

A large, dark brown oval frame containing a background of a grid with glowing white dots and vertical lines, suggesting a data visualization or network. The text is centered within this oval.

**Maricopa Community Colleges'
High Tech Manufacturing
Strategic Framework**

February 18, 2005

Who is Battelle?

- One of world's largest non-profit R&D organizations (**\$3 billion in annual R&D activity at more than 100 locations**)
- Worldwide leader in development, commercialization, and transfer of technology
- Contracts with just under 1,000 clients on approximately 4,000 projects annually
- Battelle, with the national labs it manages or co-manages (Brookhaven, PNNL, Oak Ridge, NREL), oversees 16,000 scientists, engineers, and staff members



Battelle's Technology Products

- Annually develop *R&D Expenditures Forecast for U.S.*
- Technology forecasts (*Top Ten Products; Top Ten Home Products*)
- Rapid product development for firms (toothbrushes to insulin pens) resulting in many product awards annually
- Commercializing technologies and establishing firms from federal laboratory management in a variety of fields — from pharmaceuticals and medical products to electronics and information management



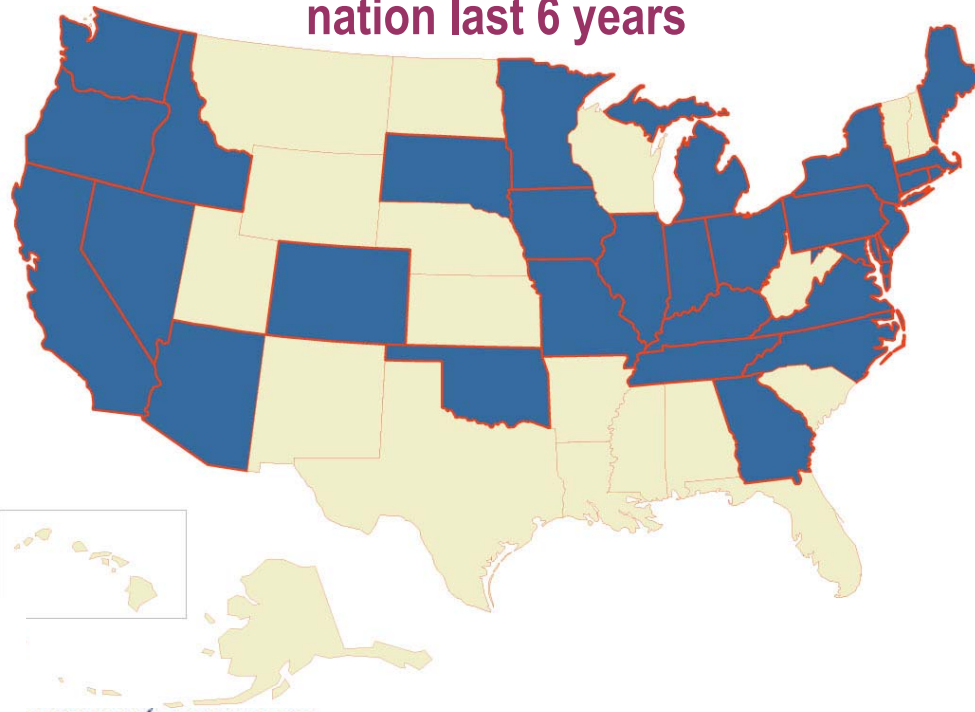
Battelle's Technology Partnership Practice

- Areas of Expertise
 - Technology Strategic Planning
 - Technical Assistance and Problem Solving
 - Program Design and Implementation
 - Impact Assessment and Evaluation
- Clients
 - State and regional technology and business coalitions (e.g. St. Louis, Pittsburgh, Indianapolis)
 - Universities
 - Foundations (Blandin, Danforth, Flinn, Kauffman)

TPP Recent Experience

Able to translate technology strengths into development strategies and design of key initiatives, including research parks, incubators, research centers, and talent and workforce development.

