LEVEL 1
SHEETMETAL
Training

ACRATS

DETAILED COURSE OUTLINE ATS2131

AIRCRAFT METALLIC STRUCTURE: MANUFACTURING, ASSEMBLY, INSPECTION, DAMAGE ASSESSMENT AND REPAIR LEVEL 1

Course Title
Aircraft Metallic Structure: Manufacturing, Assembly, Inspection, Damage Assessment and Repair, Level 1

Course Tag
Sheetmetal Level 1

Course ID
ATS2131

Course Duration
15 Working Days

Prerequisites
Prior sheetmetal training or experience is not required

Learning Hours
Classroom: 30 Hours
Practical 90 Hours

Highest Standards
Meets EASA, FAA and OEM SRM Standards

Scope and Purpose

This aircraft metallic structure course has been developed to meet the knowledge and skill requirements of an aircraft sheet metal worker. Participants will develop essential practical skills and gain a fundamental understanding of sheet metal structures fabrication, inspection, and repairs. By the end of the course, participants will be able to manufacture aircraft metallic parts and perform inspections and repairs on aircraft structures in compliance with the manufacturer's documentation and other acceptable or approved repair data and technical drawings.

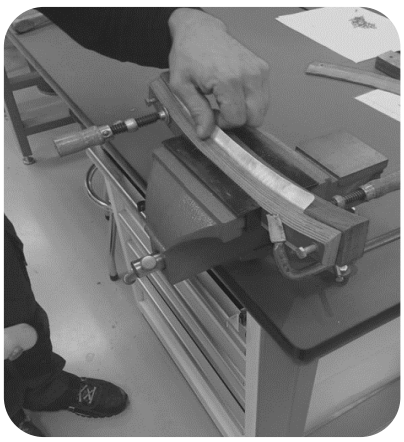
Course Module Overview

- Introduction
- Metallic Materials Part 1
- Basic Measuring Techniques and Marking
- Metal Forming and Machining Operations Part 1
- Bending of Sheet Metal Parts
- Hole Preparation (Drilling and Countersinking)
- Assembly of Sheet Metal Parts
- Aircraft Solid Shank Rivets and Riveting
- Basic Aircraft Fasteners
- Aircraft General Knowledge: Introduction to Aircraft Metallic Structures
- Source Documentation Part 1
- Standard Repair Principles
- Structural Repair Part 1
- Practical Exercises
- Assessment Criteria
- Examination

Selection of the Learning Goals

Upon successful completion of this training, the student will be able to:

- Understand the roles and responsibilities of a sheet metal worker, including the importance of professionalism, safety, and proper work ethics;
- Classify and describe the properties of aluminum and its alloys, understanding their vulnerabilities and appropriate handling techniques;
- Correctly use basic measuring tools and marking techniques while understanding and adhering to restrictions to prevent damage;
- Demonstrate various metal forming and machining operations, including cutting, filling, sanding, grinding, milling, sawing, and slip roll forming, and understand tool maintenance and post-processing steps;
- Describe and perform the processes involved in bending sheet metal into angled parts, utilizing calculations and understanding the importance of bend lines and equipment maintenance;
- Use different types of drills and drill bits correctly, demonstrating proper drilling methods, deburring, and countersinking techniques with quality control;
- Assemble sheet metal parts by correctly drilling, fastening, and using temporary fasteners to ensure proper alignment and tension-free assemblies;
- Install and remove solid shank rivets using appropriate tools, perform quality inspections, and understand the heat treatment process for rivets;
- Identify, install, and remove common aircraft fasteners, select the correct fasteners using grip gauges, and conduct quality inspections;
- Describe the build-up and function of aircraft structural members, understand loads and stresses, and use structural terminology accurately;
- Interpret and navigate aircraft blueprints and the Structural Repair Manual (SRM), understanding the NAS512 rivet code and managing "gray areas" responsibly;
- Apply standard repair principles in aircraft metallic structure repairs, including techniques for edge distance, edge margin, pitch distance, hole pattern layout, and sealant application;
- Perform structural repairs by identifying and repairing damage, replacing parts, using repair materials and tools correctly, and conducting quality inspections.



