CHAPTER 15

PO 270 – DISCUSS AIRCRAFT MANUFACTURING AND MAINTENANCE

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 1

EO M270.01 – IDENTIFY ASPECTS OF AIRCRAFT MANUFACTURING

Total Time: 60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/PG-001, Chapter 4. Specific uses for said resources are identified throughout the Instructional Guide within the TP for which they are required.

Review the lesson content and become familiar with the material prior to delivering the lesson.

Photocopy career information sheets located at Annex A for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TP2 to orient the cadets to the topic, to generate interest, to introduce aircraft manufacturing and to give an overview of it.

A group discussion method was chosen for TP3 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about aircraft manufacturing.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify aspects of aircraft manufacturing.

IMPORTANCE

It is important for cadets to learn about the aircraft manufacturing industry to gain an awareness of the aircraft systems, materials and careers in the industry. Developing an interest in aircraft manufacturing may lead to future opportunities in the Air Cadet Program and aircraft manufacturing.

Teaching Point 1 **Identify Aircraft Systems**

Time: 15 min Method: Interactive Lecture

When assembling an aircraft, there are multiple aircraft systems included that are manufactured for the aircraft. The following are just a few aircraft systems and components that are manufactured to be used in assembling aircraft.

AIRCRAFT INSTRUMENT SYSTEMS

The development of efficient flight instruments is one of the most important factors that contributed to the growth of the present air transportation system. Prior to World War II, few airplanes were equipped for flight without using ground reference navigation or pilotage.

Aircraft instrument systems include flight instruments that depict the attitude, airspeed, and altitude of the aircraft, making up the aircraft instrument systems. Other instruments provide information such as engine operational parameters and electrical system performance. Other components manufactured to support these systems include electrical wiring and fluid-line plumbing.

Integrated circuits, containing microprocessors and other digital electronics, have revolutionized flight instrumentation and control systems. New generation flight instruments show textual and analog information on brightly coloured displays.

AIRFRAME ELECTRICAL SYSTEMS

These systems generate and route electricity to various aircraft components such as generators, motors and inverters. There are many manufacturers of these components that make up the airframe electrical systems. Because of the expense of the tools, test equipment and current technical publications, component manufacturers or certified repair stations service many of the electrical components.

HYDRAULIC AND PNEUMATIC POWER SYSTEMS

Early aircraft were equipped with flight controls and systems that were connected directly to the cockpit controls. As aircraft became more complex, it became necessary to operate systems remotely and the first of these was the brake system. Instead of cables or pushrods operating the brakes, hydraulic pressure was used to solve routing problems and multiple forces on the braking surfaces. While small aircraft continue to use cables or pushrods for operating flight controls, aircraft manufacturers equip larger aircraft with hydraulic or pneumatic control systems for their primary system.

AIRCRAFT LANDING GEAR SYSTEMS

The landing gear of the very first airplanes was not very complex. The Wright Flyer, for instance, took off from a rail and landed on skids. However, soon after the basic problems of flight were solved, attention was turned to providing better control and stability of the aircraft while it was operated on the ground. Retraction systems, shock absorbing and non-shock absorbing systems, aircraft wheels, nose wheel steering systems and aircraft brakes are some of the other components involved in manufacturing the landing gear.

AIRCRAFT FUEL SYSTEMS

Aircraft fuel systems vary in complexity from the extremely simple systems found in small, single-engine aircraft to the complex systems in large jet transports. Regardless of the type of aircraft, all fuel systems share many of the same common components. Every system has one or more fuel tanks, tubing to carry the fuel from the tank(s) to the engine(s), valves to control the flow of fuel, provisions for trapping water and contaminants and a method for indicating the fuel quantity.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. List the aircraft systems manufactured to be used in assembling an aircraft.

Q2. What do aircraft manufacturers equip larger aircraft with for their control systems?

Q3. What are some of the other components involved in manufacturing landing gear?

ANTICIPATED ANSWERS

A1. The aircraft systems are:

- aircraft instrument systems,
- airframe electrical systems,
- hydraulic and pneumatic systems,
- aircraft landing gear systems, and
- aircraft fuel systems.

A2. Aircraft manufacturers equip larger aircraft with hydraulic or pneumatic control systems for their primary control systems.

A3. Retraction systems, shock absorbing and non-shock absorbing systems, aircraft wheels, nose wheel steering systems and aircraft brakes are some of the other components involved in manufacturing landing gear.

Teaching Point 2 **Identify the Materials Used in Aircraft Manufacturing**

Time: 15 min Method: Interactive Lecture

The techniques and materials used in the early years of aviation were quite primitive by modern standards. The Wright brothers' "Flyer," for example, was made from steel, wire, cable, silk and wood. However, as aircraft development advanced, a breakthrough occurred in the aircraft aluminum industry. Metallurgists found that mixing, or alloying aluminum with other metals resulted in a much stronger material. In fact, alloying increased the tensile strength of pure aluminum from about 13 000 pounds per square inch (psi) to a tensile strength of 65 000 psi or greater, which is equivalent to structural steel. As the need for aluminum alloys grew, manufacturers continued to refine them to produce materials with better corrosion resistance and greater strength.

Today, military aircraft are constructed of about 65 percent aluminum and 35 percent of other alloys, including titanium, inconel, silver and nickel. Civilian aircraft are approximately 80 percent aluminum alloy and 20 percent other alloys.

Today, military aircraft are constructed of about 65 percent aluminum and 35 percent of other alloys, including titanium, inconel, silver and nickel. Civilian aircraft are approximately 80 percent aluminum alloy and 20 percent other alloys.

NON-FERROUS METALS

Much of the metal used on today's aircraft contains no iron. The term that describes metals which have elements other than iron as their base is non-ferrous. Aluminum, titanium, nickel and copper are some of the more common non-ferrous metals used in aircraft manufacturing and repair.

Aluminum and Its Alloys. Pure aluminum lacks sufficient strength to be used for aircraft construction. However, its strength increases considerably when it is alloyed, or mixed with other compatible metals (e.g. when aluminum is mixed with copper or zinc, the resultant alloy is as strong as steel with only one third the weight).

Titanium. Titanium and its alloys are lightweight metals with very high strength. Pure titanium weighs 0.163 pounds per cubic inch (4.5 g/cm^3), which is about 50 percent lighter than stainless steel, yet it is approximately equal in strength to iron. Furthermore, pure titanium is soft and ductile with a density between that of aluminum and iron.

Nickel. Aircraft technicians need to be familiar with two nickel alloys. They are monel and inconel.

- **Monel.** Monel contains about 68 percent nickel and 29 percent copper, along with small amounts of iron and manganese. Monel works well in gears and parts that require high strength and toughness, as well as for parts in exhaust systems that require high strength and corrosion resistance at elevated temperatures.
- **Inconel.** Inconel contains about 80 percent nickel and 14 percent chromium, and small amounts of iron and other elements. Inconel is frequently used in turbine engines because of their ability to maintain their strength and corrosion resistance under extremely high temperatures.

Copper. Neither copper nor its alloys find much use as structural materials in aircraft construction. However, due to its excellent electrical and thermal conductivity, copper is the primary metal used for electrical wiring.

COMPOSITE FIBRES

Graphite, Kevlar and fibreglass are composite materials used to form various types of aircraft structures.

Graphite Fibres. Graphite fibres are manufactured by heating and stretching rayon fibres. This produces a change in the fibres' molecular structure that makes it extremely lightweight, strong, and tough.

Kevlar Fibre. Kevlar fibre is one of the most commonly used cloth-reinforcing fabrics. In its cloth form, Kevlar is a soft yellow organic fibre that is extremely light, strong and tough. Its great impact resistance makes it useful in areas where damage from sand or other debris can occur. These areas include around landing gear and behind propellers. Kevlar is rather difficult to work with however, and does not perform well under compressive loads.

Glass Fibre/Fibreglass. Fibreglass greatly enhances the strength and durability of thermosetting resin, which is a material that hardens when heated. For high strength requirements, the glass fibres are woven into a cloth. On the other hand, where cost is of greater importance than strength, the fibres are gathered into a loose mat which is saturated with resin and moulded into a desired shape.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What was the breakthrough that occurred in the aircraft aluminium industry?

Q2. Name four non-ferrous metals.

Q3. What are some of the more common non-ferrous metals used in aircraft manufacturing and repair?

ANTICIPATED ANSWERS

A1. Metallurgists found that mixing, or alloying aluminum with other metals resulted in a much stronger material.

A2. Four non-ferrous metals are:

- aluminum and its alloys,
- titanium,
- nickel, and
- copper.

A3. Aluminum, titanium, nickel and copper are some of the more common non-ferrous metals used in aircraft manufacturing and repair.

Teaching Point 3 **Discuss Careers Within the Aircraft Manufacturing Industry**

Time: 20 min Method: Group Discussion

Distribute Career Information Sheets located at Annex A to the cadets.

BACKGROUND KNOWLEDGE

The following careers are available in the aircraft manufacturing industry:

AIRCRAFT INTERIOR TECHNICIAN

An aircraft interior technician's primary responsibilities include the removal, disassembly, cleaning, inspection, repair and re-installation of aircraft cabin furnishings. The technicians work both in an aircraft cabin and in a shop, and are familiar with the function, operation and safety requirements of aircraft passenger support systems. They maintain oxygen, water, waste, entertainment, and emergency systems and equipment. In addition, they refurbish seats, seat belts, carpets, interior panelling, windows, and galley and washroom modules. Their duties often overlap with those of other aviation technicians, such as aircraft maintenance engineers.

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "E" (AVIONICS)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) – Category "E" license. Aircraft avionics technicians are responsible for the servicing, repair and modification of aircraft electronic systems and components. The job includes removing and installing components, bench testing and troubleshooting complex electronic aircraft systems. Today's aircraft can be quite sophisticated with "fly by wire," auto flight, global positioning, satellite navigation, in-flight entertainment, and automatic communication and receiving systems.

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "M" (MAINTENANCE)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) – Category "M" license. AMEs are responsible for the release (certification) of an aeronautical product (aircraft), after maintenance or inspection. The job responsibilities include a variety of tasks including removing and installing components and troubleshooting complex systems. A qualified AME is able to maintain small aircraft, helicopters, and large transport category aircraft. Larger aircraft are quite sophisticated as they possess many different electrical, electronic, pneumatic, hydraulic, mechanical and propulsion systems, and the AME must understand and maintain them.

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "S" (STRUCTURES)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) – Category "S" license. Category "S" structures technicians are responsible for the assessment, planning and implementation of aircraft structural fabrication and repairs. Structures technicians are often an integral part of repair crews including maintenance technicians, avionics technicians and professional engineers. They are expected to precisely follow aircraft fabrication and repair schemes for aluminium, titanium and stainless steel structures, as well as plastics and composites.

AIRCRAFT MECHANICAL COMPONENT TECHNICIAN

Aircraft mechanical component technicians are involved in the overhaul, repair, modification, inspection, testing and certification of aviation components of pneumatic, hydraulic, fuel, electrical, environmental and mechanical aircraft systems. Working in a shop environment, technicians are thoroughly familiar with the set-up and operation of tools and shop equipment as well as some semi-automatic processes. Possessing a high degree of manual dexterity, and a strong interest in mechanics, they work cooperatively with others and are able to follow directions precisely.

AIRCRAFT GAS TURBINE TECHNICIAN

Aircraft Gas turbine technicians enjoy a challenging occupation requiring a high degree of responsibility and skill. Technicians perform the disassembly, inspection, repair, assembly and testing of gas turbine engines in a clean shop environment with regular working hours. Qualified technicians experience many opportunities for advanced training and continued career satisfaction.

The point of the group discussion is to discuss careers within the aircraft manufacturing industry using the tips for answering/facilitating discussion and the suggested questions provided.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. Share with the class three pieces of interesting information that you did not know about careers in the aircraft manufacturing industry.

Q2. Why did you find this information interesting?

Q3. What was the most interesting career to you?

Q4. What are the primary responsibilities of the career that you found most interesting?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 3

The cadets' participation in the group discussion will serve as the confirmation of this TP.

END OF LESSON CONFIRMATION

The cadets' participation in the discussion on careers in the aircraft manufacturing industry will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Learning about the aircraft manufacturing industry will help the cadet gain an awareness of the aircraft systems, materials and careers in the industry. This new knowledge will help develop the cadets' interest in aircraft manufacturing and may lead to future opportunities in the Air Cadet Program and the aircraft manufacturing industry.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-107 British Columbia Institute of Technology. (2007). *Programs and Courses.* Retrieved 8 February 2007, from http://www.bcit.ca/study/programs/

C3-108 (ISBN 0-88487-203-3) Jeppesen Sanderson Training Products. (2000). *A&P Technician: General.* Englewood, CO: Jeppesen Sanderson Inc.

C3-109 (ISBN 1-894777-00-X) Canadian Aviation Maintenance Council (CAMC). (2002). *Aviation Maintenance Orientation Program.* Ottawa, ON: CAMC.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 2

EO M270.02 – IDENTIFY REQUIREMENTS FOR AIRCRAFT MAINTENANCE

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/PG-001, Chapter 4. Specific uses for said resources are identified throughout the Instructional Guide within the TP for which they are required.

Review the lesson content and become familiar with the material prior to delivering the lesson.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to orient the cadets to aircraft maintenance, generate an interest and present basic material.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify requirements for aircraft maintenance.

IMPORTANCE

It is important for cadets to identify the different components and aircraft systems for which maintenance technicians are responsible for the upkeep of the aircraft. Identifying the requirements of aircraft maintenance may stimulate an interest in the subject and this may lead to future aircraft maintenance course opportunities within the Air Cadet Program.

Teaching Point 1 **Introduce Aircraft Maintenance**

Time: 10 min Method: Interactive Lecture

AIRCRAFT MAINTENANCE

In air operations, maintenance, overhaul, and repair are ongoing duties performed to maintain the performance and safety of the aircraft. In air operations, maintenance, overhaul and repair are defined as follows:

Maintenance. Continuing repair work; work that is done regularly to keep a machine, building, or piece of equipment in good condition and working order.

Overhaul. Checking for mechanical faults; to examine a piece of machinery thoroughly to identify faults and improve or repair as necessary.

Repair. Fixing or mending something; to restore something broken or damaged to good condition.

AIRCRAFT INSTRUMENT SYSTEMS

Maintenance technicians must be familiar with the various types of instruments used to convey information to the pilot. Some are flight instruments that depict the attitude, airspeed, and altitude of the aircraft. Other instruments provide information such as engine operational parameters and electrical system performance.

The aircraft instrument systems group includes mechanics and technicians who install, adjust, repair and overhaul aircraft instruments and electrical or avionics systems on aircraft. This group also includes avionics inspectors who inspect instrument, electrical and avionics systems following assembly, modification, repair or overhaul. Workers in this group are employed by aircraft manufacturing, maintenance, repair and overhaul establishments and by airlines, the Canadian Forces and other aircraft operators.

AIRFRAME ELECTRICAL SYSTEMS

An aviation maintenance technician must be familiar with aircraft electrical systems, including ways in which electricity is generated and routed to various aircraft components. By understanding the principles of electricity and electrical system designs, a technician can effectively diagnose, isolate and repair malfunctions.

HYDRAULIC AND PNEUMATIC POWER SYSTEMS

Work performed by liquids is called ‘hydraulic’ whereas work performed by air is called “pneumatic”. Today’s aviation maintenance technician must be familiar with the principles of hydraulic and pneumatic systems as well as how the different aircraft systems utilize these principles.

AIRCRAFT LANDING GEAR SYSTEMS

The landing gear of the very first airplanes was not very complex. The Wright Flyer, for instance, took off from a rail and landed on skids. However, soon after the basic problems of flight were solved, attention was turned to providing better control and stability of the aircraft while it was operated on the ground. Bicycle and motorcycle designs were first used, which in turn, gave way to specially designed landing gear and wheels that absorbed the extreme loads imparted during takeoffs and landings. In addition, braking systems were installed to provide safer and more efficient control of slowing an airplane after landing.

In later years, as aircraft designs improved to increase speed and efficiency, retraction systems were provided to allow the landing gear to be stowed during flight to reduce aerodynamic loads or drag. With continued improvements in technology, landing gear systems on modern aircraft are highly reliable and capable of handling extreme conditions, enabling safe transitions between flight and ground mobility.

The industry regulation requires the strictest performance of scheduled maintenance, repairs, and overhauls on aircraft landing gear systems.

