The Canadian Bush Pilot Industry

SECTION 1: THE ORIGIN AND DEVELOPMENT OF BUSH FLYING

SECTION 2: AIRCRAFT FLOWN

SECTION 1
THE ORIGIN AND DEVELOPMENT OF BUSH FLYING

POST WORLD WAR 1 (WWI)

Did you know?

In Canada, the word "bush" has been used since the 19th century to describe the hostile environment beyond the clearings and settlements.

There were few registered pilots in Canada at the beginning of WWI. To avoid the hazards of trench life as a soldier, young men took to the skies as members of the British Air Service. For those men who survived wartime flying, returning to civilian life was not as interesting or exciting. These veterans of aerial combat were to become pioneers as bush pilots.

Did you know?

For pilots returning to a civilian life of flying, the main choices included:

- barnstorming,
- crop-dusting, and
- bush flying.

In the remote Canadian north, lack of roads restricted the transporting of necessities such as food, medicine and building material. With the availability of aircraft and pilots willing to fly into these remote areas, bush flying filled this transportation void.

Between 1917–18, Fairchild Aerial Surveys (of Canada) conducted the first winter bush flying. Fairchild Aerial Surveys (of Canada) flew supplies from Hudson, Ontario to Narrow Lake, Ontario for Bathurst Mines.

In 1919, the first aerial survey was completed in Labrador for the South Labrador Pulp and Paper Company, Limited (Ltd). Over 15 000 aerial photographs were taken of the timberland.

With continued development and demands for service in Northern Ontario, ex-Royal Naval Air Service (RNAS) and Royal Air Force (RAF) pilots were hired to fly war-surplus aircraft. The handful of flyers who could fly and fix their aircraft became the core of the fledgling bush flying industry. To survive in the wilderness regions, aircraft needed maintenance.

The first commercial flying started in 1919 when an organized group lead by the Laurentide Paper Company requested two aircraft from the St. Maurice Forestry Protection Association in Quebec to fly fire patrols. The Curtiss HS-2L "La Vigilane" was the first commercial aircraft to complete this duty.

Did you know?

It took 12 hours and 20 minutes over three days to fly the Curtiss HS-2L "La Vigilane" from Dartmouth, Nova Scotia to Grand-Mère on Lac à La Tortue, Quebec.

You can see the La Vigilane and read its story at the Canada Aviation Museum in Ottawa, Ontario.

During the 1919 season, 80 hours of flying time was accumulated. During the 57 flights, experiments in aerial photography for forestry purposes were completed.

The Forest Protection Association decided to withdraw from the operation. The Laurentide Paper Company entered into agreement with one of the pilots, W.R. Maxwell and together they formed Laurentide Air Service Ltd.

Passenger service and surveying was a major role of this new service. Forest fire patrols over the St. Maurice River valley in Quebec was extended to include from Lake-of-the-Woods to James Bay, both in Ontario. The Ontario Department of Lands and Forest requested a survey of forest resources in Northern Ontario.

Did you know?

The first Canadian private pilot licence, air engineer's certificate and commercial aircraft registered were issued in January 1920.

At the same time, the Canadian government approved the establishment of a Canadian Air Force.

The bush flying role continued to evolve with the development of the aircraft. Transporting personnel, patrolling for forest fires and sketching or taking aerial photograph of timber limits became a common task for the pilots.

In 1920, pilots with engineers would fly to Northern Ontario regions not accessed before. Ray Maxwell with his engineer Geordie Doan made the first flight to James Bay, flying from Remi Lake, Ontario near Kapuskasing to Moose Factory, Ontario in an H-Boat. They flew the first ambulance flight in northern Canada 11 days later. Maxwell continued to fly firsts when he made the first volume carriage of airmail in Canada.

The Ontario government promoted the continued growth of bush flying by contracting services from the few air services. Large government contracts provided flying work for detail mapping, to include:

- showing lakes,
- waterways, and
- forest types.

Other contracts required the transporting of firefighting personnel and to complete fire patrols.

Pilots started flying to the North for the thrill of flying into remote areas, but this soon changed from thrill of flying to flying for profit. The number of licensed pilots, registered aircraft and private flying companies decreased by 1924; flying hours and amount of freight carried increased.

The Canadian Air Force discontinued providing flying services that could be provided by private companies.

