SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT
METRO RAIL PROJECT

PROPOSAL FOR

ENGINEERING SUPPORT SERVICES

FOR PROCUREMENT OF

PASSENGER VEHICLES AND FARE COLLECTION EQUIPMENT

METRO RAIL TRANSIT CONSULTANTS
DMJM/PBQD/KE/HWA

2891,484

METRO RAIL TRANSIT CONSULTANTS

March 28, 1986

Mr. Robert J. Murray
Assistant General Manager
Transit Systems Development
Southern California Rapid Transit District
425 South Main Street
Los Angeles, California 90013

Subject: Proposed Engineering Support Services for Procurement of Passenger Vehicles and Fare Collection Equipment

Purpose: Information Transmittal

File No. P001X003

Dear Mr. Murray:

Per your request of March 17, 1986, MRTC is pleased to submit six copies of our proposal for Engineering Support Services for Procurement of Passenger Vehicles and Fare Collection Equipment.

MRTC possesses unique qualifications and broad experience in the areas of Vehicle and Fare Collection procurement, having served the District as the engineer of record for the design of Contracts A650 and A660. This design responsibility has provided us with clear understanding of the design intent for the proposed Metro Rail systems and will insure continuity between the design and procurement phases of the project.

MRTC has a highly qualified staff of individuals available to us locally in the L.A. area, as well as in the home offices, having direct experience in design, production, inspection, and testing in all phases of transit technology. Member firms of the MRTC joint venture have provided similar services on the vast majority of recent and current procurement contracts of a directly comparable nature. MRTC's combined, directly related, experience cannot be equaled by any other firm or organization, thus we are able to provide you with the assurance that qualified personnel will be available throughout the duration of the program. Our firms maintain full time staff specialists in unique disciplines such as metalurgy, structural analysis, industrial engineering and quality assurance, who stand ready to provide solutions to special problems should they arise.

548 S. Spring Street, Seventh Floor, Los Angeles, CA 90013 · (213) 612-7000

We are pleased to be joined in this procurement effort by several DBE/WBE firms with very specific, applicable capabilities. We currently enjoy an existing contractual relationship with many of these firms and will establish contracts with others as outlined in our proposal. As you are aware, MRTC has a record of meeting or exceeding DBE/WBE participation in the Metro Rail Project.

The MRTC team offers:

- An existing local office, presently staffed with experienced personnel who have a full understanding of procurement contract requirements.
- Resources and support in both U.S. and international offices.
- Knowledge of vehicle and fare procurement and all of the manufacturers through our current participation in design and procurement in several cities in the U.S. and abroad.
- Professional specialist available as needed.
- An appropriate affirmative action plan and an outstanding record in the promotion of disadvantaged and women business enterprises.

We have based our manpower estimates and associated costs on your request for proposal and our experience on similar projects directly related to the services of procurement of passenger vehicles and fare collection equipment. The resulting costs reflect what we consider to be a realistic level of effort to assure the District of obtaining a reliable product that is in accord with the intent of the design. However, we fully recognize that there is always a range of effort, especially associated with procurement services and within this the range the client must decide on the level of services to assure proper procurement. The degree of this range is somewhat associated to risk and to what level do the services cover the in-plant inspection, review of vendors drawings and testing. This issue can only be resolved by across the table discussion with the District which will lead to a common understanding of scope level of effort and schedule.

Further, we wish to point out that the associated costs with the procurement of a limited number of vehicles is somewhat out-of-proportion as compared to a large vehicle order. In addition, our estimate of $4.51 million is based on a stand-alone project because we did not want to make any assumption about future AWPs for MRTC. With continuity of MRTC in its present role and the ability to utilize staff in a dual-mode and in a cost-effective manner -- the resulting costs associated with the procurement can be substantially reduced. This cost reduction is demonstrated in that the draft AWP submitted to the District on March 5, 1986 defined a level of engineering support necessary for continuity in responding to prospective A650 proposer questions and in

proposal evaluation. This proposal, responding to the District's RFP for procurement support, overlaps our proposed AWP labor and will allow an approximate 12 man-month reduction in the AWP services. MRTC's selection for the procurement support tasks required by the District's RFP will reduce redundant technical support requirements throughout the procurement program, which will result in significant cost savings to the District.

We are prepared to discuss this proposal with you at your earliest convenience, and should you desire any clarification or amplification of any portion of this proposal, please feel free to contact us.

In conclusion, we know of no firm or team of firms that can match the experience of MRTC -- no one knows more about the project and the issues than MRTC -- and no other firm can provide the same level of services with the cost-effectiveness of MRTC.

METRO RAIL TRANSIT CONSULTANTS

Howard J. Chaliff
Project Director

HJC:cc

cc: J. Christiansen
W.J. Rhine
J. Sandberg
DCC(2)

SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT
METRO RAIL PROJECT

PROPOSAL FOR
ENGINEERING SUPPORT SERVICES
FOR
PROCUREMENT OF
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March 28, 1986

Prepared by Metro Rail Transit Consultants
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PROPOSAL FOR ENGINEERING SUPPORT SERVICES FOR PROCUREMENT OF PASSENGER VEHICLE AND FARE COLLECTION EQUIPMENT

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Section 1

PROFESSIONAL QUALIFICATIONS

1.1 MRTC Qualifications: MRTC is singularly qualified to carry out and be responsible for the vehicle and fare collection equipment procurement tasks required by the District. The member firms of the MRTC Joint Venture represent a labor force of over 5,000 employees engaged in transportation planning and engineering, civil and structural design, mechanical and electrical design, metallurgy, industrial design, and other specialties. This pool of technical resources has made us the leaders in transit engineering.

Over the last two decades, MRTC Joint Venture firms have been continuously engaged in vehicle and fare collection equipment work in the transit field, both in the continental United States, as well as in overseas locations. Figures 1.1 and 1.2 graphically depict our direct participation in recent programs that are directly similar in scope to the services solicited by the District. Our efforts and responsibilities for preparation of procurement specifications have led to continuous assistance to our clients for evaluation of proposals, review of supplier submittals, in-plant inspection, test witnessing, and acceptance testing.

MRTC offers the advantage of utilizing a broad base of personnel established in the Los Angeles area. Resources will be applied to the proposed procurement projects with a minimum of relocation and travel expense to the District. An additional local work base offers the advantage to the District of specialized personnel that may be utilized on a part-time basis for specific tasks within their specialty.

As the engineer of record for both the passenger vehicle and fare collection equipment contracts, MRTC offers continuity between the design, manufacture, and test phase of the procurements, without the risks to the District of divided responsibilities. Our resident staff clearly understands the design intent as well as the entire content of the specifications and can offer the District the advantages of existing familiarization with the proposed tasks and minimum mobilization.

The District's requirements for the field work associated with these procurements fits well with the Joint Venture firms' existing work of a directly comparable nature. The firms are doing or have done similar inspection, test witnessing, and design review work on equipment manufactured by the suppliers most likely to be awarded contracts A650 and A660. As such, our personnel and management team has existing knowledge of the customs, weaknesses, and strengths likely to be encountered, whether the manufacturer is in Europe, the Far East, Canada, or the U.S.

1.2 DBE/WBE Qualifications: MRTC proposes to utilize DBE and WBE firms that are well-known to the Joint Venture, and who have a proven capability in the passenger vehicle and fare collection field. The specific application of DBE/WBE firms to the

procurements is highlighted in Section 3 of the proposal. A short summary of their respective qualifications follows.

1.2.1 Unified Industries, Inc. (UII): UII furnishes engineering, technical management, and inspection services to government and industry. Since 1970, UII has developed expertise in a broad range of disciplines, including mass transit engineering, electrical and electronics engineering, automated data processing, and technical documentation.

Transit projects include participation in Baltimore, Washington Metro, SCRTD, and New York Mass Transit Administration projects.

1.2.2 Polytech, Inc.: Polytech is a large, minority-owned engineering, planning, and consulting firm established in 1969. Offices are maintained in Atlanta, Washington D.C., Milwaukee, and Houston. Polytech's participation in transit projects includes engineering and inspection for Houston Metro, engineering and assurance for SCRTD specifications, and support work at the Transportation Test Center at Pueblo, Colorado.

1.2.3 Transportation and Transit Associates, Inc. (TTA): TTA is a young company of excellent talent in the field of transportation and transit engineering. Their expertise ranges from transportation studies and economic analyses to vehicle concept, engineering, inspection, and management of projects. The TTA team is compact, hard-hitting, and comprised of personnel with extensive qualifications and direct experience. The staff, without exception, possess an excellent track record of successful participation in several transportation and transit projects, both in the U.S. and overseas.

Current projects include work for the Chattanooga Area Regional Transportation Authority and the Port Authority of New York & New Jersey.

1.2.4 H.A. Anderson Associates: H.A. Anderson Associates is a recently established Women Business Enterprise. The firm, headquartered in Culver City, California, provides various consulting services to the transit industry, including the planning and conceptual design of maintenance and operating facilities, operations and maintenance studies, and the development of equipment lists and specifications.

Ms. Anderson has been involved in the transit field for almost 10 years. Prior to establishing her own firm, she was employed by the transit section of an internationally based architectural/engineering organization and, before that, by the Southern California Rapid Transit District in Los Angeles. Her experience has included preparation of transit-related equipment specifications, analysis of various fare collection systems, route planning, and scheduling.

1.2.5 Sharon Clark Associates, Inc.: Sharon Clark Associates, Inc., founded in 1979, is a certified Women Business Enterprise (WBE) providing specialized services and personnel to public and

private sector clients in transit, urban planning, and aerospace. Corporate capabilities include:

- o Document control/correspondence control
- o Information management/records management
- o Configuration Management/Change Control/Design Review
- o Safety/Security/Emergency Preparedness.

1.3 Supporting Disciplines: MRTC's combined firms currently retain engineers in the disciplines required by the District's RFP at the approximate staff levels indicated below. Specialists within these disciplines can be made immediately available to MRTC to aid in resolving any problem which might arise during design, manufacture, test, or start-up of the equipment being procured for contracts A650 and A660.

Table 1.1

PARTIAL LIST OF JOINT VENTURE SPECIALISTS

	Total
Systems Engineering	146
Electronics/Electrical Engineering	175
Mechanical Engineering	253
Structural Engineering	263
Civil Engineering (Facilities Installation)	490
Metallurgy	10
Industrial Design	19
Quality Assurance	180
Human Factors Engineering	23
Test Engineering	85
Management Information Systems (MIS)	70
Computer Sciences	40
Plant Surveillance	50

1.4 In-plant Inspection Qualifications: MRTC will utilize the Joint Venture firms existing staff of experienced inspection and quality assurance personnel to perform daily inspections of car assembly and equipment installation at the carbuilder's plant. Inspection will be augmented by DBE/WBE personnel, depending on the location of the work. It should be noted that we currently maintain inspection forces in several U.S. and foreign locations that can move to the SCRTD project when suppliers are selected. MRTC will monitor and report on the production progress, change status, schedule performance, safety program compliance, configuration control, subcontractor inspection, and quality programs. Contract documents, specifications, and approved plans and drawings provide the basis for checklists that will be established and used to provide continued compliance with contract requirements. MRTC maintains a qualified staff of technical personnel to implement the tasks described below.

1.4.1 Monitor Progress: The in-plant reporting at the carbuilder's and supplier's plants by MRTC's assurance personnel will be closely monitored by engineering personnel so that potential problem areas receive early attention and resolution.

1.4.2 Inspection of Components, Equipment, and Assemblies: Inspection of in-process and completed components, tooling, test equipment, and equipment assembly steps will be performed by personnel experienced with manufacturing methods and practices. MRTC's inspectors document and maintain records of the quality assurance program as equipment progresses through the stages of production, test, and preparation for shipment. Selected staff will be located at the prime contractor's facility. Selected surveillance personnel will be at subsystem supplier's plants on a visiting or long-term residence basis, as required by the supplier's performance.

Specialists in all technical aspects of procurement, and in vehicle systems such as propulsion, trucks, HVAC, and friction brake equipment are available to SCRTD. They can be utilized during the design review cycle as well as at first-article inspections and acceptance and performance testing.

MRTC PARTICIPATION IN VEHICLE PROGRAMS
(Similar to SCRTD Requirements)

Client	Specification	RFP or Bid Evaluation	Design Review	Inspection	Test Witnessing	Recommendation for Acceptance	Current Status	Client Contact
BART A&B Cars	X	X	X	X	X	X	Complete	K. Hari
BART C Cars	X	X	X				Complete	K. Hari
MARTA CQ 310	X	X	X	X	X	X	Complete	J. Healey
MARTA CQ 311	X	X	X	X	X	X	Nearly Complete	J. Healey
Dade County Miami	X	X	X	X	X	X	Nearly Complete	J. Brownson
MTA Baltimore	X	X	X	X	X	X	Nearly Complete	P. Schmidt
PATH PA-4	X		X				Nearly Complete	H. Meadows
NYCTA R-62 & R-62A			X	X	X	X	Ongoing	A. Dzingelis
PAT Pittsburgh	X	X	X	X	X	X	Nearly Complete	R. Sedlock
Singapore				X	X	X	Active	D. Ballou
METRO Houston	X	X					Project Cancelled	A. Locke
Hong Kong Kawloon Canton Railway	X	X	X	X	X	X	Active	P. Quick
San Jose Guadalupe	X	X	X			X	Active	L. Miller
DART Dallas	X	X	X	X	X	X	Active	T. Venturato

Figure 1.1

MRTC PARTICIPATION IN FARE COLLECTION EQUIPMENT PROGRAMS
(Similar to SCRTD Requirements)

Client	Specification	RFP or Bid Evaluation	Design Review	Inspection	Test Witnessing	Recommendation for Acceptance	Current Status	Client Contact
BART San Francisco	X	X	X	X	X	X	Complete	K. Hari
MARTA Atlanta	X	X	X	X	X	X	Complete	W. Medley
Dade County Miami	X	X					Complete	J. Brownson
MTA Baltimore	X	X	X	X	X	X	Essentially Complete	P. Schmidt
LACTC LRT	X	X	X	X	X	X	Will be Bid in late 1986	N. Jester
DART Dallas	X	X	X	X	X	X	Active	T. Venturato

Figure 1.2

Section 2

MANAGEMENT AND ORGANIZATION

The organization established to implement the work required by the District's RFP will be designated as the Procurement Support Organization (PSO). The organization will be made up of three sections under the direction of the Program Manager (PM). Figure 2.1 is the proposed Organization Chart for the PSO.