AIRCRAFT FUEL SYSTEMS

Modern aircraft fuel is generally stored in the wings, and on ultra-long-range jetliners, extra fuel storage is located in the tail area. Volatile fuels are crucial to the performance of fuel systems in modern aircraft. Although the fuel systems are relatively simple, the safety and reliability of these systems is dependent on proper inspection and maintenance.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Define maintenance.

Q2. What systems were installed, in addition to the landing gear, to provide safer and more efficient control of slowing an airplane after landing?

Q3. What are the safety and reliability of fuel systems dependent on?

ANTICIPATED ANSWERS

A1. Maintenance is defined as continuing repair work; work that is done regularly to keep a machine, building, or piece of equipment in good condition and working order.

A2. Braking systems were installed to provide safer and more efficient control of slowing an airplane after landing.

A3. The safety and reliability of fuel systems are dependent on proper inspection and maintenance.

Teaching Point 2 **Discuss the Maintenance of Aircraft Instruments**

Time: 20 min Method: Interactive Lecture

Maintenance technicians must be familiar with various types of instruments used to convey information to the pilot. Some are flight instruments that depict the attitude, airspeed, and altitude of the aircraft. Other instruments provide information such as engine operational parameter and electrical system performance. Maintenance technicians must maintain the components that support the instruments, such as electrical wiring and fluid-line plumbing.

The following aircraft systems are maintained by aircraft maintenance technicians:

Altimeter. An altimeter is simply a barometer that measures the absolute pressure of the air. This pressure is caused by the weight of the air above the instrument. As an aircraft climbs, there is less atmosphere above the aircraft and the absolute pressure decreases. The instrument is calibrated to indicate higher altitude with decreased pressure and is usually referenced to sea level. The altimeter is one of the most important instruments used on an aircraft especially when the aircraft is operated in instrument meteorological conditions. Regulations require that the altimeter system be tested and inspected by the aircraft manufacturer or a certified and approved repair station.

"Google Images", Willkommen, Altimeter. Retrieved 23 April 2007, from www.lspl.ch/Images/Pictures/Altimeter.jpg

Figure 15-2-1 Altimeter

Air Speed Indicator. An air speed indicator is a differential pressure gauge that measures the difference between the pitot, or ram air pressure, and the static, or ambient air pressure. It consists of an airtight case that is vented to the static source. The diaphragm is also mechanically linked to a pointer on the instrument face, which indicates air speed.

"Google Images", Global Aviation, Air Speed Indicator. Retrieved 23 April 2007, from www.globalav.com.au/uma_flight_instruments.html

Figure 15-2-2 Air Speed Indicator

Gyroscope. Gyroscopes or gyros, have made it possible to fly an aircraft more precisely without an outside visual reference. A gyro is simply a rotating mass similar to a child's toy top. In most general aviation airplanes, there are three gyro instruments: the heading indicator, the attitude indicator and the turn and slip indicator.

"Google Images", Murphy Design, Gyroscope. Retrieved 23 April 2007, from www.cmurphydesign.com/images/gyroscope.jpg

Figure 15-2-3 Gyroscope

Heading Indicator (Directional Gyro). The heading indicator is an instrument designed to indicate the heading of the airplane and, because it is steady and accurate, to enable the pilot to steer that heading with the least effort.

"Google Images", Sea Gull, Heading Indicator. Retrieved 23 April 2007, from www.sgsim.com/instruments/DSCN7513-gyro-200.jpg

Figure 15-2-4 Heading Indicator

Attitude Indicator (Artificial Horizon/Gyro Horizon). The attitude indicator provides the pilot with an artificial horizon as a means of reference when the natural horizon cannot be seen because of clouds, fog, rain or other obstructions to visibility. It shows the pilot the relationship between the wings and nose of the airplane and the horizon of the Earth.

"Google Images", F-16C Reference Library, Attitude Indicator. Retrieved 23 April 2007, from www.xflight.de/f16/original/parts/center_console/adi/adi.gif

Figure 15-2-5 Attitude Indicator

Vertical Speed Indicator (VSI). The rate of climb or descent indicator, more properly called a vertical speed indicator (VSI), helps a pilot establish the rate of climb or descent, to allow arrival at a specified altitude at a given time. The VSI also backs up other instruments, such as the altimeter, by providing early indication of changes in pitch.

"Google Images", MSA, Vertical Speed Indicator. Retrieved 23 April 2007, from www.microlightsport.co.uk/Catalogue/Instruments/Instruments_List/VSI_vs2K.jpg

Figure 15-2-6 Vertical Speed Indicator

Radar Altimeter (Radio Altimeter). Displays the aircraft's altitude as measured by a radio signal, instead of by atmospheric pressure. It sends a high-frequency signal toward the ground, which is reflected back to the aircraft's radio altimeter receiver. Typically, this instrument is used at altitudes within 2500 feet of the ground, and provides a digital display of the aircraft's absolute altitude above ground level (AGL).

"Google Images", Willkommen, Altimeter. Retrieved 23 April 2007, from http://us.st11.yimg.com/us.st.yimg.com/I/yhst-10237233231589_1940_15587562

Figure 15-2-7 Radar Altimeter

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is one of the most important instruments used on an aircraft?

Q2. Where do regulations state an altimeter must be tested and inspected?

Q3. What shows the pilot the relationship between the wings and nose of the airplane and the horizon of the Earth?

ANTICIPATED ANSWERS

A1. The altimeter is one of the most important instruments used on an aircraft.

A2. Regulations require that the altimeter system be tested and inspected by the aircraft manufacturer or a certified and approved repair station.

A3. Attitude indicator (artificial horizon/gyro horizon) shows the pilot the relationship between the wings and nose of the airplane and the horizon of the Earth.

Teaching Point 3 **Discuss Landing Gear Maintenance**

Time: 20 min Method: Interactive Lecture

The function of the landing gear is to take the shock of landing and also to support the weight of the airplane and enable it to manoeuvre on the ground. The earliest type of main landing gear was a through axle, similar to the wheel and axle arrangement on a cart or wagon. This is now completely obsolete, having been replaced with more sophisticated, shock absorbing landing gear systems.

Landing gear systems require maintenance technicians to test hydraulic and pneumatic systems and components made up of diverse materials that make up the landing gear of an aircraft.

TYPES OF LANDING GEAR

Fixed Undercarriage. On land airplanes, there are two basic classes of a fixed gear undercarriage: a main gear with a nose wheel, commonly called a tricycle gear, and a main gear with a tail wheel. There are several types of undercarriages in use for the main gear. These are used with both the tail wheel and the tricycle gear configuration.

"Google Images", ByDanJohnson.com, Fixed Landing Gear. Retrieved 23 April 2007, from http://www.bydanjohnson.com/picture0.cfm?330_5

Figure 15-2-8 Fixed Landing Gear

Slower aircraft lose little efficiency by using the lighter-weight fixed landing gear. The fixed landing gear decreases drag markedly by enclosing the wheels in streamlined fairings, called wheel pants. Many light airplanes utilize fixed landing gear that consists of spring or tubular steel landing gear legs with small frontal areas that produce minimum drag.

Retractable Landing Gear. Retractable landing gear is made to retract or fold up into the wing or fuselage in flight. The mechanical means and methods for accomplishing this are varied. The wheel may fold sideways, outward toward the wing or inward toward the fuselage. The latter is most common on high speed military airplanes when the wing camber is shallow. On some multi-engine airplanes, the wheels fold straight back or forward into the nacelle and is left partly projecting in order to protect the belly of the ship in the case of a wheels-up landing. Some retractable undercarriages are made to turn through 90 degrees as they travel up and fold into the side of the fuselage.

"Google Images", Xalasys Gallery, Retractable Landing Gear. Retrieved 23 April 2007, from http://gallery.xalasys.com/albums/speyer2005/DSCN4940.thumb.jpg

Figure 15-2-9 Retractable Landing Gear

Faster aircraft retract the landing gear into the structure and thus gain efficiency even at the cost of slightly more weight.

Tail-wheel. The landing gear configuration, in which the third wheel is rearward of the main gear (e.g. at the stern of the airplane), is referred to as a tail-wheel configuration (also known as "tail-draggers").

"Google Images", Loginet, Tail-Wheel. Retrieved 23 April 2007, from http://www.loginet.nl/europa/img/tailwheel2.jpg

Figure 15-2-10 Tail-wheel

Nose Wheel (Tricycle Gear Configuration). The practice of placing a steerable third wheel forward of the main gear has found universal acceptance in modern airplane design and is referred to as being a tricycle gear configuration. The prevalence of tricycle gear configurations, as used by most of today's manufacturers, is the result of certain advantages that this type of landing gear has over tail-wheel configuration.

The majority of modern aircraft do not utilize a conventional landing gear, resulting in a generation of pilots who have never flown an airplane with a tail-wheel arrangement. Tail-wheel aircraft are configured with the two main wheels located ahead of the aircraft's centre of gravity and a much smaller wheel at the tail. Moving the rudder pedals that are linked to the tail-wheel steers the aircraft on the ground.

Prior to WWII, almost all airplanes used the tail-wheel type landing gear. During WWII such airplanes as the Lockheed Lightning, the Consolidated Liberator, and the Boeing Superfortress, as well as the commercial Douglas DC-4, proved that the tricycle gear configuration was superior in ground handling ease. The tricycle gear configuration has since become the most widely used landing gear arrangement.

"Google Images", Acme Aerospace, Nose Wheel. Retrieved 23 April 2007, from http://www.acmeelec.com/aerospace/images/boeing777.gif

Figure 15-2-11 Nose Wheel

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What is the function of the landing gear?

Q2. State the types of landing gear.

Q3. What is another name for the nose wheel landing gear?

ANTICIPATED ANSWERS

A1. The function of the landing gear is to take the shock of landing and also to support the weight of the airplane and enable it to manoeuvre on the ground.

A2. Fixed gear, retractable gear, tail wheel, and nose wheel.

A3. Tricycle gear configuration.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What are the ongoing duties performed to maintain the performance and safety of the aircraft?

Q2. List three aircraft systems that are maintained by aircraft maintenance technicians.

Q3. What is the function of the landing gear?

ANTICIPATED ANSWERS

A1. Maintenance, overhaul, and repair are ongoing duties performed to maintain the performance and safety of the aircraft.

A2. Three aircraft systems that are maintained by aircraft maintenance technicians, include (any of the following):

- altimeter,
- airspeed indicator,
- gyroscope,
- heading indicator (directional gyro),
- attitude indicator (artificial horizon/gyro horizon),
- vertical speed indicator (vsi), and
- radar altimeter (radio altimeter).

A3. The function of the landing gear is to take the shock of landing and also to support the weight of the airplane and enable it to manoeuvre on the ground.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Identifying the requirements for aircraft maintenance will familiarize the cadets with the importance of aircraft maintenance in the aviation industry. The knowledge gained in this lesson may assist in stimulating an interest in aircraft maintenance in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-109 (ISBN 1-894777-00-X) Canadian Aviation Maintenance Council (CAMC). (2002). *Aviation Maintenance Orientation Program.* Ottawa, ON: CAMC.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Ltd.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 3

EO M270.03 – DISCUSS EDUCATION AND EMPLOYMENT OPPORTUNITIES IN AIRCRAFT MANUFACTURING AND MAINTENANCE

Total Time: 60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/PG-001, Chapter 4. Specific uses for said resources are identified throughout the Instructional Guide within the TP for which they are required.

Review the lesson content and become familiar with the material prior to delivering the lesson.

Photocopy the handouts located at Annexes B to F for each learning station.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for this lesson as it is an interactive way to present education and employment opportunities in the aircraft manufacturing and maintenance industry and to stimulate an interest among cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to have discussed education and employment opportunities in the aircraft manufacturing and maintenance industry.

IMPORTANCE

It is important for cadets to learn the different employment, education and career opportunities in order to gain an awareness of the options available to them in the aviation industry.

Teaching Point 1 **Introduce the Aircraft Manufacturing and Maintenance Industry**

Time: 50 min Method: In-class Activity

This activity should be conducted as learning stations. Each learning station will be conducted concurrently.

Take notes after reading the material and looking at the relevant visual aids at each station. Do not move materials from one station to another. Groups will rotate from one learning station to the next, every fifteen minutes, until every learning station has been visited.

The three learning stations include:

1. employers in Canada,
2. career options, and
3. education and training institutions.

Learning Station One

Provide information about the employers in Canada, such as:

- Rolls-Royce Canada,
- Standard Aero,
- Aerospace and Defence Industries Association of Nova Scotia (ADIANS),
- Air Canada Technical Services,
- CHC Helicopter Corporation,
- Field Aviation,
- Goderich Aircraft Inc.,
- Canadian Heli Structures Ltd., and
- Bombardier.

Information on these employers can be found at Annex B.

Learning Station Two

Provide information about the career options in Canada, such as:

- aircraft gas turbine engine repair and overhaul technician,
- aircraft interior technician,
- aircraft maintenance technician,
- avionics maintenance technician,
- aircraft structures technician,
- aviation ground services attendant, and
- aviation and aerospace engineers.

Information on these careers can be found at Annex C.

Learning Station Three

Provide information about education and training institutions, such as:

- Simon Fraser University,
- Canadore College of Applied Arts and Technology,
- Centennial College,
- McGill University,
- École des métiers de l'aérospatiale de Montréal,
- Gander Aerospace Training Centre,
- Holland College,
- University of Calgary,
- Nova Scotia Community College, and
- Buffalo School of Aviation.

Information on these education and training institutions can be found at Annexes D to F.

ACTIVITY

Time: 50 min

OBJECTIVE

The objective of this activity is to introduce the cadets to the aircraft maintenance and manufacturing industry.

RESOURCES

Handouts located at Annexes B to F.

ACTIVITY LAYOUT

Create three learning stations in the classroom.

Place copies of the handouts for each cadet at the corresponding learning station.

ACTIVITY INSTRUCTIONS

1. Divide cadets into three groups.
2. Have each group start at different learning stations.
3. Each group will spend 15 minutes at each learning station.
4. After 15 minutes have each group rotate to the next learning station.
5. Rotate the groups until each group has visited all three learning stations.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Share with the class, three pieces of information about aircraft maintenance and manufacturing, that interested you.

Q2. Why did you find this information interesting?

Q3. Name an education or training institution in your area.

ANTICIPATED ANSWERS

A1. Answers may vary.

A2. Answers may vary.

A3. Answers may vary.

END OF LESSON CONFIRMATION

The cadets' participation in the in-class activity will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Introducing education and employment opportunities in aircraft manufacturing and maintenance will help the cadet gain an awareness of the industry and may develop their interest in future opportunities in the aircraft manufacturing and maintenance industry.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-101 Canadian Aviation Maintenance Council. (2006). *Careers in Aviation and Aerospace.* Ottawa, ON: Government of Canada's Sector Council Program.

C3-102 Canadian Aviation Maintenance Council. (2007). *Index of Corporate Profiles.* Retrieved 23 February 2007, from http://www.camc.ca/en/CorporateProflies/.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 4

EO C270.02 – IDENTIFY CANADIAN AVIATION MAINTENANCE COUNCIL (CAMC) INTERACTIVE MULTIMEDIA LEARNING TOOL (IMLT) ACTIVITIES

Total Time: 30 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/PG-001, Chapter 4. Specific uses for said resources are identified throughout the Instructional Guide within the TP for which they are required.

Review the lesson content and become familiar with the material prior to delivering the lesson.

Before proceeding with this lesson, the instructor must become familiar with the procedures involved in using the IMLT.

Contact your Area Cadet Officer (ACO) to receive a log-on user ID and password.

Current instructions for exploring the IMLT are provided at http://3da.com/imlt/.

The following procedures are to be researched in advance:

- accessing the internet;
- logging onto the CAMC IMLT; and
- operating the IMLT.

Photocopy handouts located at Annexes G and H for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to clarify, emphasize and summarize the teaching points. An on-line visit to the IMLT will provide an overview of and promote interest in CAMC activities.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify CAMC IMLT activities.

IMPORTANCE

It is important for cadets to know about the IMLT because it may help further develop their understanding of aviation. Identifying the modules in IMLT may develop an interest in aviation which may lead to future opportunities in the Air Cadet Program.

