Aerospace/Aircraft Assembly (AAA) Standard

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NCATT Aerospace/Aircraft Assembler Standard
Subject, Performance and Task Knowledge Requirements

I. General

- Aircraft Structures and Terminology
- Shop Mathematics
- Hand Tools
- Shop Tools
- Shop Practices (General)
- Quality Processes

II. Technical Drawings Principles and Use

- Aircraft Drawings, Prints and Engineering Documents
- Work Instructions
- Tolerances
- Tolerance Buildups
- Geometric Dimensioning & Tolerancing (GD&T)

III. Material Use and Processes

- Sheet Metal Marking Tools
- Sheet Metal Layout Measurements and Spacing
- Corrosion Prevention
- Corrosion Preventative Compounds
- Sealants and Epoxy
- Wiring and Fiber Optics Installation
- Hydraulic and Pneumatic Tubing Installation
- Structural Assembly –Metallic / Composite

There are nineteen (19) *Subject Knowledge, Task Performance and Task Knowledge* activities and functions within the NCATT Aerospace / Aircraft Assembler Standard. The Aerospace / Aircraft Assembler Standard was identified and defined by aerospace industry Subject-Matter-Experts (SMEs) through an NCATT facilitated occupational analysis workshop. NCATT workshops focus on the "job" an individual performs in relation to an identified topic or career field.

The NCATT Aerospace / Aircraft Assembler Standard can be used by Aerospace Industry education and training entities to develop lesson plans as part of a complete education and training program focused on aerospace vehicle or aerospace component assembly. The Standard can also be used to develop specialized and/or targeted education and training needs.

NCATT Aerospace/Aircraft Assembler Standard
Subject, Performance and Task Knowledge Requirements

The depth, complexity and detail of task performance, task knowledge and subject knowledge, required for *NCATT Accredited* programs, can be determined by referring to the NCATT Level Definitions provided below.

Educational entities that wish to align their programs with the NCATT Standards (and required teaching levels) should refer to the NCATT webpage (www.ncatt.org) for additional guidance.

NCATT Level Definitions

	Scale Value	Definition: The Individual
Task Performance Levels	1	***IS EXTREMELY LIMITED.*** (Can do simple parts of the task. Needs to be told or shown how to do most of the task)
	2	***IS PARTIALLY PROFICIENT.*** (Can do most parts of the task. Needs only help on hardest parts.)
	3	***IS COMPETENT.*** (Can do all parts of the task. Needs only a spot check of completed work.)
	4	***IS HIGHLY PROFICIENT.*** (Can do the complete task quickly and accurately. Can tell or show others how to do the task.)
Task Knowledge Levels	a	***KNOWS NOMENCLATURE.*** (Can name parts, tools, and simple facts about the task.)
	b	***KNOWS PROCEDURES***. (Can determine step-by-step procedures for doing the task.)
	c	***KNOWS OPERATING PRINCIPLES.*** (Can identify why and when the task must be done and why each step is needed.)
	d	***KNOWS ADVANCED THEORY.*** (Can predict, isolate, and resolve problems about the task.)
*Subject Knowledge Levels	A	***KNOWS FACTS.*** (Can identify basic facts and terms about the subject.)
	B	***KNOWS PRINCIPLE.*** (Can identify relationship of basic facts and state general principles about the subject.)
	C	***KNOWS ANALYSIS.*** (Can analyze facts and principles and draw conclusions about the subject.)
	D	***KNOWS EVALUATION.*** (Can evaluate conditions and make proper decisions about the subject.)

Explanations

A task knowledge scale value may be used alone or with a task performance scale value to define a level of knowledge for a specific task. (Example: b and 1b)

*A subject knowledge scale value is used alone to define a level of knowledge for a subject not directly related to any specific task, or for a subject common to several tasks.

I. General

1. Aircraft Structures and Terminology
NCATT Level B

Outcome: A successful education or training outcome for this task/subject will produce an individual who knows and can identify the relationship of basic facts and state general principles about "Aircraft Structures" and be able to recognize and use "Terminology" related to this subject.

The following is a minimum list of common titles and terms associated with this subject and should be used as a base vocabulary list in the education and training needs of the individual.