The Procurement Support Organization will function as a largely independent entity within the MRTC framework. The PSO will function in a matrix relationship with the remainder of MRTC. In the early stages of the procurement program, the full-time staff assigned to PSO will consist only of the management and clerical staff. Other full-time employees will be added at the appropriate time to staff field positions. Other personnel required to perform the tasks assigned to PSO will be drawn, when needed, from MRTC and the Joint Venture member organizations.

The names of qualified, experienced personnel available for work in PSO are provided in Section 4 (Resumes of Key Personnel) of the proposal. Other qualified personnel will be available depending on the actual timing of program events. The PSO Program Manager will bring staff on board to meet the program needs. The flexibility this method of operating permits, is a highly productive feature of a matrix-type organizational arrangement.

The Program Manager will have responsibility for direct management of all activities of employees when they are on assignment to the PSO. The Program Manager will report directly to the District's Director of Systems Design and Analysis (SDA). The proposed Program Manager, Mr. Sanderson, has already established a direct working relationship with the District's Director of SDA during the conduct of his current duties.

2.1 Organizational Responsibilities: Two operating sections within the PSO are planned. They will be designated as "Engineering" and "Systems Assurance and Test Operation." Each section will be directed by a highly qualified senior manager with responsibility for the execution of the tasks assigned to their section. The task assignments are shown on Figure 2.1. The Engineering Manager will have additional duties and responsibilities as Assistant Program Manager.

While the PSO will contain a staff organization devoted to the very important function of CDRL control, other required services, such as word processing, drafting, reproduction, etc. will be obtained from the existing MRTC organization.

2.2 Communication Policies

2.2.1 Communication With the District: Official communications between MRTC and SCRTD will be directly between the PSO Program Manager and the District's Director of SDA. This channel of

communication has been used successfully in the past for informational transfers related to procurement planning.

Direct information communication channels will be established between the PSO Section Managers and the District's Senior SDA Staff Managers. Contractual direction to the PSO will come through the Director of SDA.

2.2.2 Communication With Prime Contractors for A650, A660: The communications arrangement between the PSO and the prime contractors for A650 and A660 is more complex. There is no contractual relationship planned between MRTC and the prime contractors. Therefore, the PSO will only be able to communicate with the contractors under the authority granted by the District to do so and within prescribed limits.

For these contracts, the District will provide the contract administration function. The District will process required Change Orders, Stop Work Orders, and similar contract documents. The PSO is very capable in contract administration and will provide assistance to the District regarding such matters.

In addition to communications of a contract nature, the prime contractors will require frequent communications of a technical nature as the projects progress. Experience with many past projects has proven that this type of information transfer is best accomplished through a single official communications channel between customer and contractor. Multiple channels can cause delay, result in lack of coordination, and increase the risk of claims. The Contract General Provisions, as currently constituted, require such communications to be between the District's Representative and the Contractor's Project Manager. It is proposed that the PSO Program Manager be the District's Representative in this context.

2.2.3 Communication With Subcontractors: There is no requirement for official communications between the PSO and subcontractors. The prime contractor is responsible for the direction of all of his subcontractors. An attempt to bypass the prime contractor could place the District at risk relative to claims. However, there may be cases where it becomes necessary for the District to provide strong, direct input to a subcontractor who may not be responding acceptably to direction transmitted through the contractor. If such a case occurs, the PSO will require the contractor to be party with it in meetings with the errant subcontractor to develop corrective action plans. By this means, PSO can be sure that the contractor is giving the proper direction to the subcontractor while minimizing the risk of claims.

2.2.4 Communication With Other Metro Rail Consultants: Contracts with other consultants will be executed between MRTC and the consultant. Official correspondence will flow between MRTC Contract Administration and the consultant. In the case of a consultant's work on tasks assigned by the PSO, MRTC Contract Administration will only initiate contract correspondence at the direction of the PSO Program Manager. Additionally, all day-to-day direction of the consultant's effort will be by the appropriate PSO Manager.

2.3 Routine Management Procedures: This section of the proposal presents the PSO approach to routine schedule, cost control, and reporting activities.

2.3.1 Schedule: The PSO intends to utilize the contractor and subcontractors in-place scheduling systems for monitoring procurement progress. Requirements for scheduling are specified in the contract. The PSO will ensure that these requirements are met and that the contractor's scheduling systems provide the necessary interface data to mesh with the District's Project Control System. Timing of periodic status updating from the contractor will be coordinated to meet the needs of the project.

2.3.2 Cost Control: The major cause of cost overruns on fixed-price contracts is from claims because of delay attributable to the buyer. This can be caused by delay in decisions by the buyer. Claims might also arise because the contractor feels technical direction is inadequate or confusing. The PSO will minimize cost overruns by applying proven project management techniques to the procurements. The PSO will assign qualified, experienced project managers for this purpose. In addition, PSO engineering will be alert to value engineering possibilities throughout the contractor's design and engineering program.

2.3.3 Reporting Activities: The PSO will provide quarterly progress reports as required by the RFP. The monthly activity and status report of the PSO will be incorporated into the regular MRTC Monthly Progress Report.

Throughout the period of procurement projects, the PSO will issue special reports, as appropriate, required to properly manage the project activities. Such reports might cover retrofit status, critical items, correspondence action requirements, etc. The need for the reports will be determined by the Program Manager.

MRTC PROCUREMENT SUPPORT ORGANIZATION (PSO)

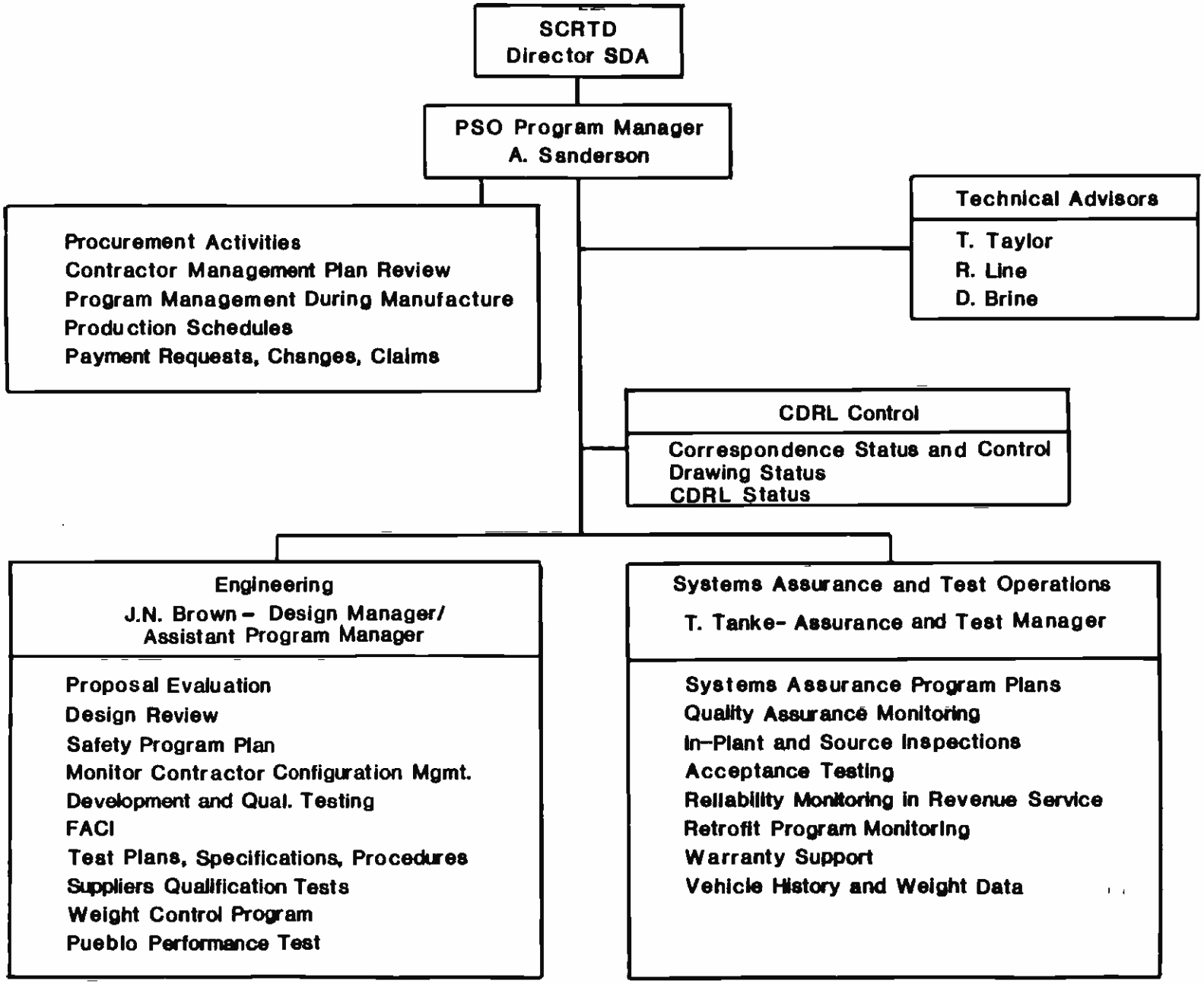


Figure 2.1

Section 3

DBE/WBE PARTICIPATION

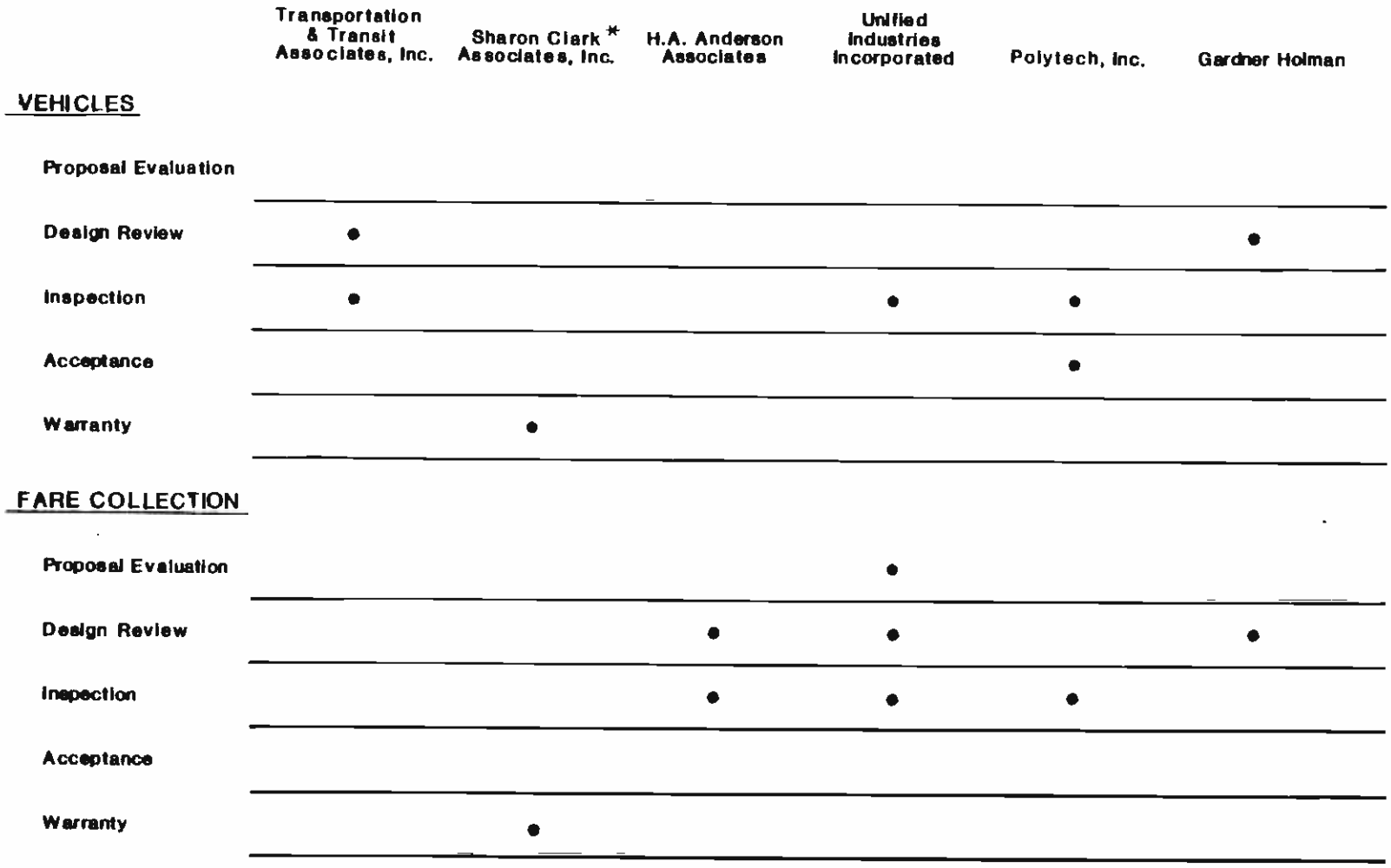
The MRTC Joint Venture is committed to provide fair, effective, and practical opportunities to disadvantaged and women-owned or controlled business enterprises who qualify themselves as subcontractors under the MRTC contract with SCRTD. During the preliminary and continued preliminary engineering phases of our current contract, MRTC is pleased to have met or exceeded DBE/WBE participation goals on the Metro Rail project. MRTC currently enjoys an existing contractual relationship with many of the firms proposed to be utilized for the requested procurements and will establish contracts with the others. Figure 3.1 contains names of six such subcontractors and their proposed role in the tasks outlined in the District's RFP. The role for each subcontractor was selected after careful comparison of their qualifications related to the tasks required to be performed during the procurement support program.