***Activate Your Brain #1*:**

W.R. Maxwell played a major role with the development of bush flying. Can you name some of the first accomplishments he made?

_____ _____

_____ _____

_____ _____

Creation of the Ontario Provincial Air Service (OPAS)

The Ontario government had seen the benefits of utilizing aircraft and created the OPAS to own and operate its own fleet of aircraft. Through its development of services and the pilots who flew the aircraft, the OPAS represented the "cradle of bush flying."

Did you know?

The OPAS established its primary base of operation at Sault Ste. Marie, Ontario. Other bases of operation were established across Northern Ontario. The first fleet of aircraft consisted of 13 surplus Curtis HS-2L flying boats.

With OPAS flying, contracts decreased for Laurentide and many of the best pilots and engineers left Laurentide to the new government flying service.

Laurentide tried to counter the loss of contracts by introducing scheduled services, including:

- air service into the Quebec gold field between Angliers, Lake Fortune and Rouyn, and
- mail service to Haileybury, Ontario, Angliers, Quebec and Rouyn, Quebec.

Both services were not well received by the communities and Laurentide Air Service Ltd. terminated operations in 1925.

With the discovery of Ontario gold at Red Lake, OPAS started to fly all the men, supplies and equipment needed, to Red Lake before the winter freeze.

Competition for air services developed with Patricia Airways and Exploration Ltd. providing the first scheduled air service into the gold field at Red Lake, carrying:

- passengers,
- freight, and
- mail.

Did you know?

Patricia Airways and Exploration Ltd. was developed by Roy Maxwell, the first director of OPAS. Many of the OPAS aircrews joined Maxwell.

***Activate Your Brain #2*:**

St. Maurice Forestry Protection Association and OPAS first used what aircraft?

_____

Northern Air Service Ltd.

In northeastern Ontario, Northern Air Service Ltd. was formed to fill the void left by Laurentide. Supplies from the Quebec goldfields were transported by Northern Air Service Ltd.

Bush flying operations continued to rely on the surplus WWI aircraft, including:

- H-boats,
- Canuck trainers,
- Avro 504Ks, and
- other available aircraft.

Did you know?

Bush flying activity was mainly developed in Ontario and Quebec. The companies set the framework for the progression of bush flying into other Canadian provinces and territories.

Western Canada Airways (WCA)

A Winnipeg businessman, James Richardson, saw the merits and potential of aircraft to serve the remote northland of Western Canada. The base of operation was located at Hudson, Ontario. With the new company a new aircraft was introduced, the Fokker Universal with a newly developed radial, air-cooled engines and a high-wing cabin.

Did you know?

Early bush pilots and engineers often sat exposed in open-cockpit aircraft during the winter when the temperature could be 35 below zero.

Bush flying duties mainly operated in the northern Ontario and Quebec goldfields. The first major undertaking of its kind in northern Canada was for WCA to supply men, machinery and materials to the west coast of Hudson Bay at Fort Churchill, Manitoba. The airlift was completed in the winter. The successful airlift was noted in government reports.

Did you know?

In 1927, Fort Churchill, Manitoba was selected as the ocean terminus of the Hudson Bay Railroad because of the successful airlift completed by WCA.

More large contracts were given to WCA, including the transporting of men and equipment to a new mining development north of Senneterre, Quebec. WCA work proved that the north was open for operations, 12 months of the year.

At this time, aircraft development was undertaken by designers, mainly because of the development of the Pratt and Whitney radial, air-cooled engine.

With winter flying, new innovations were made to improve the operation of the Fokker which was not designed for the bush. The Elliott Brothers of Sioux Lookout, Ontario redesigned skis to replace the Fokker designed skis. The new skis improved landing on rough frozen lakes and the design was used on bush planes for many years.

Did you know?

Admiral Byrd used the Elliot Brothers skis on his aircraft for all three expeditions into the Antarctic.

Expanding to the Artic Circle

With flying a common sight in the southern bush, companies looked further north, well into the Artic Circle. Aircraft would build fuel cashes in the summer, landing on the lakes with aircraft equipped with floats. Once the lakes froze, flights continued with aircraft landing using skis.

The cooperation and team work of the pilots and mechanics or air engineers kept the far north open 12 months of the year. Unreliable aircraft would leave the crew stranded on a remote lake miles from anywhere with no communications. The skills of the mechanic would make the aircraft flyable or the crew would have to make the long walk out of the bush.

