Programs, coordination of high school STEM events at LMC, creation and maintenance of mentoring programs and activities, creation of high school STEM mentorship program for middle school students; Incubator Team participation; assessment of component activities and assurance of effective component accountability with grant director.</p>
<p><b><u>Reporting Lines:</u></b> This position reports to the Grant Director and will work closely with the Dean of Liberal Arts and Sciences, LMC Outreach Director, academic and student services leaders and faculty at LMC, and high school administrators and faculty.</p>
<p><b><u>Minimum Qualifications:</u></b> Masters in STEM field; three years teaching or outreach experience; experience building and managing a program, familiarity with student support services and matriculation, bilingual preferred.</p>

<p><b>ACTIVITY COMPONENT 2: Transfer Readiness</b></p>
<p><b>MESA Director Carol Hernandez (100%):</b></p>
<p><b><u>Job Responsibilities:</u></b> Direct and oversee planning and implementation of the MESA Program as outlined in Activity and work plan; oversee MESA staff and faculty recruitment and development of MESA activities; supervise the day-to-day functions of the MESA Center and the program’s activities including Academic Excellence Workshops, mentoring and industry partnerships, internships, and summer boot camp; supervise student employees and tutors,</p>

develop/maintain partnerships at LMC and with high school MESA programs, assure effective overall accountability; monitor the activity budget; assess component activities and ensure effective component accountability with grant director.
<b><u>Reporting Lines:</u></b> This position reports to the Grant Director.
<b><u>Education and Related Professional Activities:</u></b> Masters of Natural Science, Biology, University of Idaho, Moscow, ID; Bachelor of Arts, Chemistry, Emory University, Atlanta, GA; Biology Instructor, LMC; Interim Coordinator of MESA pilot, Instructor: Anatomy, Physiology, Biology, Highline Community College, Everett, WA; part time instructor: Biology, Shoreline Community College and Seattle Community College, Seattle, WA; member, National Science Teachers Association, Society for College Science Teacher and National Association of Biology Teachers.

<b>ACTIVITY COMPONENTS 2 &amp; 3 – Transfer Readiness &amp; Articulation Readiness</b>
<b>STEM Counselor (50%)/STEM Articulation Specialist (50%) – Marie Karp</b>
<b><u>Job Responsibilities:</u></b> This position will work approximately 50% as a STEM Counselor and 50% as the Articulation Specialist, as needed. <b>As STEM Counselor:</b> Meet with STEM students regarding STEM educational and transfer planning, career direction and transfer applications; link STEM students with academic and other student support services; conduct MESA Orientation with MESA Director; work closely with LMC Transfer Center staff and with four-year colleges for a seamless transition of STEM Transfer. <b>As STEM Articulation Specialist:</b> Work closely with LMC’s Articulation Officer; form & chair STEM Articulation Committee to develop a STEM Articulation Strategic Plan and conduct, analyze and update a comprehensive review of LMC’s STEM course and major articulations with top transfer universities; conduct a thorough analysis of SB1440 model articulation pathways under development; work closely with STEM faculty, deans and research office to analyze enrollment trends and need for new courses; recommend course revisions and serve as a consultant to departments in the creation and revision of course outlines; initiate and facilitate articulation agreements for existing, revised and new courses and articulation agreements for major STEM pathways; assess component activities and ensure effective component accountability with grant director.
<b><u>Reporting Lines:</u></b> This position reports to the Dean of Student Development (for Counseling) and the Articulation Officer (for Articulation) and works closely with the Grant Director, the MESA Director, Academic Deans and STEM faculty.
<b><u>Education and Related Professional Activities:</u></b> Master of Science, Counseling, California State University, East Bay; Bachelor of Science, Psychology, City University of New York; Licensed Marriage & Family Counselor and Licensed Educational Psychologist, CA; Counselor, Los Medanos College; Counselor, MESA Program and Honors Transfer Program, Los Medanos College; Transfer Center Director, Los Medanos College; Regional Representative to CA State Chancellors Office for Transfer Center Directors; member, Curriculum Committee, Los Medanos College; regular attendance at STEM, transfer, and articulation conferences.

<b>ACTIVITY COMPONENT 4: Institutional Readiness</b>
<b>STEM Incubator Lead – (25%) Ryan Pedersen</b>
<b><u>Job Responsibilities:</u></b> Form and facilitate the action-research, data-driven Incubator Team of faculty administrators, staff, students and community partners to focus on research and

development and implementation of innovations for STEM student success; integrate related and other STEM professional development activities with particular attention to effective practices of cultural relevancy, equity and access; assess component activities and ensure effective component accountability with Grant Director.
<b><u>Reporting Lines:</u></b> This position reports to the Grant Director and works closely with the Dean of Liberal Arts and Sciences, STEM faculty, Institutional Research and Professional Development staff, and academic and student services leaders.
<b><u>Education and Related Professional Activities:</u></b> Masters of Science, Applied Mathematics, University of Colorado Denver, Denver, CO; Bachelors of Science, Mathematics, and Bachelors of Arts, Physics, University of the Pacific, Stockton, CA; Tenure-Track Mathematics Faculty, Los Medanos College; Member, Research and Planning Committee, Los Medanos College; Member, MESA Advisory Council, Los Medanos College; Instructor & Research Fellow, University of Colorado Denver; SIAM (Society for Industrial and Applied Mathematics) Front Range Chapter Coordinator.