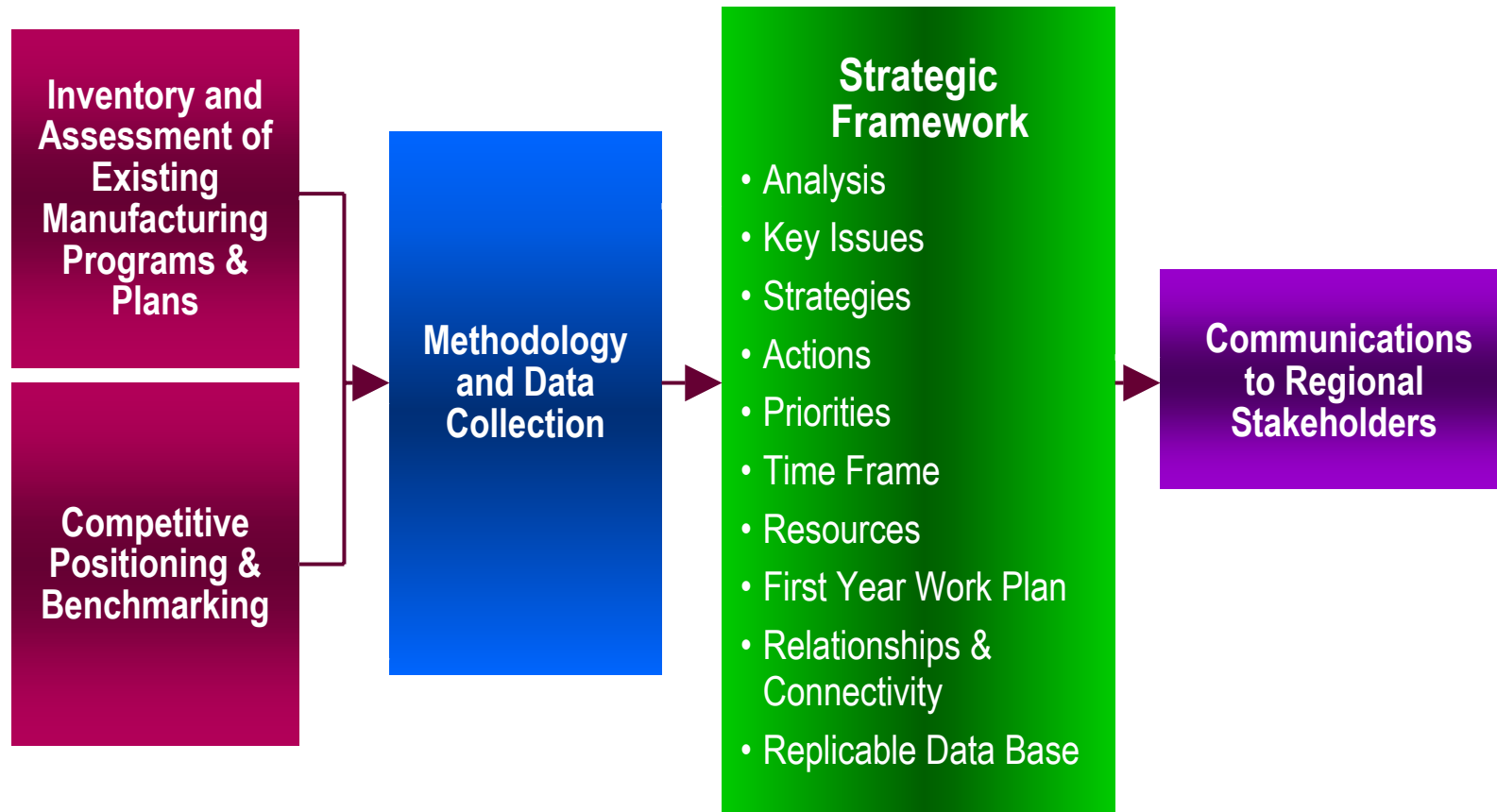
Broad breadth – TPP projects across the nation last 6 years



Examples of Recent TPP Projects

- **Arizona:** Biosciences Roadmap, Biosciences Workforce, IT/Communications Roadmap, Sustainable Systems Prospectus, ADCRC Translational Research Model, Flinn Implementation Support, Maricopa Regional Arts & Culture Strategy
- **Advanced Manufacturing/Workforce:** Connecticut, Central Indiana, Ohio, Iowa, Long Island, St. Louis, Syracuse

