TCOM Purchase order
Quality Codes

	CALIBRATION SYSTEM REQUIREMENTS
1	Supplier shall maintain a calibration system to assure that all inspection, measuring, and test equipment used to determine compliance with specifications are calibrated to standards traceable to national or industry-accepted standards.
	CHANGE AUTHORIZATION
2	A Purchase Order Change Notice and a drawing/specification revision notice shall constitute change authorization.
	SOURCE INSPECTION
3	Source inspection is required for this item before shipment. Contact TCOM's Buyer to schedule an inspection.
	IN-PROCESS INSPECTION
4	In-process inspection is required for this item prior to finishing and assembly. Welded assemblies require in-process inspection of welded joints and assembly dimensions prior to paint preparation and application.
	NON-CONFORMING MATERIAL LIMITATIONS
5	Non-conforming material shall not be used or shipped without written approval from TCOM Quality Assurance. Supplier shall notify TCOM, in writing, of non-conformity for formal Material Review Board action. This can be done by submitting a supplier deviation request through purchasing. **For electronic components:** **1A)** The seller shall ensure that only new and authentic materials are used in products delivered to TCOM, LP. The seller may only purchase parts directly from Original Component Manufacturers (OCM), OCM authorized (franchised) distributors or authorized aftermarket manufacturers. Use of product that was not provided by these sources is not authorized unless first approved in writing by TCOM, LP. The seller must present compelling support for its request (e.g., OCM documentation that authenticates supply chain traceability of the parts to the OCM), and include in its request all actions to ensure the parts thus procured are authentic/conforming parts **1B)** The organization shall disclose in writing at the time of each individual quote, the source of supply by company name and location, whether or not the organization is authorized (franchised) for the part(s) being quoted and whether or not providing full manufacturer's warranty on the quoted material. If the organization considers that the name of the source of supply is proprietary to the organization, the organization and TCOM, LP shall negotiate an appropriate non-disclosure agreement. **Non-OEM/non-authorized Sellers:** **2A)** The seller shall establish and implement test and inspection activities necessary to assure the authenticity of purchased product, in accordance to the requirements established by TCOM through its customer's requirements including: Supply chain traceability and documentation verification, visual examination, and other tests and inspections in accordance with defined accept/reject criteria provide or approved by TCOM (ref Appendix E of SAE AS5553). The seller shall prepare and provide to TCOM records evidencing tests and inspections performed and conformance of the produc t to the specified acceptance criteria. Tests and inspections shall be performed by persons that have been trained and qualified concerning the types and means of EEE parts fraud and counterfeiting and how to conduct effective product authentication. **2B)** If suspect or confirmed fraudulent/counterfeit EEE parts are furnished under this purchase agreement, such items shall be impounded. The seller shall promptly replace such items with items acceptable to TCOM and the seller may be liable for all costs relating to impoundment , removal and replacement. TCOM may turn

	such items over to the authority having jurisdiction (e.g., Office of Inspector General, FBI, etc.) for investigation and reserves the right to withhold payment for the items pending the results of the investigation.
	Certificate of Conformance
6	A certificate of compliance/conformance is required to provide quality evidence of specific characteristics of the material supplied as indicated on the drawing, specification, or purchase order (e.g., test results, heat treatment, surface finish, material, standard specification, etc.). Valid certifications shall clearly identify the manufacturer or supplier of the certified characteristic, shall contain enough information to identify the C of C with the item or material supplied, shall reference the specific characteristic(s) being certified, and shall be signed by a Supplier quality assurance representative and/or company executive identified by specific titles(s). **For electronic components:** The manufacturer and the seller of its products shall complete a C of C and full supply chain traceability for all parts. The C of C supplied by the manufacturer shall be copied and passed through to the end customer. The seller's C of C shall also accompany each shipment of product to the end customer. In no case shall the manufacturer's C of C be altered or show signs of alteration. The seller shall retain copies of certificates with the lot records until the lot is completely shipped and shall retain the product and shipment traceability for a period consistent with the contract requirements. A manufacturer's C of C should include the manufacturer's name and address, manufacturer's and/or buyer's full part number and part description, batch identification for the item(s) such as date codes, lot codes, serializations or other batch identifications, signature or stamp with the title of seller's authorized personnel signing the certificate.
	SOLDERING/ELECTRONIC WORKMANSHIP STANDARDS
7	Unless specified otherwise on the TCOM purchase order, drawing, or specification, the manufacture and handling of soldered assemblies shall comply with the requirements of ANSI/J-STD-001 [Latest Revision], Class 2., Cleanliness Designator C-20. Quality acceptability requirements shall be in accordance with the Class 2 acceptance criteria of ANSI/IPC-A-610 [Latest Revision] for Electronic Assemblies and IPC/WHMA-A-620 for Cable and Wire Harness Assemblies.
	TCOM Suppliers doing A & W (assembly and wiring) work on TCOM kitted parts or providing completed assemblies that include electrical/electronic component soldering or wiring on TCOM purchase orders shall comply with PS-10052 [latest revision].
	WELDING REQUIREMENTS
8	For the purposes of interpreting the welding codes on this contract, your firm is “the Contractor” and TCOM is the “Owner” and the “Engineer” is TCOM’s duly appointed employee. Welding procedures, welders and weld inspectors shall be qualified in accordance with the welding code referenced in the drawing or specification. Welders and weld inspectors shall be certified in accordance with the welding code referenced in the drawing or specification. The use of any welding codes or specifications not referenced by the applicable drawings must be approved by TCOM prior to production. **Equivalent codes are usually limited to:** • The ASME Pressure Vessel Code. • A Military (MIL-) Standard as modified by some particular branch of the Department of Defense. The Supplier shall be prepared to show, by records, that successful welds can be made for the material type, joint types, material thicknesses and welding positions required while using the Supplier’s facility, equipment and personnel. With rare exceptions (for some pre-qualified steel joints and for welders who perform a first PQR).

