

Supplier Quality Requirements

1. Purpose and Scope

- 1.1. **Purpose:** Northwest UAV (NWAUV) is committed to building strong supplier partnerships. This manual provides instructions and guidance for suppliers to be able to deliver product and services compliant to NWUAV and customer drawings and or specifications.
- 1.2. This document is to ensure that NWUAV suppliers shall have a documented quality management system (QMS) in place composed of quality management plans and processes that assures drawing and specification compliant products and services are delivered and performed to NWUAV requirements. Additionally, it is to provide a means for suppliers to request authorization for changes to existing NWUAV requirements.
- 1.3. These requirements may be in *addition to* the standard NWUAV Purchase Order Terms & Conditions.
- 1.4. **Scope:** This document applies to NWUAV, and NWUAV suppliers and subcontractors that are subcontract manufacturers or fabricators and/or laborers (all definitions hereinafter referred to as "suppliers") that provide non-Commodity product or services to NWUAV that is intended for sale or lease to an NWUAV customer.

2. Definitions:

- 2.1. **Bubble:** A circled or boxed character that identifies a characteristic which corresponds with an item number on the First Article Inspection Report (FAIR).
- 2.2. **Certificate of Conformity (CofC):** A certificate stating a product purchased by NWUAV, when shipped by the supplier, meets documented requirements.
- 2.3. **Commodity Item:** Hardware (e.g. nuts, bolts, screws, batteries, etc) or software that are not made specifically for NWUAV or NWUAV suppliers, are commercially available to the general public, and require no modification by NWUAV or NWUAV suppliers
- 2.4. **Components Conformity Report:** An index listing sub-tier level FAIRs stored either at NWUAV or at the supplier. This Index shall be submitted with the FAI Report from the supplier
- 2.5. **Conformity:** The fulfillment of all requirements.
- 2.6. **Contract Fabricators:** Suppliers that perform processes to NWUAV defined requirements that will be part of final assemblies. This includes but is not limited to manufacturers of composite materials, metal fabrications, electronic subassemblies and custom packaging materials.
- 2.7. **Contract Manufacturers:** Suppliers that perform final and sub assemblies that go into or are used by NWUAV's products. This includes, but is not limited to, final wing and winglet assemblies, final avionics unit, final engine

- assembly, launcher, retriever, final ground control unit assemblies, and finished carrying cases
- 2.8. **Control Plan:** A management tool to identify and monitor the activity required to control the critical or key inputs/outputs for a process so the process will continually meet its product or service requirements. It includes an inspection plan/rate/method and reaction plans for potential defects.
- 2.9. **Critical Product Characteristic(CPC ▷):** Those product characteristics that if not controlled within the specified limits, may have an unacceptable affect to form, fit, function, safety, performance, agency approvals, or any governmental regulations.
- 2.10. **Critical to Quality (CTQ):** Those product or process characteristics identified as CPC, SPC, Critical Items, or Key Characteristics. CTQ characteristics mandate quality or control plan use to assure CTQ's are delivered.
- 2.11. **Critical Items:** Those items (e.g., functions, parts, software, characteristics, processes) having significant effect on the product realization and use of the product; including safety, performance, form, fit, function, producibility, service life, etc.; that require specific actions to ensure they are adequately managed. Examples of critical items include safety critical items, fracture critical items, mission critical items, key characteristics, etc.
- 2.12. **ESD:** Electrostatic discharge
- 2.13. **First Article Inspection (FAI):** The initial inspection to the first production part. It is the source of data for a First Article Inspection Report.
- 2.14. **First Article Inspection Report (FAIR):** Is the initial inspection report that is to accompany the first production parts. The FAIR is used as the means to verify the capability of a production process to manufacture a product that meets all drawing requirements and functional product specifications.
- 2.15. **Gage Repeatability and Reproducibility (GR&R):** A statistical tool that measures the amount of variation in the measurement system arising from the measurement device and the people taking the measurement.
- 2.16. **Key Characteristic:** An attribute or feature whose variation has a significant effect on product fit, form, function, performance, service life or producibility, which requires specific actions for the purpose of controlling variation.
- 2.17. **Non-commodity item:** Systems, subsystems or components specifically designed or adapted for use in NWUAV products or as an NWUAV product. Examples: unmanned aerial systems, avionics modules, payloads, training/simulation devices, wings, cameras, engines, igniters, controls, wiring harnesses, etc.
- 2.18. **Product Characteristics:** Drawing or specification entities such as dimensions, tolerances, assembly interfaces, surface contours or shapes,

materials, requirements for materials that would be an exception to an identified material specification, processes, surface preparations, etc.