<b>Other Grant Related Positions</b>
<b>Velocidad Assistant:</b> (100%) Provide project record and fiscal bookkeeping; assist Project Director, MESA Director and other staff with programs and services.
<b>Velocidad Math Lead:</b> Provides leadership and professional development for Math and STEM Path and in the development of new accelerated math initiatives. (LMC-paid)
<b>STEM Lab Technician:</b> (50%) <b>for Brentwood Lab:</b> Maintain lab and equipment; prepare lab for all classes.
<b>Student Ambassadors and Tutors:</b> Assist with high school outreach, orientations, tutoring, Academic Excellence Workshops. Minimum qualifications: 2.75 GPA, enrolled in MESA with minimum of 6 units completed, demonstrated leadership potential.

**PART V - ADEQUACY OF RESOURCES**

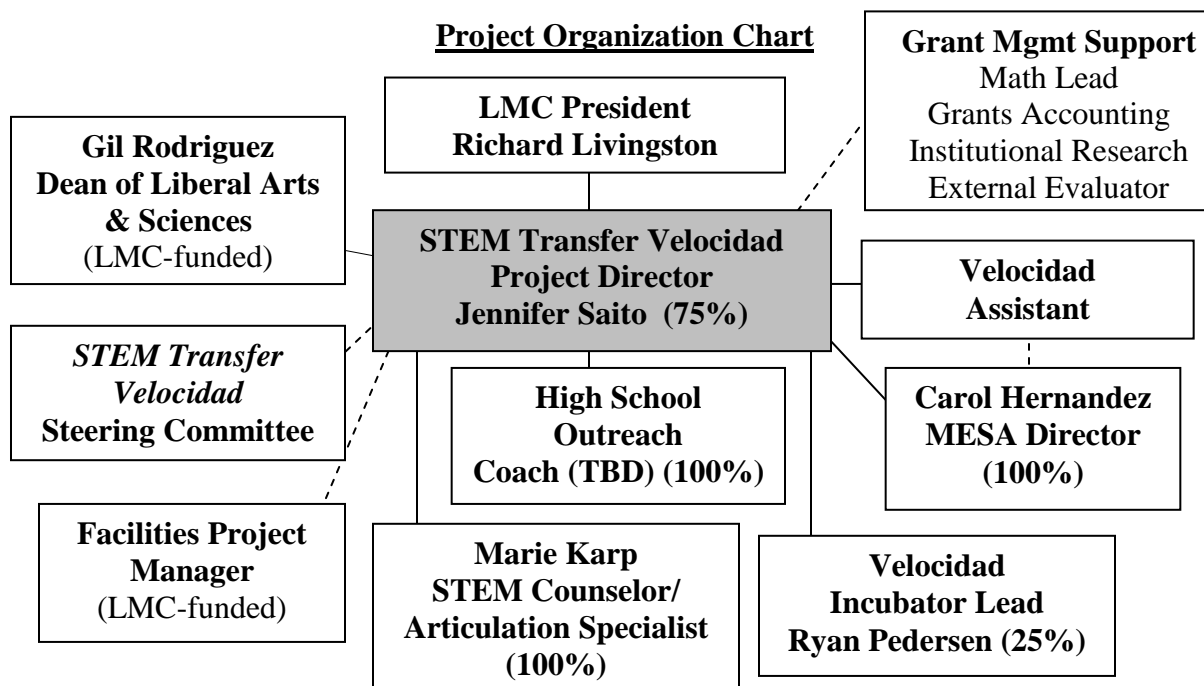
<p><i>East County has one of the fastest growing Hispanic populations in California, but last year only nine Hispanic students transferred from LMC to a university in a STEM field. The area has 14% unemployment, but local STEM jobs - which are regularly available - must be staffed from elsewhere.</i></p> <p style="text-align: right;">Blas Guerrero, Dean of Student Development</p>
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**This project will strengthen and add velocity to the educational pathways to lead the targeted population to STEM careers.** Not only will the STEM transfer success of LMC’s growing population of Hispanic and low-income students increase substantially, but by establishing the *STEM Transfer VELOCIDAD* 2+2+2 pipeline, LMC will fundamentally shift the way its six feeder high schools will participate in STEM transfer education.