	TCOM will expect to have access to or copies of all of the following documents: • A Welding Procedure Specification (WPS): This describes the welding process and joints in detail. A Procedure Qualification Record (PQR): This proves that the Supplier's equipment can make the joints. • A Welder's Qualification: based upon a separate test for any welder who did not perform the PQR. • Data on filler metal certification – the alloy used should conform to the WPS. • Data on shielding gas certification – the gas used should conform to the WPS. • A written report of visual inspection, in the contractor's format, covering all welds and meeting the requirements of the applicable Code. (Inspectors are expected to regularly observe joint preparation, assembly practice, welder technique and performance to make certain that Code requirements are met during the fabrication/erection process.) • A written report of visual inspection, in the contractor's format, covering all welds and meeting the requirements of the applicable Code. (Inspectors are expected to regularly observe joint preparation, assembly practice, welder technique and performance to make certain that Code requirements are met during the fabrication/erection process.) **Minimum qualifications and visual inspections are as follows:** • AWS D1.1 [Steel] • AWS D1.2 [Aluminum] • AWS D1.3 [Sheet Steel] • AWS D17.1 [Aerospace]
	SUBMISSION OF INSPECTION RECORDS
9	A legible and reproducible copy of the Supplier's inspection report is to be submitted with this item. Each inspection document, in Supplier format, shall evidence compliance with the applicable drawing and/or specification requirements and shall include the part number, applicable drawing and/or specification with revision letter or number, and the signature on title of the responsible agent of the Supplier. All actual measurements of specified drawing dimensions shall be recorded - the Supplier's engineer or quality manager shall have dispositioned any indications of "out-of-tolerance" conditions. Inspection records for welded assemblies shall reflect assembly dimensions after completion of welding. Unless otherwise noted, all drawing dimensions shall be recorded before painting and/or plating. When serialization is required by the drawing or specification, such serialization shall be a part of the inspection/test report data.
	SUBMISSION OF TEST DATA SHEET
10	A legible and reproducible copy of the test data sheets are to be submitted with this item. If TCOM has supplied a test document then that document shall be used; otherwise the test report shall be in Supplier's format. Each test document shall evidence compliance with the applicable drawing and/or specification requirements and shall include the part number, applicable drawing and/or specification with revision letter or number, and the signature on title of the responsible agent of the Supplier. All actual measurements of specified test performance shall be recorded - the Supplier's engineer or quality manager shall have dispositioned any indications of "test failure" conditions.
	RETENTION OF INSPECTION/TEST RECORDS
11	Inspection (Code 09) and test (Code 10) records shall be maintained at the Supplier's facility for a period of five years.
	FAILURE ANALYSIS REPORT
12	Failure analysis report shall be delivered with the item returned for repair and/or analysis.

	REQUIREMENTS FOR AND RETENTION OF MATERIAL CERTIFICATION
13	1) The bill of material or parts list for the items ordered include a requirement for particular metal alloys (or sometimes special non-metallic raw materials) whose physical properties depend upon chemical composition or processing. Such properties must be proven by providing a certificate of analysis (COA), usually obtained from the Sub-supplier that sold the raw material, which records actual chemical composition data. Supplier shall retain on file, for a period of five years, the certifications for raw materials used to manufacture this item. 2) Suppliers should demand a substantial certificate from their raw material Sub-suppliers; a proper COA should include actual discrete data (physical and chemical analysis report) taken from the lot of material supplied and the actual quantity of each constituent measured should be listed and compared to the requirements of each constituent identified in the applicable specification. 3) Unidentified and untraceable raw materials may not be used without TCOM's advance approval and if the Supplier's chosen raw material pedigree is indeterminate and the chemical composition is uncertain, TCOM may require the Supplier to have the material tested by a lab to determine its composition and properties before proceeding with the work. 4) The COA should be checked and annotated by the Supplier to trace the Sub-supplier's raw material lot to the Supplier's TCOM's job and signed by a quality assurance or other assigned representative of the Supplier identified by name and job title.
	MRB AUTHORITY
14	Supplier is authorized to disposition non-conforming material in accordance with established Material Review Board (MRB) procedures that have been approved by TCOM. This authority is limited to aspects of the item inside the boundary controlled by TCOM's configuration description (a.k.a. "Class II") that might otherwise be transparent to any customer or end-user. If this code appears on the purchase order, the Supplier was usually the Original Equipment Manufacturer (OEM) of a commercial part whose design was captured in a TCOM Source Control Drawing or else the Supplier participated substantially in the design of the product or its manufacturing process. In such cases, the Supplier is usually in possession of the superior knowledge necessary to determine dispositions; the intent here is to grant the supplier latitude in dealing with manufacturing defects or sub-supplier material/service issues without unnecessary interference from TCOM.
	PACKAGING FOR LITHIUM BATTERIES
15	Lithium batteries shall be packaged and transported per current OSHA/DOT regulations.
	SHELF LIFE MATERIAL REQUIREMENTS
16	Material susceptible to quality degradation due to aging shall be marked with the date of manufacture or when the useful shelf life will be expended. Upon receipt at TCOM, material shall have a minimum of 80% shelf life remaining.
	HYDRAULIC COMPONENTS & HYDRAULIC SYSTEMS REQUIREMENTS
17	Hydraulic components and/or systems shall be supplied with a cleanliness level of NAS 1638 Class 8 or better. Plumbing/manifold, tubing, hoses and similar assemblies shall have no residual interior corrosion by-products (loosely adhering rust or scale) or other foreign material; shall have been flushed clean with hydraulic fluid; and shall be capped before shipment. If the part requires pickling (acid cleaning followed by passivation and hydraulic oil coating) of piping/manifolds or tanks to remove corrosion then this shall be done before flushing. Items built to a TCOM drawing that require pressure testing shall be tested hydrostatically (using potable