Teaching Point 1 **Explain CAMC**

Time: 10 min Method: Interactive Lecture

CANADIAN AVIATION MAINTENANCE COUNCIL (CAMC)

The Canadian Aviation Maintenance Council (CAMC) is a not-for-profit sector council that represents and assists Canada's aviation and aerospace industry with its human resource strategy, issues and solutions. With the participation of industry members, they develop and publish National Occupational Standards with supporting log books (for professional certification) and curricula (for post-secondary training organizations). They promote safety, professionalism and standardization through:

- national communication with industry;
- human factors and safety management systems training;
- individual certification in 24 occupations; and
- accreditation of training organization programs.

AVIATION MAINTENANCE ORIENTATION PROGRAM (AMOP)

The CAMC Leading Edge/Youth Internship Program provides students with an academic orientation and work-based experience in aviation maintenance and technology. The program aims to develop interest among youth in careers within aviation and aerospace. It also establishes pathways for the transition from school to the working world of the aviation and aerospace industry.

The Leading Edge program provides a school-to-workplace transition for students who are about to make important decisions about their future. This program provides stepping stones from elementary school, to high school, to post secondary education, to industry. Therefore, community colleges and industry partnerships are essential elements to the success of the program at each location across Canada.

The program involves an aviation maintenance curriculum that begins at the high school level and is completed at the college level. High school graduates of the program will be able to proceed directly into a college technician diploma program or enter the industry workforce with some aviation knowledge and skills.

The funding model, which was initiated in September 1996, contains three elements:

- an academic phase comprising of classroom instruction and interactive multimedia based on the CAMC AMOP;
- a practical hands-on phase with a local industry partner where students can ideally work on or around aircraft under the guidance and supervision of a qualified technician; and
- a phase where students get to put theory into practice by:
    - working on/with aircraft or aircraft parts primarily provided by CAMC; or

- by participating in the construction of available aircraft kit programs across Canada.

INTERACTIVE MULTIMEDIA LEARNING TOOL (IMLT)

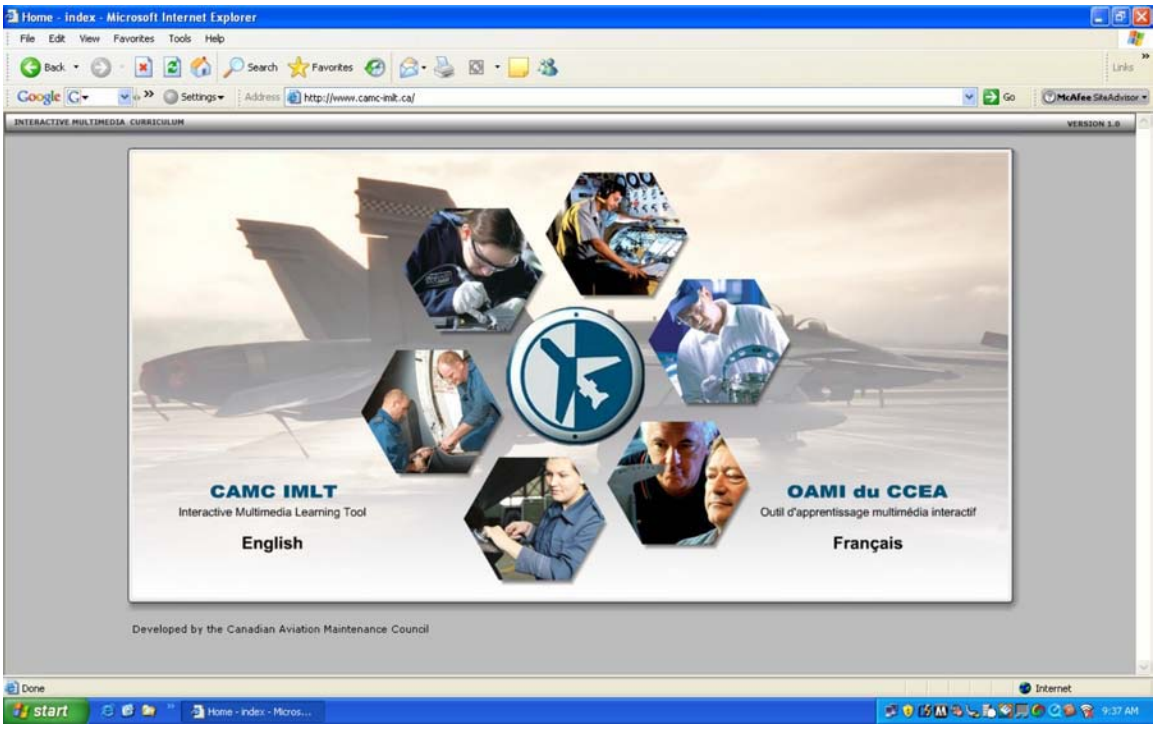
The IMLT is an interactive aviation curriculum that a cadet can individually log on to and create profiles, complete modules, and ask question related to the aviation industry. This can be done on their own time, using their personal computers.

Distribute handouts located at Annex G and review the following IMLT log-in screenshots with the cadets.

The following steps must be completed in order to log-in to the IMLT curriculum.

STEP ONE

Go to the IMLT Website at www.camc-imlt.ca and click on “English” or “French” (Figure 15-4-1).

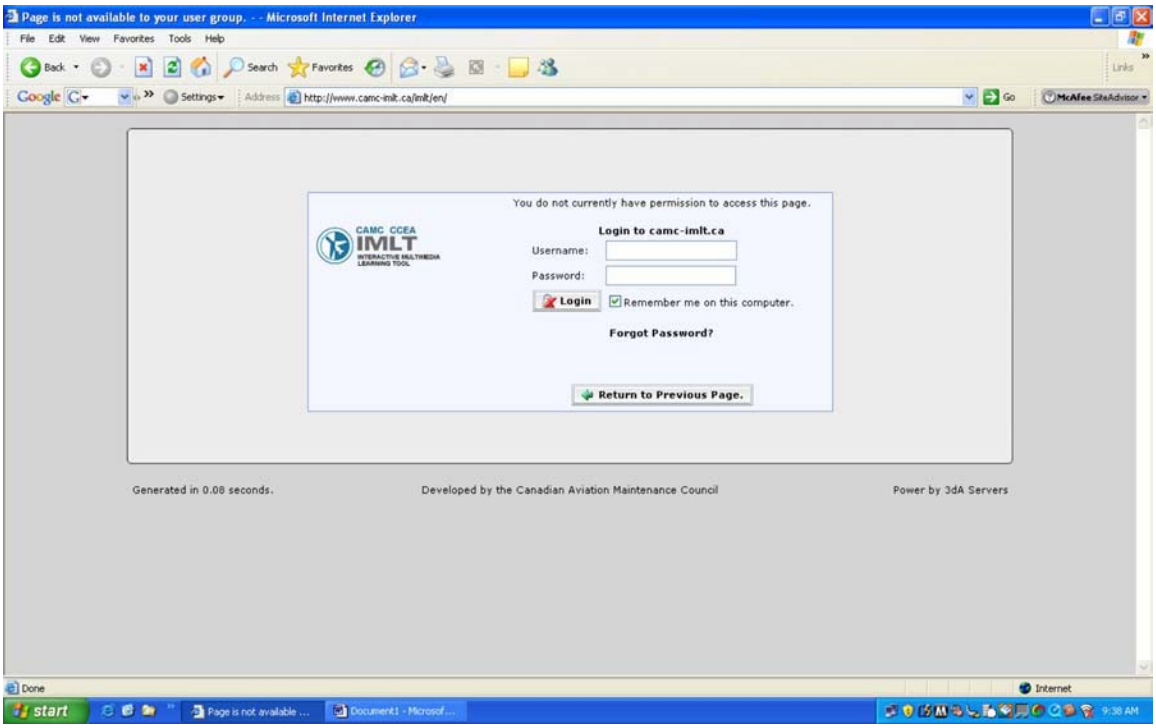


“CAMC”, IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15-4-1 Home Index

STEP TWO

Enter the username and password (provided by the instructor) and then click enter (Figure 15-4-2).



"CAMC", IMLT, Log-in. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15-4-2 Log-in

STEP THREE

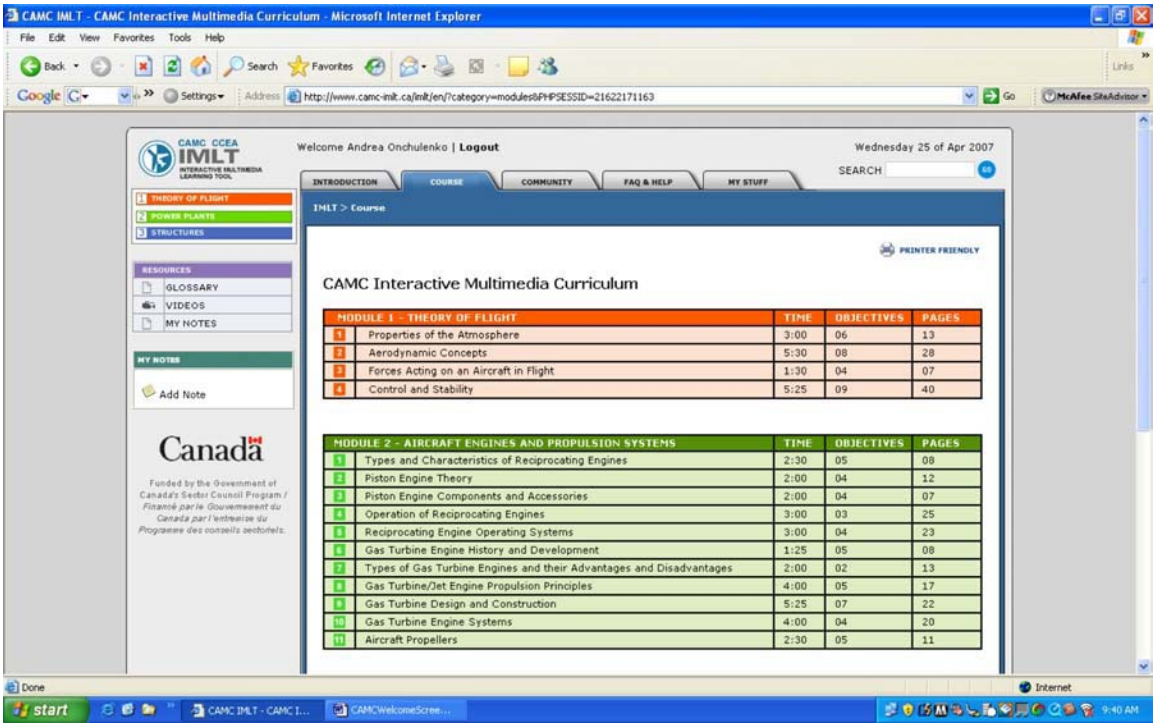
Select the course by clicking on the tab at the top of the welcome page (Figure 15-4-3).

"CAMC", IMLT, Welcome Page. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15-4-3 Welcome Page

STEP FOUR

Select the module that you wish to complete by clicking on the title (Figure 15-4-4).



"CAMC", IMLT, Modules. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15-4-4 Modules

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What does CAMC stand for?

Q2. What does IMLT stand for?

Q3. Where do you get a username and password to log-in to IMLT?

ANTICIPATED ANSWERS

A1. CAMC stands for Canadian Aviation and Maintenance Council.

A2. IMLT stands for Interactive Multimedia Learning Tool.

A3. The instructor will provide a username and password to log-in to IMLT.

Teaching Point 2 **Explain the IMLT Modules**

Time: 15 min Method: Interactive Lecture

There are three IMLT curriculum modules.

MODULE 1 – THEORY OF FLIGHT

The theory of flight module establishes the basis upon which all aircraft fly. It includes the study of the atmosphere and the application of the laws of physics to explain how lift is generated and affected.

Module 1 includes the following topics:

- properties of the atmosphere,
- aerodynamic concepts,
- forces acting on an aircraft in flight, and
- control and stability.

MODULE 2 – POWER PLANTS

The power plant module examines the evolution, design and classification of various types of engines.

Module 2 includes the following topics:

- types and characteristics of reciprocating engines,
- piston engine theory,
- piston engine components and accessories,
- operation of reciprocating engines,
- reciprocating engine operating systems,
- gas turbine engine history and development,
- types of gas turbine engines and their advantages and disadvantages,
- gas turbine/jet engine propulsion principles,
- gas turbine design and construction,
- gas turbine engine systems, and
- aircraft propellers.

MODULE 3 – AIRCRAFT STRUCTURES

The aircraft structures module identifies the principle structural components and how their construction is such that they withstand the loads and stresses of flight as well as methods used to prevent premature problems.

Module 3 includes the following topics:

- loads and stresses imposed on an aircraft,
- aircraft parts and empennage structures,
- aircraft ground and engine support structures,
- rotorcraft structures,
- control systems,
- electricity,

- documentation,
- inspection, and
- inspections methods.

Distribute the handout located at Annex H to the cadets to review when using the IMLT on their own.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What are the three IMLT modules?

Q2. What is studied in the theory of flight module?

Q3. What does the power plant module examine?

ANTICIPATED ANSWERS

A1. The three modules are:

- theory of flight,
- power plants, and
- aircraft structures.

A2. The theory of flight module includes the study of atmosphere and the application of the laws of physics to explain how lift is generated and affected.

A3. The power plant module examines the evolution, design and classification of various types of engines.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What topics from the IMLT interest you?

Q2. How can IMLT help you in the Air Cadet Program?

Q3. What are the benefits of using IMLT?

ANTICIPATED ANSWERS

A1. Answers may vary.

A2. Answers may vary.

A3. Answers may vary.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Introducing the cadets to IMLT will help the cadets to further develop an understanding of aviation. Identifying the modules in IMLT may develop an interest in aviation which may lead to future aviation opportunities in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-115 Canadian Aviation Maintenance Council (CAMC). (2007). *CAMC Interactive Multimedia Learning Tool (IMLT).* Retrieved 6 March 2007, from http://3da.com/imlt/.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 5

EO C270.04 – WATCH WORLD'S BIGGEST AIRLINER: THE AIRBUS A380 – COMING TOGETHER

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/PG-001, Chapter 4. Specific uses for said resources are identified throughout the Instructional Guide within the TP for which they are required.

Review the lesson content and become familiar with the material prior to delivering the lesson.

Copy the handout located at Annex I for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for TP1 as it is an interactive way to provoke thought and stimulate an interest among cadets.

A group discussion was chosen for TP2 as it allows the cadet to interact with their peers and share their knowledge, experience, opinions and feelings about aircraft manufacturing.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have watched the *World's Biggest Airliner: The Airbus A380*, participated in a discussion on aircraft assembly and to stimulate an interest in the aircraft manufacturing industry.

IMPORTANCE

It is important for cadets to develop an interest in how aircraft are manufactured because this lesson will lead to future summer training opportunities in aircraft manufacturing and maintenance. This EO will assist in stimulating an interest in aircraft manufacturing and maintenance in the Air Cadet Program.

Teaching Point 1 **Watch and Discuss the *World's Biggest Airliner: The Airbus A380 – Coming Together***

Time: 45 min Method: In-class Activity

The *World's Biggest Airliner: The Airbus A380* is a three-part DVD series. The cadet is required to watch the second DVD of the three-part series in order to complete this EO.

The following is a summary of the scenes included in this DVD. Do not stop the DVD to review each scene.

Scene: Toulouse, France. The process of assembling the major components of this aircraft is five weeks. The fuselage is assembled and the wing is attached to the fuselage.

Scene: Guided Tour. The tour takes place at the Airbus headquarters in France and takes the viewer through a realistic mock-up of the interior of the Airbus A380. There is also a focus on the horizontal tail plane and the materials used to construct it. The landing gear installation and testing is addressed. The landing gear is tested at the Goodrich Corporation outside of Toronto in Oakville, Ontario.

Scene: First Fully Assembled A380. The Airbus A380 leaves the main assembly station, where it is moved to another hangar and prepared for its unveiling. The fly-by-wire technology used in the aircraft and how it performs when the pilot manipulates the controls is mentioned. The vertical tail plane and new camera technology are installed in the fin. The viewer observes the performance of the aircraft in a flight simulator as it is taken through a worst-case scenario test.

Scene: Another Test Engine. The new Trent 900 engine custom made for the Airbus A380 is tested. The outcome of turbine fan blade failure is tested.

Scene: The Airbus A380 Goes Public. The Airbus A380 is unveiled to the stakeholders and heads of state involved in the construction of the aircraft.

ACTIVITY

OBJECTIVE

The objective of this activity is to familiarize the cadet with the aircraft manufacturing industry by presenting this DVD to develop an interest and understanding of the many occupations involved in designing and manufacturing an aircraft.

