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**A FEASIBILITY STUDY FOR A
MANUFACTURING TECHNOLOGY DEPLOYMENT CENTER**

**SUBMITTED TO
U.S. DEPARTMENT OF ENERGY
INSTRUMENT # DE-FG05-94ER40888**

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**SUBMITTED BY
AUTOMATION & ROBOTICS RESEARCH INSTITUTE
THE UNIVERSITY OF TEXAS AT ARLINGTON
AND
TEXAS ENGINEERING EXTENSION SERVICE
TEXAS A&M UNIVERSITY SYSTEM**

OCTOBER 31, 1994

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FORWARD

This paper presents the results of a study performed by the Automation & Robotics Research Institute and the Texas Engineering Extension Service. The study was funded by the U.S. Department of Energy to determine the feasibility of a regional industrial technology institute to be located at the Superconducting Super Collider Central Facility in Waxahachie, Texas. The results are presented in three sections: Executive Summary, Business Plan, and Technical Plan.

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1.0 EXECUTIVE SUMMARY

The Automation & Robotics Research Institute (ARRI) and the Texas Engineering Extension Service (TEEX) were funded by the U.S. Department of Energy to determine the feasibility of a regional industrial technology institute to be located at the Superconducting Super Collider (SSC) Central Facility in Waxahachie, Texas. In response to this opportunity, ARRI and TEEX teamed with the DOE Kansas City Plant (managed by Allied Signal, Inc.), Los Alamos National Laboratory (managed by the University of California), Vought Aircraft Company, National Center for Manufacturing Sciences (NCMS), SSC Laboratory, KPMG Peat Marwick, Dallas County Community College, Navarro Community College, Texas Department of Commerce (TDOC), Texas Manufacturing Assistance Center (TMAC), Oklahoma Center for the Advancement of Science and Technology, Arkansas Science and Technology Authority, Louisiana Productivity Center, and the NASA Mid-Continent Technology Transfer Center (MCTTC) to develop a series of options, perform the feasibility analysis and secure industrial reviews of the selected concepts. The final report for this study is presented in three sections: Executive Summary, Business Plan, and Technical Plan. The results from the analysis of the proposed concept support the recommendation of creating a *regional technology alliance* formed by the states of Texas, New Mexico, Oklahoma, Arkansas and Louisiana through the conversion of the SSC Central facility into a *Manufacturing Technology Deployment Center (MTDC)*.

The implementation of the MTDC, which builds on existing regional efforts, will help to create new manufacturing startup operations, develop new products, promote the deployment of advanced technologies, support U. S. exports through NAFTA initiatives, increase technical job skills and expand employment in technology based jobs. The MTDC will provide fast, easy access to manufacturing technologies and methods, specialized facilities and resources, a backbone for electronic commerce, and solution oriented experts who are committed to supporting small manufacturers. This unique "one stop shop" for manufacturers, research personnel, and educators will become a national asset for outreach in manufacturing technology development, deployment and education.

1.1 Statement of Needs and Study Objectives

The fundamental objective of the study was to evaluate the feasibility of and develop a plan for using the SSC Central Facility and its associated assets to create an economic opportunity for the local community, the state of Texas, the adjacent multi-state region and the country as a whole. In as much that the objective was to create economic gain from the available assets, the team chose to investigate options that would maximize the potential benefits to U. S. competitiveness through:

- the expansion of the existing industrial base
- the creation of high skill-high pay jobs
- the transfer of federal and university technology to the private sector and
- the export of U. S. goods and services.

1.2 Expected Benefits

During the first year of full operation, the MTDC will provide assistance to 1000 small manufacturers and incubate 4 firms. By the fifth year, the MTDC will reach 17,195 small manufacturers, perform 180 significant technical assistance projects, incubate 18 companies and graduate 6 companies. Additionally, the MTDC through its partnerships with minority institutions and service providers will ensure that a minimum of ten percent of the clients will be minority or women owned firms.

Using information gained from over five years of ARRI assistance to small manufactures, it is predicted that on average each company assisted will create or retain 16.5 manufacturing jobs during a 24 month assistance period. According to the Texas Comptroller, the average wage paid to manufacturing employees in the Metroplex is \$28,283. This yields a direct economic impact of \$466,670 per company. Additionally, the Governor's defense conversion study indicates that the "ripple effect" of manufacturing dollars through the economy can be estimated using a 176% factor to give an indirect impact per manufacturer of \$821,338. Based on the fact that by the end of six years of operation, the MTDC will have been serving a minimum of 7000 companies for the necessary 24 month period, the expected benefits by the end of year five are:

- \$3.267 billion direct economic impact
- \$5.750 billion indirect economic impact due to manufacturing dollars "ripple effect"
- \$9.017 billion total regional economic impact
- 115,550 manufacturing jobs created or retained
- 203,280 related jobs created or retained
- 318,830 total jobs created or retained

In order to put these numbers into perspective, the 115,550 jobs created or retained equates to approximately 6.7% of the over 1.7 million manufacturing employees in the five state region. The \$9.017 billion total regional economic impact is approximately 2.3% of the Texas Gross State Product of \$387.9 billion.

1.3 Methodology

The initial assessment of the SSC Central facility indicated that the infrastructure and equipment had the ability to support a variety of manufacturing, research and development (R&D) and educational concepts. The team, with industry input, determined that a manufacturing focus would satisfy five key evaluation criteria associated with selecting a successful use for the SSC Central Facility: (1) the widest range of interest to private, state and federal stake holders, (2) a large base of potential customers, (3) the ability to have a positive economic impact in the five state region, (4) the best opportunity to produce options that would become self sufficient over time, and (5) the potential to serve as a national asset. In consideration of the stated objectives and key evaluation criteria, the six options proposed for analysis in the original Expression of Interest (EOI) were:

- a product development and manufacturing process development center
- a teaching factory for advanced manufacturing concepts
- a shared use manufacturing facility
- a business incubator for manufacturing
- a business accelerator for manufacturing
- a regional manufacturing trade center

These options were chosen in response to information collected on the needs of manufacturers and the resources available in the five state region. Over the past two years, the state of Texas has completed a detailed analysis of the needs of small manufacturers to support the creation of the Texas Manufacturing Assistance Center (TMAC). The results of several thousand company interviews, 25 industry focus groups, 42 technology transfer and environmentally conscious manufacturing workshops, and hundreds of manufacturing service requests have identified the following manufacturing assistance needs:

- implementing quality improvement programs
- reducing workers compensation costs
- incorporating energy efficient technologies and practices
- access to capital
- improving business and manufacturing processes
- acquiring ISO 9000 certification
- developing new products or upgrading existing products
- expansion into new domestic and foreign markets
- acquiring technology from federal and university laboratories
- defense conversion and the development of dual use product/process technologies
- development and upgrades of skilled technical labor
- incorporating environmentally conscious manufacturing technologies
- improving inventory and distribution control
- executing CAD/CAM/CAE
- implementing electronic commerce

The data obtained from the Texas study are consistent with information on the needs of small manufacturers gathered during site visits to several National Institute of Science and Technology (NIST) sponsored Manufacturing Technology Centers (MTC) and inputs from manufacturing service providers in the other four states in the study region. In addition, small manufacturers expressed the frustration of trying to identify and interface with the large number of local, state and federal agencies and service providers who are generally inaccessible due to geographic dispersion.

Each of the six options was developed into a working concept using information gathered from literature reviews, interviews with industry experts, site visits to manufacturers, incubators, federal laboratories and universities, collaborations with service providers and discussions with other EOI investigators. The working concepts were then evaluated by a series of industry focus groups held in early October 1994. The results of the industry focus groups were then consolidated into a technical plan and an associated business plan.

1.4 Results

As a result of the industry focus groups, the original six options were restructured into four core components and three supporting elements as shown in Figure 1.4-1. Industry acceptance of the revised concepts indicated a high degree of interest in creating value from the conversion of the SSC Central Facility into the MTDC. The core components as defined with the industry inputs are:

- Product/Process Development Center
- Teaching Factory and Shared use Manufacturing Center
- Manufacturing Incubator/Accelerator
- Regional Trade Distribution Teaching Factory

The three supporting elements were included to provide specialized services in both a stand alone and integrated mode of operation. The CAD/CAM Center, the Technology Resource Center and the Outreach Center are structured to facilitate customer interaction with the core components of the MTDC and provide a direct link into the federal laboratory system for technology development and deployment.

Manufacturing Incubator/Accelerator

The manufacturing incubator helps start-up manufacturing companies become viable by assisting in the development of products and processes and to initiate low rate production. The incubator makes use of existing assistance resources such as SBDC's, educational institutions, and other service providers, as appropriate. The accelerator is an industry focused facility where young existing companies are accelerated toward world class status through technical assistance, training, re-engineering, and development of capability and capacity.

Product and Process Development Center (PPDC)

The product and process development center facilitates the development of both products and manufacturing processes for the manufacturing community. This includes a comprehensive approach to prototype design and fabrication, concurrent design of product and manufacturing processes, and market research. The center provides access to both technology opportunities and development expertise available from national sources. A special focus is the development of technology available in the federal laboratories. An ongoing federal laboratory presence is envisioned to be part of the supporting technology resource center.

Figure 1.4-1

Teaching Factory and Shared Use Manufacturing Center (Teach-SUM)

The teaching factory helps students from industry and academia learn advanced manufacturing methods and technologies. This facility enhances the competitiveness of the regional manufacturing community through hands-on cooperative training. Teaching factory staff support the training needs of the manufacturing community through permanent on-site staff and, more importantly, through partnerships with educational institutions for developing and delivering technical courses. The shared use manufacturing center is available to regional manufacturers to use for commercial purposes on a shared use basis. Manufacturers use both the manufacturing equipment and the computing facilities.

Regional Trade /Distribution Teaching Factory (RT/DT)

The regional trade and distribution teaching factory has two functions. It is an industry focused facility where manufacturing trade relationships are developed. International trade along the Interstate 35 Corridor between Mexico and the U.S. is of particular interest. The facility also serves as a trade and distribution teaching factory where advanced distribution concepts and technologies are taught in a hands-on working environment. Included in this concept is the use of a working electronic commerce network to support international trade. This provides companies, students and researchers access to the complexities and opportunities found in modern electronic

commerce networks. A final aspect of the trade center is the use of the warehouse as a commercial venture. The rental of the space to a distribution company generates revenues and provides the essential element of realism to the distribution teaching factory.

CAD/CAM Center

The CAD/CAM center is an adjunct to the teaching factory and shared use manufacturing center. The center houses hardware, software, and expertise needed to support the computer aided design and manufacturing activities of the MTDC and its customers.

Technology Resource Center (TRC)

The Technology Resource Center is an adjunct to the product and process development center. The TRC will house information resources regarding federal technology available for transfer to the private sector. The center is staffed with technical experts and information specialists from the federal laboratories, universities and other partnerships. These people assist manufacturers in the development and commercialization of technology. The library provides access to technical information available on-site and through electronic linkages with the federal and state technology networks.

Outreach Center

The outreach center supports all of the MTDC program elements by organizing and conducting workshops, seminars and classes. The classes include those offered by the two teaching factories.

Facility Layout

Figure 1.4-2 shows a facility conceptual layout for the MTDC as envisioned by this study. The four core and three supporting components occupy most of the facility, as shown. The section shown as lease space will be offered to the as high end office space to companies and organizations that would support or make use of the MTDC or the High Performance Computing Center (HPCC). This space may also house one or more of the other EOI proposed uses of the facility. The warehouse will also be commercially available, as indicated above. The HPCC is assumed to exist as an independent entity cooperating with the MTDC. It is assumed that this space will not generate revenue for the MTDC.

Discussion

The MTDC will be operated as a non-profit organization specifically structured, staffed and equipped to support the development, deployment and education of manufacturing technologies. The MTDC as proposed will require \$15.4 million of grants over six years to support the four core components and three supporting elements. These funds will be used to: (1) hire professional staff, (2) purchase necessary equipment, (3) perform facility modifications and (4) support operating expenses until sufficient revenue is generated to cover expenses.

Figure 1.4-2 Conceptual Layout of MTDC

The MTDC will leverage these funds with a variety of public and private funds in conjunction with fees from services to cover operating expenses. The conservative pro-forma balance sheets and income statements found in the associated business plan show that the MTDC will *achieve break-even performance during year six* of the center's operation.

The value of the MTDC goes far beyond its impact on the five state region under evaluation. In discussions with the Texas Department of Commerce, the Texas Manufacturing Assistance Center, Los Alamos National Laboratory, the DOE Kansas City Plant and the NASA Mid-Continent Technology Transfer Center, the MTDC would be organizationally and electronically linked with other regional service providers to extent its economic impact across the nation. Each of these organizations have existing contractual and electronic links with multistate service networks that could be expanded and enhanced by the addition of the MTDC's *regional technology alliance*. Moreover, the MTDC's location on the important I-35 NAFTA trade corridor, its international electronic commerce linkages and partnerships with active export service networks will make the center an ideal provider of export assistance to U. S. companies. In this manner, the conversion of the SSC Central Facility into the MTDC will fulfill the key evaluation criteria of becoming a *national asset*.

Another important opportunity for the MTDC lies in its ability to serve as a site for facilitating the "outreach" of federal laboratory environmental technology. The MTDC is only 20 minutes driving time from the new City of Dallas International Environmental Center located at the McCommas Bluff Landfill. This new multimillion dollar initiative will support the development, deployment and education of environmental technologies, management practices and economic development opportunities. The center is international in scope and will host companies, communities, and governments from around the globe. Moreover, the center will provide job opportunities in a high unemployment minority section of the city. The City of Dallas has initially pledged \$9.6 million to this endeavor.

In a similar initiative, the Fort Worth Office of Economic Adjustment has announced the opening of the Fort Worth Business Assistance Center. The center will open in January 1995 and will occupy offices in the Water Garden Place in downtown Fort Worth. The center, with significant financial support from the city, state and federal government will offer financial and business services for defense conversion and technology startup companies. Fort Worth Officials are extremely interested in the developments at the SSC site and see several economic development opportunities associated with the MTDC concept.

The electronic linkages and partnerships associated with the MTDC would allow the federal labs to reach out to service providers throughout the U. S. and potential users on a global basis. This would facilitate access to and use of the extensive experience of the DOE facilities and other federal labs in the areas of manufacturing and environmental technologies.

1.5 Recommendations

On the basis of the positive inputs from industry, state and federal agencies, researchers and educators and the financial analysis of the proposed technical plan, it is the recommendation of the ARRI and TEEX team that the Manufacturing Technology Deployment Center be considered for funding by the Department of Energy. The conversion of the SSC Central Facility into the MTDC will facilitate the creation of a *regional technology alliance* that will have significant economic impacts on the entire five state region. Moreover, the inclusion of the federal laboratory system and the partnering with existing manufacturing extension efforts in Texas and other regions will facilitate economic development, international exports and electronic commerce for the entire nation.

If selected for funding consideration, the next step would be the development of a detailed start-up and implementation plan for each program element of the MTDC. Special consideration must be given to include other DOE selected EOI and TNRLC proposals into a coordinated and comprehensive business plan.

2.0 Business Plan

2.1 Background and Purpose

Competition in the global manufacturing market is getting tougher and most firms are realizing that cheap labor alone will not solve the problem. Manufacturers are faced with an ever increasing barrage of complex issues associated with product design, material processing, labor skill levels, process controls, equipment selection, regulatory controls, product distribution and market development. While large manufacturers have the resources to deal with these issues, most small manufacturers are at a distinct competitive disadvantage. Small manufacturers need access to a *"one-stop shop"* to help them compete in the fast paced technologically complex world of manufacturing. In response to this need, the ARRI and TEEX led team purposes to improve the manufacturing competitiveness of the U.S. by creating a *regional technology alliance* formed by the states of Texas, New Mexico, Oklahoma, Arkansas and Louisiana through the conversion of the SSC Central Facility into a *Manufacturing Technology Deployment Center* (MTDC). The MTDC will expand the existing industrial base, create high skill-high pay jobs, develop and deploy federal and university technology to the private sector and aid in the export of U.S. goods and services.

2.1.1 History

The Superconducting Super Collider (SSC) project, was approximately 20% complete when terminated in October 1993. The completed project would have been an accelerator complex and high energy physics laboratory for basic research, and would have provided access to particle collision energies 20 times greater than available at existing facilities. The chosen site of the project was Ellis County, which is about 30 miles south of Dallas, Texas. During construction of the SSC, many physical assets were acquired to support the project. These assets include buildings, laboratories, shops and equipment, various technical facilities, computing and communication resources, and accelerator systems. The closure of the SSC project necessitates the creation of alternative uses for these assets.

Because of the need to utilize the extensive federal and state investment and thus, steward the assets built and purchased by tax payers, in May of 1994 the DOE issued a Request For Proposal to study alternative uses for the Central Facility of the SSC. The Automation & Robotics Research Institute (ARRI) and the Texas Engineering Extension Service (TEEX) with the support of the United States Department of Energy Kansas City Plant (managed by Allied Signal, Inc.), Los Alamos National Laboratory (managed by the University of California), Vought Aircraft Company, the National Center for Manufacturing Sciences, KPMG Peat Marwick, and others responded to the RFP and were funded to develop a plan for the use of the former Superconducting Super Collider (SSC) central facility as a regional *Manufacturing Technology Deployment Center* (MTDC).

2.1.2 Current Condition

Although the closing of the SSC has had detrimental effects upon the local economy and the global scientific community, the available facilities and extensive inventory of equipment present an opportunity to produce alternative economic benefit. The re-deployment of these assets into productive and useful tools to be utilized for the benefit of American manufacturing is a worthwhile and feasible endeavor. It is the recommendation of this study to create a regional industrial technology institute within the boundaries of the SSC complex and to consequentially restore tax payers investments and to provide significant opportunities for U.S. manufacturing.

It is important to realize that no other enterprise exists to the same magnitude as the one proposed in this study. The Manufacturing Technology Deployment Center will consist of seven cohesive and complementary components which will work together with common goal of providing technology and other assistance to manufacturers so that these manufacturers may successfully compete in the world marketplace. Other similar entities within the United States operate simply as business incubators. A business incubator will comprise only a part of the MTDC. Further discussion of the components as well as similar entities will be discussed later.

Upon the announcement of the SSC closing, the Department of Energy and the State of Texas entered into negotiations for settlement of the land, buildings, and other physical assets. The settlement became final in August 1994. The State of Texas retains ownership of the land, buildings, and fixtures, in addition to 65 million dollars designated to complete the linear accelerator which will occupy one complex on the west campus. The term "fixtures" has added a dimension of confusion to the process, causing disagreement over which items are termed as fixtures and which items are not. However, for the purpose of this study it is assumed that all equipment will remain intact.

2.1.3 MTDC Objective and Goals

The ultimate objective of the Manufacturing Technology Deployment Center is the creation and retention of manufacturing jobs.

Goals

The MTDC intends to:

- assist business in identifying new markets, products, and growth opportunities which would otherwise not be possible.
- help the military and manufacturing industrial base to merge into a new infrastructure that strengthens the local economy.
- demonstrate that technology development and technology deployment can maximize the commercialization potential of sponsored research.
- identify and develop dual use opportunities.
- provide engineering services to facilitate product development.

- provide training in relevant topics.
- incubate new high technology and manufacturing companies.
- accelerate emerging companies through their growth stage successfully.
- offer shared manufacturing resources that otherwise would not be readily accessible to companies who need to diversify their product lines
- provide assistance in exporting U.S. goods and services.

The accomplishment of these goals will significantly impact the competitiveness of MTDC customers. Improved manufacturing competitiveness is the primary means of job creation. The MTDC sees itself as a start up enterprise whose success is dependent upon its ability to recover its costs through an aggressive plan for reducing government support while increasing value added services. The MTDC can accomplish the additional goal of being self sufficient within six years.