	water) before flushing or in conjunction with flushing (using the flushing hydraulic oil) - calibrated gauging (Code 01) shall be used. Criteria, unless otherwise specified shall be "no leaks" following 10 minutes at the maximum test pressure - "no leak" means no discernable pressure drop or no formation of any droplet of oil within the tested boundaries (the supplied item).
CONTINUITY CHECK REQUIREMENTS	
18	All electrical circuits shall be continuity checked to the schematic.
ACCEPTANCE TEST REQUIREMENTS	
19	The unit shall pass a performance acceptance test prior to acceptance by TCOM receiving Inspection.
WITNESSED PREPERATION FOR SHIPMENT	
20	Supplier is responsible for the protective wrapping, boxing, and/or crating of all items as required to prevent physical and surface finish damage (including contamination/intrusion by foreign material) during shipping and handling from place of origin to destination. TCOM shall be notified prior to the loading phase. A TCOM representative shall be present and witness the loading, packing and securing of equipment to the vehicle.
FIT CHECK	
21	Supplier is required to fit-check/assemble the items purchased following/in conjunction with quality assurance In-Process or Source Inspection.
MECHANICAL ASSEMBLY ONLY	
22	For items requiring both mechanical and electrical assembly operations, Supplier is to perform mechanical assembly only.
COMPRESSION SPRING TESTING	
23	Supplier will test a random sample (per MIL-STD-105 or equivalent ISO standard) for spring rate and for load at specific points per the drawing. If the drawing has no load points, test at 20% and 80% compression. A written report will be shipped with the parts.
DOMESTIC SOURCES ONLY	
24	In order to provide complete traceability, the parts supplied on this purchase order shall be procured only from domestic sources located in the United States of America. The vendor may supply parts made in his factories located in North American Free Trade Association (NAFTA) nations, as long as complete, traceable product data is established, maintained and accurate for certification of all materials and processes. When a certificate of compliance is also requested (Code 06), records will be provided showing that the parts were manufactured by a domestic source.
SOLE SOURCE REQUIRED FOR OEM	
25	The part numbers for items supplied on this purchase order contain identifying information for a particular Original Equipment Manufacturer (OEM). Suppliers may obtain parts from any authorized distributor of that OEM, but no substitution of source is allowed. Identical part numbers are necessary but are not sufficient evidence to prove the OEM source. When a certificate of compliance is also requested (Code 06), records will be provided showing the proper OEM Supplied the original parts delivered under this purchase order. **For electronic components:** The seller shall maintain a method of item supply chain traceability that ensures tracking of the supply chain back to the manufacturer of all Electrical, Electronic, and Electromechanical (EEE) parts included in assemblies and subassemblies being delivered per this contract. This supply chain traceability method shall clearly identify the name and location of all of the supply chain intermediaries from the manufacturer to the direct source of

	the product for the seller and shall include the manufacturer's batch identification for the item(s) such as date codes, lot codes, serializations, or other batch identifications.
	VISCOSITY REQUIREENTS
26	Liquid raw materials or chemicals ordered on this purchase order are required to be within specified viscosity limits. The supplier shall test that the viscosity of the liquid supplied meets the requirements of TCOM's specification (the viscosity in thousands of cps is usually part of the TCOM part number following a dash). Material supplied under this item will be measured using a calibrated instrument (Code 01) and results of the viscosity test will be sent with the item purchased.
	NON-DESTRUCTIVE TESTING & EVALUATION REPORTS [NDT/E]
27	Supplier must have (on staff or under subcontract) a competent person to provide all nondestructive testing required for this work. Supplier must submit the credentials of this competent person showing qualification to a relevant standard (ASNTS NT-TC-1A Recommended Practice or NAS 410 or equivalent) along with a report on nondestructive tests conducted and the results thereof. Individuals casually nominated by the supplier based on perceived skill or experience who are without documented formal training and Level II or III certification will NOT be accepted. The competent person performing this work must do it on a regular basis in support of the supplier's own ongoing production or else shall be employed by a sub-contracted firm that specializes in providing NDT/E. Preferred NDT/E suppliers shall have at least one audit-based approval by a major company or the government that supports competency in the relevant technique (PT/UT/MT/RT/Eddy-Current) - examples of preferred suppliers include: • A Raytheon-approved supplier in good standing. • A NADCAP-approved supplier. • A Northrop-Grumman-approved ASPL supplier. • A Lockheed-Martin-approved QCS-001 supplier. • A Boeing-approved D1-4426 supplier. If no existing approvals are in place, TCOM may choose to audit the supplier/sub-supplier prior to awarding the work; if shortfalls are found, corrective/preventive actions must be taken (under a control plan) to become a TCOM supplier of the part requiring NDT. The supplier (or sub-supplier) must have written procedures and any supporting technique sheets under document and revision control; these procedures must be on-site and available for review at each in-process or final inspection event and at other times (at the supplier's plant) upon request. The supplier's findings shall be reported on an appropriate form, including the name of the NDT/E technician and the approval signature and title of a responsible agent of the supplier. An adequate method of identifying and cross-referencing each film exposure, report, and item must be provided. When dye penetrant (PT) is specified, pre-cleaning shall be per **ASTM-E-1417.** When radiographic inspection is specified, certified personnel shall perform the Supplier's reading and interpreting of the X-ray film. The X-ray film shall accompany the shipment of the items and report.
	VISUAL WELDING INSPECTION
28	Supplier must have (on staff or under subcontract) a competent person to provide all visual welding inspection (including fit-up, in-process and final fabrication/erection inspections) required for this work. Supplier must submit the credentials of this competent person showing qualification (to AWS QC1 Standard for AWS Certification of Welding Inspectors or equivalent) along with a report of visual weld inspections conducted and the results thereof.