- Major Structural Stresses
  - Tension
  - Compression
  - Torsion
  - Shear
  - Bending
- Fixed-Wing Aircraft Structures
  - Cockpit
  - Fuselage
  - Wing Structure
  - Nacelles or Pods
  - Empennage
  - Flight Control Surfaces (Primary)
  - Landing Gear
  - Skin and Fairing
  - Access and Inspection Panels / Doors
- Helicopter Structures (Minimum Listing)
  - Main Rotor
  - Tail Rotor (Rotary Rudder / Anti-Torque Rotor)
  - Tail Boom (Tail Cone)

2. Shop Mathematics
NCATT Level 4c

Outcome: A successful education or training outcome for this task/subject will produce an individual who is highly proficient in the performance of each mathematic computation activity and application identified herein. For each mathematic computation activity and application, the individual will be able to do the complete calculation quickly and accurately and can tell or show others how to do the calculation. In addition, they will know the mathematical operating principles used, and can identify why and when the calculations must be done and why each step is needed.

The following is a base-line list of mathematics subjects and terms to be covered in this section.

- Roots and Powers of Numbers
- Areas and Volumes of Various Geometrical Shapes
- Ratio, Proportion, and Percentage Problems
- Algebraic Operations

3. Hand Tools
NCATT Level 4a

Outcome: A successful education or training outcome for this task/subject will produce an individual who is highly proficient in the performance of "Hand Tool" selection and use. The individual will be able to select and use hand tools quickly and accurately and can tell or show others how to do the same. In addition, they can name component parts, as applicable, of hand tools and simple facts about the selection and use of these tools.

As general information, the following is a list of *typical* base-line hand tool knowledge requirements.

- Selection of Personal Protective Equipment (PPE)
- Tool Identification
  - Common
  - Specialized
- Tool Selection
- Tool Use Safety Precaution
- Tool Inspection for Condition and Operation
- Tool Adjustments in Accordance with Operating Instructions

4. Shop Tools
NCATT Level 3b

Outcome: A successful education or training outcome for this task/subject will produce an individual who is competent in the performance task of "Shop Tool" selection and use. The individual will be able to do all parts of the shop tools selection process and will need only a spot check of the completed selections. In addition, they will know the task procedures, and can determine step-by-step procedures for doing the task.

As general information, the following is a list of *typical* base-line shop tool knowledge requirements.

- Selection of Personal Protective Equipment (PPE)
- Tool Identification
  - Common
  - Specialized
- Tool Selection
- Tool Use Safety Precaution
- Tool Inspection for Condition and Operation
- Tool Adjustments in Accordance with Operating Instructions

5. Shop Practices (General)
NCATT Level B

Outcome: A successful education or training outcome for this task/subject will produce an individual who knows and can identify relationships of basic facts and state general principles about aerospace industry "Shop Practices".

As general information, the following is a *typical* list of subjects and terms associated with shop practices.

Note: NCATT provides educational resources on FOE. See NCATT website at www.ncatt.org.

- Electrostatic Discharge (ESD)
- Foreign Object Elimination (FOE / FOD) Awareness
  - Basic Terms & Definitions
  - Principles of Housekeeping
  - Tool Accountability
  - Hardware Accountability
  - Lost Item Control
  - Physical Entry & Personnel Control
  - Reporting & Investigating
  - Parts Protections
  - Hazardous Materials
  - Wildlife / Environment as FOD
  - FOD Effects
- Utilize Safety Practices

  - Ergonomics in the Workplace
  - Hazardous Materials Awareness and Disposal
  - Use of Personal Protective Equipment (PPE)
  - Material Safety Data Sheets (MSDS)
  - Occupational Safety and Health Administration (OSHA) Requirements as it Relates to Assembly Processes
  - Pneumatic Shop Safety
  - Power-feed Motors and/or Equipment
  - Principles of Lock Out / Tag Out
  - Relationship of Human Factors
- Non Destructive Inspection (NDI)
  - Types of NDI
  - Use and Limitations on NDI
  - Safety Considerations

6. Quality Processes
NCATT Level B

Outcome: A successful education or training outcome for this task/subject will produce an individual who knows the basic principles of "Quality Processes", and can identify relationships of basic facts and state general principles about "Quality Process".

As general information, the following terms are *typically* associated with quality processes.

