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Teamwork for Oversight of Processes and Systems (TOPS)

Implementation Guide for TOPS
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1. Background

In the Spring of 1991, Defense Contract Management Command selected the Defense Plant Representative Office (DPRO) at TRW Space & Defense as one of seven organizations nationwide to develop and implement a Performance Based Management (PBM) Plan — a Total Quality Management (TQM) initiative. DPRO elected to develop the PBM Plan with TRW and to pursue it jointly. TRW and DPRO concurred on the Plan and mutually agreed on implementation.

2. Introduction

As the nation redefines priorities to deal with a rapidly changing world order, both government and industry require new approaches for oversight of management systems, particularly for high technology products. Declining defense budgets will lead to significant reductions in government contract management personnel. Concurrently, defense contractors are reducing administrative and overhead staffing to control costs. These combined pressures *require bold approaches* for the oversight of management systems.

In the Spring of 1991, the DPRO and TRW created a Process Action Team (PAT) to jointly prepare a Performance Based Management (PBM) system titled Teamwork for Oversight of Processes and Systems (TOPS). The primary goal is implementation of a performance based management system based on *objective* data to review critical TRW processes with an emphasis on continuous improvement. The processes are: Finance and Business Systems, Engineering and Manufacturing Systems, Quality Assurance, and Software Systems. The team established a number of goals.

- Delivery of quality products to contractual terms and conditions,
- Ensure that TRW management systems meet government guidance and good business practices,
- Use of objective data to measure critical processes,
- Elimination of wasteful/duplicative reviews and audits,
- Emphasis on teamwork — all efforts must be perceived to add value by both sides and decisions are made by consensus, and
- Synergy and the creation of a strong working trust between TRW and the DPRO.

TOPS permits the adjustment of oversight resources when conditions change or when TRW systems performance indicate either an increase or decrease in surveillance is appropriate. Monthly Contractor Performance Assessments (CPA) are derived from a summary of supporting system-level and process-level ratings obtained from *objective* process-level data. Tiered, objective, data-driven metrics are highly successful in achieving a cooperative and effective method of measuring performance.

The teamwork-based culture developed by TOPS proved an unequaled success in removing adversarial relationships and creating an atmosphere of continuous improvement in quality processes at TRW. The new working relationship does not decrease the responsibility or authority of the DPRO to ensure contract compliance and it permits both parties to work more effectively to improve total quality and reduce cost. By emphasizing teamwork in developing a stronger approach to efficient management of the defense industrial base TOPS is a singular success.

3. Responsibilities

TOPS consists of four main areas: Finance and Business Systems, Quality Assurance, Engineering and Manufacturing, and Software.

3.1 Finance and Business Systems

Finance and Business Systems covers the following TRW functions: contracts, pricing and cost data systems (estimating system), procurement, and property. Three of the systems, (pricing and cost data systems [estimating system], procurement, and property) require written certification by the Divisional Administrative Contracting Officer (DACO) that TRW policies and procedures satisfy all applicable laws, rules, and regulations of the government. The program applies to all TRW organizations in the Los Angeles area under DPRO cognizance.

3.1.1 TRW Functional Organization for Finance and Business Systems

3.1.1.1 Contracts

The contracts function participates in the sales acquisition process; serves as the official channel for business communications with the customer; conducts negotiations and commits TRW; determines contract requirements; and provides direction to company organizations regarding contractual compliance. Contracts also protects TRW financial, legal, ethical, and proprietary interests while promoting compliance with applicable laws and acquisition regulations.

3.1.1.2 Pricing and Cost Data Systems (Estimating System)

Pricing and Cost Data Systems provide financial leadership during the strategy, planning, development, and support of cost volumes. They strive to meet or exceed the needs of external and internal customers during cost estimating and pricing activities. Pricing and Cost Data Systems assures compliance with the Truth in Negotiations Act, the Estimating System Disclosure Statement, and all applicable laws and regulations. An element of the Estimating System is indirect and direct labor rate management activities. These functions are normally performed within the controller's organization of the applicable profit center.

3.1.1.3 Procurement (Subcontracts and Purchasing)

Sole authority for selecting sources; obtaining quotations; and awarding orders for materials, products, equipment, and services lies with Procurement, conducting these activities in the most economical and efficient manner. To accomplish this mission, purchasing serves as the official channel of communication to all suppliers; acts as negotiation agent of the company; and ensures compliance with all legal, ethical, administrative and documentation policies. Subcontracts manages acquisition from identification of need, to obtaining proposals or quotes, through final delivery and acceptance of systems, equipment, products, material, and services. They ensure compliance with all quality, reliability, technical, legal, and administrative requirements.

3.1.1.4 Property

A written Property control system provides for proper management and use of corporate assets and government property. Contracts require TRW to meet specific minimum requirements for the control, protection, preservation, and maintenance of all government property accountable to those contracts.

3.1.1.5 Critical Processes

Both TRW and the DPRO will review each functional system for the selection of "critical processes" for measurement. These reviews ensure compliance with government policy and verify efficient and effective operations. Some critical process measures reflect DPRO performance, such as the number of days it takes the DPRO to obtain a completed assist field pricing audit following a request from TRW. Criticality, impact, opportunity for improvement, and the ability to maintain regular surveillance will govern process selection. Following this review, TRW and the DPRO will agree on areas to measure. If a disagreement occurs, the DPRO position takes precedence. Addendum A lists current critical processes.

3.1.2 Finance and Business Systems Evaluation

To remove as much subjectivity as possible the performance of the critical processes will be measured with statistical process control (SPC) charts. The rating methodology of each critical process includes four key criteria: existence of process data (metrics), acceptability of the process, state of process control, and measurable improvement.

Existence of Data. The TRW process owner/evaluator has available an acceptable process performance metric and supporting data of the critical process.

Acceptability. Meeting statutory, regulatory, or contractual requirements. Processes whose output cannot be traced to statutory, regulatory, or contractual requirements will have their level of acceptability determined by the process owner/evaluator with the concurrences of the Finance and Business subteam.

Control. A measure of the deviations of the SPC data through the upper control level (and lower control level when appropriate for things such as rates), its variability, or trends that represent control of the process.

Improvement. The last eight data points show a positive trend, a reduction in variability, or have reached a level below which a further reduction would not be cost effective or meaningful (to be determined by the process owner/evaluator with the concurrences of the Finance and Business subteam).

Evaluators analyze the data collected on SPC charts and complete a rating of the four key processes with a point assignment as follows: 0 or 0.5 for existence of data and for improvement and 0, 0.5, 1.0, or 1.5 for acceptability and for control. Ratings of the critical processes in a functional area are weighted (if appropriate) and averaged to provide a monthly Contractor Performance Assessment (CPA). Ratings are prepared by the process owner/evaluator and presented with the SPC charts for concurrence at the monthly Finance and Business subteam meeting. The consolidated Finance and Business CPA is the average of the four functional CPAs.

3.2 Engineering and Manufacturing

3.2.1 Identification of Top-Level and Critical Processes

The Engineering and Manufacturing subteam based the identification of top-level and critical processes on the product development life cycle because it describes, in a generic manner, the steps a product goes through from conception to delivery. Process definitions fall into one of two categories: generic, top-level processes that make up the product development life cycle, or processes critical to a generic process that ensure an aspect of success. In the selection of top-level processes, TOPS uses brainstorming techniques and achieves consensus for each of the seven processes defined between concept definition and satellite delivery. They are: systems engineering, detailed design, subcontracts, parts procurement, manufacture, support equipment, and systems integration and test. Figure 1 shows a generic flow of the processes.