Detailed Module Overview

	Topic	Teaching Level	Classroom Hours	Practical Hours
1	Introduction	1	1,5	
2	Metallic Materials Part 1	1	2	
3	Basic Measuring Techniques and Marking	2	1,5	
4	Metal Forming- and Machining Operations (including Tooling and Equipment) Part 1	2	3	
5	Bending of Sheet Metal Parts	2	3	
6	Hole Preparation (Drilling and Countersinking)	2	2	
7	Assembly of Sheet Metal Parts	1	2	
8	Aircraft Solid Shank Rivets and Riveting	2	3	
9	Basic Aircraft Fasteners	2	2	
10	Aircraft General Knowledge: Introduction to Aircraft Metallic Structures	1	2	
11	Source Documentation Part 1	1	2	
12	Standard Repair Principles	2	2	
13	Structural Repair Part 1	2	2	
14	Practical Exercises	3	-	90
15	Assessment Criteria	-	-	
16	Written Test	-	2	
	Total Hours	-	30	90
	Course Length		120 Hours	

Teaching Level 1
Teaching level 1 includes the transferring of knowledge from the instructor to the student, through instruction, lecture, demonstration and by having topic-related discussions. Knowledge transfer can take place in a classroom (physical training) as well as through online learning (Computer Based Training (CBT)). The content of e-learning modules should be structured in such a way, keeping in mind that discussions are not possible (it is classified as passive learning), and the participant should be able to understand the material without the intervention of an instructor. Online classes or e-learning modules should be arranged in such a way that the participant has the opportunity to ask questions to the designated instructor or to provide (general) comments. Teaching level A does not include a practical application (hands-on) or the development of practical skills.

Teaching Level 2
Teaching level 2 includes the transferring of knowledge from the instructor to the student, through instruction, lecture, demonstration, topic-related discussions, and limited practical application, but does not include the development of sufficient manipulative skill to perform basic operations. Knowledge transfer can take place in a classroom (physical training) as well as through online learning (Computer Based Training (CBT)). The content of e-learning modules should be structured in such a way, keeping in mind that discussions are not possible (it being classified as passive learning), that the participant should be able to understand the material without the intervention of an instructor. Online classes or e-learning modules should be arranged in such a way that the participant has the opportunity to ask questions to the designated instructor, o to provide (general) comments. Online classes or e-learning modules must contain sufficient demonstration by means of explanatory videos. A high degree of interaction must be built in. Teaching level B requires some hands-on manipulative skills, or practical demonstration of the skills and their accompanying actual or simulated components/equipment, but still may be taught primarily in the classroom environment.

Teaching Level 3
Teaching level 3 includes the transferring of knowledge from the instructor to the student, through instruction, lecture, demonstration, having topic related discussions and a high degree of practical application to develop sufficient manipulative skill to accomplish return to service (normal operation). Teaching level C requires hands-on skill, as well as sufficient and appropriate instructional aides to train the participants to develop manipulative skills sufficient to simulate return to service mechanical skill. At this level, the teaching aids must be similar to or be the actual items of equipment on which the participant is expected to develop the required skill levels. A teaching level C subject cannot be taught solely by instruction or lecture in the classroom; the appropriate training aids and hands-on experience must be used. E-learning modules can be used as a guide through practical assignments. Teaching level C includes a high degree of practical application (hands-on) and a strong focus on the development of practical skills.

Module 1 - Introduction

In Module 1, you'll learn about the roles and responsibilities of a sheet metal worker, especially in aircraft maintenance. You'll find out what you need to do before, during, and after working on an aircraft to ensure its safety and structural integrity. We'll talk about what's expected from you in terms of attitude, behavior, and professionalism. You'll also learn the right way to work, both personally and professionally. On top of that, you'll learn about potential health and safety risks and how to choose and use the right personal protective equipment (PPE). By the end of this module, you'll have a clear understanding of your role and how to work safely and responsibly.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Explain the roles and responsibilities of a sheet metal worker before, during, and after aircraft maintenance;
- Understand the importance of restoring the integrity of an aircraft and/or its components;
- Explain the required and desired attitude, behavior, and professionalism;
- Understand the morally correct way of working in the field;
- Recognize potential health and safety hazards and risks;
- Select and use the appropriate personal protective equipment (PPE).