Figure A-1 Fokker Universal

Note. From "Western Canada Aviation Museum", 2006, *Ghost of Charron Lake-Fokker Universal Standard Aircraft G-CAJD*. Copyright 2006 by fokkeraircraftrecovery.ca. Retrieved December 2, 2009, from http://www.interactivestudio.ca/fokker2/history.htm

New challenges faced the crew, especially in this cold environment. At times, a new engine had to be delivered to the crippled aircraft and changed in the field or repairs to a collapse landing gear made in hot or cold situations. The challenges of working in the sub-zero temperatures lead to innovations. To protect the pilot and engineers, an all-weather canvas nose hanger was designed with a small stove for servicing aircraft engines outdoors.

Did you know?

Starting an engine in the late 1920's was challenging. The oil was drained from the engine at the end of the day and stored in a warm building then returned to the engine in the morning. If the oil was too thick, it had to be warmed over a fire pot while another fire pot was placed under the engine to thaw it. The oil was added and if it did not start, the process was repeated until the engine started.

Flying in the Artic Circle was limited to the daylight hours. Many times the crew would spend the night in the sub-zero temperatures, starting the aircraft in the early morning darkness to maximize the daylight flying time.

Canadian Airways

Canadian Airways was formed in 1930 by uniting WCA and the Aviation Corporation of Canada. The flying interests of the Canadian Pacific Railroad (CPR) and the Canadian National Railroad (CNR) was included. Canadian Airways controlled almost all air business in Canada. With the new company was introduced the Junkers JU52.

Aircraft design continued to grow and more aircraft were developed to serve multiple roles from carrying large freight including:

- bulldozers,
- tractors,
- a complete sawmill,
- cement,
- dynamite,
- fuel oil,
- horses, and
- cows for milk.

Flying locations continued to expand, supplying freight and personnel to communities, mining sites and dam constructions sites.

Austin Air Service

Two Toronto, Ontario brothers, Jack and Chuck Austin created Capreol and Austin Air Service in 1934. The name changed to Austin Airways shortly after the opening. The aircraft were Waco cabin biplanes. The modifications the brothers introduced included a removable panel on the port side behind the cabin. This allowed the loading of a stretcher, creating Canada's first commercial air ambulance.

Mining personnel were the main clients but in 1936, the Department of Lands and Forest used many air services to aid during the large forest fire season.

Did you know?

Pilots were paid a monthly salary and a dollar a flying hour. When the dollar an hour was changed to a dollar a mile, aircraft started moving faster in shorter times.

Austin Airways established numerous Ontario bases from Sudbury, Chapleau, Gogama and Biscotasing. A summer base was established at Temagami, Ontario. Austin aircraft flew over Northern Ontario and beyond, linking remote native communities. Fish hauling was a profitable business with these communities.

By 1941, Austin Airways had expanded in Ontario, to South Porcupine and Nakina with regular flights into James Bay and soon flying on both sides of Hudson Bay.

The creation of northern airlines provided the mainstay of transporting personnel and material between southern communities to northern remote communities. The expansion of roles for these airlines changed with the development of aircraft, better suited for remote flying duties. From the larger cargo aircraft to smaller aircraft better suited to fly into smaller remote lakes, the role of the bush pilot continues to evolve to today's standards.

Did you know?

Television shows such as The Discovery Channel show "Ice Pilots", are created to show the role and hardships of pilots in northern Canada.

The bush aircraft come in various sizes and shapes but are designed to withstand the take-off and landing in short distances.

The skills of men and women include good piloting skills and a need to adapt to precise flight at slow speeds for landings and take-offs on small lakes and landing strips. Bush pilots tend to be self reliant individuals with knowledge of wilderness survival.

Today, bush flying has evolved into a new outlet, supporting new services to remote locations.

Missionaries fly in and out of remote communities to provide religious service to communities.

Bush flying has evolved into a family activity with the availability of rentals and charter tours. Small companies provide bush pilots to fly people into small remote locations to provide recreational support to many people, including:

- hunters,
- fishermen,
- photographers, and
- outdoor enthusiasts (campers and hikers).

Did you know?