3.1 Subcontracting Plan: Figure 3.1 depicts the role for each subcontractor and their proposed areas of participation on this program. The tasks to be performed during the procurement support period were carefully reviewed and compared to the firm's experience and staff capabilities. Additional areas of participation will be identified as the program progresses.

3.2 Work Methods, Contractual Interface: The subcontractors will maintain two-fold interfaces with MRTC, i.e., technical and contract administration. The technical interface under the management of Mr. A. Sanderson will be defined contractually such that he will be required to assign personnel to work directly under supervision of MRTC supervisors, either in the Los Angeles engineering office or in field offices.

The contract administration interface will be with MRTC and will deal primarily with contract negotiations, determination of contract ceiling, duration of contract, and any subsequent revisions to the scope. Both the original contract and subsequent revisions will be processed through SCRTD for review and approval in accordance with current procudures. Accurate records will be maintained of DBE/WBE participation in all work related to this specific procurement support program.

SUBCONSULTANT (DBE/WBE) SUMMARY



*Also qualified to provide document control personnel.

FIGURE – 3.1

Section 4

RESUMES OF KEY PERSONNEL

The following list of personnel and resumes of key personnel for each of the skills required to implement this procurement project are provided to demonstrate MRTC's capacity to apply ample resources with specific experience and skills either from the joint venture firms or from WBE/DBE firms. The systems engineers have been identified under passenger vehicles and fare collection separately, however, the procurement engineering, inspection, and the testing staff members have experience in many areas, and can be utilized to staff either of the procurements. Figures 1.1 and 1.2 show the various projects the Joint Venture firms are currently supporting, the personnel listed herein represent only a portion of our overall capability. The resumes are selected to highlight the experience and background of key personnel, however, proposal space limitations necessitate that they are abbreviated. Additional information will be provided upon request. Since the District's schedule indicates that no testing or inspection will start until 1988, and the point of manufacture in unknown, we offer this list to also be representative of the field personnel who will be made available to your project at that time.

1. Principals
   - A. Sanderson * Manager
   - J.N. Brown * Design Manager and Assistant Project Manager
   - T.J. Tanke * Assurance and Test Manager

2. Project Advisors
   - R.H. Line *
   - T. Taylor
   - P.S. Brine *

3. Systems Engineers - Passenger Vehicles
   - D. Kriens *
   - R.P. Karlen *
   - R.H. Line *
   - D. Allen *
   - T.C. Blaschke *
   - D.F. Fordham *
   - T. McCranie
   - G. Wasz
   - G. Trnka
   - D. Godley
   - K. Fattahi
   - D. Caudwell

4. Systems Engineers - Fare Collection
   - W. Volkmer *
   - G.E. McCoy * - UII
   - P.S. Brine *
   - J.T. Dowtin * - UII
   - H.A. Anderson (HAA)

5. Procurement Engineering
   - Roger Harrison *
   - Delmar Pierce
   - E.A. Carmichael
   - J.C. Reeve
   - G.N. Robbins

6. QA and Inspection
   - G.P. McCann *(Supervisor)
   - K.E. Kouder *
   - S. Alexander *
   - G.A. Grawe *
   - C.E. Snowden - UII
   - C. Malatray
   - R.D. Kochler
   - M. Ingram
   - W.E. Price
   - J.H. Graham *(Polytech)

7. Testing
   - J. Mesa
   - C. Diaz
   - J.H. Graham *(Polytech)
   - A. Zubor

*Resume included

4.1 RESUMES

Alan C. Sanderson

Alan C. Sanderson has 30 years of broad-based experience in systems engineering, project management, and project procurement, wherein he has progressively assumed positions of increasing responsibility. He has participated in a wide variety of projects, including transportation, space nuclear propulsion, and naval nuclear propulsion program.

Mr. Sanderson as Manager of Procurement Engineering, at the Los Angeles Metro Rail Project, is engaged in procurement planning of the systemwide equipment, developing contract terms and conditions to be used for equipment procurement, and developing bid packages for the various procurements.

He has reviewed technical specifications and provided guidance relative to their acceptability for contracting purposes. This effort requires ascertaining that documents clearly and contractually define the items being procured and the contractor's responsibilities so that the contract can be fairly administrated. Prepared procurement plans and developed procurement strategies.

Westinghouse Electric Corporation, Transportation Division: As Manager of Systems Engineering, was responsible for all systems engineering activities for propulsion subsystems, automatic train control, and people mover systems. Work included system design and analysis, component specifications, interface design and control, and marketing support (proposals and negotiations). Had responsibility for the operations at the factory's people mover test track.

Miami People Mover Project: As Manager of Systems Design, was responsible for the Westinghouse systems design effort and for managing the engineering contracts for the design of the guideway and stations.

As Manager of Projects, was responsible for project management of all transportation projects from contract award to acceptance. Personally assigned as project manager for the Atlanta Airport People Mover Project.

Had responsibility for developing and managing the Division Field Organization that carried out all field operations for systems supplied by the Division. Field operations included installation, test, start up, and warranty support; and, where the contract required, operations and maintenance.

BART Project, San Francisco: As Manager, had project responsibility for the automatic train control contract with BART and for the propulsion supply contract with Rohr. Directed major efforts required to resolve problems and make the systems operational, to client's satisfaction.

Education: B.S., Physics, Ohio State University, 1948.

J. Nicholas Brown

Mr. Brown has 27 years of progressively responsible experience in project and engineering management, product engineering, and reliability and safety analysis. Recent assignments include managing systems design activities for the Los Angeles Metro Rail Project, including Fare Collection and Passenger Vehicle Systems procurement specification preparation. Previous assignments include acting as project manager of joint vehicle procurement for the regional transit systems in Baltimore, Miami, and Boston; and management of engineering product support activities for BART, WMATA, and Amtrak Turboliner vehicle programs with Rohr Industries.

Los Angeles Metro Rail Project: As manager of mechanical equipment, Mr. Brown is responsible for supervision of the fare collection, passenger vehicle, and the support groups, including safety, security, quality assurance, and safety certification. He also participated in the preliminary engineering leading to systems alternatives analysis, and criteria development.

Long Beach Light Rail Project: Participated in the fare collection system alternatives analysis.

Universal Studios (MCA) Project: Performed safety study of the Super Tram; directed the efforts of safety engineers performing gross hazard analysis and performed safety overview of the A-Team live action show.

Miami and Baltimore Joint Vehicle Procurement Project: Directed the engineering and contractual interface activities at the Budd Company facilities during manufacturing and testing of these Metro Rail type vehicles.

Light Rail Vehicle Project, Boston, Mass: Managed the systems engineering reliability, in-plant inspection, warranty management and testing departments for the procurement of Boeing Vertol articulated light rail vehicles for MBTA.

At ROHR Industries, Chula Vista, California: Responsible for systems engineering of the vendor equipment, production testing, and manufacturing of 200 BART cars. Also managed the BART and Amtrak Turboliner acceptance test team.

At General Dynamics, San Diego: Managed a group responsible for failure and reliability analysis of Atlas and Centaur missile components.

At Westinghouse Electric Company, Baltimore, Maryland: As designer, performed packaging design tasks for airborne radar sets.

Education: B.S., Mechanical Engineering, University of Texas, 1958
Management Certificate, University of California, 1977

Registration: Mechanical Engineer, California, 1984

Professional Affiliation: American Society of Mechanical Engineers

Thomas J. Tanke

Mr. Tanke has 18 years of experience in system safety, systems assurance, fire protection, testing, quality assurance, and security management in the transportation and construction industries. A summary of the projects in which he has participated in various capacities follows:

Los Angeles Metro Rail Project: As Manager of Safety, Assurance & Security, he managed, controlled, and directed systems safety, fire/life safety, systems analysis, systems assurance (reliability, maintainability, availability), quality assurance, integrated testing, and security activities.

Regional Transit Program, Houston, Texas: As Manager of Program Integration, Assurance and Safety, he managed, controlled, and directed the groups comprising the program integration department, including: configuration management, integrated testing, systems safety and assurance, quality assurance, and records and reprographics for the regional transit program in Houston.

U.S. Department of Transportation Test Center at Pueblo, Colorado: As Manager of Safety, Quality Assurance and Emergency Services, he approved all designs of facilities, trackage, systems, and tests from a systems safety and assurance viewpoint. He oversaw and approved all testing programs for every mode of transportation, including heavy rail, light rail, conventional rail, air-cushion, AGT, and linear induction motor vehicles. Participated in and approved design for numerous facilities.

Dynalecton Corporation, Manager, Safety and Emergency Services: In charge of all safety, systems assurance, and emergency services (fire, medical, security) activities in support of the U.S. Department of Transportation at the Transportation Test Center, Pueblo, Colorado for Dynalecton Corporation.

Kentron International in Pueblo, Colorado: Managed all safety, systems assurance, and emergency services (fire, medical, security) activities.

Green Construction Company: As Loss Prevention Manager, he directed all safety, security, medical, fire protection, and loss prevention activities at the Pueblo Dam project in Pueblo, Colorado.

Wright, Inc.: As Corporate Safety Director, he was responsible for all loss prevention, insurance, safety, training, and personnel activities for Wright, Inc. in Des Moines, Iowa. Traveled throughout 17 states in viewing all projects, including power transmission line construction, telephone communication line construction, and facilities construction.

Royal-Globe Insurance Company: As Loss Prevention Engineer, he supervised safety activities for Royal-Globe Insurance Company in both its Minneapolis and Chicago offices. His duties included directing five safety engineers in Minnesota, Wisconsin, North Dakota, South Dakota, Saskatchewan, Manitoba, and Alberta.

Education: B.S. Mechanical Engineering, University of Illinois
M.S. Mechanical Engineering, University of Wisconsin

Registration: Professional Engineer, California, Illinois, and Texas

Sam Alexander

Mr. Sam Alexander has 20 years of experience in mechanical field inspection and quality control, and supervision of inspection personnel. The following is a summary of projects that he has participated in various capacities.

Miami Dade County Rapid Transit Project System Quality Assurance Representative: Performed detailed inspection on vehicles being built at the Budd Company, Philadelphia, Pennsylvania.

Great Plains Project at Beulah, North Dakota: Served as the Quality Mechanical Inspector.

At Mount Clemens division of Gulf Western, Inc., as Quality Control Manager: Responsible for all phases of inspection from raw stamping to finished product; and customer relations with Ford, General Motors, and American Motors.

Education: B.S., Central Michigan College, 1950

Dennis Allen

Mr. Allen has 25 years of experience in locomotive, transit vehicle, passenger car and freight vehicle manufacture and maintenance. He is credited with an invention of a warning device to alert personnel of proximity to high-voltage power lines. A summary of projects in which he has participated in follows.

For the MARTA, Hitachi heavy rail transit vehicles: Acted as Chief Test Engineer both at Pueblo, Colorado, and in Japan.

For NFTA: Performed project engineering for the light rail passenger vehicle systems and represented NFTA at Pueblo for prototype vehicle testing.

For the Caracas, Venezuela project: Prepared vehicle specification, evaluated bids, and made purchase recommendations.

At Boeing Services, International: Directed demonstration testing program for MARTA, MBTA, and SOAC vehicles.

At British Rail's research department: Supported the testing of new concept vehicles, including the advanced passenger train, high-speed diesel locomotive, high-speed freight vehicles, and magnetic levitation systems.

At Pullman Standard: Served as project engineer for manufacture and assembly of Amtrak bi-level cars.

Education: Diploma in electrical engineering, Derby Institute of Art & Technology

Theodore C. Blaschke

Mr. Blaschke has 28 years of experience, 17 years in systems engineering of transit vehicles and support for procurement of components as well as inte-

grated vehicle systems. A summary of projects in which he has participated follows.

Assigned to Avondale car shop to provide technical assistance for redesign of motor/gearbox coupling support and vehicle overhaul program for the MARTA vehicles. Earlier, as a member of the vehicle engineering group, contributed to its development of vehicle specifications coordination and testing of MARTA vehicles.

Port Authority of Allegheny County, Pittsburgh, Pennsylvania: Lead vehicle engineer responsible for project engineering of six-axle articulated light rail vehicle procurement program.

Bay Area Rapit Transit vehicles: Supervised the mechanical/electrical groups for the manufacturer, and participated in static and dynamic testing of the BART vehicles.

Education: B.S., Purdue University
M.S., M.I.T.

Patrick S. Brine

Mr. Brine has 37 years of professional experience, of which 18 years have been spent in the transit industry, mainly in fare collection and vehicle systems engineering. A summary of projects in which he has held various positions follows.