Topics

1. Course Introduction
2. Introduction to the Profession of sheetmetal worker
3. Job Description
4. Responsibilities
5. Way of Working
    a. Required Mindset and Attitude (Ethics)
    b. Hazardous Materials and Chemicals
    c. Accuracy and Precision (Including Working with Tight Tolerances)
    d. Scratch & Damage Prevention
6. Quality Awareness
7. Health, Safety and Environmental Precautions
    a. Fumes, Vapor and Dust
    b. Safety Data Sheets (SDS)
    c. Personal Protective Equipment (PPE)
8. FOD Awareness & Prevention
9. Tool Control
10. Human Factors in Aircraft Maintenance
11. Quality Awareness
12. Traceability Awareness
13. Order and Tidiness in the Sheetmetal Shop ACRATS Training-/House Rules)

Module 2 - Materials & Hardware

In Module 2, you'll focus on metallic materials, especially aluminum. You'll learn about the different types of aluminum, including pure aluminum and various aluminum alloys. We'll cover the properties of these materials and why each type is used. We'll discuss the vulnerabilities of aluminum alloys, such as scratches and damages, and how to prevent them. Additionally, you'll learn about the proper handling and storage requirements to avoid any damages.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Describe the classification of light and heavy metals;
- Understand the position of aluminum within these classifications;
- Describe the properties of pure aluminum;
- Explain the different aluminum alloys designated by the Aluminum Association;
- Understand the differences and purposes of each aluminum alloy series;
- Recognize the vulnerabilities of aluminum alloys, including scratches and damages;
- Understand the consequences of damage to the alclad layer;
- Learn ways to prevent damages and proper handling and storage requirements.

Topics

1. Introduction
2. Ferrous- and Non-Ferrous Metals
3. Light & Heavy Metals
4. Properties of Pure Aluminum
5. Alloys & Alloy Elements
6. Aluminum Alloys
    a. Aluminum Association Series Designation
    b. 1000- through 8000 Series
    c. 2024 vs. 7075
    d. Identification of Metals
    e. Chemical Difference
    f. Practical Difference
7. Product Forms
    a. Sheet
    b. Extruded and Formed
8. Processing
    a. Marking
    b. Cutting
    c. Sawing
    d. Filing
    e. Sanding
    f. Deburring
    g. Drilling
    h. Cold forming
9. Materials and State (Condition) Indication
10. Sheet Thickness Indications
11. Alclad Layer
12. Application of Protective Treatment to Metallic Sheets and Parts
13. Scratches & Scratch Prevention
14. Storage, Transportation & Handling (incl. Damage Prevention)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Module 3 - Basic Measuring Techniques and Marking

In Module 3, you'll learn about basic measuring techniques and marking. You'll get hands-on experience with basic measuring tools, understanding how to use them correctly and which tools to avoid to prevent scratches. Additionally, you'll learn about the restrictions on certain tools to ensure proper and safe handling and prevent damage to both the product and the tools.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Understand and describe the techniques for measuring with basic tools;
- Demonstrate the correct application of basic measuring tools;
- Identify tools used for marking and those that should be avoided to prevent scratches;
- Apply techniques to ensure precise and accurate measurements in various scenarios;
- Comprehend the importance of tolerance levels and how they affect measurements and overall quality.

Topics

1. Introduction
2. Basic Measuring Tooling
    a. Ruler
    b. Sliding Caliper (inches and millimeters)
    c. Try-Square and Framing Square
    d. Half-Circle- and Universal Bevel Protractor
3. Basic Measuring Techniques
4. Marking and Layout Tooling
    a. Pencil
    b. Ink Marker: Use and Restrictions
    c. Metal Scriber: Use and Restrictions
5. Marking and Layout on Sheet Metal Materials
    a. Marking for Product Outlining
    b. Marking for Hole Pattern Lay-out
    c. Scratch Prevention
6. Tolerances

Module 4 - Metal Forming- and Machining Operations (including Tooling and Equipment) *Part 1*