2.2 Products and Services

The product of the MTDC is the improved competitiveness of the small manufacturing companies who use the center. This product is realized through the delivery of an array of assistance services that include: engineering assistance, information services, product and process prototyping, education and training, manufacturing incubation, and export and product distribution assistance.

These products and services are offered through the seven complementary components of the MTDC. The seven components are:

- Product and Process Development Center
- Manufacturing Incubator/Accelerator
- Teaching Factory and Shared Use Manufacturing Center
- Regional Trade / Distribution Teaching Factory
- Technology Resource Center
- CAD/CAM Center
- Outreach Center

The Process and Product Development Center focuses on the delivery of engineering services in support of product and process development. The Teaching Factory and Shared Use Manufacturing Center offers capability to customers on a time share basis. The Manufacturing Incubator / Accelerator focuses on the start-up and acceleration of both tenant and non-tenant companies. The Technology Resource Center provides access to information and actively seeks federal and other technology, and partners with small manufacturing companies for technology development and deployment purposes. The Regional Trade Center addresses domestic and international trade issues, especially as they relate to product distribution. The Outreach Center and the CAD/CAM Center both support the other components.

In addition, the High Performance Computing Center is an important service provided to the MTDC and its customers. The HPCC, located within the MTDC facility, is to be operated by an independent entity.

2.2.1 Product and Process Development Center

The Product and Process Development Center (PPDC) is an industry driven facility designed to facilitate the successful development of both new products and manufacturing processes. Companies work directly with the technical staff to evaluate company needs and to determine the appropriate measures to implement. Companies may use the equipment available at the MTDC to produce prototype products or experiment with new manufacturing techniques.

Research indicates that one of the primary needs of small manufacturers is low cost engineering assistance. When coupled with machining and other operating costs, product and process development costs are not within their reach. For this reason, the MTDC will market engineering services, including the building of products and development of processes, at very low comparative rates. It is important that the clients of the MTDC focus on products that have market potential and that are technologically competitive. Therefore, the MTDC will provide market research, commercialization, and information retrieval services that will allow its customers to make solid business decisions and to access the best available technology. Through its relationships with the federal laboratory and university infrastructures, the MTDC will help to ensure that its customers are developing cutting edge products and processes at competitive prices.

The PPDC facilitates the development of both new products and manufacturing processes for the manufacturing community. This is accomplished using a comprehensive approach to prototype design and fabrication, concurrent design of product and manufacturing processes, and market research. The center provides access to both technology opportunities and development expertise available from national sources. A special focus is the development of technology available in the federal laboratories. An ongoing federal laboratory presence is envisioned to be part of the supporting Technology Resource Center. The PPDC will actively encourage the development of agile, clean, environmentally conscious, and energy efficient manufacturing. It is the goal of the Product and Process Development Center is to work closely with manufacturing companies so that products may be patented.

2.2.2 Manufacturing Incubator / Accelerator

The Manufacturing Incubator/Accelerator helps start-up manufacturing companies become viable by assisting in the development of products and processes and to initiate low rate production. The incubator makes use of existing assistance resources such as SBDC's, educational institutions, and other service providers, as appropriate. The incubator/accelerator helps young existing companies move toward world class status through technical assistance, training, re-engineering, and development of improved capability and expanded capacity.

In recent years, the business incubator has risen as a legitimate method of improving the success rate of small businesses. The MTDC will offer incubation services to high technology and manufacturing companies that are either new or emerging. Due to the intensive support that will be offered to these companies, which includes access to federal laboratory and university assistance, it is expected that several successful companies will emerge from the incubator during the first two years. Through the renting of space and delivery of services, these companies will be an excellent source of revenue for the MTDC.

The purpose of the manufacturing incubator/accelerator is to provide an environment of success for small manufacturing companies. Like the PPDC, the manufacturing incubator/accelerator will focus on the theme of agile, clean, environmentally conscious, and energy efficient manufacturing. This theme is driven by the need of small and medium sized manufacturers to successfully adopt and implement manufacturing processes and techniques that promote agility, minimize waste, improve quality and delivery, reduce costs, and maximize throughput. It is widely recognized that clean and agile companies have a higher probability of successfully competing in the global marketplace.

2.2.3 Teaching Factory and Shared Use Manufacturing Center

As a one stop shop enterprise, the MTDC understands that the future of American competitiveness relies on its skilled workforce. The Teaching Factory and Shared Use Manufacturing Center (Teach-SUM) enhances the competitiveness of the regional manufacturing community through hands-on cooperative training for the manufacturer's employees. Employees completing training will provide the competitive edge to their respective employers as skilled workers. The teaching factory and shared use manufacturing center is also available to regional manufacturers to use for commercial purposes on a shared use basis. Customers of the Teach-SUM will have access to both the manufacturing equipment and the computing facilities.

Additionally, continuing education classes, coordinated by the outreach center will be taught within the MTDC facility. Courses are taught by professionals in CAD/CAM, machine operation, machine maintenance, enterprise excellence, industrial math, industrial reading, industrial safety, ISO 9000, presentations, quality assurance, statistical quality control, shop management, supervisory skills, tooling and fixturing, process planning, component design, shop aids, negotiation skills, quick change tools, one-piece flow, just-in-time inventory systems, load balancing, and factory simulation.

2.2.4 Regional Trade / Distribution Teaching Factory (RT/DT)

The Regional Trade / Distribution Teaching Factory has two functions. It is an industry focused facility where manufacturing trade relationships are developed. International trade along the Interstate 35 Corridor between Mexico and the U.S. is of particular interest. The facility also serves as a trade and distribution teaching factory where advanced distribution concepts and technologies are taught in a hands-on working environment.

A final aspect of the trade center is the use of this warehouse as a commercial venture. The rental of the space to a distribution company generates revenues and provides the essential element of realism to the distribution teaching factory. One of the advantages of the SSC facility is its high quality warehousing space, which will be marketed as an initial product of the MTDC. Due to NAFTA and the recent void in building construction in Texas, warehouse space is in great demand. Literally within two miles of the Interstate 35 highway, it is estimated that up to 66% of the trade between Mexico and the U.S. passes by the SSC facility. This presents a tremendous opportunity to achieve initial cash flow, which will help the MTDC to offset its initial start-up costs.

The RT/DT offers courses in logistics, trade and tariff regulations, trucking and bills of lading, intermodal transportation, industrial safety, inventory accounting, warehouse equipment operation, enterprise excellence, industrial math, industrial reading, presentations, quality assurance, ISO 9000, statistical quality control, warehouse and distribution management, supervisory skills, negotiation skills, and just-in-time inventory systems.

2.2.5 Technology Resource Center (TRC)

The Technology Resource Center is an adjunct to the Product and Process Development Center. The TRC houses information resources regarding federal technology available for transfer to the private sector. The TRC also houses technical experts and others from the federal laboratories, universities and other partnerships. These people assist manufacturers in the development and commercialization of technology. The library provides access to technical information.

The Technology Resource Center catalogues and organizes technologies available from the federal laboratories and the universities in such a manner as to make them readily available to the public. Personnel from the network of laboratories are located on-site to counsel and guide customers. The video conference room in the main office is used to link distant labs and universities with the customers.

The center provides the following services: Internet, Mosaic, World Wide Web, Dialog, NASA Recon, NTIS, and Electronic Bulletin Board Service. Research is tedious, time-consuming and often overwhelming. It is also a necessity for technology deployment. On-line searching is an effective tool for accessing information networks to expose pertinent data. The technology resource center personnel will assist users in performing searches. Searches locate information on federal laboratories, technical literature, marketing, patents, and other pertinent topics. The library contains government publications, technical journals, and trade publications. The collective capabilities and services provided by the MTDC will provide a powerful one stop shop for its customers, who will tremendously improve their ability to introduce marketable products.

2.2.6 CAD/CAM Center

The CAD/CAM Center is an adjunct to the Teaching Factory and Shared Use Manufacturing Center. The center houses hardware, software, and expertise needed

to support the computer aided design and manufacturing activities of the MTDC and its customers.

2.2.7 Outreach Center

The Outreach Center supports all of the MTDC program elements by organizing and conducting workshops, seminars and classes. The classes include those offered by the two teaching factories.

2.3 Market Analysis

The MTDC will focus on three geographic market segments. The primary market is Ellis County where the SSC is located plus the counties of Collin, Denton, Dallas, Henderson, Hill, Johnson, Kaufman, McLennan, Navarro, Rockwall, and Tarrant. The secondary market is the entire State of Texas while the tertiary market consist of Arkansas, Louisiana, Oklahoma and New Mexico.

The entire region consists of 565,128 square miles and has a total population of 32,353,230. More than 12 percent of the total regional population, or 4,135,368, live within the primary market area under consideration. Nationally, an average of 45.2% of the population 25 years and over have some college experience. This experience is highly desirable in a market of high employer expectations and requirements for employment. High technology employers look for workers with experience beyond the basic high school degree to operate sophisticated equipment and to handle complex processes. In the primary market area, five counties have higher percent educational attainment than the national average. The counties of Collin (68.9%), Denton (65.2%), Rockwall (58.3%), Tarrant (55.1%), and Dallas (53.36%) exceed the national average in percent of population 25 years and older who have some level of college experience. Texas and New Mexico both exceed the national average as well. Oklahoma is very close to the national average with 44.1 percent of the population with some college experience.

The primary private sector client base for the MTDC is small businesses with 500 or fewer employees. According to D&B-Dun's Electronic Business Directory¹, there are over 35,000 small manufacturing businesses within the five state region. There are 19 two-digit SIC Codes which represent the range of manufacturing according to the US Department of Commerce. All aspects of manufacturing are represented significantly in the five state region, with the exception of SIC code 21, tobacco products, which has a total of 9 small businesses represented.

The following SIC codes are represented among the top five most numerous categories of manufacturing in the five-state region: 20, Food and kindred products; 24, Lumber and wood products, except furniture; 32, Stone, clay, glass and concrete products; 34,

¹ This source provides on-line directory information for more than 9.4 million businesses throughout the US. They make no claim regarding the comprehensive nature of the database. It is maintained through their intensive credit interviewing process and is supplemented with data from large-volume telemarketing and direct mail campaigns, government filings, and a variety of other sources.

Fabricated metal products, except machinery and transportation equipment; 35, Industrial and commercial machinery and computer equipment; 36, Electronic and other electrical equipment and components, except computer equipment; and 39, Miscellaneous manufacturing industries.

Many of the companies in the five state region are categorized as "high tech."² There are 2,500 high tech companies in the five-state region; of these companies, more than 81% of them or 2,029, are small companies, employing 500 or fewer people. Of the total high tech companies, 54.4% of them (1,361) are within a radius of 100 miles of the primary market area while 48.4% of the total (1,219) employ 500 or fewer people.

It is important to note that the concept of the MTDC, including its products and services, are a result of several industry focus groups that were held recently. On October 10, 12, and 14, 1994, ARRI and TEEX held focus group sessions for the MTDC. Vought Aircraft Company facilitated the sessions with the purpose of receiving input from industry, college, and consulting representatives. Each session included representatives from industry, academia, and business service providers who were asked to provide feedback concerning the establishment of the MTDC. The facilitated work sessions revealed that the participants support the concept of the MTDC as presented in the workshops. The PPDC and the Incubator/Accelerator gained the most enthusiastic support. The participants expressed interest in using a facility such as the MTDC. A small portion of the participants reported that the distance to Waxahachie posed a problem for them, while the most felt that travel to take advantage of the services offered by the MTDC would be more than worthwhile.

Business enterprises as extensive and complex such as the one proposed in this study have not been in existence long enough to accurately evaluate. Recently two similar deployment centers were seeded through TRP awards. The Manufacturers EnterCorp is located in Kansas City while the Regional Advanced Manufacturing Project (RAMP) operates out of Los Angeles. Through the NIST MEP program and the complementary TRP program, hundreds of private public partnerships have been seeded through government sources to deliver added value services to the private sector.

Usually, there is a goal to become self sustaining within 6 years, but the history of the NIST Manufacturing Technology Centers indicates that this is a very difficult goal to achieve. From the standpoint of the stakeholders, it appears that it is more important that these organizations demonstrate a positive influence on job creation and economic benefit then on the attainment of self sufficiency. In fact, the drive to accomplish self sufficiency usually influences the organizations to modify their target market away from small business and to the more lucrative corporate customer, whose ability to pay is significantly stronger than the small company.

2

As defined by CorpTech, publisher of *Corporate Technology Directory*. This is "a comprehensive reference on over 36,000 US entities that manufacture or develop high technology products" (*Corporate Technology Directory*, 1994, page 1-vi). Technologies incorporated in this publication are advanced materials, factory automation, biotech, chemicals, computer hardware, defense, energy, environmental, manufacturing, medical, pharmaceuticals, photonics, computer software, subassemblies and components, telecommunications, test and measurement, and transportation.

This does not imply, however, that it is not possible to achieve this goal. Through tight management, resource leveraging, and innovative income policies such as taking equity in companies, some of these organizations appear to be on the road to self sufficiency. It is reasonable that the MTDC will see government agencies whose mission is consistent with the MTDC as customers along with the private sector.

With respect to the MTDC, there is really only one component that has an extensive history to evaluate. In 1993, over 500 incubators existed in the United States; 30 of which are in Texas. Statistics show that if managed and operated properly, business incubator enterprises such as the MTDC out-perform the marketplace in reducing business failures. In 1984, there were 50 operating incubators, in 1994, there are over 500 operating incubators. Incubators have become a major tool for successful business formation.

To be successful as an economic development tool for business formation and expansion, the Manufacturing Technology Deployment Center (MTDC) must "add value" (increase probability of success) to tenant firms above and beyond what the existing market does. It is projected that hundreds of manufacturers will be served each year and at least twelve tenants will be located in the incubator at any one time.

2.4 Marketing Strategy

The key to any good marketing strategy is the effective communication of the benefits of doing business with the seller. It is said that people do not buy products, they trade money for benefits. With respect to the MTDC, the benefits are numerous, but conveying them effectively will be a challenge. One of the major start up tasks of the MTDC will be an intensive awareness campaign that includes media releases, mass mailings, workshops, conferences and basically any mechanism that will help to get the word out on the benefits of working with the center. The basic message will include a clear concise message on the benefits.

In the primary market area, the MTDC will market its products and services by utilizing the numerous contacts already established by ARRI and TEEX. These contacts include regional SBDCs and satellite offices, colleges and universities, manufacturing companies, local government, chambers of commerce, and economic development corporations. Newsletters, brochures, breakfast workshops, speaking engagements, advertisements in newspapers and radio will be utilized to provide information concerning the MTDC services and success stories.

The secondary market will be penetrated by utilizing the Texas Manufacturing Assistance Centers across the state.

In the tertiary market area, the MTDC will work with the Mid Continent Technology Transfer Center, SBDCs, colleges and universities.

2.5 Competitor Analysis

The MTDC does not plan on duplicating services offered in the market region but instead, working with them to utilize their strengths and offer office space for them to provide services to MTDC clients. To comprehensively evaluate the competitive climate requires a brief description of the local service providers that perform similar services to that of the MTDC. They can be identified as follows:

- Incubators
- Service Providers (Business)
- Service Providers (Technical)
- Service Provider (Commercialization)

There are both public and private organizations that provide some type of manufacturing assistance. The Small Business Development Center network, operated locally by Dallas County Community College District, is both a partner and competitor in this regard. It is the intention of the MTDC to work with this network on behalf of its customers. Texas State Technical College is a capable service provider organization that would complement the capabilities of the MTDC in delivering training and technical assistance. Not for profit research organizations such as Southwest Research Institute have very high rates that few small businesses can afford. The Texas Manufacturing Assistance Network is a partnership of six organizations whose mission is to outreach to small manufacturers in Texas. Since both ARRI and TEEX are part of this network, it is not realistic to classify them as a competitor to the MTDC. Also, since the MTDC will not maintain a large staff, it will be incumbent to obtain outside assistance as required. In essence, the MTDC will act as a broker. This is especially the case with the professional organizations such as accounting and professional engineering firms, who will benefit from a relationship with the MTDC.

Thirty incubator facilities exist in Texas, most of which claim success. However, it is difficult to compare these facilities with the facility being proposed due to magnitude of the MTDC, both in terms of services and physical size. The other facilities consist basically of a small business incubator, only one component of the seven planned by the MTDC. Teaching factories do exist in the region, yet they are separate and apart from the incubators and are housed within technical colleges. The nearest incubator that accepts manufacturers is 38 miles away in Corsicana. However, it is at full capacity. The incubator operated by the Dallas County Community College District does not accept manufacturers. The MTDC will focus on the manufacturing market segment and cater to manufacturing companies. Local CAD/CAM teaching factories do not consist of powerful computer workstations operating their CAD tools. Also lacking in the region are CAD/CAM centers with accessible CNC multi-axis milling machines to produce their products. No other enterprise such as the one proposed in this study exists to the same capacity as the MTDC. By far, the biggest challenge of the MTDC will be to attract the steady stream of customers based on the benefits of the center and then to get acknowledgment of value through a willingness to pay for the center's services.

2.6 Facilities and Equipment

A detailed analysis of the facilities and equipment is included in the Technical Plan, including scale layouts of the operation. The MTDC has designed its layout to minimize major construction modifications while remaining flexible to the needs of its customers. Aside from basic partitioning and some relocation of equipment, there is very little change from the basic layout of the original central facility. A conceptual layout is shown below.

2.7 Management Team

The management team responsible for the MTDC is comprised of an appointed board of directors, a full time on-site director, and several full time managers. Assisting the on-site director will be a marketing professional who will coordinate all marketing activities. This team will act to ensure the delivery of quality services to client companies. The individual responsibilities of each team member will be discussed separately.

2.7.1 Organization Structure

The MTDC will be organized as a not-for-profit corporation [501(c)(3)] with a board consisting of key stakeholders in the enterprise. This corporation is a result of a partnership between TEEX and ARRI. The MTDC is governed by a Board of Directors selected from leaders in industry, academia, and government. The members of the

board are not compensated for their time. The board provides overall guidance to the MTDC Director. The managers of the four major components report to the director. The administration and support personnel report to the director. The outreach center personnel report to the director. The Technology Resource Center personnel are managed by the PPDC Manager. The CAD/CAM Center personnel report to the Teach-SUM Manager. The aforementioned staff will be employed by ARRI and TEEX who will be the principle contractors for MTDC operations. The HPCC personnel are under the direction of the HPCC sponsoring body. The HPCC is an important component of the MTDC and is assumed to cooperate fully with the MTDC personnel and clients.

2.7.2 Key Personnel

Board of Directors

The MTDC will be organized as a not-for-profit corporation with a board consisting of key stakeholders in the enterprise. The board will consist of selected from leaders in industry, academia, and government, including two or three representatives from government including economic development representatives, and four industry mentors who are closely and actively associated with the companies housed within the center.

A committee consisting of TEEX and ARRI representatives will govern the activities until a board of directors has been selected. This committee will jointly appoint members to serve on the board. Following their appointments, the board members will guide and direct the activities of the MTDC. Additionally, the board is responsible for the financial viability of the corporation.

The board of directors is responsible for the general management and control of the activities and affairs of the corporation. The board is responsible for planning and formulating policy to guide the programmatic directions taken by the corporation and ensuring that all actions taken by the corporation are consistent with the corporation by-laws. The board is responsible for the overall financial viability of the corporation.

