# **PURPOSE AND SCOPE**

## Purpose

This document supports the Process Flow PF-030 which defines the First Article Inspection (FAI) process. This document provides clarification regarding:

* When a first article is required
* Responsibilities for execution and approval
* Records required for documenting the FAI.

## Scope

The FAI process applies to material from outside suppliers and internal Cubic Manufacturing and Procurement (CMP) departments.

## references

* PF-030, First Article Inspection Process Flow
* F-008, FAI Template/Attribute Sheet

## terms and DEFINITIONS

**Assembly:** A group of components combined to create a unique assembly which is based on approved build documentation.

**Break in Production:** A work stoppage which causes an interruption in a steady flow of product. This typically involves teardown of a production line or machine so that a different product may be produced before resetting to produce the initial product.

A break in production may include a situation in which the product has not been produced for a period of time but the production line or machine remains set up.

A break in production may also include machine or tool repair, software programming revision, and subsequent verification of the repair or software update.

**Bubbled drawing:** A drawing that has all notes and measurable features identified, normally corresponding to the items of an inspection report or the attribute sheet.

**Build documentation:** Build documentation normally consisting of drawing(s) or models, specifications, software, purchase order provisions, or related documentation that provides product definition.

**CMP:** Cubic Manufacturing and Procurement, the manufacturing division of Cubic Corporation, often referred to as Cubic.

**CoC:** Certificate of Conformance. Document provided by the source of material or services certifying compliance to the specification and/or contractual requirements for a given product.

**COTS:** commercial off-the-shelf - components or parts readily available to the general public. Examples:

* resistors
* fasteners
* adhesives
* simple hardware

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| ISO Read 6 NOTE  *Once a COTS component is added to a Cubic drawing and is identified as specification controlled or source controlled, the component is no longer considered a COTS component.*  *See the definitions for specification controlled and source controlled in this section.* |

**Delta FAI:** See **“**Partial FAI”

**ECN / DCN / ECO:** engineering change notice / drawing change notice / engineering change order. Official documentation of a change to a Cubic or customer design.

**FAI:** First Article Inspection. A quality record providing objective evidence that all engineering design specification requirements are properly understood, accounted for, verified, and documented.

**FAIR:** First Article Inspection Report

**IDO:** Inter-departmental order. An order between CMP facilities for a product, service, or sub-component of an assembly that may be used for production, spares, or to support a depot repair.

**LAI:** Last Article Inspection. If required, i.e., as part of a product transfer or in-source / out- source activity, a representative part may be evaluated to the FAI requirements in order to document the actual output of its current production, sometimes termed a “Golden Sample.”

**Manufacturing Method:** Manufacturing methods consist of material, source of supply, location of manufacture, and/or process (equipment, fixturing, program, testing, etc.).

**ODM:** original design manufacturer. The ODM has the authority to change, modify or relax aspects of the build documentation.

**OEM:** original equipment manufacturer. The current manufacturer of the part or assembly, and normally is also the OEM of the part.

**Partial FAI:** An FAI performed on a previously verified part after a design, process, or tooling change that can potentially affect form, fit, or function. The inspection requirements for a Partial FAI are based on affected characteristics and are documented, along with Baseline FAI information and reason for Partial FAI, in block 14 or equivalent of the FAIR.

**Point Cloud:** is considered a data base containing points in three-dimensional coordinate system. A point cloud is a very accurate digital record of an object or space. It is saved in form of a very large number of points that cover surfaces of a sensed object. This can be used to show a color map deviation of the rendered part in comparison to a designer’s CAD model.

**Production change**: Production changes to:

* build documentation
* manufacturing method
* observed or predicted change in tooling (e.g., casting dies, injection molds).

**Raw material: Raw material such as bulk metals, fabric, and raw castings.**

**Source controlled:** Identifies the supplier which must be used for acquisition of a specific component.

**Specification controlled:** Identifies the design/configuration of a designed part.

**Sub-Tier:** A lower tier provider of parts or services to the Tier 1 supplier with whom Cubic is directly contracted. **The Tier 1 supplier is responsible for flow down of this requirement to their sub-contractors and to provide an FAI report upon request.**

# ****General Requirements****

## When is a First article Required?

A first article is required for qualification of and changes to:

* custom fabricated parts such as, but not limited to:
* circuit boards
* cable looms
* machined, welded, casted, molded, die cut, and sheet metal parts
* Specification Control drawings
* Source Control drawings
* sub-contracted parts
* top level assemblies
* fixtures or gages used for functional qualification of Cubic parts.

