



AMT 2106 –AIRCRAFT MATERIALS CONSTRUCTION AND REPAIR II
(Composite)

PRELIM PERIOD

MODULE V

Composite Safety

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TABLE OF REFERENCES

REFERENCES	Ref no.
SAFETY MANAGEMENT SYSTEM RETRIEVED FROM https://www.skybrary.aero/index.php/Safety_Management_System	1
A&P Technician Airframe Textbook - Jeppesen	2
Fibre Glast Developments Corp.(2020) CITATION SAFETY IN COMPOSITE RETRIVED FROM https://www.fibreglast.com/product/safety-in-composites/Learning_Center	3
FAA System Safety Handbook, Chapter 3: Principles of System Safety December 30, 2000 RETRIVED FROM https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/risk_management/ss_handbook/media/Chap3_1200.pdf	4
Material safety data sheet retrieved from https://www.uregina.ca/hr/hsw/assets/docs/pdf/Laboratory-Safety/Material-Safety-Data-Sheet.pdf	5





Safety is always of the outmost importance around the aircraft. It is no different when working with composite materials . Even if there is no apparent danger, proper safety precautions must be observed at all times to prevent personal injury or aircraft damage.

This module briefly discusses the importance guidelines to be done to achieve safety working condition specifically in composite. This module also addresses the proper protections equipment to be used with specific activities, also the rules and regulations inside the laboratory .



TIMEFRAME

You should be able to complete this module including all the self-assessments, research works, assignments, and other performance tasks within **1.5 hours**.

LEARNING OUTCOMES

Course Learning Outcomes (CLO)

- CLO 2. Formulate effectively the techniques to conduct thorough, independent impartial and awareness regarding safety of an aircraft composite particularly in the composite laboratory or shops.
- CLO 5. Analyze the airworthiness standards and practice the basic policies, and procedures for the proper handling of composite materials and follow the basic procedure in specific methods; repair and assessments.
- CLO 6. Exercise and demonstrate the proper mixture of the resin to reinforcing material and practice its standard ratio, application of heat and pressure and handling of different tools and equipment
- CLO 9. Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria, methods and techniques.

Module Learning Outcome (MLO)

- MLO1. Demonstrate understanding of facts and ideas by comparing the different types of PPE with chemical and matrices and overview and importance of the MSDS.
- MLO 2. Exhibit the proper measurement of resin to fiber mixture ratio and proper handling and storage of the materials.
- MLO 3. Exhibit and demonstrate understanding the proper safety consideration while machining the composite.

Topic Learning Outcomes(TLO)

- TLO 10. Discussion understanding of facts and ideas by comparing the different types of PPE being used and overview and importance of the MSDS.
- TLO 11. Review of proper measurement of resin to fiber mixture ratio and proper handling and storage of the materials.
- TLO12. Discussion by demonstrate understanding the proper safety consideration while machining the composite.





MODULE V: COMPOSITE SAFETY

Safety is always important when working with composite materials. Many accidents have occurred because of the improper usage and handling of composite materials. Before working with any composite resin or solvent, it is important to know exactly what type of material you are using and exactly how to use it.

System safety is a specialty within system engineering that supports program risk management. It is the application of engineering and management principles, criteria and techniques to optimize safety. The goal of System Safety is to optimize safety by the identification of safety related risks, eliminating or controlling them by design and/or procedures, based on acceptable system safety precedence.

- ✓ **Safety management system (SMS)** is a systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures. (ICAO)
- ✓ **Safety Management System (SMS)** - A systematic and explicit approach defining the activities by which safety management is undertaken by an organisation in order to achieve acceptable or tolerable safety. (ESARR 3).

Safety planning and the implementation of safety management procedures are the next key steps in the processes designed to mitigate and contain risk in operations. Once these controls are ready, quality management techniques can be utilised to ensure that they achieve the intended objectives and, where they fail, to improve them. This is accomplished by deployment of safety assurance and evaluation processes which in turn provide for a continuous monitoring of operations and for identifying areas of safety improvement.