Director

The activities involved in directing the MTDC require that the candidate chosen to fulfill this role needs to be trained and experienced in business, business management, accounting, public relations, journalism, and construction management, and possess an understanding of entrepreneurial relationships and associations. The director is responsible for implementing the projects, programs, policies and activities of the MTDC at the direction of the appointed board of directors. The director is responsible for the day-to-day operational and financial activities of the corporation and for the supervision of other salaried staff. The TEEX and ARRI team will select an interim director of the center to begin operations and locate tenants for the incubator and lease space. The interim director will also initiate a search for director of the MTDC as well as managers of each components.

Managers

There are four managers that report to the MTDC director, corresponding to the four core components of the center. All managers are required to orchestrate access to external advisors who possess specialized knowledge and can offer their services to the MTDC. The manager will staff the center to best achieve the center objectives. The manager must coordinate services to clients with other MTDC components or outside services as appropriate. These responsibilities are highly specialized and require previous experience in a technology or manufacturing field.

Marketing Professional

Assisting the director and managers is a full-time marketing professional who serves as a media coordinator and liaison between the public and the MTDC. The marketing professional develops and maintains contact with the TV/newspaper/radio media as well as design firms and printers. In addition, the marketing professional creates the center's newsletter and brochure, prepares layouts utilizing desktop publishing software, obtains or creates photos and illustrations, and ensures all revisions are incorporated into the final layout for printing.

The Automation & Robotics Research Institute (ARRI) is the premier applied manufacturing research, education, development, and high technology deployment center in the Southwest. ARRI is a part of the College of Engineering of The University of Texas at Arlington, a full service University with approximately 25,000 students

enrolled. ARRI is a non-profit organization dedicated to helping local manufacturers improve their quality, productivity, and general performance. Special emphasis is placed on successfully helping small manufacturers on the journey to world class manufacturing. ARRI prides itself on its proven track record for deploying technology to industry quickly and effectively. Using research funded by such agencies as the National Science Foundation, the National Center for Manufacturing Sciences, the State of Texas Advanced Technology Program, and the Electric Power Research Institute, ARRI has successfully deployed manufacturing systems for industry on time and within budget. Several ARRI developments have resulted in spin-off companies, one of which is already at 30 employees after three years of operation.

The Texas Engineering Extension Service (TEEX) is one of eight state agencies within the Texas A&M University System and a core component of the Texas A&M University College of Engineering. TEEX's vision is to be recognized nationally as the premier engineering/industrial extension agency serving public needs through training, technical assistance, and technology transfer. With a staff of more than 400 dedicated professionals, TEEX consultants traveled over 1.8 million land miles in 1993 to reach their clients. Contracts and fees from non-State sources exceeded \$35 million in 1993. TEEX consists of 13 divisions whose core business ranges from environmental safety to technology and economic development. In 1993, TEEX conducted over 5,600 training classes and enhanced the technical skills of 120,000 students. In the same year, technical assistance was rendered to over 1,000 companies. TEEX operates eight offices and six major technical training facilities throughout the state of Texas.

2.8 Risk Factors

The primary roadblock that will directly affect the MTDC is the possibility that the state of Texas will deny MTDC use of the SSC facility. The secondary roadblock facing the MTDC's establishment would occur if the state charged a rental fee to the MTDC. Additionally, any inability to obtain funds to begin operations may occur and would hinder the efforts of the MTDC to assist small manufacturers. Concurrently, if the opinion that small manufacturing assistance will not aid in the effort to improve the United States' position in the world trade market, the flow of federal moneys could decrease and thus limit the abilities of the MTDC.

If small manufacturers deny or refuse the need for assistance, then the efforts of the MTDC will be wasted. Also, the possibility that lease projections are not attained presents a problem as the revenue generated from rental property is a major source of operating funds. A down-turn in the need for manufacturing workers, new technologies, technician assistance would create a hardship for the MTDC.

2.9 Financials

Financial statements and graphs were prepared by KPMG Peat Marwick using data provided by ARRI and TEEX. KPMG Peat Marwick contributed modifications to the study data used in the financial calculations based upon their extensive business experience. Complete financial statements are included in section 2.11, the Business Plan Appendix.

2.9.1 Capital Requirements

The proposed MTDC requires \$15.4 million of grants over six years to support the planned product and process development center, regional trade/distribution teaching factory, technology resource center, teaching factory and shared use manufacturing center, and manufacturing incubator/accelerator. These funds will be used to 1) hire a professional staff, 2) purchase necessary equipment, 3) perform facility modifications, and 4) supporting operating expenses until sufficient revenue is generated to cover expenses. The MTDC will require the external sources of funding shown below to meet facility requirements, working capital requirements, and start-up expenses. No additional grants will be required after 2000 to sustain the MTDC as shown in the financial statements.

External Sources of Funding (\$Millions)

	1995	1996	1997	1998	1999	2000	2001
Federal/State Grants	4.0	3.4	2.9	2.2	1.0	0.0	0.0
Corporate Sponsorships	0.15	0.30	0.35	0.35	0.50	0.25	0.00

2.9.2 Assumptions

The 1995-1999 pro-forma balance sheets and income statements for the MTDC are shown in the Business Plan Appendix. In addition, the assumptions used to support these financial statements are located in the same appendix. The financial assumptions used in the financial statements were determined from 1) historical facility maintenance, utilities, and operating costs, 2) best estimate for staffing levels to support the projected service levels, 3) feedback obtained from the local industrial base on the level of interest in the outlined interests, and 4) evaluation of similar business incubator projects.

The major financial assumptions used in the development of the pro-forma financial statements include:

- Federal/State/Local/University and Industry grants of \$15.4 million will be available to provide necessary funding to achieve financial self sufficiency during 2000. External financing (debt) may be utilized to offset lower grant contributions.
- The State of Texas will maintain ownership of the proposed MTDC facility, facility fixtures, and land. The State of Texas will provide a long-term (10 years) facility lease to the MTDC at no cost.

- The MTDC will be responsible for facility maintenance, insurance, and modifications required for this business venture.
- No major facility modifications or repairs will be required during the 5-year period. The State of Texas as the owner of the facility will be responsible for major facility repairs or structural modifications.
- The MTDC will sublease 127,593 square feet of office space, 105,995 square feet of warehouse space, and 63,068 square feet of incubator space at the estimated market value of \$7 per square foot per year, \$4 per square foot per year, and \$6 per square foot per year, respectively.
- The estimated revenue for engineering services and proposed workshops will be realized at the projected hourly rates and course cost.
- The average salary rate for each job classification will remain relatively flat over the 5-year period.
- The proposed lease rates obtained from resident companies for the office, warehouse and incubator space was assumed flat over the period, 1995-1999.
- Expenses associated with major facility modifications, heavy utilities usage, and unique equipment requirements will be the responsibility of companies leasing at the MTDC.

2.9.3 Financial Risks

The proposed large facility represents a large asset with high fixed costs. Therefore, the viability of the MTDC is sensitive to the realized revenue stream. The inability to lease the projected office and warehouse space will substantially impact the success of the proposed MTDC.

2.9.4 Financial Data

The financial statements reflect a break-even period (operating revenues equal operating expenses) of 6.5 years with an average revenue growth rate of 40% during 1996-1999. This is presented graphically in Figure 2.9.4-1. At this point, the MTDC will be financially self sustaining. Revenue contributions from grants is shown in Figure 2.9.4-2. At year 5, the MTDC is projected to generate \$4.6 million in revenue from workshops, engineering services, market assessments, data searches, manufacturing shared-use contracts, incubator service fees, and facility leases. Figure 2.9.4-3 depicts MTDC revenues from services, and Figure 2.9.4-4 shows MTDC lease revenues. The estimates for projected revenue and operating expenses reflect the most probable business scenario for the MTDC.

Figure 2.9.4-1

Figure 2.9.4-2

Figure 2.9.4-3

Figure 2.9.4-4

Engineering services (\$2.0 million, 1999) and office leases (\$0.9 million, 1999) represent the largest contributors to the operating revenue base at year 5. This supports the basic business strategy to leverage extra office and warehouse space into a revenue source for the MTDC.

Employee salaries (\$2.3 million, 1999) and facility maintenance (\$1.3 million, 1999) represent the largest contributors to the operating expense base at year 5. This follows the MTDC business strategy to 1) concentrate on professional services (training, engineering, workshops, and consulting) and 2) provide facility space (manufacturing and incubator space) to the identified market segments.

2.10 Summary

The purpose of the proposed *Manufacturing Technology Deployment Center* (MTDC) is to improve the global competitiveness of the U. S. through the dramatic and fundamental improvement of the small manufacturing community. The MTDC improves manufacturing practices, facilitates economic growth through a manufacturing incubator/accelerator, enhances the workforce skill base through manufacturing and product development training and workshops, and supports basic manufacturing needs of the regional industrial base. By providing substantive assistance to manufacturers, the MTDC provides the community with jobs and improved standard of living.

The MTDC is staffed with the experience and expertise of technical manufacturing personnel capable of assisting clients with their individual needs. In addition to the on-site staff, the MTDC has a close association with ARRI and TEEX with access to their vast resources, expertise, and networks. The partnership with the statewide Texas Manufacturing Assistance Center enhances available information and provides additional expertise and concrete feedback directly extracted from small manufacturers. The MTDC offers access to federal technologies through the affiliation with the Mid-Continent Technology Transfer Center and federal laboratory partners. These partners will provide assistance to MTDC customers through their own office in the MTDC complex. Customers have the advantage of access to computer-aided design and computer-aided manufacturing laboratory that is complete with high end computer workstations and possesses the capability to produce the designs with the use of computer numerically controlled milling machines. A high performance computer center resides in the MTDC and offers additional computer imaging capabilities.

2.11 Business Plan Appendix

This appendix contains the financial statements prepared by KPMG Peat Marwick along with a copy of their submittal letter.

3.0 TECHNICAL PLAN

3.1 Introduction

The Automation & Robotics Research Institute (ARRI) and the Texas Engineering Extension Service (TEEX) with the support of the United States Department of Energy Kansas City Plant (Managed by Allied Signal, Inc.), Los Alamos National Laboratory (Managed by the University of California), Vought Aircraft Company, the National Center for Manufacturing Sciences (NCMS), KPMG Peat Marwick, and others have developed a plan for the use of the former Superconducting Super Collider (SSC) central facility as a regional *Manufacturing Technology Deployment Center* (MTDC). This section of the report presents the detailed technical plan for the proposed MTDC. The plan presented initiates a regional technology alliance formed by the service providers in the states of Texas, New Mexico, Oklahoma, Arkansas, and Louisiana.

The study was based upon the premise that small manufacturing companies become more competitive through the deployment of advanced manufacturing principles, practices, and technologies. The basic focus of the study was the deployment of agile, clean, environmentally conscious, and energy efficient manufacturing. This was driven by the need of small and medium sized manufacturers to successfully adopt and implement manufacturing processes and techniques that promote agility, minimize waste, improve quality and delivery, reduce costs, and maximize throughput. It is widely recognized that clean and agile companies have a higher probability of successfully competing in the global marketplace. It is also widely acknowledged that value-added manufacturing is the most effective way to positively impact the regional economy.

3.1.1 Study Objectives

The stated objective of the study was to develop a comprehensive plan to develop and implement a *Manufacturing Technology Deployment Center* at the SSC central facility. The product of the study is this comprehensive report with recommendations for the use of the SSC assets. The comprehensive report is comprised of an executive summary, a business plan, and a technical plan (this section).

3.1.2 Study Approach

This report presents the results of a three month study conducted during August through October of 1994. The high level research tasks undertaken are as listed below.

- The development of a preliminary concept as presented in the proposal
- The collection and analysis of a large amount of data describing the site and assets
- The completion of a demographic analysis for the five state proposed service region
- The analysis of needs, services, and options
- A review of concepts with industry
- The development of a final concept

- The compilation of the technical plan
- The development of the business plan

The team members met regularly to review progress, analyze findings, develop concepts, and initiate additional research on the potential applications of the SSC Central Facility building and equipment. The team also interviewed industry experts and visited manufacturers, federal labs, and other service providers. Due to the expansive size of the facility (550,000 sq. ft.), research into multiple and shared applications of the facility focused on combinations that promote the deployment of agile, clean, environmentally conscious, and energy efficient manufacturing to small and medium size manufacturers. Primary research was performed in the area of manufacturing incubators and accelerators. Several incubators were visited where both management and tenants of these incubators were interviewed. Additionally, literature research was accomplished on teaching factories and other issues.

3.2 Customer Definition and Demographics

The customers of the MTDC are divided into three segments: primary, secondary, and tertiary. The Superconducting Super Collider facility is located in Ellis County, therefore, the primary market will be manufacturing companies in the Dallas-Fort Worth Metroplex. The counties included in the primary area are: Ellis, Dallas, Tarrant, Navarro, McLennan, Hill, Johnson, Henderson, Kaufman, Rockwall, Collin, and Denton. The secondary market benefiting from services offered, includes the remaining counties in the State of Texas. The tertiary market adds the four surrounding states of New Mexico, Oklahoma, Arkansas, and Louisiana. Additionally, due to the fact that the Interstate 35 Corridor passes through the Metroplex and connects Mexico with the United States, Mexico is considered a pertinent and valued member of the tertiary market. However, demographics for Mexico are not included.

Figures 3.2-1, 3.2-2, and 3.2-3 all clearly show that manufacturing is the top three sectors in terms of percentage of employment. Manufacturing is very important to each of the defined market areas. This is especially true for the Dallas-Fort Worth Metroplex. This very compact region is home to approximately 6,800 manufacturing companies, 99% of which are small manufacturers. Most of these are within two hours driving time of the Central Facility. The Metroplex employs 370,000, or 37%, of the total state workforce in manufacturing. It has the highest concentration of defense companies in the state with 2,600 firms, or 65% of the state's total. Major industry sectors of the region are: aerospace, semiconductors, electronics, and communications.

Figure 3.2-1

Figure 3.2-2

Figure 3.2-3

Manufacturing accounts for approximately 17% of the region's total employment of nearly 2.1 million jobs. Manufacturing pays 34% of all salaries and wages in Tarrant County and 19% of all salaries and wages in Dallas County. The Metroplex is more heavily manufacturing oriented than the state as a whole and, along with the Houston area, has the largest concentration of manufacturers in the state. The Metroplex has the highest industry diversification index and the highest rate of new business generation in the state.

Figures 3.2-4 through 3.2-8 show the number of small manufacturers by SIC code for each of the states in the region. These data show that SIC codes 34 (Fabricated metal products), 35 (Industrial machinery and computer equipment), 36 (Electronic and electrical equipment), and 39 (Misc. manufacturing) are the most numerous. The figures indicate that the equipment and facilities of the SSC Central Facility are well suited to support the types of industries found in the target market.

Figure 3.2-4

Figure 3.2-5

Figure 3.2-6

Figure 3.2-7

Figure 3.2-8

An extensive customer needs study was conducted by the Texas Manufacturing Assistance Center during the early part of 1994. This study confirmed the results of a study conducted by the governor's office approximately a year earlier. While these studies were confined to Texas manufacturers, it is suggested that they represent the needs of manufacturers in general. The data collected was consistent with that obtained by NIST and service providers in other states. The results of the studies are presented in the following table with manufacturing needs divided into two categories: the top six strategic needs and the top six productivity needs. The table also includes information concerning where companies currently look for assistance. The surveys indicate that quality, inventory, equipment, and information technology are very important productivity needs. Likewise, the more strategic needs include new markets for products, product development, and access to capital. A reasonable strategy to satisfy these needs would include the use of technology to develop better manufacturing processes and products. It is noted that public providers of assistance are not among those more frequently used by small companies.

Productivity Needs	Strategic Needs	Sources of Assistance
Quality Improvement Programs	New Markets	In House R & D
Just-In-Time Inventory	Product Improvement	Trade Associations
Inventory Management	New Product Development	Assistance from Other Firms
Materials Requirement Planning	Access to Capital	Recruitment of Expertise
Plant and Equipment Upgrades	Relief from Government Regulation	Other
Information Technology	Partnering	

These needs are well understood and are part of the basis for the design of the Manufacturing Technology Deployment Center.

3.3 Analysis

The six concepts proposed in the original expression of interest include:

- a *product development and manufacturing process development center*.
- a *teaching factory* for advanced manufacturing concepts.
- a *shared use manufacturing facility* for production use.
- a *business incubator* for manufacturing
- a *business accelerator* for manufacturing.
- a *regional manufacturing trade center* for commerce with Mexico.

3.3.1 Assumptions

The analysis is based upon a collection of assumptions that constrain the conceptual design of the MTDC. Additional assumptions are presented in the detailed design section of this document.

Assumption #1: It is assumed that the building and fixtures, infrastructure, grounds, and parking lots are sound and require no substantial repair or replacement. This assumption applies to the basic structure, HVAC, utilities, etc. as currently installed.

Assumption #2: It is assumed that the building will be maintained during the interim period between the writing of this report and any potential future occupancy.

Assumption #3: It is assumed that other EOI's will share the facility and that detailed coordination of these alternative uses will occur during a second facilities design activity after project selection.

Assumption #4: It is assumed that the required existing capital equipment, furniture, modular offices and computers (as defined later) will be available to the MTDC at no initial cost. The ongoing cost of maintenance and operations will be borne by the MTDC.

Assumption #5: It is assumed that the facility will be leased at no cost to the MTDC.

Assumption #6: It is assumed that the High Performance Computing Center will be operational and accessible to the MTDC.

3.3.2 Analysis of Options

The original six concepts, mentioned above, were reformulated during the early stages of the analysis and design of the proposed enterprise. The manufacturing incubator and accelerator concepts were combined. In addition, the trade center concept was modified to include elements of a teaching factory. As presented below, the five remaining options were analyzed for the *Manufacturing Technology Deployment Center*. As will be discussed in section 3.3.3, the analysis resulted in an additional modification of the trade center option, the addition of three new program elements, and further development of each of the other options.

Manufacturing Incubator/Accelerator

The concept of a business incubator is, of course, not new. Many such facilities exist in Texas and across the nation. Approximately thirty manufacturing incubators are in operation in Texas. These are almost exclusively focused on light manufacturing. A wide variety of literature discussing the operations of incubators was compiled and reviewed. Management and tenants from several incubators were also interviewed. The sites were chosen from a list of incubators prepared by the National Business Incubator Association in Ohio. The specific sites visited are listed below:

High Technology of Rochester	Rochester, NY	high tech, 30,000 sq ft, stand-alone in existing building
Business Incubation Center at Bill J. Priest Institute for Economic Development	Dallas, TX	all purpose with some high tech, co-located, 30,000 sq ft
Business Ventures	Garland, TX	high tech, mfg, and service, 90,000 sq ft, stand alone in existing building
Austin Technology Incubator	Austin, TX	high tech, 30,000 sq ft, stand alone in existing building
K-Wolen's Industrial Incubator	Corsicana, TX	mfg, 96,000 sq ft, stand alone in existing building

Briefly, the common success factors and lessons learned include:

- high occupancy rate is achievable
- buildings should be finished out as space is leased
- stability of an anchor tenant is desired
- rental rates are 75% to 100% of comparable space
- most incubator services are included in rent
- phones should be the responsibility of the tenant
- selection criteria varies considerably among incubators
- support of the community leaders is crucial
- can be self-supporting within 6 years
- set up costs can be low if building is modern and in good shape
- on-site assistance and coordination with other services contributes to success
- lease agreements need to be specific in terms of use and liability

Product and Process Development Center

The information on existing product and process development centers is limited except as similar services exist within incubators or manufacturing technology centers. The focus groups conducted to discuss concepts (discussed later) indicated that small companies will respond to a "one stop shop" concept where they can access technology, develop the product or processes, and try out the technology. Such a center should provide access to a generic machine shop on-site to support many types of prototype development. Likewise, access to computing to support design and development is important. A highly technical, highly motivated staff, with flexible schedules, is essential. Audio/video conferencing to access specific scientists and to view specific technologies without the expense of travel is also useful.