Proposed Work Plan



Project Tasks

- Task 1: Orientation with Stakeholders
- Task 2: Inventory & Assessment of Existing Manufacturing Programs/Plans
- Task 3: Competitive Positioning & Benchmarking Analysis
- Task 4: Development of Collection Methodology & Data Collection
- Task 5: Strategic Framework for Meeting Region's Future High Tech Manufacturing Needs
- Task 6: Communication Strategy to Regional Stakeholders

Task 1: Orientation

- Meet with Stakeholders Committee
- Finalize statement of work and content of effort
- Review methodology and approach to data collection
- Identify individuals and organizations to be interviewed
- Identify and obtain past reports and studies
- Identify future meetings and involvement

Principals: Plosila, Grueber, Zucca, Horowitz

Time Frame: February 18, 2005

Deliverable: Revised final work plan

Task 2: Inventory & Assessment of Existing Manufacturing Programs & Plans

- Inventory covers both producer and feeder programs in Community Colleges, K-12, and universities
- Review will address sources of students, characteristics, placements, etc., as well as a review of curriculum and skills addressed
- Conducted both on site and by telephone interviews
- Completed review will result in an assessment of strengths, weaknesses, opportunities, and threats of current inventory relative to industry's future needs

Principals: Grueber, Andrade, Zucca, Kelley

Time Frame: February 21, 2005 to April 30, 2005

Deliverable: Inventory Assessment and Analysis

Task 3: Competitive Positioning and Benchmarking Analysis

- Benchmarking of other educational institutions' efforts focused on next generation manufacturing
- Develop criteria for selection and candidate list from which to select six benchmark examples
 - Selective sample of best practices in western states and states with manufacturing base similar to Maricopa
- Identify success factors, elements, and best practices for next generation manufacturing
- Written summary of lessons, best practices, and comparison to region
- Identify national and international trends as to markets, technologies, skill requirements, and other issues affecting future talent pool for advanced manufacturing

Principals: Hochman, Grueber, Kelley, Zucca, Meyers

Time Frame: February 21, 2005 to June 15, 2005

Deliverable: Benchmarking Analysis

Benchmarking/Best Practice Analysis

- What is most needed -- benchmark comparisons or best practice examples?
- Potential criteria for selection
 - Similar regional industry mix or common company connections (e.g., Intel)
 - Programmatic efforts in key technologies and application areas
 - Existing peer institutions to MCC (other western CC systems)
 - Similar level of “technician” awards (from NCES data)
 - Other??
- Data to be collected includes:
 - Structure and coordination among programs, including faculty size, curriculum, and resources
 - Level of industry connection – use of programs; financial, technical, and advisory support; degree to which industry pushes envelope towards future
 - Connections to broader economic development efforts
 - Key elements and success factors

Task 4: Development of Collection Methodology & Data Collection

- Develop profiles of key occupations, skills, education, and experience requirements including skill assets and specific jobs needed across the high tech manufacturing sectors, which can:
 - Inform and guide curriculum content
 - Identify career pathways
 - Prioritize employment skill requirements and future demands
- Design and develop a data instrument to provide a detailed data hierarchy for each profile
 - Data hierarchy to include industry subsector, functions, product composition, automation today and tomorrow, skills which informs us on use of technology and composition of product
 - Create a replicable data base to be able to assess employment needs and priorities in the future
- Industry data collection conducted via:
 - **Internet-based** survey to assess occupation mix, hiring trends, growth forecast
 - **Targeted interviews** of sample firms for detailed interviews.
 - **Focus groups** organized by subsectors
- Outcome will be profiles of key occupations and skills for next generation manufacturing in Greater Phoenix

Principals: Grueber, Zucca, Andrade, Kelley, Horowitz
Time Frame: March 1 to July 31, 2005
Deliverable: Data Collection Methodology & Data Collection Completion

Survey Based Profile

- Determine involvement in technology and application areas
 - wireless, displays, semiconductors, embedded systems, composites, MEMS, nanotechnology, etc.
 - others?
- Determine involvement in advanced manufacturing areas
 - automation, machining, forming, robotics, ERP, etc.
 - others?
- Areas developed in conjunction with Task 2 inventory
- Information gathered through survey instrument will allow for a “purposeful” sample for the detailed interviews to capture “technician” role in above areas