Training is available to teach pilots the skills to fly and land float aircraft which has opened new locations for the owners of private aircraft. With more pilots receiving the skills to fly specially equipped aircraft, comes the dangers of inexperienced pilots flying to remote locations.

With the development of helicopters, bush flying has introduced specific helicopters to fly into remote communities not accessible by aircraft. The ability to manoeuvre a helicopter into confined spaces introduced a modern mode of transportation to provide support to more northern communities and outposts. The role of fire detection is better suited for helicopters as they can hover over tight spots, give accurate information, fly loaded detection patrols during high-hazard days or high-risk areas and land crews in specific areas.

***Activate Your Brain #3*:**

Can you name some of the air services?

_____ _____
_____ _____
_____ _____
_____ _____

SECTION 2
AIRCRAFT FLOWN

Many aircraft were used to promote the bush flying role for Canadian air services. Development of bush flying specific aircraft was not a priority as many air services used the aircraft of the day. Many aircraft were float planes as most of the land planes could not land on unprepared fields and the large amount of undeveloped, forested land led to many aircraft having to land on lakes.

PIONEER BUSH FLYING AIRCRAFT

Pilots who trained on different aircraft during WWI returned to Canada and flew the war-surplus aircraft purchased for pioneering services to northern, isolated communities. The aircraft were large flying boats that required specific sized lakes and landing stripes to operate. The main base of operation was a water base suitable for the large lumbering aircraft to land and take-off.

Curtiss HS-2L

The Curtiss HS-2L flying boat was an open cockpit aircraft used for costal patrols during WWI. This aircraft was the pioneer bush flying aircraft. The single Liberty engine aircraft could land and take-off from water but had wheels for manoeuvring on land. The Canadian government first used these aircraft for anti-rum-running, fishery and custom patrols on the east and west coast before two HS-2Ls were sent to fly fire patrols for the St. Maurice Forestry Protection Association of Quebec.

Figure A-2 Curtiss HS-2L

Note. From "Défense nationale", 2004, *Curtiss HS-2L*. Retrieved December 2, 2009, from http://www.airforce.foces.ca/v2/equip/resrc/images/hst/l-g/hs2l.jpg

Vickers Vedette Flying Boat

The Vickers Vedette flying boat was the first aircraft built to a Canadian specification for Canadian conditions. The RCAF flew this aircraft for forestry surveying and fire protection patrols. The aircraft was flown to wilderness areas for communications and photography surveys for the preparation of maps by the Geological Survey of Canada.

Figure A-3 Vickers Vedette Flying Boat

Note. From "Government of Canada", 2004, *Canadian Military Heritage*. Retrieved December 2, 2009, from http://www.cmhg-phmc.gc.ca/cmh/en/image_587.asp

de Havilland Moth

The OPAS used the de Havilland Gypsy Moth but the RCAF used the de Havilland Cirrus Moth.

Figure A-4 de Havilland DH-60 Cirrus Moth

Note. From "National Defence", 2004, *Canada's Air Force, Aircraft, Historical Aircraft, de Havilland DH-60 Cirrus Moth*. Retrieved December 2, 2009, from http://www.airforce.foces.ca/v2/equip/hst/moth-eng.asp

Did you know?

The word Gypsy and Cirrus was the name of the engine design.

Curtiss JN-4 "Canuck"

The Curtiss JN-4 was used by Northern Air Service Ltd. to fly many firsts including:

- first ski flying,
- first airmail,
- first aerial survey, and
- first flight across the Canadian Rockies.

Figure A-5 Curtiss JN-4

Note. From "Canada Aviation Museum", *Curtiss JN-4 "Canuck"–Canada Aviation Museum*. Retrieved December 2, 2009, from http://www.aviation.technomuses.ca/collections/artifacts/aircraft/CurtissJN-4Canuck

Avro 504k

Only two of the Canadian version of the Avro 504 were built and flown by the RCAF. A civil Avro 504k was one of the first commercial passenger flights into the Canadian bush on October 15–17, 1920. Two passengers sat in the front open cockpit seat and were flown from Winnipeg to Le Pas, Manitoba.

An Avro 504k made the first winter flight to James Bay in 1922.