Teaching Factory

An extensive body of literature exists describing many variations on the theme of the teaching factory. In addition, the participants in the study have considerable experience operating organizations having similar objectives. A reasonable model of the teaching factory is that proposed by the National Center for Manufacturing Sciences (NCMS). The teaching factory, as proposed by NCMS, has five primary functions:

- Technology awareness - enhancing understanding and knowledge of manufacturing technology issues.
- Technology education - developing the basic knowledge and skills required for productive employment in manufacturing.

- Technology demonstration - systematic exhibitions which demonstrate advanced manufacturing principles, practices, and technologies. This makes use of the *mini-factory* idea for demonstration and, in some instances, full scale production.
- Technology support - technical and management assistance provided to manufacturers on a project basis.
- Technology advancement support - the development and deployment of advanced manufacturing technologies. This also makes use of the mini-factory for prototyping purposes.

Another benchmark model is the Manufacturers EnterCorp (MEC), a product realization access network headquartered in Kansas City and funded through a Technology Reinvestment Project. The MEC's team consists of the NIST Mid-America Manufacturing Technology Center (MAMTC), the DOE Kansas City Plant, the Center for Business Innovation, Los Alamos National Laboratory, Sandia National Laboratory, Lawrence-Livermore National Laboratory, several universities and community colleges, Sprint Corporation, and others. The MEC is a practical, comprehensive, integrated and electronically linked resource network that provides effective one stop service to manufacturers. It quickly pinpoints specific client needs and matches them with the network resources best able to fill them--regardless of geographic location. The MEC concentrates on assisting new product development, transferring technologies for improving productivity and product design, providing shared manufacturing and technology demonstration capabilities, and delivering pre-service and in-service training in manufacturing technologies.

Many other models exist that encompass all or part of the above as well as other functions. Among these is the Manufacturing Extension Partnership (MEP) sponsored by the National Institute of Standards and Technology (NIST). The MEP is a nationwide network of manufacturing extension engineers who provide a wide range of services to small manufacturers. It should be noted that ARRI and TEEX are part of a Texas partnership called the Texas Manufacturing Assistance Center (TMAC). TMAC will become part of the NIST network in 1995. The first year funding for TMAC will place approximately 45 engineers in the field. They will provide engineering and other services to small manufacturers to include:

- Manufacturing assessments - formal and informal assessments to determine needs, help establish relationships, and help build assistance plans.
- Referrals - referrals to third party providers of assistance.
- Technology awareness - seminars, workshops and other programs designed to improve awareness of modern manufacturing practices.
- Deployment groups - companies working together to solve common problems.
- Technical projects - specific technical solutions.
- Integrated solutions - larger more comprehensive projects

The relationship between TMAC and the MTDC is critically important for the MTDC in general and, in particular, for the manufacturing accelerator, the shared use facility,

and the product and process development center. TMAC will have 45 engineers (first year) working with small manufacturers from across the state to solve manufacturing problems. Through referrals, TMAC engineers will perform a very significant marketing and outreach function for the MTDC.

Shared Use Manufacturing Center

The concept of a "commercial time-share" facility is relatively uncommon except, again, as part of an incubator where facilities are shared for both prototyping and production purposes. Given that the shared use concept is explicit in the incubator/accelerator, the product and process development, and the teaching factory options, it was decided to combine the shared use manufacturing center with the teaching factory for management purposes. The shared use center will be available for all intended purposes to include prototyping, teaching and production.

Regional Trade /Distribution Teaching Factory

The importance of trade and distribution cannot be over emphasized. The advent of NAFTA makes this especially important for the stated service region. The trade/distribution teaching factory will focus on this function of manufacturing. From the analysis of the incubator and, particularly, from discussions with incubator operators, it is apparent that a key success factor is the existence of an ANCHOR tenant who will provide substantial cash flow to the organization. This coupled with the scarcity of good warehouse space in the region led to the conclusion that the existing warehouse space should be leased to a distribution company and leveraged as a teaching factory for distribution.

Results of Industry Focus Groups

The analysis options, as explained above, were presented to industry in a series of facilitated focus groups. The groups were led and facilitated by Vought Aircraft Company and were attended by a total of fifteen manufacturers and other stakeholders. The groups provided very detailed and valuable input pertinent to the design and operation of the MTDC. At the end of the sessions, the participants were asked to rank the five analysis options. These rankings are as shown below.

- First - Incubator/Accelerator
- Second - Shared Use Manufacturing Center
- Third - Product Development Center
- Fourth - Teaching Factory
- Fifth - Regional Trade/Distribution Teaching Factory

It must be noted that the group indicated that each of the analysis options have merit and are worthy of serious consideration.

Summary

Through the literature review, the interviews of incubator participants and management, and the facilitated workshops with industry representatives, the following opportunities and threats were identified for each of the analysis options.

MTDC Component	Threats	Opportunities
Manufacturing Incubator / Accelerator	low occupancy rate bad debt problems	new jobs new businesses lower failure rate of new businesses increased competitiveness of existing businesses low set-up costs I-35 corridor highway/airport access customer demand community support low fixed costs
Product and Process Development Center	customer demand set-up cost anticipation of equipment needs distance to critical mass of potential users	increased skill level of workforce increased competitiveness of new and existing businesses pull technology out of federal labs into mfg. new jobs new companies electronic data interchange

MTDC Component	Threats	Opportunities
Teaching Factory	ability to pay fees customer demand high fixed costs distance to critical mass of potential users cost of equipment and skill update anticipation of needs timeliness of response high set-up costs	increased skill level of workforce increased earning potential of workers increased competitiveness of existing businesses
Teaching Factory	ability to pay fees customer demand high fixed costs distance to critical mass of potential users cost of equipment and skill update anticipation of needs timeliness of response high set-up costs	increased skill level of workforce increased earning potential of workers increased competitiveness of existing businesses
Shared Use Manufacturing Center	cost of equipment and skill update high set-up costs high fixed costs anticipation of needs timeliness of response utilization by industry	increased skill level of workforce increased competitiveness of new and existing businesses

MTDC Component	Threats	Opportunities
Regional Trade/Distribution Teaching Factory	occupancy by anchor tenant distance from metropolitan area	new jobs new business I-35 corridor highway/airport access possible establishment of a free trade zone electronic commerce

3.3.3 Selection of Options and Conceptual Design of MTDC

It is concluded from the analysis that each of the five options analyzed have merit. The concept of a manufacturing incubator and accelerator seems to be the most attractive. Several designs were considered during the process of selecting a concept. It was concluded that in order to have the critical mass necessary, the broadest array of services must be offered. Therefore, elements of all options analyzed were combined into one unique MTDC concept.

The conceptual design of the MTDC, as shown in Figure 3.3.3-1, has four core components. The four components complement each other so as to make the best possible use of the facilities and equipment of the Central Facility. The incubator/accelerator and product/process development center options remain essentially the same as described in section 3.3.2. The teaching factory and shared use manufacturing center options have been combined into a single component. As a result of the input from industry, the trade center option has been significantly modified. In addition, a supporting Technology Resource Center, a supporting CAD/CAM Center, and an Outreach Center have been added. Each of the MTDC components is defined below at a conceptual level.

Manufacturing Incubator/Accelerator

The manufacturing incubator helps start-up manufacturing companies become viable by assisting in the development of products and processes and to initiate low rate production. The incubator makes use of existing assistance resources such as SBDC's, educational institutions, and other service providers, as appropriate. The accelerator is an industry focused facility where young existing companies are accelerated toward world class status through technical assistance, training, re-engineering, and development of capability and capacity.

Figure 3.3.3-1
MTDC Components

Product and Process Development Center (PPDC)

The product and process development center facilitates the development of both products and manufacturing processes for the manufacturing community. This includes a comprehensive approach to prototype design and fabrication, concurrent design of product and manufacturing processes, and market research. The center provides access to both technology opportunities and development expertise available from national sources. A special focus is the development of technology available in the federal laboratories. An ongoing federal laboratory presence is envisioned to be part of the supporting technology resource center.

Teaching Factory and Shared Use Manufacturing Center (Teach-SUM)

The teaching factory helps students from industry and academia learn advanced manufacturing methods and technologies. This facility enhances the competitiveness of the regional manufacturing community through hands-on cooperative training. Teaching factory staff support the training needs of the manufacturing community through on-site staff and, more importantly, through partnerships with educational institutions. The shared use manufacturing center is available to regional manufacturers to use for commercial purposes on a shared use basis. Manufacturers use both the manufacturing equipment and the computing facilities.

Regional Trade /Distribution Teaching Factory (RT/DT)

The facility also serves as a trade and distribution teaching factory. The regional trade and distribution teaching factory has two functions. It is an industry focused facility where manufacturing trade relationships are developed. International trade along the Interstate 35 Corridor between Mexico and the U.S. is of particular interest. The facility also serves as a trade and distribution teaching factory where advanced distribution concepts and technologies are taught in a hands-on working environment. Export assistance and international electronic commerce are integral to the RT/DT. A final aspect of the trade center is the use of the warehouse as a commercial venture. The rental of the space to a distribution company generates revenues and provides the essential element of realism to the distribution teaching factory.

CAD/CAM Center

The CAD/CAM center is an adjunct to the teaching factory and shared use manufacturing center. The center houses hardware, software, and expertise needed to support the computer aided design and manufacturing activities of the MTDC and its customers.

Technology Resource Center (TRC)

The Technology Resource Center is an adjunct to the product and process development center. The TRC will house information resources regarding federal technology available for transfer to the private sector. The center also houses technical experts and others from the federal laboratories, universities and other partnerships. These people assist manufacturers in the development and commercialization of technology. The library provides access to technical information.

Outreach Center

The outreach center supports all of the MTDC program elements by organizing and conducting workshops, seminars and classes. The classes include those offered by the two teaching factories. Distance education technology will enrich the offerings and impact of the Outreach Center.

Conceptual Layout

Figure 3.3.3-2 shows a conceptual facility layout for the MTDC as envisioned. The four core and three supporting components occupy most of the facility, as shown. The section shown as lease space will be offered to the community as high end office space. This space may also house one or more of the other proposed uses of the facility. The warehouse will also be commercially available, as indicated above. The High Performance Computing Center (HPCC) is assumed to exist as an independent entity cooperating with the MTDC. It is assumed that this space will not generate revenue for the MTDC.

Figure 3.3.3-2
Conceptual Layout of MTDC

3.4 MTDC Operations Design

The Manufacturing Technology Deployment Center (MTDC) will be organized as a not-for-profit corporation designed to provide practical, affordable solutions which address manufacturers' real needs. Funding will be secured for the first six years of operation. Due to the income supplied by the fees for services provided by such applications, external funding will be decreased during subsequent years until year six, at which time the MTDC will become fully self-supporting. The Automation & Robotics Research Institute (ARRI) and the Texas Engineering Extension Service (TEEX) will cooperate to manage the MTDC, under contract. The Manufacturing Technology Deployment Center (MTDC) contains the following components:

- Manufacturing Incubator/Accelerator
- Product and Process Development Center
- Teaching Factory and Shared Use Manufacturing Center
- Regional Trade /Distribution Teaching Factory
- Technology Resource Center
- Outreach Center
- CAD/CAM Center

These are the components of a single business, the MTDC. The MTDC has been designed to occupy the entire Central Facility for operations and lease space. In the event that additional EOI's are funded, the modular design of the MTDC allows for a reduction in scope to correspond to the floor space available. In addition, the High Performance Computing Center (HPCC), proposed under other studies, is important in attracting high technology, high skill, companies to the MTDC. The HPCC is assumed to exist as an independent entity cooperating with the MTDC on a rent-free lease.

3.4.1 MTDC Mission and Overview

The Manufacturing Technology Deployment Center is designed to be a public-private partnership between industry, academia, and government that enhances the global economic competitiveness of small and medium sized manufacturers in Texas, Louisiana, Oklahoma, Arkansas, and New Mexico. This will be accomplished through industry focused training and education, technical assistance, and the development and deployment of agile, clean, environmentally conscious, and energy efficient manufacturing technologies that reside in the Department of Energy, other federal laboratories, universities and colleges, and the defense program infrastructure.

The goal of the MTDC is to promote economic growth through the development and enhancement of manufacturing within the region. The objective is to create high wage, high skill jobs in companies whose competitiveness in the world market is enhanced by agile, environmentally conscious, and energy efficient practices. The MTDC recruits manufacturing and high technology firms both in and out of the area. Tenants are a mix of new and existing businesses that can utilize the services provided.

The MTDC, housed in the Central Facility, will occupy approximately 411,000 square feet of usable space, consisting of 147,000 square feet of office space, 160,000 manufacturing space, and 104,000 square feet of warehouse space. The MTDC uses space that includes office, manufacturing, and warehouse space all within close proximity of each other. In addition, the space includes some number of truck docks and designated parking. Due to the high visibility desired by potential tenants and participants, the MTDC must have a visible entrance and signage separate from the other potential uses in the Central Facility.

Participants and tenants are light manufacturing, R&D, high technology firms with a desire to develop into more agile, clean, and energy efficient companies. Selection criteria for tenants and participants include:

- potential to grow
- ability to create jobs
- focus on a specific industry
- ability to pay operating expenses
- business plan
- market analysis
- financial statement

The on-site staff of the MTDC include a director, managers, administrative assistants, technicians, and technical professionals. The MTDC director will be an experienced manager selected by the Board of Directors. MTDC staff will be well-versed in the capabilities of the MTDC, other SSC users, and the free and fee based service providers in the area. SCORE, SBDC, ARRI, TEEX, and other service provider staff will be provided temporary office and/or conference space to be used when providing services to MTDC clients. Professionals from the federal laboratories and academic research institutes will have on-site space to provide client services. This will facilitate the growth of the companies and the ease of service to the clients. In addition, distance learning conference capability may be provided to facilitate access to federal labs and universities.

3.4.2 Organization Structure

The management team responsible for the MTDC is comprised of an appointed board of directors, a full time on-site director, and several full time managers. Assisting the on-site director will be a marketing professional who will coordinate all marketing activities. This team will act to ensure the delivery of quality services to client companies. The individual responsibilities of each team member will be discussed separately.

The MTDC is governed by a Board of Directors selected from leaders in industry, academia, and government. The members of the board are not compensated for their time. The board provides overall guidance to the MTDC Director. The managers of the four major components report to the director. As shown in Figure 3.4.2-1, the administration and support personnel report to the director. The Outreach Center personnel report to the director. The Technology Resource Center personnel are managed by the PPDC Manager. The CAD/CAM Center personnel report to the Teach-SUM Manager. The aforementioned staff will be employed by ARRI and TEEX who will be the principle contractors for MTDC operations. The HPCC personnel are under the direction of the HPCC sponsoring body. The HPCC is an important component of the MTDC and is assumed to cooperate fully with the MTDC personnel and clients. Each of the four core components will operate as stand alone cost centers responsible for the associated programs. The MTDC will ensure that the various components and elements of the center cover program costs and provide high value services to customers in the five state region.

Figure 3.4.2-1
MTDC Organization Chart

Board of Directors

The Board of Directors is responsible for the general management and control of the activities and affairs of the corporation. The board is responsible for planning and formulating policy to guide the programmatic directions taken by the corporation and ensuring that all actions taken by the corporation are consistent with the MTDC by-laws. The board is responsible for the overall financial viability of the corporation. In order to fulfill these broad responsibilities the board's specific duties include the following:

- Reviewing annually and modifying as appropriate the mission statement and formulating near-term goals and objectives for the corporation that are consistent with the MTDC's established mission;
- Reviewing and approving all major financial commitments of the corporation;
- Approving an annual budget for the operation of the corporation before the beginning of the fiscal year;
- Reviewing and approving all revisions and amendments to the budget that affect total income and expenses in order to ensure that a deficit financial position is avoided;
- Conducting a mid-year budget review and revising the budget as required;

- Reviewing, on a quarterly basis, the budgeted versus actual finances of the corporation and 12-month cash projections;
- Reviewing and approving major new projects, programs and activities of the MTDC;
- Periodically reviewing ongoing board and staff activities to evaluate the effectiveness and appropriateness of these activities;
- Providing specific assistance to the manager and staff in the accomplishment of approved activities;
- Keeping the manager apprised of its independent activities;
- Electing new directors and officers of the board at its annual meeting and removing and appointing board members as necessary;
- Considering, preparing and approving, as appropriate, position and policy statements.

MTDC Director

The MTDC Director is responsible for the overall operation of the Manufacturing Technology Deployment Center. The activities involved in managing the MTDC require that the candidate chosen to fulfill the managing role will have experience in business management, accounting, public relations, journalism, and construction management, and possess an understanding of entrepreneurial relationships and associations. The director is responsible for implementing the projects, programs, policies and activities of the MTDC at the direction of the appointed board of directors. The director is responsible for the day-to-day operational and financial activities of the corporation and for the supervision of other salaried staff. In order to fulfill these broad responsibilities the director's specific duties include the following:

- Allocating the corporation's resources to implement the mission, goals, objectives and policies of the organizations of the organization and initiating and executing programs, projects and activities and making the decisions required for the day-to-day operations of the MTDC;
- Maintaining positive and mutually supportive working relationships with other organizations involved in economic development in the state and with the tenants of the incubator and other corporation facilities;
- Promoting economic development in the region and providing advice and counsel to individuals and groups requesting assistance with all aspects of economic development;
- Preparing press releases, contacting and responding to the media, and public speaking and making presentations;
- Implementing new activities and projects that are consistent with MTDC's mission, goals, and objectives provided the activities will not place the corporation in a deficit budget position;

- Attending to the improvement and more efficient utilization of the affiliate management program, and technical and office practice services;
- Managing the administrative and support staff, the managers of the core components, and the outreach efforts.

The director must act as a business consultant who regularly counsels and advises product-focused clients and tenants concerning the most advantageous avenues of managing their growing businesses. Additionally, the director is required to orchestrate access to external advisors who possess specialized knowledge and can offer their services to the MTDC. Because financial self-sufficiency is the ultimate goal by year six with graduated levels of self-sufficiency being achieved yearly until then, the director must possess the skills necessary to initiate income as well as budget and predict financial shortfalls. Therefore, the director will pay close attention to operating efficiencies and cost control.

It will be the responsibility of the director to act as an ambassador of the MTDC to the sponsoring organizations and to the community, which is perhaps more important than the internal roles performed by the director. Such a relationship between entities builds the MTDCs' credibility through ongoing management reporting and public relations activities. In this role, the director assures sustainability and growth of programs by seeking programmatic funding and other support. Additionally, the director must assess operational changes, determine whether the mission of the MTDC is being adequately met, and take corrective actions where needed.

Managers

There are four managers that report to the MTDC director, corresponding to the four core components of the center. All managers are required to orchestrate access to external advisors who possess specialized knowledge and can offer their services to the MTDC. The responsibilities of each manager are described below.

The PPDC manager is responsible for the operation of the Product and Process Development Center. The manager will staff the center to best achieve the center objectives. The manager has several engineers and engineering technicians within the center providing services to clients. The manager must coordinate services to clients with other MTDC components or outside services as appropriate. The PPDC manager is also responsible for the operation of the Technology Resource Center. The PPDC manager will coordinate the incorporation of federal laboratory personnel and academic researchers into the PPDC. These responsibilities are highly technical and require previous experience in a technology field.

The Manufacturing Incubator/Accelerator manager is responsible for the operation of the Manufacturing Incubator/Accelerator. The manager will staff the center to best achieve the center objectives. The manager must attract and screen manufacturing tenants and supporting industry tenants to the incubator/accelerator. The manager is responsible for the execution of lease agreements and the collection of fees. The manager must act as business consultant who regularly counsels and advises product-focused clients and tenants concerning the most advantageous avenues of managing

their growing businesses. The manager must coordinate services to clients with other MTDC components or outside services as appropriate. These responsibilities are technical and require previous experience in a technology field.