	• “Competent person” means a person holding an active, valid American Welding Society CWI (or SCWI/CAWI) credential. • “or equivalent” means a valid credential-in-force from a 3rd Party regulatory body or industry/trade association relevant to an alternate welding code that is accepted by TCOM (ASME Pressure Vessels, MIL-STD DoD Welding, etc.). Some NDT credentials (PT, UT, RT) may also include sufficient visual welding inspection training so that they will be accepted, too. It is NOT sufficient to appoint a Contractor’s inspector meeting only the minimum AWS Code standards for qualification (by asserting a Contractor-accepted combination of education, training and experience).TCOM‘s customary owner/engineer inspections (conducted at In-process or Source Inspection) by TCOM’s own staff CWI/CAWI will not fulfill this requirement.
TRACEABILITY REQUIREMENTS FOR TYPE-CERTIFIED AIRCRAFT	
29	Parts supplied under this purchase order to be used by TCOM in a type-certified aviation vehicle (one which is manned or operates over populated areas). The U.S. Federal Aviation Administration (or an equivalent international regulatory agency) requires TCOM to have part traceability information suitable for aircraft. Supplier must submit objective evidence (records) to TCOM with the parts of: 1. Complete raw material traceability (before processing operations) 2. Complete production traceability (following processing operations) 3. Certificate of conformance/compliance (to TCOM's purchase order/drawings/specifications) For raw materials, this means that the supplier must pass onto TCOM the source and pedigree (batch/heat/lot number) of piece parts or raw materials provided to the supplier by vendors. If not available, supplier must perform and submit any physical or chemical test reports that prove the raw materials. For production traceability, this means that a batch/lot number must be assigned by the Supplier for his own processing/manufacturing operations that turned the raw materials into the finished parts/assemblies. The reason for these requirements is that the FAA must be able to trace back (through TCOM, L.P. and the Supplier) to the raw material and have an unbroken chain of inspection and test records that prove that all parts supplied on this purchase order are properly made from the correct materials and conform to approved drawings and specifications. The supplier must certify that this is the case and submit the necessary records.
SMOOTH EDGE/DEBURRING REQUIREMENTS	
30	When notes on the drawing refer to deburring and removal of sharp edges, Suppliers make this voluntary, advance agreement per ANSI B46.1 regarding edge flaws. Parts without a specific radius or chamfer, but requiring deburring and removal of sharp edges, will meet the standard in this paragraph [loosely based on Class 1 criteria (depending on the part thickness) per un-adopted Mass Finishing Job Shops Association standard MFJSA Standard 1. 1992]. • **Class 1** edges applies to parts of thickness (t) of 0.100 or less and these shall have a radius of t/10 or greater while still meeting all other drawing criteria. Class 1 edges must also be burr-free at 5x magnification. • **Class 2** edges applies to parts of thickness (t) over 0.100in and these shall have a radius of 0.010in or greater while still meeting all other drawing criteria. Class 2 edges must be burr-free at no magnification (naked eye). Visual inspections shall not permit projections beyond the plane of adjacent surfaces. Edges defined to Class 2 level of finishing will be smoothed to the extent that hands will not be cut nor would electric wires or mating parts.

	QA/QC SYSTEM OR CONTROL PLAN
31	Prior to award of a contract for the work described in this purchase order , the supplier's Quality System must be surveyed by and approved by TCOM. The survey will require an actual visit to the supplier's facilities where the work is to be done; examples of non-proprietary documents and records relevant to the supplier's management of quality must be made available for review; supplier personnel responsible for quality must be made available for discussions with TCOM QA . TCOM will use SAE AS9003, Inspection and Test Quality System, as the basis of comparison when evaluating the supplier's quality system. AS9003 is available from the SAE . When there are areas of the supplier's Quality System that do not generally meet AS9003, TCOM will require that contract- specific processes are implemented for this individual purchase order. TCOM will decide upon a Control Plan that may require additional effort from the supplier (expenditures for labor or materials/services) to provide documented proof that quality requirements are met. After the control plan is drafted, TCOM may need to obtain Prime Contractor or Customer approval of the supplier and any control plan; if other authorities disapprove of any part of TCOM's planned arrangements or if the supplier declines the additional controls, TCOM may choose not to award the purchase order and TCOM will find others to perform the work . Any Control Plan will, as a pre-condition for award, become a binding part of the contract for the supplies and services on this purchase order. **For electronic components:** The seller shall have a quality management system that complies with ISO 9001 and when required SAE AS9120 or AS9100. Independent certification/registration is not required unless specified by TCOM. Organizations that obtain certification/registration to ISO9001 (AS9120, AS9100) and subsequently change certification/registration bodies (CRB), lose registration status or are put on notice of losing registration status, shall notify TCOM's purchasing department within three days of receiving such notice from its CRB.
	Government Source Inspection
32	All items supplied under this Purchase Order are subject to inspection by a Government Quality Representative at the Seller's facility, or at the facility of a subcontractor to the Seller, prior to shipment. Detailed parts of assemblies are subject to Government inspection or Government witness of Seller inspection prior to assembly and of any tests after assembly. Intermediate Government inspection does not, however, negate requirements for the Seller's inspection/test of the finished item prior to shipment. The Seller shall make available his inspection records to the Government Quality Representative at the time of presentation of the produced items. The seller shall notify TCOM Purchasing no less than seventy-two (72) hours in advance of the time items are ready for inspection or test (if Government inspector resides at your facility) or no less than eight (8) days in advance (if Government not in residence). TCOM Quality Assurance will make notifications and arrange for the Government Quality Representative to attend with TCOM's inspector. The Supplier will provide calibrated gauging/instrumentation (Code 01) and labor required to move items and operate inspection/test equipment.
	FIRST ARTICLE INSPECTION
33	The particular revision of the item ordered has never been manufactured by anyone or has never been manufactured by your company. TCOM will use SAE AS9102, Aerospace First Article Inspection Requirement, as a guide in developing the FAI requirements. The supplier should NOT need this standard, but AS9102 is available from the SAE.