Figure A-6 Avro 504k G-CYFG

Note. From "Canada Aviation Museum", *Avro 504K G-CYFG–Canada Aviation Museum*. Retrieved December 2, 2009, from http://www.aviation.technomuses.ca/collections/artifacts/aircraft/Avro504KG-CYFG

Fokker Standard Universal

The Fokker Standard Universal was built in 1926. The fuselage and tail surfaces were made of welded tubular steel, covered with fabric. The wings were plywood with a Sitka spruce spar and the engine was the Wright J-4B 200 horse power (hp). The pilot sat in an open cockpit while the engineer travelled in the enclosed cargo section.

Figure A-7 Fokker Standard Universal

Note. From "Western Canada Aviation Museum", 2006, *Ghost of Charron Lake-Fokker Universal Standard Aircraft G-CAJD*. Copyright 2006 by fokkeraircraftrecovery.ca. Retrieved December 2, 2009, from http://www.interactivestudio.ca/fokker2/history.htm

Did you know?

A Fokker Stand Universal was used by Admiral Byrd for his 1928–1930 expedition to the Antarctic.

Junkers Ju-52 CF-ARM

Canadian Airways Ltd. flew the Junkers Ju-52 from the Red River. The Junkers Ju-52 was the largest single-engine aircraft operated in Canada and was fondly referred as the "Flying Boxcar". The single engine aircraft was brought to Canada from Germany and outfitted with a 830 hp Roll Royce Buzzard engine.

Figure A-8 Junker Ju 52 CF-ARM

Note. From "Western Canada Aviation Museum", 2009, *Junkers Ju-52*. Copyright 2009 by Western Canada Aviation Museum. Retrieved December 2, 2009, from http://www.wcam.mb/junkers.html

Did you know?

The Junkers Ju-52 lands at 47 miles per hour and appears to float toward the ground like a glider.

Waco

The Waco biplane had a cabin for both the pilot and engineer to fly protected from the environment. Up to three people can travel in this aircraft.

Figure A-9 Waco UIC

Note. From "Alberta Aviation Museum Edmonton", 2009, *Waco UIC (1933)*. Copyright 2009 by Alberta Aviation Museum. Retrieved December 2, 2009, from http://www.albertaaviationmuseum.com/index.php?option=com_content&task=view&id=31&item=41

Noorduyn Norseman

The Noorduyn Norseman is a commercial aircraft designed as a light transport. The Norseman has a Whitney R-1340 radial engine. The design of this large bush plane enabled it to remain in service from 1935–1959 when many were replaced by the de Havilland Otter.

Figure A-10 Noorduyn Norseman

Note. From "U.S. Centennial of Flight Commission", 2009, *General Aviation: Noorduyn Norseman Bush Plane*. Copyright 2009 by John Stephens. Retrieved December 2, 2009, from http://www.centennialofflight.gov/essay/GENERAL_AVIATION/bush_flying/GA18G3.htm

Did you know?

During WWII, famed band leader Glenn Miller disappeared over the English Channel. It was rumoured that he was abducted by space aliens or the Norseman, he was flying, had design flaws. Neither was true.

PRESENT BUSH FLYING AIRCRAFT

With the advancement of engine design, more powerful power plants allowed new designs to be considered for future bush flying aircraft. Large and small aircraft were built for role specific duties. Helicopter development and refinement created numerous multi-role airframes.

Did you know?

Engines were identified with lettering to include:

- opposed (O),
- radial (R),
- fuel injected (I),
- turbocharged (T or TS),
- geared (G), and
- helicopter or vertical installation (H or V).

de Havilland DHC-2 Beaver

The Beaver was designed as a no-nonsense bush plane with a nine cylinder Pratt & Whitney radial engine. The all metal aluminum, semi-monocoque design had tube frame seats and first flew in 1947. The Beaver had short take-off and landing capability (STOL) and could fly with floats or skis. It was known as a "half-ton truck with wings".

Figure A-11 de Havilland Beaver

Note. From "U.S. Centennial of Flight Commission", 2009, *General Aviation: de Havilland Beaver*. Copyright 1996 by Geoff McDonell. Retrieved December 2, 2009, from http://www.centennialofflight.gov/essay/GENERAL_AVIATION/bush_flying/GA18G3.htm

de Havilland DHC-3 Otter

The Otter first flew in 1951 and was the successor of the DHC-2 Beaver. It was initially called the "King Beaver" but was renamed the Otter. It was like the Beaver but many were converted to turbo-prop Pratt & Whitney or Walter engines.