The Incubator/Accelerator manager recruits companies that have the potential to become successful in the MTDC. Tenant companies usually reside in an incubator between one and four years and frequently require additional space as they expand. In the incubator's high turnover environment, the director will be required to work with the incubator manager to recognize and balance pressure to maximize leased space and the need to retain space for expansion of existing tenants. The MTDC assists tenants and participants in developing mutually beneficial synergistic relationships among themselves. Acting as tenant advocate, the director will aid small business owners with grant proposals and with referrals to external sources of debt and equity financing.

The priorities of the director must be strongly biased toward participant development and success. It is reported in a study conducted by Collins, Coopers & Lybrand (1992) that full-time managers spend up to 60 hours a week with clients to advise and counsel them and to help them become more successful. The median amount of time was 10 hours per week spent in this capacity which is a decrease from the 15 -hour median reported two years earlier. Collins, Cooper & Lybrand also report that participants received the greatest amount of time from managers in facilities sponsored by community colleges and four-year universities. It is expected that the director of the MTDC will exceed this time constraint, and devote an even greater amount of time to individually counseling and advising.

The RT/DT manager is responsible for the operation of the Regional Trade/Distribution Teaching Factory. The manager will staff the center to best achieve the center objectives. The manager must attract and screen trade/warehouse/distribution tenants to the factory. The manager is responsible for working with the tenant company to develop the curriculum and schedule the courses; for the execution of lease agreements and for the collection of fees. The manager must coordinate services to clients with other MTDC components or outside services as appropriate. These responsibilities are technical and require previous experience in a warehousing and/or distribution field.

The Teach-SUM manager reports to the MTDC director and is responsible for the operation of the Teaching Factory and Shared Use Manufacturing Center. The manager will staff the center to best achieve the center objectives. The manager must attract and screen manufacturers to the factory. The manager is responsible for working with the client manufacturers to develop the curriculum and schedule the courses, working with the area education and training providers to provide the best instructors within the constraints of budget and time. The manager is responsible for the execution of lease agreements, the collection of fees, and for the safe use of the equipment by certified personnel. The operation of the CAD/CAM center as a resource to the MTDC is the responsibility of the manager. The manager must coordinate services to clients with other MTDC components or outside services as appropriate. These responsibilities are of a technical nature and require previous experience in a manufacturing field.

3.4.3 MTDC Management and Administration

Operations

The purpose of the main office is to house the administration of the MTDC. This office is the first point of contact the user has with the center. Trained personnel guide the user through the MTDC experience. First, the user is greeted by a staff person. The staff person assesses the users' needs to determine the specific course of action to be taken. Then, the user begins their journey at the MTDC.

Human Resources

The human resources required to support these objectives include a center director, administrative assistants, and community relations. These positions are described further in the table below.

Title	Role
MTDC Director	Coordination of center activities
Admin. Assistant	Accounting, scheduling, correspondence
Marketing	Marketing plan, brochures, advertisements, newsletter, press releases, mailings, annual reports, tours, hospitality Serves as a media coordinator and liaison between media and manager; develops and maintains contact with TV/newspapers/radio as well as design firms and printers, creates center's newsletter and brochure, prepares format utilizing Pagemaker (or similar) desktop publishing software, obtains or creates photos / illustrations using photographers, stock photos, clip/click art, or other software, makes all revisions, completes final layout for printer
Secretary/Reception	Word-processing, telephones, reception
Facility Engineer	Construction Supervision, Oversight of Telephone & Utility Installation, Repair/Replace equipment

3.4.4 Manufacturing Incubator/Accelerator

Operations

The manufacturing incubator/accelerator is an industry focused facility where start-up manufacturing companies use the facilities to develop product and processes and to initiate low rate production. The accelerator is an industry focused facility where young existing companies are accelerated toward world class status through technical assistance, training, re-engineering, and development of capability and capacity.

The manufacturing incubator provides small, entrepreneurial businesses with manufacturing, technical, business, and management assistance, affordable space, and shared support services. The incubator nurtures the manufacturing company, helping it survive and grow during the vulnerable start-up period. The manufacturing incubator/accelerator works with companies that are selected on the basis of criteria, including financial information, business plan, and personal interview. The incubator/accelerator provides the wide range of services listed below. Critical to the success of the incubator is a highly motivated and knowledgeable staff that can facilitate access to existing free and fee based services. It is the intention of the incubator to work with existing service providing organizations to prevent duplication of services and to facilitate higher utilization of existing services.

- manufacturing assistance
- product development assistance
- machining equipment access and education
- networking with other companies
- federal lab technology transfer assistance
- business operation assistance
- administrative and secretarial services, receptionist/answering service
- conference rooms, audio/visual equipment, computer resources
- word processing, bookkeeping, photocopying
- telecommunications equipment and services
- warehousing, shipping and receiving
- financing and capital acquisition
- university faculty and library access
- strategic planning
- environmentally conscious manufacturing techniques
- NAFTA assistance
- free and fee business assistance knowledge
- education in manufacturing live and distance learning
- on-site access to free and for fee business services
- foreign trade assistance
- accounting and legal services

The incubator will refer companies to appropriate existing service providers such as the SBDCs, SCORE, Chambers of Commerce, and local banks. In addition, service providers will be invited to participate in the incubator to provide services on-site.

The incubator has room for up to 25 companies at 1600 square feet each. The 63,000 square feet of the incubator facility will have approximately 40,000 square feet of space available to these companies in the form of office and factory floor space. This space can be subdivided into areas ranging from 140 square feet to 6000 square feet, depending on the needs of the company. The incubator has access to the Teach-SUM manufacturing shops and the other services of the MTDC. Incubator/accelerator companies are added to the MTDC in a phased approach. The companies lease space using a formal lease agreement. The companies will graduate by the end of their fourth year or when their profitability is at a certain level to be defined by the MTDC Board of Directors.

Human Resources

The human resources required to support these objectives include a center manager, administrative assistants, and information resource manager. These positions are described further in the table below.

Title	Role
Incubator Manager	business analyst and leasing manager
Admin. Assistant	scheduling, bookkeeping
Technology Deployment Specialist	referrals, evaluate needs and locate resources to be used by tenants.

3.4.5 Product and Process Deployment Center

Operations

The Product and Process Development Center (PPDC) is an industry focused facility designed to facilitate the development of both products and manufacturing process for the manufacturing community. This includes a comprehensive approach to prototype design and fabrication, concurrent design of product and manufacturing processes, and market research, with special focus on the development of technology available in the federal laboratories.

The product development center works with manufacturing companies to pull appropriate technologies out of the federal laboratories. These technologies will be both product and process related. Product technologies are patented or non-patented ideas, materials, or devices that can be used in or compose a product manufactured by the company. Process technologies are patented or non-patented techniques, materials, devices, or ideas that are used to manufacture products for the company.

The product development center works with companies throughout the five state region. Companies visit the center to work with skilled professionals to learn more about these technologies. In addition, hands-on assistance in using the technology is available. The expertise of the federal labs will be accessed to assist companies in product and process development. Cooperative agreements and licensing agreements

will be facilitated through the center. Companies may use the equipment available at the MTDC to produce prototype products or try out new manufacturing techniques. The product development center is a resource for the manufacturing incubator/accelerator. Companies pay a fee for services, depending on type of service and duration. It is anticipated that the synergy with the High Performance Computing Center will prove beneficial in attracting the desired participants. By utilizing the services of the center, these participants are those that can help bring new products and services to market, create new high-wage jobs, and upgrade existing jobs.

To further support the theme of agile, environmentally conscious, and energy efficient manufacturing, technologies from the federal labs and universities will be brought to bear on solutions to participant company problems. Both TEEX and ARRI have experience in accessing federal technologies and university technologies. A distance learning conference room containing audio/visual communication equipment will be utilized to communicate with these sources. This communication capability provides the potential for distant college, university, and professional credit and non-credit courses to be delivered to participants. In addition, pertinent seminars on manufacturing technologies from federal labs and distant companies may also be offered to participants.

Human Resources

The human resources required to support these objectives include a center manager, administrative assistant, engineering staff, and information resource manager. These positions are described further in the table below.

Title	Role
Product and Process Development Center Manager	coordinate center activities, write contracts, coordinate activities with federal labs and research institutes
Admin. Assistant	word-processing, correspondence, bookkeeping
Technology Deployment Specialist	referrals, evaluate needs and locate resources to be used by clients.
Engineering Staff	assist in product and process development

3.4.6 Teaching Factory and Shared Use Manufacturing Center

Operations

The Teaching Factory and Shared Use Manufacturing Center (Teach-SUM) is an industry focused facility where students from industry and academia learn advanced manufacturing methods and technologies. This facility enhances the competitiveness of the regional manufacturing community through hands-on cooperative training. The shared use manufacturing center is available to regional manufacturers to use for

commercial purposes on a shared use basis. Manufacturers use both the manufacturing equipment and the computing facilities.

The Teach-SUM offers courses in CAD/CAM, machine operation, machine maintenance, enterprise excellence, industrial math, industrial reading, industrial safety, presentations, quality assurance, statistical quality control, shop management, supervisory skills, tooling and fixturing, process planning, component design, shop aids, negotiation skills, quick change tools, one-piece flow, just-in-time inventory systems, load balancing, and factory simulation.

The Shared Use Manufacturing equipment is available to companies at a fee. The equipment is operated by Teach-SUM certified operators to produce products or to develop processes. The Teach-SUM operates the CAD/CAM center which is available to users for a fee.

Courses lead to certification in Department of Labor trades, credit at community colleges, or continuing education units. Courses will be offered by local community colleges and Texas State Technical College through agreements with the MTDC.

Human Resources

The human resources required to support these objectives include a center manager, clerical assistant, instructors, machinist, maintenance, engineering staff, and information resource manager. These positions are described further in the table below.

Title	Role
Center Manager	coordinate activities, schedule classes and machine time, manufacturing counseling
Admin. Assistant	perform secretarial and administrative duties
Technology Deployment Specialist	referrals, evaluate needs and locate resources to be used
Engineering Staff	assist in product process development
Machinist	operate machines, instruct, maintain machines
Instructors	prepare instruction materials, instruct courses, counsel students, operate machines, .
CAD/CAM center operator	maintain CAD/CAM network, administer user accounts, help users with
Maintenance	maintain machines.(electrical, pneumatic, hydraulics, controls)

3.4.7 Regional Trade/Distribution Teaching Factory

Operations

The Regional Trade/Distribution Teaching Factory (RT/DT) is an industry focused facility that enhances the competitiveness of the regional trade and distribution community through hands-on cooperative training. The center warehouse is available to companies to use for commercial purposes on a lease basis. The host company operates a working warehouse and trade center while warehousing, distribution, and international trade is taught to students.

The RT/DT, in partnership with local community colleges, offers courses in logistics, trade and tariff regulations, trucking and bills of lading, intermodal transportation, industrial safety, inventory accounting, warehouse equipment operation, enterprise excellence, industrial math, industrial reading, presentations, quality assurance, statistical quality control, warehouse and distribution management, supervisory skills, negotiation skills, and just-in-time inventory systems.

Critical to the success of the MTDC is the lease of a major portion of the facility to one or more anchor tenants. The ideal anchor tenant would be a successful company that is looking for a place to expand their operations. The tenant or tenants would ideally require the use of the entire warehouse and a portion of the office and manufacturing space. The location of a properly selected anchor tenant would help attract other desirable tenants to the incubator. These other tenants would want to locate near the anchor because they may be in related industries, may be customers or suppliers to the anchor tenant, or may be aware of the success of the anchor tenant within the facility. The other obvious benefits of an anchor tenant are stability of rental income and stability of occupancy. With a large anchor tenant, the job of the MTDC director becomes more of that of a business catalyst and less of that of a property leasing manager. The catalytic effects are those that produce the economic benefits desired. The recruitment of an anchor tenant is obviously a critical start-up issue. Assistance from state and local economic development agencies will be essential and will be sought.

Human Resources

The human resources required to support these objectives include a center manager and clerical assistant. These positions are described further in the table below.

Title	Role
Center Manager	manage center, coordinate incorporation of students into program, schedule classes, coordinate curriculum, secure funding, leasing manager
Admin. Assistant	correspondence, bookkeeping, phones

3.4.8 Technology Resource Center

Operations

The Technology Resource Center (TRC) is a facility operated by the Product and Process Deployment Center where technologies available from the federal laboratories and the universities are catalogued and organized in such a manner as to make them readily available to the public. The repository would have an electronic database with a user-friendly graphical interface that facilitates the intelligent access of the technologies. Personnel from the network of laboratories are located on-site to counsel and guide users. The video conference room is used to link distant labs and universities with the MTDC users.

The center provides access to and instruction on Internet, Mosaic, Worldwide Web, Dialog, NASA Recon, NTIS, and other pertinent electronic bulletin board services.

Research is tedious, time-consuming and often overwhelming. It is also necessity for technology deployment. On-line searching is an effective tool. The technology resource center operates an on-line electronic database with an intelligent query capability to facilitate access to required information. TRC personnel will update the databases and assist users in performing searches. Searches locate information on federal laboratories, technology literature, marketing, patents, and other pertinent topics. The library contains government publications, technical journals, and trade publications.

Human Resources

The human resources required to support these objectives include several information technology professionals. These positions are described further in the table below. In addition, personnel from the Federal labs will be on-site to counsel and guide users. The number of Federal people will depend on demand and funding.

Title	Role
Information Technology Specialist	coordinate incorporation of fed lab folks into program, database front-end design and programming,
Programmer	database front-end programming, test, maintenance
Network Administrator/Operator	accounts, maintenance of machines, scheduling
Technical Librarian	access information for users, cataloging, referencing

3.4.9 CAD/CAM Center

Operations

The CAD/CAM Center is operated by the Teach-SUM. It provides access to and instruction on high-end CAD/CAM hardware, software, and philosophies.

Human Resources

The human resources required to support these objectives include two CAD/CAM network administrators. Classes will be taught by professional instructors on a contract basis. These positions are described further in the table below.

Title	Role
Network Administrator/Operator	accounts, maintenance of machines, scheduling

3.4.10 Outreach Center

Operations

The Outreach Center reports to the MTDC director. It supports each of the other program elements by organizing and conducting workshops, seminars, and classes, including those offered by the two teaching factories. The outreach personnel work with the director and the marketing/publicist to produce the catalog of services and course offerings.

Human Resources

The human resources required to support these objectives include an outreach specialist, graphic artist, and a clerical assistant. These positions are described further in the table below.

Title	Role
Outreach Specialist	coordinate the outreach program and produce appropriate documents
Graphic Artist	desktop publishing software user, create camera ready art and layouts, arrange printing
Clerical Assistant	word processing, phone, correspondence

3.4.11 Lease Space

The four core and three supporting components occupy most of the facility. A portion of the facility is reserved as lease space that will be offered to the business and research community as high end office space. The space may also be occupied by one or more of the other proposed uses presented by other EOI studies. The office space has at least four connections for phone and data per office. The AT&T PBX equipment is able to serve 10,000 connections. The leasing of this space will be the responsibility of the director.

3.4.12 High Performance Computing Center

The High Performance Computing Center (HPCC) was originally established by the SSC for physics experiments and accelerator systems design. The HPCC is a UNIX workstation farm consisting of 120 workstations organized in groups that are tightly coupled by FDDI and Ethernet. Typical workstations are HP 9000/735, SUN Sparc 10, and SGI 4D/360s. Each workstation has 6 processors with at least 64MB RAM and 1 gigabyte disk per processor. An additional 150 gigabytes disk space is provided by four SGI Challenge L file servers. Two Summus STL-2300-12 tape robots store archives. An Intel iP860 Hypercube with 64 nodes can be used for massively parallel scientific and technical applications for processing complex models, typical of many advanced engineering and scientific fields. Due to its modular architecture, the HPCC can be upgraded and expanded.

The farm is accessible via Internet and is available for batch and interactive use. The large amount of disk space is ideal for distributed databases and information retrieval systems.

The HPCC is assumed to exist as an independent entity cooperating with the MTDC. It is assumed that this space will not generate revenue. Staffing for the HPCC will be determined by the independent entity.

3.4.13 Marketing Strategies

Developing a public relations program is one of the most cost-effective methods available for promoting the MTDC and its services. Among the public relations activities that the director will undertake with the support of the marketing professional are media relations, public speaking, newsletters, brochures, slide shows, and videos. Rather inexpensively the director will be able to bring the center and its participants to the attention of influential community members, including politicians, business leaders and key professionals (from Ellis County as well as the Dallas-Fort Worth metroplex). The goals of the public relations program will be to increase funding levels and the number of participants. Advantages may not be realized immediately, but in time, the center will benefit from increased and steady exposure to various audiences. The internal benefits will be that public relations activities will help build staff morale and help foster camaraderie among tenants and other participants. Greatest attention will be given to media relations and public speaking which are the two most readily implemented and cost-effective elements of a public relations program.

It is important that the director and the marketing professional maintain good media relations, therefore it is important that the marketing professional report activities concerning the MTDC that are newsworthy and of interest to the public. Because Ellis County is in close proximity to the Dallas-Fort Worth metroplex, Dallas and Fort Worth news media will be valuable resources in informing the public about MTDC activities.

The marketing professional will be responsible for preparing news releases and contacting the media, and also will be active in reporting events that will interest the public such as:

- Receipt of funding (stressing how the funding will help the MTDC have a greater impact on the local as well as the state, and possibly national economy);
- Tenant activities (announcing new tenants, tenants whom graduate from the incubator's aid, unique enterprises, and "success stories");
- Participant success stories in all the four core components and the success generated by working cooperatively with other state, local, and federal service providers;
- Election of board members and staff appointments;
- Workshops or seminars scheduled for small business owners;
- New program funded or new service offered;
- Information from annual report (such as the number of local employees using incubator services, number of jobs created, gross revenues of incubator firms and the resulting impact on the local economy).

Additionally, the director and marketing professional will make personal contact with Ellis County and Dallas-Fort Worth news media in order to build personal relationships with them. Media personnel are more responsive and consequently easier to work with if personal relationships are established. Media will include newspapers and news services, radio, and television. Representatives from the Associated Press and United Press International will be contacted and relationships maintained.

News releases will be written by the marketing manager and reviewed by the director. Information concerning deadlines will be obtained and observed. When strong relationships have been developed with news media representatives, the MTDC may be able to provide information to the editor or reporter in the form of fact sheets and background information packets. In order to prepare a facts sheet, the marketing professional must work with the participant in order to produce a sheet of facts listing pertinent information about the company: when founded, number of employees, type of manufacturing done, types of products produced, unique products and applications. The background information packet must be prepared by the marketing professional and tenant, and should include the company's annual report, sales brochure, fact sheet and additional information that will provide media personnel with useful information for preparation of stories. Background information packets help assure accuracy and in-depth coverage and serve to strengthen interest in the story.

Additionally, the MTDC will take advantage of Public Service Announcements to inform listeners and viewers about worthwhile non-profit endeavors such as informational meeting and presentations, direct mail marketing or an "open house" or tours of the MTDC and its tenant firms.

Public speaking is one of the most effective and inexpensive avenues of promoting the incubator and tenant firms. The MTDC directors and professional personnel will seek

opportunities to speak publicly when deemed appropriate. Many groups, whose members can offer support and services to the MTDC, will be contacted by the manager. Among these, for example, are civic and community groups (Rotary, Jaycees, etc.), business services organizations (SCORE), chambers of commerce and professional groups (legal, accounting, banking). The speaker may use slide shows or videos, both of which are low-cost options.