RESOURCES

- *World's Biggest Airliner: The Airbus A380* (second DVD of the series),
- TV, and
- DVD player.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Provide each cadet with a copy of the handout located at Annex I to be completed as they watch the DVD.
2. Watch the DVD.
3. After viewing the DVD confirm the correct answers to the handout located at Annex I.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 1

The cadets' participation in the in-class activity will serve as the confirmation of this TP.

Teaching Point 2 **Conduct a Group Discussion on the *World's Biggest Airliner***

Time: 10 min Method: Group Discussion

BACKGROUND KNOWLEDGE

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Ask questions that help facilitate discussion; in other words, avoid questions with yes or no answers.
- Prepare question ahead of time.
- Be flexible (you are not bound to only the prepared questions).
- Encourage cadets to participate by using praise such as "great idea" or "excellent response, can anyone add to that?"
- Try to involve everyone by directing questions to non-participants.

SUGGESTED QUESTIONS

Q1. How did this DVD help you to understand more about how an aircraft is assembled?

Q2. What did you like most about this segment of the Airbus A380?

Q3. What careers interested you in this DVD and why?

Other questions and answers will develop throughout the discussion stage. The discussion should not be limited to only those suggested.

SAFETY

N/A.

END OF LESSON CONFIRMATION

The cadets' participation in the group discussion will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Watching the *World's Biggest Airliner: Airbus A380* will develop the cadets' interest in how aircraft are manufactured and introduce the cadet to future summer training opportunities in aircraft manufacturing and maintenance. The knowledge gained in this lesson will assist in stimulating an interest in the aircraft manufacturing and maintenance field in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-105 Brisley, T. Pascaud, S. (Executive Producer), and Bowie, B. (Writer/Director), (2003). *World's Biggest Airliner: The Airbus A380* [Motion Picture]. United States: The Learning Channel.

AIRCRAFT MANUFACTURING INDUSTRY CAREERS

AIRCRAFT INTERIOR TECHNICIAN

An aircraft interior technician's primary responsibilities include the removal, disassembly, cleaning, inspection, repair and re-installation of aircraft cabin furnishings. The technicians work both in an aircraft cabins and in shops, and are familiar with the function, operation and safety requirements of aircraft passenger support systems. They maintain oxygen, water, waste, entertainment, and emergency systems and equipment. In addition, they refurbish seats, seat belts, carpets, interior panelling, windows, and galley and washroom modules. Their duties often overlap with those of other aviation technicians, such as aircraft maintenance engineers. Successful completion of this program plus work experience, recorded and certified in a personal logbook, may qualify the candidates for national certification from the Canadian Aviation Maintenance Council (CAMC).

Job Opportunities

Aircraft interior technician jobs have historically been filled by automotive upholsterers who required intensive on the job re-training. Organized training for this trade has been put in place due to the demand for trained personnel. Jobs are found in national and regional airline companies and approved Aircraft Maintenance Organizations (AMOs).

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "E" (AVIONICS)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) - Category "E" license. Aircraft avionics technicians are responsible for the servicing, repair and modification of aircraft electronic systems and components. The job includes removing and installing components, bench testing and troubleshooting complex electronic aircraft systems. Today's aircraft can be quite sophisticated with "fly by wire," auto flight, global positioning, satellite navigation, in-flight entertainment, and automatic communication and receiving systems.

Job Opportunities

Opportunities are available across Canada in aviation electronic shops, helicopter operations and large and small aircraft operators/airlines. Other job opportunities such as fixed-based airport equipment servicing are also available.

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "M" (MAINTENANCE)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) - Category "M" license. AMEs are responsible for the release (certification) of an aeronautical product (aircraft), after maintenance or inspection. The job responsibilities include a variety of tasks including removing and installing components and troubleshooting complex systems. A qualified AME is able to maintain small aircraft, helicopters and large transport category aircraft. Larger aircraft are quite sophisticated as they possess many different electrical, electronic, pneumatic, hydraulic, mechanical and propulsion systems and the AME must understand and maintain them.

Job Opportunities

Graduates from the AME M program have, for the last 40 years, found employment in both the Canadian and foreign aviation industry. First employment is as a log book-controlled work experience and then as an AME. Some graduates have gone on to become managers and owners of domestic and international aircraft maintenance establishments. Overall, through the year 2005, aircraft mechanics, particularly those with work experience, are expected to have excellent job opportunities since the number of job openings is expected to exceed the supply of qualified applicants (Aerospace Industry Association of BC AIABC study of October 2000). It is an exciting and rewarding industry with opportunity for travel and career development.

AIRCRAFT MAINTENANCE ENGINEER CATEGORY “S” (STRUCTURES)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) - Category “S” license. Category “S” structures technicians are responsible for the assessment, planning and implementation of aircraft structural fabrication and repairs. Structures technicians are often an integral part of repair crews including maintenance technicians, avionics technicians and professional engineers. They are expected to precisely follow aircraft fabrication and repair schemes for aluminium, titanium and stainless steel structures, as well as plastics and composites.

Job Opportunities

First employment is as a log book-controlled work experience. Then, as an AME, graduates from this program have found employment in a variety of companies in the aerospace industry across Canada. They may be employed in helicopter or light aircraft repair, airline maintenance of aircraft and component manufacturing. Some graduates have gone on to manage or own repair businesses.

AIRCRAFT MECHANICAL COMPONENT TECHNICIAN

Aircraft mechanical component technicians are involved in the overhaul, repair, modification, inspection, testing and certification of aviation components of pneumatic, hydraulic, fuel, electrical, environmental and mechanical aircraft systems. Working in a shop environment, technicians are thoroughly familiar with the set-up and operation of tools and shop equipment as well as some semi-automatic processes. Possessing a high degree of manual dexterity, and a strong interest in mechanics, they work cooperatively with others and are able to follow directions precisely.

Job Opportunities

The men and women who enter this career path can expect to find employment with companies that specialize in aircraft component overhaul, Approved Maintenance Organizations (AMOs) involved in the manufacture and overhaul of airframe systems, as well as major airlines. As a CAMC-developed course, the training and associated jobs skills provided are recognized anywhere in Canada. Recent trends indicate a strong demand for individuals trained in aviation component overhaul.

AIRCRAFT GAS TURBINE TECHNICIAN

Aircraft gas turbine technicians enjoy a challenging occupation requiring a high degree of responsibility and skill. Technicians perform the disassembly, inspection, repair, assembly and testing of gas turbine engines in a clean shop environment with regular working hours. Qualified technicians experience many opportunities for advanced training and continued career satisfaction.

Job Opportunities

The men and women who enter this career path find employment in both aircraft and industrial gas turbine engine repair and overhaul facilities across Canada. There is also a demand for trained technicians with this skill set in the aircraft component and propeller over-haul trades.

AIRCRAFT MANUFACTURING AND MAINTENANCE EMPLOYERS IN CANADA

ROLLS-ROYCE CANADA

The company employs 1500 people at facilities in Montréal, Quebec, and Vancouver, British Columbia.

Montréal's capabilities include: repair and overhaul on a wide range of civil and military aero engines; research and development for the energy business; new production assembly and test for the Industrial RB211 engine; and component repair services for the Industrial Trent engines.

The Montréal facility is the largest of seven Rolls-Royce Canadian sites occupying more than 152 000 square metres of plant, laboratory and office space, and housing six engine test cells. Annual sales are in excess of $600 million, 90 percent of which is exported. The company supports 500 customers in 30 countries on five continents.

The Vancouver-based Marine Propulsion division of Rolls-Royce manufactures an integrated unit that performs both steering and propulsion functions. This unit replaces a conventional propeller, rudder and reduction gearbox.

The state-of-the-art test facility, which consists of approximately 8473 square metres, was constructed with the financial assistance of the Government of Quebec. The installation is intended to serve as a test bed for the industrial Trent engine as well as a provider of electricity to the City of Montréal, allowing the city to continue to supply drinking water in case of an emergency caused by a power failure affecting its water filtration plants.

STANDARD AERO

Standard Aero is one of the world's largest independent small gas turbine engine and accessories repair and overhaul companies. Standard Aero services engines used on corporate/business aircraft, commercial airliners, helicopters, and government/military aircraft. They do service for the following engines:

- PW100,
- PT6A,
- Model 250,
- T56/501D,
- AE3007,
- AE2100,
- CF34,
- GTCP 36, and
- 85.

AEROSPACE AND DEFENCE INDUSTRIES ASSOCIATION OF NOVA SCOTIA (ADIANS)

The Aerospace and Defence Industries Association of Nova Scotia (ADIANS) supports the growing and diversified aerospace and defence industry, which employs approximately 5200 workers. The association operates in both the defence and commercial markets. Approximately 80 percent of its revenue comes from maintaining the Department of National Defence's (DND) $25 billion worth of assets.

The large, medium and small firms which make up ADIANS' membership offer a range of products and services from advanced composite materials to training to transmitters and receivers.

ADIANS' initiatives foster sector strength in military and commercial development at the local, national and international level. The association helps members expand and position themselves for global market

opportunities by helping them access government programs for industrial development opportunities. The association facilitates discussion and cooperation amongst industry, government, and all levels of academia when it comes to human resource training issues and technology challenges needed for innovation and growth.

ADIANS' development of an aerospace and defence sector export strategy, enhances current and future opportunities for manufacturers, suppliers and service companies.

AIR CANADA TECHNICAL SERVICES

Air Canada Technical Services provides a diverse range of maintenance, repair and overhaul services to many of the world's commercial airlines, leasing companies and the military. Their highly skilled personnel, state-of-the-art facilities and their commitment to excellence assures all their customers superior quality, reduced turn around times and competitive pricing.

OPERATIONS

Airframe Maintenance

- Line and heavy maintenance,
- Aircraft modifications,
- Cabin conversions,
- Aircraft painting, and
- Landing gear changes.

Component Maintenance

- Avionics,
- Instruments and electrical,
- Pneumatics and hydraulics,
- Fuel systems,
- Landing gears,
- Safety, and
- Wheels and brakes.

The aircraft handled under airframe and component maintenance are:

- The Airbus A310, A320, A330 and A340,
- The Boeing 737, 747, and 767; and
- The Bombardier Canadair Regional Jet (CRJ).

Engine Maintenance

Maintenance, repair and overhaul services are completed on the following engine models:

- CFM56,
- CF34,
- PW4000, and

- JT9D.

Other services include:

- On-wing support,
- Quick engine change,
- Thrust reversers,
- Auxiliary Power Unit GTCP36-300, and
- Engine components repairs.

Specialized Services

- Technical training,
- Fleet management and engineering,
- Technical records and publication services,
- Material management, and
- Composite repairs.

CHC HELICOPTER CORPORATION

CHC Helicopter Corporation is the world's largest provider of helicopter services to the global offshore oil and gas industry, with aircraft operating in 30 countries and a team of approximately 3500 professionals worldwide.

CHC continues to strengthen its position as the helicopter service company of choice for the world's leading oil and gas companies. CHC is a total solutions transportation service company, providing its customers with aircraft, pilots, maintenance, insurance, logistics support and training anywhere in the world. The company works on seven continents, from the Canadian Arctic to Antarctica, and from Azerbaijan to Venezuela.

CHC's current projects include: offshore industries support, offshore search and rescue, air ambulance services, repair and overhaul services, aerial firefighting support, construction industry service, mineral exploration support, composite materials manufacturing, flight training and flight simulator facilities, humanitarian aid work and a variety of other helicopter services around the world.

FIELD AVIATION

Since 1947, Field Aviation (Field) has grown into a worldwide airline support centre serving regional aircraft including commercial, corporate, individual, and military aircraft. Field is dedicated to servicing most turboprop and regional jet aircraft.

With over 50 years experience in repairing, modifying, and refinishing regional aircraft, Field has become one of Canada's largest full-service support organizations with major operation centres in Calgary and Toronto. Field employs aviation technicians that conduct a multitude of heavy checks, airframe structural repairs and modifications, exterior and interior refurbishments, along with a comprehensive array of aircraft avionics and engineering services. Field also manufactures quality spare parts and is equipped to repair sheet metal, hydraulic and composite components.

GODERICH AIRCRAFT INC.

Goderich Aircraft Inc. began in 1993. Goderich Aircraft Inc., formerly Crown Charter-Phoenix Aviation out of Brantford, Ontario, is located in Huron Park, Ontario and has grown to a staff of approximately 80 employees.

Over the years it moved into the US market for aircraft refurbishment market and transformed into a company that provides a wide range of services for aircraft.

The company services include:

- aircraft painting,
- interior refurbishment, such as:
    - cabinets,
    - carpet, seats, or
    - floor plan modifications, and
- avionics, maintenance, such as:
    - large scale rebuilds,
    - modifications, and
    - parts sales.

Goderich Aircraft Inc. is able to complete maintenance inspections while the aircraft is undergoing other services.

CANADIAN HELI STRUCTURES LTD

Founded in 1996, Canadian Heli Structures Ltd. (C.H.S.) is a Canadian company incorporated under the laws of British Columbia, Canada. C.H.S. is a Bell Helicopter Textron (BHT) “Specialty Customer Service Facility” and is committed to the utmost in service of Bell Helicopter major structural repairs, modifications, and specialty welding on light and medium turbine helicopters.

With years of experience specializing on BHT light and medium airframe jigs, C.H.S. is able to perform airframe repairs with the knowledge of complete overhauls to the highest standards and quality service in a timely manner.

Their maintenance department is staffed with a wide range of technicians and all their maintenance is performed in compliance with Transport Canada Regulations, which is equivalent to the Federal Aviation Administration (FAA) regulations.

BOMBARDIER

In 1942, J. Armand Bombardier founded a company to manufacture tracked vehicles for transportation on snow-covered terrain. The company’s name is L’Auto-Neige Bombardier Limitée. In 1967, L’Auto-Neige Bombardier Limitée became Bombardier Limited.

Bombardier Aerospace is a world leader in the design and manufacturer of innovative aviation products and services for the business, regional and amphibious aircraft markets. This legacy of innovation consolidates more than 250 years of aviation history and has developed 19 successful new aircraft programs since 1989. Bombardier employs approximately 27 000 people worldwide.

Bombardier manufactures business, regional and amphibious aircraft to address the specific aviation needs of their customers. Their aircraft have a multiple range of applications. Their aircraft include:

- Bombardier Learjet family, to include:
    - Learjet 40 XR,
    - Learjet 45 XR, and

  - Learjet 60 XR;
- Bombardier Challenger family, to include:
  - Challenger 300,
  - Challenger 605,
  - Challenger 850,
  - Challenger 850 Corporate Shuttle,
  - Challenger 870 Corporate Shuttle, and
  - Challenger 890 Corporate Shuttle;
- Bombardier Global family, to include:
  - Bombardier Global 5000, and
  - Global Express XRS;
- Bombardier CRJ series regional jets, to include:
  - 50-passenger CRJ200,
  - 70- to 78-passenger CRJ700,
  - 75-passenger CRJ705,
  - 86- to 90-passenger CRJ900, and
  - up to 100-passenger CRJ1000;
- Bombardier Q series regional turboprops, to include:
  - 37- to 39-passenger Q200,
  - 50- to 56-passenger Q300, and
  - 68- to 78-passenger Q400; and
- Bombardier amphibious aircraft (Bombardier 415).

The world's most productive firefighting aircraft in service is the Bombardier 415. This amphibious water bomber can also be configured for a wide range of multi-mission capabilities including search and rescue, maritime patrol, law enforcement and environmental control.

THIS PAGE INTENTIONALLY LEFT BLANK

AIRCRAFT MANUFACTURING CAREERS

AIRCRAFT GAS TURBINE ENGINE REPAIR AND OVERHAUL TECHNICIAN

The gas turbine was one of the greatest inventions of the last century: it is unique and simple in its basic operation and yet immensely complicated to design and build. In the aviation industry, gas turbine engines are used in jet aircraft and power turbo-prop aircraft.

Aircraft gas turbine engine repair and overhaul technicians enjoy a very challenging and rewarding career that requires a high degree of responsibility and skill. Technicians perform the disassembly, inspection, repair, assembly and testing of gas turbine engines in sophisticated shop environments and test cells, complete with computer-assisted systems and leading-edge tools, machinery and techniques.

Education

An aircraft gas turbine repair and overhaul technician will need a high school diploma. You will also need to complete a recognized structured training program in gas turbine repair and overhaul; these courses may be taken at a college or through a company-sponsored program. See the College and University section for more information.