- 2.19. **Part Number:** Configuration control of product definition is maintained by both part number and revision level controls. NWUAV designed products must be identified with both part number and revision level which is considered the part number.
- 2.20. **Significant Product Characteristic (SPC ◇):** Those product characteristics that if not controlled within specified limits will negatively affect form, fit, function, safety, performance, flight worthiness (as applicable), agency approvals, or any governmental regulations
- 2.21. **Site Quality Acceptance Rate:** A calculated rating defined as the minimum of either:
- 2.21.1. The ratio of the number of non-compliant parts divided by the total number of parts received by NWUAV in 3 consecutive calendar months.
Example:
Parts rejected in a quarter
100 parts received during a quarter
3% Rejection Rate
- Or -
- 2.21.2. The number of lots received with defective parts, divided by the total number of lots received, in 3 consecutive calendar months.
Example:
10 Lots received with defective parts
100 Lots received
10% Rejection Rate
- 2.22. **SM&P:** NWUAV Supplier Management and Purchasing
- 2.23. **Special Requirements:** Those requirements identified by the customer, or determined by the organization, which have high risks to being achieved, thus requiring their inclusion in the risk management process. Factors used in the determination of special requirements include product or process complexity, past experience and product or process maturity. Examples of special requirements include performance requirements imposed by the customer that are at the limit of the industry's capability, or requirements determined by the organization to be at the limit of its technical or process capabilities.
- 2.24. **Traceability:** Ability to trace the history, application or location of that which is under consideration, for origin of material and parts, processing history, and distribution and location of product after delivery.

3. References

- 3.1. QP-830 Control of Nonconforming Product
3.2. MP-750 Control Plan

- 3.3. AP-500 Failure Mode and Effects Analysis
- 3.4. MP-824 Gage Repeatability and Reproducibility
- 3.5. MP-824 First Article Inspection
- 3.6. AP-500 Management Review
- 3.7. Forms are referenced in this procedure that may be used and modified by the supplier to suit their needs.
- 3.8. Any document referenced in this procedure will be made available electronically to our suppliers by emailing a request to quality@nwuav.com.
- 4. NWUAV Propulsion Systems Requirements to support Supplier Quality**
 - 4.1. NWUAV will provide input on supplier qualification and on-going performance monitoring and issue Supplier Corrective Actions Requests when required.
 - 4.2. Provide suppliers with updated purchase orders reflecting approved Change in Designs.
 - 4.3. Maintain records of supplier quality performance monitoring.
 - 4.4. Review supplier quality performance.
 - 4.5. Review all First Article Inspections and issue a SCAR for any specifications or dimensions that are not met on the First Article submission.
 - 4.6. Identify the Purchasing sole point of contact for all NWUAV Propulsion Systems commitment communications with suppliers.
- 5. General Supplier Requirements**
 - 5.1. All products custom produced to NWUAV Propulsion Systems supplied or approved drawings must comply with all drawings and purchase order requirements. These include materials, subcontracted processes and drawing tolerances.
 - 5.2. Purchasing requirements take precedence in the following order:
 - 5.3. When required, certification, inspection and testing requirements are specified on the purchase order or referenced documents. Certificates may include material, processing, inspection and testing results, traceability and conformance.
 - 5.4. Contract Manufacturers, Fabricators and Vendors are responsible for establishing and maintaining a documented quality system that includes the elements listed below. NWUAV Propulsion Systems reserves the right to audit these systems upon request.
 - 5.4.1. Organization, personnel job descriptions, and training
 - 5.4.2. Purchase order / contract review
 - 5.4.3. Document and data control
 - 5.4.4. Product identification and traceability
 - 5.4.5. Process control
 - 5.4.6. Inspection and testing
 - 5.4.7. Maintaining internal quality metrics supporting systematic quality improvement.
 - 5.4.8. Control of qualification and inspection of measuring and test equipment
 - 5.4.9. Control of nonconforming product

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- 5.4.10. Corrective and preventive action
- 5.4.11. Storage, handling and packaging
- 5.5. Suppliers are responsible for notifying NWUAV Propulsion Systems purchasing of any change to their quality system, their Quality Management Representative, and the effective date of any change requiring a First Article Inspection. When specifically requested by NWUAV Propulsion Systems, the supplier will make specified quality data and or approved design data available in the English Language.