Bus and rail networks of MARTA: Performed project engineering of the fare collection system, including specifications preparation, cost analysis, and proposal evaluation leading to system selection. Participated in production supervision and warranty program implementation after start-up and acceptance.

WMATA system: Provided input to the specification and maintained close contact with the manufacturer to ensure proper component capability for this complex system.

Also acted as the resident engineer in Japan to observe manufacture and testing of MARTA vehicles.

Education: Higher National Certificate

Joseph T. Dowtin

Mr. Dowtin has 10 years total experience, of which 3 are in installation and testing of automatic fare collection equipment for the Washington Metropolitan Area Transit Authority Subway. His earlier experience includes preparation of instruction manuals for operation, maintenance, and training programs with the U.S. Navy.

Education: High School Graduate, vocational training in electronics and communications

Dennis F. Fordham

Mr. Fordham is a Chartered Engineer in the U.K. and has 24 years of mechanical/electrical manufacturing experience, and extensive experience in vehicle equipment design, operations, and maintenance. A summary of projects in which he has participated in follows.

Port Authority Trans Hudson Corporation (PATH): Reviewed the door system and the pneumatic design of the PA-4 Kawasaki vehicles. Also performed project engineering for the Yard & Shops layout.

Acted as a general consultant to New York City Transit Authority (NYCTA) for the modernization of 13 barn facilities.

London Regional Transport: Managed the Ealing Common Maintenance Depot that had daily scheduled maintenance for 550 vehicles. Performed project engineering for door control and train brake equipment.

London Regional Transport: Performed project engineering for vehicles, including specification preparation, production monitoring, and final acceptance. Earlier, gained hands-on experience in brake testing and door maintenance.

Education: Diploma in Mechanical Engineering, South East London Technical College

Jack H. Graham (Polytech)

Mr. Graham has 38 years of professional experience, of which 10 are in the transit industry mainly in quality assurance, system assurance, and interface engineering technical services. A summary of applicable project experience follows:

Metro Rail Project, Los Angeles: Provided quality assurance service.

Houston Transit Consultants: As a Systems Assurance Specialist, developed RMA allocations, programs and criteria; performed various system analyses in support of the total design effort.

Transit Vehicle Maintenance Supervisor at Transportation Test Centers, Boeing Services, International, Inc., and Dynalectron Corporation, both in Pueblo, Colorado.

Acted as Chief Test Engineer at Rohr Industries, Chula Vista, California for the Washington, Metropolitan Area Transit Authority (WMATA) Test Program, conducted at Department of Transportation (DOT) Test Center.

Winder Transportation System (Rohr): Supervised the production of rapid transit vehicles.

He was actively engaged in the direct support or in a supervisory capacity on the following test programs conducted at the DOT Test Center:

ACT I
MBTA (Orangeline and Blueline)

VIF (Vehicle Induced Forces using R-42 type cars)
SOAC/ASDP
SOAC/Wheel Rail Noise
SOAC/Rail Dynamics Lab GVT on RDU
MARTA "C" Car
WMATA Wheel Alignment Tests - Washington, D.C.

Education: Numerous college, military, professional management and technical courses.

Gene A. Grawe

Mr. Grawe has 35 years of experience in Quality Control, Quality Assurance & In-plant inspection. The following is a summary of projects that he has participated in various capacities.

Miami/Baltimore vehicle procurement. At the Budd Company, Philadelphia: Responsible for source inspection, process inspection, surveillance inspection and documentation of all discrepancies.

Pullman Standard: Served as Quality Planning and Product Scheduler for Amtrak's Superliner and served as Inspection Supervisor for the NYCTA R46 transit cars.

St. Louis Car Co.: Served as Inspection Supervisor for the R44 NYCTA transit cars.

Education: Job-related experience.

Roger Harrison

Mr. Harrison has 25 years of experience in the procurement, manufacture, testing, and installation of vehicles. Fifteen years have been devoted to all facets of transit vehicle planning, procurement, and testing. Following is a summary of applicable project experience:

New York City Transit Authority: Project Director for the procurement of 825 new R-62A subway cars produced in Canada, with assembly and testing taking place in the U.S.A. Earlier, he managed the procurement of 352 R-62 cars built by Kawasaki, Japan.

MARTA, Atlanta project: Served as resident engineer in the France field office for the procurement of MARTA cars.

In addition, he was test track manager for a major transit car manufacturer where he was responsible for completion of the performance testing of a fleet of 450 Bay Area Rapid Transit (BAPT) vehicles.

Education: B.S., Mechanical Engineering, University of Michigan

Robert P. Karlen

Mr. Karlen has 30 years of professional design and engineering experience, the last 24 as a specialist in the design of transportation vehicles. In addition, he has been responsible for industrial design and human engineering support for passenger vehicle and fare collection systems. Following is a summary of projects in which he has participated in various capacities:

Los Angeles Metro Rail Project: Industrial designer and human factors engineer for the passenger vehicle, fare collection, security, and surveillance systems. Directed the production of the model for passenger vehicles.

Miami transportation improvement program: Performed industrial design and human engineering for cab design, station attendant booth, and all passenger/equipment interfaces, such as fare collection, security and surveillance system, and central control.

Australian urban passenger train project: Directed the industrial design programs.

Budd Company, Railway Division: Performed conceptual engineering of skylounge vehicle.

For San Francisco Metro & MBTA, Boston: Designed passenger environment and visual aspects of vehicles.

For Boeing Vertol and UMTA: Performed conceptual engineering and final design of advanced concept train (ACT-1).

For Long Island Railroad: Supervised the shop renovation of Wyer and double deck commuter cars.

For Northern Virginia Transport Commission and UMTA: Developed special interiors for the GMC transit buses.

For the Cleveland Transit System: Redesigned the airport vehicle interiors.

Education: B.F.A., Industrial Design, Carnegie Institute of Technology

Kenneth E. Kouder

Mr. Kouder has 22 years of experience in quality control, quality assurance, and procurement support activities in the transportation industry. A summary of applicable project experience follows.

MARTA Project, Atlanta: Senior Quality Assurance Inspector.

CDI Corporation, Atlanta, Georgia: Technical specialist providing interface between MARTA and utility companies.

Winder Transportation Systems, Winder, Georgia: Prepared design modifications on mechanical and electrical installations for rapid transit vehicles.

General Dynamics: Coordinated daily test activities for the F-111 aircraft.

Various other systems projects for aircraft instrumentation and testing.

Education: Attended Purdue University

Donald D. Kriens

Mr. Kriens is a registered Professional Engineer in the State of California and has 26 years of extensive project management, procurement, and systems engineering experience for transit vehicles and mechanical equipment, including design of mechanical systems, propulsion systems, and car body.

Port Authority Trans Hudson (PATH), New Jersey as vehicle engineer, prepared specifications for the procurement of vehicles compatible with existing vehicles.

Los Angeles Metro Rail Project: Assisted in preparation of specification, design criteria, and cost estimates for comparative evaluation of alternatives; participated in industry and design reviews.

Performed alternatives analysis and conceptual engineering for LACTC for the LA-LB Light Rail Study.

San Francisco Cable Car: Reviewed the hydraulic brake design and supervised installation.

Participated in the light rail system, alternatives analysis for the Orange County Transit District.

Managed the specification preparation, reflecting state-of-the-art material and technology selection leading to procurement of BART "C" cars.

Coordinated the start-up efforts for San Francisco Muni light rail system.

Acted as consultant to Rohr, UMTA, and Kaiser Engineers for transit vehicle development.

Provided technical supervision during various phases of BART, system engineering, and start-up.

Prepared specification for the MBTA and the Caracas vehicles.

Education: B.S., Mechanical Engineering
University of California, Berkeley

Richard H. Line

Mr. Line is a registered professional engineer in the State of Pennsylvania and Washington and has 22 years of professional engineering experience in design, procurement and testing of rapid transit vehicles. A summary of projects in which he has participated in various capacities follows.

Port Authority Trans Hudson Corp., (PATH), New Jersey: Performed technical review of the Kawasaki PA-4 series vehicles.

Seattle Monorail Project: Responsible for preliminary and final engineering for rehabilitation and upgrading of Seattle Monorail.

Transportation Improvement Program, Miami: Acted as a client representative for Dade County for technical administration and procurement of 136 Rapid Transit vehicles. During design phase, performed project engineering for propulsion, train control, and traction power systems.

Boeing Vertol Co. for the State of the Art (SOA) train project: Provided overall supervisory coordination for engineering, production, and demonstration of the SOA vehicle in Cleveland, Chicago, and Philadelphia subways. On the Advanced Subsystems Development Program (ASDP), provided technical coordination for friction brakes.

For Lee Tire & Goodyear Tire Company: Planned, tested and produced test result reports for the vehicle tires.

Education: B.S., Mechanical Engineering, Carnegie-Mellon Institute, Pittsburgh

G.P. McCann

Mr. McCann has 22 years of experience in quality assurance and quality control, primarily in the manufacturing and testing of aircraft and light/heavy rail vehicles. Following is a summary of applicable project experience:

Miami/Baltimore joint procurement inspection for 236 Budd vehicles.

Performed NDE Level-II inspection for Zimmer nuclear power plant.

Inspected 175 light rail Boeing Vertol vehicles for MBTA at Philadelphia manufacturing site.

Boeing Aircraft Company, Pennsylvania: Flight test inspector.

Hayes Aircraft Corporation, Delaware: Quality Control Foreman.

Cook Electric Company, Delaware: Quality Control Foreman.

Flight Enterprise, Inc., Connecticut: Aircraft Inspector.

Education: High School Graduate, Mechanical & Nondestructive testing training

Gerald E. McCoy

Mr. McCoy has 14 years of experience, of which 6 are six in project engineering, manufacture monitoring, quality control, installation, and acceptance testing activities of the fare collection system. A summary of the projects in which he has had diverse functions follows.

Serves as fare collection project engineer for the Baltimore rapid transit system. Responsible for monitoring the manufacturing, quality control,

installation, acceptance and testing activity for the fare collection equipment.

Washington, D.C. WMATA fare collection system: Responsible for the installation and supervision of the automatic fare collection system. Compiled reliability and maintainability data during the first year of operation.

Los Angeles Metro Rail Project: Reviewed and commented on prefinal specifications, and prepared responses to the comments received.

Has participated extensively on various FAA projects for reliability evaluation of communication systems, etc.

Education: B.S., Electrical Engineering, University of Arkansas
Graduate Studies in Digital Electronics, Eastfield College

W.D. Volkmer

Mr. Volkmer has 26 years of mechanical engineering and transit-related experience with 5 years in fare collection system engineering. Following is a summary of applicable project experience:

Rapid Transit System, Miami: Served as fare collection project engineer for Stage 1 Rapid Transit System in Metropolitan Dade County, Florida. Analyzed proposed integrated bus and rail transit system to determine the best method of collecting fares and parking fees. Wrote specification for selected equipment.

Los Angeles-Long Beach Light Rail: Performed alternate study, providing input to the fare collection specification.

Has extensive experience in vehicle system engineering, procurement, testing, and start-up.

Education: B.S., Mechanical Engineering, Georgia Institute of Technology
Graduate Study, Mathematics, Pennsylvania State University

Section 5

TASK DESCRIPTIONS

5.1 Procurement Activities

Passenger Vehicle (Task A)
Fare Collection (Task A)

The activities in this task are applicable to both the passenger vehicle procurement and the fare collection system procurement.

5.1.1 Verification of Procurement Package: The PSO will initiate this task by verifying that there are no last minute changes needed to the print ready specification package and the RFTP. If there are changes they will be incorporated and the documents quality checked using standard MRTC procedures, and forwarded to the District for readiness certification. The final printing of documents will occur after such certification.

5.1.2 Proposal Review Team Indoctrination: The PSO will submit a recommendation for the makeup of the proposal review team to the District for approval. PSO will utilize, to the utmost, personnel located in the Los Angeles area, thus minimizing travel and per diem expenses. However, if needed, the Joint Venture members have available a large pool of transit-experienced personnel to assist in the evaluation effort.

When the District has approved the makeup of the team, the PSO will arrange an indoctrination meeting for the team members. At the meeting, members will be provided with all documents and procedures they will need during the evaluation process. A complete and thorough explanation of the procurement process (two-step) will be given. Discipline and security requirements will be emphasized. Special attention will be devoted to the steps required to minimize possibility of protests. The need for evaluation checklists will be covered and team members will be required to prepare them for their disciplines and submit them to the PSO in advance of the evaluation effort. The schedule for the actual evaluation work will be provided.

5.1.3 Pre-Proposal Conference: The PSO will participate as requested in a pre-proposal conference. Selected experts will be available at the meeting to be called on as requested by the meeting chairman. Following the meeting, the PSO will prepare replies to questions as requested by the District. The PSO will be prepared to process and distribute the written answers to questions and addenda (if required).

5.1.4 Evaluation of Proposals: The evaluation teams will be assembled after proposals become available. All proposals will be evaluated for compliance with requirements, utilizing previously prepared checklists as an aid in the process. This method will ensure uniformity in the evaluation. Each team member will document the results of the evaluation. Areas of noncompliance or of uncertainty

as to content or intent of the proposals will be highlighted. Each reviewer will be asked to supply a list of any questions to be answered by the proposer as a means of clarification. The PSO will provide for proposal security and for overall documentation of the evaluation activity. The necessary resources will be provided to maintain the documentation on a current basis.