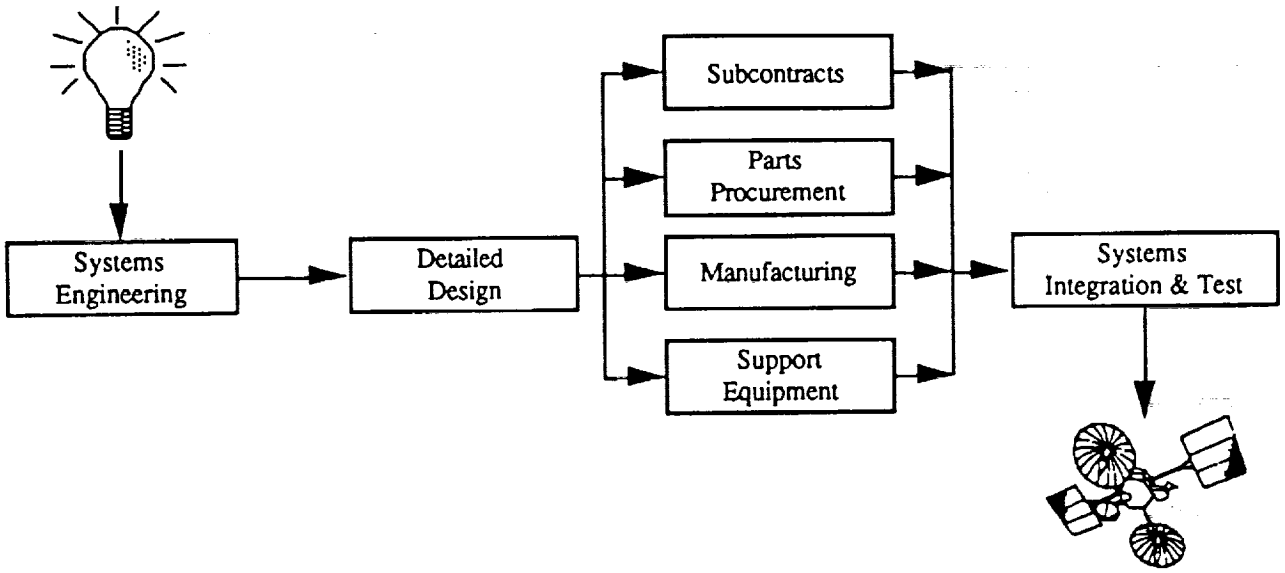

Figure 1. Generic Process Flow

The subteam chose critical processes from a high-level flowchart of each top-level process, as depicted in Figure 2.

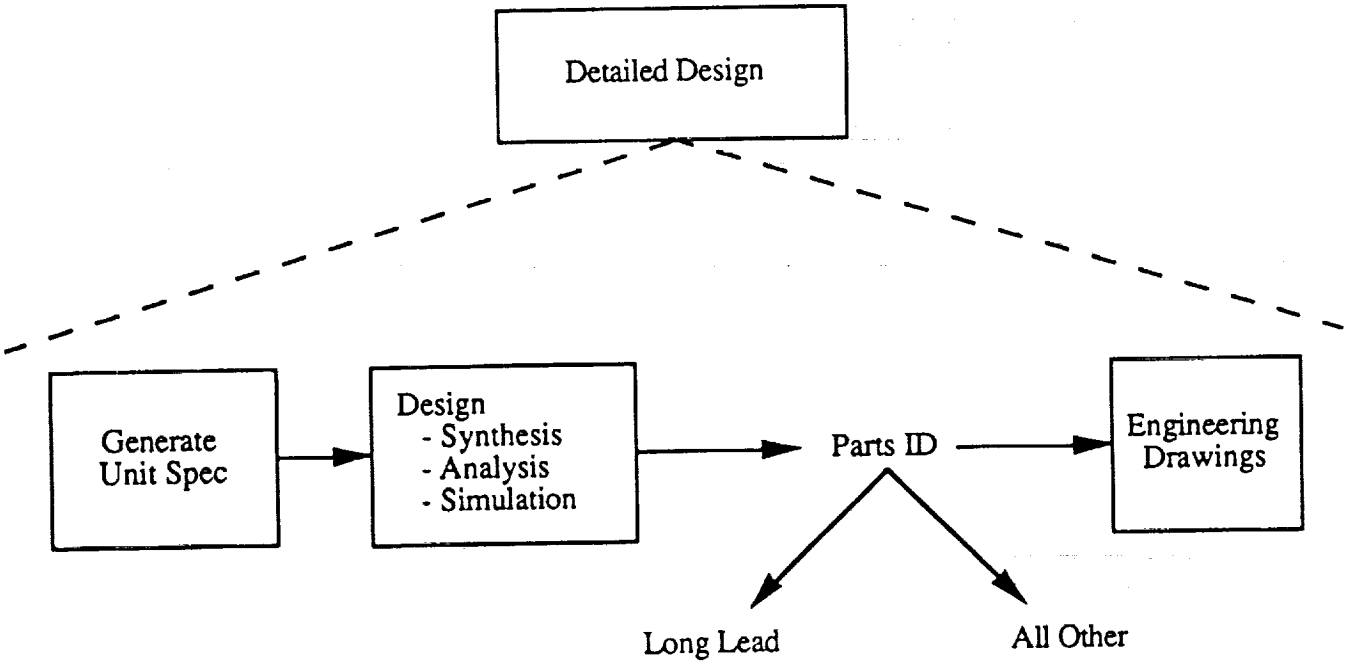

Figure 2. Top-Level Process Flow

To ensure correct selection of critical processes and to facilitate meaningful metric selection, the subteam completes a process schematic for each critical process. A process schematic defines the inputs, outputs, customer(s), customer expectations, quality expectations, and possible measurements (Figure 3). The document "Engineering & Manufacturing Subteam Process Package" contains high-level flowcharts for the top-level processes and process schematics for each critical process.

Inputs - Mini Spec,
- PM&P Requirements

Outputs - Unit Spec

Customer - RDE

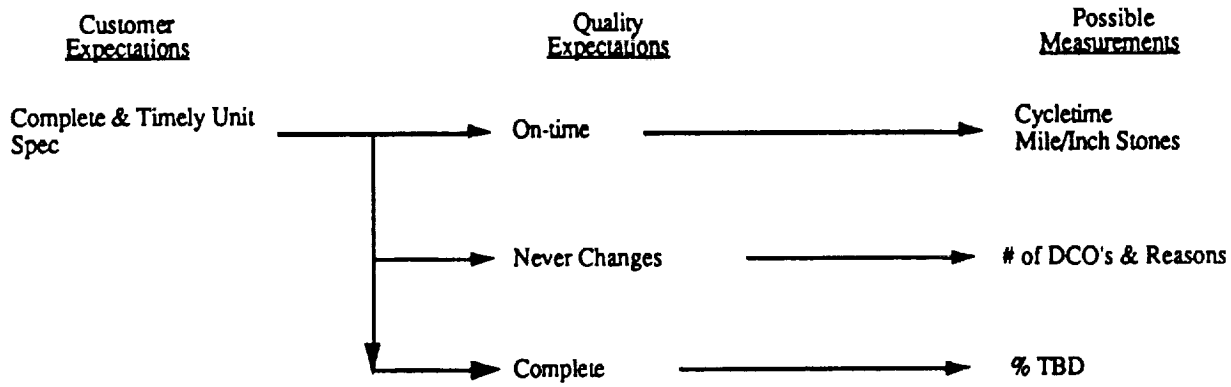

Figure 3. Unit Specification Generation Process

3.2.2 Identification of Process Performance Metrics

To remove as much subjectivity as possible from the rating scheme, the subteam, with the aid of the process owners, identifies process performance metrics (which characterize quality and cycle time) for each critical process, using the process schematic. The subteam avoids "reinventing the wheel" wherever possible using applicable metrics previously defined by TRW personnel in company TQM activities such as the Design Through Manufacturing (DTM) and Satellite Cost Reduction (SCORE) efforts. Defined metrics can and will change when new or superior metrics are established, or deleted if found to provide no added value.

3.2.3 Methods of Process Performance Analysis

To facilitate analysis statistical methods, preferably the use of SPC charts, will determine process trends; however, processes unsuitable for the application of SPC charts use other statistical means for interpreting data.

3.2.4 Methods Evaluation and Rating

3.2.4.1 Evaluation Criteria

To give both TRW and DPRO management a clear picture of the health of critical processes throughout TRW, the rating methodology embodies four key criteria: existence of process data (metrics), acceptability of the process, state of process control, and measurable improvement. Analysis of the collected metrics, plus other tangible and intangible information, determine point assignments. Where applicable, evaluators will normalize and analyze data via SPC charts, with point assignment as follows: 1 point for existence of data, 1 point for acceptability, 1 point for being in-control, and 1 point for improvement. Points for each critical process are equally distributed among the two categories of measurements (cycle time and quality). If there are multiple quality measurements, then points within the quality category are equally distributed, as well.

Key Term Descriptions:

Existence of Data. Initially, it is defined as performance metric(s) identified by the process owners and concurred by the subteam to be meaningful. The definition will change as the development of metrics mature.

