enabled the Canadian Corps to take Vimy Ridge, the muddy flats of Passchendaele in 1917, and to break the German lines of defence in 1918. All this reflected well on the Canadian Corps commander, Lieutenant General Sir Arthur Currie, who had always encouraged his officers to think and use their initiative.

Notes

1. *Canada and the Great World War*. Vol. II, pp.1188-89.
2. Daniel G. Dancocks, *Spearhead to Victory* (Edmonton, 1987), p.21.
3. G.W.L. Nicholson, *The Canadian Expeditionary Force 1914-1919* (Ottawa 1962), p.122.
4. At the beginning of the war the Princess Patricia's Canadian Light Infantry (PPCLI) formed part of the British 27th Infantry Division. The unit was privately raised and equipped by Mr. Hamilton Gault, a wealthy Montreal business man who gave $100,000 to organize the unit. The PPCLI was originally composed solely of veterans and frontiersmen, and would be considered one of the fiercest of all Canadian regiments in battle. Three members of the regiment were awarded the Victoria Cross during World War I, and the unit still lives today as one of three Canadian regular forces units.
5. A.J. Kerry & W.A. McDill, *The History of the Corps of Royal Canadian Engineers*. Vol.1 1749-1939. (Ottawa, 1962), p.127.
6. 4th Field Company War Diary, National Archives of Canada [NAC] RG9 III D 3, Vol. 4995. 16 October 1916.
7. D.J. Corrigall, *The History of the Twentieth Battalion (Central Ontario Regiment) CEF* (Toronto, 1935), p.99.
8. NAC RG9 III D3, Vol.4930. 21st Battalion Operation Order No.73, 16 January 1917.
9. Nicholson, p.233.
10. Corrigall, p.99.
11. *Letters from the Front*. Volume I (Toronto, 1920), pp.47-48.
12. Both Raymond and Bowerbank were awarded the Military Cross for their role in the Calonne Raid. See *Letters From the Front*. Volume I. pp.47-48.
13. Corrigall, p.100.
14. *Ibid*. p.100.
15. Normally sappers went in with the support waves carrying as much as 120 pounds of gear and stores. It is assumed that for raids they would have travelled more lightly, but this was not to be the case.
16. *Ibid*., p.100.
17. B.I. Gudmundsson, *Stormtroop Tactics: Innovation in the German Army, 1914-1918*. (New York, 1989), pp.96-97. See also David Nash. *German Army Handbook April 1918*. (London, 1977). A reprint of the British Army staff handbook of the German Army at War, first published in 1918.
18. *Ibid*., p.97.
19. NAC RG9 III D3, Vol. 4930, 21st Battalion, CEF, Reference memoranda to accompany operation order No.73, 16 January 1917.
20. Corrigall, p.102.
21. Nicholson, p.233.
22. NAC RG9 III D3, Vol. 4930. War Diary 20th Battalion, CEF. 17 January 1917.
23. NAC RG9 III D3, Vol. 4930, 21st Battalion, CEF, Reference memoranda to accompany operation order No.73, 16 January 1917. This report contains an appendix attachment of all telephone communications reports that were received during the raid on 17 January.
24. NAC RG9 III D3, Vol. 4930. DHS File 4-30. *Narrative of Raid, 17.1.17, by G. Bowerbank, OC B Coy, 21st Battalion*. p.1.
25. NAC RG9 III D3, Vol. 4930. DHS File 4-30. 21st Battalion, CEF, *Documents belonging to the late Lieutenant Colonel Elmer Jones, Officer Commanding 21st Battalion*. Each company commander submitted a narrative of their respective area of operations to the Lt. Col. Following the raid. Their notes were donated to the Historical Section of the Canadian Army in June 1928 by Mr. A.S. Fraser who was in possession of the notes at the time.
26. Corrigall, p.103.
27. As quoted from *The Communiqué*, Newsletter of the 21st Battalion CEF.
28. The German officer was a professor from Strasbourg University and spoke good english. See *The Communiqué*, newsletter of the 21st Battalion CEF.
29. The Germans often chained their machine guns down to two-foot pickets within specific arcs of fire. This hindered attempts at turning the weapon around and firing on retreating troops or into the trench should it be overrun by the enemy. The Canadian answer to this was to simply get the sappers to blow the chains off using small amounts of explosives.
30. Nicholson, p.234, and Corrigall, pp.103-104.
31. A. Millet and W. Murray, *Military Effectiveness Volume One: The First World War* (Boston, 1990), pp.2-3.
32. Dancocks, p.22.
33. Bill Rawling,. *Surviving Trench Warfare: Technology and the Canadian Corps, 1914-1918* (Toronto, 1992), p.47.
34. John Swettenham, *To Seize the Victory: The Canadian Corps in World War 1* (Toronto 1965), p.92.
35. Nicholson, p.124.