The PSO will assist the District in holding meetings with proposers. Based on the results of the meetings, the PSO will recommend changes to the RFP that will either enhance competition or reduce the vehicle cost. The PSO will recommend which proposals should be judged acceptable and will recommend the disposition of the remainder.

When the evaluation is completed and the District has developed their final bidders list, the PSO will prepare the Invitation to Bid. The ITB will indicate, by means of a proposer's unique document identifier, the precise version of the proposal that is acceptable to the District's requirements and for which a price bid is being requested.

5.1.5 Bid Evaluation: When the bids have been opened, the PSO will assist in the evaluation of the apparent low bid. The completeness of the bid will be verified. The PSO will provide an assessment of reasonableness of the price and assist in any preaward survey. Following award, the PSO will assist the District in the preparation of the conformed contract.

5.2 Design Review

Passenger Vehicle (Task B)
Fare Collection (Task B)

MRTC's approach to the design review tasks is based upon past experience on similar programs, as listed on Figures 1.1 and 1.2.

There are many factors that effect how the design review process should be organized and executed. Sensitivity to and experience with these factors are vital to a successful design review program. Success can be defined as a program that is performed at reasonable costs, in a manner that does not delay or add claim costs to the total program, and, most importantly, as one that produces quality equipment and software.

The primary purpose of the design review process is to develop equipment that meets the specification and is of the highest quality. There are, however, secondary objectives, which include the confirmation of the compatibility of various detailed requirements in the specification, and the review of material that will be used in the operation and maintenance of the equipment.

The PSO will review the passenger vehicle and fare collection contractor's plans, drawings, calculations, specifications, samples, models, markups, software data, and other CDRL items necessary for approving the contractor's design. The review will evaluate the design for conformance with the contract documents, District requirements, the contractor's proposal (as finalized during Step I of

the bidding process), and good design practice. Additionally, contractor equipment performance at other properties will be reviewed to determine if any unresolved safety or reliability problems exist that should be corrected in the District's equipment. Special emphasis will be placed upon the submittals relating to safety, reliability, maintainability, industrial design, and human factors engineering. The design review process will confirm that the various system elements are compatible by comparing the specification requirements with the contractor's design.

The data submitted by the contractor in support of the design review meetings will be reviewed by the PSO prior to the meetings. Open questions will be raised at the meetings. Particular attention will be given to modifications incorporated since the various systems were last in use. In addition, the passenger vehicle data relating to fire/life safety requirements will receive special emphasis.

The review cycle will follow the design review process established in the technical specifications and further defined by the contractor's plan submittals, as required by the CDRL.

The contractor's production schedules will be reviewed for completeness and accuracy, particularly with respect to the availability of subcontractor equipment, tooling, design and manufacturing resources to perform to the schedule, with adequate allowance for testing and shipping time. If the contractor is overseas, special emphasis will be given to determining the adequacy of the time allowed for all aspects of shipping by sea.

For the passenger vehicle, the schedule of the first two pairs of cars for Pueblo will be reviewed to determine if adequate time is allowed for testing, shipment, retrofit of design modifications resulting from testing, and refurbishment for shipment to the District.

The testing program proposed by the contractor will receive special attention. The test plans will be reviewed to determine completeness with respect to full compliance with specification requirements. The test procedures will be reviewed to determine if all performance and acceptance test parameters are identified. Particular emphasis will be placed on the demonstration of contractually required test equipment to test the system parameters, including the identification of faults. Test data will be analyzed to confirm that the test objectives were met.

For fare collection, emphasis will be placed on the testing and checkout of the complete five-station system and the RCC equipment. The successful operation of the fare collection computer, in conjunction with the station fare collection control unit and the other station equipment, must be confirmed by extensive tests and review of test results.

Safety and systems assurance program plans will be reviewed for compliance with contract requirements and design intent. The contractor's approach to providing the required data to support scheduled design review meetings will be examined closely. Past programs

have suffered because this important documentation was not available to support approval of designs in a timely manner.

For the passenger vehicle, carbody and truck stress and fatigue analyses will be reviewed for accuracy and completeness. When the related test procedures are submitted, they will be reviewed to confirm that the proper high-stress points have been selected for monitoring.

Near the completion of the design phase, the O and M manuals will be submitted for review. These manuals have, in prior projects, been lacking in depth and have been of limited use to the buyer for the purpose intended. To prevent this, MRTC will closely monitor the progress of manual preparation, much of which may be done by subcontractors, to confirm that satisfactory manuals are being produced.

MRTC will utilize a proven computer-assisted system to maintain control of and to identify approval status of all documents, drawings, etc. that are submitted. A dynamic database program is used in MRTC's computer system to assist in record keeping and tracking submittal information. As materials are received, they are categorized, described, and assigned a file number. Figure 5.1 is a sample page from the program currently in use to control documents for the PA-4 design review. Information needed to respond to and incorporate data and task completion dates are also logged into the program. When all information for a particular submittal has been responded to/incorporated, a final disposition sign-off is recorded. MRTC is able to generate reports on particular reviewers, vendors, or even subject matter, depending on the needs of the user. This program results in accurate submittal progress monitoring and record keeping, essential to an organized procurement process.

The PSO will monitor the implementation and execution of the contractor configuration control processes, which is a critical design control process to prevent equipment from being delivered in unapproved configurations.

All engineering changes and value engineering proposals will be evaluated for sound engineering practice and benefit to the District. It is anticipated that improvements not required by the specification will be available as the program progresses and should be taken advantage of by the District.

5.3 Quality Assurance

Passenger Vehicle (Task C)
Fare Collection (Task C)

The objective of a quality program is to achieve complete customer satisfaction in a cost-effective and expedient manner. A quality program consists of the collective documents, activities, and events provided to confirm that a product will satisfy the specified requirements. The total quality assurance program addresses safety, reliability, maintainability, design, quality, and documentation. To achieve optimum results, each contractor involved must develop, implement, and assign responsibilities for quality assurance tasks.

Effective quality assurance monitoring will be provided through the development and use of concise, documented procedures, instructions, checklists, and experienced personnel. This will result in a consistent, systematic process to determine that effective quality practices are used during the manufacturing process and to verify that the contractor and subcontractors comply with the quality standards established in the contract documents.

MRTC will review the contractor's system assurance program plans to confirm that description of the systems assurance work is in conformance with the contract documents.

The assessment of the effectiveness and adherence to established quality requirements will be documented by the generation of quarterly quality status reports that will identify trends and progress. These quality status reports will be based upon the results of quality audits performed on specific elements of the quality program, review of the contractor systems assurance analyses, reports, change proposals, and other relevant CDRL items.

Contractor control of manufacturing, fabrication, installation, inspection, and testing processes will be monitored to prevent excessive product defectiveness and variability, and to verify conformance of the characteristics that can be verified only at the time and point of manufacture/assembly. The PSO will provide on-site representatives at the contractors' facilities to observe and sign off on inspections and tests of designated critical items. Inspections will be performed in accordance with specific instructions and checklists, and at appropriate points in the manufacturing process, to verify compliance with drawings, process specifications, test specifications, and quality standards. Procedures and forms will be developed to document defects and noncompliance through the use of nonconformance reports and corrective action requests. Sample forms, currently in use on other programs, can be supplied upon request.

Audits will be performed on a systematic basis, or as warranted by general quality trends, to determine the effectiveness of, and to verify compliance with, the specified systems assurance requirements imposed on contractors and subcontractors. Audits will be performed and documented in accordance with the SCRTD Quality Assurance Review Guidelines, using contract-specific audit checklists, with reports distributed to the appropriate management levels.

Objective evidence of compliance with systems assurance and other contractual requirements will be provided through the generation and maintenance of quality records. Documentation comprising the quality records will be specifically identified and will be maintained in the locations deemed appropriate in an organized and readily retrievable manner. Minimum data requirements to be contained in quality records will be defined to provide completeness and traceability. History files will be established and maintained for each individual passenger vehicle and will contain all pertinent quality records.

Supervision will be provided and records maintained of contractually required follow-up services, such as retrofit programs. Records will be maintained and will be used to assist in determining the need for further corrective action during the acceptance or warranty program.

The progress of the vehicle production program will be monitored to verify that systems assurance hold-points identified in the manufacturing plan are observed.

Performance of inspections, prerequisite tests, and the acceptability of results will be reviewed to prevent further processing of unacceptable or nonconforming materials or items. Change requests and value engineering proposals will be reviewed to assess the potential effect on systems assurance requirements. For designated critical items, the disposition of nonconforming material will be reviewed through participation of the material review board.

5.4 Inspection at the Contractor's Plant

Passenger Vehicle Inspection (Task D)

The PSO will establish a team of inspectors at the carbuilder's facility that have recent experience on other similar projects, depending on the location of this procurement. The inspection process will start during the manufacture of components for the Pueblo vehicles and continue through the shipment of the last dependent pair.

Components manufactured at the carbuilder's facility will be thoroughly inspected prior to installation onto the vehicle. Tooling and the first production articles will be inspected to confirm configuration and acceptable quality standards. Calibration status of test equipment will be confirmed for each test on each vehicle.

The inspection personnel will become thoroughly familiar with specification requirements and the carbuilder's manufacturing plan, quality documentation, and quality organization in order to establish inspection hold points for the vehicle. These hold points will be used to establish acceptability of vehicle quality during all phases of production. Contractor quality documentation will be reviewed at hold points.

The methods and equipment utilized for handling and packaging will be reviewed and inspected to confirm that component and vehicle quality is not compromised during handling and movement.

Quality records will be prepared and maintained for each vehicle. Significant inspection, deficiency, and test records will be included in a car record book.

The vehicle components and subsystems will be thoroughly inspected. The following list of major items is presented to illustrate MRTC's familiarity with points to be covered in performing inspections.

5.4.1 Car Body Exterior: Perform complete visual inspection covering: fit, finish, logo, graphics, body configuration, door and window configuration, front-end molding, anticlimber, door openings, glazing, and lights. Check door opening devices, crew steps, grab handles, operation of head, tail, trouble, door lights, and operation of signs.

5.4.2 Car Body Interior: Check for liner fit and finish. Check complete interior for cleanliness, loose or missing hardware, and discoloration. Inspect all seats, stanchions, and windscreens for secure installation, weld quality, and uniformity. Visually inspect logo, graphics, equipment installation, access panels, lighting, and HVAC diffusers. Check installation of floor covering, thresholds, glazing, and doors. Check operation of access panels, door releases, and door lights. Check seating alignment and spacing.

5.4.3 Operator Cab: Visually inspect arrangement. Check door operation, locks, and releases. Confirm console-to-seat relationship. Visually inspect all exposed equipment. Check cab and console, lighting, and reading light. Check and inspect modular components, wiring harnesses, indicators, and switches. Check side door open/close panel and other panels. Check side window operation, HVAC diffusers, defogger/heater, ladder, isolation paddles, sun visor, fire extinguisher holder, glazing, key operated panel locks, and windshield wiper. Confirm clearance and dimensions of cabinet-mounted equipment.

5.4.4 Car Underfloor: Confirm that all equipment is securely installed in accordance with the drawings. Inspect truck/carbody wiring/piping interfaces for potential interference during truck and coupler motion. Inspect wiring and piping runs. Check for chafing, water traps, and proper installation. Check dimensions and clearances for maintainability and replacement. Check door latches, locks, and markings.

5.4.5 Car Construction, Including Raw Materials and Structural Elements: Visually inspect structural shapes for dimensional and processing defects. Inspect/monitor the forming and fabrication of structural pieces. Inspect jigging, assembly, fit-up, welding, and finishing of car structure.

5.4.6 Castings and Machining: Monitor contractor's quality inspection of castings for voids, thin walls, cracks, and overall casting quality. Inspect machined surfaces for evidence of poor casting quality. Monitor the inspection of all machining for dimensional conformance and interchangeability.

5.4.7 Wheels, Axles, and Mounting: Inspect wheels and axles at time of mounting, checking machining quality, fit, and condition of mating surfaces, plus overall condition and quality of wheels and axles, including balance records and presence/absence of laps on wheels. Verify pressing for proper lubricant application, pressure build-up, and recording of information. Verify lubrication of bearings.

5.4.8 Truck Parts and Components: Inspect for maintenance of proper clearances, shimming, and binding of moving components, such as shock absorbers. Check torque of fasteners, and installation of wiring and air lines, as applicable.

5.4.9 Couplers and Drawbars: Verify free coupler swing, and level and true installation of coupler carrier bars. Check smooth coupler hook operation. Inspect couplers with gauges. Test coupler centering and electric head operation. Verify trainline makeup and looping.

5.4.10 Friction Brake Equipment: Verify air tightness and quality of equipment and piping. Inspect installation of air hoses for absence of twists, kinks, chafing points, and for proper support.

5.4.11 Glazing: Inspect for proper type and quality of glass. Verify that glazing installation is watertight in car without the use of sealant.

5.4.12 Propulsion Equipment: Inspect for cleanliness and wire dress in the microprocessor cabinet, inspect all high-voltage wiring terminations, inspect motor/gearbox installation, and inspect for proper installation of all subassemblies and assemblies such as the propulsion blower motor, the chopper control box, and the contactor assemblies. Inspect wire harness support and marking of wires.

5.4.13 Doors, Door Operators, and Controls: Check for free movements of doors, proper switch adjustment, and control panel operation. Monitor door fit and finish. Dimensional checks to the drawings will be performed.

5.4.14 HVAC Equipment: Perform dimensional checks to the drawings. Monitor inspection of motors and electrical control gear. Inspect pipe preparation brazing and installation on the carbody.