Acceptability. 1) One or two performance metrics that measure a significant element of the process (such as span time, efficiency, or quality of the process). 2) Additional metrics must be developed and implemented in a reasonable time frame. 3) The absolute value of metric (for example, 100 EO's per drawing) is also considered as applicable.

In-Control. 1) The measured data have established control limits or are judged by the process owner to be in control, but eventually must have established control limits. 2) If variability swings widely, process owner must explain.

Improvement. A positive trend is either a positive shift in the process mean or a reduction in variability.

3.2.4.2 Evaluation Method

Evaluation teams evaluate and determine a grade for each critical/top-level process and give the result first to the process owner, then to the TOPS Engineering and Manufacturing subteam for incorporation into the overall group evaluation. The final grade, along with any necessary back-up documentation, goes to the DPRO Commander and the appropriate TRW Vice-President/General Manager (VP/GM) as part of the comprehensive TOPS rating. This structure pushes responsibility, accountability, and evaluation down to the level of work accomplishment. The

process owner knows the grade for his or her process(es) *before* the grade reaches upper management, enabling timely response preparation.

Figure 4 illustrates this method of process performance assessment.

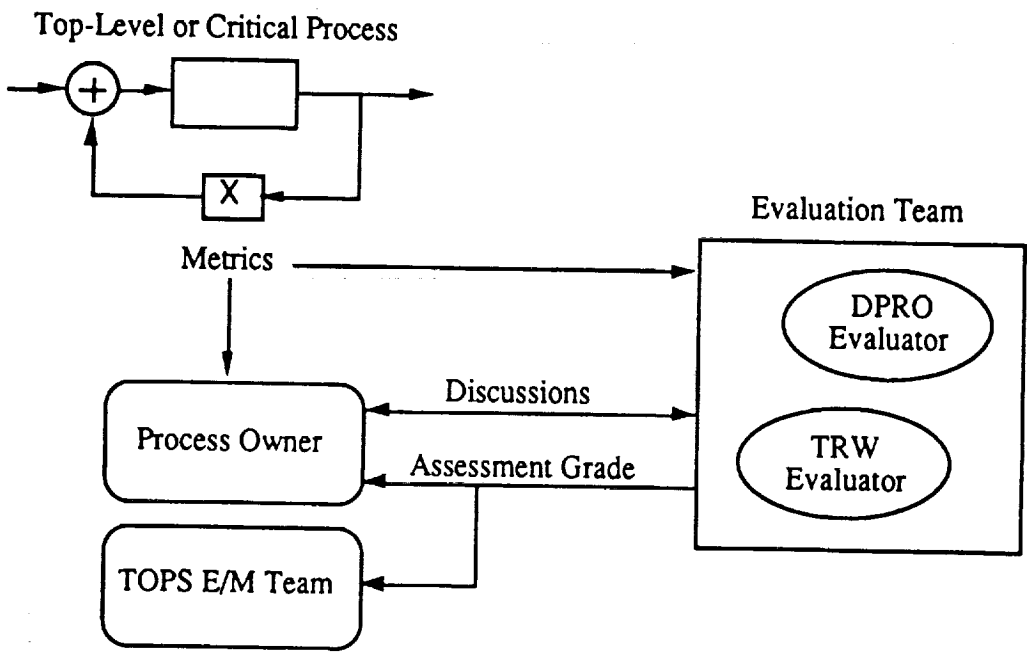

Figure 4. Top-Level or Critical Process Performance Assessment

Key Term Descriptions.

Assessment Grade. That grade determined from the evaluation criteria (see Section 3.2.4.1).

Discussions. Interactions with the process owner – interviews, investigations of out-of-control conditions, joint reviews, etc.

DPRO Evaluator. A DPRO employee knowledgeable of the TRW process.

Evaluation Team. A DPRO evaluator and a TRW evaluator who review the process performance metrics, discuss/investigate issues with the process owner, and determine an assessment grade.

Process Owner. The person responsible/accountable for process performance.

TRW Evaluator. A TRW employee knowledgeable of the process under evaluation and neither responsible for nor associated with the process performance.

Periodic evaluation of top-level and critical process occur as defined later in this guide.

3.3 Quality Assurance

Under TOPS, DPRO and TRW Space & Technology Group (S&TG) and Electronic Systems Group (ESG) will jointly review TRW quality systems and functions to support and facilitate the DPRO Quality Assurance (QA) Division's implementation of In-plant Quality Evaluation (IQUE). For Systems Integration Group (SIG) West, periodic audits are performed in lieu of TOPS surveillance. The DPRO/QA and TRW/QA group-level Major Support Processes (MSPs) are those key quality processes jointly identified by DPRO/QA and TRW/QA. Key subprocesses within each MSP are identified, flowcharted, and proofed, with measurement points selected or metrics developed for trending, analysis, and evaluation by the TOPS QA subcommittee and DPRO and TRW senior management. Management takes action as necessary to correct or to prevent undesirable trends or to address major deficiencies, problems, or concerns.

3.3.1 Responsibilities

As an integral part of the overall TOPS effort, a joint DPRO/TRW QA Steering Committee (TOPS QA subcommittee) meets regularly to direct and assure effective implementation of the TOPS QA efforts in support of the PBM initiative. This team will create and empower ad hoc working teams of DPRO/QA Operations Support Branch (RTQT) and TRW/QA personnel to analyze processes and data, to develop metrics and audit techniques, to work special problem areas, and to assist in implementation of the TOPS QA efforts. TOPS QA ratings, i.e., "TOPS-level metrics," will be prepared jointly and assessment reports made to DPRO and TRW management by the TOPS QA subcommittee. The TOPS QA subcommittee will evaluate the progress, problems, and lessons learned and redirect the overall effort as appropriate.

3.3.1.1 Mission Statement

Identify and define major support processes, emphasize the objective of continuous improvement, jointly, through consensus, develop objective criteria for an overall assessment method for measurement of the processes.

3.3.1.2 Goals and Objectives

a. Flow key quality processes and define associated value added metrics.
b. Reduce oversight through:
   (1) Achievement of confidence in key quality processes.
   (2) Institutionalizing process metrics for major support processes (MSPs).
   (3) Building trust between DPRO and TRW.
   (4) Conducting joint reviews.

3.3.2 Process Identification, Proofing, and Monitoring

3.3.2.1 Major Support Processes

Addendum C identifies the nine MSPs which describe the key quality processes. DPRO/QA and TRW/QA will use these MSPs to monitor the performance of TRW's quality system.

3.3.2.2 Process Selection

The TOPS QA team jointly selects the subprocesses in each MSP based on:

a. Identification by the Government and/or TRW.
b. Analysis of data which reflects opportunities for improvement.
c. Process(es) which represent the key quality systems.

3.3.2.3 Process Proofing and Monitoring

The ad hoc teams, appointed by the TOPS QA team, perform the following functions:

a. Flowchart the "as is" process(es).
b. Proof (validate) the process(es) against policy, procedures, and contract requirements.
c. Recommend metrics to measure the process(es).
d. Identify measurement points.
e. Perform process and/or product audits.
f. Collect, compile, review, trend, and analyze data and develop trend charts.
g. Use statistical process control (SPC) charts, as applicable.
h. Provide recommendations for process improvements.

3.3.2.4 Continuous Improvement Opportunities (CIOs)

Continuous Improvement Opportunities (CIOs) normally found when analyzing contractor data, conducting product audits, or proofing the adequacy of a process are submitted to the contractor. Implementation of CIOs by the contractor is optional. However, the contractor upon request by the government will provide feedback whether improvements were implemented or not. The TOPS QA team uses the standard format methods described below to issue CARs.

3.3.3 Standard Format Methods

3.3.3.1 Corrective Action Requests (CARs)

CARs consist of two types: verbal or written (Internal Compliance Review Reports [ICRRs]). Determination of which type to issue depends on the following factors: criticality of the nonconformance; frequency; effect on reliability, maintainability, or operability; whether the contractor has planned or taken corrective action (C/A); reluctance to initiate C/A; effectiveness (or lack thereof) of previous C/A; etc.

In all cases, DPRO/QA will: discuss the CAR with the responsible element(s) of both the contractor's performing organization and the TRW quality organization. Distribute written CARs (ICRRs) to the responsible discipline(s) and the quality organization. Enter all CARs (verbal and written) into a database. Verify adequacy of the C/A proposed, initiated, and implemented by the contractor, as evidenced by the absence or reduction of the defect in follow-on analysis of data or process/product audits. Record this verification in a log or record (manual or computer based).