- Lean Principles
- Agency Oversight
- Corrective Action Processes
- External Standards (i.e. ISO, ASME, ICAO)
- Quality Checks
  - Review specs / engineering drawings
  - Verify Work Meets Specs / Engineering Drawings
- Manufacturing Process (The Big Picture)
- Relationship of Human Factors
- Work to Approved Data
  - Review Approved Data
  - Verify Currency of Approved Data

II. Technical Drawings Principles and Use

7. Aircraft Drawings, Prints and Engineering Documents
NCATT Level C

Outcome: A successful education or training outcome for this task/subject will produce an individual who can analyze facts and principles and draw conclusions about "Aircraft Drawings" and their use. The following is a non-inclusive list of aircraft drawing and blue print subjects, terms and titles that education and training programs should consider for inclusion when addressing this subject.

As general information, the following terms and titles are *typically* associated with technical drawings.

- Reference Planes
- Fastener Code Block
- Flag and General Notes
- Drawing Sizes and Zones
- Parts List
- Title Block
- Tolerance Block
- Drawing Lines
- Drawings Types
- Drawing Effectively
- Engineering Change Authorization
- Drawing Revisions

8. Work Instructions
NCATT Level 3c

Outcome: A successful education or training outcome for this task/subject will produce an individual who is competent in the task and steps associated with the selection and use of "Work Instructions". The individual will be able to do all parts of the task and will need only a spot check of completed work. In addition, they will know the operating principles used with this task/subject, and can identify why and when the task must be done and why each step is needed.

As general information, the following terms and activities are *typically* associated with work instructions.

- Interpretation and application of instructions and specifications
- Selection of materials and supplies
- Use of instructions and specifications

9. Tolerances
NCATT Level A

Outcome: A successful education or training outcome for this task/subject will produce an individual who can identify basic facts and terms about the application of tolerances.

As general information, the following terms and activities are *typically* associated with the use of tolerance data and instructions.

- Determine Allowable Tolerance to Apply
- Apply the Tolerance
- Locate Reference Points
- Take Measurement
- Verify Accuracy of Layout

10. Tolerance Buildups
NCATT Level 2c

Outcome: A successful education or training outcome for this task/subject will produce an individual who is partially proficient in the performance of tasks and steps associated with "Tolerance Buildups". For each task, the individual will be able to do most parts of the task and will need help only on the hardest parts. In addition, they will know the operating principles used with this subject, and can identify why and when the task must be done and why each step is needed.

As general information, the following terms and activities are *typically* associated with tolerance buildup.

- All Measurements are taken from a Single Point
- Each Dimension is added for a Cumulative Measurement for Each Point

11. Geometric Dimensioning & Tolerancing (GD&T)
NCATT Level B

Outcome: A successful education or training outcome for this task/subject will produce an individual who knows the basic principles of "Geometric Dimensioning and Tolerancing" (GD&T), and can identify relationships of basic facts and state general principles about GD&T. GD&T is a system of symbols, rules and definitions used to define the geometry of mechanical parts. The following is a non-inclusive, basic list of subjects and terms associated with this subject.

As general information, the following terms and definitions are *typically* associated with Geometric Dimensioning and Tolerancing.

- American Society of Mechanical Engineers (ASME)

- ASME Y14.5M-1994 (adopted by the Department of Defense (DoD) March 13, 1994 - Formerly ANSI Y14.5M - American National Science Institute) Establishes:
  - Engineering Drawing and Related Documentation Practices
  - Definitions, and General Dimensioning
  - General Tolerancing and Related Principles
  - Symbology
  - Datum Referencing
  - Tolerances of Location
  - Tolerances of Form, Profile, Orientation, and Runout
- GD&T – Basic Use and Purpose (Examples)
  - Traditional Methods – "plus something" and "minus something" using two dimensions to locate a three dimensional feature
  - GD&T Method – uses three dimensional tolerances to locate three dimensional features.
  - GD&T provides a "tolerance zone" based on the geometrical shape of the feature, part or assembly
  - GD&T defines the nominal, as-molded or as-intended geometry of a part or assembly
  - GD&T defines the allowable variation of a part or assembly
- GD&T Symbols and Definitions
  - Symbols commonly used for fabrication and assembly
  - Symbols commonly used for engineering, tooling, machining, etc.