6. Records and Documents

- 6.1. All documentation generated as a result of this specification must, at a minimum, be retained and kept available for review at the supplier's facility 7 years from the date of manufacturing.
 - 6.1.1. NWUAV Propulsion Systems Purchase Order or Contract
 - 6.1.2. Referenced drawing(s) with revision number
 - 6.1.3. Referenced NWUAV Propulsion Systems or customer specifications
 - 6.1.4. Industry specifications not listed
 - 6.1.5. If the supplier ceases to deliver product or services to NWUAV Propulsion Systems within the 7 year period, all records become property of NWUAV Propulsion Systems.
 - 6.1.6. Records should include:
 - 6.1.6.1. Who completed the documentation
 - 6.1.6.2. When the record was made
 - 6.1.6.3. Who made additions or corrections and when they were made
- 6.2. If the rationale for a change is not evident, additional documentation is highly recommended for explanation. A note to the side or memo to the file may serve this purpose.
- 6.3. Handwritten entries must be recorded legibly in ink. Any correction should be crossed out with a single line, initialed and dated with current date. This is so the original entry is not obscured.
- 6.4. Not acceptable:
- 6.5. Additions to source documents that are not initialed or signed and dated
- 6.6. Write-over's of the original entry
- 6.7. Correction fluid (white-out)
- 6.8. Pencil

7. Production Control

- 7.1. Suppliers must develop and maintain effective methods of production control. A control plan and written work instructions are the minimum requirement.
- 7.2. Where the supplier uses material with limited shelf-life control, a method for ensuring that the material has not exceeded the recommended shelf life prior to use is required.
- 7.3. When NWUAV Propulsion Systems requires specific methods of production control due to the critical nature of the process or product, these requirements

will be stated on NWUAV Propulsion Systems purchasing documents and must be addressed in the written work instructions and the supplier control plan.

8. Incoming Inspection

- 8.1. Suppliers must perform an inspection prior to performing release of components/material for further processing or assembly. This inspection is to include verification that quantities/part descriptions match and that there is no damage or non-conformances. Suppliers must verify that any required certifications or test reports are included.
- 8.2. Suppliers are fully responsible for controlling quality of their suppliers of subcontracted materials and processes. *In the case of NWUAV Propulsion Systems-supplied items:* if there is evidence of damage, non-conformances or paperwork discrepancies, the supplier must notify NWUAV Propulsion Systems Quality within 3 working days of discovery. The NWUAV Propulsion Systems Material Review Board will determine what action is required.
- 8.3. If the supplier fails to achieve and maintain 98% site quality acceptance rate, which is a prerequisite for delegated inspection authority awarded at NWUAV Propulsion Systems' discretion, the supplier shall be responsible for one or more of the following as directed by NWUAV Propulsion Systems:
 - 8.3.1. Obtaining source inspection from an NWUAV Propulsion Systems qualified contractor at the supplier's expense
 - 8.3.2. Reimbursing NWUAV Propulsion Systems for reasonable NWUAV Propulsion Systems costs incurred at the point of manufacturer (i.e. supplier site) to verify product conformance
 - 8.3.3. Reimburse NWUAV Propulsion Systems for reasonable NWUAV Propulsion Systems costs incurred at the point of receipt to verify product conformance.
- 8.4. The site quality acceptance rate is a calculation of the ratio of acceptable units delivered to the total units delivered, or an alternate criteria quality acceptance rating equivalent to 98% as defined by the contracting NWUAV Propulsion Systems sites.