In Module 4, you'll learn about metal forming and machining operations, including the tools and equipment used. You'll get an introduction to various methods for cutting, filling, sanding, grinding, milling, sawing, and slip roll forming sheet metal through interactive discussions and live demonstrations. You'll also learn how to properly care for and maintain these tools and equipment. Additionally, you'll understand the post-processing steps like edge smoothing and deburring to ensure high-quality finishes.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Describe and demonstrate various sheet metal operations, including cutting, filling, sanding, grinding, milling, sawing, and slip roll forming;
- Describe and demonstrate the processes and operations for each metal forming and machining task, including tooling and equipment preparation, operation, and quality control;
- Describe and demonstrate proper care and maintenance of the tooling and equipment;
- Describe and demonstrate the post-processing steps, such as edge smoothing and edge and hole deburring;
- Identify the correct tools and equipment for various metal forming and machining operations;
- Understand and apply quality control techniques to ensure the integrity and accuracy of formed and machined parts;
- Recognize and implement safety practices to prevent accidents and injuries during metal forming and machining operations;
- Develop problem-solving skills to address common issues encountered during metal forming and machining processes.

Topics

1. Introduction
2. Cutting
    a. Tooling (Various)
    b. Process/Operation
    c. Tooling & Equipment Maintenance
3. Filling and Sanding
    a. Tooling
    b. Process/Operation
    c. Tooling & Equipment Maintenance
4. Grinding
    a. Tooling (Various)
    b. Process/Operation
    c. Tooling & Equipment Maintenance
5. Milling and Routing
    a. Tooling (Various)
    b. Process/Operation
    c. Tooling & Equipment Maintenance
6. Hole Saw
    a. Tooling (Various)
    b. Process/Operation
    c. Tooling & Equipment Maintenance
7. (Band) Sawing
    a. Tooling (Various)
    b. Process/Operation
    c. Tooling & Equipment Maintenance
8. Edge Deburring
    a. Tooling (Various)
    b. Process/Operation
9. Slip Roll Forming
    a. Tooling (Various)
    b. Process/Operation
    c. Tooling & Equipment Maintenance
10. Shrinking and Stretching (Eckhold) (Practical Demonstration)
    a. Tooling (Various)
    b. Process/Operation
    c. Tooling & Equipment Maintenance

Module 5 - Bending of Sheet Metal Parts

In Module 5, you'll learn about bending sheet metal parts. You'll understand how to bend sheet metal into single and multiple angled parts with 90º angles through interactive discussions and live demonstrations. You'll also learn about the formulas and charts used for calculating developed lengths and determining bend lines. Additionally, you'll learn about important considerations and precautionary measures to take before bending, such as minimum bend radius, the need for heat treatment, and edge smoothing. You'll also learn about the care and maintenance of bending equipment.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Describe and demonstrate how to bend sheet metal into single and multiple angled parts with 90º angles;
- Explain the different formulas and charts used for developed length calculation and bend line determination;
- Describe the considerations and precautionary measures to take before bending, such as minimum bend radius, the need for heat treatment, and edge smoothing;
- Identify the restrictions and requirements related to sheet metal bending, including edge smoothing, deburring, and handling primed/painted parts;
- Explain how material type, thickness, hardness, condition, and grain direction affect the bending process.

Topics

1. Introduction
2. Restrictions, Requirements and Considerations
    a. Sheet Requirements: Edge Smoothing and Deburring
    b. Primed/Paint parts and their Restriction regarding Bending
    c. Minimum Bend Radius
    d. Material Type, Thickness, Hardness and Condition
    e. Grain (Rolling) Direction
3. Tooling and Equipment
    a. Purpose and use (Operation)
    b. Maintenance
4. Developed Length Calculation (Flat Pattern Lay-out)
    a. Bend Allowance Formulas
    b. Empirical Formula
    c. Use of tables, graphs, and charts (for e.g. Set Back Determination)
    d. 90º degree bends
5. Bend Lines (Sight Lines)
6. Quality Control Finished Part

Module 6 - Hole Preparation (Drilling and Countersinking)