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The Franks Flying Suit in Canadian Aviation Medicine History, 1939-1945

George Smith

It is not widely appreciated that Canadians were active during the war in the field of aviation medicine. Aviation medicine research in Canada during the Second World War involved a significant commitment of personnel and resources. However, there has been little historical investigation of this and that which has occurred is misleading. In 1947 C.B. Stewart argued that Canadian research was boosted by an early start and achieved unsurpassed results; the most prominent of which was the work of Wilbur Franks.[1] In the years since 1947, Stewart's conclusions have never been challenged. In fact, historians have ultimately judged the entire Canadian research effort equal to Great Britain's and even equal to the United States'.[2] Unfortunately, this well-established consensus is not completely accurate. The problem is that Canadian historians have consistently described Canadian work without reference or comparison to foreign research. Perhaps the most interesting and illustrative example is that of the Franks Flying Suit.

Designed by Dr. Wilbur Franks, it was the first anti-g suit to be worn in combat. In the years since World War Two, this achievement has become symbolic of Canadian success in aviation medicine. Whenever one research program has been singled out to represent Canadian work, it has usually been the Franks Flying Suit.[3] But, in fact, the Franks suit was far from an unqualified success.

The Franks suit was developed to extend human tolerance to radial accelerations. Radial accelerations result from changes in one component of velocity; direction. Radial accelerations are encountered during sharp, acrobatic manoeuvres, pull-outs from power dives or anytime an aircraft is forced to circumscribe an ever-tightening, circular flight path. Radial accelerations are of utmost importance, even today, as a limiting factor in aircraft and human performance.

Radial or centrifugal acceleration is measured in multiples of the acceleration due to earth's gravity, which is 9.8 m/sec/sec (32.2 ft/sec/sec). The normal force (1 g) applied from head to foot upon a standing person with a mass of 80 kg is 80 kg. But if this same person is subjected to an acceleration of 8 g, the force then applied from head to foot will be 640 kg. For medical purposes, this person will now weigh 640 kg.

Because of the attitude of the aircraft in conventional manoeuvres, the acceleration or centrifugal force acts upon the seated aviator from head to foot. The g-force seems to be pressing the pilot into the seat. The magnitude of the g experienced is a function of the velocity of the aircraft and the radius of the circle being circumscribed. The resulting equation is expressed as $g=V^2/r$.[4] From this equation, it can be seen that the importance of velocity is paramount in the calculation of g, as any increase in velocity has an exponential effect on the final outcome.

The most important physiological effect of g is upon the circulatory system. At 7 g blood is as heavy as iron. Sitting in a conventional upright position in the aircraft, the great vessels of the body are subject to this force.[5] In these