Work

Recent surveys indicate excellent job placement rates with opportunities in engine repair and overhaul facilities as well as airlines, component and propeller overhaul businesses and engine manufacturers. You can receive an aircraft gas turbine repair and overhaul technician certification through the Canadian Aviation Maintenance Council (CAMC).

AIRCRAFT INTERIOR TECHNICIAN

Aircraft interior technicians are responsible for maintaining the quality of aircraft interiors and cabin furnishings including safety, survival and evacuation equipment such as rafts, flotation devices and escape slides.

This trade is also responsible for aircraft reconfigurations, such as changing from cargo to passenger or passenger to cargo, and aircraft interior seating arrangements: first class, business class, economy class, etc. From headliners, carpet and cabinets through to panels, coverings, seats and bulkheads, these aviation experts have to assess, remove, repair and reinstall everything and anything that has to do with interior components. Not only are the tasks diverse for an aircraft interior technician, but so are the skills and the challenges they have. Aircraft interior technicians are master craftspeople that also have to be excellent team players that pay tireless attention to details and the highest maintenance and safety standards.

Education

Aircraft interior technicians have a high school diploma and have benefited from an apprenticeship or college training program. See the College and University section for more information.

Work

As a consummate team player and professional, aircraft interior technicians have promising careers as part of larger units working for airlines or major repair and overhaul companies and manufacturers. You can receive an aircraft interior technician certification through the Canadian Aviation Maintenance Council (CAMC).

AIRCRAFT MAINTENANCE TECHNICIAN

Aircraft Maintenance Technicians (AMTs) have the important responsibility of keeping aircraft operating safely and efficiently. It is not just important—lives depend on it. AMTs are the frontline aviation professionals that service, repair and overhaul aircraft components and systems including airframes, engines, electrical and hydraulic systems, propellers, avionics equipment and aircraft instruments.

As an AMT, you might work on one or many different types of aircraft such as jets, propeller-driven airplanes and helicopters. To keep aircraft in peak operating condition, AMTs perform scheduled maintenance and complete inspections that have to meet the strictest industry regulations. There are no exceptions. You have to be a perfectionist with excellent communication skills and an unshakeable commitment to safety. You must remain up to date as safety regulations change very rapidly. Innovations in space-age technology mean that AMTs have to be front-runners in their field in order to meet the rapid advances in computer technology, electronics and fibre composite structural material. It is fast, intense, deadline-driven and very high tech. If you are looking for a challenging career with limitless potential, be sure to look into becoming an aircraft maintenance technician.

Education

Aircraft maintenance technicians have a high school diploma. AMTs must complete training at a certified college or training facility. See the College and University section for more information.

Work

As a successful AMT, you can find a rewarding career with airlines, aircraft manufacturers, aerospace organizations, the military, as well as repair and maintenance facilities. There are many avenues open to experienced AMTs, for instance you can be certified by the Canadian Aviation Maintenance Council (CAMC) and/or become an aviation maintenance engineer “M” class (AME)(M), which is a Transport Canada licensed trade. From there, you could go on to join management as a company’s director of maintenance.

AVIONICS MAINTENANCE TECHNICIAN

Avionics is the study and practice of complex electronic and electrical systems including navigation, guidance systems, communications, surveillance and flight control. Critical to safe and timely operation of all aircraft on the ground and in the air, thorough and up-to-date knowledge of avionics opens the door to numerous employment opportunities in the aviation and aerospace industries.

As an avionics maintenance technician, you are a master of aircraft micro-processor technology. You are on the front-line doing tests, calibrations, repairs and maintenance on state-of-the-art systems including “fly by wire”, auto flight, global positioning and satellite navigation. Fascinated with sophisticated electronics systems, a good avionics maintenance technician is an excellent team player with solid communication skills and a tireless commitment to safety and excellence. This is arguably one of the most demanding trades in aviation.

Education

Avionics maintenance technicians have a high school diploma with strong grades in English, communications and mathematics; you will then complete a college program in electrical and electronics or specialized training at a certified college or training facility. See the College and University section for more information.

Work

A career as an avionics maintenance technician opens the door to airports, aviation electronic shops, airlines, helicopter operations, aircraft manufacturers and repair facilities and aerospace organizations. There are many avenues open to experienced avionics maintenance technicians, for instance you can be certified by the Canadian Aviation Maintenance Council (CAMC) and/or become an aviation maintenance engineer “E” category (AME)(E), which is a Transport Canada licensed trade.

AIRCRAFT STRUCTURES TECHNICIAN

An aircraft structures technician is one of the key members of the air maintenance team that handles services and maintains aircraft and associated equipment. This job is critical to aviation safety and quality maintenance as aircrews depend on your skills to keep them safe.

The aircraft structures technician’s job is to keep the aircraft in perfect flying condition by constructing and repairing metal and composite parts of an aircraft’s fuselage, wings and control surfaces, which include

machining, painting, welding and refinishing. You will also be expected to follow aircraft fabrication and repair schemes with surgical precision for aluminum, titanium and stainless steel structures, as well as plastics and composites. If you enjoy working with tools, machines and state-of-the-art equipment, and you have stamina and are able to master new procedures quickly, this profession may be for you.

Education

Aircraft structures technicians have a high school diploma and require additional training at a certified college or training facility. See the College and University section for more information.

Work

You can become certified by the Canadian Aviation Maintenance Council (CAMC) as an aircraft structures technician and find a rewarding career with airlines, maintenance and overhaul companies, aircraft manufacturers or aerospace organizations. This trade is a prerequisite to becoming an aviation maintenance engineer “S” category (AME)(S), which is a Transport Canada licensed trade.

AVIATION GROUND SERVICES ATTENDANT

If you look out at the airport terminal grounds and see aircraft coming and going, you are at the same time viewing the busy workplace of an aviation ground services attendant. The individuals servicing the aircraft fill many roles that require in-depth training.

Every imaginable type of motorized equipment is used to service an aircraft, from pallet loaders, potable water trucks, mobile conveyor belts, tugs for pulling baggage cart trains to high-speed aircraft tow tractors, to name a few.

Ground services attendants are the people who load and unload the aircraft materials, and who are responsible for positioning the baggage/cargo in such a way as to stay within the operating weight and balance limits of the aircraft (an unbalanced aircraft is an unsafe aircraft), all the while working within stringent time constraints in a high noise environment with jet blast hazards.

The lead attendant is responsible for the final pre-flight security inspection and commands the push-back crew. Excellent math and physics skills, environmental awareness and hazardous material knowledge are but some of the skills necessary to the position. A love of the outdoors, the ability to operate in all weather conditions, and good physical conditioning are assets in this demanding job.

This serious role is often the entry level for other positions, especially in large organizations: promotion to lead or cargo loadmaster, for example. Baggage, commissary, cargo, weight and balance controllers can also rise up to management positions, overseeing people/teams, terminal control, gate assignments, and more.

Education

As a successful aviation ground control attendant, you will need to have a high school diploma. You also will have to receive internal company training in aviation general practices and specialized courses. Companies will provide the licenses for heavy equipment operator, safety training, firefighting proficiency, air side security, and a driving permit. Canadian Aviation Maintenance Council (CAMC) certification is available with a minimum of one year’s experience in the occupation at level 1 - Cargo, and one more year’s experience at level 2 - Passenger.

Work

Some of the job titles available in this occupation include:

- Station attendant,
- Lead station attendant,

- Cargo attendant, and
- Commissary attendant.

AVIATION AND AEROSPACE ENGINEERS

If there ever was an industry designed to meet the challenges and rewards of engineering, the aviation and aerospace industry is it. The following engineers are contributors in aviation and aerospace:

- Aerodynamics,
- Avionics,
- Design,
- Engineering reliability,
- Equipment,
- Field service,
- Flight test,
- Instrumentation,
- Manufacturing materials,
- Aeronautical,
- Aerospace,
- Ceramic,
- Chemical,
- Civil,
- Electronic,
- Electrical,
- Engineering physics,
- Industrial,
- Mechanical,
- Petroleum,
- Metallurgical, and
- Computer and nuclear.

What do all these engineers contribute? As an example, petroleum engineers research, develop and supervise projects associated with the design and operation of gas turbine and piston aero-engines. Aerospace engineers research, design and develop aircraft, spacecraft, missiles, aerospace systems and their components. Whatever the area that most interests you, there are countless opportunities within this dynamic, forward-thinking industry.

Education

You must complete a university degree in your preferred area of expertise in order to become an Engineer; in fact you must receive provincial recognition or accreditation. See the College and University section for more information.

Work

Engineers can find stimulating and rewarding careers in all aviation and aerospace-related firms that design, manufacture, repair and overhaul aeronautical products including complete aircraft, engines, components and systems and sub-systems.

THIS PAGE INTENTIONALLY LEFT BLANK

EDUCATIONAL INSTITUTIONS

BRITISH COLUMBIA

Simon Fraser University
School of Engineering Science
8888 University Drive
Burnaby, BC V5A 1S6
www.sfu.ca

University of British Columbia
Faculty of Applied Science
2329 West Mall
Vancouver, BC V6T 1Z4
www.ubc.ca

University of Victoria
Faculty of Engineering
P.O. Box 1700 STN CSC
Victoria, BC V8W 2Y2
www.uvic.ca

ACRO Aerospace
ACRO Aerospace Inc.
4551 Agar Drive
Richmond, BC V7B 1A4
www.acro.ca

Kelowna Flightcraft
5655 Airport Way
Kelowna, BC V1V 1S1
www.flightcraft.ca

ALBERTA

University of Calgary
Faculty of Engineering
2500 University Drive NW
Calgary, AB T2N 1N4
www.ucalgary.ca

SASKATCHEWAN

University of Saskatchewan
College of Engineering
105 Administration Place
Saskatoon, SK S7N 5A2
www.usask.ca

University of Regina
Faculty of Engineering
3737 Wascana Parkway
Regina, SK S4S 0A2
www.uregina.ca

MANITOBA

University of Manitoba
Faculty of Engineering
Winnipeg, MB R3T 2N2
www.umanitoba.ca

ONTARIO

Carleton University
Faculty of Engineering
1125 Colonel By Drive
Ottawa, ON K1S 5B6
www.carlton.ca

Ryerson University
Faculty of Engineering and Applied Science
350 Victoria Street
Toronto, ON M5B 2K3
www.ryerson.ca

University of Toronto
Faculty of Applied Science and Engineering
Division of Engineering Science
Galbraith Building, Room 149
35 St. George Street
Toronto, ON M5S 1A4
www.utoronto.ca

University of Toronto Institute for Aerospace Studies (UTIAS)
4925 Dufferin Street
Toronto, ON H3H 5T6
(416) 667-7700

EDUCATIONAL INSTITUTIONS

Lakehead University
Faculty of Engineering
955 Oliver Road
Thunder Bay, ON P7B 5E1
www.lakeheadu.ca

McMaster University
Faculty of Engineering
2329 West Mal1280 Main Street West l
Hamilton, ON L8S 4L8
www.mcmaster.ca

Queen's University
Faculty of Applied Science
99 University Avenue
Kingston, ON K7L 3N6
www.queensu.ca

Royal Military College
Engineering Division
P.O. Box 17000 Station Forces
Kingston, ON K7K 7B4
www.rmc.ca

University of Guelph
Faculty of Engineering
Guelph, ON N1G 2W1
www.uoguelph.ca

University of Ottawa
Faculty of Engineering
161 Louis Pasteur
Ottawa, ON K1N 6N5
www.genie.uottawa.ca

University of Waterloo
Faculty of Engineering
200 University Avenue West
Waterloo, ON N2L 3G1
www.uwaterloo.ca

University of Western Ontario
Faculty of Engineering Science
1151 Richmond Street, Suite 2
London, ON N6A 5B8
www.uwo.ca

University of Windsor
Faculty of Engineering
401 Sunset Avenue
Windsor, ON N9B 3P4
www.uwindsor.ca

Renaissance Aeronautics
169 Deer Park Circle
London, ON N6H 3B9
www.raacomposites.com

Canadore College of Applied Arts and Technology
55 Aviation Avenue
P.O. Box 5001
North Bay, ON P1B 8K9
www.canadorec.on.ca

Centennial College
P.O. Box 631, Station A
Scarborough, ON M1K 5E9
www.centennialcollege.ca

QUEBEC

École de technologie supérieure
1100, rue Notre-Dame Ouest
Montréal, QC H3C 1K3
www.etsmtl.ca

Université du Québec à Chicoutimi
Département des sciences appliquées
555, boulevard de l`Université
Chicoutimi, QC G7H 2B1
www.dsa.uqac.uquebec.ca

École nationale D`aérotechnique
Du Collège Édouard-Montpetit
5555, place de la Savane
St. Hubert, QC J3Y 5K2
www.collegeem.qc.ca

École des métiers de l`aérospatiale de Montréal
5300, rue Chauveau
Montreal, QC H1N 3V7
www.csdm.qc.ca/emam/

EDUCATIONAL INSTITUTIONS

John Abbott College
21, 275 Lakeshore Road
Ste, Anne de Bellevue, QC
H9X 3L9
www.johnabbott.qc.ca

Concordia University
Faculty of Engineering and Computer Science
1455 de Maisonneuve Blvd. West
Montreal, QC H3G 1M8
www.concordia.ca

École Polytechnique de Montréal
C.P. 6079, Succ. Centre-ville
Montréal, QC H3C 3A7
www.polymtl.ca

McGill University
Faculity of Engineering
845 Sherbrooke Street West
Montreal, QC H3A 2T5
www.mcgill.ca

Université de Sherbrooke
Faculté des sciences appliquées
2500, boulevard de l`Université
Sherbrooke, QC J1K 2R1
www.usherb.ca

Université Laval
Faculté des sciences et de génie
Cartier Boone-enfant, Local 2440
Cite Universitaire
Quebec, QC G1K 7P4
www.ulaval.ca

Université du Québec à Rimouski
Module de génie
300 allée des Ursulines, B.P. 3300
Rimouski, QC G5L 3A1
www.uqar.uquebec.ca

Université du Québec en Outaouais
Module de génie
C.P. 1250 Succursale B
Hull, QC J8X 3X7
www.uqo.ca

Université du Québec à Trois-Rivières
Département d'ingénierie
3351, boulevard des Forges, B.P. 500
Trois-Rivières, QC G9A 5H7
www.uqtr.ca

NOVA SCOTIA

Dalhousie University
Faculty of Engineering
1360 Barrington Street
Halifax, NS B3J 1Z1
www.dal.ca

Nova Scotia Community College
4 Hangar, Shearwater,
P.O. Box 1171, Stn. Main
Shearwater, NS B0J 3A0
www.nscc.ns.ca

NEW BRUNSWICK

Université de Moncton
École de génie
165, avenue Massey
Moncton, NB E1A 3E9

University of New Brunswick
Faculty of Engineering
3 Bailey Drive, P.O. Box 4400
Fredericton, NB E3B 5A3
www.unb.ca

EDUCATIONAL INSTITUTIONS

PRINCE EDWARD ISLAND

Holland College — Aerospace and Industrial Technology Centre
40 Parkway Drive
P.O. Box 235
Slemon Park, PE C0B 2P0
www.hollandc.pe.ca

NEWFOUNDLAND

College of the North Atlantic
Gander Campus
1 Magee Road, P.O. Box 395
Gander, NF A1V 1W8
www.northatlantic.nf.ca

Memorial University of Newfoundland
Faculty of Engineering
and Applied Science
St. John's, NF A1C 5S7
www.mun.ca

Gander Aerospace Training Centre
Gander Flight Training
P.O. Box 355
Gander, NF A1V 1W7
www.gft.nf.ca

NORTHWEST TERRITORIES

Buffalo School of Aviation
Box 2015
Yellowknife, NT X1A 2R3
www.buffaloairways.com

AVIATION TECHNICIAN PROGRAMS

AVIATION TECHNICIAN PROGRAMS

Program	Acro Aerospace (BC)	British Columbia Institute (BC)	Canadore College (ON)	Carlton University (ON)	Centennial College (ON)	College of North Atlantic (NL)	DND Canadian Forces School of Aerospace Technology and Engineering (ON)	École des métiers de l`aérospatiale de Montréal (QC)	École nationale D`aérotechnique (QC)	Gander Aerospace Training Centre (NL)	Holland College — Aerospace and Industrial Technology Centre (PE)	Kelowna Flightcraft (BC)	Northern Alberta Institute of Technology (AB)	Nova Scotia Community College (NS)	Southern Alberta Institute of Technology (AB)	Stevenson Aviation and Aerospace Training Centre (MB)
Aircraft Gas Turbines Engine Repair and Overhaul Technician	x	x						x		x	x					
Aircraft Interior Technician		x														
Aircraft Maintenance Technician		x	x		x		x				x			x	x	x
Aircraft Structures Technician		x	x			x			x		x	x		x	x	x
Aviation Mechanical Component Technician		x														
Aviation Painter		x							x							
Aviations Welding Technician		x														x
Avionics Maintenance Technician		x	x		x		x		x				x		x	x
Helicopter Component Technician										x						

The column heads are grouped under "Education / Training Institutions".