5.4.15 Wire and Cable: Audit manufacturer's receiving inspection records. Check for insulation defects (nicks, scratches, cuts, and depressions) on the car. Review samples for insulation thickness, quality, and concentricity. Check for sharp bends, correct terminations, sufficient strain relief and support, and rubbing cables on the car.

Fare Collection Inspection (Task D)

The PSO will assign an inspector to the supplier's plant who has experience in recent manufacture of similar fare collection equipment. The inspector will not only inspect components and completed assemblies, but will also monitor software development.

The inspector will be thoroughly familiar with the specification requirements and the fare collection contractor's manufacturing plan, quality documentation, and quality organization, so that full inspection coverage of components, tooling, systems, and documentation is possible. Close contact with the project manager will be maintained by telephone, frequent plant visits, and daily reporting.

Test equipment calibration will be confirmed for each item of test equipment used to conduct tests and inspection on assemblies and finished equipment.

The methods and equipment utilized for handling and packaging will be reviewed and inspected to confirm that quality of components and assemblies will not be compromised during movement and handling.

The inspector will maintain inspection records for each deliverable item of equipment and its subassemblies. A data book will be prepared for each deliverable. The inspection staff will be augmented by engineering and management personnel at timely intervals to monitor progress of production, configuration management compliance, revisions and changes, schedule compliance, corrective action, contract changes, and to verify payment certificates. The deliverable equipment and its components and subassemblies will be thoroughly inspected. Emphasis will be placed on items that have been troublesome in past procurements and would include: cabinets for fit and finish, printed circuit boards/modules for quality component installation, and adequate tie-down, transport mechanisms for jam-free operation, and completed assemblies for successful repetitive operations, using actual coins, bills, and fare media.

5.5 Program Management During Manufacture

Passenger Vehicle (Task E)

A key factor for success in performing this task is the contractor's management plan. When properly developed by the contractor and approved by the District, the plan provides the foundation for good program implementation. Close monitoring of progress against the schedules in a well-prepared and realistic plan offers the best means for assuring good contractor performance on a project.

Immediately after contract award, the Program Manager will convene an organizational meeting with the contractor. This meeting will be for the purpose of:

- Introducing the key personnel to be engaged in the project.
- Discussing any contract issues that may require clarification.
- Emphasizing key program management requirements.
- Establishing regulated communication channels.
- Ensuring that the contractor clearly understands the importance of his management plan and the District's intent to thoroughly examine it and assure its adequacy prior to approving it. (A significant early pay item.)

When the contractor submits his management plan, the Program Manager and his staff will perfrom a thorough review and make recommendations to the District relative to approval. A key element for analysis is the contractor's engineering schedule and staffing plan. There are many examples of past procurements, where failure to

complete engineering on schedule has been a major cause of poor or late performance by a contractor. The PSO will ensure that the contractor's plans for the engineering activities are adequate, realistic, and meet the requirements of the project. Subsequently, the Program Manager will closely monitor progress in the early stages of the program to ensure a good start in this critical activity.

Another potential source of delay to the start of manufacturing relates to development and qualification programs for any modifications to previously proven design. The District intends to purchase a proven vehicle to an existing design. It is unlikely that his will be completely possible; some modifications will be necessary. If that is the case, the schedule for the modification effort will be thoroughly examined by the PSO for adequacy and reality. Once a program is agreed to with the contractor, its progress will be closely monitored and corrective action recommended immediately if any slippage occurs.

Routine program monitoring and control can be accomplished by the Program Manager's review of progress reports, payment requests, routine correspondence, and his frequent communication with the contractor's PM. However, periodic visits by the Program Manager to the contractor's facility and to his subcontractors is absolutely essential for effective program management. Such visits may be frequent at the start of a program. Visits will be less frequent as confidence in the contractor's performance and the accuracy of his reports is achieved. When the manufacturing operations are fully underway, PSO will have in-plant representation to provide the Program Manager with an independent assessment of the contractor's progress and performance.

To summarize, PSO intends to manage all program activities, including manufacturing, by assuring the contractor has developed adequate plans and schedules, has adequate staff and facilities, and by closely monitoring all phases of his program for progress against the schedule. If the contractor falls behind in any area, the Program Manager will require prompt development of corrective action plans for recovery.

5.6 Source Inspection

Passenger Vehicle (Task F)

The primary task associated with source inspection is to assure that quality standards are established and maintained at the vehicle (and fare collection if applicable) subcontractor's manufacturing facilities. The prime contractor is ultimately responsible for the quality of subcontracted items. However, experience has demonstrated the need for the prime contractor's inspection plan to be augmented by District quality representatives. MRTC proposes to accomplish source inspection utilizing senior inspectors, who frequently will visit the subcontractor, coordinated with or accompanied by the prime contractor. Visits will be timed to cover first production assembly and tests prior to shipment of equipment to the prime contractor.

It is anticipated that most major subcontractors will be U.S. suppliers who are already well-known to our experienced staff. Full-time residence at a subcontractor's plant is not anticipated, due to the size and delivery rate of these procurements, but resident inspectors can be provided during any unusual period of trouble with a supplier if needed.

Source inspection will be scheduled so that more than one subcontractor is visited on each inspection trip. The primary requirements for source inspection will be determinded from the prime contractor's manufacturing and subcontracting plan, but the major equipment items that are usually subcontracted are: propulsion, brakes, auxiliary electric, HVAC, trucks, and door equipment. These subsystems will be followed closely until quality trends are established that may allow reduced coverage by MRTC inspectors. Source inspectors then will monitor closely the prime contractor's source inspection practices and quality records.

5.7 Supervision of Contractor Testing

Passenger Vehicle (Task G)
Fare Collection (Task F)

A successful test program during all phases of the procurement is essential to confirm that the passenger vehicle and fare collection systems are ready to perform in revenue service, in accordance with specified requirements. The PSO will utilize a combination of engineering and quality personnel with related experience to perform testing supervision tasks. Personnel that have developed the testing specifications for A650 and A660 will assist with the task, to ensure that the intent of the specification is adhered to.

The contractually required test plans and detailed test procedures will be reviewed for compliance with specification requirements, proper selection of test parameters, planning and scheduling, complete data sheets, call-out of test facilities requirements and fixtures, environmental conditions, pass/fail criteria, test objectives, test duration, test type, and test conditions. Test reports will be reviewed and test data analyzed to verify that all requirements were met. This work will supplement that done on test plans and procedures during the design review phase.

When confidence level testing is performed, these repetitive tests will be observed to confirm that the contractor has achieved the required confidence level.

Tests at the contractor's facility will be closely monitored. In addition to observing test results, MRTC personnel will observe the methods used to perform the tests and recommend changes where necessary. Reports will be provided to the District providing the status of all tests.

For the passenger vehicle, tests will also be conducted at the TTC in Pubelo, Colorado. In addition to observing performance tests, special attention will be paid to problems that may develop during testing. These problems will be tracked to confirm that adequate

corrective action is implemented for production vehicles. Extensive in-plant tests, such as water test, hipot and megger tests, and system tests, will be monitored for conformance to approved test procedures.

For fare collection, acceptance testing of deliverable equipment, such as ticket vending machines, gates, etc. will be monitored and recorded. Of particular importance is the testing of a sample set of station equipment at the contractor's facility. All equipment must be functioning satisfactorily before it is shipped to the stations. After installation, station tests by the contractor will be monitored to confirm that all the interfaces and the equipment are functioning as required. Safety-related checks of the gate operation will receive special emphasis. Once the RCC fare collection computer and equipment in all five stations is operational, MRTC personnel will assist the District in monitoring reliability demonstration testing.

5.8 Receiving Inspection and Acceptance Testing

Passenger Vehicle (Task H)

Prior to the delivery of the first vehicles to Pueblo, the PSO will prepare a detailed acceptance cycle plan and detailed acceptance test procedures. These documents will cover all activities, from delivery to the site to final acceptance, required to confirm that each vehicle meets the District's quality and performance requirements.

The vehicles will be shipped from the contractor to a designated site at the yards and shops. Some minor dissassembly of the dependent pair will be required prior to shipment. PSO inspectors will perform an initial receiving inspection to check for shipping damage. After the contractor's site team has completed reassembly of the dependent pair, receiving inspection will be completed, and confirmation will be made that electrical and mechanical connections are in-place and that all equipment is securely mounted. A similar function will be performed at Pueblo.

Performance tests that could not be completed at Pueblo will be accomplished at the site.

After the inspection phase is satisfactorily completed, the PSO will monitor the modified vehicle performance tests and the vehicle performance tests of each dependent pair. The PSO will monitor the two- and four-car loaded and empty tests to confirm acceptability to the previously approved test procedures. The PSO will ride the vehicles, participate in the observation of meters and chart recorders, and make an initial determination as to the pass/fail status of each test.

In light of the 30-day time allocated for acceptance testing, MRTC will assist with test scheduling and coordination with other contractors with respect to track, power, and train control availability.

After the performance tests are initially completed, it is anticipated that retrofits will be required and some tests reperformed. The PSO will monitor these open tasks until completion.

During the first year of revenue service, the PSO will support the reliability demonstration test by participating in the Incident Evaluation Committee's review activities, review of contractor status reports and failure analyses, and District incident reports. The PSO will inform the District when it appears that parts or all of the test may be failed. The PSO will critique the changes proposed by the vehicle contractor and recommend approval or provide comments.

Monthly reports will be provided summarizing the PSO's activities and the achieved MTBF/MMBF results.

After completion of all tests, the PSO will perform a final inspection before recommending acceptance by the District. The car record books will be updated to include all activity prior to acceptance. Testing results will be evaluated on a continuing basis and, where appropriate, changes to equipment, maintenance procedures, or operations will be made.

5.9 Installation Inspection

Fare Collection (Task E)

The contractor is required to install all station equipment, pull and install power and control wiring, and install the computer and related peripherals at the RCC. Also, the contractor will have to remove sections of the finished floor in the gate arrays to install gates required for MOS-1, as well as blockouts for future installations. MRTC inspectors will be on-site whenever the contractor is on-site.

Areas to be inspected in the station include mounting, wiring installation, leveling, completed tile work in the gate array, and filler panel installation. When the equipment arrives, it will be inspected for shipping damage.

In the RCC, the installation will be closely observed, since this element provides the link between fare collection equipment and other Metro Rail systems. A PSO representative will closely monitor the installation progress vs. the schedule, review field changes, interface between the contractor and the construction manager resident engineer, and verify progress payment certificates. Extra work charges will be closely monitored and certified.

The PSO will maintain quality records describing the quality status of all equipment.

5.10 Revenue Service Reliability Testing

Fare Collection (Task G)

MRTC personnel with experience in reliability demonstration testing will monitor system performance based upon failure data provided by the District. This data will be compiled and calculations made for individual machine MTBFs and MTFs. Failure rates for the complete MOS-1 system will be calculated and trends will be developed so that early identification of problem areas requiring contractor corrective action can be made. To assist in the performance of this task, the PSO representative will review incident reports, contractor failure analyses and status reports, and develop trend charts showing test results. Contractor-proposed changes will be critiqued. The District will be assisted with the review of incidental reports for inclusion in the reliability test calculations.

5.11 Follow-up Supervision

Passenger Vehicle (Task I)
Fare Collection (Task H)

PSO representatives will monitor the program during the post-manufacturing phase. A prime goal will be to enable the District to receive all the equipment, software, and services in accordance with the contract documents for the agreed-upon price. To this end, the PSO will recommend that the holdback of contract payments always exceed the potential costs to the contractor to satisfactorily complete the required work. To assist the District in accomplishing this goal, the PSO will perform the tasks described below.

- Certify the final progress payment after confirming that all work has been accomplished.

- Assemble all weight, performance, schedule compliance, and modification information and develop backup for assessment of liquidated damages and/or other liability by the contractor for the contract damages.

- Review and inspect the contractors' and suppliers' retrofit programs for compliance with quality and engineering requirements. Evaluate the effectiveness of the modifications and identify the requirements for further retrofit programs.

- Evaluate the production incorporation point for design changes. Monitor contractor adherance to configuration control procedures during retrofit programs. Assist the District with the diagnosis of problems that require correction of design or manufacturing defects.

- Provide assistance to the District in the implementation of the warranty program, including a maintenance information system, tracking of warranty repairs, replacement of failed components, evaluation of remedies, and meeting with the contractor's representatives to resolve problems.

- The PSO will support the resolution of claims filed by the District or the contractor. Formal reports will be prepared to support the District's position. Change orders will be evaluated for accuracy and reasonable cost. The PSO will evaluate and reply to all contractor change requests.

5.12 General Program Oversight

Passenger Vehicle (Task J)
Fare Collection (Task I)

5.12.1 Progress Reports: The PSO Project Manager will report quarterly to the District as to the prior quarter's actual activities and the following quarter's planned activities. Estimated vs. actual costs by month for the PSO organization will be plotted. A bar chart that shows the project progress based upon the contractor's work status will be provided. A status of pending engineering changes will be included.

The PSO will closely monitor the contractor's progress and schedule. In the event the delivery schedule appears to be in jeopardy, the PSO will recommend a top-level meeting with contractor management to resolve the causes of problems affecting the schedule. Corrective action will be recommended based upon the PSO staff's extensive experience with passenger vehicle and fare collection contractors.

5.12.2 Consultant Performance Evaluation Criteria: Several factors are important to a successful procurement management program. The consultant's role in procurement support is defined by the scope of services prepared by the District and the consultant's performance relative to that scope can be measured by the following factors:

- Budget Compliance: Consultant's estimate of tasks compared to his actual expenditures.