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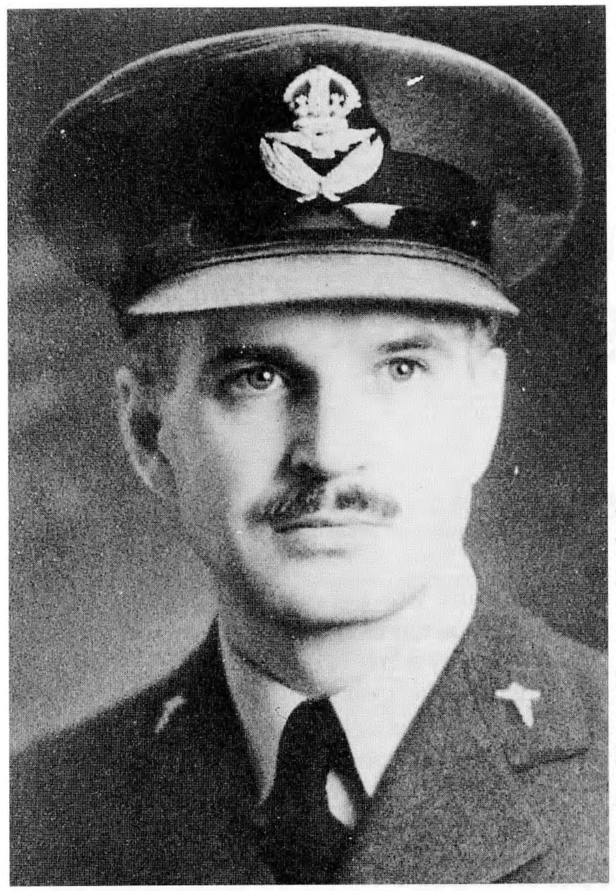

(Banting House Museum, London)

Dr. Wilbur Franks, inventor of the Franks Flying Suit.

conditions, the heart is not able to maintain adequate circulation. The result is first a dimming of vision at 3 g, followed by total blackout and finally loss of consciousness at 4-6 g.

In order to increase human tolerance to radial accelerations, it is necessary to maintain blood pressure to the brain and this objective is undermined by the pooling of blood in the lower extremities, as a result of the elasticity of the human vascular system.[6] The basic concept of the Franks suit was ingeniously simple. In 1939 Dr. Wilbur Franks, while conducting cancer research, had concluded: "that mice, when suspended in a fluid the specific gravity of which approached that of the mouse's body, could withstand, without apparent damage, over 100 times the normal gravity."[7] Obviously, however, it was not practical to suspend pilots in a cockpit filled with fluid. Therefore, Franks decided to "construct and test out a semi-rigid fluid jacket."[8] This jacket, or suit as it would later become, was of very special construction. It consisted of a "non-extensible" outer covering, which acted as a shell to hold the fluid inside the suit.[9] This shell had to be non-extensible because the purpose of the suit was to direct the fluid inwards against its wearer. If the fluid was allowed to expand outwards all benefits were lost. There was also an inner layer, which was extensible. Between the two layers of the suit was contained the "non-compressible fluid."[10] This fluid, under high accelerations, was forced downward in the suit. Because the suit's outer shell was non-extensible, the fluid was then forced inward, thereby providing sufficient pressure on the lower extremities to prevent the pooling of venous blood.

Although the concept was straightforward, it quickly became obvious that a number of problems would have to be overcome. The first problems were in the physical construction of the suit. Development work had to be undertaken with the Dunlop Tire and Rubber Company and Dominion Textiles Ltd to create a suitably strong and non-extensible fabric.[11] The problem then became the joints, which eventually had to be vulcanized.[12]

One of the most important problems which Franks solved was coverage. The original concept had provided for total coverage of the flier's body below the level of the heart. Franks suspected that full coverage would cause problems. Hence, even before flight tests began, Franks had a theoretical solution in hand. Since the body was "essentially a fluid system" and would allow the pressure from one surface to be transmitted throughout the surrounding area,[13] Franks concluded that "the rubber enclosed fluid system need only cover selected portions of the body to have the system effective."[14] Franks was right and, when it became necessary to reduce the coverage of the suit, Franks was ready.