9. First Article Inspection

- 9.1. The supplier must perform a first article inspection prior to release of production product to verify that all CPC/SPC dimensions, features, and product attributes meet specified requirements. Documentation of first article inspection must be submitted for review and approval by NWUAV Propulsion Systems Quality prior to the first production shipment.
- 9.2. First Article Inspection Reports (FAIR) documents may be submitted via email to fai@nwuav.com or shipped with FAI item.
- 9.3. First article inspection must be performed from the first production run of a new part or following any subsequent change that invalidates the previous first article inspection result:
 - 9.3.1. The part is being introduced into production for the first time as a result of a new product development.

- 9.3.2. The part is being sourced from a new supplier.
- 9.3.3. The part manufacturing location has changed
- 9.3.4. In the judgment of NWUAV Propulsion Systems Engineering or Quality, that significant changes have been made to the manufacturing process/work instructions that could affect product conformance
- 9.3.5. Changes have been made to features or characteristics identified on the engineering drawings as "Critical to Quality".
- 9.3.6. There has been a material change as a result of a cost reduction, warranty reduction or producibility improvement effort.
- 9.3.7. The part has been released at a new revision level
- 9.4. In the case of changes to an existing part, a partial first article may be acceptable if stated on the purchase order.
- 9.5. The supplier may use their own documents.
- 9.6. First article inspection documentation must include:
 - 9.6.1. Part number and revision level
 - 9.6.2. Part name as shown on the drawing
 - 9.6.3. Part serial number, if applicable
 - 9.6.4. Drawing or Specification used for the inspection
 - 9.6.5. Characteristic number – a unique number for each design characteristic
 - 9.6.6. Reference location – drawing zone, page number and section, specification, etc.
 - 9.6.7. Requirement of the design characteristic including nominal and tolerances if applicable
 - 9.6.8. Measured Results for all non-referenced drawing requirements and specifications.
 - 9.6.9. Identification of acceptance or nonconformance
 - 9.6.10. Type, identification and qualification of measurement equipment used for critical/significant characteristic measurements
 - 9.6.11. Who performed the FAI
 - 9.6.12. Date of the performed FAI
 - 9.6.13. Certificate of Conformance for process
 - 9.6.14. Material Analysis Report (MAR) for materials
 - 9.6.15. The Control Plan that documents the supplier's plan that assures at a minimum that all NWUAV Propulsion Systems defined CPC/SPCs is met.
 - 9.6.16. The results of the measurement studies/Gage R&Rs that validate the measured results on all the critical and significant characteristics.
 - 9.6.17. First article characteristics found to be nonconforming are to be handled per AP-740

10. In-Process Inspection

- 10.1. Once approved for production, the supplier must monitor, at a minimum, all features identified as Critical and Significant Product Characteristics on the drawing and functional product specifications.

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10.2. When sampling inspection is used by the supplier, the sampling inspection plans must be statistically valid and preclude the acceptance of lots whose samples have known nonconformities. Sampling AQL must be a minimum of 2.5.

10.3. An approved sampling plan is provided in Appendix-A; on page 11 of this document. If the supplier uses a different sampling plan, it may require NWUAV Propulsion Systems approval, if requested.

11. Inspection Records

11.1. Inspection documentation must include:

- 11.1.1. Purchase order number with revision number from the drawing or specification specified in the purchase order
- 11.1.2. Part or piece number inspected
- 11.1.3. Dimension or attribute being inspected
- 11.1.4. Criteria for acceptance and/or rejection
- 11.1.5. A record of the measurement/inspection result
- 11.1.6. Type of measurement instruments used
- 11.1.7. Name of person performing the inspection and date of the inspection

12. Manufacturer's/Supplier's Certificate of Conformance (C of C)

12.1. C of C's will be provided and contain the following information:

- 12.1.1. Name and address of manufacturer
- 12.1.2. NWUAV Purchase Order (PO) and/or contract number
- 12.1.3. Statement attesting that goods and services conform to all PO/Contract, and associated product requirements and specifications.
- 12.1.4. Part number(s) and revision(s), as applicable
- 12.1.5. Product definition identification with revision level to which goods were manufactured (e.g. Drawing number and revision level; FPS number and revision level).
- 12.1.6. Chemical analysis and mechanical properties, for required material C of Cs.
- 12.1.7. Quantity, type of process and what specification used, for required process C of C's.
- 12.1.8. Quantity, serial numbers, type of test, results, specification used, for required test C of C's.
- 12.1.9. Authorized signature & date