The director and marketing professional will work together in producing newsletters and a brochure as effective means of creating and maintaining visibility for the MTDC. These will be used to provide information to supporters about the MTDC and its services, as well as news and information pertaining to tenants and the incubation industry. These documents will be instrumental in recruiting new participants and seeking sources of funding. A brochure must be maintained in order to promote the incubator. The brochures will be used as handouts, placed in professional offices and agencies and included in grant proposals and news media packets, serving as supporting documents.

3.4.14 MTDC Partnerships

The greatest value and perhaps the largest economic development potential of the MTDC concept lies with the scope and quality of the existing and future partnership networks. The existing partnerships formed by the members of the study team presently provide limited manufacturing assistance services to a 15 state area as shown in Figure 3.4.14-1. The conversion of the SSC Central Facility into the MTDC will facilitate the creation of a *regional technology alliance* formed by service providers in Texas, New Mexico, Oklahoma, Arkansas, and Louisiana.

Existing MTDC Partnerships

Figure 3.4.14-1

This new *regional technology alliance* will enhance the existing service relationships through the "one stop shop" structure of the MTDC and accelerate the expansion of electronic commerce throughout the region. Additionally, the MTDC will allow the five states to have greater access to federal and university laboratory technology and provide concentrated resources for commercial product/process development and eventual deployment into the private sector.

The recent NIST award to Texas for the funding of the Texas Manufacturing Assistance Center when combined with the service abilities of the Oklahoma Center for the Advancement of Science and Technology, the Arkansas Science and Technology Center and the Louisiana Productivity Center through the MTDC will create a multi-state regional network to support technology development, deployment, and education as shown in figure 3.4.14-2. Additionally, TMAC partners have existing relationships with several institutions and corporations in Mexico and Latin America which will benefit U.S. companies in taking full advantage of NAFTA export opportunities. The TMAC network through its El Paso member has a direct connection with the NIST sponsored New Mexico Inc. manufacturing extension network which will facilitate greater access and cooperation between regional customers.

Figure 3.4.14-2

The Texas Department of Commerce has expressed interest in linking the Texas One and Texas Marketplace data bases into the MTDC which will facilitate the economic commerce activities associated with the center.

The intent of the MTDC is to provide resources to local community and technical colleges for the delivery of technical courses. The facility would essentially be available for these service providers to use the center's instructional facilities and

technical outreach services to meet the needs of their associated customer base. The Dallas Community College, Navarro Community College and Texas State Technical College have all expressed an interest in using MTDC facilities. Additionally, these educational providers would be involved in developing and serve as deployment networks for technical courses and instructional materials created at the MTDC.

Both TEEX and ARRI have long standing contractual relationships with Small Business Development Centers and the Economic Development Administration. Each of these organizations would be used through the appropriate referrals by MTDC to its customers. Additionally, the strong TEEX and ARRI presence in the Metroplex will facilitate linkages with chambers of commerce, economic development corporations and other service providers. The existing TEEX and ARRI contracts with the CALS Shared Resource Centers located in Texas will be used to promote services in electronic commerce for MTDC customers.

One of the strongest aspects of the MTDC is the involvement of the federal laboratories in the development, deployment and education of manufacturing and environmental technologies. The Los Alamos National Laboratory (managed by the University of California) brings expertise in:

- advanced computing and modeling
- advanced materials selection and processing
- environmentally conscious manufacturing technology
- advanced manufacturing technology
- energy efficiency and conservation
- medical instrumentation
- real time monitoring and control
- advanced polymers

The DOE Kansas City Plant (managed by Allied Signal, Inc.) possesses expertise in:

- high reliability electronics design and manufacturing
- high tolerance machining
- electromechanical design
- environmental conscious manufacturing
- advanced materials processing
- process control

The MTDC will allow companies to have direct access to these federal facilities through electronic and face to face contact. This contact combined with the extensive technology and business support located at the center will overcome many of the distance and bureaucratic hurdles that prevent effective technology development and deployment from the federal government into the private sector. The inclusion of federal representatives on site at the MTDC will extend the normal "*outreach*" activities

and greatly enhance the public understanding and appreciation for federal research. These same services will be applied to other sources of technology such as university research laboratories and non-profit research facilities (represented by Southwest Research Institute).

3.5 MTDC Facilities Design

The following sections describe the facilities design for the Manufacturing Technology Deployment Center (MTDC) to be located within the existing Superconducting Super Collider Central Facility building in Waxahachie, Texas. The facility houses the Manufacturing Incubator/Accelerator, Product and Process Deployment Center, Teaching Factory and Shared Use Manufacturing Center, Regional Trade/Distribution Teaching Factory, Technology Resource Center, CAD/CAM Center, Outreach Center, Lease Space and High Performance Computing Center as described above.

Site visits were conducted to collect information on the layout, mechanical and electrical configurations, and suitability of areas within the facility for this design. The mezzanines in the factory area were not used since (1) there is currently no handicapped access to the mezzanines, and (2) the load rating for the mezzanines has not been determined for use in a manufacturing environment. An engineering study should be conducted to assess the load rating before planning use of the mezzanines within the factory area. All assumptions used to develop this facilities design are listed in section 3.5.4.

The cost data is based on references as listed or upon experience, no actual bids for any portion of this proposal were solicited or made. Allowances have been added for estimating purposes to cover contingencies. The layout design utilizes existing facilities to the greatest extent and benefit for the purpose and to minimize costs of renovation.

3.5.1 Overview

The Central Facility is located within the city limits of Waxahachie, Texas on Highway 77 only 1.4 miles south of Highway 287. The building was a privately-owned warehouse prior to purchase by the State of Texas. The building has metal exterior trim and skin surrounding large span steel framed high-bays supported by steel columns on a slab foundation. The 45.85 acre site is generally level with drainage being primarily to the west. The facility was planned as a 31 foot clear distribution facility with office support in the semi-detached scheme. Access to the site is on a feeder road of approximately 1600 feet. Newly provided parking areas and existing parking total 1208 spaces with truck court areas in front of the dock. A newly erected traffic light now controls the Intersection along with a new turn lane coming south on Highway 77. The facility does not front Highway property. Rail service is not provided on site but could be provided with site improvements to support a spur and redirection of the existing drainage. The structure of the main portion of the facility is considered a manufactured steel building. Structural bays are nominally 41' by 45'. The sheet steel exterior skin of the facility has lap joints that run in the vertical direction. The steel reinforced 5" concrete floor is placed on select fill and a vapor barrier.

3.5.2 Existing Facility/Infrastructure

Space Categories

The Central Facility is an improved metal structure with parking lot, truck docks, and all utilities. The building is generally utilized in three categories: (1) office, (2) labs/shops and (3) warehouse. The breakdown of the 555,837 square feet is as follows.

Description	Square Feet
Office	119,722
Conference	8,405
Server Rooms	5,147
Food Service	3,658
Flex Space (Office)	9,625
General Storage	346
Lab, Shop & Medical	160,265
Warehouse	104,236
Sub-Total Occupiable Space	411,454
Non-Occupiable Space	144,383
Total	555,837

Office

The office environment is designed for modular office furniture systems. The dropped 12' lay-in ceilings provide all air conditioning, power feeds, lighting at roughly 30 foot-candles, and fire protection. Cooling towers provide condenser water to DX style fan coils on structural mezzanines. Electrical substations and electrical closets are located in core areas. Above the ceiling is a fully integrated suspended cable tray network which can provide data and communication cabling for all areas. Data/Communication/network distribution rooms are strategically located within 300' of all occupied areas. All Data/Communications rooms are provided with specialized air conditioning units and raised floors. Adequate restrooms meet all occupancies and codes for ADA criteria.

Labs/Shops

A major investment has been made in setting up a number of specialized laboratories in the environmentally controlled, high bay area of the Central Facility. According to SSC Central Facility documentation, each has been furnished with state of the art equipment that permits the development of new products, the enhancement of existing systems and the collection of data necessary to make experimentation and development useful to others. About 80,000 square feet of the laboratory serviced by a

network of bridge cranes varying in capacity from ten to thirty five tons. The lab space is also serviced by loading docks within the environmentally controlled areas provides easy access for transferring equipment in and out of the shop/lab. The high-bay central area is surrounded by hard-wall labs containing special equipment for manufacture and testing of mechanical and electrical components/systems. Laboratories that require special cleanliness levels have been fully enclosed and air conditioned. Specialized Radio Frequency (RF) screen rooms are also located within the lab space. Enclosures have been constructed around areas where hazardous operations are to be accomplished.

The Central Facility is serviced with a low conductivity cooling water system (LCW) and a compressed air system. The LCW system has an overall capacity of 2000 GPM at a maximum pressure of 120 psi. Most lab areas are serviced with LCW, conventional electrical power, shop air, computer Ethernet wiring and telephones. A portion of the laboratory is provided with cryogenic capability which permits superconducting component investigations at temperatures of 4 degrees Kelvin. The Central Facility also has a central compressed air system consisting of four duplex air compressors capable of supplying 600-scfm at 125 psig total full-load capacity.

The laboratory has a 400 sq. ft class 1000 clean room facility to provide precise temperature control and clean environment to perform precision instrumentation and equipment assembly. Inspection of components, assembly of coils and the magnetic measurement and alignment of conventional and superconducting magnet assembly.

This specially constructed space is separated from the office space by a 2 hour fire separation wall. Space is (31' clear) conditioned with the use of direct condenser water supplied DX units. All HVAC is ducted supply and free direct return. A high (277/480V) and low (120/208) voltage buss bar distribution system has been provided above all lab spaces. This allows maximum flexibility for configurations to be changed with minimum disruption. Fire protection is classified ordinary hazard and is at the deck level. There are three overhead bridge cranes ranging in lengths from 180 feet to 416 feet. Bridges are top running single girder with ratings of 10 to 35 tons. Hook heights are approximately 23' to finish floor. One 10' freestanding floor mounted 3 ton jib crane exist. Lighting is deck mounted high pressure sodium with supplemental fluorescent strip lights at 12' in machine shop areas. A very extensive compressed air system is provided throughout. A Low Conductive Water system (LCW) is piped throughout the facility in schedule 10 stainless steel. Floors have been coated for safety and for aid in lighting.

Warehouse

The warehouse has roughly a 24' clear space and is separated by a 4 hour fire wall with bays at 41' by 45'. A mezzanine structure of 11,000 sq. ft. is across the front staging area. Fire protection is provided and is classified for ordinary hazard. Fire hose stations can be re-equipped. The concrete floor of the warehouse has been sealed. The space is cooled by typical cooling-only roof top mounted units. Heating is provided by gas fired infrared heaters. There is no electrical distribution since space has been outfitted with racks for storage.

Infrastructure

The facility is served with 12.47 KVA of primary power from Texas Utilities to two locations on the south side of the building and one new primary power service termination on the north side.

An additional sewer line has been provided along the south service drive to the city main near the south west corner. Storm drainage is all exterior to surface collection which drains to the paved areas. From there a subsurface system carries drainage to the west and then north side. A drainage swale exist between the west facade and the property line.

3.5.3 Existing Equipment

It is the intent of the MTDC to use much of the equipment on-site at the Central Facility as of October 1994; including the warehouse racks, specific manufacturing equipment listed below, shop workbenches, modular office furniture, and HPCC, CAD/CAM, and desktop computers. This equipment will be used to support the activities of the MTDC.

Equipment List to Support Shared Use Manufacturing Facility

DESCRIPTION		QUANTITY
SURFACE PLATE.	4'x5'	1
VERTICAL BAND SAW	DoAll Model V-60	1
SHEAR	Atlantic Model HDS	1
PRESS BRAKE	Atlantic Model HD 135-8-6	1
POWER NOTCHER	Unipunch Model EHN 260	1
VERTICAL MACHINING CENTER	LeBlond Makino Model FNC 106	1
MACHINING CENTER	Mazak 35N-ATC CNC	1
CNC LATHE	Hardinge Model CHNC-1	1
CONVENTIONAL LATHE 1	Monarch EE	1
CONVENTIONAL LATHE 2	Hardinge HVL-H	1
CONVENTIONAL LATHE 3	Monarch 20	1
CONVENTIONAL LATHE 4	Harrison	1
MILLING MACHINE 1	Bridgeport Series II	1
MILLING MACHINE 2	Bridgeport Series I	1
PEDESTAL GRINDER	Baldor 6" diameter	1
SANDBLASTER	Trinco Dry-Blast	1
RADIAL DRILL PRESS	Powermatic	1

DESCRIPTION		QUANTITY
WELDING MACHINE 1	Thermal Dynamics Stak-Pac	1
WELDING MACHINE 2	Miller Sycrowave 350	1
WELDING MACHINE 3	Miller Deltaweld 451	1
WELDING MACHINE 4	Miller Shopmaster 300 ac/dc	1
5 TON CRANE	Abacus Acculift	1
PRECISION MACHINING CENTER	Charmilles Technologies Robofil 6000	1

3.5.4 Facilities Design

Approach

As mentioned above, the MTDC will house four core components and three supporting components. Complete layout drawings of the facility are included in the appendix. The components will share the shipping/receiving areas with securable spaces for temporary storage. A full service machine shop and welding center is designed for shared use by the components as part of the teaching factory. The machining area is centrally located beneath a 20-ton bridge crane. The approach used in this design is to leave the machining area open to access by the crane. If resident manufacturers require access to cranes or cannot reside within a walled structure, they can be accommodated beneath the other bridge crane in the eastern portion of the Manufacturing Incubator/Accelerator.

The conceptual design accommodates a full-time staff of the MTDC to provide management assistance, clerical and technical support, common use copiers/mail room, machine shop/tool crib, and maintenance. Conference rooms are provided for use by all residents/staff.

The Regional Trade/Distribution Teaching Factory utilizes existing office/lab space to accommodate incoming client manufacturers with modifications made for accessibility/security. Additionally, construction and reconstruction is made to accommodate resident full-time staff, reception area, conference room, and mail/copy room. Construction of an outside entry/facade and inside aesthetic and safe entryway is also included in this portion of the conceptual design.

The existing offices offer a range of square footage from 320 ft² to 2100 ft², with the option of subdividing larger offices if needed.

Assumptions

Below is a list of the assumptions used for the conceptual facilities design. The assumptions made were based on information gathered during the site visits and from the project leaders.

- The existing Mechanical, Electrical, and Plumbing systems (MEP) system will be sufficient to support this facility design. Where enclosed offices are constructed, ducts will tie into the existing system with the addition of air control mechanisms for controlling air flow within the enclosures.
- All equipment specified in the machine shop and welding area is located in the existing SSC Central Facility building and will be available for use in this design.
- No additional production equipment will be purchased for this facility design, except as specified for construction or renovation.
- No equipment, workbenches, or office furniture is included for any of the tenant manufacturing areas. For this facility design, only floor space, utilities, and HVAC are provided for in these areas. It is suggested that the over 100 electrified workbenches being stored in the facility at this time be used to support the MTDC.
- A separate outside entrance will be provided on the north side of the Central Facility building at the entrance to the Regional Trade/Distribution Teaching Factory.
- Each mechanical/electrical substation services approximately 23,400 ft². The substations in this facility will be sufficient to provide adequate utilities, heating and cooling.
- The compressed air supply is 125 psi maximum and is sufficient for the machining center use and general use by the client manufacturers.
- Electrical utilities are located on a raceway grid within the facility, running overhead. This minimizes the costs of rearrangement/construction for this conceptual facility design.
- The electrical supply is sufficient for the majority of manufacturing facilities to be resident in this design (480V/3 phase, 208V/3 phase or single phase). No additional MEP are included in this proposal.
- Existing toilet facilities in the facility conforms to OSHA guidelines regarding the number of toilet facilities required. For this conceptual facility design, no additional restroom facilities will be constructed.
- Voice and data communications lines exist in most areas and the cost to drop new lines is minimal.
- All new construction must meet OSHA, Americans with Disabilities Act (ADA), and all other federal, state, and local building codes that apply.
- The SSC has secured the necessary emissions and waste stream permits relative to the former SSC operation. The MTDC will ensure that the addition of new tenants within the facility will acquire all necessary permits relative to starting operations.

3.5.5 Construction Requirements

Cost Estimating Factors

Below is a list of the estimating factors used to derive the construction cost estimates. The costs assume construction using similar materials to the existing facility.

New Construction:	
Drywall - 10' high partitions	\$ 18.75/lineal foot
Drywall - 12' high partitions	\$ 25.00/lineal foot
Painting - walls	\$ 1.13/square foot
Painting - door frames	\$ 31.00/each
Doors, Frames and Hardware:	
3' opening	\$ 538.00/each
6' opening	\$ 788.00/each
Acoustic Ceiling & Lighting	\$ 1.75/square foot
HVAC routing	\$ 2.00/square foot
Fire Protection - drop sprinkler heads	\$ 88.00/head (one head per 100 square feet)
Renovation:	
Painting existing walls	\$ 0.63/square foot

All estimating factors listed above were provided by the SSC Facilities department staff. Thanks to Jeff Lanier, Burger Hurtz, and John E. Walker for their assistance.

Cost Estimates for MTDC Construction and Renovation

The cost of construction and renovation of the Central Facility is broken down by the components of the MTDC. This cost is included in the business plan as year 1 construction costs. The following table summarizes the construction costs for each component. More detailed information is included in the paragraphs that follow.

<i>Manufacturing Incubator/Accelerator</i>	
New Construction	\$114,675
Renovation	<u>\$30,881</u>
Total	\$145,556
<i>Teaching Factory and Shared Use Manufacturing Center</i>	
New Construction	\$20,919
Renovation/Rearrangement	<u>\$6,545</u>
Total	\$27,464
<i>Regional Trade/Distribution Teaching Factory</i>	
New Construction	\$36,652
Renovation	<u>\$9,138</u>
Total	\$45,790
<i>Technology Resource Center</i>	
Renovation	\$24,533
<i>Product and Process Deployment Center</i>	
Renovation	\$18,222
<i>Lease Space</i>	
Renovation	\$80,384
<i>MTDC Admin. Office and Outreach Center</i>	
Renovation	\$17,010
<i>High Performance Computing Center</i>	
Renovation	\$13,538
<i>CAD/CAM Center</i>	
Renovation	\$7,138
Grand Total for Construction/Renovation	\$379,635

Within the MTDC, new construction is required for three of the components: the Manufacturing Incubator/Accelerator, the Teaching Factory and Shared Use Manufacturing Center, and the Regional Trade/Distribution Teaching Factory. The other components do not require new construction for start up; but renovation cost

estimates are included for fresh paint on all interior walls. Detailed below are the construction estimates for the three centers mentioned.

Manufacturing Incubator/Accelerator

New construction is required for the tenant space to be located on the eastern strip of the incubator/accelerator, between the CAD/CAM/HPCC and the Teaching Factory and Shared Use Facility.

Construction of 14,050 square feet of tenant space:

Drywall labor and materials @ \$25/lineal foot	\$26,100
Painting walls @ \$1.13/square foot	\$15,877
Painting door frames (4) @ \$31/door frame	\$310
Doors, frames, and hardware	\$7,380
Acoustic ceiling and lighting @ \$1.75/square foot	\$24,588
HVAC duct routing and air flow control @ \$2.00/square foot	\$28,100
Fire Protection (dropping existing sprinkler heads, 1 head per 100 sq ft) @ \$88/head	<u>\$12,320</u>
Total for Construction	\$114,675

Renovation - painting existing 49,018 sq ft @ \$0.63/sq ft	\$30,881
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Grand Total for Manufacturing Incubator/Accelerator	\$145,556
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Teaching Factory and Shared Use Manufacturing Center

New construction is required for two classroom facilities, each accommodating up to twenty students. Renovation and rearrangement costs for relocating the machine tools and tables into the share use machining area. It is estimated that a five person crew using existing cranes and forklifts could complete the rearrangement within a week. Labor cost estimates are taken from the Means Construction Standards which should run 15-20% higher than actual labor costs for the south-central United States.