MATERIAL SAFETY DATA SHEETS (MSDS)

All manufacturers/suppliers of chemicals are required by law to produce an SDS which can be made available to you upon request at no charge. The SDS is a relatively standardized form which offers health and safety information about any particular chemical or material. SDS's are available for nearly all materials; not just those which are considered hazardous.

A The data sheet may be written, printed or otherwise expressed, and must meet the availability, design and content requirements of WHMIS legislation. The legislation provides for flexibility of design and wording but requires that a minimum number of categories of information be completed and that all hazardous ingredients meeting certain





criteria be listed subject to exemptions granted under the Hazardous Materials Information Review Act.

The MSDS contains the ff. informations on:

1. Health precautions
2. Flammability of the materials
3. Ventilation requirements
4. Health professionals in case of an accidents

The Purpose of the Data Sheet

The data sheet is the second element of the WHMIS information delivery system and is intended to supplement the alert information provided on labels. The third element of the system is the education of employees in hazard information on controlled products, including instruction in the content and significance of information on the MSDS.

Sections of the MSDS

- Section 1 – Nomenclature
- Section 2 – hazardous ingredients
- Section 3 – physical data
- Section 4 – fire and explosion data
- Section 5 – health hazard data
- Section 6 – reactivity data
- Section 7 – spill or leak procedures
- Section 8 – special protection information
- Section 9 – special precautions
- Section 10 – transportation and labeling

Note: The MSDSs may be made available on a computer if the employer takes all reasonable steps to keep the terminal in working order, makes the data sheets Readily available to the employee and provides training in accessing the computer stored data to the employee.





Material Safety Data Sheet Content (**SAMPLE ONLY**)

A supplier material safety data sheet must provide at least nine categories or sections of content and approximately sixty items of information distributed among those categories. An MSDS must be reviewed at least every three years.

The categories must have the following similar headings:

I. Hazardous Ingredients

This section will include:

- The chemical names and concentrations concerning the hazardous ingredients
- The LD 50 and LC50 indicate the short term toxic potential
- CAS number which is useful in locating more information especially if the product is known by numerous names

II. Preparation Information

This section includes:

- The name address and telephone number of who prepared the MSDS
- The date the MSDS was prepared . If more than three years old, it must be updated

III. Product Information

This section:

- Identifies the product by the name on the supplier label
- Provides the chemical name, family and formula (including molecular weight)
- Lists the product identifiers, manufacturer and supplier names, addresses and emergency telephone numbers

IV. Physical Data

This section includes information indicating how it looks and how it will behave when it is used, stored, spilled and how it will react with other products indicated through:

- The state it is in e.g. liquid
- The odor and appearance of the product
- The specific gravity, vapor density, evaporation rate, boiling point and the freezing point
- The vapor pressure, the higher the concentration the higher the possible air concentration
- The odor threshold, which is the lowest airborne concentration of a chemical that can be perceived by smell
- The pH reflecting the corrosive or irritant nature of the product





V. Fire and Explosion Hazard

This section describes:

- The temperature and conditions that can cause the chemical to catch fire or explode
- UEL (upper explosion limit) or UFL (upper flammable limit) will indicate the highest concentration of a substance in the air that will produce a fire or explosion when a source of ignition (heat, spark or flame) is present LEL (lower explosion limit) or LFL (lower flammable limit) will indicate the lowest concentration of a substance in the air that will produce a fire or explosion when a source or ignition is present
- From the LEL to the UEL, the mixture is explosive. Below the UEL the mixture is too lean to burn; above the LEL the mixture is too rich to burn. However, concentrations above the UEL are still very dangerous because if the concentration is lowered (by introducing fresh air), it will enter the explosive range
- Means of extinction including the type of fire extinguisher required
- Personal Protective Equipment required for fire fighting
- Some of the storage requirements however more of this information is found in the reactivity data section