3.3.3.2 Method C

Chronic or systemic process problems not addressed by the contractor typically indicates a failure to recognize that the problem exists. Normally, DPRO/QA issues a letter of concern requesting C/A. Inadequate C/A results in the issuance of a Method C. When serious quality problems exist and the contractor fails to take positive C/A, a letter forwarded to senior contractor management through the TRW DPRO Liaison Office will request immediate C/A for the observed deficiencies and their causes.

3.3.3.3 Method D

Where the contractor cannot or will not comply with contract requirements and C/A cannot be effected directly with the contractor by other methods, DPRO/QA personnel will request that the Administrative Contracting Officer (ACO) inform the contractor that all IQUE actions will be discontinued as required by Defense Logistics Manual DLAM 8105.1, "Contract Administration Manual for Contract Administration Services." This initiates Method D escalation. The ACO, in consultation with DPRO/QA personnel, determine the appropriate course of action. Government IQUE actions will totally discontinue only when authorized in writing by the ACO.

3.3.3.4 Method E

Where a subcontract is involved and the requirements for C/A are of the magnitude of a Method C or D, DPRO/QA will request that TRW take immediate C/A with the subcontractor.

3.3.4 Quality Assurance Evaluation

Each MSP rating uses the numerical application listed below, ranging from 0 (unsatisfactory) to 4 (exemplary).

4 = Exemplary
3 = Excellent
2 = Satisfactory
1 = Marginal
0 = Unsatisfactory

Each TRW group will be rated monthly by MSP (example below):

Systems	ESG	S&TG
QA1	4	3
QA2	3	3
QA3	4	3
QA5	4	3
QA6	4	3
QA7	4	4
QA8	4	4
QA9	3	3
QA10	3	3
TOTAL	**33**	**29**

Adding the 9 elements and dividing by the number of MSPs yields an overall numerical rating for each group. The accompanying descriptive rating comes from the following range chart.

Divide by 9 MSPs 3.6 (Excellent) 3.2 (Excellent)

0.0 - 0.5 = Unsatisfactory
0.6 - 1.5 = Marginal
1.6 - 2.5 = Satisfactory
2.6 - 3.5 = Excellent
3.6 - 4.0 = Exemplary

QA4 Software – Assessed by Software Process Improvement Initiative (SPII).

3.4 Software

The software subteam's goal is to develop a system for evaluation of the software development processes used at TRW. Once established, the system will be used as a base for continuous process improvement initiatives for TRW and for providing an objective measuring system for the DPRO. The system will identify the problem areas (or areas which could be improved) and provide the ability to detect improvements (or degradings) in the processes. The evaluation process is established by identifying metrics and then using continuous process improvement (in terms of the validity of the evaluation metrics) to continually improve the measurement system. Two divisions will be used to develop the first rating systems. These systems will be analyzed for similarities and used as a base for expanding surveillance to the rest of TRW. The similarities in the first two divisions and those in the rest of TRW should give some indicators as to the value of different metrics (i.e., identical metrics used throughout all the divisions shows a high value of the metric).

3.4.1 Scope

Software activities from all Space Park Divisions/Groups as well as the Division at Dominguez Hills will be included in these evaluations. At first, evaluations are limited to the SDD and SEDD divisions of the Systems Integration Group (SIG). The two divisions will be used in the development of evaluation processes and the descriptions contained herein are based on the similarities of the two divisions.

3.4.2 Structure

The overall TOPS software evaluation has three components: 1) the underlying process capability (20% of the grade), 2) the effectiveness of management's implementation of the processes (40% of the grade), and 3) the ultimate performance of the processes (40% of the grade). These components along with "Key Process Areas" are shown in Figure 5.

The process capability component of the evaluation is based on four processes. The first depends on meeting the maturity improvement goals of the Software Engineering Institute's (SEI) Capability Maturity Model (CMM). The SEI was set up by the government (because of the increasing life cycle importance of software) to identify and solve problems with software acquisition. The CMM provides as a baseline to evaluate the contractors ability to produce the required software product within all the procuring agency's constraints. The second and third processes involve the use of technology (i.e., introduction and dissemination) within an organization. The fourth process for the capability evaluation is based on TQM/CPI practices.

The management component of the evaluation examines management oversight, project metrics, and feedback from the customer. The weightings assigned to each of these categories varies depending on the division and/or group. The management oversight entails C/SCSC, CSSR, or some other type (if used) of cost/schedule reporting. Project metrics will vary from division (or group) to division (or group). Some examples of these are number of source lines of code (SLOCs) design and built versus the number planned to be built, number of SLOCs turned over (for test) versus the number of SLOCs planned to be turned over, and number of capabilities integrated verses number of capabilities planned to be integrated. The actual metrics used depends on the division/group as well as the definitions of the measurable quantities.

The performance component of the evaluation is based on a combination of DPRO and TRW quality data. DPRO data is comprised of IQUE activities (e.g., SDF code inspection. The SDF code inspections are a metric which identifies the number of SDFs evaluated for coding versus SDFs found with code nonconformances.) TRW data is comprised of various contractor evaluations/functions conducted by program level QA (contractual) and independent management level (system) evaluations. Two types of findings are generated during these reviews — internal corrective actions that require formal review and correction and noted recommendations identified to the project by the review team.

3.4.3 Review Methodology

For the software process:

- Senior management within a TRW surveillance area identifies functional points of contact (engineering, quality assurance, program management, etc.).
- These personnel work with the identified DPRO members to establish a joint team to identify, prioritize, and implement the processes for surveillance.

The team shall:

- Identify the data which will be collected.
- Collect and report on the agreed upon data.
- Verify the collected data is correct.
- Interview cognizant personnel, as required.
- Review documentation, as required (i.e., UDFs, SDFs, etc.)
- Establish and update the rating (and reporting) system, as required.
- Identify, evaluate, and implement (as required) capability improvements to the rating (and reporting) process.
- Identify, evaluate, and implement (as required) capability improvements to the software development processes.

Figure 5 illustrates this structure:

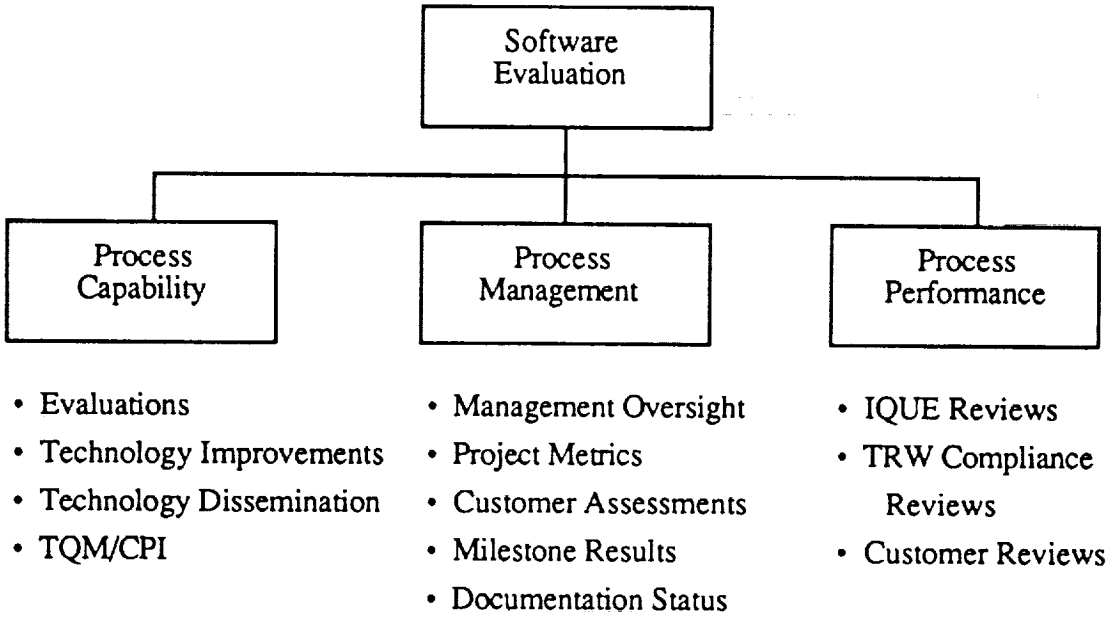

Figure 5. TOPS Software Evaluation Components

4. TOPS Evaluation

Figure 6 presents the flow of rating data within the DPRO and TRW. Each functional subteam must supply data based on a five point scale for review by TOPS management at a monthly meeting. The lead DPRO representative of each subteam will present the consolidated process ratings as an overall group rating (see Figure 7 for a sample group-level assessment chart). Additionally, the subteam leader must present back-up data, as appropriate, for concerns that the subteam wishes to elevate. Also at the monthly meetings, DPRO and TRW management will review and discuss the results of joint or independent evaluations and any other pertinent information, including TRW TQM activities. Finally, discussions would cover potential problem resolutions and recommended courses of action. These could run from continued problem monitoring, to establishing a process action team (joint or independent), to a letter from the DPRO to correct the problem. When the DPRO notifies TRW in writing of a problem, the notification should go to the TRW DPRO Liaison Office to ensure proper distribution and coordination within TRW. Figure 8 presents the corrective action matrix, depicting the methods of notification and escalation for each subteam.