Construction of 1800 square feet of classroom facilities:	
Drywall labor and materials	\$5,775
Painting walls	\$2,034
Painting door frames	\$124
Doors, frames, and hardware	\$3,152
Acoustic ceiling and lighting	\$3,150
HVAC duct routing and air flow control	\$3,600
Fire Protection (dropping existing sprinkler heads)	\$1,584
Miscellaneous teaching aids and audiovisual equipment	<u>\$1,500</u>
Total for Construction	\$20,919

Relocation of Machining Equipment and Accessories	
One electrician @\$227/day	\$1,135
One supervisor @\$240/day	\$1,200
Three skilled laborers @ \$180/day	<u>\$2,700</u>
Total for Labor	\$5,035
Materials @ 30% of labor cost	<u>\$1,510</u>
Total for Relocation	\$6,545

Grand Total for Teaching Factory and Shared Use Mfg. Center	\$27,464
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Regional Trade/Distribution Teaching Factory

New construction is required for an enclosed entrance and reception area. This is necessitated in order to isolate the office areas from the machining center which is located adjacent to the Regional Trade/Distribution Teaching Factory. Additionally, construction is needed for the outside, separate entrance, as well as renovations to the entrance to make it compliant to the Americans with Disabilities Act (ADA) for wheelchair accessibility. Renovation includes painting the existing walls within the office/lab areas. No construction or renovation is included for the warehouse facility.

Construction of 3000 square feet of entrance and reception/common area:

Drywall labor and materials	\$3,100
Drywall labor and materials in the dock area with extra structural support @\$60/lineal foot for a 62 foot long wall	\$3,720
Painting walls	\$3,390
Painting door frames	\$248
Doors, frames, and hardware	\$4,304
Acoustic ceiling and lighting	\$5,250
HVAC duct routing and air flow control	\$6,000
Fire Protection (dropping existing sprinkler heads)	\$2,640
ADA compliant wheelchair ramp	\$2,000
Construction of "storefront" with doors and enclosure	<u>\$6,000</u>
Total for Construction	\$36,652

Renovation - painting existing 14,050 sq ft @ \$0.63/sq ft \$9,138

Grand Total for Regional Trade/Distribution Teaching Factory \$45,790

Average Cost per 1000 square feet of New Construction

For the purposes of this study, an average cost of new construction was estimated for use in calculating costs of anticipated future construction. The assumptions for this estimate are a 50' by 20' room, totaling 140 lineal feet, 1000 square feet, and one 6' doorway and one 3' doorway per 1000 square feet.

Drywall labor and materials @ \$25/lineal foot	\$3,500
Painting walls @ \$1.13/square foot	\$1,130
Painting door frames @ \$31/door frame	\$62
Doors, frames, and hardware	\$1,325
Acoustic ceiling and lighting @ \$1.75/square foot	\$1,750
HVAC duct routing and air flow control @ \$2.00/square foot	\$2,000
Fire Protection (dropping existing sprinkler heads, 1 head per 100 sq ft) @ \$88/head	<u>\$880</u>
Total Construction Cost Estimate per 1000 square feet	\$10,647

It should be noted that within the construction and renovation cost analysis, the average cost per 1000 square feet is \$9,500.00 for new construction. This cost varies with the lineal footage of drywall. Also, the overall construction and renovation cost average for the entire facility for start-up comes to only \$756.34 per 1000 square feet.

3.5.6 Regulatory Requirements

It is assumed that the SSC Central Facility was constructed in a manner that met all necessary regulatory requirements for the operation. As the proposed MTDC components do not vary significantly from the original use, most regulatory requirements should have already been met. However, prior to placement of new tenants or the development of each component, a thorough investigation into the specific requirements will be conducted. TEEX has worked with several start-up manufacturing companies in investigating necessary requirements and in assisting the companies in meeting these requirements. Appropriate state, local, and federal agencies will be contacted when specific needs arise. For example, the City of Waxahachie must be contacted for construction and other city licensing and zoning permits. The Texas Natural Resource Conservation Commission must be contacted for air and water quality issues.

The details of setting up a not-for-profit 501(c)(3) corporation were obtained from the Center for Non-Profit Management in Dallas, Texas. Because the list of details is quite lengthy, only a few critical details are given. For example, a request to reserve the name must be submitted to the Texas Secretary of State. In addition, the Texas Secretary of State must be petitioned with Articles of Incorporation to form the not-for-profit organization. IRS Publication 557 explains the process which must be followed to complete Form 1023. This form must be reviewed by the IRS prior to issuing a determination letter. This letter may be requested by potential funders as evidence the corporation is considered a not-for-profit organization.

3.5.7 Utilities Requirements

Current utility usage information was provided by the SSC Facilities Maintenance staff. Even though the current use of the Central Facility does not exactly match the proposed use, the following utilities expense data are used to estimate future expenses of the MTDC.

TU Electric	\$65,765/month
Garbage/Water/Sewer	\$6700/year
Waste Dumpsters	\$1350/year
Water	\$4215/month
Gas (Industrial Gas Transmission)	\$1124/month
 Total Utilities per year	 \$861,298

3.5.8 Maintenance Requirements

Current maintenance cost information was provided by the SSC Facilities Maintenance staff. Even though the current use of the Central Facility does not exactly match the proposed use, the following maintenance expense data are used to estimate future expenses of the MTDC.

Chemical Treatment of Cooling Towers	\$1300/mo
Cleaning Cooling Towers	\$5000/yr
Pest Control	\$2000/yr
Custodial	\$137,600/yr
Grounds	\$40,000/yr
Parking Lot	\$1200/yr plus \$9000 every 2 years for re-stripping
Roof - re-patched monthly	\$3500/month
(Recommended replacement within 5 years)	\$1,500,000 not included in the total maintenance per year
Power supply interrupts	\$10,000 per year
Fire extinguisher/equipment testing	\$2500 per year
Maintenance supplies, materials, contract labor.	\$1,000,000/year
Total Maintenance per year	\$1,260,400/year

3.6 Relationship to Other EOIs

Due to its focus as a regional industrial technology institute, the MTDC will provide complementary capabilities to the other EOI's. Specifically, for the technically based EOI's (Velocity of Light in a Magnetic Field, Cryogenic Helium Convection Research, Geotechnical Research Facility, and the Applied Superconductivity and Cryogenics Technology Center) the MTDC will provide the following services :

- The MTDC will conduct on going evaluation of the commercialization opportunities of the research that is accomplished by these EOI's. This includes patent potential, valuation of the technologies, and identification of industry partners who would commercialize the research. It is very possible that several companies could be started in the MTDC as a result of the research developed by these EOI's.
- The MTDC will provide services, such as design drafting, prototype development and machining as requested by the EOI's.
- The MTDC will provide information retrieval services to the other EOI's that supports their research needs.

- The MTDC will provide marketing support, such as development of promotional material, brochures, newsletters, and other media that supports the research needs of the EOI's.

Generally, the MTDC will perceive the other EOI's as their customers, and offer any associated support consistent with its mission.

3.7 Technical Feasibility

3.7.1 Similar Facilities

The facility that most closely reflects the concept of the MTDC is the Manufacturers EnterCorp (MEC) in Kansas City, Missouri, which is located at the DOE Kansas City Plant in partnership with universities, other DOE laboratories, local community colleges, and private sector partners such as Sprint and the Center for Business Innovation. Receiving its seed funding from the 1993 TRP round of solicitations, the MEC concentrates on assisting new product development, transferring technologies for improving productivity and product design, providing Shared Manufacturing and technology demonstration capabilities, and delivering pre-service and in-service training in manufacturing technologies.

Sophisticated telecommunication links and teleconferencing capabilities provide clients with practical, convenient access to network partners. Remote demonstration via two-way video, and data transfer links for sharing engineering data are some of the planned service outreach methods. The MEC serves as its primary market for the manufacturers within the states of Missouri, Kansas, and Colorado. Access to the MEC occurs primarily through the Mid America Manufacturing Technology Center, a NIST sponsored outreach center of field engineers who work with small manufacturers to identify opportunities to utilize the MEC capabilities. Similarly, the Texas Manufacturing Assistance Centers (TMAC) which was just awarded a manufacturing extension contract under the NIST MEP, will act as a central point to access the MTDC on behalf of its manufacturing customers. MEC is a not for profit corporation governed by a Board of Directors comprised of significant stakeholders in the MEC project.

Another similar concept to the MTDC that is now underway is the Los Angeles based RAMP program. The Regional Advanced Manufacturing Project is a three year industry-labor-academia joint venture to develop methodologies for re-engineering the supplier chain to remain competitive in industries undergoing rapid market or technological change. At the core of RAMP is a strategic partnership between the Textron Corporation and the International Association of Machinists and Aerospace Workers. Other partners include Hughes Aircraft, Los Alamos National Laboratory, the DOE Kansas City Plant, California State University System, and the California Community College System. The goals of RAMP are two fold. The primary business entities are seeking a new way of doing business that can provide new markets, products and growth which would otherwise not be possible. RAMP seeks to be a self sustaining business enterprise within 3 years.

These two programs are considered to be the anchors of a National Manufacturing Deployment Center Network which would consist of at least 11 components distributed nationally. The MTDC sees itself potentially as a component of this network that form regional alliances to deploy technical assistance and technology within a regional boundary.

Contained within the MTDC is a manufacturing incubator/accelerator whose mission is to start up and or accelerate new or existing companies by providing technical and business support within the facility. There are now over 500 incubators in North America with over 30 in Texas. The National Business Incubator Association (NBIA) indicates that not-for-profit or public incubators make up 44% of all incubator facilities. Fourteen percent of the incubators are based on research conducted by the scientific community, including academia and federal laboratories. The Johnson Technology Commercialization Center and the Ames Technology Commercialization Center are two federal laboratory based incubators located at NASA Johnson Space Center in Houston and NASA Ames Research Center in California. One focus of the MTDC incubator will be the commercial spin offs of SSC and DOE technology through the formation of new technology based companies.

The NBIA also suggests that criteria for successful incubators includes facility selection, governance structure, formation of value added management assistance service programs, access to financing and capitalization, in-kind financial support, community support, entrepreneurial network, entrepreneurial education, perception of success, selection process for tenants, ties to universities or other sources of technology, and a concise program with milestones and clear policies. The minimum size to operate a self sustaining incubator is 30,000 sq. ft. and revenues should be at least \$1.50 per sq. ft. above facility fixed costs. Rent collection techniques should be well articulated and enforced. The incubator manager should balance his/her time equally between facility management and service delivery to the tenant companies. Issues regarding management responsibilities versus policy decisions should be clearly specified by the Board of Directors. Collecting fees for services is very important to the long term success of the incubator. Exit policies should encourage tenant graduation without mandating a specific exit period. Two classic errors that incubators should avoid is to accept the worst building in town and to underestimate the need of the tenant companies for management assistance, including business, technical, and administrative assistance.

The following is a list of manufacturing incubators located in Texas as listed by the National Business Incubator Association.

Name and Sponsorship Type	Type	Location	Sq. Ft.	Clients	Graduates	Year Opened
Business Innovation Center - Local Govt.	HT,LM, S/M, S	Abilene	40,000	10	2	1991
Austin Technology Incubator - Hybrid	HT, R&D, LM, NFP, S	Austin	60,000	33	7	1989
Southeast Business Incubator - Local Govt.	HT, R&D, LM, W/D, C, S/M, S, C/FA	Austin	9,813	19	8	1989
Borger Business Development Center - Econ. Development	LM, S, HT, W/D, S/M	Borger	7,000	3	-	1992
Promethean Corp. - For Profit	LM, S	Brenham	22,000	3	1	1989
Bryan College Station Research & Development Incubator - Local Govt	HT, R&D	Bryan	8,000	5	-	1993
K-Wolen's Industrial Incubator - Local Govt.	LM	Corsicana	96,000	6	0	1987
DCCCD Business Incubator Center - College	HT, W/D, C, S/M, S, C/FA	Dallas	30,000	36	11	1990
ExecMark Systems, Inc. - For Profit	HT, W/D, S/M, S	Dallas	16,000	114	-	1992

Name and Sponsorship Type	Type	Location	Sq. Ft.	Clients	Graduates	Year Opened
Business Ventures - Local Govt.	HT, R&D, LM, S/M, S	Garland	90,000	32	1	1989
Entrepreneurial Development Center - For Profit	R&D, LM, S/M, S, MO, NFP	Houston	12,800	12	-	1985
Houston Small Business Development Corp. - Econ. Devel.	LM, W/D, S/M, C, S, MO, NFP	Houston	160,000	13	4	1989
International Business Center - For Profit	R&D, LM, S/M, S, MO	Houston	12,800	0	0	1993
Product Development Center - For Profit	R&D, LM, S/M, S, MO	Houston	12,800	1	-	1992
Software Business Center - For Profit	R&D	Houston	12,800	3	-	1991
Womens Business Center - For Profit	R&D, HT, S	Houston	12,800	10	-	1990
Marshall Business Development Center - Local Govt	LM, C, S/M, S, NFP, HT	Marshall	24,000	19	10	1990
Odessa College Noel Center Business Incubator - College	S, R&D	Odessa	8,000	7	2	1990

Name and Sponsorship Type	Type	Location	Sq. Ft.	Clients	Graduates	Year Opened
Pharr Manufacturing Incubator Centre - Econ. Devel.	LM, S/M	Pharr	13,500	5	-	1991
Advanced Technology Innovation Center - University	HT, LM, S	Richardson	30,000	10	5	1988
Excel Business Incubator - Econ. Devel.	S, HT, LM, MO, S/M	Round Rock	21,000	2	-	1993
St. Paul Square Small Business Incubator - Econ. Devel.	LM, WD, C, F/A, S, R, NFP, C/FA	San Antonio	3,600	11	-	1991
Texas Research & Technology Center - Econ. Devel.	R&D, S, NFP, HT, LM	San Antonio	26,400	6	3	1990
Free Enterprise Center - College	HT, LM, C, S/M, S	Stafford	40,000	18	9	1988
West Texas Innovation Center	C, S, MO, S/M, HT	Sweetwater	7,300	25	3	1989
Tyler Area Business Incubator - College	HT, R&D, S, W/D, LM, MO, S/M, C/FA	Tyler	26,000	18	-	1990
Heart of Texas Business Resource Center Incubator - Hybrid	WD, C, SM, S, NFP, HT	Waco	6,177	9	9	1988

Legend:

HT	High Tech	R&D	Research & Development	LM	Light Mfg.
MO	Mail Order	W/D	Wholesale/Distribution	C	Construction
S/M	Sales/Mrktg.	NFP	Not for Profit	HM	Heavy Mfg.
R	Retail	C/FA	Commercial/Fine Arts	S	Service

3.7.2 Other Service Providers

The MTDC team has as one of its strengths a proactive relationship with the service providers within Texas and the surrounding states. Texas does have an extensive capability, primarily through its university, community college and technical college infrastructure, to provide services to companies throughout Texas. Both ARRI and TEEX have long standing relationships with this infrastructure, since they are both an important component of it.

Both ARRI and TEEX have working agreements with the Dallas Community College District's North Texas Small Business Development Center Network, which covers a 49 county region and has several SBDC's in close proximity to the Central Facility. These agreements consist of cost sharing contracts with the SBDC network to deliver technical services to SBDC clients. The Navarro SBDC is located approximately 45 minutes away in Corsicana. In addition, the SBDC Network headquarters, located at the Bill Priest Institute for Economic Development in Dallas, provides a variety of specialty services that include counseling and seminars on commercialization of intellectual property, exporting assistance, government procurement training, vocational skill training, and business incubation. The MTDC will provide complementary access to product development, technology commercialization, and manufacturing support that is not currently available by this SBDC network.

The Texas Manufacturing Assistance Center (TMAC) is a network of manufacturing assistance field engineers that is centrally managed by the Texas Department of Commerce in Austin. The partners in the network include ARRI, TEEX, the University of Houston, Southwest Research Institute, and The University of Texas at El Paso. The TMAC network of field engineers, through a partnership with the MTDC, will provide statewide access to the product development capabilities of the facility. Networks of service providers in the other states will extend the MTDC's outreach. This model is very similar to the utilization of extension agents in Missouri, Kansas and Colorado to provide their manufacturing clients with access to the Manufacturers EnterCorp in Kansas City.

The Mid Continent Technology Transfer Center, operated by TEEX and with an office at ARRI, is a NASA Regional Technology Transfer Center that focuses on the commercialization of federally funded technology in a 14 state region. Through its 14 state network, which includes New Mexico, Oklahoma, Texas, and Arkansas, the MCTTC will provide the MTDC with marketing outreach capabilities and services to its clients that include technology commercialization planning. In addition, the MCTTC

has access to the federal laboratory technical assistance infrastructure and has a Memorandum of Understanding with the DOE Kansas City Plant to provide technical outreach assistance to companies within the region through an office at the SBDC in Dallas. This arrangement has proven to be very effective and beneficial to the customers of the MCTTC. The MCTTC intends to occupy space within the MTDC to compliment the services that will be provided.

The community college system within Texas provides a wide variety of vocational training services to its customers. These services will be available to MTDC clientele through the teaching factory and other training curriculum that is offered. It is anticipated that the community colleges within close proximity to the MTDC facility will occupy space within the facility. Similarly, the Texas State Technical College system will have access to the facility to provide added value training and technical assistance, especially as it pertains to the Teaching Factory.

3.7.3 Risk

The overarching risk associated with the MTDC is that of becoming self sustaining, meaning no need for public funds, within a six year time frame. To our knowledge, there still does not exist any publicly funded organization in technology deployment, including the NIST Manufacturing Technology Centers, that have been able to become self supporting as originally planned. The reasons for this primarily include an under estimation of the start up costs coupled with an overestimation of the income that can be realistically derived from the customers. The public subsidies that are provided these organizations allow for the subsidized delivery of services to small businesses, who otherwise could not afford the assistance. In essence, the public subsidies allow for a waiver of overhead costs, which is passed along to the customer. When that subsidy goes away, however, the overhead does not, which forces the service provider to increase their fees. This, in turn, results in a smaller market that is able to pay and puts these providers in direct competition with private consulting firms. Unless the subsidy is extended, the service providers will tend to market toward the bigger clients, such as bigger corporations who have an ability to pay full price. The full circle occurs when the original target market (small businesses) no longer get access to subsidized services and are considered a tertiary market versus a primary market by the provider. Since the Manufacturer's EnterCorp in Kansas City and the RAMP in Los Angeles are new programs, it is still too early to tell if this model will allow its operators to overcome this risk.

Specific to the MTDC, the least amount of risk associated with income is that of renting warehouse space. Research indicates that at least 90% occupancy of warehouse space can occur within 18 months, which will bring in over \$2,000,000 within five years. This still leaves a significant shortfall, however, which must be made up in the short term by a combination of public subsidy (federal and state) and the selling of services. In the long term, however, and within six years, the selling of services and renting of space will have to overcome the shortfall entirely.

Another risk associated with this project is the potential impact of the remote location of the SSC site relative to the operation of the MTDC. As a pure science project, the

location of the SSC site was not an issue. However, the only benefit of this location, if any, to the MTDC is its proximity to a major highway (Interstate 35), which will allow it to be an attractive warehousing site for trucking commerce. Overall, the distance and inconvenience of the MTDC's primary market with the Dallas/Fort Worth area, will have to be overcome through intensive market development and value added services that are worth the inconvenience of traveling to the MTDC site. The industry focus groups addressed the issue of the Waxahachie location. Most said that the location was not a problem, if the services were valuable to their company.

Since the MTDC will be a multi-use facility that requires a diverse stakeholder base, including the warehousing industry, small manufacturers, corporations, and state, local and federal governments, the risk of stakeholder fallout is fairly high. This would leave the MTDC with a resource shortfall that would have to be recovered from other stakeholders.