<b>Adequacy of Resources Factors</b>
<p><b>(i) Adequacy of Support:</b> State of the art science and math buildings with new labs. However, as we study our curriculum and articulation we recognize the need to match lower division best practices in our 4 year institutions with our use of equipment in our current labs, consequently, our request for new equipment. Brentwood Center; grant supported by LMC President, Dean of Liberal Arts &amp; Science who will work with it closely; sound Business Office who will work with the <i>VELOCIDAD</i> Director.</p>
<p><b>(ii) Relevance and Commitment of Each Partner:</b> Our 4 feeder high schools who will be involved with MESA Programs—Antioch, Deer Valley, Liberty, and Pittsburg; our top ten transfer schools through articulation and transfer agreements; local industry council who are very supportive of establishing internships and job shadowing; STEM Steering Committee has members from the original STEM grant Planning Committee establishing both continuity and depth.</p>
<p><b>(iii) Adequacy of Budget to Support Project:</b> All costs were carefully determined by the STEM Planning Committee working with LMC Business Office to determine that they were adequate, cost effective based on actual costs.</p>
<p><b>(iv) Reasonableness of costs in relations to objectives, design and significance:</b> Utilizing cost effective practices to purchase only those things that will have an impact on building the capacity of the college to transfer more STEM students, we will use this money to set up systems that will endure—a 2+2+2 pipeline from high school through LMC to transfer institutions—from focusing on MESA programs in high school to math acceleration and MESA at Los Medanos to developing model articulation and transfer agreements at our 4 year transfer institution. By our collection and analysis of high quality and timely data we will continue to keep these new systems in place, especially in terms of enrollment, persistence and completion.</p>
<p><b>(v) Reasonableness of costs in relation to number of students served and anticipated results and benefits:</b> The significance and magnitude of the <i>VELOCIDAD</i> project is enormous as we stop the leaks in our STEM pipeline in the next five years. In the 2+ high school part of the pipeline 6 feeder high schools, comprising of approximately 12000 students, will be impacted. In the 2+ at LMC, retention, persistence and the acceleration in STEM will be increased substantially; in the 2+ of our 10 top transfer institutions, at least 20 articulation agreements will be completed. It will take time, but as we build capacity by our high school outreach, establishing our new lab in the Brentwood center, and as our courses are well articulated, our numbers will incrementally grow. This grant is not only about the next five years it is about the future of LMC and East County.</p>
<p><b>(vi) Cost-effectiveness and impact of acceleration on STEM transfer:</b> It takes over 6 years for our students to transfer as STEM majors. A key reason is that 40% of our STEM students begin at DE level algebra. Studies show that a student who places at that level of math has a 17% of completing a college level math course due to too many exit points along the traditional math sequence. In our accelerated Math Path pilot by eliminating these exit points we saw a 40% higher number of students go into Calculus. Because we are going to have 6 of these accelerated classes each year in the <i>VELOCIDAD</i> project and study its results in the <i>VELOCIDAD</i> Incubator, we will be able to apply our learning within other STEM courses and contexts.</p>

**PART VI - PROJECT MANAGEMENT**

**Project Leadership:** Because the project involves multiple administrative areas of LMC, STEM Transfer Velocidad Director Jennifer Saito will report directly to LMC President Richard Livingston. Ms. Saito will maintain overall responsibility for achievement of project objectives and oversight of the independent evaluation. She will have access to key decision-makers and institutional shared governance, assuring her of the support needed to manage this Grant. She will work most closely with Dean Gil Rodriguez on curricular matters.



*STEM Transfer Velocidad* Project Director Saito will have signing authority on all budget matters, assure that the project is in compliance, and personally handle all communications with the Department of Education. The Mesa Activity Directory, Carol Hernandez, will have the authority necessary for effective implementation of her grant component. The Velocidad Assistant will handle day-to-day record and fiscal bookkeeping functions for both the project administration and the MESA Program. Administrative support with these tasks will allow Ms. Saito and Ms. Hernandez to focus their collaborative leadership skills on achieving grant

objectives. Working closely with the LMC Articulation Officer, the STEM Counselor/ Articulation Specialist Marie Karp will take the lead on the STEM Articulation portion of the grant activity. STEM Incubator Lead Ryan Pederson, working closely with Institutional Research staff and STEM faculty, will facilitate research and data-based decision-making leading to enhanced faculty, staff and student learning. Improvement of STEM student outcomes relating to enrollment, persistence, completion, and achievement of STEM careers will remain our ultimate goal and expectation

**The Velocidad Steering Committee** will include representation from faculty, staff, and administrators, and students, and will report to the LMC Shared Governance Committee. In its advisory role, the Steering committee will meet twice each semester to review reports, recommend program improvements, ensure that project goals and activities remain consistent with the intent of this proposal and with the college mission and goals, and support institutionalization of new practices and improvements. Additionally, the committee will meet with the External Evaluator regarding evaluation and resultant improvement plans and initiatives.

