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The Development of Air Power....

"It is quite possible for a nation to have an amorphous mass of aircraft, even in prodigious numbers, and still have no air power."
—*Major Alexander de Seversky*

IT WAS EARLY in the cool morning of September 8, 1910, when W. W. Gibson revved up the engine of his "Twin-Plane" for its first flight. In front of him stretched Mr. Dean's large, grassy meadow, which was part of the Dean farm, just north of Victoria, B.C. It was a momentous occasion. For the Twin-Plane, including its 60 hp. six cylinder engine, had been designed and built by Gibson. With his two helpers standing clear, Gibson pushed open the trottles. In a moment, he was airborne, for the first short hop of a Canadian-built aircraft and engine.

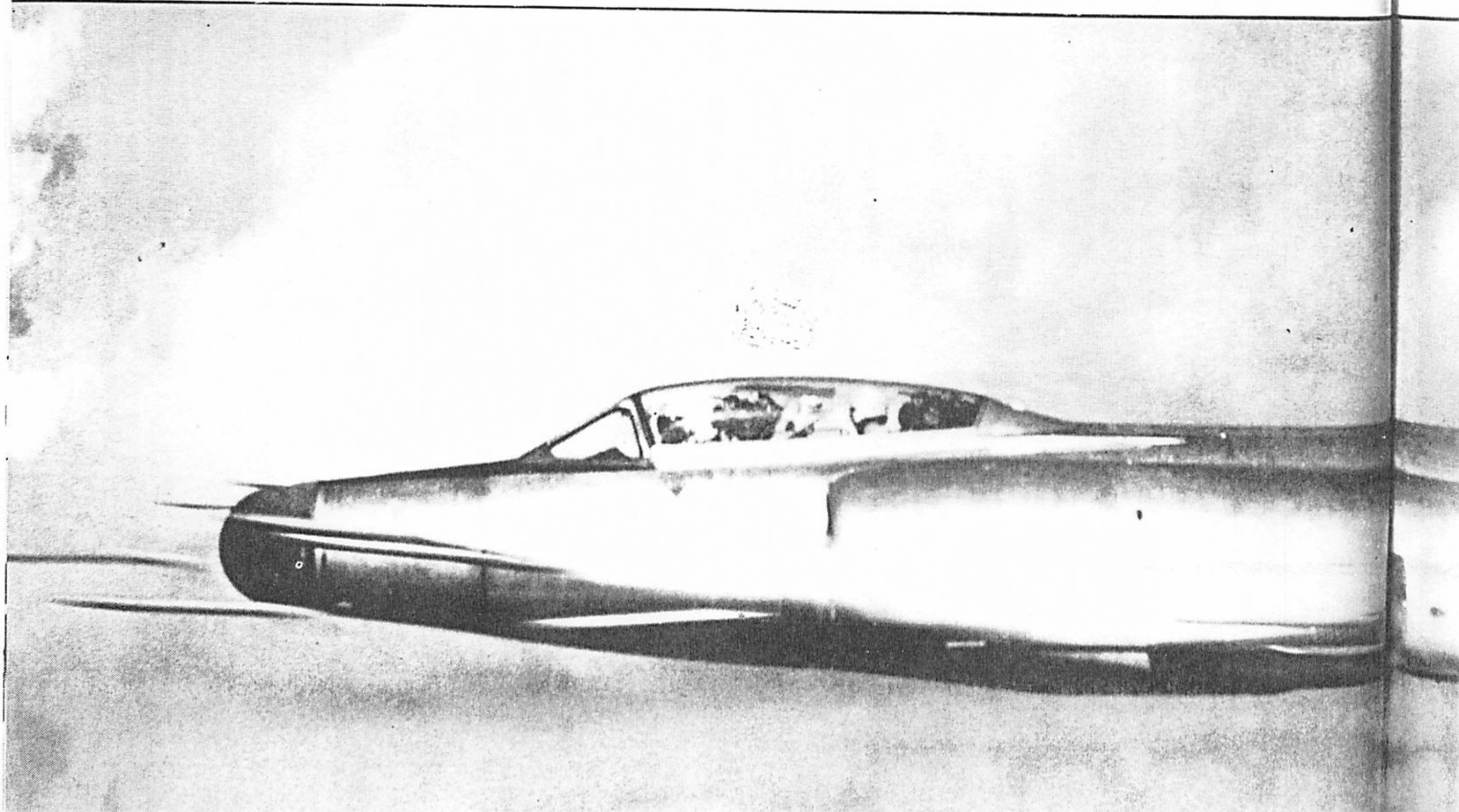
Frank H. Ellis in his book, *Canada's Flying Heritage,* carefully records this highlight in aviation history. But the part that is impressive today is the fundamental fact that all Gibson required was a flat field, an airplane, and he was set for flight. After fifty years of flying, these simple requirements are no longer sufficient. Gone forever are the play days of the pioneers.