## Who Generates a First Article?

A first article must be completed on the product by the supplier or Cubic assembler at the level the product is to be delivered to Cubic by the supplier or as required on the work order. First article documentation includes the documented inspection of sub-components within an assembly.

In the event that parts are not given to a QA group for a first article inspection, the requirement for a first article, in this document, fall to the group responsible for the design and build.

When QA is not tasked with the inspection, product design and build personnel are responsible for performing first article inspections and for providing evidence of full FAI compliance.

## What conditions constitute a first article requirement?

A first article is required and should be completed before release to production of additional parts for the following conditions:

* Vanguard/pilot run or production use of a newly designed fabricated/assembled part
* Existing part which has been modified by an engineering change order that results in a change of material or a critical dimension. Only those dimensions or material impacted by the ECN require a first article
* A change in supplier. This can include changing from in-house to a buy part or from a buy part to making in-house
* A supplier transfers production of an item from one facility to another
* Production transfer from one Cubic facility to another. Machine work using identical machines and programs may be satisfied with a partial FAI that includes, as a minimum, representative measurements in each dimension and all key characteristics identified on the drawing. Additional requirements may be included by the design or production engineer. These requirements and the Baseline FAI must be referenced in block 14 or equivalent of the FAIR.
* A break in production which exceeds 12 months
* New tooling is created to replace existing tooling
* Tooling is reworked to restore dimensional integrity
* A significant change to manufacturing methods
* Periodic tool wear for molds or other tooling susceptible to wear which may change critical dimensions. In this case, a layout of critical dimensions is required unless contractually defined at time of tooling purchase.
* The expected interval for die cast molds and investment casting molds is 10,000 cycles on mold; this includes set up cycles and scrap cycles.
* The expected interval for plastics molds is 50,000 cycles on mold; this includes set up cycles and scrap cycles.
* The expected interval for die cut tooling is 10,000 cycles on tooling; this includes set up cycles and scrap cycles.

## first article inspection exceptions

Unless relaxed by the customer, the FAI should be completed before the release of additional production lots.

The following are exempt from the First Article Inspection (FAI) requirement:

* Commercial off-the-shelf components unless specifically identified in a purchase order requirement. These parts must be in full compliance with original equipment manufacturer (OEM) datasheets, COC, and/or other associated COTS specifications. In situations where a COTS part is modified to meet a Cubic requirement, a first article shall be required to prove compliance,
* Parts where Cubic does not have access to the Intellectual Property (IP) for the product or no reasonable validation method, e.g. Vendor Part Number (VPN) drawing,
* Products procured by Sub-contracts organization as defined in Statement of Work

## FIRST ARTICLE INSPECTION NON-CONFORMANCE

Non-conformances identified during the First Article Inspection shall be documented, dispositioned, and tracked per standard NC reporting. NC documentation (e.g. QN number) shall be recorded in FAI Report. FAIs with non-conformances are marked “Not Complete” on the FAI Report and will not be “Complete” until corrective actions are implemented and verified with a Partial FAI for all affected characteristics, or full FAI.

## first article inspection report format

Preferred format for the First Article Inspection Report (FAIR) is form F-008. Other formats may be used subject to contractual constraints. FAIRs from suppliers and subcontractors may use F-008 or user-defined format, subject to contractual mandates imposed by Purchase Order text or Quality Clauses. All FAIRs shall include, as a minimum:

* part number of the item
* part name of the item
* serial number (if the item is serialized)
* revision level of the item
* date of the report
* organization name of the company performing the first article
* name and signature of the person conducting the first article
* name and signature of the person reviewing the report if different than the one conducting the report
* whether this is a full or partial first article; if not a full first article, describe the purpose of the first article and define required characteristics to be verified
* all drawing:
* material type requirements (Example: Is material certification required?)
* coating or finishing requirements (Example: Is material or processor certification required?)
* dimensions, including tolerances
* test requirements which are identified on the drawing or purchase order
* If a point cloud report is provided in the first article inspection report that shows comparison of the scanned object to the designer’s CAD model using a color map deviation report, there is no need to provide a dimensional layout using the 2D inspection format comparing individual dimensions to tolerance requirements on a drawing.