III. Materials and Process

12. Sheet Metal Marking Tools
NCATT Level 2c

Outcome: A successful education or training outcome for this task/subject will produce an individual who is partially proficient in the performance of tasks and steps associated with the use of "Sheet Metal Marking Tools". For each task, the individual will be able to do most parts of the task and will need help only on the hardest parts. In addition, they will know the operating principles used with this standard, and can identify why and when the task must be done and why each step is needed.

As general information, the following activities are *typically* associated with sheet metal marking.

- Determine the type of material to be marked
- Select the appropriate marking tool for the material being marked

13. Sheet Metal Layout Measurements & Spacing
NCATT Level 4c

Outcome: A successful education or training outcome for this task/subject will produce an individual who is highly proficient in the performance of each "Sheet Metal Layout Measurement and Spacing" activity or functional task identified in this subject. For each measurement or spacing task the individual will be able to do the complete task or step quickly and accurately and can tell or show others how to do the task. In addition, they will know the operating principles and procedures used to complete the measurement and spacing task and can identify why and when the task must be done and why each step is needed.

As general information, the following terms and activities are *typically* associated with sheet metal layout, measurements and spacing.

- Edge Margin and Equal Spacing
  - Review Engineering Drawings
  - Apply Data to All Edge Margin
  - Verify Accuracy
- Basic and Precision Measurement
  - Verify Dimensions as per Engineering Drawings
  - Locate Reference Points
  - Take Measurement
  - Verify Accuracy of Layout
- Precision Instruments
  - Machinist Scale
  - Micrometer
  - Go No-Go Gauge
  - Dial Caliper
  - Vernier Caliper

14. Corrosion Prevention
NCATT Level B

Outcome: A successful education or training outcome for this task/subject will produce an individual who knows and can identify relationships of basic facts and state general principles about "Corrosion Prevention" in aerospace vehicles and components. The following is a non-inclusive, list of subjects and terms associated with this subject.

As general information, the following terms, considerations and activities are *typically* associated with corrosion prevention.

- Corrosion Causes
- Types of Corrosion and Effects
- Prime and Paint Touchup
- Compatibility of Dissimilar Materials
- Corrosion Prevention Methods
- Proper Material Handling

Note: As an additional resource see the Material Handling Section in the NCATT FOE – Elements of Basic Awareness Standards

15. Corrosion Preventative Compounds
NCATT Level 2b

Outcome: A successful education or training outcome for this task/subject will produce an individual who is partially proficient in the performance of the task of "Corrosion Preventative Compounds". The individual will be able to do most parts of the task and will need help only on the hardest parts. In addition, they will know the procedures for the task, and can determine step-by-step procedures for doing task.

As general information, the following terms and activities are *typically* associated with corrosion preventative compounds and their application.

- Selection of the appropriate Personal Protective Equipment (PPE) for the task
- Review of relevant specifications and application procedures
- Application of corrosion preventative compounds
- Post application inspection
- Dispose of waste in accordance with the applicable governing agency

16. Sealants and Epoxy
NCATT Level 2c

Outcome: A successful education or training outcome for this task/subject will produce an individual who is partially proficient in the performance of tasks and steps associated with the use of "Sealants and Epoxy" on aerospace vehicles and components. For each task, the individual will be able to do most parts of the task and will need help only on the hardest parts. In addition, they will know the operating principles used with this subject, and can identify why and when the task must be done and why each step is needed.

As general information, the following terms and activities are *typically* associated with sealants and epoxies, and their application.

- Sealant Terminology
- Sealant Tools and Equipment
- Types of Seals (i.e., Faying, Fillet, Dome)
- Mixing Sealants and Epoxy products
  - Identify Materials
  - Review relevant specifications and instructions
  - Mix per instructions

- Sealant / Epoxy Application
  - Determine Type of Sealant / Epoxy, Tools and Application Methods
  - Prepare Surface
  - Apply Sealant / Epoxy
  - Perform post application inspection
  - Post Assembly Rework
  - Dispose of waste in accordance with the applicable governing agency

17. Wiring and Fiber Optics Installation
NCATT Level 2b

Outcome: A successful education or training outcome for this task/subject will produce an individual who is partially proficient in the performance of the task of "Wiring and Fiber Optics Installation" in an aerospace vehicle or component; in an assembly application. The individual will be able to do most parts of the task and will need help only on the hardest parts. In addition, they will know the procedures for the task, and can determine step-by-step procedures for doing task.

As general information, the following terms and activities are *typically* associated with wiring and fiber optics installation.