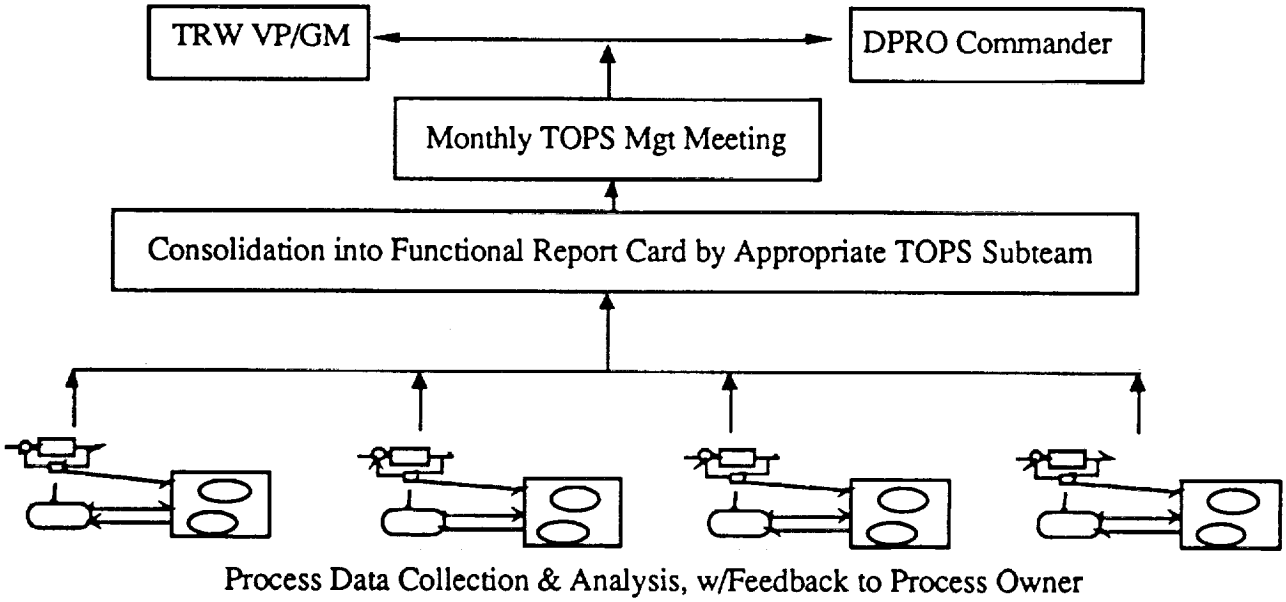

Figure 6. Management/Rating Assessment Structure

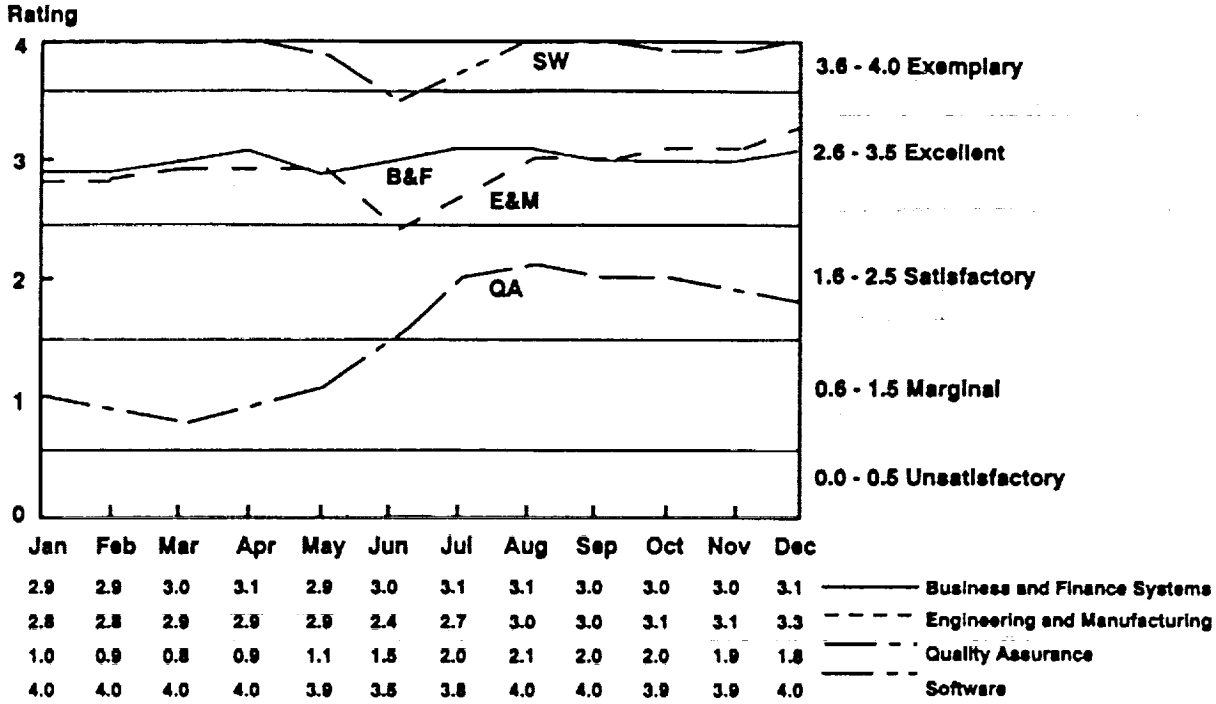

Figure 7. TOPS Monthly Assessment (Sample Data)

Notification and Escalation

Functions	Level 1 Continuous Improvement Opportunities (Non Contractual)	Level 2 Minor Non-Conformance (Contractual)	Level 3 Systemic/Process Non-Conformance (Contractual)	Level 4 Systemic/Process Failure (Contractual)	Level 5 Failure to Take Timely and Effective Corrective Action (Contractual)	Level 5a Supplier/ Subcontractor Non-Conformance (Contractual)
Commander	Continuous Improvement Opportunities (CIO) letter	Not applicable	Not applicable	Use formal letter addressing major concerns or problems	Letter addressing the fact that corrective action not timely and/or effective	Not applicable
Finance and Business	Continuous Improvement Opportunities (CIO) letter	Verbal or written letter addressing areas of concern	Letter from Division Chief requesting corrective action plan addressing problem or concern	Letter of notice of intent to disallow progress payments from DACO	Execution of notice of intent to withhold/ disallow progress payments from DACO	Not applicable
Engineering and Manufacturing	Continuous Improvement Opportunities (CIO) letter	Letter from evaluator addressing areas of concern	Letter from Division Chief requesting corrective action plan addressing problem or concern	Letter from Division Chief to group general manager requesting corrective action plan addressing problem or concern	Letter from Commander addressing the fact that corrective action not timely and/or effective	Not applicable
Quality Assurance	Continuous Improvement Opportunities (CIO) letter	Verbals (daily log entries)	• ICRRs (Internal Compliance Review Reports)	• Method C Letter to TRW from the Quality Division Chief or the Commander	Method D Letter from ACO based on recommendations from Commander/ Quality Division Chief for discontinuation of IQUE	• Method E Letter addressing a problem or concern at a TRW supplier/ subcontractor
Software	Continuous Improvement Opportunities (CIO) letter	Verbals (daily log entries)	• ICRRs (Internal Compliance Review Reports)	Letter from Division Chief to group general manager requesting corrective action plan addressing problem or concern	Letter from Commander addressing the fact that corrective action not timely and/or effective	Not applicable