VI. Reactivity Data:

This section describes:

- The chemical stability of the product and its reactions to light, heat, moisture,
- shock and incompatible materials
- Storage requirements based on the reactivity or instability of the product
- Incompatible products that must not be mixed or stored near each other
- The need for disposal before they become extremely reactive

VII. Toxicology Properties:

This section describes:

- The harmful effects of exposure
 - How the product is likely to enter the body and what effects it has on the organs in the body
 - The short-term (acute) and long-term (chronic) health effects from exposure to the product
 - The exposure limits, which indicates the maximum concentration in air of a hazardous substance (gas, vapour, dust, mist, fume) to which nearly all workers (without personal protective equipment) can be repeatedly exposed without adverse health effects. Exposure limits are expressed in three ways:
- ✓ TWA (time weighted average) indicating the maximum average concentration to which workers can safely be exposed for a normal 8- hour workday or 48-hour workweek





- ✓ STEL (short-term exposure limit) indicating the maximum concentration to which workers can safely be exposed for a period of up to 15 minutes. The STEL is higher than the TWA. It may not be sustained more than four times a day
- ✓ C (ceiling) describes the concentration that may not be safely exceeded at any time, even for an instant. The C is higher than the STEL
 - If these limits are to be exceeded, the worker must use recommended
 - personal protective equipment. Exposure limits are expressed as ppm for
 - gases and vapours and as mg/m³
 - for dusts, fumes and mists
 - Note these limits may be expressed as OEL, PEL and TLV
 - Information used to assess the health problems of any employee who uses
 - the chemical and determine if that worker's problems are related to the chemical

VIII. Preventative Measures:

This section provides:

- Instruction for the safe use, handling and storage of the product
- The personal protective equipment or safety devices required
- The steps for cleaning up spills
- Information on the waste disposal requirements

IX. First Aid Measures:

This section describes:

- Specific first aid measures related to acute effects of exposure to the product
- First aid steps in the correct sequence
- Information to assist in planning for emergencies

The MSDS may contain additional sections providing further information related to the specific product.

Location of the MSDSs

- Hard copy readily available
- Computer terminals
- Employees and others must know where the MSDS is and how to use them

MSDS revisions are required every 3 years or sooner if new product information is available.

Trade Secret Exemptions

Information may be withheld to protect industries' right to protect confidential business information. This information is referred to as trade secrets.





The producer of the product can withhold:

- The name and concentration of any ingredient
- Name of relevant toxicological studies.

Once a claim is filed to withhold information the product label must state:

- Date the exemption filed
- Claim registration number

The MSDS must state:

- That an exemption has been granted
- Date it is granted
- Registry number
- Product hazards

Medical Access

Doctors and nurses can access withheld information however this information remains confidential.

Note: to maintain the highest level of the safety in the shop, you must know where your company keeps the MSDSs. If something should happen to you while working with hazardous chemicals it is important that you take the MSDS to the doctor with you. A doctor cannot be expected to know every chemical, so if you bring an MSDS with you, the doctor can treat you appropriately, and it may cause, quicker.

Mastery Check

Self-Assessment: Before we proceed with our discussion, let's check how well you have understood the discussion so far. Using the table below, try to compare and contrast the following terminologies: **Time frame: 10-15 mins . pls. refer to the last page the criteria for grading .**

1. What do you think safety is very important especially with this kind of specialized skills.





PERSONAL SAFETY WITH CHEMICALS AND MATRICES

SKIN PROTECTIONS

Protective gloves are produced from many types of material. Make sure you review the MSDS to find out what materials do not react with the composite materials you are using. For example, natural rubber gloves disintegrate when exposed to certain types of epoxy resins. In any case, do not reuse; replace safety gloves after heavy use.



Certain materials can cause allergic reactions when they contact the skin. Some people are more sensitive to these materials than others.