In Module 6, you'll learn about hole preparation, including drilling and countersinking. You'll understand the different types of drills and drill bits, their purposes, and the correct way to use them. Through interactive discussions and live demonstrations, you'll see the proper methods of drilling, including set-up and preparation, drill bit selection, and RPM determination. You'll also learn about hole rework operations, from mandatory deburring to countersinking with various angles and depths using common countersinking tools, including the microstop.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Describe the different types of drills and the differences between them;
- Explain the different types of drill bits, their purposes, and correct usage;
- Demonstrate proper drilling methods, including set-up and preparation;
- Select appropriate drill bits according to tolerance requirements and determine the correct RPM;
- Demonstrate hole deburring and countersinking operations with various angles and depths;
- Use common countersinking tools, including the microstop, correctly;
- Perform quality control checks on drilled and countersunk holes to ensure proper shape, dimension, and tolerance;
- Explain the importance of avoiding the knife effect and ensuring flush requirements.

Topics

1. Introduction
2. Types of (Rotary) Drills
    a. Pneumatic Vs. Electrical
    b. Drill Press
    c. Tool Pressure
3. Types of Drill Bits
    a. Millimeters
    b. Inches
    c. Numbers
4. RPM Determination
5. The Drilling Process
    a. Preparation
    b. Center Punch
    c. Prohibition
    d. Exceptions and Restrictions
    e. The Process
    f. Quality Control
    g. Shape, Dimension & Dimension
    h. Tolerance
6. Deburring of holes
    a. Tooling
    b. Restrictions
7. Countersinking Tooling
    a. Microstop & Countersinking Bits
    b. 82º and 100º Angles
8. Countersinking for Different Head Styles
    a. Tension Loads (“Full” Head)
    b. Shear Loads (Reduced Head)
9. The Countersinking Process
    a. Preparation
    b. The Process
    c. Quality Control
10. (The importance of) Avoiding Knife Effect
11. Flush Requirements


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Module 7 - Assembly of Sheet Metal Parts

In Module 7, you'll learn about the assembly of sheet metal parts. You'll understand how to properly drill, temporarily fasten, and assemble sheet metal parts in the correct order to prevent tension during manufacturing or structural repairs. Through interactive discussions and live demonstrations, you'll see which tools can and must be used for temporary fastening, including the use of clecos and blind rivets. You'll also learn methods for copying holes into other sheet metal parts when access from the backside is not available. Additionally, you'll cover considerations and precautionary measures to take before assembly, such as hole and edge deburring and smoothing.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Describe and demonstrate how to drill, temporarily fasten, and assemble sheet metal parts in the correct order;
- Explain and demonstrate the use of various temporary fasteners, including clecos and blind rivets;
- Describe and demonstrate methods for copying holes into other sheet metal parts, especially in situations with no access from the backside;
- Describe and demonstrate the considerations and precautionary measures to take before assembly, such as hole and edge deburring and smoothing;
- Explain the importance of tolerances in single parts versus assembled parts;
- Demonstrate methods to prevent damage during the assembly process.

Topics

1. Introduction
2. Drilling Order
3. Hole Deburring
4. Edge Deburring
5. Use of (various types of) Clecos
6. Temporary Fasteners
7. Riveting (Fastening) Order
8. Tolerances of Single Parts vs. Assembled Parts/Assemblies
9. Damage Prevention

Module 8 - Aircraft Solid Shank Rivets and Riveting

In Module 8, you'll learn about aircraft solid shank rivets and riveting. You'll understand the philosophy behind using solid shank rivets, the different types of rivets, and their applications. Through interactive discussions and live demonstrations, you'll learn how to select the correct rivet, calculate the suitable length, and install rivets using common tools like rivet guns and squeezers. You'll also cover fastener removal without affecting hole integrity, and the importance of heat treatment for solid rivets. Finally, you'll learn how to conduct quality inspections on riveted joints.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Understand the philosophy of fastening with solid shank rivets, including where and why they are commonly used;
- Describe the types of rivets, their head shapes, and how to identify them;
- Select the correct rivet using source documentation and calculate the suitable length using formulas;
- Demonstrate the correct installation of rivets using tools like rivet guns and squeezers;
- Understand when to use each type of tooling for the best results;
- Describe and demonstrate the removal of various types of fasteners without damaging the hole;
- Explain the reasons for and methods of heat-treating solid rivets;
- Perform quality inspections on riveted joints, including checking for proper placement, fitting, and absence of damage.