<b><i>STEM Transfer Velocidad Steering Committee Members</i></b>	
Gil Rodriguez, Dean Liberal Arts & Sciences	Blas Guerrero, Dean of Student Development
Carol Hernandez, MESA Director	Humberto Sale, Institutional Researcher
Julie von Bergen, Math Lead	Eileen Valenzuela, LMC Articulation Officer
TBD, High School Outreach Coach	Rosa Armendariz, Transfer Programs Director
Marie Karp, STEM Couns/Artic Specialist	Dave Belman, IDEA Equity & Access Chair
Ryan Pedersen, STEM Incubator and Professional Development Lead	
Ruth Goodin, Professional Development Advisory Committee	
Faculty Representatives from Biological and Physical Sciences - TBD	
Brentwood Center Representatives – TBD	STEM Students - TBD

**Management Procedures to Monitor Project Progress:** The **STEM Transfer Velocidad Director** (Project Director), working closely with project leads and the assistant, will develop a comprehensive Project Manual. The manual will be distributed to all STEM staff, the Steering

Committee and other college personnel associated with the project. The manual will specify all program policies and procedures, staff responsibilities, lines of authority, and job descriptions, and will provide required forms and clarify reporting procedures and timelines.

<b>Chart of Activity Progress Monitoring Procedures</b>
<b>Start-up Procedures:</b> Upon notification of award, Project Director (PD) will work with Business Office to finalize fiscal procedures for expenditures/approvals/accounting, and to clarify authority and scope of responsibility of PD, Project Assistant, and key grant staff.
<b>Monthly Title V Staff/Strategy Team Meetings:</b> PD will meet with project staff a minimum of once per month. Initially meetings are anticipated to be every two-three weeks. Other faculty and staff will be invited to these meetings as appropriate.
<b>Time/Effort Reports:</b> <i>Monthly T&amp;E Reports</i> will be completed for each employee paid by STEM as approved in the grant. These reports to be submitted to PD at end of each month.
<b>Monthly Progress Reports:</b> <i>Monthly Progress Reports</i> will be completed by Component Leads and submitted to PD. Reports will include travel, consultants, equipment, piloting of new practices, and formative evaluation data. Unanticipated delays, alternative solutions and requests for assistance will also be noted.
<b>Semester Executive Summary Reports:</b> The PD will synthesize reports into a one- or two-page <i>STEM Grant Executive Summary Report</i> to be distributed to college administrators, managers of impacted areas, and project staff. It will comprise a brief summary of monthly reports, reflecting progress toward objectives and activities.
<b>Interim Progress and Annual Performance Reports:</b> Reports will be prepared and submitted to the federal STEM program office each year for documentation of substantial progress toward achievement of objectives to assure continued funding.
<b>Fiscal/Accounting:</b> All federal, state & institutional requirements will be followed.
<b>Evaluation of Project Personnel:</b> Fully consistent with institutional policies, including all negotiated agreements with faculty, administration and classified staff.
<b>Communication with the U.S. Dept. of Education STEM Grant Office:</b> Communication will be encouraged through the STEM PD. Grants compliance personnel will be kept apprised of rules and policy changes from the program office, as well as changes in grants management or fiscal issues in EDGAR.

<b>Activity Implementation Strategy and Timetable</b>				
<b>Ongoing throughout the Project:</b>				
* Compliance with all Contra Costa Community College District, LMC and federal guidelines for purchasing, travel and contracts				
* Sound project, staff and budget management and monitoring and regular college and community communications				
* Continual evaluation, including formative feedback for improvement and assessment of project activities in relationship to goals				
<b>Task and Outcome</b>	<b>Responsibility</b>	<b>Methods Employed</b>	<b>Tangible Results</b>	<b>Timeline</b>
<b>Year 1 – PROJECT INITIATION</b>				
Form STEM Steering Committee	Project Director, College President, Dean of Liberal Arts & Sciences	Appoint Comm members representing key campus constituencies.	Meet 2x a semester to review reports, recommend improvements and support institutionalization. Minutes of mtgs will be kept. Yearly report of issues discussed and recommendations made.	10/11 – on-going
Hire all STEM Staff (Lab Tech in Yr 3)	Project Director, President and Deans With Faculty representation	Follow LMC procedures to advertise, screen & hire.	Positions filled with staff fully oriented to objectives/roles/responsibilities.	11/11 - 01/12
Establish Grant Staff Team -	Pr Director, MESA Dir, Outreach Coach, Coun/Artic. Sp, Math Lead, Incubator & PD Lead and other staff	Form teams to develop/impl work plans for achieving Objectives.	Grant Staff Team meets monthly throughout the grant period.	01/12 On-going
Finalize STEM Evaluation Plan	Project Director, Grant Staff, External Evaluator, Institutional Researcher	Retain external evaluator who will collaborate w/grant staff	Evaluation Plan that tests effectiveness of grant strategies.	11/11 - 01/12
Finalize Communication Plan including website	Project Director, Grant Staff	Design comm. plan to increase awareness of grant goals & activities	Communication plan complete, implemented throughout grant and beyond	11/11 – on-going



