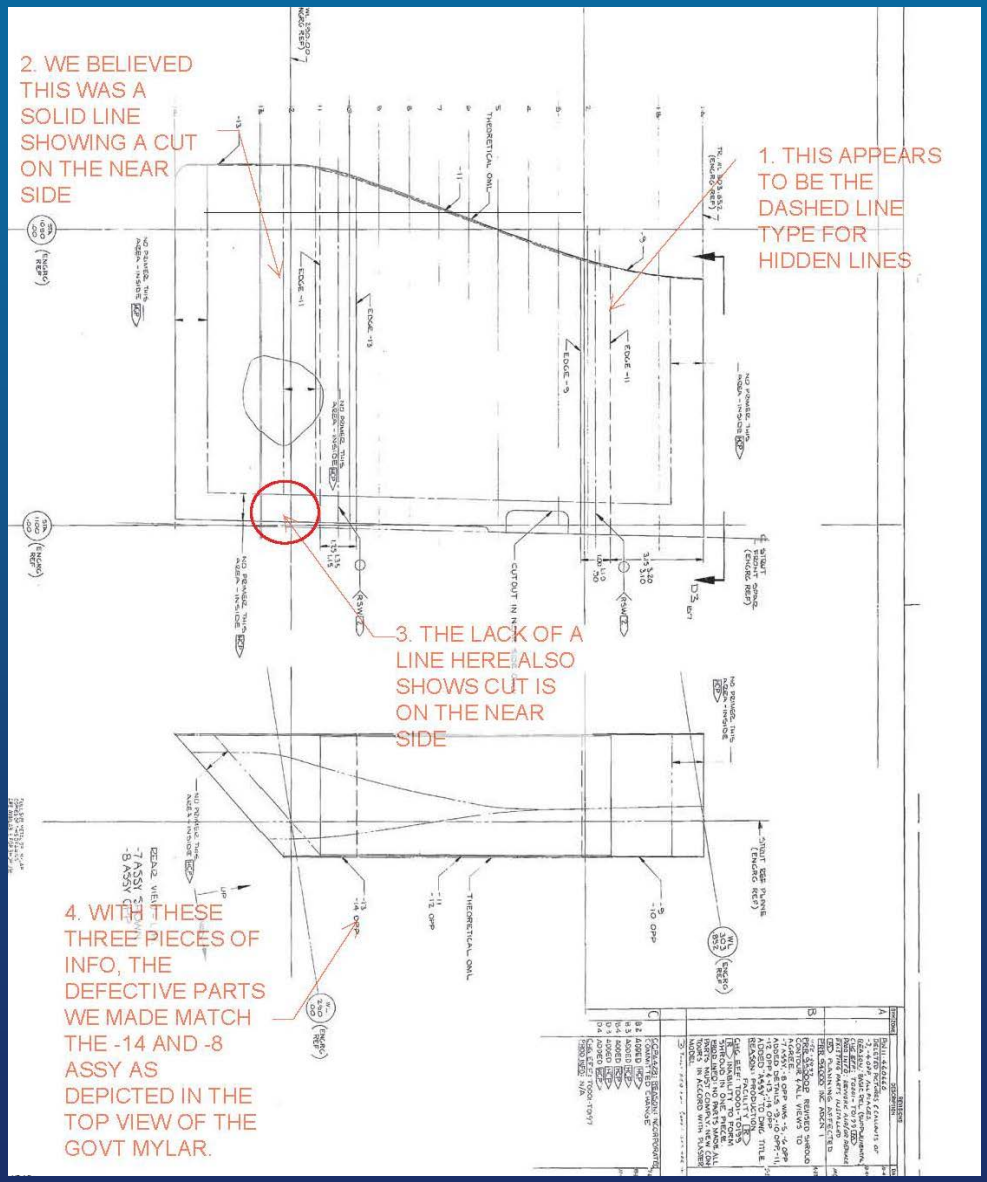
First Article Testing (FAT)

Problem: Quality assurance of cast components requires a unique skillset as castings offer complex geometry and casting-specific specifications.

Goals: Educate labs through case studies to transition the technical skills to inspect castings to ensure parts meet performance requirements and prevent the disapproval of components that meet TDP requirements. Ensure manufacturers are not unduly burdened by delays or additional testing costs to best enable a responsive supply chain to support defense procurements, minimize PLT, and reduce impacts on stock availability.