3.8 Financials

Financial statements were prepared by KPMG Peat Marwick using data provided by ARRI and TEEX. Complete financial statements are included in the Business Plan.

3.8.1 Cost of Proposed Approach

The estimated cost of the MTDC includes personnel, construction, building maintenance, utilities, and subcontracts. These estimates were based on an analysis of the requirements for each component to meet operational goals and are included in the business plan.

3.8.2 Forecasted Revenues

Forecasted revenues include lease income, course fees, engineering services, information retrieval, market assessment, equipment, user fees, tenant fees, corporate sponsors, and state and federal grants. Lease income is generated from leasing the warehouse space, manufacturing incubator/accelerator space, and office space. Course fees are collected from attendees of courses offered by the Product and Process Development Center, the Regional Trade/Distribution Teaching Factory, and the Teaching Factory and Shared Use Manufacturing Center. Fees for engineering services will be collected from clients of the Product and Process Development Center. Fees for information retrieval and market assessments are charged to MTDC clients who request key information on markets, demographics, competition, technologies, and industries. Clients requiring access to specific manufacturing equipment, office equipment, and CAD/CAM workstations will be assessed a usage fee. Tenants of the incubator/accelerator will be charged a support fee for access to office equipment and computer equipment. Grants will be solicited from key corporate sponsors. A portion of income will be requested from the state and federal government for the first five years. This number will decrease each year as revenues increase. It is estimated that this operation will be self-sufficient in the sixth year.

3.8.3 Fee Structure and Client Distribution

Fee structure is based on the following premises:

For lease space, the fair market value has been applied according to research into the local marketplace. For conditioned warehouse space, the current market is between \$3 and \$4 per square foot. The fair market value for office space is \$7 per square foot, which the MTDC will charge to its office tenants. For the manufacturing incubator, the fair market value is \$6 per square foot.

The MTDC will offer its shared use manufacturing facility at \$1000 per month but is subject to modification depending on the type of use and the time each user will require of the facility.

Course fees will be offered at an average rate of \$400 per week per student. This is a typical fair market value for courses of this nature.

Engineering services, including machine time for prototyping and process development, will be charged at \$100 per hour average. Other cost components such as materials will be priced according to actual costs. Other services, such as information retrieval, market research, and business consultation will be charged at an average rate of \$50 per hour plus on-line connect time. For specific market research reports, the average price will be between \$2000-\$3000.

The MTDC also intends to solicit corporate sponsorships (subscriptions) that will be priced according to the size of the company relative to sales. Typically, a large corporation would pay \$50,000 per year to be a sponsor.

The MTDC expects its clients to be distributed geographically in three areas. Obviously, the local Dallas/Fort Worth Metroplex with its 6800 small manufacturers, a large percentage being defense related, is the primary target for clients. Due to the familiarity of Texas' businesses with the prime operators of the MTDC, it is expected that the secondary target for clients will come internal to the state. As a tertiary, yet important target market, the MTDC will market to the surrounding four states to identify opportunities to assist clients in Arkansas, Oklahoma, New Mexico, and Louisiana. Functionally, the MTDC has a very broad target population from which to obtain its clients. There are over 35,000 small manufacturers in the 5 state region who would benefit from the services of the MTDC. In addition, large defense contractors and big corporations, who have an interest in supporting their supplier base are expected to become clients of the MTDC. Engineering firms, who develop high technology products, would have a stake in working with the MTDC to ensure that they are maintaining state of the art expertise in product and process development. Due to its capability to deliver information retrieval services, the MTDC intends to market this capability to the general public. Finally, the market for training curriculum that provides skills to technical and vocational workers is very large. The state of Texas, through its Smart Jobs Program, actually provides incentives to the business community to upgrade their skills base. The MTDC will be well positioned to take advantage of this program.

3.8.4 Funding Sources

The MTDC expects that this concept will receive positive response from the Department of Energy and that the DOE will provide partial support for the start-up of the MTDC. In addition, the MTDC intends to submit a proposal to the TRP under Regional Technology Alliances when the next solicitation is offered in 1995. In either case, the MTDC intends to seek matching funds from the State of Texas' federal match pool. Other sources of funding will come from corporate sponsorships within 1 year of start-up and income from the renting of warehouse space, office space, incubation space, and delivery of services as described in the previous section. The MTDC business plan contains the schedule for income relative to the sources.

By year six, the MTDC intends to be self supporting through income derived from rent and services. The MTDC will also investigate the possibility of soliciting Economic Development Administration support, especially as it applies to infrastructure modifications. There is some evidence that taking equity in the MTDC's client base, especially start up companies in the incubator, could result in financial benefits in 5- 10 years. This will be thoroughly evaluated during the start up phase of the MTDC.

3.9 Implementation Plan

The implementation of the MTDC will be an incremental approach. The first task will be to appoint the board of directors who will then hire the director. The director will hire staff as needs increase. Of prime importance is the placement of anchor tenants in the warehouse, lease, and manufacturing incubator/accelerator to generate an income stream. Attracting appropriate tenants will be facilitated by the operation of the HPCC, CAD/CAM, and the shared use machine shop. Upon opening, all components of the MTDC will be operational at some level. However, managers and the director may be performing more than one role. As the demand for services increases, staffing will increase and the number of roles per person will be reduced. The MTDC director and marketing professional will be working to secure funding and to create the appropriate image for the center. The following chart depicts the implementation of staffing.

MTDC Staffing Plan

Staffing Profile	1st 95	2nd 95	3rd 95	4th 95	1996	1997	1998	1999	2000	2001
Director	1	1	1	1	1	1	1	1	1	1
Managers	1	1	2	2	3	4	4	4	4	4
Technicians	0	2	2	2	2	2	2	2	2	2
Engineer	1	1	1	1	1	1	1	1	1	1
Business Mgr	1	1	1	1	1	1	1	1	1	1
Marketing	1	1	1	1	1	1	1	1	1	1
Outreach Spec.	1	1	1	1	1	1	1	1	1	1
Marketing Supt	0	2	2	2	2	2	2	2	2	2
Admin. Supt	2	2	2	3	4	4	5	5	5	5
Facilities Plan	2	2	2	2	2	2	2	2	2	2
Inftr. Tech. Spec	1	1	1	1	1	1	1	1	1	1
CAD/CAM Oper	1	1	1	1	2	2	2	2	2	2
Tech. Dept. Spec.	0	4	4	4	8	8	8	8	8	8
Receptionist	1	1	1	1	1	1	1	1	1	1
Instructors	0	1	1	1	2	2	2	2	2	2
Contract Trainers	0	0	0	0	4	4	4	4	4	4
Maint. Tech.	0	1	1	1	2	2	2	2	2	2
Co-op. Stff.	0	0	6	6	6	6	6	6	6	6
Asst. Librarian	0	1	1	1	1	1	1	1	1	1
Human Res. Mgr	0	1	1	1	1	1	1	1	1	1
HR Asst.	0	0	0	0	1	1	1	1	1	1

MTDC Implementation Plan

IMPLEMENTATION PLAN	1Qtr 95	2Qtr95	3Qtr95	4Qtr95	1996	1997	1998	1999	2000	2001
Start up and Planning										
Appoint Board of Directors	xxxx									
Select Director	xxxxx									
Select Initial Staff	xxxxxxxx									
Update/modify business plan	xxxxx									
Develop operations plan	xxxxx									
Prepare detailed marketing/strategic plan	xxxxx									
Gain commitment from community	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx								
Develop/acquire training curriculum	xx	xxxxxxxxxxxxxx								
Initiate construction modifications	xxxx									
Execute Plans										
Select core staff		xxxxxxxxxxxxxx								
Start Process and Product Development Center		xxxx								
Initiate engineering services		xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx
Initiate MTDC awareness program	xxx	xxxxxxxxxxxxxx								
Develop marketing materials	xxx	xxxxxxxxxxxxxx								
Solicit corporate sponsorship	xxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx
Start Manufacturing Incubator			xxxxxx							
Lease warehouse space			xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx
Start Shared Use Manufacturing Facility			xxxx							
Start Technology Resource Center			xxxx							
Start Regional Trade Center			xxxx							
Initiate Training Programs			xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx
Select balance of staff			xxxxxxxxxxxxxx	xxxxxxxxxxxxxx						
Quarterly Report to Stakeholders		x		x	x	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx	xxxxxxxxxxxxxx

3.10 Benefits

The conversion of the SSC Central Facility into a *Manufacturing Technology Deployment Center* will have a direct impact on the economic development of the five state region formed by Texas, New Mexico, Oklahoma, Arkansas and Louisiana through the creation and retention of high skill-high pay manufacturing jobs, the incubation of new manufacturing companies, the development and deployment of federal and university laboratory technology into the private sector and the assistance to U.S. companies in promoting exports of goods and services.

The MTDC as designed will be unique in that no other enterprise exists to the same magnitude as the one proposed in this study. The center, in direct response to the needs of small manufacturers, provides a *"one stop shop"* for technical and business assistance. Moreover, the seven components of the MTDC form a cohesive and complementary approach to supplying a wide range of services from local, state and federal resources. As designed, the MTDC holds the promise to serve as a model for the collaboration of industry, academia and government in supporting the growth of small business. Ultimately, the *regional technology alliance* formed as a result of the conversion of the SSC assets will produce a healthy return on the investment of the taxpayer in the form of jobs, industrial base expansion, an increased tax base and the export of U.S. goods and services to positively impact the present trade imbalance.

3.10.1 Operational Benefits

The major operational benefit associated with the creation of the MTDC is the collaboration of industry, academia and government to provide a "one stop shop" for manufacturing assistance. The four core components and the three supporting elements provide a unique and comprehensive approach to servicing the needs of small manufacturers in the five state region. The service modules are formed by the:

- Product/Process Development Center
- Manufacturing Incubator/Accelerator
- Teaching Factory/Shared Use Facility
- Regional Trade/Distribution Teaching Factory
- Technology Resource center
- CAD/CAM Center
- Outreach Center.

The inclusion and physical presence of the federal partners presently represented by Los Alamos National Laboratory and the DOE Kansas City Plant at the MTDC will accelerate the development and deployment of agile, clean, environmentally conscious and energy efficient technologies into the small manufacturing community. An added benefit to the industrial base is the direct exposure of manufacturers, educators, government officials, researchers, economic development specialists and

congressional representatives to the vast, yet largely unappreciated resources available in the federal laboratory system.

The MTDC was designed with the understanding that successful entrepreneurial development requires a synergy among talent, capital, technology, and know-how. Small manufacturers will have access to a variety of resources and benefits that will free them of some of the operational concerns that would otherwise hinder their development. Some of these benefits include the following:

- low-cost office and lab space
- administrative services
- skilled technical and business consultants
- access to library and computer facilities
- workforce technical skill development
- special contacts (bankers, venture capitalists, technologists and other officials)
- flexibility in leasing assembly and management space
- centralized services to help reduce overhead costs of the tenant company
- access to a large array of third party business assistance
- export assistance and product distribution training
- access to training and assistance in electronic commerce
- product and process development assistance
- access to federal and university developed technologies
- a unique social atmosphere that encourages trading relationships

Additionally, the MTDC serves as an access point for small manufacturers to existing technology, business assistance and educational service provider networks. These networks include local community and technical colleges, senior institutions of higher learning, state and federal agencies, non-profit organizations and private sector service providers.

3.10.2 Technological Benefits

In addition to operational benefits, small manufacturers will also be able to access technological support in such areas as:

- advanced computing and modeling
- advanced material selection and processing
- environmentally conscious manufacturing
- environmental assessment and remediation
- energy efficient manufacturing
- real time process monitoring and control
- high reliability product design

- advanced CAD/CAM and three dimensional modeling
- electronic commerce
- advanced imaging and signal processing
- medical instrumentation and diagnostic testing
- agile manufacturing

The various components of the MTDC are structured and staffed to provide hands on technical assistance in addition to information access. This approach combined with the factory and laboratory equipment will facilitate the development and deployment of technology into the private sector while reducing the time and risk normally associated with this process.

3.10.3 Educational Benefits

The MTDC has been designed and equipped to be a "learning organization" that will identify, package and deliver educational programs, training courses, instructional packages and informational services to small manufacturers, educators, researchers, government officials and other interested parties. The facility uniquely offers the space, support staff and capital equipment to develop and deploy information on a wide range of technologies, business assistance programs, best manufacturing practices, and innovative technical skill training methodologies. Consistent with its design, the facility will allow community and technical college educators, researchers, industry practitioners, federal laboratory specialists, and other service providers the opportunity to collaborate on the solutions to specific industry problems. An additional benefit is the planned electronic linkage of the MTDC into existing educational networks. This will allow programs developed at the MTDC or by other parties to be delivered to service providers and customers throughout the five state region. These same networks have access to national and international networks for global distribution of developed programs.

3.10.4 Economic Benefits

During the first year of full operation, the MTDC will provide assistance to 1000 small manufacturers and incubate 4 firms. By the fifth year, the MTDC will reach 17,195 small manufacturers, perform 180 significant technical assistance projects, incubate 18 companies and graduate 6 companies. Additionally, the MTDC through its partnerships with minority institutions and service providers will ensure that a minimum of ten percent of the clients will be minority or women owned firms.

Using information gained from over five years of ARRI assistance to small manufacturers, it is predicted that on average each company assisted will create or retain 16.5 manufacturing jobs during a 24 month assistance period. According to the Texas Comptroller, the average wage paid to manufacturing employees in the Metroplex is \$28,283. This yields a direct economic impact of \$466,670 per company. Additionally, the Governor's defense conversion study indicates that the "ripple effect" of manufacturing dollars through the economy can be estimated using a 176% factor to

give an indirect impact per manufacturer of \$821,338. Based on the fact that by the end of six years of operation, the MTDC will have been serving a minimum of 7000 companies for the necessary 24 month period, the expected benefits by the end of year five are:

- \$3.267 billion direct economic impact
- \$5.750 billion indirect economic impact due to manufacturing dollars "ripple effect"
- \$9.017 billion total regional economic impact
- 115,550 manufacturing jobs created or retained
- 203,280 related jobs created or retained
- 318,830 total jobs created or retained

In order to put these numbers into perspective, the 115,550 jobs created or retained equates to approximately 6.7% of the over 1.7 million manufacturing employees in the five state region. The \$9.017 billion total regional economic impact is approximately 2.3% of the Texas Gross State Product of \$387.9 billion.

An additional reality check is provided by the Austin Technology Incubator in Austin, Texas. Since its inception in 1989, Austin Technology Institute has assisted 44 new businesses and creating over 640 jobs. The 15 current graduates have created 479 jobs since leaving the incubator, with combined revenue of nearly \$35 million according to a recent issue of *NBIA Review*.

3.10.5 Benefits Summary

Social institutions (government, industry, and non-profit organizations) and other institutions (government laboratories, industry, universities and colleges) are looking for innovative ways to collaborate, to promote entrepreneurial activity, and to diffuse technology while reaping the rewards of their intellectual property assets. The MTDC as designed will provide the opportunities for small manufacturers to:

- grow in existing and expand into new markets
- create more high skill-high pay jobs
- access, develop and commercialize new product and process technologies
- incorporate best manufacturing practices
- upgrade workforce skills
- promote and assist in the expansion of electronic commerce
- export goods and services.

The unique opportunity presented by the conversion of the SSC assets will facilitate the creation of a *regional technology alliance* formed by the five states of Texas, New Mexico, Oklahoma, Arkansas, and Louisiana which will assist small manufacturers throughout the region. Moreover, the "one stop shop" service concept for small manufacturers will provide access to a wide range of business and technical services

while reducing the frustration, time and expense of acquiring assistance. The partnerships between the MTDC and existing manufacturing extension networks, federal and university laboratory systems community and technical colleges, and private sector service providers will assist in the development and deployment of advanced technologies. The electronic linkage of the MTDC into existing and future networks will allow the facility to serve an ever expanding base of clientele in the U.S. and abroad. An added benefit to the industrial base is the direct exposure of manufacturers, educators, government officials, researchers, economic development specialists and congressional representatives to the vast, yet largely unappreciated resources available in the federal laboratory system. Finally, the MTDC provides an opportunity to create a national asset to assist in strengthening the U.S. manufacturing infrastructure through the collaboration of industry, academia and government.

In summary, the potential benefits are best expressed by following points from the NBIA report "Everybody Wins:"

- Entrepreneurs win through receiving the support and services needed to succeed.
- Universities win through the commercialization of research and education, as well as through business opportunities for alumni, faculty and students.
- Investors win through the development of commercial and industrial real estate and the opportunity to profit on investment tenant firms.
- Big business wins through technological development, investment opportunities and unique marketing opportunities.
- The general public wins through employment opportunities and the economic growth of their communities, states and nation.

3.11 Recommendations

On the basis of the positive inputs from industry, state and federal agencies, researchers and educators and the financial analysis of the proposed technical plan, it is the recommendation of the ARRI and TEEX team that the Manufacturing Technology Deployment Center be considered for funding by the Department of Energy. The conversion of the SSC Central Facility into the MTDC will facilitate the creation of a *regional technology alliance* that will have significant economic impacts on the entire five state region. Moreover, the inclusion of the federal laboratory system and the partnering with existing manufacturing extension efforts in Texas and other regions will facilitate economic development, international exports and electronic commerce for the entire nation.

If selected for funding consideration, the next step would be the development of a detailed start-up and implementation plan for each program element of the MTDC. Special consideration must be given to include other DOE selected EOI and TNRLC proposals into a coordinated and comprehensive business plan.

3.12 References

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3.13 Technical Plan Appendix

MANUFACTURING TECHNOLOGY DEPLOYMENT CENTER

SCALE: 1" = 120'

PRODUCT & PROCESS DEPLOYMENT CENTER 28,924 SQ. FT.

SCALE: 1" = 30'

DETAIL VIEW OF MANUFACTURING INCUBATOR/ACCELERATOR 63,068 SQ.FT. (COMBINED)

SCALE: 1" = 70'

The floor plan is divided into several sections:

- Top Section:** Labeled "EXPANSION SPACE 52,800 SQ. FT. TOTAL". It includes a "14' AISLE" on the left and a "12' AISLE" on the right. There are two sets of rooms: "BLK. 1001" and "BLK. 1002" on the left, and "DATA/COM." and "REC." on the right.
- Middle Section:** Labeled "EXPANSION SPACE". It includes a "6' AISLE" and a "12' AISLE". There are rooms for "ELECTRICAL, RECEPTION", "ELECT. 1001", "DATA/COM.", and "REC.".
- Bottom Section:** Labeled "EXPANSION SPACE". It includes a "12' AISLE" and a "LOAD/UNLOAD SPACE". There are two "CLASSROOM" rooms, each "900 SQ. FT.", and a "STORE" room. There are also rooms for "SHARED USE MACHINING ARE" and "LIVE" spaces.
- Far Left:** Labeled "MFG. INCUBATOR/ACCELERATOR".
- Far Right:** Labeled "DOCKS".

REGIONAL TRADE/DISTRIBUTION TEACHING FACTORY

105,995 SQ.FT. (COMBINED)

SCALE: 1" = 50'

MFG. INCUBATOR/
ACCELERATOR

WAREHOUSE/DISTRIBUTION SPACE
88,490 SQ.FT.

TECHNOLOGY RESOURCE CENTER

38,942 SQ. FT.

SCALE: 1' = 30'

SCALE: 1" = 30'

CAD/CAM CENTER

11,330 SQ.FT.

14' AISLE

127,593 SQ.FT. TOTAL

HIGH PERFORMANE COMPUTING CENTER

21,489 SQ.FT.
(COMBINED)

SCALE: 1" = 40'