Eventually, the problems were overcome. In April 1941 Franks arrived at the Royal Aircraft Establishment in Farnborough England, the centre for RAF aviation medicine. In the several months that followed, Franks was successful in demonstrating the effectiveness of his concept. Flight tests were conducted using Fairey Battle and Hawker Hurricane aircraft and the "suit was found to prevent blackout up to 9 G."[15] On 21 August 1941, in a report entitled "Tactical Trials with Hydrostatic Flying Suit" the operational

benefits of the Franks suit were explained: "In combat the wearer of the suit can follow his opponent however sharply he turns and still retain his vision which will enable him to use his sights. In the pull-out from a high speed dive at low level a protected pilot will be able to force a following opponent to black out or break away."[16] In other words, the Franks suit conferred upon its wearer decisive advantages in both offensive and defensive situations.

Thus, the effectiveness of the Franks Flying Suit had been established by August 1941, little more than a year after its first flight tests. This short period of time represented a significant scientific achievement, for it meant the conquest of numerous design and manufacturing problems. It was, however, a purely scientific achievement. Would the Franks Flying Suit measure up in operational conditions?

Almost from its inception, the Franks suit had been the object of concern in this regard. In early testing, at Malton in June 1940, Wing Commander Greig had qualified his recommendation of the suit with "the principle involving the design of the suit is sound but in its present form it is not a practical proposition."[17] A further report on service trials, dated 8 June 1942 and written by W.K. Stewart, a respected British pioneer in aviation medicine, found "difficulties" with the suit.[18] The Franks suit had another problem.

How was it possible for the Franks Flying Suit to be a complete technical success yet prove ultimately impractical in combat? In fact, it already had. German researchers, among whom Siegfried Ruff and Otto Gauer were very prominent, had been working on anti-g suits since 1935. In May 1939, Siegfried Ruff had outlined the German concept:

> A particularly appropriate measure to hinder this dislocation of blood would be to surround the body with a fluid which possesses a specific gravity as similar as possible to that of the tissues and fluids of the body and which, upon increase of its pressure, cannot distend. It has been proposed to surround the body up to the neck with a double walled suit, of which the outer wall is indistensible and the inner distensible, adjusted closely to the body surface. In case of acceleration the changes of hydrostatic pressure in the suit and in the organism would oppose each other.[19]

The Germans, then, proposed to use a double walled, fluid-filled hydrostatic anti-g suit.

In other words, German scientists had discovered the Franks suit before Franks. And, as Franks would later find, the Germans had encountered a number of obstacles. As Siegfried Ruff explained, "However correct these technical considerations, this is a somewhat difficult matter to put into practice."[20] Ultimately, Ruff concluded German scientists had found the "idea of using a double-walled, fluid-filled suit (inner wall pliable for adjustment to the body surface and outer wall rigid), although theoretically correct, is practically impossible."[21] Not only had the Germans already invented the Franks Flying Suit, they had already discovered that it was not practical.

The fluid-filled suit was not practical as a result of one feature inherent in any fluid-filled suit - the fluid. The German suit had not been practical because of the weight and bulk of its fluid. In Siegfried Ruff's judgement, the "weight of the suit alone, as well as the hindrance to the movements of its wearer,...interfere with its effectiveness."[22] This, then, was the fundamental flaw in the concept.

The Franks suit was ultimately judged impractical by British and Canadian fighter pilots. Combat trials dragged on for two years. There were successes, as at Oran in November 1942, but the old problem, the fluid, couldn't be beaten. In "The Remotest of Mistresses," Peter Allen concluded that, in rejecting the Franks suit, RAF fighter pilots were motivated by concerns for their physical comfort and their "macho image."[23] This is unlikely.[24] In fact, in assessing the Franks suit, RAF fighter pilots were motivated by deeper misgivings. They found that the weight and bulk of the Franks suit rendered it a liability in operational flying. In 1946, a National Research Council study noted that "[c]ertain objections were eventually raised against the suit, in particular discomfort while 'at the ready', and difficulty in turning to search for enemy aircraft coming from behind."[25] These two objections were based on years of experience in aerial combat.