Figure A-12 de Havilland Otter

Note. From "findtarget reference", 2009, *Seaplane Information*. Copyright 1999–2009 by FindTarget.com. Retrieved December 2, 2009, from http://reference.findtarget.com/search/seaplane

Did you know?

The Otter was the basis for de Havilland's successful Twin Otter.

Cessna Floatplanes

Cessna floatplanes were designed in numerous configurations, including:

- single-engine Cessna 182,
- twin-engine Cessna 337 Skymaster, and
- single-engine Cessna Caravan.

The high wing placement allowed the pilot an unobstructed view of the area below. The slow-speed requirement was met by the Cessna, allowing the pilot to observe and report accurately on a fire.

Figure A-13 Cessna 182 Floatplane

Note. From "Creek Side Landing", 2009, *Cessna 182*. Copyright 2009 by Old Planes and Cars for Sale. Retrieved December 2, 2009, from http://www.oldplanesandcars.com/inventory

Figure A-14 Cessna 337 Skymaster

Note. From "Canadian Bushplane Heritage Centre", 2009, *Cessna 337 Skymaster*. Retrieved December 1, 2009, from http://www.bush-planes.com/detection-aircraft-canadian-bushplane-heritage

Helicopters

With the introduction of helicopters to the role of bush flying, more remote areas were accessible and specific tasks were assigned to the helicopter. Helicopters could land and take off from tight spots and hover over a fire for the observer to note and report the details.

Helicopters varied in size and could fulfill various roles, to include:

- fire watch,
- firefighting,
- construction,
- lumber collection, and
- recreational hunting and fishing excursions.

Figure A-15 Helicopter

Note. From "Canadian Bushplane Heritage Centre", 2009, *Helicopter*. Retrieved December 1, 2009, from http://www.bush-planes.com/detection-aircraft-canadian-bushplane-heritage

Figure A-16 Bell 47 Bush Helicopter

Note. From "bush-planes.com", *Bell 47*. Retrieved December 3, 2009, from http://www.bush-planes.com/Bell47Helicopter.htm

Figure A-17 Bell Jet Ranger Bush Helicopter

Note. From "bush-planes.com", *Bell Jet Ranger*. Retrieved December 3, 2009, from http://www.bush-planes.com/BellJetRangerHueyHelicopter.htm

Figure A-18 Sky Crane Helicopter

Note. From "bush-planes.com", *Sky Crane*. Retrieved December 3, 2009, from http://www.bush-planes.com/SkyCraneHelicopter.htm

Figure A-19 C47 Chinook Helicopter

Note. From "bush-planes.com", *C47 Chinook*. Retrieved December 3, 2009, from http://www.bush-planes.com/ChinookandSeaKnightHelicopters.htm

If you visit Sault St. Marie, Ontario, you can see and learn about bush planes at the Canadian Bushplane Heritage Centre, or go to http://bushplane.com

Can you Identify bush aircraft?

Number the name of the aircraft with the picture of the aircraft.

1	Curtis HS-2L
2	Vickers Vedette Flying Boat
3	de Havilland DH-60 Cirrus Moth
4	Curtis JN-4
5	Avro 504k G-CYFG
6	Fokker Standard Universal
7	Junker Ju 52 CF-ARM
8	Waco UIC
9	Noorduyn Norseman
10	de Havilland Beaver
11	De Havilland Otter
12	Cessna 182 float plane
13	Cessna 337 Skymaster
14	Bell 47 bush helicopter
15	Bell Jet Ranger bush helicopter
16	Sky Crane helicopter
17	C47 Chinook helicopter

Bush aircraft	Number of name
	


COLUMBIA

	
	
 G-CYDY	

	
	
	

	
	
	


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YF

CONCLUSION

The historical value of the bush pilot to open Northern Canada can be traced back to the returning pilots from WWI. Although the original reason to become a bush pilot was for the excitement of flying in the wilds of Canada, the development of the air services allowed business to expand during the times of forestry and mining.

Northern communities received the support from the flying services to provide the resources and services that would not be available if the bush aircraft had not been developed to the level of operation today.

Congratulations, you have completed your self-study package on EO C560.02 (Examine the Canadian Bush Pilot Industry). Hand your completed package to the Training Officer / Proficiency Level Officer who will record your completion in your Proficiency Level Five logbook.