- Wiring and Fiber Optics
  - Review specifications
  - Selection of the appropriate Personal Protective Equipment (PPE) for the task
  - Route and install wiring / fiber optics per specifications
  - Verify the completed installation through inspection or operational checks as appropriate

18. Hydraulic and Pneumatic Tubing Installation
NCATT Level 2b

Outcome: A successful education or training outcome for this task/subject will produce an individual who is partially proficient in the performance of the task of "Hydraulic and Pneumatic Tubing Installation" in an aerospace vehicle or component; in an assembly application. The individual will be able to do most parts of the task and will need help only on the hardest parts. In addition, they will know the procedures for the task, and can determine step-by-step procedures for doing task.

As general information, the following terms and activities are *typically* associated with hydraulic and pneumatic tubing installation.

- Hydraulic and Pneumatic Tubing Installation
  - Review specifications
  - Selection of the appropriate Personal Protective Equipment (PPE) for the task
  - Route and install hydraulic and pneumatic tubing per specifications
  - Verify the completed installation through inspection or operational checks as appropriate

19. Structural Assembly – Metallic / Composite

NCATT Level 2c

Outcome: A successful education or training outcome for this task/subject will produce an individual who is partially proficient in the performance of tasks and steps associated with "Structural Assembly – Metallic / Composite" of aerospace vehicles or components. For each task the individual will recognize the need for application of specific methods and techniques used with metallic and/or composite structures. For each task, the individual will be able to do most parts and will need help only on the hardest parts. In addition, they will know the operating principles used with this standard, and can identify why and when the task must be done and why each step is needed.

As general information, the following terms and activities are *typically* associated with metallic and composite aircraft structural assembly.

- Electrical Ground and Bonding
  - Select tool
  - Prepare and protect surface
  - Test as applicable
  - Perform bonding / grounding
- Ream hole to size
  - Select reaming tool
  - Perform test on scrap material
  - Verify hole size from test piece
  - Ream hole
  - Inspect reamed hole for accuracy
- Shimming Process
  - Determine Need
  - Determine Size
  - Select / Fabricate Shim
  - Install
- Hole Countersinking
  - Select countersink tool
  - Set depth
  - Perform test on scrap material
  - Verify countersink depth and diameter from test piece
  - Countersink hole
  - Inspect countersink for accuracy
- Fastener Installation
  (Threaded Fastener, Blind Fastener, Lock Bolt, Rivet)
  - Select tool
  - Install fastener
  - Verify installation

- Torquing and Safetying
  - Review specifications
  - Select Torquing or Safetying tool
  - Set torquing value
  - Apply torque and safety
  - Verify safety Fastener Removal
    (Threaded Fastener, Blind Fastener, Lock Bolt, Rivet)
  - Select tool
  - Remove fastener
  - Inspect hole for damage
- Trim and Fit
  - Select tool
  - Set-up tool
  - Perform trim / file
  - Verify accuracy in trim and fit
- Cleco Installation
  - Select Size / Color
  - Installation / Application
- Counter Bore and Spot Face
  - Select tool
  - Set depth
  - Perform test on scrap material
  - Verify counter bore for correct depth from test piece
  - Bore Hole
  - Debur
  - Verify accuracy of counter bore
- Dimpling – Hot and Cold
  - Select Dimple Dye
  - Adjust tool
  - Perform test dimple on scrap material
  - Verify dimple depth from test piece
  - Dimple hole
  - Verify for accuracy of dimple
- Drill a Hole to Specification (hole size and depth)
  - Select drill according to specifications
  - Set depth
  - Perform test on scrap material
  - Verify for correct hole diameter and depth (blind hole) on test piece
  - Drill hole
  - Debur
  - Verify for accuracy of hole depth and diameter

Tool List:

1. Huck Gun
2. Inspection Mirrors
3. Lock Bolt Gun
4. Measurement Devices
5. Mounted Belt and Disk Sander
6. Nibblers
7. Nut Plate Jigs
8. Pliers
9. Punches
10. Ratchets
11. Rivet Gun
12. Rivet Sets
13. Rivet Tape
14. Riv-Nut Puller
15. Snips / Shears
16. Sockets
17. Torque Wrenches
18. Vice
19. Winslow Gun
20. Wire Crimpers
21. Wire Strippers
22. Wrenches