Example of Drawing Errors

"Defective" parts match the government mylar

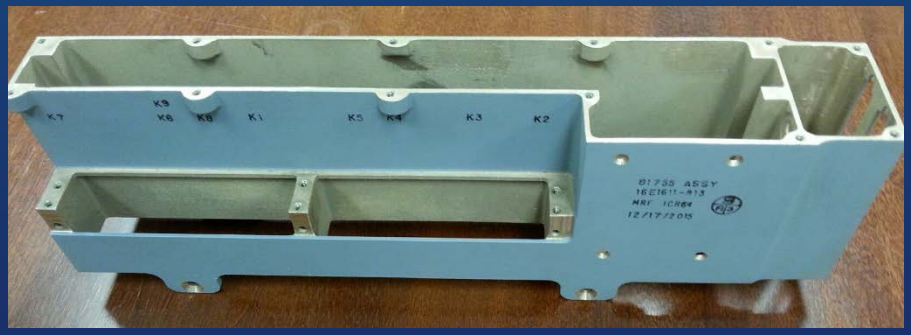


Surface Finish Disapproval

Problem: F-16 Fighting Falcon cast housing FA was disapproved due to a surface finish issue

AFCAT-Proposed Solution: Teamwork with Post Awards and the FAT Coordinator allowed supplier to resubmit after foundry made a process change

Outcome: Resubmitted FA was approved, saving 4 contracts, 133 parts, and $165k



AMC
AMERICAN METALCASTING CONSORTIUM

Unnecessary FAT Inspection Delay

Problem: No drawings were available for go/no-go gauges required to measure parts per the Supplemental Quality Assurance Provision (SQAP) dated 1961

Contractor-Proposed Solution: Accept verification of tolerances using state-of-the-art Laser Scanning Geomagic Control Software in lieu of go/no-go gauges

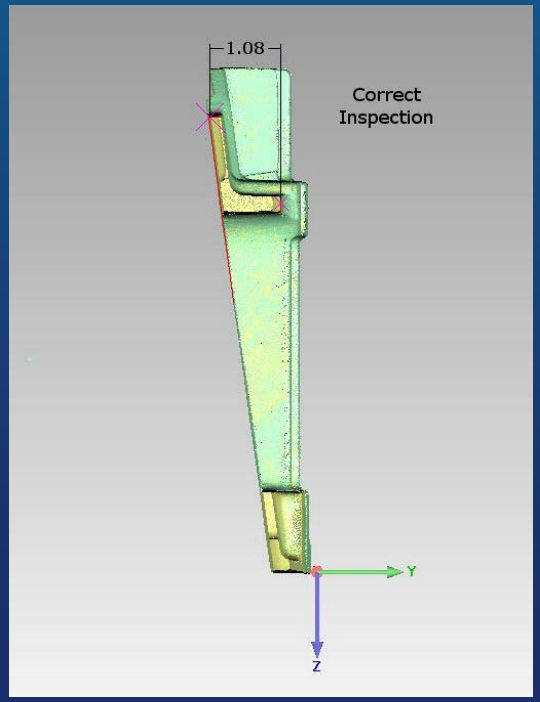
Unnecessary Delay: Supplier produced aluminum gear sector castings (cast, machined, and plated) at own risk while waiting for over 6 months for an outdated inspection procedure

Dimensional FAT Disapproval

Problem: Trailing Edge Cargo Ramp Pedestal FA was disapproved for non-conformance to dimensional requirements.

Specifics: Out-of-tolerance dimensions were measured from the wrong plane.

Outcome: Supplier submitted a rebuttal. Conditional approval was granted pending corrections on production items.