Starting Point for Industry Survey and Interviews

ES-202 2003 Data	Phoenix MSA		Statewide	
	Establishments	Employment	Establishments	Employment
Advanced Materials	209	7,789	293	10,372
Aerospace/Defense	115	14,670	145	26,933
Electronics/Communications/Instruments	125	12,435	165	14,156
Medical Equipment	152	1,023	233	3,439
Semiconductors/Computer Hardware	139	26,468	179	30,586
Information/Telecomm Services	2,691	34,837	3,536	43,954

- Capturing presence of “sustainable systems” and breadth/reality of “advanced materials” is difficult with existing NAICS codes
 - List of potential “sustainable systems” companies compiled as part of previous project for state
- Also, true function of company often masked by NAICS code definition

Defining Industries – Examples of Key Firms

Industry	Key Firms (non-MSA)
Advanced Materials	Rohm & Haas, Cytec Engineered Materials, (W.L. Gore, Advanced Ceramics Research, Materials & Electrochemical Research Corp.)
Aerospace/Defense	Boeing, Goodrich, Honeywell, Pacific Scientific Energetic Materials Co., Talley Defense Systems, (Raytheon Missile Systems)
Electronics, Communications & Instruments	General Dynamics Decision Systems, Motorola, Lockheed Martin, Rogers Corporation, Hypercom Corp., Polymicro Technologies
Medical Equipment	Medtronic, Ventana Medical Systems, Inc., IMPRA, Inc., C.R. Bard, Inc.
Semiconductors & Computer Hardware	Intel, ON Semiconductor, Microchip Technologies, White Electronic Designs Corp., Three-Five Systems, Suntron, (IBM)
Information & Telecomm Services	Calence, Cox Communications, Qwest, JDA Software Group, Inter-Tel Incorporated, Comtech EF Data Corporation
Sustainable Systems	AdobeAir, Inc., Envirotech Systems Worldwide, Kyocera Solar, Ionics, Gemtek Products, Eurofresh

Overlapping Industries and Application Areas

	Embedded Systems	Navigational Instruments	Display Technology	Wireless Systems	Medical Instruments	Solar Cells	Composites	Bio-Materials	Repurposed Materials
Aerospace & Defense	X	X	X	X			X		
Semiconductors & Computer Hardware	X	X	X	X	X	X			
Electronics & Instruments	X	X	X	X	X	X			
Medical Equipment			X	X	X			X	
Advanced Materials	X		X		X		X	X	X
Sustainable Systems						X	X	X	X
Information & Telecomm Services		X	X	X					

What is appropriate “skill” level for analysis?

- Collecting “skill” information can mean different things to different people/organizations
 - Need to pursue approach that provides informative detail in least burdensome fashion to firms
- Options:
 - **Grade level estimations** – What grade level of algebra is required for this occupation?
 - **Expertise scales** – Provide scale endpoints and ask for estimation
 - **Selection from example** – Provide examples of basic, intermediate, advanced skill level to be used to categorize skill requirements
 - **O-NET data** – Respondents react to O-NET listed skill requirements
 - **Focus solely on activities performed** – with translation into “skills” after the fact (requires significant faculty input/involvement)
- **Suggested Approach:**
 - *Selection from example (will require faculty input on requirements categories)*

Task 5: Strategic Framework for Meeting Region's Future High Tech Manufacturing Needs

- The strategic framework will address:
 - Analysis of skills, employer training and education needs, timing and priorities of demand
 - Key issues which need to be addressed for retention and growth of advanced manufacturing in the region
 - Strategies and actions
 - Priorities
 - Resources
 - First Year Work Plan
 - Relationships and Connectivity
- Replicable data base for ongoing data collection

Principals: Plosila, Horowitz, Grueber, Kelley, Zucca, Andrade
Time Frame: June 16 to August 30, 2005
Deliverable: High Tech Manufacturing Framework

Task 6: Communications Strategy to Regional Stakeholders

- Outreach and education effort to key stakeholders
 - Industry and trade associations
 - Governing boards within the Colleges, ABOR, elected officials, business groups, and economic development and trade organizations
- Information materials and presentations