THIS PAGE INTENTIONALLY LEFT BLANK

ENGINEERING PROGRAMS

Program	Education / Training Institutions													
	Buffalo School of Aviation (NT)	Carlton University (ON)	Lakehead University (ON)	McMaster University (ON)	Queen's University (ON)	Ryerson University (ON)	Simon Fraser University (BC)	University of British Columbia	University of Calgary (AB)	University of Manitoba	University of Regina (SK)	University of Saskatchewan	University of Toronto (ON)	University of Victoria (BC)
Aviation Maintenance Engineer	x													
Bachelor of Aerospace Engineering		x				x							x	
Bachelor of Manufacturing Technology				x										
Chemical Engineering			x	x		x						x		
Computer Engineering				x	x	x	x	x	x	x			x	x
Computer Systems Engineering		x												
Electronics Engineering							x	x						
Electronic Systems Engineering											x			
Electrical Engineering		x	x	x	x	x			x	x		x	x	x
Electrical / Computer Engineering									x					
Engineering Physics					x		x	x				x		
Industrial Engineering						x							x	
Industrial Systems Engineering										x	x			
Manufacturing / Mechanical Engineering									x					
Masters of Applied Science in Aerospace Engineering		x											x	
Masters of Engineering Mechanics and Engineering Aerospace													x	
Materials Engineering													x	
Mechanical Engineering		x	x	x	x	x							x	x
Mechanical Engineering with Aerospace Option										x		x		
Metallurgical Engineering				x	x			x						
Metals and Materials Engineering								x	x					
PHD Aeronautical Aerospace Engineering		x												
Software Engineering			x	x		x			x					x
Systems Engineering							x				x			

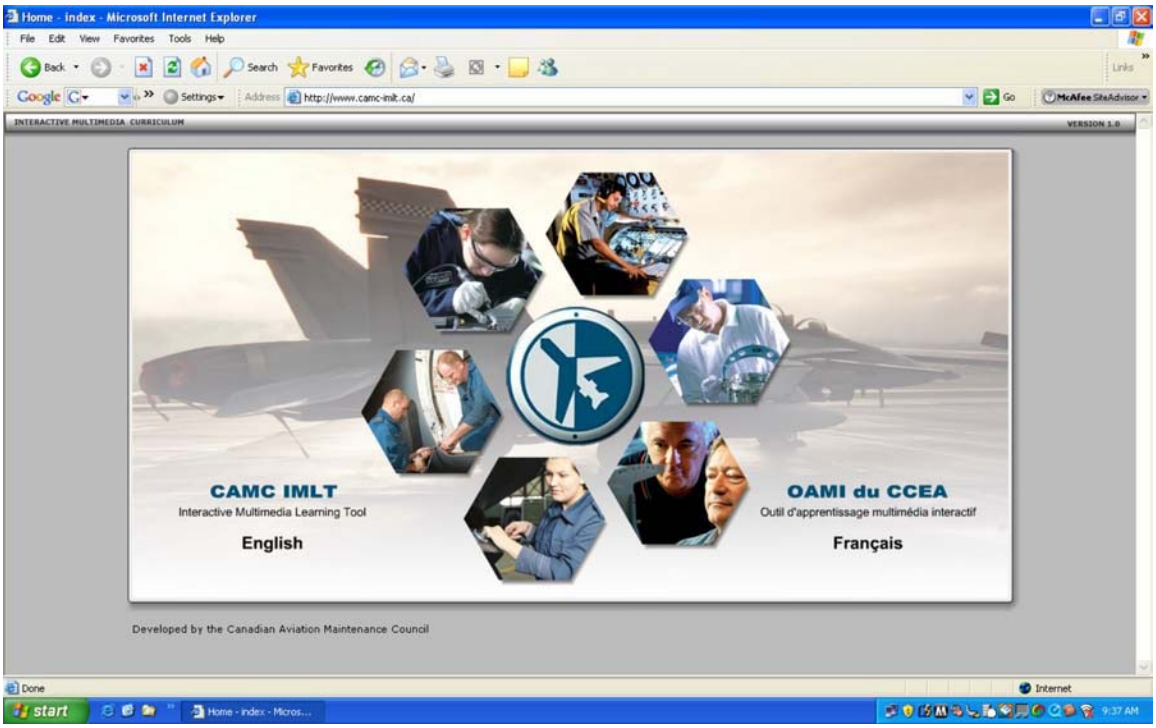
THIS PAGE INTENTIONALLY LEFT BLANK

IMLT USER'S GUIDE

The following steps must be completed in order to log-in to the IMLT curriculum.

STEP ONE

Go to the IMLT Website at http://www.camc-imlt.ca/ and click on "English" or "French".

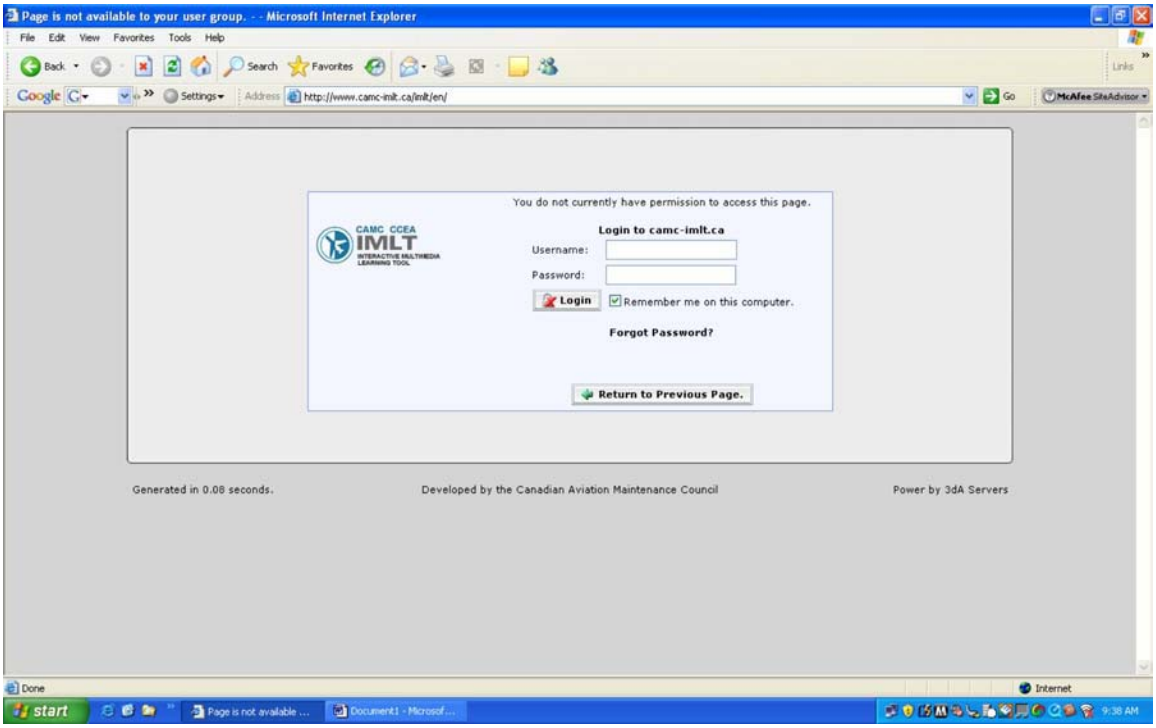


"CAMC", IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15G-1 Home Index

STEP TWO

Enter the username and password (provided by the instructor) and then click enter.

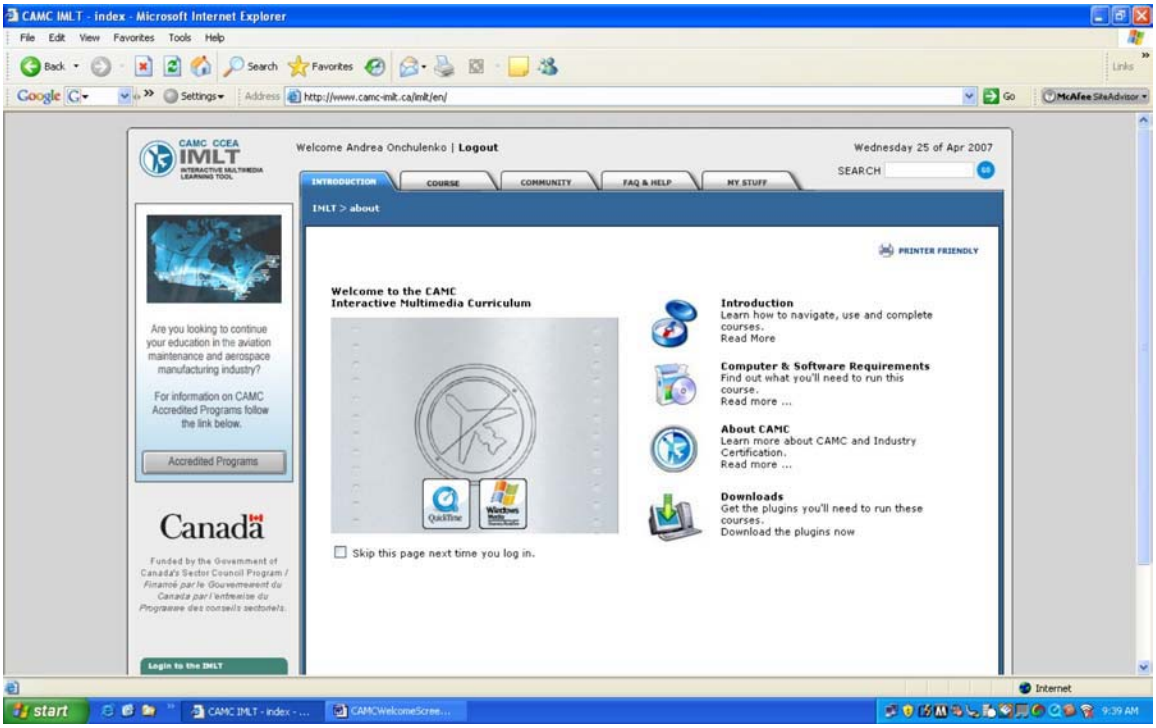


"CAMC", IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15G-2 Log-in

STEP THREE

Select the course by clicking on the tab at the top of the welcome page.

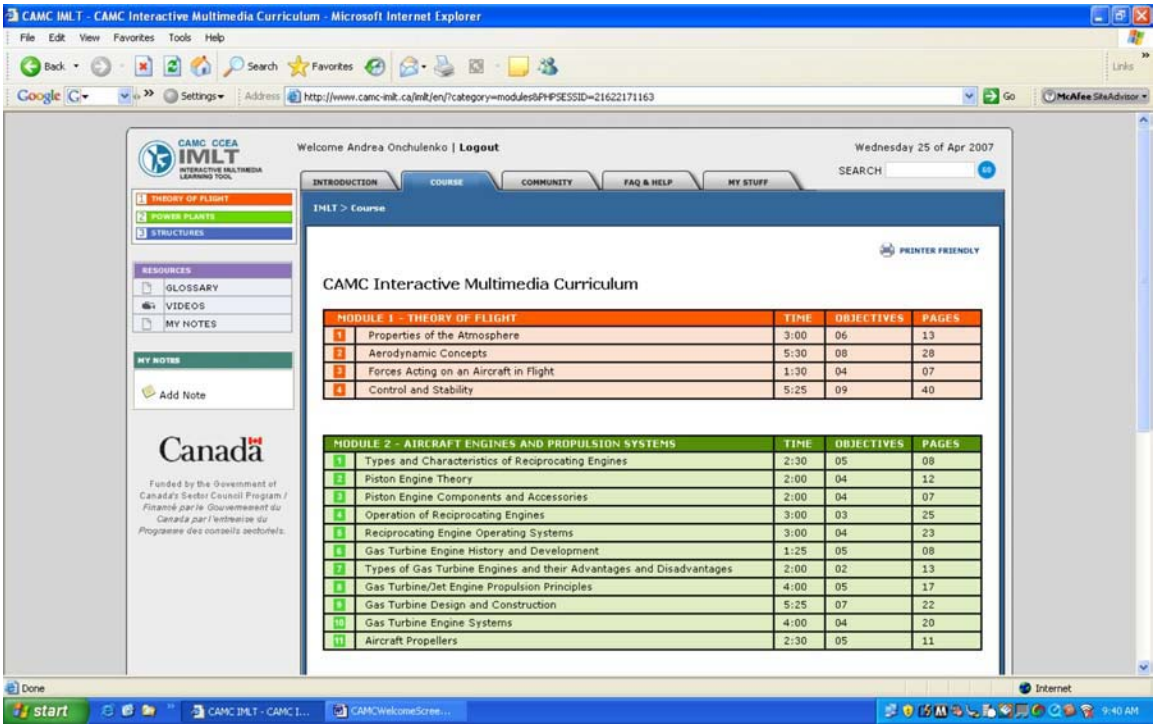


"CAMC", IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15G-3 Introduction

STEP FOUR

Select the module that you wish to complete by clicking on the title.

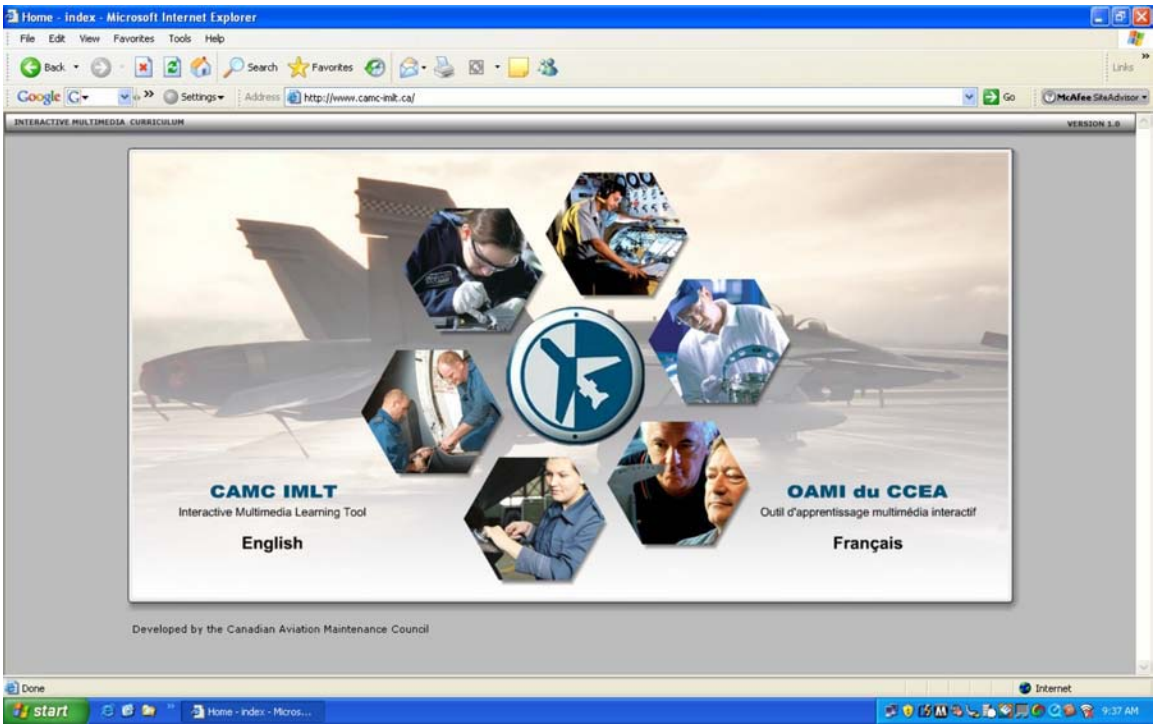


"CAMC", IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15G-4 Course Curriculum