The Franks Flying Suit, it must be remembered, had been intended to confer an advantage to its wearer in only one aspect of aerial

(Banting House Museum, London)

Franks, centre, with two assistants, fitting a Franks Flying Suit. Franks is lacing the suit up to fit the individual wearer and thereby to obtain the maximum protection from acceleration.

combat. This it did very successfully. In air combat manoeuvering, or dogfighting, the Franks suit enabled pilots to turn more sharply than their opponents, either to gain the necessary angle of deflection in the attack or to prevent an opponent from doing so in the defence. Unfortunately for the Franks suit, air combat manoeuvering was only one aspect of a very complex environment. Fighter missions also involved long hours in the cockpit, be it 'at the ready' or en route to the combat area. Most importantly, the very nature of fighter combat had changed. By World War Two the increased speeds of fighter aircraft, together with their small physical size, had made the 'bounce', or surprise attack, by far the most deadly tactic.[26] As a result, of all fighter aircraft shot down in World War Two, at least 80 percent never saw their attacker.[27] In these circumstances, alertness and visibilty, especially to the rear, were of primary importance.

Meanwhile, the Franks suit hindered pilots in turning to search behind them. It is apparent, then, that the advantage gained in wearing the Franks suit was more than offset by the disadvantages the suit presented under wartime combat conditions. The Franks suit might have helped its wearer to avoid a 20 percent chance of being shot down. But it was working for the enemy the rest of the time.

By 1944, the future of the Franks suit was, at the very least, uncertain. It had been proven to work from a technical standpoint but not from an operational standpoint. This state of affairs might have continued for quite some time. However, wartime aviation medicine, being what it was, did not wait patiently for evolutionary improvements.

The one problem which the Franks suit had never been able to overcome, like the German one before it, was the weight of the suit's fluid. This fluid made the suit heavy, it hindered the movements of its wearer and, equally important, it was there all the time, whether it was needed or not. The only possible solution to the problem was to remove the fluid and this is exactly what was done. Inspired by Australian thinking and utilizing Canadian practical experience, the Americans developed an air-filled anti-g suit which used compressed air to provide counter-pressure to the wearer's body.[28] Working at the Aero Medical Laboratory, Wright Field, Dayton, Ohio, American scientists first reported the

results of their research in January 1945. The Type G-3 suit consisted of five air bladders covering the calves, thighs and abdomen. It weighed a mere two pounds. Moreover, it was activated only when the force on the aircraft exceeded 2g.[29] When activated the G-2 pressure valve supplied compressed air to the G-3 suit at the variable rate of $1.0\ lb/in^2/g$.[30] That is, the higher the acceleratory forces, the more counter-pressure was applied.

After the war German scientists who evaluated the American G-3 suit were amazed. Otto Gauer, who had worked on the first *Luftwaffe* fluid-filled suit, had previously believed water to be the ideal solution. Yet, Gauer found that the American G-3 suit gave better protection than was possible with fluid-based suits.[31]

In fact, the G-3 suit was superior to the Franks suit in every respect. The American G-3 suit was more effective when needed and almost non-existent when not needed because the weight of the fluid had been removed. Defeat was finally acknowledged by wartime proponents of the Franks suit following one terribly simple experiment. The Franks suit was emptied of fluid and filled with compressed air. It gave better protection.[32]

In the final analysis, the Franks Flying Suit was an impressive scientific achievement; a great number of technical obstacles were overcome in the development of the Franks suit. Materials and construction techniques were invented and perfected. The degree of coverage was refined. Much of this work was useful to the postwar development of the Franks air-filled suit, as well as to the Americans.

Only one problem, the weight of the suit, could not be overcome. The fluid-filled suit dangerously restricted the movements of its wearer and was, therefore, never practical for widespread service. The Franks suit simply presented more operational liabilities than benefits. Ultimately, the Americans developed the air-filled G-3 suit, which had superior performance to fluid-filled suits yet none of the liabilities.

The history of the Franks suit demonstrates the necessity of qualifying, by careful examination

Human centrifuge at No.1 ITS in operation. When completed the Canadian centrifuge was the best in any Allied country.