- Rubber gloves
- Shop coats



Note: always wash your hands before using the restroom. Many of the chemicals are potential carcinogens and may cause serious irritations and possible cancers NOT ONLY FOR THE TECHNICIAN, BUT ALSO WITH YOUR SEX PARTNER.

REPIRATORY AND INGESTIONS

Always work in well-ventilated areas when working with resins or solvents. Some resins are toxic enough to cause difficulty breathing and, in some cases, severe allergic reactions. Wear a respirator when working with, mixing, and applying resins, solvents or any other hazardous chemical, and keep contaminated hands away from your mouth. Do not ever ingest any composite chemical, because some are fatally poisonou



You must have the proper ventilation when working with any resin and solvents. Additionally, some resins are sufficiently toxic as to require you to wear protections when working with them.

- Respirator
- Mask

Note: keep contaminated gloves, clothing or material away from your mouth. Some of the composite materials are very toxic and have NO ANTIDOTE. If you drink them, you are good as dead.

EYE AND FACE PROTECTION

Again, it is important to review and be familiar with MSDS information on each type of material you work with in the shop. Some composite materials can cause severe eye irritation and/or permanent blindness. In addition, plastic contact lenses may craze from resin fumes. Therefore, it is recommended to wear only glasses, not contact lenses, when working with resins. In all events, safety goggles are required to reduce the chance of eye injury. **Goggles** provide eye protection from front and side impact hazards, chemical splashes, and dust. **Face shields** also provide protection when working with resins. However, do not wear face shields that pull down over the face when working at an up-draft table. Up-draft tables draw fumes up through an exhaust vent. Face shields that pull down over the face trap





fumes and may cause respiratory problems. Face shield-respirator combinations that open at the forehead do not trap up-draft fume.



Some of the solvents and matrices components can cause permanent blindness within a few seconds after contact with the eye.

- Goggles
- Face shield

Note

➤ **if you accidentally splash any solvent or resin into your eyes, the following actions must be done.**

- Rinse the eyes out immediately
- Report the accident to your supervisor
- Seek medical help.

SOLVENT: USAGE AND SAFETY

There are many types of solvents used in composite construction today. Solvents are mainly used for cleaning purposes in composite construction. However, most solvents are flammable and must be used with the highest degree of safety in mind. Methyl-Ethyl-Keystone (MEK) and acetone are two common solvents used in composite construction.

Many types of solvent are used when working with or repairing composites. Some of the most common solvents with the composites includes:

- ✚ **METHYL-ETHYL KEYTONE (MEK)** – used for cleaning dust, grease, and mold grease agents from composite components
- ✚ **ACETONE** – Used for general Cleanup of tools and equipment and used as a prebond prep to clean the composite parts after sanding.

MEK is mainly used for cleaning dust, grease, and mold release agents from composite components. Always use protective gloves and goggles when using it. MEK is an excellent cleaner but also a carcinogen. It can be absorbed directly into the bloodstream through





the skin and the eyes. Acetone is used for general equipment and tool cleanup, in addition to cleaning the composite parts after sanding as a pre-bond preparation. Follow the manufacturer's recommendations when choosing the proper solvent.

These safety guidelines should be followed with all the solvents and matrices:

- ✚ All solvents are flammable so there is strictly no smoking policy in effect when solvents are in use.
- ✚ Use solvents neatly. Do not pour any solvents directly on the part. A soft cloth moisten with the solvent is usually adequate.
- ✚ Used solvents in a well-ventilated area and avoid pro-longed breathing of the vapor
- ✚ Wear gloves when applying solvents to protect the skin from drying out.
- ✚ Never use solvents to clean skin. These are more suitable epoxy cleaners that are less dangerous to your health.
- ✚ Wear goggles when pouring solvents.
- ✚ Solvents should be kept in the original containers

USED & STORAGE OF MATRIX MATERIALS

For safety, read and follow the manufacturer's instructions closely when handling the storing composite materials. Read the labels on containers for all information's on handling, storage, and safety precautions. Improperly storage adhesives, resins or pre-preg may result in structurally unsafe aircraft component.