	TCOM will require that data is provided by the supplier proving that all constituent raw materials, features, attributes, processes, key characteristics, interfaces and functions meet drawing and specification requirements. **<u>Such data may also require recording:</u>** 1. Evidence that any TCOM-directed sources of hardware/services was used as required. 2. Identification of special tooling used to make the item. 3. S/N of all inspection, measuring and test equipment used to measure conformance. 4. Credentials of personnel carrying out critical operations. TCOM will create and provide in advance (with the RFQ and Purchase Order) the specific details of what data must be provided. If the supplier has sufficient quantity or dollar-value of TCOM work and adequate computer resources, the forms may be provided by granting the supplier access to a hosted internet web-site; in such cases, TCOM will provide training and software (DISCUS and/or Net-Inspect). For smaller orders or less sophisticated supplier computing situations, the forms may be provided as a Microsoft Excel Spreadsheet. If necessary, manual paper forms may be used (legibly completed in black or blue-black ink by the supplier). Any First Article data that is outside expected limits, reflects a failure or fault or is un-available must be treated as a Non-conformance and must be adjudicated by TCOM, L.P. before the data is approved. No item may be shipped until the supplier's First Article Data Package is provided to and approved (electronically or in writing) by TCOM, L.P
WAIVER OF PAINTING REQUIREMENT	
34	Parts supplied need not be painted per any drawing notes that refer to TCOM Specification 950672. However, parts must be delivered in solvent-cleaned condition ready for painting with a primer. Parts must be clean and free of corrosion (except for minor flash rust on the surface of steel) and without slag splatter or any other surface contamination.
WAIVER OF HOLE DRILLING	
35	Supplier need not drill holes shown on drawings for this part. (TCOM must either match-drill with a mating assembly or requires a different hole pattern/location and we will complete all drilling.) However, all other portions of these parts must match their drawing configuration with materials and orientation/location tolerances as shown on those drawings.
FIBER-OPTIC SERVICES	
36	This line item or purchase order involves work to splice/mechanically connect fiber-optic cables and components OR to measure fiber-optic continuity and attenuation OR to perform all of these services. Services shall be conducted using instruments that are either within their OEM's original standard warranty for new equipment OR are currently calibrated using standards traceable to NIST or to the accepted industry reference (Code 01). This calibration will be proven by traceable records presented with the instrument or by valid calibration stickers affixed thereto. Technicians or engineers who are trained and certified shall perform services. Certification may be made by the Supplier based on a combination of education, training and experience of the individual OR by applicable 3rd-Part certification by some relevant authority of the fiber-optic industry. The personnel qualifications will be provided in writing on company letterhead by the Supplier or by recognized credentials carried by the Supplier's technician. The Supplier should provide records of inspection of his own work and retain copies on file for 36 months. This should normally include "as released" traces showing attenuation of areas impacted, disturbed or bounded by the splicing/connectorization work. Traces must be identified to the fiber, direction,

	condition, frequency and wavelength. Traces must be legible. Traces should be provided (if possible) in a file format that is viewable by free viewing software [one example: EXFO OTDR Viewer 6.7 free at www.exfo.com]. Traces can also be supplied in other file formats if approved by TCOM. [These may include Adobe Acrobat PDF files and various JPG, TIFF and BMP files that can be read in the Microsoft Windows operating system environment with common software. Such files should be able to be viewed in a zoom mode where discontinuities can be seen.] Text reports of tests printed from instruments may be provided (in lieu of traces) if losses can be measured between cursors and cursor locations are clearly identified. Where there is no drawing or statement of work attached to the purchase order, or where the drawing or SOW is silent, the Supplier shall: **A.** Come prepared to do both multi-mode and single mode work. **B.** Have at least one power meter. **C.** Have at least one Optical Time Domain Reflectometer (OTDR). **D.** Have sufficient length of clean, temporary leader available so that the OTDR can see the leading/inbound end of the connection. **E**. Have all necessary splicing tools and supplies (raw materials) for at least one connector and two fusion splices. **F**. Plan to prove continuity and measure dB loss in each optical circuit in the UP and DOWN (e.g., both) directions. **G.** Make measurements at wavelengths of 850nm, 1310 nm and 1550 nm. **H.** Make measurements with a pulse width of 5 meters or less. **I**. Make connector attachments with a loss (attenuation) less than 0.50 dB **J.** Make fusion splices with a loss (attenuation) less than 0.25 dB **K.** Be able to provide dB/length traces of attenuation read with the OTDR (so that TCOM can determine if the finished optical circuit meets TCOM's optical loss budget). Traces must be provided within 24 hours of the completion of work.
ELECTROSTATIC DISCHARGE (ESD) PACKAGING	
37	The supplier shall take necessary precautions to ensure that static susceptible devices are adequately protected from electrostatic discharge (ESD) damage during packaging and shipping. Items received without proper ESD packaging, including ESD labeling, shall be cause for rejection at the Supplier’s expense. **IPC-A-610 summarizes minimum requirements. ESD sensitive parts and assemblies shall:** A). Have an outer layer of “static shielding or static barrier” packaging material. B). Have any inner packaging layers and all cushioning of “anti-static (low charging)” or “static dissipative” materials; care should be exercised in using packing materials that will not contaminate, corrode or affect the solderability of packed components. C). have a warning label applied The devices supplied under this contract shall be packaged in accordance with the latest revisions of MIL-STD-1686 (Electrostatic Discharge Control Program for Protection of Electronic Devices) and MIL-HDBK-263 (ESD Control Handbook for Protection of Parts, Assemblies and Equipment) or, if the Supplier chooses, the following equivalent industry standards: • JEDEC JESD 625 [formerly ANSI/EIA-625 • EIA-541 [Packaging]/CEA-556[Labeling] • BS EN 61340-5-1 [General]/ 61340-5-2 [User Guide] Packaging shall be marked with an ESD cautionary note and symbol. The marking criteria used is changed frequently; although the current symbology of ANSI/ESD S8.1 is preferred, previous standard’s (EIA-471 or