The Cubic QA department for the fabricating/assembly location is responsible for first article inspection and validation. Any interdepartmental transfer of the fabricated/assembled product is exempt from a second first article provided the initial location completed and approved the first article.

## Last article Inspection

In cases where a part is identified for transition (in-sourcing/out-sourcing), a Last Article Inspection (LAI) may be requested to provide a “Golden Sample” of a compliant part. Also, where there may be concern of manufacturing change over time, an LAI may be requested to validate current production to the original product build documentation requirements.

# ****RESPONSIBILITIES****

## ****ENGINEERING****

The responsibilities listed below apply to design and/or production engineers.

* Submit parts to appropriate QA for review when doing in-house prototype work
* Review ECNs to determine if a complete first article is required due to the nature of the change. If so, add note to the ECN stating a full first article layout is required and check “Full FAI” in Block 14 or equivalent of FAIR. If not, check “Partial FAI”, specify Baseline FAI and Delta FAI reasons and requirements in Block 14 or equivalent in FAIR.
* Identify in the ECN documentation if business unit approval or customer design authority approval is required
* Participate in a material review, as required, with production, procurement and QA
* Review any first article inspection discrepancies and provide appropriate disposition and corrective action necessary to clear the non-conforming condition

## procurement

The responsibilities listed below apply to production procurement personnel.

* Ensure that purchase orders for new tools or modification to tools require the supplier to perform the appropriate first article inspection and documentation
* Ensure that the initial purchase orders include a requirement for a first article inspection as outlined in the general requirements section
* Ensure that if business unit approval or customer design authority approvals are required that the purchase order accurately reflects this need
* Provide external suppliers with the necessary instruction to perform a first article inspection according to this procedure
* Ensure that suppliers return existing fixtures for change or provide documented evidence of change compliance to an ECN
* Ensure that suppliers provide a copy of the first article documentation
* Participate, as required, in a material review with engineering and QA
* Follow up with suppliers regarding any discrepancies found during review of a first article report in addition to notifying supplier of necessary corrective actions
* Notify suppliers when first article reports are approved

## supplier quality engineer

The responsibilities listed below apply to the supplier quality engineer.

* Augment procurement responsibilities
* On-site source inspection as required
* Supplier follow-up and corrective action requests as required to complete FAI and part approval

## production

The responsibilities listed below apply to production personnel.

* Notify engineering of need for build instructions or modification of instructions for a new or changed part
* Request build fixtures or gages as appropriate new or request to update existing build fixtures or gages as required to accommodate ECN changes
* Review adequacy of build instructions, with engineering, on first part
* Notify QA of need for a first article inspection and provide part as required
* Provide adequate time in schedule planning to allow for time to complete a first article on a sub-assembly or a top level assembly
* Participate, as required, in a material review with engineering and QA

## production quality assurance

The responsibilities listed below apply to production QA personnel.

* Expedite first article inspection/tests
* Ensure that all documentation is forwarded for appropriate approvals before releasing a first article for production if a business unit or customer design authority approval is required (per ECN)
* Review sub-assembly for compliance to inspection plan and build instructions
* Review top level assembly for compliance to inspection plan
* Request build fixtures or gages as appropriate new or request to update existing build fixtures or gages as required to accommodate ECN changes
* Request updates to automated test software affected by an ECN
* Perform all defined relevant production tests on first article samples
* Provide feedback to engineering and production
* Participate, as required, in a material review with engineering and production

## Receiving quality assurance

The responsibilities listed below apply to receiving QA personnel.

* Review production material receipts to determine if a first article review is required
* Ensure that that all documentation is forwarded for appropriate approvals before releasing a first article for production if a business unit or customer design authority approval is required (per ECN)
* Reject material that requires a first article but is lacking documentation
* Notify procurement of any documentation non-conformance
* Review first article report and if necessary, audit the critical dimensions for reverification
* Ensure that appropriate material certifications and product traceability requirements have been met
* Notify engineering and procurement of discrepancies found with a first article report
* Participate in a material review, as required, with engineering and procurement
* Notify procurement when the first article is approved