- Communication With Client: The Director of SDA and his staff must be kept current on supplier progress, schedules, and submittals.

- Responsiveness to Client: Client direction must be implemented promptly, with technical excellence and follow-up.

- DBE/WBE Goals: Achievement of goals must be measured and reported.

- Records Management: Submittals and correspondence must be promptly responded to and the status of all correspondence maintained and reported.

- Plant Inspection: Effectiveness of the inspection staff and the quality program can be measured by the reduction in numbers of supplier discreparcies.

After award of a contract, if it is desired by the District, the PSO will work with the District to develop a method for quantifying these performance factors.

Cumulative Vendor Transmittal Report DATE: 07-Mar-86

(Arranged by (NI-NT-#)

VENDOR TRANSMITTAL NUMBER	TITLE	FILE NO.	REVIEWER	DWG. CODE NO.	DOCUMENT NUMBER	REV. NO.	DATE RECEIVED	INTERNAL REVIEW DATE	CLIENT REVIEW DATE	REC TRANSMIT DATE	REC TRANSMIT NUMBER	FINAL DISP.
NI-NT-0611	PRINTED CIRCUIT BOARD DATA	09.02	ADELA				16-Oct-85	23-Oct-85			NOT REQ'D	INFO
NI-NI-0612	TSC (N-130) MISC. ELECT. DC MOTOR	09.02	ADELA		N-130	0	16-Oct-85	25-Oct-85		28-Oct-85	0620	AMEN
NI-NI-0613	PROP & LVPS-COUNTER COMMENTS TO PA-NT-0414	10.02	ADELA				16-Oct-85	24-Oct-85	18-Dec-85	25-Oct-85	0621	AMEN
NI-NI-0614	TRUCK FATIGUE TEST RESULTS(THRU 1,500,000)	11.02	ERIENS				16-Oct-85	18-Oct-85	17-Oct-85	18-Oct-85	0589	APP
NI-NI-0615	POLYCARBONATE SHEET FOR WINDOW	03.10	ERIENS/TRNKA/HUNT				17-Oct-85	13-Dec-85		13-Dec-85	0748	APP
NI-NI-0616	DATA FOR A/C SYSTEM	07.00	FATTAHI/RICHARDS				18-Oct-85	21-Oct-85	16-Dec-85	06-Nov-85	0643	R&R
NI-NI-0617	EVAC, PRESSURE & LEAK TESTS FOR A/C SYSTEM	07.01	FATTAHI/RICHARDS				17-Oct-85	05-Nov-85	01-Nov-85	07-Nov-85	0647,0077	RAR
NI-NT-0618	CARBODY DRAWINGS (25 DWGS)	03.00	TRNKA/ANGLISS				18-Oct-85	27-Nov-85	18-Dec-85	04-Dec-85	0724	SEE LI
NI-NI-0619	WINDSHIELD	03.10	ANGLISS/TRNKA		PAN-J-1021C	3	21-Oct-85	20-Nov-85	18-Dec-85	21-Nov-85	0691	AMEN
NI-NT-0620	STRENGTH CAL.-COLLISION POST & CORNER POST	03.02	ERIENS/PADDOCK		PAN-J-1090A	1	21-Oct-85	31-Oct-85	09-Dec-85	13-Nov-85	0664	R&R
NI-NT-0621	DOOR OPERATING SYSTEM DWGS. (3 DWGS.)	06.01	NOMURA/TRNKA/ADELA				21-Oct-85	26-Nov-85	04-Dec-85	26-Nov-85	0711	R&R
NI-NI-0622	AT-2 BRAKE EQT ELECTRIC & PIPING DIAGRAM	12.01	TRNKA	996	B-A85240-11A	1	21-Oct-85	16-Nov-85	17-Dec-85	18-Nov-85	0676	APP
NI-NI-0623	LOAD CURRENT DATA-ROTARY SWITCH-HDC/CREW	06.02	RUNNEL/ADELA				21-Oct-85	30-Oct-85	02-Jan-86	19-Nov-85	0670	APP
NI-NI-0624	LUBRICATION OF DOOR TRACK	06.01	ANGLISS/TRNKA				21-Oct-85	12-Nov-85	02-Jan-86	15-Nov-85	0669	R&R
NI-NI-0625	MINUTES OF BI-WEEKLY MTG (PA-4) 9/30/85	02.11.04	ERIENS				21-Oct-85	25-Oct-85	09-Dec-85		NOT REQ'D	INFO
NI-NI-0626	EPR FAILURE	06.02	RUNNEL/ADELA				21-Oct-85	30-Oct-85	06-Jan-86	19-Nov-85	0677	APP
NI-NT-0627	CLARIF OF PA COMMENTS-ANTICLIMBER LD TEST	03.02	ERIENS				22-Oct-85	24-Oct-85	22-Oct-85	24-Oct-85	0615	INFO
NI-NI-0628	FAB TRUCK FATIGUE TEST OPEN ITEMS	11.02	ERIENS				21-Oct-85	24-Oct-85	21-Oct-85	24-Oct-85	0612	AMEN
NI-NI-0629	DATA OF ALUMINUM CONDENSER FAN	07.01	FATTAHI/RICHARDS				21-Oct-85	28-Oct-85	16-Dec-85	18-Dec-85	0740	R&R
NI-NT-0630	PROTEC-DISSIMILAR METAL CONTACTS-IDOC/ISAR	19.01	ERIENS				22-Oct-85	16-Nov-85	09-Dec-85	18-Nov-85	0673	SEE LI
NI-NT-0631	WELD THROUGH SEALANT	19.01	LUMMUS/ERIENS				22-Oct-85	23-Oct-85	09-Dec-85	23-Oct-85	0685	APP
NI-NI-0632	FRICTION AIRBRAKE SYSTEM (B-4 COMPRESSOR)	12.01	NOMURA/TRNKA				22-Oct-85	19-Nov-85		19-Nov-85	0684	INFO
NI-NI-0633	DOOR SYSTEM	06.01	ANGLIS/TRNKA/MURRE				22-Oct-85	20-Nov-85	18-Dec-85	21-Nov-85	0692	AMEN
NI-NI-0634	HIGH VOLTAGE SWITCH AND FUSE PANEL	09.06	ADELA				22-Oct-85	30-Oct-85	02-Dec-85	03-Dec-85	0721	AMEN
NI-NI-0635	CARBODY INTERIOR/HVAC/LIGHTING (23 DWGS)	03.00	ADELA/TRNKA/COOLID				23-Oct-85	04-Nov-85	18-Dec-85	25-Nov-85	0700	SEE LI
NI-NT-0636	REVISED CONTROL SCHEMATIC FOR HSCB	10.02	ADELA/MARCHETTI				22-Oct-85	04-Nov-85	06-Nov-85	04-Nov-85	0641	AMEN
NI-NI-0637	FIRE TEST PROCEDURE FOR FLOOR STRUCTURE	03.05	FATTAHI/TRNKA/HUNT		PAN-J-11020	4	23-Oct-85	01-Nov-85	18-Dec-85	05-Nov-85	0637	R&D
NI-NI-0638	CARBODY LOAD TEST PROCEDURES (3 DOCS)	03.02	ERIENS				23-Oct-85	23-Oct-85	02-Jan-86		NOT REQ'D	SEE LI
NI-NI-0639	CONFIG MGMT PROG/CODE D FOR DOC (2 DOCS)	16.01	ERIENS				23-Oct-85	31-Dec-85	02-Jan-86	02-Jan-86	0795	R&D
NI-NI-0640	CARBODY DWGS (21 DWGS)	03.00	TRNKA/ADELA/ANG/CA				24-Oct-85	02-Dec-85	17-Dec-85	06-Dec-85	0730	SEE LI
NI-NI-0641	TYPE TF-26 FUSE BOX OUTLINE (1 DWG)	18.02	ADELA	997	1063432 (R/3)	2	25-Oct-85	04-Nov-85	06-Nov-85	26-Nov-85	0708	AMEN
NI-NI-0642	PICKUP HSG INSTALL TRAC GEAR UNIT (1 DWG)	10.02	ADELA	997	1048394	1	24-Oct-85	14-Nov-85	17-Dec-85	26-Nov-85	0706	APP
NI-NI-0643	KEY SWITCH (1 DWG)	06.02	ADELA/RUNNEL	991	1725706 (R/1A)	0	24-Oct-85	14-Nov-85	02-Jan-86	26-Nov-85	0707,0747	AMEN
NI-NI-0644	FIRE TEST PROC. FOR FLOOR STRUCT. (2 DOCS)	03.05	FATTAHI/TRNKA/HUNT				24-Oct-85	01-Nov-85	09-Dec-85	05-Nov-85	0637	SEE LI
NI-NI-0645	CARBODY & ELECT. DWGS. (66 DWGS.)	03.00	TRNKA/ADELA/CABAPA				25-Oct-85	09-Dec-85	17-Dec-85	13-Dec-85	0742,0752	SEE LI
NI-NI-0646	CARBODY & HVAC DRAWINGS (37 DWGS)	03.00	TRNKA/FATTAHI/ADEL				25-Oct-85	12-Dec-85	23-Dec-85	16-Dec-85	0758	SEE LI
NI-NI-0647	CORRECTION OF DRAWING NUMBER	03.05	TRNKA/FATTAHI				24-Oct-85	31-Oct-85	09-Dec-85		NOT REQ'D	INFO
NI-NI-0648	TRUCK FATIGUE TEST RESULTS-THRU 2,000,000	11.02	ERIENS				24-Oct-85	25-Oct-85	09-Dec-85	25-Oct-85	0623	AMEN
NI-NI-0649	MOCK-UP	03.01	ERIENS/NELSON		PAN-J-1154	0	25-Oct-85	04-Nov-85	09-Dec-85	04-Nov-85	0638,0665	INFO/A
NI-NI-0650	FATIGUE LIFE CALCULATION OF FAB. TRUCK	11.02	ANGLISS/LUMMUS		PAN-J-1157	0	25-Oct-85	07-Nov-85	07-Nov-85	07-Nov-85	0640	R&R
NI-NI-0651	NON-DESTRUCTIVE INSPECTION PROCEDURE	11.02	LUMMUS/ERIENS		PAN-J-3006	0	25-Oct-85	31-Oct-85	09-Dec-85	04-Nov-85	0636	R&D
NI-NI-0652	SECTIONING OF FABRICATED TRUCK	11.00	LUMMUS/ERIENS		PAN-J-3007	0	25-Oct-85	01-Nov-85	09-Dec-85	04-Nov-85	0640	R&R
NI-NI-0653	TSC'S N-131,132,133,015C (4 DOCS.)	07.00	FATTAHI/DICH/ADELA				28-Oct-85	28-Nov-85	06-Nov-85	21-Nov-85	0694,0812	SEE LI
NI-NT-0654	RADIO EQUIPMENT	13.01	ADELA				28-Oct-85	15-Nov-85	06-Jan-86	15-Nov-85	B-100	INFO
NI-NI-0655	SEALING COMPOUND & ADHESIVE	19.01	FATTAHI/HUNT		PAN-J-1053G	6	25-Oct-85		09-Dec-85		0	
NI-NI-0656	EXTERIOR EMERGENCY LIGHT	03.09	NOMURA/TRNKA/ADELA		PAN-J-1150	0	25-Oct-85	28-Nov-85	28-Dec-85	28-Nov-85	0689	APP

Figure 5.1

Section 6

COST PROPOSAL

6.1 Work Flow and Budget Plan: The figures supplied with this section of the proposal are designed to show two aspects of the procurement program plan. These are the planned flow of work in the various tasks and the budgeted manpower to be applied to each task. The work planning has been coordinated with the procurement schedules provided in the RFP. Four labor categories have been depicted, where appropriate, on the enclosed figures. They are:

- Engineer (Eng), applicable to Engineers and Management
- Inspectors (Insp), applies to field inspection personnel
- Draftsman/Technician (D&T)
- Clerk/Word Processor (C&W).

Figure 6.1 shows the effort to be expended by the PSO on the program during the next Annual Work Program (AWP) year. The only task scheduled to be started in that period is the procurement activities task for the passenger vehicle. Selected subtasks are shown for this task in Figure 6.1. The work program is spread out on a monthly basis for the first year, in accordance with the requirements of the RFP, and budgeted manpower is shown for each subtask.

Figure 6.2 provides a summary of manpower by year for the full duration of the passenger vehicle program. Figure 6.3 depicts comparable estimates for fare collection procurement.

The cost proposal is based upon the information contained in Figures 6.2 and 6.3, with the 4400 forms provided for the period May 1, 1986 through April 30, 1987. The costs presented on the 4400 forms are based upon Figure 6.1.

MRTC had previously foreseen a level of engineering support for passenger vehicle procurement in the AWP draft submitted to the District on March 5, 1986. This support is necessary for continuity in responding to prospective A650 proposer questions and in proposal evaluation. This proposal, responding to the District's RFP for procurement support, overlaps our proposed AWP labor and will allow an approximate 12 man-month reduction in the systems design vehicle discipline as previously submitted. MRTC's selection for the procurement support tasks required by the District's RFP will reduce redundant technical support requirements throughout the procurement program, which will result in significant cost savings to the District.

6.2 Assumptions on Cost Projections: The cost projections shown on Figure 6.4 are based upon a number of assumptions:

- Burden rates are not changed from those shown on MRTC's 4400 forms for the 1986-87 AWP.

- Travel is based on the following schedule of trips by engineers and inspectors to suppliers' facilities:

1986	1987	1988	1989	1990	1991
0	14	44	44	44	9

  Air fare has been assumed at $1,000/trip, and subsistence cost at $600/trip. In addition, a minimal allowance for travel between Joint Venture firm home offices and Los Angeles has been assumed.