Figure 8. TOPS Corrective Action Matrix

5. Acronyms

ACO	Administrative Contracting Officer
AFMC	Air Force Material Command
APMA	Automated Property Movement Authorization
BOE	Basis of Estimate
C/A	Corrective Action
CACO	Corporate Administrative Contracting Officer
CAR	Corrective Action Request
CAS	Contract Administration Service
CCN	Contract Change Notice
CER	Cost Estimating Relationship
CIO	Contractor Improvement Opportunity
CPAR	Contractor Performance Assessment Report
CPI	Continuous Process Improvement
CPSR	Contractor Purchasing Systems Review
CSE	Contractor System Element
DACO	Division Administrative Contracting Officer
DCAA	Defense Contract Audit Agency
DCMC	Defense Contract Management Command
DCMDW	Defense Contract Management District West
DFAR	DOD supplement to the FAR
DLA	Defense Logistics Agency
DLAM	DLA Manual
DOD	Department of Defense
DPRO	Defense Plant Representative Office
DTM	Design through Manufacturing
ESG	TRW Electronic Systems Group
FAR	Federal Acquisition Regulation
GAO	General Accounting Office
I&T	Integration & Test
ICRR	Internal Compliance Review Report
IG	Inspector General
IQUE	In-Plant Quality Evaluation
LAN	Local Area Network
MGI	Mandatory Government Inspection
MOA	Memorandum of Agreement
MSP	Major Support Process
NASA	National Aeronautics and Space Administration
ODC	Other Direct Cost
OFPP	Office of Federal Procurement Policy
OMB	Office of Management & Budget
P&TS	Program & Technical Support
PAT	Process Action Team
PBM	Performance Based Management
PCO	Procuring Contracting Officer
PO	Purchase Order
PR	Purchase Requisition
PROCM	Procurement Manual
QA	Quality Assurance
R&D	Research & Development
RFP	Request for Proposal
ROAE	Return on Assets Employed
S&D	TRW Space & Defense Sector

S&TG	TRW Space & Technology Group
SCORE	Satellite Cost Reduction
SEC	Securities & Exchange Commission
SIG	TRW Systems Integration Group
SOW	Statement of Work
SPC	Statistical Process Control
SPII	Software Process Improvement Initiative
TBD	To Be Determined
TINA	Truth in Negotiations Act
TOPS	Teamwork for Oversight of Processes and System
TQM	Total Quality Management

6. Addenda

A. Finance and Business Systems

A.1 Critical Process Oversight

The DPRO and TRW jointly selected as critical processes those processes essential to DPRO's oversight responsibilities and operational effectiveness. Compilation of specific data by TRW will facilitate oversight of the critical processes and provide the DPRO with tangible evidence of the effectiveness of these processes. DPRO may also select and gather data on some critical processes to assess their own performance, e.g., the number of days required for the DPRO to obtain a completed field pricing audit report per a TRW request. The DPRO will use statistical process control (SPC) charts to assess these processes. SPC charts will be prepared such that situations or occurrences that would be deemed to be "out of tolerance" by the DPRO will be easily identifiable, so the measurement of the number of such occurrences is clear and indisputable.

A.2 Critical Processes

A.2.1 Contracts

A.2.1.1 Contract Closeout

After contract completion, when the product and/or service is delivered to and accepted by the customer, a specific closeout process is conducted. Before TRW submits a final invoice to the customer, several internal closeout actions are completed as specified in Contracts Manual section 501, "Closeout of Cost Type Contracts." On completion of these actions, a final invoice, release, and assignment are prepared. For this critical process, the time intervals identified below will be tracked and measured. The source of the data points will be the Contract Closeout Status Report CM071EM published by the Contract Information Center. The data tracks the time interval between the date the contract entered into closeout and the date all closeout actions are completed. The time interval between the date the final invoice is submitted to the DPRO and the date payment is received from the paying office is also tracked..

A.2.1.2 Restrictive Markings Notification

Contracts manual bulletin number 16 requires that the contract administrator to provide written notification to the contracting officer within 60 days after award of the name and title of the person having final responsibility for determining whether restrictive markings are to be placed on technical data to be delivered under the contract. In order to monitor TRW's compliance with this clause, we will track the time interval between the date of contract award and the date restrictive markings notification is submitted by the contract administrator.

A.2.1.3 Waivers and Deviations

When project management determines that a need exists to request a waiver to or deviation from contractual specifications, the waiver/deviation is prepared in a manner suitable for government review and approval. Waivers and deviations are granted by the cognizant government contracting officer. For this critical process, the following time intervals will be tracked and measured. The time interval between the date the waiver or deviation was submitted and the date the approval or denial was received from the DPRO/customer.

A.2.1.4 Progress Payments

Progress payments will be tracked from the time they are prepared by Accounting Operations, delivered to the DPRO or DCAA, as appropriate, and returned to Accounting Operations after approval by the cognizant government office.

A.2.1.5 Invoices

Invoices will be tracked from the time they are prepared by Accounting Operations, delivered to the DPRO or DCAA, as appropriate, and returned to Accounting Operations after approval by the cognizant government office.

A.2.1.6 Cost Accounting Standards Disclosure Statements

The Cost Accounting Standards (CAS) require TRW to submit disclosure statements regarding its accounting practices. These disclosure statements are amended each time a change in cost accounting practices occurs. TRW must submit amendments to the government 60 days prior to their effective date. As a process essential to the government's oversight responsibility, TOPS will measure the adequacy and timeliness of TRW's CAS disclosure statement modifications.

A.2.2 Pricing and Cost Data System (Estimating System)

Six processes have been identified as critical in the Pricing and Cost Data System (Estimating System) area. The primary areas of focus were identified as part of the joint DCAA, DPRO, and TRW Proposal Process Action Team (PAT), and the recently completed Estimating System Survey conducted by DCAA and the DPRO. In addition the DACO must submit written certification that the TRW Estimating System satisfies all applicable laws, rules, and regulations of the government. To ensure that the estimating system requirements are continually met, six critical processes will be monitored monthly against control limits established in each area. Those critical processes are listed below.

A.2.2.1 Cost Estimating Relationship (CER)

CERs are used within proposals for elements that are estimated in relationship to another element, i.e., ODC as a percent of labor dollars. CERs will be monitored to ensure that the actuals incurred are within the control limits established in the CER methodology and therefore remain valid CERs.

A.2.2.2 Basis of Estimate (BOE)

A BOE contains the estimating methodology for a proposed task including the documentation of the logic used, i.e., the historical costs referenced and justification for differences. The results of the joint proposal review checklist questions regarding BOEs will be monitored against the control limits established as quality measures.

A.2.2.3 Material

Material includes electrical, mechanical, and engineering purchased parts and raw material used in the fabrication of hardware. The results of the joint proposal review checklist questions regarding material will be monitored against the control limits established as quality measures.

A.2.2.4 Subcontract Analysis

Subcontract analysis is performed on all major subcontracted products or services that are in excess of $500,000 to determine that the price is fair and reasonable. The results of the joint proposal review checklist questions regarding subcontract analysis will be monitored against the control limits established as quality measures.

A.2.2.5 Assist Field Pricing Audit Reports

Assist field pricing is performed by DCAA when a prospective subcontractor denies TRW access to their books and records. The average number of days to obtain completed Assist Field Pricing Audit Reports will be monitored against established control limits.

A.2.2.6 Other Direct Cost (ODC)

ODCs includes accounts for items used in support of program activities, i.e., travel, repro, and computing. The results of the joint proposal review checklist questions regarding material will be monitored against the control limits established as quality measure.

A.2.2.7 Direct Labor Rates

Direct labor rates will be tracked and compared to the negotiated rates on a composite basis. As long as the rates remain within the established tolerances, no additional effort is required by either TRW or the DPRO staff.

A.2.2.8 Indirect Rates

Indirect rates will be tracked and compared to the negotiated rates for the major indirect cost pools on a quarterly basis. As long as the rates remain within the established parameters, no additional effort is required by either TRW or the DPRO staff. Should the rates fall outside the tolerance range, TRW will provide additional support/explanation in order to assist the DPRO in their determination as to whether an adjustment to billing is appropriate.