	other commercial) stickers/symbols may be used until stock is expired. A legible, high-contrast or bold color note shall be affixed on exterior and interior packaging saying something like: “ CAUTION: CONTAINS PARTS AND ASSEMBLIES SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD). USE ESD PRECAUTIONARY PROCEDURES WHEN TOUCHING, REMOVING OR INSERTING!” Polymer barrier film, expanded or molded products, commonly referred to as "pink poly” does not provide acceptable electrostatic discharge (ESD) protection and are NOT to be used as primary outer packaging. If used at all, anti-static, static dissipative packing material (pink poly formulations) must comply with Contact Corrosivity Testing in accordance with MIL-STD-3010 Method 3005 (formerly Federal Standard 101, Method 3005) and may not be used in direct contact with Optics and Polycarbonates.
IRIDITING/ALODINING (CHROMATE CONVERSION COATING) REQUIREMENTS	
38	The item ordered has one or more aluminum or aluminum alloy parts that require anti-corrosion protection to MIL-DTL-5541F. This may be the final finish for the part or it may be a prerequisite required before painting. Check the TCOM drawing notes or part specification for the Class and Type of chromate conversion. If Class is not specified, use Class 1A. If Type is not specified then the Type is optional but Type II is preferred. TCOM considers chromate conversion to be a "special process" that requires the use of approved suppliers. If you plan to apply this coating in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and a non-batch, continuous line process by a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort). If the iriditing company you choose has no dedicated quality function and/or plans to use brush application of retail commercial (auto-parts store) products then TCOM will NOT award you the work on this purchase order. **<u>TCOM approval is satisfied by one of the following:</u>** **<u>A)</u>** Use a supplier that complies with one the below requirement. • Use a Raytheon-approved supplier. • Use a NADCAP-approved supplier. • Use a Northrop-Grumman-approved ASPL supplier. • Use a Lockheed-Martin-approved QCS-001 supplier. • Use a Boeing-approved D1-4426 supplier. **B)** A TCOM audit of you or your sub-supplier's facility for compliance to the Military Standard; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added as an approved supplier Any TCOM audit will require that you or your sub-supplier follow MIL-DTL-4451F including (but not limited) planned arrangements for: • [3.1] qualified materials MIL-DTL-81706 (purchased off QPL-81706 and Amendments 1 and 2); proper use of replenishing chemicals (such as fluorides). • [3.2] proper cleaning to a water-break free surface prior to coating; absence of prohibited abrasives; controls and procedures for re-cleaning, touch up and rejection. • [3.3] application methods including pre-treatment masking. • [3.4] (maximum) 5% touch-up. • [3.5] requiring continuity in appearance; requiring discernable visibility in daylight; minimizing and touching up contact marks.

	• [3.6.1/4.4.1] 168 hour 5% salt spray testing. • [3.6.2/4.4.2] wet tape adhesion testing (ONLY if CARC or other paint system is called for. • [3.7] electrical contact resistance testing (ONLY for Class 3 coatings). • [3.8] chemical analysis of the conversion coating (concentration, pH and temperature) and comparison to manufacturer's requirements. • [4.1a/4.2] process control inspection(tests and solution analysis); frequency of tests; test specimens; actions after failure. • [3.9/4.1b/4.3] workmanship/conformance inspection; sampling; visual examination; actions after failure.
	ANODIZING REQUIREMENTS
39	The item ordered has one or more aluminum or aluminum alloy parts that require anti-corrosion protection (perhaps with cosmetic color for appearance enhancement) to MIL-A-8625F Amendment 1. This usually means the final finish for the part buy may also be a prerequisite required before painting. TCOM considers anodizing to be a "special process" that requires the use of approved suppliers. If you plan to apply this coating in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and use of a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort). **TCOM approval is satisfied by one of the following**: **A)** Use a supplier that complies with one of the below requirements: • Use a Raytheon-approved supplier in good standing. • Use a NADCAP-approved supplier. • Use a Northrop-Grumman-approved ASPL supplier. • Use a Lockheed-Martin-approved QCS-001 supplier. • Use a Boeing-approved D1-4426 supplier. **B)** A TCOM audit of you or your sub-supplier's facility for compliance to the Military Standard MIL-8625F; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added as an approved supplier. Any TCOM audit will require you or your sub-supplier to follow MIL-A-8625F including (but not limited to) planned arragements for the following: • [3.3.2] Proper cleaning to a water-break free surface prior to coating; absence of prohibited abrasives. • [3.3.4] 5% touch-up (maximum). • [3.6.1/4.5.3] 336 hour 5% salt spray testing. • [3.7.1.1/3.7.2.1.1/4.5.2] Weight of Types I (unsealed), II (unsealed) & III coating. • [3.7.2.1/4/5/1] Thickness of Type III coating. • [3.7.1.4/4.5.6] Wet tape adhesion testing (ONLY if CARC or other paint system is called for). • [3.8] Sealing. • [3.9] Final dimensions. • [3.12] Required wetness/rinse time limits for dyeing. • [3.13.1] Contact marks. • [4.2a/4.3] Document requirements; process control inspection (tests and solution analysis). • [4.2b/4.4] Quality conformance inspection; sampling; visual examination; dimensional measurements; actions after failure.