Increase campus awareness of STEM goals, activities, and progress	Project Director, Grant Staff, Grant Leads	Website, Newsletters, Annual Progress Report & Presentation and Annual Progress Report Presentations	for SGC, Cabinet, College Assembly, Steering Committee, etc.	01/12 - 09/16
Leadership & Planning Retreat with Grant Staff and Key Administrators	Project Director, President, Dean, Grant Staff, Leads, Incubator Team, etc.	Orient Staff and Key Admin re: grant vision, obj, activities, roles/responsib.	Minutes, recommendations, actual published vision statement on Website; report by STEM grant director.	03/12
<b>Year 1 – COMPONENT ONE: COLLEGE READINESS</b>				
Implement STEM Coaching at key High Schools	Outreach Coach, LMC Outreach Director HS Principals and Science Faculty	Establish work space, weekly schedules, etc.). Work with faculty, students, and families.	Meet with MESA high school students ; will establish a MESA Program on 4 High school campuses. Meet with families once a semester.	01/12 - 09/16
Link existing Project Lead the Way program to LMC pipeline	Outreach Coach, High School Counselors	Work with program leaders at Antioch High to connect program components and participants to LMC STEM preparation activities.		01/12 - 09/12
<b>Year 1 – COMPONENT TWO: TRANSFER READINESS</b>				
Support continuation of MATH PATH program	Math Lead, Project Director	Recruit and train additional faculty to offer two cohorts of MATH PATH per semester.		11/12 - 06/12
Upgrade Math classrooms at Brentwood Center/ Software at Pitts and Brntwd.	Project Director, Dean LA&S, Facilities Pr Manager	Purchase and install computers and <i>MyMathLab</i> and <i>Mathematica</i> software.	Begin offering enhanced Beginning and Intermediate Algebra and Calculus courses.	10/11 - 01/12
Begin to establish Brentwood Science Lab	Project Director, Dean LA&S, Facilites Pr. Manager	Finalize plans and state approvals. Begin lab remodeling work (initial phase of remodel project).		11/11 - 09/12
Update and augment MESA website	MESA Director	Expand resources and content available to include resources, department portals.		01/12 - 03/12
Expand and Increase capacity of MESA Center to serve students	MESA Director, Facilities Project Manager, Dean	Hire and train additional staff. Purchase furniture, equipment, resources, and software.	Extended hours of operation and additional services offered.	10/11 - 03/12

Design and offer first MESA Summer Jam	MESA Director, Dean, Grant	Research effective models, create specific curriculum, and integrate academic/student supports.	Program design and schedule complete. First summer program offered.	10/11 - 08/12
Create additional STEM student internship opportunities	Project Director, STEM Counselor, MESA Director	Work with local and regional companies/organizations and community leaders to develop additional internship opportunities for STEM students.		01/12 - 06/12

<b>Year 1 – COMPONENT THREE: ARTICULATION READINESS</b>				
Form STEM Articulation Committee	Articulation Specialist With Articulation Officer	Recruit key STEM faculty and transfer university representatives to participate.	Committee formed; meets regularly.	01/12 – on-going
Create a STEM Articulation Strategic Plan	STEM Articulation Specialist, Articulation Officer, STEM Faculty LMC, UC, CSU, Deans	Confirm STEM Gaps at Top Transfer Universities and prioritize courses for articulation.	Completed 3-Year Strategic Plan detailing goals and measurable outcomes.	01/12 - 06/12
Articulate critical STEM courses	STEM Articulation Specialist, Articulation Officer, STEM Faculty LMC & CSU and UCs	Work w/faculty and transfer University representatives to revise/create courses and process.	Articulation of critical courses as identified in this grant and the STEM Articulation Strategic Plan.	01/12 – on-going
<b>Year 1 – COMPONENT FOUR: INSTITUTIONAL READINESS</b>				
Form STEM Incubator	STEM Incubator & PD Lead, Project Director, STEM Faculty	Identify and orient team members representing key STEM stakeholders.	An action-research team prepared to collect and assess data, and develop solutions.	01/12
Initiate action-research process of STEM Incubator	Incubator & PD Lead, Project Director & Incubator Members	Review STEM Planning Team research and data to identify opportunities to further address the barriers to STEM transfer.		02/12-06/12
Attend STEM Project Director's Meeting and HSI Best Practices Conference	Project Director	Send key grant staff for training in best practices for STEM and HSI programs.	Participants gain new ideas and share with STEM and college faculty and staff.	03/12 - 04/12

<b>Year 2-4 – COMPONENT ONE: COLLEGE READINESS</b>				
<b>Continue to work with High School faculty, students, and families to increase STEM preparation for college.</b>				
Implement High School MESA Programs annually	Outreach Coach	Finalize program components and structure with staff of each High School.	Creation and ongoing implementation of MESA at all four key High Schools.	08/12-09/16
Further support & develop Project Lead the Way programs at High Schools	Outreach Coach and High School Counselors	Continue to support existing programs (Antioch) and develop programs at one additional school (Pittsburg, Deer Valley, Liberty) per year.		10/11 - 09/16
<b>Year 2-4 – COMPONENT TWO: TRANSFER READINESS</b>				
<b>Continue to offer enhanced STEM courses, MESA Summer Jam and two cohorts of MATH PATH each semester with institutionalization of funding for MATH PATH by 08/13.</b>				
Complete Brentwood Science Lab Remodel	Project Director, Facilities Manager, Dean	Work with contractor to complete renovation. Purchase and install equipment. Hire Lab Technician.	Furnished and fully functional lab opens.	07/12 - 08/13
Offer STEM lab courses at Brentwood Center	Brentwood Facilities Manager, Dean	Schedule and staff lab courses in biology, chemistry, physics, and engineering.		08/13 - 09/16
Launch STEM PATH program	Math Dept. STEM Math Lead, Dean	Complete development of program and integration of math and science curriculum.	Development and annual offering of one cohort per year.	08/12 - 09/16
Increase offering of Academic Excellence Workshops (AEW)	Student Consultants for AEW and faculty	Recruit and train student facilitators to offer AEW's in additional subject areas.	At least five AEW's offered each semester in Math, Chemistry, Biology, and Physics.	08/12 - 09/16
Increase MESA student participation in Internships	MESA Director Project Director	Work with local and regional businesses/organizations to create new internship opportunities.	At least five student internships added per year leading to at least 35 annually by grant end.	08/12 - 09/16