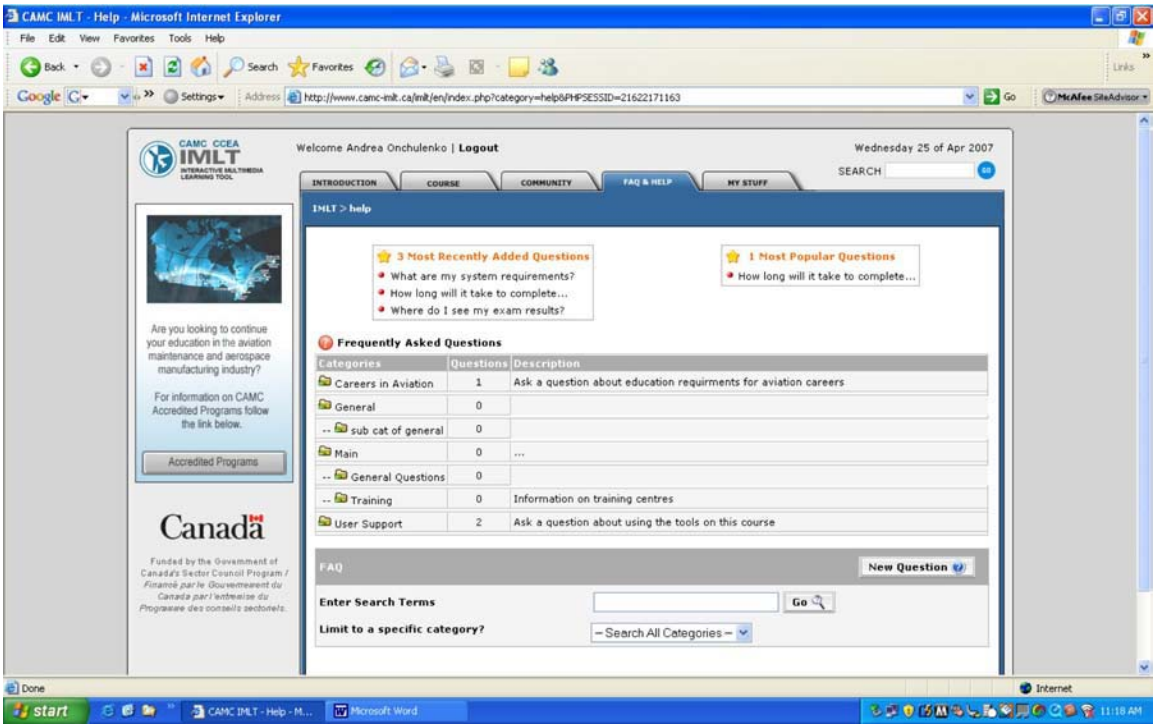
INTERACTIVE MEDIA LEARNING TOOL WELCOMING SCREENS

IMLT Sample Module Screen Shots



"CAMC", IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

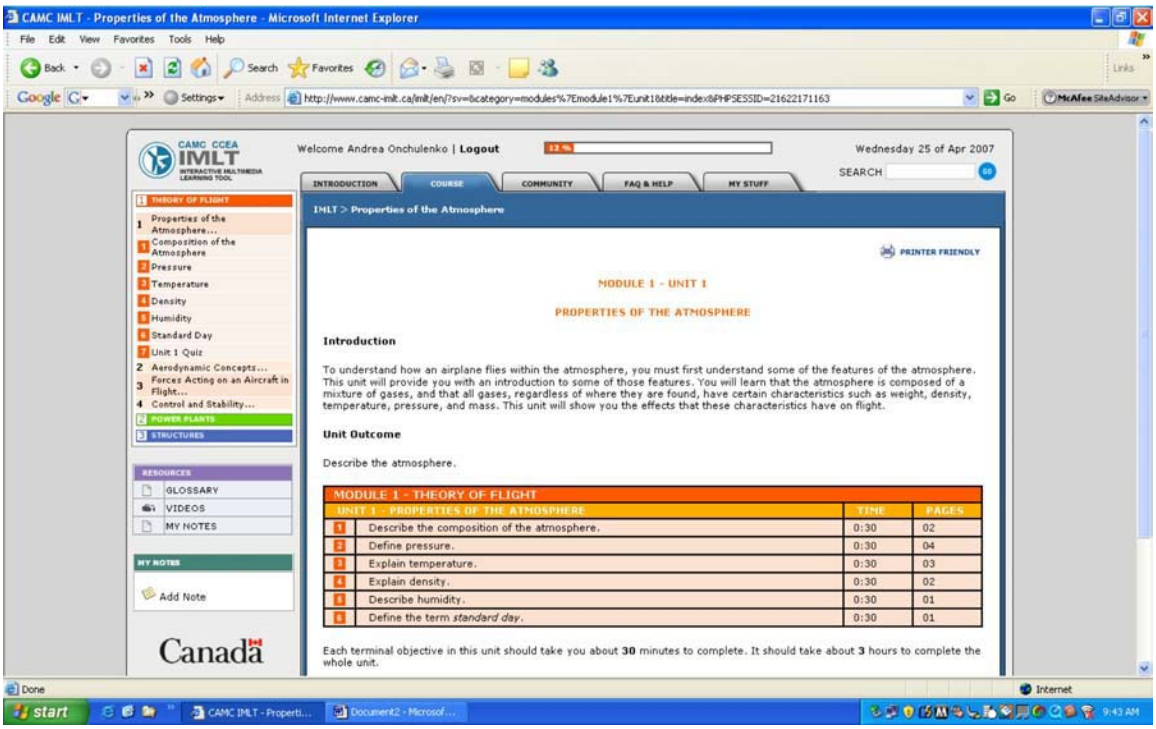
Figure 15H-1 Home Index



"CAMC", IMLT, FAQ and Help. Retrieved 23 April 2007, from www.camc-imlt.ca

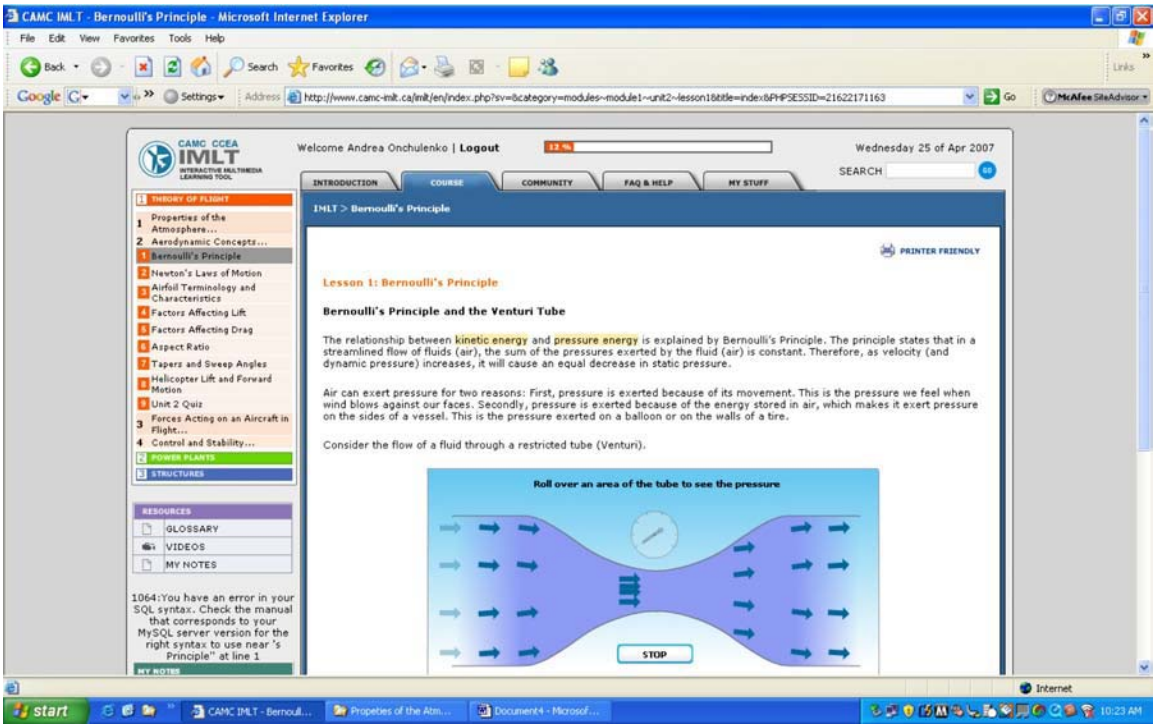
Figure 15H-2 FAQ and Help

THEORY OF FLIGHT



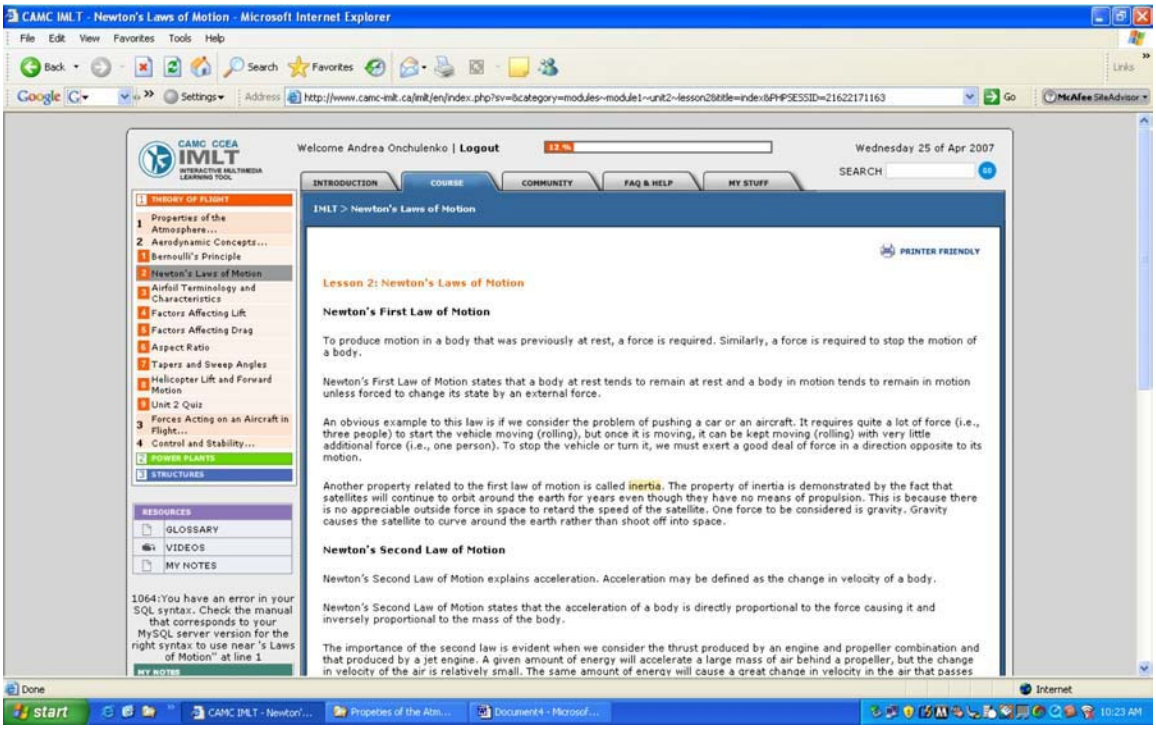
"CAMC", IMLT, Property of the Atmosphere. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15H-3 Theory of Flight: Property of the Atmosphere



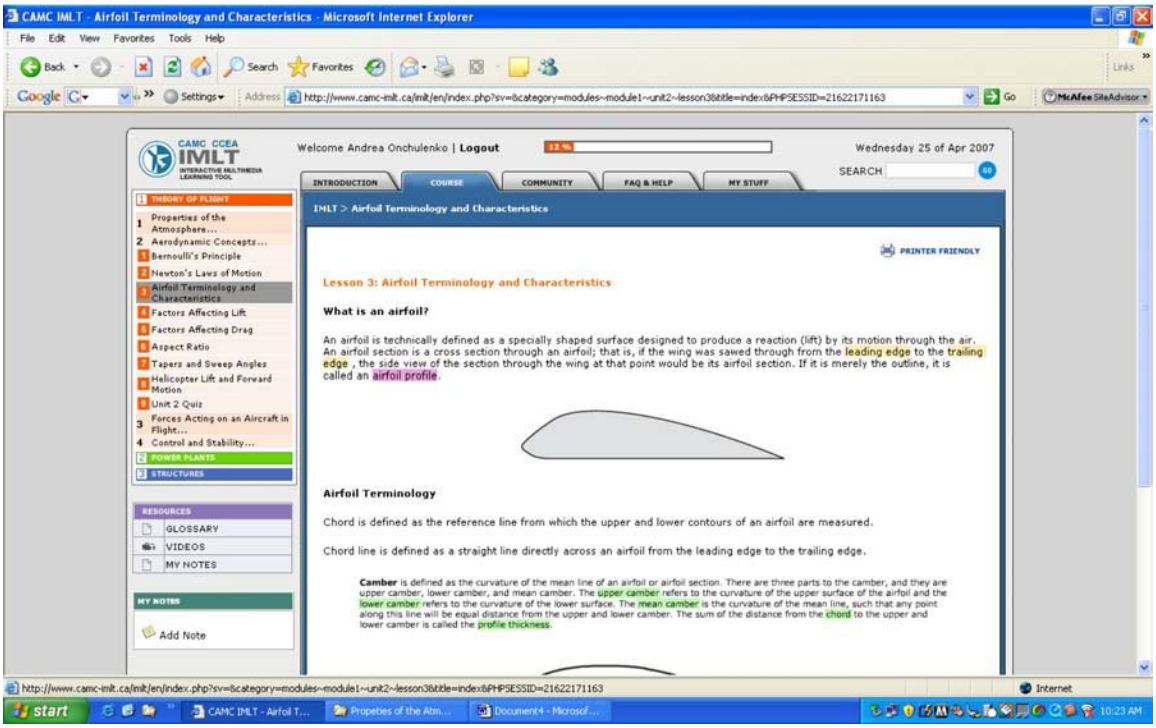
"CAMC", IMLT, Bernoulli's Principle. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15H-4 Theory of Flight: Bernoulli's Principle



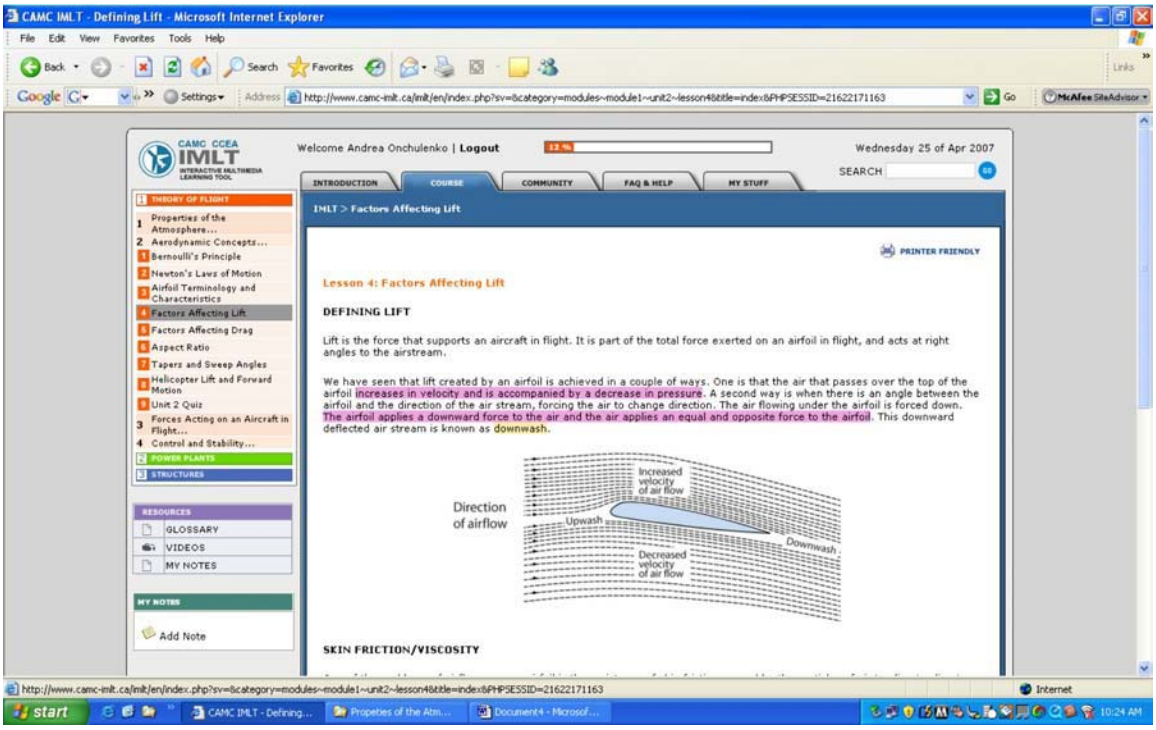
"CAMC", IMLT, Newton's Law of Motion. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15H-5 Theory of Flight: Newton's Laws of Motion