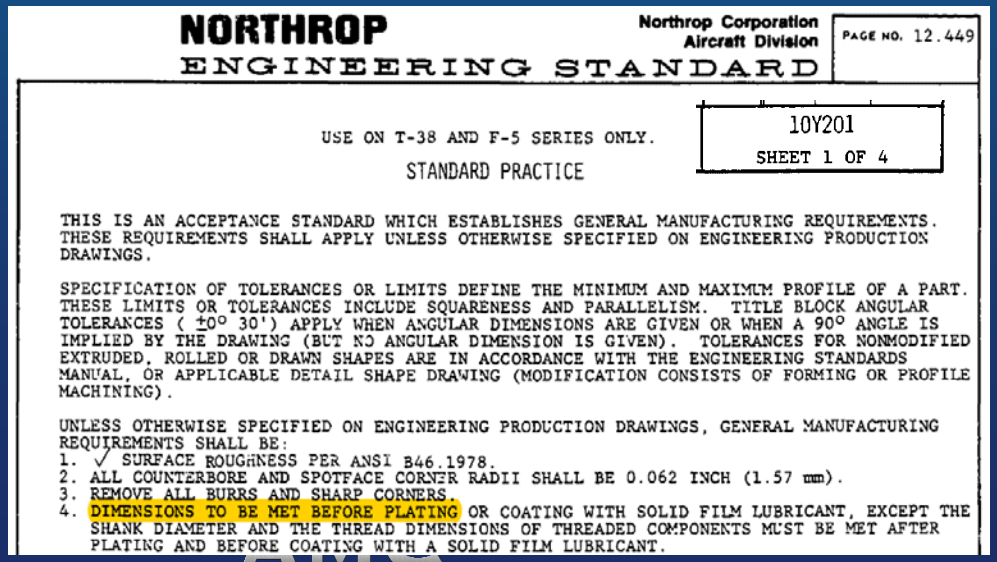


Measuring Over Plating Disapproval

Problem: Arm Rudder Pedal FA was disapproved for non-conformance to dimensional requirements.

Specifics: Out-of-tolerance dimensions were incorrectly measured after plating even though drawing notes indicated “dimensions to be met before plating” per 10Y201.

Outcome: Supplier submitted a rebuttal requesting conditional approval. Air Force agreed to remove the over paint discrepancies per 10Y201.



NORTHROP
Northrop Corporation
Aircraft Division
PAGE NO. 12.449

ENGINEERING STANDARD

10Y201
SHEET 1 OF 4

USE ON T-38 AND F-5 SERIES ONLY.

STANDARD PRACTICE

THIS IS AN ACCEPTANCE STANDARD WHICH ESTABLISHES GENERAL MANUFACTURING REQUIREMENTS. THESE REQUIREMENTS SHALL APPLY UNLESS OTHERWISE SPECIFIED ON ENGINEERING PRODUCTION DRAWINGS.

SPECIFICATION OF TOLERANCES OR LIMITS DEFINE THE MINIMUM AND MAXIMUM PROFILE OF A PART. THESE LIMITS OR TOLERANCES INCLUDE SQUARENESS AND PARALLELISM. TITLE BLOCK ANGULAR TOLERANCES (±0° 30') APPLY WHEN ANGULAR DIMENSIONS ARE GIVEN OR WHEN A 90° ANGLE IS IMPLIED BY THE DRAWING (BUT NO ANGULAR DIMENSION IS GIVEN). TOLERANCES FOR NONMODIFIED EXTRUDED, ROLLED OR DRAWN SHAPES ARE IN ACCORDANCE WITH THE ENGINEERING STANDARDS MANUAL, OR APPLICABLE DETAIL SHAPE DRAWING (MODIFICATION CONSISTS OF FORMING OR PROFILE MACHINING).

UNLESS OTHERWISE SPECIFIED ON ENGINEERING PRODUCTION DRAWINGS, GENERAL MANUFACTURING REQUIREMENTS SHALL BE:

1. ✓ SURFACE ROUGHNESS PER ANSI B46.1978.
2. ALL COUNTERBORE AND SPOTFACE CORNER RADII SHALL BE 0.062 INCH (1.57 mm).
3. REMOVE ALL BURRS AND SHARP CORNERS.
4. DIMENSIONS TO BE MET BEFORE PLATING OR COATING WITH SOLID FILM LUBRICANT, EXCEPT THE SHANK DIAMETER AND THE THREAD DIMENSIONS OF THREADED COMPONENTS MUST BE MET AFTER PLATING AND BEFORE COATING WITH A SOLID FILM LUBRICANT.

Measuring Over Paint or Plating?

Check the drawing for clarification,
but most dimensions apply before plating or coating

Per ANSI Y14.5, paragraph 2.4.1

2.4.1 Plated or Coated Parts

Where a part is to be plated or coated, the drawing or referenced document shall specify whether the dimensions apply before or after plating. Typical examples of notes are the following:

(a) "DIMENSIONAL LIMITS APPLY AFTER PLATING."
(b) "DIMENSIONAL LIMITS APPLY BEFORE PLATING."

(For processes other than plating, substitute the appropriate term.)