Upgrade Science Labs at Pittsburg Campus	Project Director Facilities Project Manager STEM faculty	Purchase and install necessary equipment.	Enhanced science classes offered in state of the art facilities.	10/12 - 09/16
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**Year 2-4 – COMPONENT THREE: ARTICULATION READINESS**

Implement on-going cycle of updating Articulation	Articulation Specialist, Articulation Officer, Articulation Team	Using the STEM Articulation Strategic Plan, regularly revise and create new courses in conjunction with LMC and University faculty that meet transfer articulation requirements.		08/12 - 09/16
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**Year 2-4 – COMPONENT FOUR: INSTITUTIONAL READINESS**

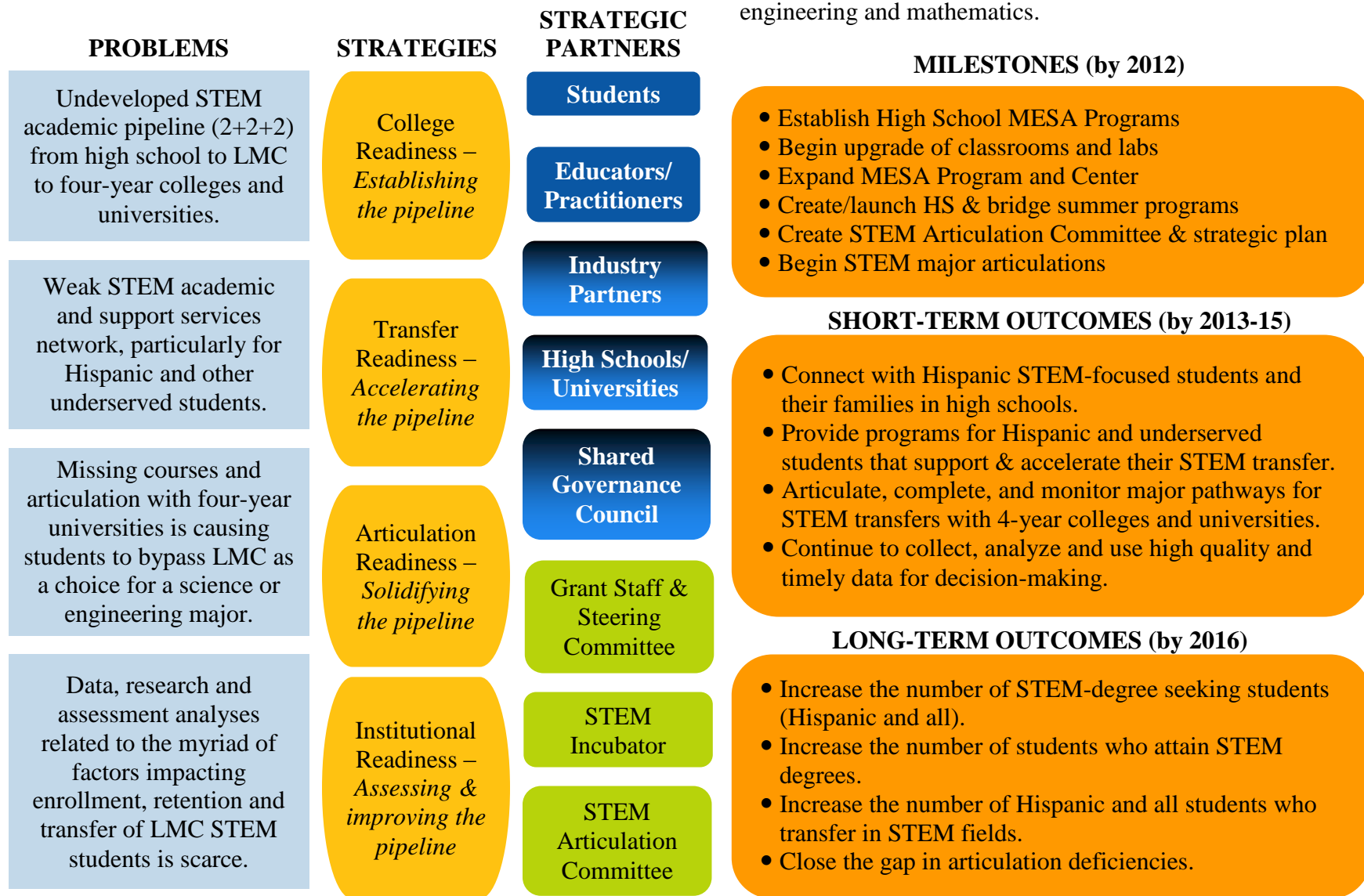
Assess Impact & Effectiveness of all four components	Project Director Steering Committee President Dean	Continue to collect, analyze, and use high quality and timely data for decision-making	Continual program and institutional improvement and based on research findings.	08/12 - 06/15
Develop & Implement professional development related to grant strategies	Project Director, STEM Incubator Team STEM Incubator & Professional Development Lead	Identify methods for providing professional development for full-time and part-time faculty staff including conferences, workshops, and trainings on best practices related to STEM.		08/12 - 06/15