Principals: Plosila, Horowitz, and Grueber

Time Frame: September 1 to November 30, 2005

Deliverable: Presentation materials

Proposed Steering Committee Schedule

- Orientation Meeting
 - February
- Meeting to review inventory and benchmarking
 - March/April
- Meeting to review field surveys and data collection
 - May/June
- Present Final Draft Report
 - August

Contacts

Walter H. Plosila, Ph.D.
Vice President
Technology Partnership Practice
Battelle Memorial Institute
20445 Emerald Parkway Drive,
S.W., Suite 200
Cleveland, Ohio 44135
Voice: (216) 898-6403
E-mail: plosila@battelle.org

Martin P. Grueber
Program Manager
Technology Partnership Practice
Battelle Memorial Institute
20445 Emerald Parkway Drive,
S.W., Suite 200
Cleveland, Ohio 44135
Voice: (216) 898-6402
E-mail: grueberm@battelle.org



**Detailed Review of
Tasks 2, 3, 4 & 5**

Specific Data Collection/Analysis Tasks, Efforts, and Issues

Task 2.
Inventory and
Assessment of
Existing
Manufacturing
Programs and
Plans

Task 3.
Competitive
Positioning and
Benchmarking
Analysis

Task 4.
Development of
Collection
Methodology and
Data Collection

Task 5.
Development of Strategic
Framework for Meeting
Greater Phoenix's High
Tech Manufacturing
Needs for the Future

- Analysis
- Key Issues
- Strategies & Actions
- Priorities
- Time Frame
- Resources by Action
- First Year Work Plan
- Relationships and Connectivity to Other Organizations

Task 2. Inventory and Assessment

- Timing Details (Weeks)

Tasks and Details	March				April				May				June				July				August			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Task 2 Existing Program Inventory																								
Finalize List of Programs for Inventory																								
Develop Inventory Discussion Guide																								
Conduct Inventory Interviews (Phone/In-Person)																								
<i>Deliverable: Inventory and Assessment</i>																								

Inventory and Assessment (continued)

- Developing list of degree and certificate programs offered throughout MCC system
 - Approximately 30-40 potentials identified
 - How best to determine inclusion in inventory?
 - Programs outside of MCC that should also be included?
- Inventory to collect information regarding:
 - Number of enrollment and “graduates” of these programs over last few years
 - Mapping to CIP codes (some already defined in information)
 - Typical student profile – recent HS grad, corporate sponsored enrollment, etc.
 - Typical path for graduates – where are they now (e.g., working, 4-year, upgraded position)
 - Strengths and limitations of each program – faculty, resources, industrial connections
 - Program coordinator/faculty assessment of how program could be improved

Task 3. Competitive Positioning and Benchmarking/Best Practice (BM/BP) Analysis

■ Timing Details (Weeks)

Tasks and Details	March				April				May				June				July				August			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Task 3 Benchmarking/Best Practice Analysis																								
Finalize Criteria for Selection	■	■																						
Create BM/BP Interview Guide	■	■	■	■																				
Determine Appropriate BM/BP Organizations	■	■	■	■																				
Develop Additional Data Elements for Benchmarks	■	■	■	■	■	■																		
Set-up and Perform Initial Interviews					■	■	■	■																
Additional Interviews, if Required, Due to Task 2 & 4 Input									■	■														
<i>Deliverable: Benchmarking & Best Practice Analysis</i>											■	■	■	■										

Task 4. Survey and Interview

■ Timing Details (Weeks)

Tasks and Details	March				April				May				June				July				August			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Task 4 Survey/Interview																								
Develop & Finalize Survey	■	■																						
Print/Mail Survey & Post on Internet			■	■																				
Survey Follow-up/Data Collection & Entry				■	■	■	■	■	■															
Develop Field Interview Questionnaire	■	■	■	■	■	■																		
Pilot Test Field Interview Questionnaire						■	■																	
Schedule Field Interviews							■	■	■	■	■													
Conduct Field Interviews									■	■	■	■	■	■	■									
Set-up Focus Groups													■	■										
Hold Focus Groups														■	■									
Draft and Finalize Profiles													■	■	■	■	■	■						
<i>Deliverable: Data Collection Methodology and Completion</i>																	■	■	■	■				