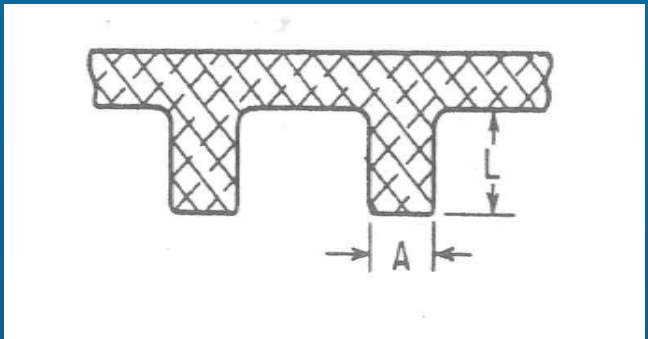
Casting Draft FAT Disapproval

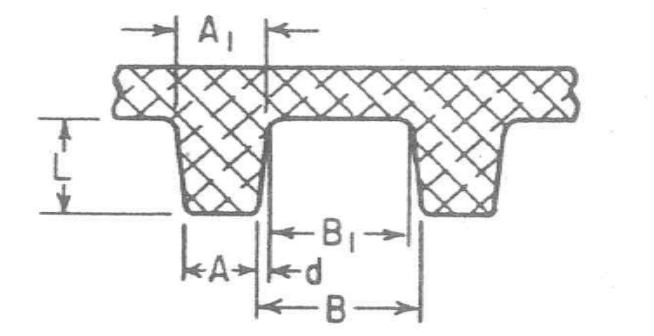
Problem: Cast aircraft fairing FA was disapproved. The cost to resubmit exceeded the total value of the contract.

Specifics: Out-of-tolerance dimensions were measured from as-cast to as-cast surfaces (both containing draft). With draft, however, dimensions can change depending upon where one measures.

Outcome: Supplier submitted a rebuttal. Conditional approval was granted pending corrections on production items. Parts were successfully delivered to the warfighter.

Casting Draft Effects





- If drawing allows, foundry adds draft “d” to “A” increasing its size to “A1”
- The addition of “d” also affects dimension “B” by decreasing its size to “B1”
- Designers must factor in casting draft so no interference problems will occur
- FAT inspectors should be aware of casting draft as well