**Year 5 – INSTITUTIONALIZATION**

Repeat pattern of annual activities for all four components with expansion, improvements, and continued training.				
Set full Institutionalization Plan for all Four Components	Project Director, President, Dean	Strategies for institutionalization are completed. Now part of budget and planning cycles.		08/15 - 01/16
Complete Final Evaluation	Project Director, External Evaluator, Steering Committee	External Evaluator meets with Steering Committee to review findings and recommendations.	Recommendations for next steps to continue and expand programs.	07/16 - 08/16
Final report to campus	Project Director, MESA Director and all STEM Leads.	Final report presented at College Assembly.	Institutionalization of successful strategies/programs/positions.	09/16

**Los Medanos College STEM Grant Plan**  
*STEM Transfer Velocidad*

**PURPOSE:** The STEM Transfer *Velocidad* project will increase the number of Hispanic and low-income students attaining degrees in the fields of science, technology, engineering and mathematics.



## PART VII - PROJECT

### EVALUATION

LMC is committed to strengthening and sustaining a Culture of Evidence, as demonstrated through three component activities within this *STEM Transfer Velocidad* grant. Consistent with this commitment, the evaluation plan for



this grant includes formative and summative design (with external evaluation) allowing us to utilize evaluation as a vibrant planning tool and to measure our success in achieving our grant goals, as illustrated in the graphic above.

**Third-Party Evaluation: Denise Bell, Ph.D., has been selected as the External Evaluator.** With the intent of creating a model STEM transfer pipeline, grant planners sought an external evaluator with an established reputation in working with STEM education programs, and particular experience with programs serving underrepresented students. Dr. Bell co-led a three-year Research and Evaluation project for the University of California, Office of the President, MESA Program in California. Additionally, Dr. Bell has conducted assessment and evaluation for higher-education National Science Foundation projects in community colleges and four-year colleges and universities. Dr. Bell has been chosen because of her proven expertise in evaluation of federal projects and her socially conscious research and evaluation leading to organizational effectiveness and collaborative learning approaches.

<b>EVALUATION RESPONSIBILITIES</b>
<b>LMC Office of Institutional Research</b> will work closely with Ms. Saito and the grant team to define the grant research agenda; refine and implement the evaluation plan; gather/generate quantitative and qualitative data; and communicate findings.
<b>External Evaluator Dr. Denise Bell</b> will work closely with Ms. Saito and LMC’s Office of Institutional Research to design and implement the evaluation plan for determining grant effectiveness; collect and analyze data; and interpret and report on the findings. Details of contract, including scope of work and receivables, are in the budget details.
<b>Grant Staff and <i>STEM Transfer Velocidad</i></b> will be responsible for gathering required program-level data, keeping grant activity records, and participating in evaluation activities as requested.
<b><i>STEM Transfer Velocidad</i> and The President’s Cabinet</b> will review evaluation reports with the evaluator and grant team at least once a year; provide feedback/direction on grant strategies to grant staff; and provide input on institutional impact to college administration.

**Evaluation Design, High-Quality and Timely Data Collection, Interpretation and**

**Analysis:** As part of the grant start-up, Dr. Bell will meet with Project Director, Jennifer Saito, and program activity leads to ensure that valid baseline data were established. They will collaboratively design the Evaluation Plan and work with grant staff to test the effectiveness of the evaluation strategies. The campus Institutional Research Office will provide support to the STEM staff to facilitate data collection. The External Evaluator will independently analyze and interpret the data.

**Sources of Data:** The California Community Colleges Chancellor’s Office has a common Management Information System that categorizes data into four areas: Student, Faculty/Staff, Course/Section, and Student Enrollment. Attributes include a wide range of descriptive data, integration of data, and longitudinal tracking. In addition, LMC uses Datatel and SARS as our primary campus-based data management systems.