Topics

1. Introduction
2. Philosophy of The Solid Rivet Fastening Method
3. Rivet Material and Corresponding Coding (Identification and rivet-head markings)
4. Solid Rivet Types and Head Shapes/Styles
5. Heat Treatment and Post Requirements
6. Diameter Indication
7. Length Indication
8. Length (Dash No.) Determination/Selection (Grip Gauges)
9. Rivet Cutters
10. Drilling, drill Bit and Hole requirements
11. Rivet Gun- and Rivet Set Selection
12. Bucking Bar Selection (by Shape, Dimension and Weight)
13. Squeezer and Squeezer (Rivet) Set Selection
14. Riveting of Solid Rivets
    a. Manual - Process/Operation
    b. Manual - Limitations
15. Squeezer
    a. Manual - Process/Operation
    b. Manual - Limitations
16. Rivet Gun and Bucking Bar
    a. Manual - Process/Operation
    b. Manual - Limitations
17. Shaving of Countersunk Rivet Heads
18. Quality Control:
    a. Placement, Fitting and (absence of) Damages
    b. Measurements Upset head
    c. Flush Requirements
19. Solid Rivet Removal

Module 9 - Basic Aircraft Fasteners

In Module 9, you'll learn about basic aircraft fasteners. You'll understand the different fastening methods using various common fasteners and the tools needed for their installation. Through interactive discussions and live demonstrations, you'll see how to correctly install and remove these fasteners without damaging the hole. You'll also learn how to select the correct diameter and length of fasteners using grip gauges. Additionally, you'll cover how to conduct quality inspections on fastened joints and recognize signs of incorrect connections, even with limited access to the backside.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Understand the philosophy of fastening methods using various common fasteners;
- Demonstrate the correct installation of each type of fastener;
- Describe and demonstrate fastener removal without affecting hole integrity;
- Describe and demonstrate how to select the correct fastener diameter and length using grip gauges;
- Perform quality inspections on fastened joints;
- Recognize signs of incorrect connections with limited access to the backside.

Topics

1. Introduction
2. Permanent vs. Non-Permanent (Temporary) Fasteners
3. Fastener Call-Up and Designation
4. Fastener Symbols
5. Friction-Lock Self Plugging
    a. Use and Restriction
6. Mechanical-Lock Self Plugging
    a. Cherry Max
    b. Cherry Lock
7. Screws and Bolts and Nuts
    a. Removing Screws and Bolts with Reverse-Thread Taps and Extractors
    b. Torque Tightening and Safety Locking
8. Bolt/Nut Type Connection
    a. Hi-Lok
9. Length (Dash No.) Determination/Selection (Grip Gauges)
10. Hole requirements
11. Procedure for Fastener Hole Preparation
12. Anchor Nuts (Nutplates)
13. Wet Installation of Fasteners
14. Fastener Removal (of all discussed types)

Aircraft General Knowledge: Introduction to Aircraft Metallic Structures

In Module 10, you'll get an introduction to aircraft metallic structures. You'll learn about the build-up of an aircraft structure, the functions of various structural members, and the terminology used by different aircraft manufacturers. Through interactive discussions and live demonstrations, you'll also understand the different types of loads and stresses on structural members and how they influence aircraft and component design.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Understand the build-up of an aircraft structure and the function of various structural members;
- Use the terminology for structural members as used by different aircraft manufacturers;
- Explain the different types of loads and stresses that act on structural members and how these influence the design of aircraft and components;
- Classify structural components into primary and secondary structures;
- Identify and describe the purpose of key structural members such as skin, frames, and stringers.