(Banting House Museum, London)

and comparison, the achievements of Canadian researchers. The Franks suit was not, as has often been supposed, an original concept. The Germans had already experimented with fluid-filled suits and found them impractical. Nor was the Franks suit the best concept. The American G-3 was that. The FFS represented an evolutionary development; a necessary first step. It was the Americans who capitalized upon Franks' work. It was the Americans who produced the best anti-g suit in the world; one which, like the Bazett jacket, is still in service today.[33]

There is no doubt that the foregoing would seem to cast a shadow upon Canadian achievements in aviation medicine. The Canadian research program was not comparable to the programs of Germany, Great Britain or America. Nor was Canadian work always revolutionary, nor even successful, in nature.

When C.B. Stewart in 1947 attributed much of Canada's success in aviation medicine to an early start and described a "nucleus" of talented personnel and facilities that were in existence at the outbreak of war,[34] this was never challenged. In the years following, this interpretation was never challenged and was often repeated, sometimes verbatim.[35] In short, historians have agreed that, at the outbreak of war in 1939, Canada was ready to compete against the rest of the world in aviation medical research.

This was simply not true. German aviation medicine in 1939 was of superior quality in almost every respect. Canadian medical scientists were not like their German counterparts. Canadian scientists knew nothing of the complexities of aviation medicine. Wilbur Franks discovered the acceleration protection afforded by water in his cancer experiments.[36] But he might have discovered it more easily in German aviation medical textbooks of the time.[37] Other Canadian researchers such as Banting, Hall, Franks and Kitching were, in fact, completely unaware of the most fundamental aspects of aviation medicine.[38] In 1939, Canadian medical scientists were out of their depth.

But, by 1945, everything had changed. Canadian researchers had made original and substantial contributions to human knowledge of aviation medical problems. The pressurized breathing equipment developed by Dr. Bazett and the electrocardiography program supervised by Dr. Manning were among the best in the world. Other work, such as the acceleration research begun by Dr. Wilbur Franks, made possible revolutionary advances elsewhere. Canadian research articles appeared in every important periodical concerned with aviation medicine. As late as the 1950s the RCAF Institute of Aviation Medicine in Toronto was conducting British low-pressure research which the RAF Institute of Aviation Medicine was not capable of completing.[39] In short, Canadian aviation medical research had achieved international recognition.

This, surely, must be the measure of Canadian success in aviation medicine. Canadian aviation medicine started the war with comparatively little expertise, a handful of personnel and few resources yet it ended the war with some of the best research programs in the world. Canadian aviation medical researchers began with severe limits placed upon their potential. But they went beyond the limits.