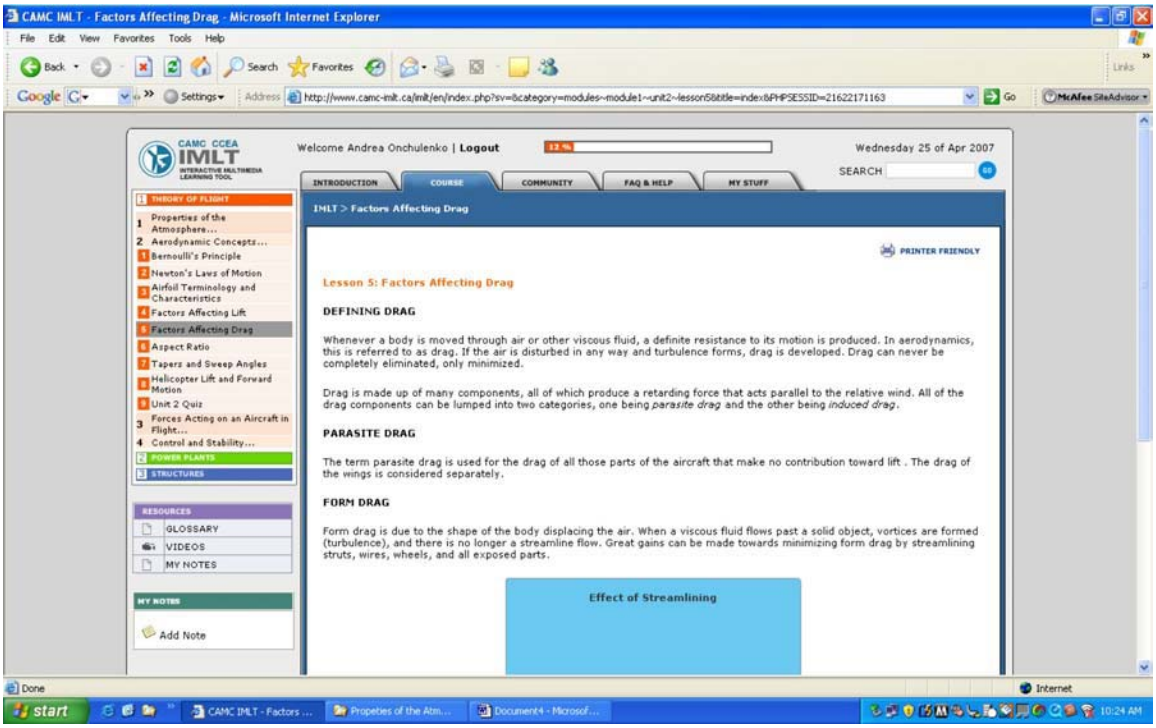
"CAMC", IMLT, Airfoil Terminology and Characteristics. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15H-6 Theory of Flight: Airfoil Terminology and Characteristics



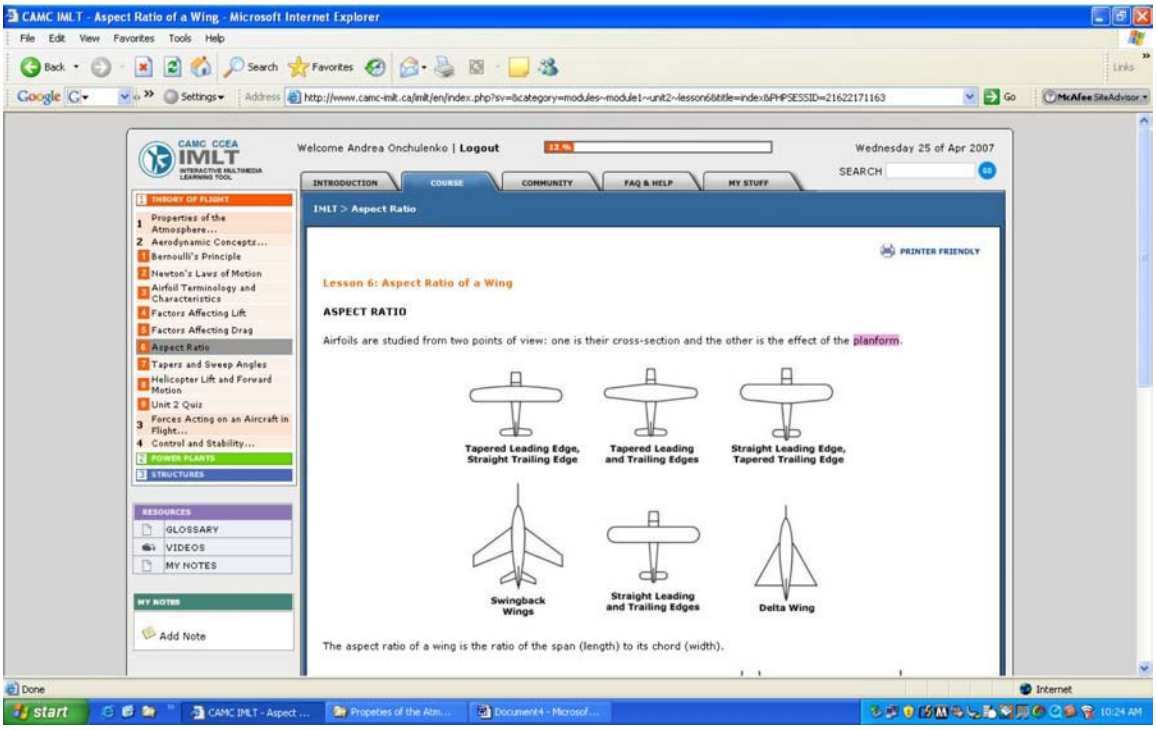
"CAMC", IMLT, Factors Affecting Lift. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15H-7 Home Index Theory of Flight: Factors Affecting Lift



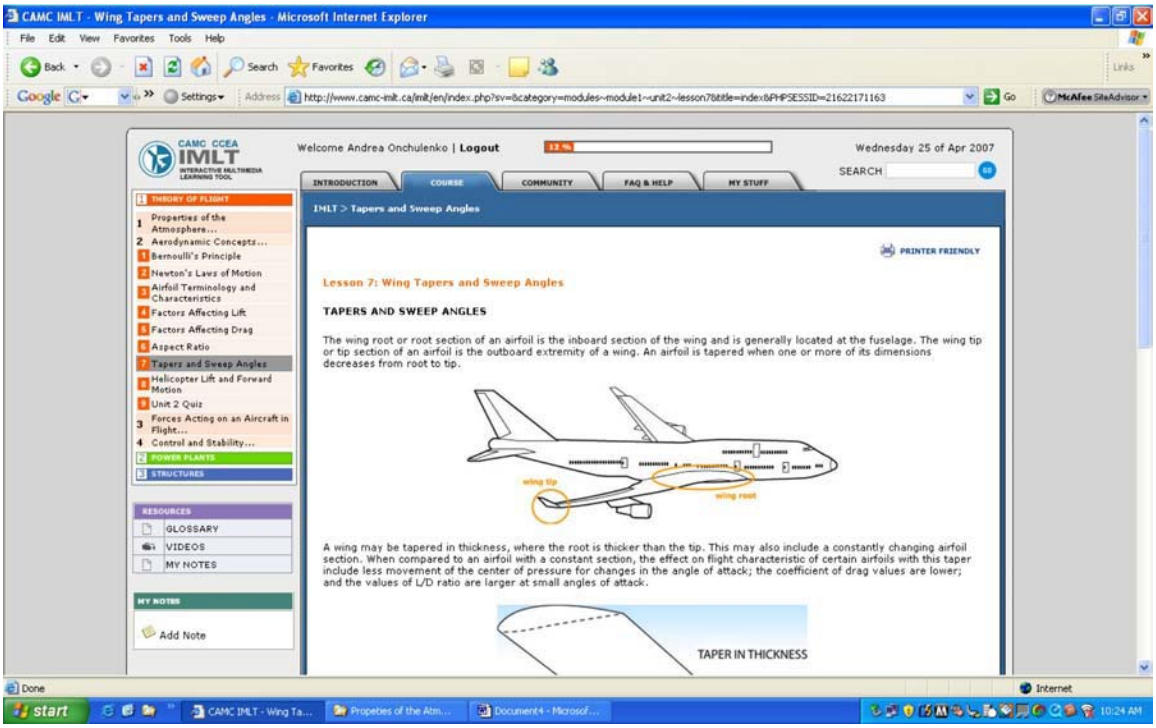
"CAMC", IMLT, Factors Affecting Drag. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15H-8 Theory of Flight: Factors Affecting Drag



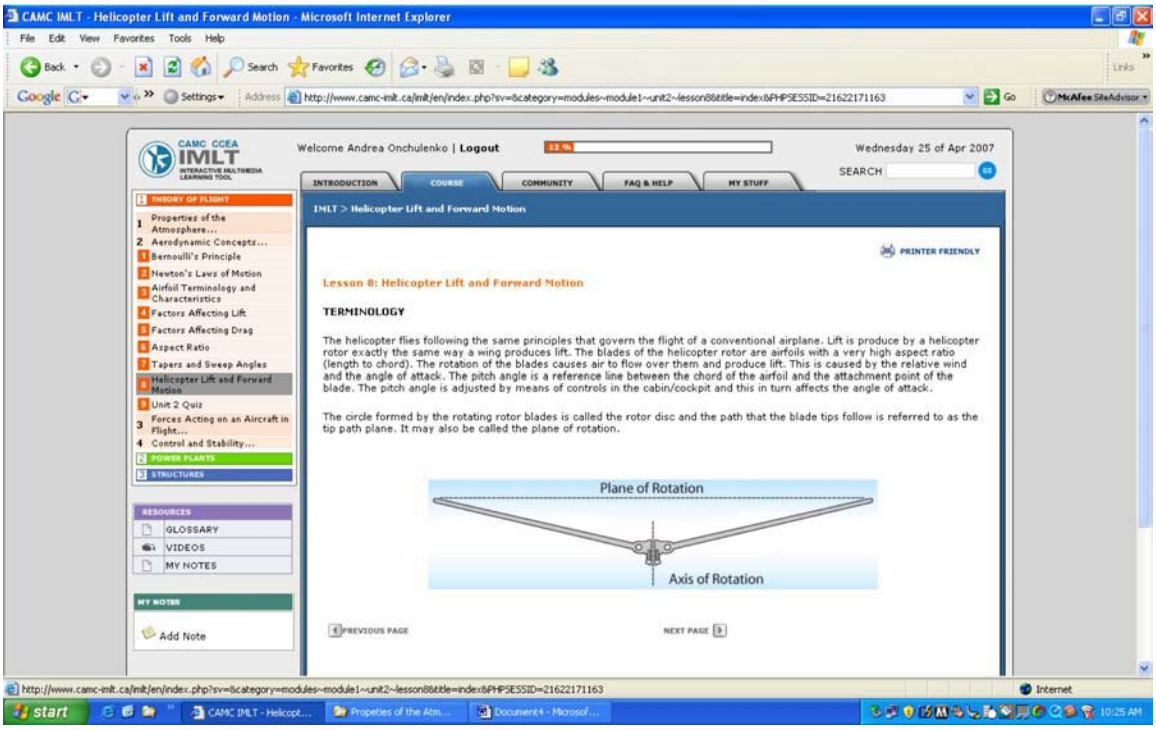
"CAMC", IMLT, Aspect Ratio of a Wing. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15H-9 Theory of Flight: Aspect Ratio of a Wing



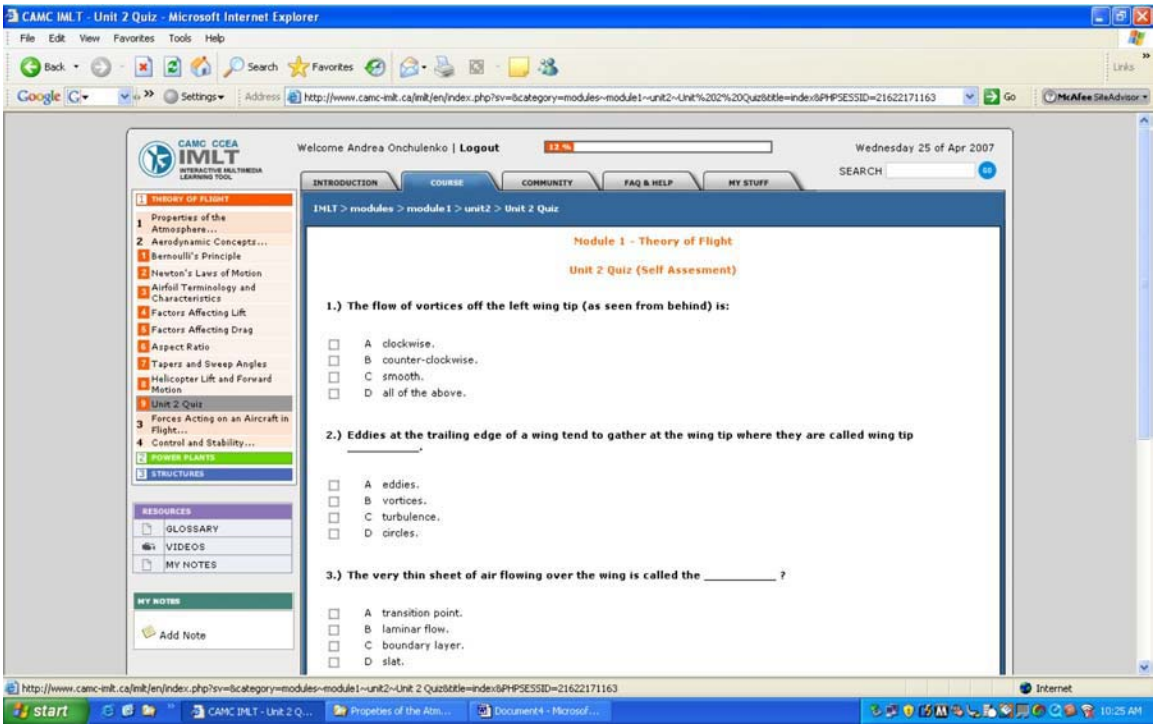
"CAMC", IMLT, Wing Tapers and Sweep Angles. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15H-10 Theory of Flight: Wing Tapers and Sweep Angles



"CAMC", IMLT, Helicopter Lift and Forward. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15H-11 Theory of Flight: Helicopter Lift and Forward Motion



"CAMC", IMLT, Quiz. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 15H-12 Theory of Flight: Quiz (Self Assessment)

THIS ANNEX HAS BEEN REMOVED FROM THE ONLINE VERSION OF A-CR-CCP-802/PF-001 IN ORDER TO PROTECT THE INTEGRITY OF THE PROFICIENCY LEVEL TWO TRAINING PROGRAM AND ASSESSMENT SCHEME. THE ANNEX IS AVAILABLE IN THE PUBLICATIONS (PRINT AND CD SUITE) DELIVERED DIRECTLY TO EACH SQUADRON AND IN THE PUBLICATION AVAILABLE ON CADETNET

THIS PAGE INTENTIONALLY LEFT BLANK

THIS APPENDIX HAS BEEN REMOVED FROM THE ONLINE VERSION OF A-CR-CCP-802/PF-001 IN ORDER TO PROTECT THE INTEGRITY OF THE PROFICIENCY LEVEL TWO TRAINING PROGRAM AND ASSESSMENT SCHEME. THE APPENDIX IS AVAILABLE IN THE PUBLICATIONS (PRINT AND CD SUITE) DELIVERED DIRECTLY TO EACH SQUADRON AND IN THE PUBLICATION AVAILABLE ON CADETNET

THIS PAGE INTENTIONALLY LEFT BLANK