Topics

1. Introduction
2. Structure Classification
    a. Primary- and Secondary Structure
3. Structure Breakdown (Build-up)
    a. ATA 52 through 57
4. Structural Members: Definition, Purpose and Identification
    a. Skin
    b. Frames
    c. Stringers


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Module 11 - Source Documentation *Part 1*

In Module 11, you'll learn about the key source documents used in aircraft structural maintenance and repair. You'll understand how aircraft blueprints are built, including picture sheets, parts lists, and engineering notes. Through interactive discussions and live demonstrations, you'll learn to interpret this information correctly. You'll also cover the purpose and use of the NAS512 rivet code. Additionally, you'll explore the Structural Repair Manual (SRM), learning how to navigate it quickly and accurately, even under time pressure, and how to handle "gray areas" responsibly.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Describe the two most important source documents used for aircraft structural maintenance and repair;
- Explain how aircraft blueprints are built, including the picture sheet, parts list, and engineering notes;
- Demonstrate correct interpretation of the information provided in blueprints;
- Explain the purpose of the NAS512 rivet code and demonstrate its correct usage;
- Explain the purpose of the SRM and the information it provides;
- Navigate the SRM to find accurate information quickly, even under time pressure;
- Be aware of how SRM information can be interpreted differently and handle "gray areas" responsibly.

Topics

1. Introduction
2. Drawings (blueprints)
    a. Blueprint System
    b. Picture Sheet
    c. Parts List
    d. Projection Methods
    e. NAS512 Rivet Code
    f. Tolerances
    g. Meaning and Purpose of Lines
3. Introduction to the Structural Repair Manual (SRM)

Module 12 - Standard Repair Principles

In Module 12, you'll learn about the standard repair principles essential to almost every type of aircraft metallic structure repair. Through interactive discussions and live demonstrations, you'll understand and demonstrate the correct and careful application of these principles. You'll also learn about the necessity and purpose behind each principle to ensure high-quality and reliable repairs.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Understand the essential principles that must be applied during aircraft metallic structure repairs;
- Demonstrate correct and careful compliance with all standard repair principles;
- Fully understand the necessity and purpose of standard repair principles;
- Apply general repair requirements effectively in various scenarios;
- Correctly use techniques related to fastener to edge distance, edge margin, fastener pitch distance, and hole pattern layout.

Topics

1. General Repair Requirements
2. (Fastener to) Edge distance
3. (Fastener to) Edge Margin
4. (Fastener) Pitch Distance
5. Hole Pattern Layout
6. Edge Chamfer
7. Cut-outs
    a. Radius
    b. Smoothness
8. Gap
9. Sealant Application

Module 13 - Structural Repair *Part 1*

In Module 13, you'll be introduced to the principles and procedures involved in structural repair within the context of aircraft maintenance. You'll gain foundational knowledge about identifying allowable and negligible damage, inspecting and removing damage, and repair techniques for minor damage. Through interactive discussions and live demonstrations, you'll also learn about part replacement, key structural repair definitions, miscellaneous metallic materials for repair, consumable materials, and the basic equipment and tools used in repair processes.

Learning Goals

Upon successful completion of this module, the student will be able to:

- Gain foundational knowledge of structural repair concepts within aircraft maintenance;
- Identify allowable and negligible damage on aircraft structures;
- Understand the procedures for inspecting and removing damage from aircraft structures;
- Learn and demonstrate repair techniques for minor damage, including repairing small dents, dressing out dents, ensuring aerodynamic smoothness, blending, rework, and removing scratches;
- Perform stop drilling of cracks;
- Understand the process of part replacement in structural repair;
- Identify and use miscellaneous metallic materials, consumable materials, and the basic equipment and tools required for structural repair.

Topics

1. Allowable Damage
2. Negligible Damage
3. Inspection and Removal of Damage
4. Repair of Minor Damage
    a. Repair of Small Dents
    b. Dress out of Dents
    c. Aerodynamic Smoothness
    d. Blending and Rework
5. Removal of Scratches
6. Stop Drilling of Cracks
7. Part Replacement
8. Structural Repair Definitions
9. Miscellaneous Metallic Materials for Repair
10. Consumable Materials
11. Equipment and Tools for Repair


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Module 14 - Practical Exercises

Manufacturing of Stringers, Frames, Brackets and Skin Plates
Participant will manufacture sheet metal parts in accordance with aircraft technical drawings (or blueprints) and will ensure that the products exactly meet the dimensions specified by the drawing, or within the applicable tolerances. Participant shall, among other things fabricate parts from aluminum sheet (by e.g. cutting, bending and rolling) and drill and countersink holes within, as well as the other operations and processes discussed in module 3 through 6.