13. Supplier Non-conformances and Deviations on Production Product

13.1. When NWUAV Propulsion Systems notifies supplier of a detected nonconformance, the supplier shall immediately take action to eliminate the nonconformance on all products in the supplier's control. The supplier shall also maintain on file verification that root cause corrective action has occurred and has resolved the subject condition. At the specific request of NWUAV Propulsion Systems, this verification shall occur for the next five (5) shipments after implementation of the corrective action to ensure detected nonconformance has been eliminated. NWUAV Propulsion Systems reserves the right to review the

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verification data at the supplier's facility or have the data submitted to NWUAV Propulsion Systems.

14. Supplier Corrective Action Request (SCAR):

- 14.1. An evaluation is made to determine the extent and impact of the nonconformance. This is based on the risk to final product quality, delivery schedules and financial impact. The Quality department determines if a formal Supplier Corrective Action request is required and issues it to the supplier if required.
- 14.2. The supplier must submit a deviation request for any known nonconformance to a Critical or Significant Product Characteristic that will not be scrapped or reworked by the supplier. Nonconforming material must be clearly identified and segregated where practical to prevent unintended use.
- 14.3. The supplier must have written approval from NWUAV Propulsion Systems Purchasing (i.e.: a PO amendment, CID, ECN, fax, e-mail) for the deviation by NWUAV Propulsion Systems prior to shipment.

15. Supplier Corrective Action Report

- 15.1. The supplier shall when requested, provide NWUAV Propulsion Systems a corrective action report within fifteen (15) days of receipt of such a request unless an extension is otherwise provided by NWUAV Propulsion Systems. Any corrective action report submitted to NWUAV Propulsion Systems shall be in the format specified by NWUAV Propulsion Systems. If after submittal to NWUAV Propulsion Systems, the supplier determines need for revision, the supplier shall immediately notify NWUAV Propulsion Systems of such revision. In the event the supplier is unable to respond within the allotted fifteen (15) day time frame, the supplier shall submit a request for an extension which shall include the reason for the extension request and the time needed to complete the corrective action report.
- 15.2. The Supplier Corrective Action Report will identify:
 - 15.2.1. The Root Cause of the non-compliance
 - 15.2.2. The identification of the lot/serial numbers/etc. of non-compliant parts
 - 15.2.3. The change in the supplier Control Plan that will eliminate the non-compliance in the future
 - 15.2.4. The date the corrective action has been incorporated, and the first date the corrected material will be received at NWUAV Propulsion Systems
- 15.3. NWUAV Propulsion Systems reserves the right to reject any root cause and/or corrective action determination provided by the supplier, and may request subsequent investigation and/or corrective action to either NWUAV Propulsion Systems or the Supplier initiated corrective action requests. If the supplier is late in responding to corrective action requests by NWUAV Propulsion Systems, or if NWUAV Propulsion Systems requires subsequent corrective action, NWUAV Propulsion Systems reserves the right to withhold acceptance of shipments either at their source, or destination until the supplier corrective action is submitted to NWUAV Propulsion Systems satisfaction.

16. Quality Metrics and Reporting

16.1. When requested by NWUAV Propulsion Systems, the supplier agrees to collaborate with NWUAV Propulsion Systems to develop and implement processes designed at improving the supplier's quality performance. Process will include sufficient detail to allow NWUAV Propulsion Systems to evaluate the supplier's progress.

16.2. Supplier Recommendations

16.3. Suppliers are encouraged to partner with NWUAV Propulsion Systems to make recommendations to material, design or processing changes that could benefit NWUAV Propulsion Systems in the form of cost, time savings or product improvement during the design and development phases.

17. ESD

17.1. NWUAV Propulsion Systems suppliers are required to provide ESD protection to ESD sensitive product, while it is being produced and in custody of the supplier.