A.2.3 Procurement (Subcontracts and Purchasing)

Four critical processes have been jointly identified by the DPRO and TRW. The monitoring of these processes will be facilitated by specific metric data displayed on SPC charts prepared by TRW. SPC charts will be prepared to identify both "out of control" as well as normal operations. The "out of control" condition, if any, will be clear and indisputable and the results of any corrective action will be readily visible. The four critical processes area are shown below.

A.2.3.1 Advance Notice and Prior Consent

Customer advance notification or prior consent (or both) may be required from TRW customers prior to TRW awarding a procurement contract. The TRW Consolidated Prime Contract Summary (CPCS) lists those procurements which require advance notification or prior consent (or both). The Procurement Analysis and Review (PAR) will determine, if required, that the procurement package has the advance notice or prior consent (or both) and that it was done in compliance with the applicable procedures. If there is an omission it will be noted for internal improvement purposes and included in the SPC chart for that month. Any correction will be made prior to package approval. In addition, an annual random sample of all procurement packages will be conducted to ensure all completed packages have satisfied the requirement for an advance notice or prior consent (or both). The number of discrepancies found by the PAR will determine if adequate instructions or additional training are necessary.

A.2.3.2 Price and Cost Analysis

Proposals and quotations obtained in support of potential POs/SCs (or changes thereto) require certified cost or pricing data whenever the proposal exceeds the dollar threshold established by public law or whenever it is required by the terms and conditions of the TRW customer contract and do not meet the exceptions to the requirements for certified cost or pricing data. The PAR will determine, if required, that the procurement package has the required price or cost data and that it was done in compliance with the applicable procedures. If there is an omission or discrepancy it will be noted for internal improvement purposes and included in the SPC chart for that month. Any correction will be made prior to package approval. In addition, an annual random sample of all procurement packages will be conducted to ensure all completed packages have satisfied the requirement for cost and pricing data. The number of omissions or discrepancies found by the PAR will determine if adequate instructions or additional training are necessary.

A.2.3.3 Small/Small Disadvantaged Business Concerns

Quarterly reports are submitted to the DPRO concerning TRW's achievements on meeting goals established for Small/Small Disadvantaged Business Concerns (S/SDBCs), Historically Black Colleges and Universities (HBCU), and Minority Institutions (MI).

A.2.3.4 Certification

Certifications are required by public law and the Defense Acquisition Regulation/Federal Acquisition Regulation (DAR/FAR) under specified conditions in TRW procurement packages. These certifications involve such things as Equal Opportunity in Employment, the Clean Air Act, The Federal Water Pollution Control Act, and related regulations of the Environmental Protection Agency (EPA). The PAR will determine if the required certifications are included and correctly filled out. If there is an omission or discrepancy it will be noted and included in the SPC chart for that month. Any correction will be made prior to package approval. In addition, an annual random sample of all procurement packages will be conducted to ensure all required certifications are included and correctly filled out. the number of omissions or discrepancies found by the PAR will determine if adequate instructions or additional training are necessary.

A.2.4 Property

The Government Property Administrator is required to perform an annual survey that reviews TRW's compliance with its property control procedures. The government's guidelines for conducting the reviews were used. Under the FAR provisions if several property system criteria are met, the annual survey requirement can be changed to a biennial audit requirement. Therefore to meet the FAR criteria for biennial survey review, the government audit guidance for reviewing the TRW property control system was used to select jointly seven processes which are essential to the DPRO oversight responsibilities. Those seven processes are shown below.

A.2.4.1 Acquisition of Equipment

The acquisition of special test equipment requires government approval in advance of the acquisition unless identified in the contract. This evaluation criteria will measure the acquisition for equipment and the compliance with the advance notice and approval request to the government. Purchase requisitions will be reviewed for inclusion of end use codes, the proper cost account codes, and the advance government approval to acquire. The matrices will be purchase requisitions reviewed and with correctly completed criteria.

A.2.4.2 Movement of Equipment

Location of equipment is an important aspect of inventory control of assets. The Automated Property Movement Authorization (APMA) is a document created in the records computer database which provides for the hard copy movement document and electronic location changes in the records. This evaluation criteria will evaluate the timeliness of the closure of the movement documents and location updates for equipment moves. The APMAs will be reviewed for the timeliness to complete (close) the APMA; this action updates the location changes of equipment. The matrices will be the number of open APMAs exceeding "x" days for each group.

A.2.4.3 Physical Inventory

Physical inventories of *material* not only fulfill a contract requirement, but also is important to ensure that parts and assemblies received into the storerooms remain available to meet the production schedule and contract delivery requirements. This evaluation criteria will measure the annual schedule and the actual performance against that schedule. The material physical inventories are completed annually and performed throughout the year. The matrices will be 1) a measure of actual performance against the planned schedule, and 2) a measure of the variances between the records balance-on-hand and the actual count of each item.

The physical inventory of *equipment* can be extended to longer periods than material because of several reasons. Equipment has a longer life span. There is less turnover of equipment than material, and material is purchased closer to its usage date. However, it is still important to verify that equipment items are available. The evaluation criteria will measure the physical inventory schedule and performance to that schedule. The physical inventory of equipment is on a biennial basis occurring in the odd number years. The matrices will be 1) the measure of the actual performance against the planned schedule, and 2) a measure of the variances between the records and the actual count of the equipment items on a contract basis.

A.2.4.4 Use of Equipment

Equipment is acquired to support a development or production task or a test requirement under contract. These equipment items are retained do to their use; and when no longer required, they become excess to that contract. When excess, the items should be legalized on another contract or disposed of. This evaluation criteria will evaluate current and projected use for the items. As a result of a TQM/CPI effort, all equipment will be coded for its utilization and retention requirements. The matrices will be timeliness in completing this semiannual task and quantity of equipment in each of the six retention code categories.

A.2.4.5 Equipment Maintenance

Government equipment must be properly maintained to provide for maximum life and correct performance. The criteria for maintenance involve both the determination of need for maintenance and, where appropriate, the performance of maintenance. Maintenance may include any of the following: inspection (evaluation), operator performed (functional), electronic or mechanical repair (corrective), or routine periodic (preventative). Based on the application of the equipment, calibration may be required. The custodian may elect to have designated equipment maintained by virtue of calibration being performed by a centralized calibration organization. The evaluation criteria for maintenance will measure the actual performed maintenance against the custodian's determination of need for said maintenance.

A.2.4.6 Contract Property Closure

The process to ensure proper disposal of all government property accountable to a contract is generally one of the last tasks to be completed prior to contract closure. This evaluation criteria will evaluate the completion of all tasks required to issue a property closeout certification. The process of property contract closure is an extended task that can often delay the contract closeout activity. This process requires focused attention and reporting. The matrices will be the time period from initiation of contract closeout until the property certification is issued.

B. Engineering and Manufacturing

B.1 Critical Processes

These defined critical process are still generic in nature and each critical process will be further defined by product line or cost center code.

B.1.1 Systems Engineering

B.1.1.1 Concept Design

Determines generic system elements and the manner in which those elements will satisfy functional requirements.

B.1.1.2 Requirements Allocation

Defines the performance requirements needed for each system element to attain the overall performance requirements of the system.

B.1.2 Detailed Design

B.1.2.1 Unit Specification Generation

Defines discrete unit level requirements, derived from the mini specification flow down from systems engineering.

B.1.2.2 Design

Determines the manner in which the unit will be designed to satisfy the unit specification engineering and M&P.

B.1.2.3 Engineering Drawing

Transfers conceptual drawings and schematics to detailed drawings used to build the design.

B.1.3 Parts Procurement

B.1.3.1 Specification Generation

Takes the parts identified from design and program quality requirements and determines the specifications needed for said parts.

B.1.3.2 Purchase Order (PR to PO)

Purchases a specified part from a list of possible vendors.

B.1.3.3 Supplier

The vendor builds the part to specification.

B.1.3.4 Receipt to Issue

Receiving of the parts and parts data, performing V&H testing if required, and delivering those parts to their respective customers.

B.1.4 Subcontracts

The subcontracts process is very similar to the parts procurement process in that two of its three defined critical processes are the same, spec generation and supplier. The order placement process is different from the purchase order process in that it involves the establishment of a subcontract that usually requires some developmental work by the subcontractor.

B.1.5 Manufacturing

B.1.5.1 Fabrication

Transforms raw materials into some desired output.

B.1.5.2 Assembly

Assembles piece parts into some desirable unit.