- The major elements of other direct costs are computer services, reproduction and printing, and postage and communications.

- Subcontractor costs have been estimated as 20 percent of Joint Venture labor plus burden, and will meet the DBE/WBE goals of our existing contract.

- Fixed fee is based on 9.5 percent of labor plus burden, and 2.5 percent of subcontractor costs.

METRO RAIL TRANSIT CONSULTANTS
ENGINEERING SUPPORT SERVICES FOR PROCUREMENT

PASSENGER VEHICLE
Summary Manpower Allocation
(Man-Months)

Eng = Engineer
C&W = Clerk/Word Processor

TASK DESCRIPTION		AMP Year 1986 →												
		← 1986 →								← 1987 →				
		MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	
PASSENGER VEHICLE Procurement Support														
Advertise Proposals						*								
Evaluate Proposals										xxxxxxxxxxxxxxxxxxxxxx				
A. Procurement Activities														Total
A.1 Prepare Final RFTP & Specifications	Eng				1.5	1.5								3
A.2 Organize/Indoctrinate Proposal Review Team	Eng							1.5	1.5					3
A.3 Participate in Pre-proposal Conference	Eng						2	1	1					4
	C&W						.3	.2	.2					.7
A.4 Evaluate Proposals - Hold Proposers Meetings	Eng									3	3	3	3	12
J. General Program Oversight	Eng			.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	2
TOTAL MH	Eng	0	0	.2	1.7	1.7	2.2	2.7	2.7	3.2	3.2	3.2	3.2	24
	C&W	0	0	0	0	0	.3	.2	.2	0	0	0	0	.7

Figure 6.1

METRO RAIL TRANSIT CONSULTANTS
ENGINEERING SUPPORT SERVICES FOR PROCUREMENT

PASSENGER VEHICLE
Summary Manpower Allocation
(Man-Months)

Eng = Engineer
Insp = Inspector
D&T = Draftsman/Technician
C&W = Clerk/Word Processor

Calendar Year ------> 86/87 87/88 88/89 89/90 90/91 91/92 92/93
AWP Year ------> <1986><1987><1988><1989><1990><1991><1992>

Passenger Vehicle Procurement Support:-
- Proposal/Bid to NTP xxxxxxx
- Design/Manufacture xxxxxxxxxxxxxxxxxxxx
- First Pair to Pueblo *
- Deliver Cars to LA & Acceptance Testing xxxxxxx
- Warranty Support xxxxxxxxxxxxxxxx

TASK DESCRIPTION									Program Total
A. Procurement	Eng	22	12						34
Activities	C&W	.7							.7
B. Design Review	Eng		12	26	9				47
	D&T		1	8	8				17
C. Quality Assurance Monitoring	Eng		2	9	9	9			29
D. Inspection at	Eng			3	6	6			15
Contractors Plant	Insp			2	24	12			38
E. Program Management	Eng		6	12	9	6			33
During Mfg.	C&W		4	6	6	6			22
F. Source Inspection	Eng			8					8
(sub-suppliers)	Insp			4	4	4			12
G. Supervision of	Eng				9	12			21
Contractor Testing									
H. Receiving Inspection & Acceptance Testing									
Pueblo	Eng				6				6
Los Angeles	Eng					14	9		23
	D&T					10	6		16
I. Follow-up Services	Eng					6	9	9	24
J. General Program	Eng	2	4	4	4	4	4	4	26
Oversight	C&W		1	1	1	1	1	1	6
TOTALS	Eng	24	36	62	52	57	22	13	266
BY YEAR ------>	Insp	0	0	6	28	16	0	0	50
	D&T	0	1	8	8	10	6	0	33
	C&W	.7	5	7	7	7	1	1	28.7
	TOTALS	24.7	42	83	95	90	29	14	377.7

Figure 6.2

METRO RAIL TRANSIT CONSULTANTS
ENGINEERING SUPPORT SERVICES FOR PROCUREMENT

FARE COLLECTION
Summary Manpower Allocation
(Man-Months)

Eng = Engineer
Insp = Inspector
C&W = Clerk/Word Processor

Calendar Year ------> 86/87 87/88 88/89 89/90 90/91 91/92 92/93
AWP Year ------> <1986><1987><1988><1989><1990><1991><1992>

Fare Collection
Procurement Support:-
Proposal/Bid to NTP xxxxx
Design/Manufacture xxxxxxxxxxxxxxx
Install & Check Out xx
(5 Stations, 1 Computer)
Revenue Operations Date *
Warranty Support xxxxxxxxxxx

TASK DESCRIPTION								Program Total
A. Advertise, Evaluate Proposal/Bids	Eng	1	3					4
B. Design Development Review	Eng		12	13	4			29
	C&W		2	2				4
C. Quality Assurance Monitoring	Eng		3	3	3	3		12
D. In-plant Inspection	Eng		1	2	1			4
	Insp		3	8	4			15
E. Installation Inspection	Insp				1	2		3
F. Testing Supervision	Eng		1	3	3	1		8
G. Revenue Service Reliability Tests	Eng					4	6	10
H. Follow-up Supervision	Eng					6	6	12
I. General Program Oversight	Eng	.6	1.5	2	2	2	1	9.1
	C&W		1	1	1	1		4
TOTALS BY YEAR ------>	Eng	0	1.6	21.5	23	13	16	13 88.1
	Insp	0	0	3	8	5	2	0 18
	C&W	0	0	3	3	1	1	0 8
	TOTALS	0	1.6	27.5	34	19	19	13 114.1

Figure 6.3

MRTC ENGINEERING SUPPORT SERVICES FOR PROCUREMENT
COST PROJECTIONS

	MAN-MONTHS 1986	1987	1988	1989	1990	1991	1992	TOTAL
POSITION								
Engineer- Off	24	37.6	33	73.5	61.5	26.5	18.5	324.6
Inspector- Off			2	2	2.5	1	0	7.5
Draft/Tech- Off		1	8	8	5	3		25
Clerical/WP	0.7	5	10	10	6	2	1	36.7
Engineer- Field			0.5	1.5	8.5	11.5	7.5	29.5
Inspector-Field			7	34	18.5	1		60.5
Draft/Tech-Field					5	3		8
Total	24.7	43.6	110.5	129	109	48	27	491.8

	COSTS							
Eng/Off	64900	101520	224100	198450	166050	71550	49950	876420
Insp-Off	0	0	4500	4500	5625	2250	0	16875
O/T- Off	0	1687.5	13500	13500	8437.5	5062.5	0	42187.5
Cler/WP	787.5	5625	11250	11250	9000	2250	1125	41287.5
Eng-Field	0	0	1350	4050	22950	31050	20250	79650
Insp-Field	0	0	15750	76500	41625	2250	0	136125
O/T- Field	0	0	0	0	8437.5	5062.5	0	13500
SUBTOTAL-OFF	65587.5	108832.5	253350	227700	189112.5	81112.5	51075	976770
SUBTOTAL-Field	0	0	17100	80550	73012.5	38362.5	20250	229275
BURDEN-OFF	91428.975	151712.51	353169.9	317413.8	263622.83	113070.83	71138.55	1361617.4
BURDEN-Field	0	0	16758	78939	71552.25	37595.25	19845	224689.5
TOTAL- LABOR	65587.5	108832.5	270450	308250	262125	119475	71325	1205045
TOTAL-BURDEN	91428.975	151712.51	370269.9	396963.8	336635.33	151433.33	91448.55	1586892.4
TOTAL-LAB+BURD	157016.48	260545.01	640719.9	706213.8	598760.33	270908.33	162773.55	2791937.4
TRAVEL	5000	30000	75000	75000	75000	20000	10000	290000
SUBCONTRACTS	39500	65000	160000	176500	150000	68000	40500	699500
OTHER DIR COSTS	45000	60000	75000	75000	75000	60000	50000	440000
TOTAL COST+BURDEN	246516.48	415545.01	950719.9	1032713.8	898760.33	418908.33	269273.55	4226437.4
FIXED FEE	15900	26400	64800	71500	60600	27500	16500	283300
TOTAL COST + FEE	262416.48	441945.01	1015519.9	1104213.8	959360.33	446408.33	279773.55	4509737.4

FIGURE 6.4

COST AND PRICE ANALYSIS

Form approved
Budget Bureau No. 04-R128

This form is to be used in lieu of FAA Form 3515 as provided under FAPR 2-16.260-2. It will be executed and submitted with proposals in response to "Requests for Proposals," for the procurement. If your cost accounting system does not permit analysis of costs as required, contact the purchasing office for further instructions.

PURCHASE REQUEST NUMBER

NAME AND ADDRESS OF OFFERER
Metro Rail Transit Consultants, A Joint Venture
of DMJM, PBQD, KE, HWA
548 S. Spring Street, Los Angeles, CA 90013

TITLE OF PROJECT
SCRTD Metro Rail Project (Revised)
General Consultant FY '86 - '87
Engineering Support Services for Procurement

DETAIL DESCRIPTION	ESTIMATED HOURS	RATE/HOUR	TOTAL ESTIMATED COST (Dollars)
1. DIRECT LABOR (Specify)			
Sr. Systems Engineer	2700	24.00	64,800
Clerical and Word Processing	79	10.00	788
Inspector	-0-	20.00	-0-
Drafter and Technician	-0-	15.00	-0-
TOTAL DIRECT LABOR			65,588
2. BURDEN (Overhead - specify) DEPARTMENT OR COST CENTER	BURDEN RATE	X BASE =	BURDEN ($)
DMJM - 32% of Direct Labor	1.45	20,988	30,433
PBQD - 27% of Direct Labor	1.38	17,709	24,438
KE - 27% of Direct Labor	1.42	17,709	25,147
HWA - 14% of Direct Labor	1.2442	9,182	11,424
TOTAL BURDEN			91,442
3 DIRECT MATERIAL			
TOTAL MATERIAL			
4 SPECIAL TESTING (Including field work at Government installations)			
TOTAL SPECIAL TESTING			
5 SPECIAL EQUIPMENT (If direct charge - specify in Exhibit B on reverse)			
6 TRAVEL (If direct charge)			
a. TRANSPORTATION		2,500	
b. PER DIEM OR SUBSISTENCE		2,500	5,000
TOTAL TRAVEL			
7 CONSULTANTS (Identity - purpose - rate)			
TOTAL CONSULTANTS			
8 SUBCONTRACTS (Specify in Exhibit A on reverse)			39,500
9 OTHER DIRECT COSTS (Specify in Exhibit B on reverse - explain royalty costs, if any)			45,000
10 TOTAL DIRECT COST AND BURDEN			246,516
11. GENERAL AND ADMINISTRATIVE EXPENSE (Rate % of item nos.			
12. TOTAL ESTIMATED COST			246,516
13 FIXED FEE OR PROFIT (State basis for amount in proposal)			15,900
14 TOTAL ESTIMATED COST AND FIXED FEE OR PROFIT			262,416

FAA Form 4400-2 (5-66) SUPERSEDES FAA FORM 3515-1

Figure 6.5

0052-625-9000

15. OVERHEAD RATE AND GENERAL AND ADMINISTRATIVE RATE INFORMATION		
A. GOVERNMENT AUDIT PERFORMED	DATE OF AUDIT	ACCOUNTING PERIOD COVERED

B. NAME AND ADDRESS OF GOVERNMENT AGENCY MAKING AUDIT	C. DO YOUR CONTRACTS PROVIDE NEGOTIATED OVERHEAD RATES? ☒ NO ☐ YES *(If yes, name Agency negotiating rates)*
Note: The rates in Item 2 are provisional rates of each of the four joint venture firms. Substantiation is through DCAA audit.	

D. *(If no Government rates have been established furnish the following information)*

DEPARTMENT OR COST CENTER	RATE	BASE	TOTAL INDIRECT EXPENSE POOL	BASE FOR TOTAL

16 EXHIBIT A - SUBCONTRACT INFORMATION *(If more space needed, use blank sheets, identifying item number)*

NAME AND ADDRESS OF SUBCONTRACTOR(S)	SUBCONTRACTED WORK	SUBCONTRACT	
		TYPE	AMOUNT
Various	DBE/WBE Staff Augmentation	CPFF	39,500

17 EXHIBIT B - OTHER DIRECT COSTS *(Specify. If more space needed, use blank sheets, identifying item number)*

Computer Services	10,000
Reproduction and Printing	30,000
Miscellaneous	5,000
TOTAL	45,000

CERTIFICATE

The labor rates and overhead costs are current and other estimated costs have been determined by generally accepted accounting principles. Bidder represents: (a) that he ☐ has, ☐ has not, employed or retained any company or person *(other than a full-time bona fide employee working solely for the bidder)* to solicit or secure his contract, and (b) that he ☐ has, ☐ has not, paid or agreed to pay to any company or person *(other than a full-time bona fide employee working solely for the bidder)* any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract, and agrees to furnish information relating to (a) and (b) above, as requested by the Contracting Officer.

(For interpretation of the representation including the term 'bona fide employee,' see Code of Federal Regulations, Title 44, Part 150.)

NUMBER OF CONTRACTOR EMPLOYEES		STATE INCORPORATED IN
☐ 500 AND UNDER	☐ OVER 500	
☐ OVER 750	☒ OVER 1,000	

DATE	SIGNATURE AND TITLE OF AUTHORIZED REPRESENTATIVE OF CONTRACTOR
3/28/86	B. C. Goodwin Manager. Project Admin.