18. Packaging & Labeling Requirements

18.1. Components, materials and assemblies shipped to NWUAV Propulsion Systems or other NWUAV Propulsion Systems suppliers for final assembly and packaging must be:

18.1.1. Free of metal or fiber shavings, sharp edges or burrs

18.1.2. Free of evidence of de-lamination or dry weave in composite material

18.1.3. Free of visible voids that cannot be cosmetically repaired by subsequent operations

18.1.4. Packaged in a manner to prevent any sliding, distortion, bending, or other damage during transit

18.1.5. Easily identified by part or assembly number clearly labeled on the packaging and additionally on the parts as identified on the part specification

18.2. Open-cell foam shapes, closed-cell foam shapes, cardboard spacers and bubble wrap should be used to best suit the particular configuration and critical nature of the item to be shipped. Use shrink-wrap, pallets and other containers suitable to the product being shipped.

18.3. All electrostatic discharge (ESD) sensitive products must be wrapped in ESD protective bubble wrap or ESD protective bags prior to boxing. Apply identification label to the outside of the package.

18.4. Unless specified, recycled boxes or other suitable shipping containers may be used. The supplier must ensure that no prior identification labels remain on the container that may conflict with the actual contents.

18.5. Shipping documents and product labeling should provide for clear identification of contents, including purchase order number, part numbers, revisions and serial numbers.

18.6. The use of unique identifiers on product labeling, such as bar coding, is encouraged for all shipments to NWUAV Propulsion Systems.



18.7. Documents (packing list, MSDS, inspection sheets, etc) attached to the outside of the container must be attached to allow damage-free removal.

19. Appendix A

Appendix A:

**C=0 SAMPLING PLANS
 INDEX VALUES
 (ASSOCIATED AQLS)**

From: *Zero Acceptance Number Sampling Plans*, 4th edition by Nicholas L. Squeglia

15.1.1.1 Note: The acceptance number in all cases in ZERO nonconforming

AQL⇒	.010	.015	.025	.040	.065	.10	.15	.25	.40	.65	1.0	1.5	2.5	4.0	6.5	10.0
LOT SIZE																
2 to 8	*	*	*	*	*	*	*	*	*	*	*	*	5	3	2	2
9 to 15	*	*	*	*	*	*	*	*	*	*	13	8	5	3	2	2
16 to 25	*	*	*	*	*	*	*	*	*	20	13	8	5	3	2	2
26 to 50	*	*	*	*	*	*	*	*	32	20	13	8	5	5	5	3
51 to 90	*	*	*	*	*	*	80	50	32	20	13	8	7	6	5	4
91 to 150	*	*	*	*	*	125	80	50	32	20	13	12	11	7	6	5
151 to 280	*	*	*	*	200	125	80	50	32	20	20	19	13	10	7	6
281 to 500	*	*	*	315	200	125	80	50	48	47	29	21	16	11	9	7
501 to 1200	*	800	500	315	200	125	80	75	73	47	34	27	19	15	11	8
1201 to 3200	1250	800	500	315	200	125	120	116	73	53	42	35	23	18	13	9
3201 to 10,000	1250	800	500	315	200	192	189	116	86	68	50	38	29	22	15	9
10,001 to 35,000	1250	800	500	315	300	294	189	135	108	77	60	46	35	29	15	9
35,001 to 150,000	1250	800	500	490	476	294	218	170	123	96	74	56	40	29	15	9
150,001 to 500,000	1250	800	750	715	476	345	270	200	156	119	90	64	40	29	15	9
500,001 and over	1250	1200	1112	715	556	435	303	244	189	143	102	64	40	29	15	9

*Indicates entire lot must be inspected

15.1.1.2 SMALL LOT SIZE SUPPLEMENT

**(ASSOCIATED AQLS)
 (Use for small lots when the associated AQL values are 1.5 and below)**

LOT SIZE	.25	.4	.65	1.0	1.5
5-10	*	*	*	8	5
11-15	*	*	11	8	5
16-20	*	16	12	9	6
21-25	22	17	13	10	6
26-30	25	20	16	11	7
31-35	28	23	18	12	8



Document Revision History			
Rev	Date	Description	Author
0	8/17/2009	Initial Release	M. VanSlyke
1	5/18/2011	Section 8, Revised C OF C paragraph. Added chemical analysis requirement and better defined existing requirements. Added FAI email for FAIR submission. Added numbered paragraphs all sections	M. VanSlyke
2	6/10/2011	Added paragraph Numbering. Added approved by lower footer. Up-dated 1.1 purpose and 1.2 scope. Up-dated 2 Definitions.	M. VanSlyke

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