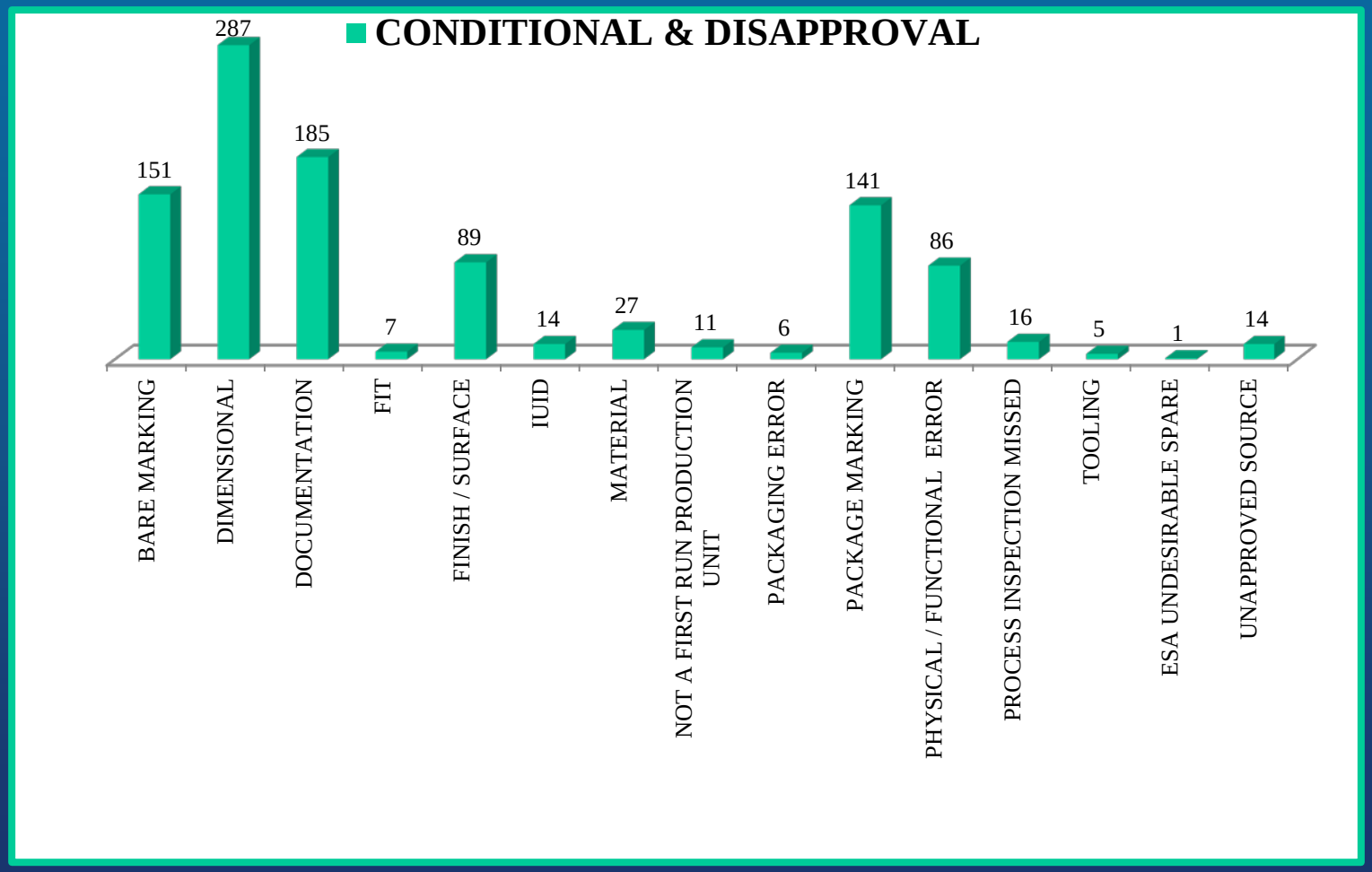
TDP Error

Problem: FA submitted in October 2014 and disapproved in February 2015 with no reason provided. To have negative delivery data removed from its record, supplier requested the contract be terminated. Contract was terminated in February 2016.

Complication: ESA investigated, found that the surface specified on the drawing was wrong, and updated the TDP. ESA also permitted FA to be resubmitted, but supplier wasn't notified until the day after it had terminated the contract.

Impact: Supplier lost money making a part that met requirements, but was disapproved. Shortage and delays for warfighter.

Snapshot of FAT Issues



AMC
AMERICAN METALCASTING CONSORTIUM

Documentation for FAT

AMC
AMERICAN METALCASTING CONSORTIUM

Delivering Innovative Metalcasting Technologies and Processes in the Procurement of Critical Cast Parts

PROGRAM OVERVIEW | SUCCESS STORIES | EVENT CALENDAR | PROGRAM AWARDS | NEWS | CASTIT | CONTACT AMC

CAST-IT™ Process | Parts Library | Teaming | CAST-IT™ Transition | Casting Quality Tips

Documentation for Contractors to Include for First Article Testing (FAT)

- Material certification sheets (chemical analysis/mechanical/physical properties with traceability to mill)
- All other certifications: including finish requirements (i.e. plating, heat treatment, welding, inspecting, anodize, painting, NDI, etc.) utilized in the manufacture of the FAT item(s)
- Traceability certifications of all purchased hardware and components used in an assembly
- Copy of the purchase order certifying the process accomplished at other than contractor facility
- Process operation documentation
- Traveler documents with quality stamps
- In-process inspections performed with inspection data included
- Sub-vendor certifications (welding, heat treat, NDT, Plating) *Proof of ISO or equivalent certification
- Quality manual (ISO 9000 or equivalent)
- Equipment calibration dates
- If not specified on the drawing, the datum point selected for all measurements
- Notes regarding drawing draft allowances against nominal dimensions
- Actual measurement data and drawing tolerances
- Any special processing notes to be considered (bar code label versus laser etching due to part geometry)
- Basic contract copy (very important that it be included in the documentation package)
- Any contract modifications (if applicable)
- WAWF receiving report with "Inspected" endorsement by DCMA (origin inspection)
- Proof of DCMA QAR inspection of FAT exhibit (DCMA Wide Area Work Flow electronic approval or signed DD-250)
- Documentation of domestic materials, particularly for inserts and fasteners
- Documentation of approved bearing and required stake tools
- UID requirements

https://amc.ati.org/punchlist.html

Effects of FAT Disconnects

- Increased costs
- Delivery delays
- Production scheduling issues
- Cancelled contracts necessitating re-procurement, resulting in further delays
- Reduced supplier pool for first articles
- Reduced responsiveness of suppliers because their working capital becomes tied up in first articles
- Wasted time of government, suppliers, and warfighter

Recommendations

- Seek Contracting Officer's approval to allow communication between suppliers, government inspectors, and ESAs
- Grant conditional approvals versus disapprovals for minor, correctable FAT deficiencies to improve part availability for the warfighter
- Provide full inspection reports on conditional approvals and disapprovals to suppliers to avoid FOIA requests
- Set resubmission costs in proportion to the contract value

Additional Recommendations

- Weigh discrepancies on their impact to the function of the part
- Provide faster turn-around times on:
  - Responses to rebuttals
  - Return of exhibits
- Provide access to contracts as well as training at FAT facilities to enable inspectors to understand the effects of contract requirements and exceptions