Assembly of Manufactured Sheetmetal Parts
Participant will assembly (previous) manufactured sheetmetal parts by means of riveting with solid rivets and other commonly used fasteners (e.g. hi-lok, cherry max and bolt/anchor nuts). Participant needs, among other things take drilling- and fastening order into account, make use of the sufficient amount of clecos for temporary fastening and install countersunk- and protruding solid rivets and other types of fasteners as well as the other operations and processes discussed in module 7 through 9.

Removal of Nicks, Scratches and Gouges
Participants will engage in hands-on exercises focused on the removal of nicks, scratches, and gouges from aircraft surfaces. Through visual inspection and practical application, they will learn to identify and assess surface imperfections. Utilizing appropriate techniques and tools, participants will practice repairing damaged areas to improve the surface condition. Quality assessment and finishing will ensure that repaired surfaces meet required standards and blend seamlessly with the surrounding material.

Stop Drilling of Cracks
During this exercise, participants will learn techniques for halting the propagation of cracks in aircraft structures. Through hands-on practice and guidance, they will understand the importance of accurately identifying crack endpoints and determining appropriate drilling locations. Participants will use specialized equipment and procedures to drill stop holes at precise locations along the crack path, effectively arresting its progression. Emphasis will be placed on ensuring structural integrity and preventing further damage through meticulous drilling and inspection techniques.

Rework or Fill Allowable Dents
In this exercise, participants will gain proficiency in reworking or filling allowable dents on aircraft surfaces to restore structural integrity and aerodynamic efficiency. Through hands-on training, they will learn to assess dent severity and determine whether rework or filling is the appropriate corrective action. Participants will utilize specialized tools and materials to carefully reshape or fill dented areas, ensuring smooth surfaces and minimal disruption to airflow.

Repair of Lighting strike damage by solid rivet installment
Participants will learn the procedures for repairing lightning strike damage on aircraft structures using solid rivets. They will be trained to identify and assess lightning strike damage accurately, considering both visible and hidden effects.

(Non-Critical) Aerodynamic Surface Skin (external) Patch Repair (between stringers and frames, with solid rivets)
Participant will perform a patch repair on a skin according to structural repair manual. Participant shall, among other things, cut out the damaged part with careful precision, manufacture a patch, drill new holes- and copy existing rivet rows within. Participant shall consider the appropriate edge chamfer on the repair patch, as well as all the other standard repair principles as discussed in module 13. Participant will install the repair patch with protruding (head style) solid rivets, for as the skin is a non-critical aerodynamic surface.

Flush Repair of a Small Hole
Participants will be trained in the procedure for conducting a flush repair of a small hole in aircraft structures. Through practical exercises, participants will gain proficiency in removing damaged material, preparing the repair area, and fabricating and installing flush repair patches. Attention will be given to achieving a smooth and aerodynamically sound surface while ensuring structural integrity. Additionally, participants will understand the importance of meticulous finishing and post-repair inspections to verify the effectiveness and quality of the repair.

Module 15 – Assessment Criteria

- ✓ Order and Tidiness (as discussed in module 1);
- ✓ Sufficient knowledge of metallic materials (as discussed in module 2);
- ✓ Showing the ability and potential of forming and machining (including hole preparation) metallic parts to meet the requirements given by source documentation (as discussed in module 3 through 6);
- ✓ Correct assembly of sheetmetal parts (as discussed in module 7);
- ✓ Sufficient knowledge- and the ability and potential to install and remove all discussed fasteners (as discussed in module 8 and 9);
- ✓ Sufficient knowledge of aircraft metallic structures (as discussed in module 10);
- ✓ Showing the ability and potential of correct usage of discussed source documentation (as discussed in module 11);
- ✓ Correct Application of Standard Repair Principles (including repair preparation) (as discussed in module 13).

Module 16 - Examination

The written examination shall contain a minimum of 30 multiple choice questions.

LEVEL 1
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DETAILED COURSE OUTLINE ATS2131

AIRCRAFT METALLIC STRUCTURE: MANUFACTURING, ASSEMBLY, INSPECTION, DAMAGE ASSESSMENT AND REPAIR LEVEL 1