Starting Point for Industry Survey and Interviews (continued)

- Employment numbers include all occupations – percentage in “technician” occupations will vary by industry
- Issues:
 - Should “universe” be limited to more tech-sophisticated NAICS codes? For example:
 - Medical equipment and supplies vs. electro-medical instruments
 - Inclusion of “plastic products” within Advanced Materials industry
 - Interest in understanding IT-related “technician” context in both telecomm/IT but also within manufacturing
 - Small “purposeful” sample of largest IT/telecom companies
 - Impact of low response rates to survey
 - Need to ensure key companies participate in both survey and interview process

Phase One: Survey Based Profile (continued)

- Questions will include following areas:
 - Employment in “occupations” of interest
 - Current numbers
 - Educational background of current employees in occupation
 - Future roles
 - Hiring plans/future demand
 - Work experience required
 - Time expected to train “new hires” within the occupations
 - Opportunities for advancement for this occupation
 - Connections to MCC and other institutions
 - Technology and application areas
- Constraint:
 - Survey needs to be limited in length since going to all of advanced manufacturing

Phase Two: Detailed Interviews for Occupation Skill Levels

- What is appropriate “occupation” level?
 - AZ LMI office has defined a set of “technician” occupations typified by an Associate’s Degree
 - 18 of these are of likely interest to key industries (table on next page)
 - 14 additional occupations (e.g., drafters, installers, repairers) often typified by some level of post-secondary education
 - Recent LMI/BLS survey data shows limited number of technicians of any kind within key industry segments.
 - However, data validity is a concern – example: Aerospace Engineering and Operations Technicians “disappears” from 2002-2003.
 - One of the largest employers of these technicians is the “professional, scientific, and business services” industry – **not currently part of industry definition**
 - Included in charts that follow for comparison and perspective

Occupations Necessitating an Associate Degree (from AZ LMI) of Potential Interest to Key Industries

Code	Standard Occupation Classification (SOC) Titles
15-1041	Computer Support Specialists
15-1099	Computer Specialists, All Other
17-3021	Aerospace Engineering & Operations Technicians***
17-3023	Electrical & Electronic Engineering Technicians
17-3024	Electro-Mechanical Technicians
17-3025	Environmental Engineering Technicians***
17-3026	Industrial Engineering Technicians
17-3027	Mechanical Engineering Technicians
17-3099	Drafters, Engineering, & Mapping Technicians, All Other***
19-4021	Biological Technicians***
19-4031	Chemical Technicians
19-4091	Environmental Science & Protection Technicians, Including Health***
19-4093	Forest & Conservation Technicians***
19-4099	Life, Physical, & Social Science Technicians, All Other ***
27-4012	Broadcast Technicians***
29-2012	Medical & Clinical Laboratory Technicians***
49-9062	Medical Equipment Repairers ***
51-9141	Semiconductor Processors

***Note: Occupations that may be of interest to only one of the key industries.

Occupations by Major High Tech Industries -- 2003

3 Digit NAICS	Industry	Occ. Code	Occupational Title	Total AZ Emp.
325	Chemical Manufacturing	15-1041	Computer Support Specialists	20
		15-1041	Computer Support Specialists	30
		17-3023	Electrical & Electronic Engineering Technicians	80
333	Machinery Manufacturing	17-3027	Mechanical Engineering Technicians	40
		15-1041	Computer Support Specialists	760
	Computer & Electronic Product Manufacturing	17-3024	Electro-Mechanical Technicians	100
334		17-3027	Mechanical Engineering Technicians	260
335	Electrical Equipment, Appliance, & Component Manufacturing	17-3023	Electrical & Electronic Engineering Technicians	80
		17-3023	Electrical & Electronic Engineering Technicians	290
336	Transportation Equipment Manufacturing	17-3027	Mechanical Engineering Technicians	40
		15-1041	Computer Support Specialists	90
517	Telecommunications	17-3023	Electrical & Electronic Engineering Technicians	ND
518	Internet Service Providers, Web Search Portals, & Data Processing Services	15-1041	Computer Support Specialists	ND
		15-1041	Computer Support Specialists	ND
		17-3023	Electrical & Electronic Engineering Technicians	570
		17-3025	Environmental Engineering Technicians	70
		17-3027	Mechanical Engineering Technicians	370
		17-3099	All Other Drafters, Engineering, & Mapping Technicians	70
		19-4021	Biological Technicians	ND
		19-4031	Chemical Technicians	ND
		19-4091	Environmental Science & Protection Technicians, Incl. Health	90
		19-4099	Life, Physical, & Social Science Technicians, All Other	50
541	Professional, Scientific, & Technical Services	29-2012	Medical & Clinical Laboratory Technicians	ND