B.1.5.3 Test

To test either functionally, visually, or dimensionally, the fabricated or assembled part to determine if it meets specifications.

B.1.6 Support Equipment

The support equipment process is a microcosm of the top-level processes. The critical processes defined are: mini-spec generation, electrical design, product design, fabrication and assembly, and integration and test. The mini-spec generation process takes an equipment spec and test requirements and generates a test set mini-spec. The electrical design process takes the test set mini-spec and identifies parts and new processes, schematics, conceptual drawings, interface drawings, and rack layouts. The product design process takes the schematics, identified processes, parts list, and mini-spec and transforms those into a completed engineering drawing. The fabrication and assembly process manufactures the subassemblies and assemblies. Finally the integration and test process integrates and tests the subassemblies into a completed piece of support equipment.

B.1.7 Systems Integration and Test

Assembly, integration, and test of various boxes into a satellite ready for launch.

B.1.7.1 Requirements Definition

Transforming systems engineering requirements into a test requirements document.

B.1.7.2 Procedure Definition

Taking the requirements documents and developing a detailed assembly and test procedure.

B.1.7.3 Assembly

Takes hardware, software, and detailed test procedures and assembles a satellite.

B.1.7.4 Integration

Takes the assembled systems and tests it to determine if requirements are being met.

B.1.7.5 Acceptance Test

The process of testing a fully assembled and integrated satellite to determine if the system is ready for launch.

B.2 Metrics Identification

Critical Processes	Metrics
Systems Engineering	• Time between program start and release of unit specs • Actual time required to release unit specs vs. planned time
Detailed Design	• Number of engineering changes per drawing • Deviation of total design hours from standard • Number of first pass successes in design
Subcontracts	• % of letter subcontracts • Average days to definitize • % of subcontracts with late deliveries • Delivery schedule of subcontracts • Integration rejects as a % of subcontracts • Nonconforming material as a % of subcontracts • Preventable notices as a % of subcontracts
Parts Acquisition	• Number of notice of delay of material per lot • Number of procurement deficiency reports per lot • Material acquisition time in weeks
Support Equipment	• Design hours per released drawing • Fabrication and assembly hours per unit • Design hours per gate • Design hours per unit • Number of deliverable source instructions developed per hour • Design errors per released drawing • Avoidable rework per assembly hour
Systems Integration and Test	• Integration returns • Time lost vs. time worked
Manufacturing	• Engineering caused rework as a % of bench hours for fabrication/assembly and test • Manufacturing caused rework • Other types of rework • Number of nonconforming materials • Number of test discrepancy reports

C. Quality Assurance

The authority and responsibility for managing the contractor's quality program should be complete, properly assigned, and documented using written policies, procedures and work instructions. The following major support processes (MSPs) should be addressed as part of the contractor's quality system.

C.1 QA Internal Audits/Training and Quality Cost (QA-1)

The quality organization must:

- Assign authority and responsibilities to organizations performing quality functions.
- Establish a training and certification program.
- Have an internal audit system.
- Have provisions for collection and use of quality cost data.

C.2 QA Planning/Work Instructions (QA-2)

The contractor's planning program should provide for timely and effective planning, which has:

- Methods for accomplishment of comprehensive contract reviews.
- Provisions for inspection and test planning during the earliest practical phase of contract performance.
- Methods for verifying that inspection and test planning is compatible with manufacturing methods, processes, drawing requirements and inspection instructions.

C.3 Records (QA-3)

The contractor's quality system is to assure that records are kept current, complete, legible, and accurate during all phases of design, development, manufacturing, test, etc., as a means of maintaining the continuous history of the product/service, e.g., fabrication and assembly history; build-up and disassembly, repairs, rework, results, configuration data, etc.

C.4 Software QA (QA-4)

This MSP will be assessed by Software Process Improvement Initiative (SPII).

C.5 Nonconforming Supplies (QA-5) (TRW, Suppliers, and Subcontractors)

The Quality organization must assure:

- Effectiveness authorized PR/MRB dispositions.
- Timeliness of dispositions.
- Provide methods for the positive identification, segregation and storage of nonconforming supplies in adequate holding areas.

C.6 Corrective Action (QA-6) (TRW and Suppliers)

The contractor's corrective action program should provide for the timely detection of discrepancies and ensure timely and positive action is taken to eliminate the cause of defects. The corrective action system should include requirements for:

- Effectiveness of completed corrective action (recurrence).
- Timeliness of corrective actions.
- Effectiveness of Supplier and Subcontractor Corrective Action(s).

C.7 Supplier QA (QA-7) (Suppliers and Subcontractors)

The contractor's quality program should ensure that all supplies and services purchased from suppliers conform to contractual requirements. The effectiveness and integrity of quality control and corrective action by suppliers should be assessed and reviewed by the contractor. The contractor's quality program should:

- Ensure that products are inspected on receipt to determine acceptability.
- Have objective evidence data to be used for adjusting the extent of receiving inspections.
- Provide for an effective vendor rating system.
- Ensure that untested product and raw material are identified and segregated from those tested and accepted.
- Provide for functional tests to be performed to the required specification, technical order, drawing or contract, if testing is required.
- Ensure that suppliers' quality systems meet the quality requirements of the subcontract/purchase order (flowdown of QA requirements).

C.8 Metrology, Calibration, and Tooling (QA-8)

The contractor's quality program should provide for an effective metrology and calibration system, for standards and measuring test equipment. The contractor's quality program should:

- Ensure that required certified measurement standards as well as gauges, testing, and measurement equipment are available and used.
- Ensure testing and measuring equipment, including personally-owned tools when authorized, to be recalibrated on a regular basis to determine that they are of required accuracy.
- Maintain records for the control of calibration activities.
- Ensure that calibrated measuring and test equipment have evidence of traceability either through primary or reference standards to the National Institute of Standards and Technology or natural physical constants.
- Ensure that environmentally controlled areas are maintained.
- Ensure that when measuring and test equipment becomes damaged or inaccurate they be effectively controlled, replaced, or repaired.
- Ensure that tooling used as a media of inspection is calibrated or certified, and proven for accuracy before use and reinspected at established intervals which ensures the adjustment, replacement, or repair of the tooling which becomes inaccurate.

C.9 Materials, Treatments, and Processes (QA-9)

The contractor's quality program should provide for monitoring materials, treatments, and processes such as soldering, welding, heat treating, etching, plating, and promptly correcting improper process monitoring methods or inspection and test techniques. This includes:

- Adequacy of materials storage and usage and proper nondestructive inspection controls.
- Contractor personnel should monitor special controls for age sensitive items such as chemicals, rubber lubricants, paints, and adhesives.
- Material should be protected against deterioration, damage, contamination, or electrostatic discharge damage in use or in storage.
- The contractor should have provisions for assuring the control of processing environment, as well as the necessary degree of certification, inspection, authorization on and monitoring, for such specialized processes.

C.10 Inspection and Test (QA-10)

The contractor's quality program should ensure final inspection and test of products are performed by quality personnel. Such inspection and testing will provide a measure of the overall quality of the completed product. Testing will be performed so that it stimulates to a sufficient degree, product end use function.

D. Software

D.1 Software Process Capability

The ability of the contractor to establish, maintain, and improve a software development infrastructure capable of fulfilling contractual cost, schedule, and technical constraints.

D.1.1 SEI CMM-Based Evaluations

D.1.1.1 Assessment Results
D.1.1.2 Evaluation Results

D.1.2 Technology Improvements

D.1.3 Technology Dissemination

D.1.4 TQM/CPI Activities

D.2 Software Process Management

The ability of contractor management to development and implement a plan to produce quality software within contractual cost, schedule, and technical constraints.

D.2.1 Management Oversight

D.2.1.1 Cost Variance
D.2.1.2 Schedule Variance

D.2.2 Project Metrics

D.2.2.1 Software Development Status
D.2.2.2 Software Capabilities Integrated
D.2.2.3 Requirements Verification
D.2.2.4 Software Problem Reports

D.2.3 Customer Assessments

D.2.3.1 Award Fees
D.2.3.2 Other Assessments

D.2.4 Milestone Results

D.2.5 CDRL Submittal

D.3 Software Process Performance

The evaluation of the quality and the cost, schedule, and technical impacts of the contractor's software development process.

D.3.1 IQUE Reviews

D.3.2 TRW Compliance Reviews

D.3.3 Customer Compliance Reviews