CARC PAINTING REQUIREMENTS

40 The drawing notes may indicate that the CARC paint color is specified on the purchase order; if so, refer to the table below (if any questions, contact TCOM's Buyer):

Drawing Note	Type	Description	Color No. FED-STD-595	Finish COAT spec.
Exterior surface	Type 1	383 Green	34094	MIL-DTL-64159 Type II
Aerostate Painted Hardware	Type VI	Aircraft White (Exterior)	37875	MIL-DTL-64159 Type II
Interior Surface	Type V	White (Interior)	27875	MIL-PRF-22750
Avionic Equipment	Type I	383 Green	34094	MIL-DTL-64159 Type II
Exterior Walkway	Type I	383 Green	34094	MIL-DTL-64159 Type II
Interior Walkways	Type IV	Gray (Interior)	36300	MIL-PRF-22750
Exterior COTS Components	Type I	383 Green	34094	MIL-DTL-64159 Type II
Interior COTS Components	Type V	White (Interior)	27875	MIL-PRF-22750

TCOM considers CARC Painting to be a "special process" that requires the use of approved suppliers. If you plan to apply this coating in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and use of a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort).

TCOM approval is satisfied by one of the following:

A) Use a supplier that complies with one the below requirements:

- Use a Raytheon-approved supplier.
- Use a NADCAP-approved supplier (for Dry Film processes MIL-DTL-53022/MIL-PRF-22750/MIL-PRF-23377).

B) A TCOM audit of you or your sub-suppliers facility for compliance to the specifications and referenced military standards; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added

Any TCOM audit will require that you or your sub-supplier follow applicable portions of MIL-DTL-53072C including (but not limited to) planned arrangements for:

- [3.2] Cleaning of ferrous and non-ferrous surfaces by chemical, electrochemical or mechanical means per TT-C-490.
- [3.3] Pre-treating of metallic substrates with DOD-P-15328 or MIL-C-8514 wash primer [but not Anodizing to MIL-A-8625 or Iriditing to MIL-DTL-5541 which are covered by other audits].
- [3.4] Priming by spray (plus brush touchup) with two-part anticorrosive epoxy primer (MIL-PRF-23377, MIL-P-53022, MIL-P-53030, MIL-P-53084, or MIL-PRF-85582) from purchase off the Qualified Products List through mixing, reduction, filtration, set time, pot life control, application, drying and dry film thickness measurement.
- [3.5] Top Coating by spray (plus brush touchup) with polyurethane or epoxy (MIL-C-46168, MIL-C-53039, MIL-

	DTL-64159, MIL-PRF-22750) from purchase off the Qualified Products List through mixing, reduction/admixing, filtration, standing time, pot life control, mist coating/application, multi-coats for humidity control, drying and dry film thickness measurement. • [3.6] Touch-up and rework. • [3.7] Process control. • [3.8] Miscellaneous requirements (surfaces NOT to be painted, engine manifolds/hot surfaces, sealing of reservoirs/cases, electrical components, steel wool prohibition, plastic media blasting for weld repairs, paint handling, storage and shelf life control).
	HEAT TREATMENT
41	Supplier (or Sub-contractor) must work to a relevant, recognized standard for all heat treatment required for this work; if a particular standard or specification is listed on TCOM's drawing, the Supplier shall either work to TCOM's choice or request a waiver in writing. The competent persons performing this work must do it on a regular basis in support of the Supplier's own ongoing production or else shall be employed by a sub-contracted firm that specializes in providing heat treatment. Heat treatment Suppliers shall have at least one audit-based approval by a major company or the Government that supports competency in the relevant technique (induction, flame, oven, etc.) - examples of approved Suppliers include: • Use a Raytheon-approved supplier in good standing. • Use a NADCAP-approved supplier. • Use a Northrop-Grumman-approved ASPL supplier. • Use a Lockheed-Martin-approved QCS-001 supplier. • Use a Boeing-approved D1-4426 supplier. If no existing approvals are in place, TCOM may choose to audit the Supplier/sub-supplier prior to awarding the work; if shortfalls are found, corrective/preventive actions must be taken (under a control plan) to become a TCOM supplier of the heat treated part being ordered. The Supplier (or sub-supplier) must have written procedures and any supporting technique sheets under document and revision control; these procedures must be on-site and available for review at each in-process or final inspection event and at other times (at the supplier's plant) upon request. Production/process equipment must have proven capability to measure and control the applied heat and methods must be in place to detect and mitigate problems. The Supplier's shall prepare a heat treatment report on an appropriate form, including the relevant process parameters and any post-treatment check (hardness); the report shall have the approval signature and title of a responsible agent of the Supplier. An adequate method of identifying and cross-referencing each treatment, report, and item must be provided.
	PASSIVATION/DE-PASSIVATION REQUIREMENTS
42	On this purchase order, TCOM requires that stainless steel parts of a specified alloy be passivated. If constructed using welding, parts will also have a known filler metal (either identified on TCOM's drawing or provided by the supplier who did the welding from the WPS). When parts are welded they may have scale or heat tint or both. TCOM requires removal of any scale to allow good passivation but TCOM does NOT require removal of heat tint. TCOM prefers processes compliant with ASTM-A-967 but will accept QQ-P-35C (or SAE-AMS-QQ-P-35) as

equivalent. Chosen processes shall follow the recommended guidelines in the alloy tables (FIG X1.1 or Table II, as appropriate to the specification) or else shall be cleared with TCOM prior to use. For scale removal per ASTM-A-967 Paragraph 5.3.1, suppliers must have stainless steel wire brushes or grinding/blasting media that is totally free of iron/zinc to perform the mechanical cleaning per ASTM A-380-1999e1. Alternatively, suppliers may use a bead-blasting media that is assumed to contain iron IF a brief acid dip is performed per A380/5.3.4(+Annex A2) before passivation.