Occupations by Major High Tech Industries -- 2000

4 Digit NAICS	Industry	Occ. Code	Occupation Title	Total AZ Emp.
3341	Computer and Peripheral Equipment Manufacturing	17-3023	Electrical and Electronic Engineering Technicians	
3342	Communications Equipment Manufacturing	15-1041	Computer Support Specialists	20
		17-3023	Electrical and Electronic Engineering Technicians	80
3344	Semiconductor and Other Electronic Component Manufacturing	15-1041	Computer Support Specialists	
		17-3027	Mechanical Engineering Technicians	
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	15-1041	Computer Support Specialists	30
		17-3024	Electro-Mechanical Technicians	
3359	Other Electrical Equipment and Component Manufacturing	17-3023	Electrical and Electronic Engineering Technicians	
3364	Aerospace Product and Parts Manufacturing	15-1041	Computer Support Specialists	30
		17-3021	Aerospace Engineering and Operations Technicians	900
		17-3023	Electrical and Electronic Engineering Technicians	140
		17-3024	Electro-Mechanical Technicians	
		17-3026	Industrial Engineering Technicians	
		17-3027	Mechanical Engineering Technicians	
		17-3099	All Other Drafters, Engineering, and Mapping Technicians	550
5112	Software Publishers	15-1041	Computer Support Specialists	340
5171	Wired Telecommunications Carriers	15-1041	Computer Support Specialists	20
		17-3099	All Other Drafters, Engineering, and Mapping Technicians	30
5181	Internet Service Providers and Web Search Portals	15-1041	Computer Support Specialists	
5413	Architectural, Engineering, and Related Services	15-1041	Computer Support Specialists	60
		17-3023	Electrical and Electronic Engineering Technicians	790
		17-3024	Electro-Mechanical Technicians	30
		17-3025	Environmental Engineering Technicians	
		17-3026	Industrial Engineering Technicians	10
		17-3027	Mechanical Engineering Technicians	430
		17-3099	All Other Drafters, Engineering, and Mapping Technicians	110
		19-4099	Life, Physical, and Social Science Technicians, All Other	10
5415	Computer Systems Design and Related Services	15-1041	Computer Support Specialists	
		17-3023	Electrical and Electronic Engineering Technicians	60
5417	Scientific Research and Development Services	15-1041	Computer Support Specialists	30
		17-3023	Electrical and Electronic Engineering Technicians	40
		19-4021	Biological Technicians	
		19-4031	Chemical Technicians	
		19-4099	Life, Physical, and Social Science Technicians, All Other	30

Phase Two: What is appropriate “occupation” level for analysis?

- Is data collection structured around BLS/OES “occupations” useful for this effort?
 - How much does it add to ERISS efforts?
 - Do occupational categories assist or hinder industry-college dialogue?
 - Need for linkage of this effort to existing data mechanisms?
- Other options:
 - Smaller number of more generic categories: operator, technicians, para-engineers, engineers
 - Focus effort on functional approach: technicians involved in R&D, design, engineering, materials, processing, logistics, manufacturing IT
- Suggested Approach:
 - *Focus on a limited (manageable) set of key occupational categories, based on broad industry connections*

Task 5. Develop Strategic Framework

- Timing Details (Weeks)

	March				April				May				June				July				August			
Tasks and Details	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Task 5 Develop Strategic Framework																								
Drafting Framework																								
Finalize Instruments/Database for On-going Data Collection																								
Finalize Strategic Framework																								
<i>Deliverable: Instruments/Database & Strategic Framework</i>																								