<b>SOURCES OF DATA FOR OBJECTIVES</b>	
<b>Objectives</b>	<b>Data Elements and Sources</b>
Increase the number of students who are in the LMC STEM pipeline.	Institutional Office of Research and MIS

Increase the number of all students (and Hispanic students) who attain STEM degrees.	Institutional Office of Research, MIS and California Post-Secondary Education Commission (CPEC) Quick Data
Increase the number of all transfers and Hispanic transfers in the STEM fields.	Institutional Office of Research, MIS and CPEC Quick Data
Close the gap in STEM articulations as documented in the Needs section of the proposal.	ASSIST.org (a CA on-line student-transfer information system re: articulation between CA public postsecondary institutions).

**Overall Evaluation Design:** Quantitative and qualitative research methods will allow us to address key research questions for each grant component.

<b>Examples of Grant Research Questions</b>
<p><b>Component 1-College Readiness for High School STEM Students-Establishing the Pipeline:</b></p> <ul style="list-style-type: none"> <li>• To what extent does participation in the high school MESA programs increase the number of students who are college-ready when they graduate from high school?</li> <li>• Does participation in <i>Project ExCEL</i> high school summer math program increase the number of students who are prepared for college-level math upon their graduation from high school?</li> </ul>
<p><b>Component 2 – Transfer Readiness: Accelerating the Pipeline:</b></p> <ul style="list-style-type: none"> <li>• To what extent does participation in the Math Path Program accelerate completion of the DE math progression? Participation in computerized self-paced DE math sequence?</li> <li>• To what extent does participation in STEM Path accelerate enrollment into Calculus?</li> <li>• Does participation in LMC’s MESA Program support STEM students in retention and persistence toward their STEM degree and transfer?</li> <li>• What are the most effective MESA strategies/interventions?</li> <li>• Do hand-on experiences with state-of-the-art lab equipment increase STEM student retention and persistence toward their STEM degree and transfer?</li> </ul>
<p><b>Component 3 – Articulation Readiness – Solidifying the Pipeline:</b></p> <ul style="list-style-type: none"> <li>• How effective are the STEM Articulation Specialist and Team in closing LMC’s STEM articulation gaps?</li> <li>• What is the impact of the STEM Counselor Articulation Specialist on students taking the correct courses to accelerate their degree attainment and transfer?</li> </ul>
<p><b>Component 3 – Institutional Readiness – Assessing and Improving the Pipeline:</b></p> <ul style="list-style-type: none"> <li>• What effect does the incubation team have on encouraging STEM innovations?</li> <li>• What are the effects of targeted STEM-related professional development strategies on faculty and staff?</li> </ul>
<p><b>Overall Grant Research Questions:</b></p> <ul style="list-style-type: none"> <li>• What are the institutional barriers to achieving equitable STEM transfer outcomes for all LMC students, particularly Hispanic and low-income students?</li> <li>• How effective is the <i>STEM Transfer Velocidad</i> Program at LMC in addressing these barriers and closing the gap in STEM degree attainment and transfer for students, particularly Hispanic and low-income students? At accelerating the time it takes for successful achievement of STEM goals?</li> </ul>



<b>Examples of Methods</b>
<p><b>Component 1:</b> A database will be designed to track students and families who participate in LMC’s high school STEM programs. Surveys will be administered to students and families participating in activities such as high school outreach events, MESA activities, Project Lead the Way and Project ExCEL. Student course-taking patterns will be tracked. Through the campus Datatel and SARS systems the evaluation team will be able to track high school MESA students who attend LMC to analyze demographic information, course selection patterns, participation in <i>STEM Transfer Velocidad</i> programs, and persistence and success rates.</p>
<p><b>Component 2:</b> LMC student ID numbers, Datatel and SARS will be used to track student participation in <i>STEM Transfer Velocidad</i> programs. SARS will be used to track counseling appointments and educational planning, while STME transfer velocity information will be collected through the California Postsecondary Education Commission (CPEC) data warehouse. Focus groups with students and faculty will be used to gather qualitative data about the effects of participation in <i>STEM Transfer Velocidad</i> activities.</p>
<p><b>Component 3:</b> LMC will use an action-research model to document the experience of faculty and staff engaged in the process of collecting, analyzing and utilizing data to design program improvements to increase STEM student outcomes.</p>

**On-Going Use of Evaluation:** This evaluation will be more than a pro-forma process. It will be the driver of the **STEM Transfer Velocidad**, informing institutional practices such as ongoing planning, decision-making and resource allocations. Ultimately, all evaluation information will contribute to increasing STEM students’ success. Specifically, the ongoing evaluation will:

<p><b>Provide feedback for <i>STEM Transfer Velocidad</i> Staff, Steering Committee and the Incubator Team</b> who will review the data and related analysis to help identify and implement interventions for improvement.</p>
<p><b>Inform the LMC Community:</b> Distribute reports to the campus community as a way of informing data-based decision-making.</p>
<p><b>Report to the East County Community:</b> Report to feeder high schools and East County Latino Community to keep community informed and to garner support and feedback for initiatives.</p>
<p><b>Track Progress toward Grant Objectives:</b> Maintain documentation of progress.</p>

Evaluation results will guide LMC in improving STEM students’ success—particularly Hispanic and low-income, traditionally underserved students—at LMC and four year institutions, and ultimately in STEM careers.