- ✚ Follow the manufacturer's instructions for mixing components.
- ✚ Always store the matrix material properly
- ✚ Keep records on refrigerated storage to ensure materials that are placed first-in and the first out for use.
- ✚ Keep refrigerated materials sealed to prevent entry of moisture
- ✚ Record accumulated time –out of the refrigerated storage
- ✚ Allow components to warm to room temperature before weighing and mixing.
- ✚ Discard all materials that exceed their storage life.
- ✚ Handle materials with gloves to maintain cleanliness
- ✚ Never used brushes contaminated with another type of resin
- ✚ Store dry fabric ad bagging materials in a clean, drea area.
- ✚ Do not allow protective hand creams to come in contact with the resins and bond lines.
- ✚ Do not remove the backing on pre-preg material until the material is used





- ✚ Store honeycomb and foams in their original packing boxes
- ✚ Clean rooms are not required for making composite repairs, however it is nice if you have a separate area for sanding and one for laying up the patches.

PERSONAL SAFETY WHILE MACHINING

While sanding, drilling or trimming composite structure, very fine dust particles contaminate the air. To help alleviate health risks, respirator must be worn. A dust collector or downdraft table also is very desirable to use while sanding because they pull the fine particles out the air.

To minimize the possibility of particles entering the pores of the skin, wear protective clothing that doesn't have loose fitting sleeves. After working with the composite, take a shower at the end of the day to flush particles from the skin and hair.

Reminders to all

SCHEDULE OF EXAM :

MODE OF EXAMINATION :

POINTERS TO REVIEW :





Rubrics for Self- Assessment

These basic rubric examples ensure that all parts of the activity are present. They help students keep track of each element of activity. Checklists also let teachers see whether a student fully participated in activity.

CRITERIA	INADEQUATE (Below Standard) 65%-74%	ADEQUATE (Meets Standard) 75%-84%	ABOVE AVERAGE (Exceeds Standard) 85%-92%	EXEMPLARY (Far Exceeds Standard) 93%-100%	SCORE
Organization	Writing lacks logical organization. It shows some coherence but ideas lack unity. Serious errors.	Writing is coherent and logically organized. Some points remain misplaced and stray from the topic. Transitions evident but not used throughout essay.	Writing is coherent and logically organized with transitions used between ideas and paragraphs to create coherence. Overall unity of ideas is present.	Writing shows high degree of attention to logic and reasoning of points. Unity clearly leads the reader to the conclusion and stirs thought regarding the topic.	
Level of Content	Shows some thinking and reasoning but most ideas are underdeveloped and unoriginal.	Content indicates thinking and reasoning applied with original thought on a few ideas.	Content indicates original thinking and develops ideas with sufficient and firm evidence.	Content indicates synthesis of ideas, in-depth analysis and evidences original thought and support for the topic.	
Development	Main points lack detailed development. Ideas are vague with little evidence of critical thinking.	Main points are present with limited detail and development. Some critical thinking is present.	Main points well developed with quality supporting details and quantity. Critical thinking is weaved into points.	Main points well developed with high quality and quantity support. Reveals high degree of critical thinking.	
Grammar & Mechanics	Spelling, punctuation, and grammatical errors create distraction, making reading difficult; fragments, comma splices, run-ons evident. Errors are frequent.	Most spelling, punctuation, and grammar are correct allowing reader to progress the essay. Some errors remain	Essay has few spelling, punctuation, and grammatical errors allowing reader to follow ideas clearly. Very few fragments or run-ons.	Essay is free of distracting spelling, punctuation, and grammatical errors; absent of fragments, comma splices, and run-ons.	





HONESTY CLAUSE

My signature below constitutes my pledge that all of my writing is my own work, with the exceptions of those portions which are properly documented

SHEILA MAY D. MOTOS, MEAM
Subject Instructor

Student Signature

Parent Signature