Notes

1. C.B. Stewart, "Canadian Research in Aviation Medicine," *Public Affairs* (March, 1947).
2. Wilfrid Eggleston, *National Research in Canada: The NRC 1916-1966* (Toronto: Clark-Irwin, 1978), p.144 and Peter Allen, "The Remotest of Mistresses: The Story of Canada's Unsung Tactical Weapon: The Franks Flying Suit," *CAHS Journal* (Winter, 1983), p.120.
3. This trend began with C.B. Stewart's article in 1947 and reached its zenith with the appearance of Peter Allen's article in 1983.
4. Siegfried Ruff & Hubertus Strughold, *Compendium of Aviation Medicine* (Ottawa: Alien Property, 1942), p.72. For the purposes of demonstration, the following discussion is based on prewar German documents. Allied researchers spent the first years of the war carefully checking these German conclusions, which were published in the open literature before 1939.
5. *Ibid.*, pp.88, 99.
6. *Ibid.*, p.88.
7. Proceedings of an Informal Meeting of the Group Interested in Aviation Medical Research, *Hall Papers*, p.7.
8. *Ibid.*
9. Progress Report on Work to Protect Personnel Against The Pressure Effects of Acceleration, *Hall Papers*, p.3.
10. *Ibid.*, p.1.
11. *Ibid.*, p.4.
12. *Ibid.*
13. *Ibid.*, p.3.
14. *Ibid.*, p.4.
15. C-2833 Report on Hydrostatic Suit, *Bibliography of Canadian Reports in Aviation Medicine 1939-1945* (Toronto: DRB, 1962), p.177.
16. C-2837 Tactical Trials with Hydrostatic Flying Suit, *Bibliography*, p.178.
17. C-2830 Report on Practical Flying Tests Carried Out With 'Special Flying Suit,' *Bibliography*, p.177.
18. C-2842 Interim Report on Franks Suit Trials at No.43 Squadron Acklington, *Bibliography*, p.179.
19. Ruff, *Compendium*, p.97.
20. *Ibid.*
21. "Influence of Tangential Forces on the Human Organism," *Bulletin of War Medicine* (July, 1942), p.510.
22. Ruff, *Compendium*, p.97.
23. Allen, *FFS*, p.120.
24. Subsequent acceptance of the American G-3 suit was virtually instanteous. American fighter pilots were quick to set aside their "macho image," as were the fighter pilots of every Western country in the post-war world.
25. Edgar C. Black, *History of the Associate Committee on Aviation Medical Research: 1939-1945* (Ottawa: NRC, 1946) p.97.
26. Mike Spick, *Fighter Pilot Tactics: The techniques of daylight air combat* (New York: Stein and Day, 1983), p.56.
27. Mike Spick, *The Ace Factor* (New York: Avon, 1989), pp.11-12.
28. T.M. Gibson and M.H. Harrison, *Into Thin Air: A History of Aviation Medicine in the RAF* (London: Robert Hale, 1984), pp.155-157.
29. G.L. Maison, C.A. Maaske, G.A. Hallenbeck and E.E. Martin, "Acceleration and the G Suit," *Air Surgeon's Bulletin* (January 1945), p.6.
30. Milton Mazer, "The G Suit in Combat," *Air Surgeon's Bulletin* (August, 1945), p.237.
31. Otto Gauer, "The Physiological Effects of Prolonged Acceleration," *German Aviation Medicine in World War II* (Washington: USAF, 1950), p.582.
32. John Ernsting and Peter King, *Aviation Medicine: 2nd ed.* (London: Butterworths, 1988), p.163.
33. Readers interested in modern aviation medicine are directed to Ernsting and King, *Aviation Medicine: 2nd ed.* and, in particular, to the discussion of the RAF partial pressure jerkin, which is a modified Bazett jacket (illustration p.110).
34. Stewart, *Canadian Research*, p.98.
35. Eggleston, *NRC*, p.144.
36. Proceedings of an Informal Meeting of the Group Interested in Aviation Medical Research, *Hall Papers*, p.7.
37. Ruff, *Compendium*, p.97.
38. Proceedings, *Hall Papers*, p.5.
39. Gibson, *Into Thin Air*, p.133.

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Brigadier-General Denis Whitaker Honoured by Belgians

Shelagh Whitaker

A wartime liaison between a Canadian infantryman and a Belgian resistance fighter culminated 54 years later with the recent presentation of Belgium's most distinguished decoration, Commander of the Order of the Crown.

Brigadier-General Denis Whitaker of Oakville, Ontario, one of Canada's most highly decorated veterans of the Second World War, was awarded the medal in Kalmthout, a village near Antwerp, by a special proclamation by Belgium's King Albert. The decoration is equivalent to Canada's Order of Canada and was awarded "for eminent services rendered."

Whitaker, as commander of the Royal Hamilton Light Infantry (RHLI), is credited with the liberation of the port of Antwerp in September 1944. This is recognized as a critical battle in opening the port for Allied logistical supply in its drive towards Germany. In a unique partnership, members of the Belgian Resistance fought alongside the Canadians in a six-week battle to drive the Germans from the Antwerp docks and clear access to the Scheldt River.

Captain Eugene Colson, codenamed "Harry," had formed a resistance force of some 600 dockworkers in Antwerp's dock area. in 1942. Their mandate was to protect the docks from German sabotage when the Allies liberated the city. The British 11th Armoured Division rolled into Antwerp on 5 September but was ordered out after two days to fight at Arnhem. This left the docks wide open to enemy sabotage. Armed