If TCOM's drawing is silent regarding the test Practice, the supplier shall use at minimum at least Practice A (Water Immersion Test) discussed in sections 1.4.1, 13.3.1 and 14 of ASTM-A-967 (or 3.7.1 and 4.4.1 of QQ-P-35C). For each shipment, suppliers shall certify process conditions and performance of tests to the required practice as permitted by section 22.1 of ASTM-A-967.

TCOM considers Passivation to be a "special process" that requires the use of approved suppliers. If you plan to perform this work in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and use of a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort).

TCOM approval is satisfied by one of the following:

A**)** Use a supplier that complies with one the below requirements:
• Use a NADCAP-approved supplier (AC7108 for "Surface Treatment/Passivation - AD 1033 or ASTM A380 or QQ-P-35 or Other).
• Use a Northrop-Grumman-approved ASPL supplier.
• Use a Lockheed-Martin-approved QCS-001 supplier.
• Use a Boeing-approved D1-4426 supplier.
B) A TCOM audit of you or your sub-suppliers facility for compliance to ASTM-A-967 specification and its references; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added to this Code (below) as an approved supplier
Any TCOM audit will require that you or your sub-supplier follow applicable portions of ASTM-A-967 including (but not limited to) planned arrangements for:
• [5.2.1] Materials (chemicals) use including maintenance of adequate volume, concentration, purity, and temperature control.
• [5.2.2] Record keeping and availability (coded if necessary for proprietary processes).
• [5.3] Preparation including mechanical and chemical methods plus results (and avoidance of passivation after more aggressive treatments).
• [6] Conduct of passivation treatments Nitric 1 through Nitric 5 plus water rinse (including water cleanliness).
• [7] Conduct of passivation treatments Citric 1 through Citric 5 plus water rinse (including water cleanliness).
• [8] Conduct of passivation with other chemical solutions (with or without electricity).
• [9] Arrangements for neutralization (rinsing with or without separate treatment).
• [10] Post-Cleaning Treatments to accelerate passivation film formation (including sodium dichromate for ferritic and martensitic steel parts).
• [11] Finish including visual inspection for cleanliness, etching, pitting or frosting.
• [12-19] Planned arrangements for testing using Practices A through F.
• [20] Rejection and re-test procedures (including lot traceability).

	EXTERIOR COMPONENT(S)
43	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be an "Exterior Component"; select and apply the paint color designated for **"EXTERIOR COMPONENT(S)**". If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Exterior Components". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
	INTERIOR COMPONENT(S)
44	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Mooring System Interior Component"; select and apply the paint color designated for **"INTERIOR COMPONENT(S)"**. If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Interior Components". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
	AEROSTAT PAINTED HARDWARE
45	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Aerostat Painted Hardware"; select and apply the paint color designated for **AEROSTAT PAINTED HARDWARE.** If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Aerostat Painted Hardware". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
	AVIONIC EQUIPMENT
46	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Avionic Equipment"; select and apply the paint color designated for **AVIONIC EQUIPMENT.** If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Support Equipment" items. Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
	SUPPORT EQUIPMENT
47	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Support Equipment" item; select and apply the paint color designated for **SUPPORT EQUIPMENT.** If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Support Equipment" items. Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
	EXTERIOR WALKWAY
48	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be an "Exterior Walkway"; select and apply the paint color designated for **EXTERIOR WALKWAYs**.If this PO line is for an assembly, consider that the assembly contains one or more parts that are an "Exterior Walkway". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
	INTERIOR WALKWAY
49	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be an "Interior Walkway"; select and apply the paint color designated for **INTERIOR WALKWAYs.**If this PO line is for an assembly, consider that the assembly contains one or more parts that are an "Interior Walkway". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
	STRUCTURE
50	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Structure"; select and apply the paint color designated for **STRUCTURE**. If this PO line is for an

	assembly, consider that the assembly contains one or more parts that are a "Structure". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
	MOORING SYSTEM EXTERIOR COMPONENT(S)
51	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Mooring System Exterior Component"; select and apply the paint color designated for **"MOORING SYSTEM EXTERIOR COMPONENT (S)**". If this PO line is for an assembly, consider that the assembly contains one or more parts that are a "Structure". Submit any questions you have about painting of complex assemblies
	MOORING SYSTEM INTERIOR COMPONENT(S)
52	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Mooring System Interior Component"; select and apply the paint color designated for **"MOORING SYSTEM INTERIOR COMPONENT(S)".** If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Mooring System Interior Components". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
	IUID MARKING REQUIRED
53	This item requires Item Unique Identification (IUID) marking, in accordance with the latest revision of MIL-STD-130. The two dimensional Construct 2 IUID data matrix shall be machine-readable with common optical scanning devices and be accompanied by the corresponding human readable markings when practical. The data matrix shall be readily visible. Information contained in the machine-readable code shall be: Commercial and Government Entity (CAGE) Code, Manufacturer part number, and unique serial number. This information will be used for asset tracking during the life cycle of the item. The Supplier shall submit documentation with this item that identifies, at a minimum, the Nomenclature, Part Number, Serial Number, National Stock Number (NSN) (if applicable) and CAGE code.

END OF TCOM QA CODES