Aviation has become a serious, complex business. Even Trans Canada Airlines, a transport system, must have miles of concrete runways, acres of taxi strips, passenger terminals, hangars, overhaul shops, control towers, emergency landing fields, and the radio beacons of the airways that criss-cross the country. The RCAF requires even further facilities. For military airpower is more than mere airplane. Yet I find that we, on the development engineering side of aviation, are continually slowing the pace of progress by failing to think of air power as a complete system. We are hindered by our heritage. We are "flying machine" thinkers.

In this age of air power, when even survival may be at stake, we can no longer afford the luxury of dallying only with the development of airplanes as such. "Air power," says the eminent expert, Major Alexander de Seversky, "is the ability of a nation to assert its will via the air medium."

The System: If we want to assert our will, then, we must develop complete air power systems and supporting systems. And this may mean airplanes, trainers, and all the ground complex of air bases and electronic aids. The latter, of course, are required so the air vehicle can operate efficiently and effectively. All these elements must be progressed on a set, planned, time scale, so no one element can delay the development and hold up the operation of the whole. This is "systems thinking", instead of "flying machine thinking." With it we can be ready and waiting, with a minimum of technological effort, when D-Day dawns, and we have to "assert our will via the air medium."

An RCAF CF-100 is photographed just at the moment it releases a salvo of air-to-air rockets from its wingtip pods.



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Air power, and its supporting air systems, following Seversky's ideas, can be illustrated by the building blocks of Figure 1. (next page). It is essential that we regard each block as a complete system, for wars have been lost by not doing so. Take, for example the U.S. Civil war of the 1860's. In those days the railways were just beginning to snake their way across the landscape of the young United States. And rail power was just beginning to exert its force in the fighting of a war.

Rail System: There are many intertwining reasons why the Confederacy of the Southern States lost out in the end to the Federal forces of the North. One of these reasons is the South's continual failure to visualize the railways as a system. True, the agriculturists of the cotton kingdom knew of tracks, locomotives, freight cars, miscellaneous rolling stock, stations, roundhouses, and yards. For at the outbreak of the war they had 9,000 miles of rail in operation.

However, late in 1861 the Southern congress realized that the civil war was not going to be settled in a hurry. In fact it already was spreading beyond the state boundaries of Virginia, where it started. They quickly pushed through a panic policy to extend their rail system to ensure tactical mobility for their armies. But to the agriculturists a rail system meant tracks. So they proceeded to lay miles and miles of new track, at tremendous cost and effort. Most of it turned out to be useless. For they failed to build the rolling stock that was necessary to complete the system. In the dying days of the war they frantically tore up many miles of the new track to keep the old mainliners rolling. "Time after time (the Confederate government) failed to understand the problem," says G. E. Turner in his book *Victory Rode the Rails*. The southerners were "track thinkers" not "system thinkers". And their wasted efforts helped them lose the war.

Home Lesson: In modern times, here in Canada, the air power system that attracts most of our attention is that connected with the number one job of the RCAF — air defence. This is a vast system of airplanes, air bases, ground control interception (GCI) radar stations, early warning radars, sector control stations, group control units, and a headquarters at St. Hubert, Quebec. The whole ground complex of Air Defence Command is knitted together by an intricate telecommunications network which ties in with a North American system. So, from the Dew radar line on our Arctic Coast, to the U.S. Air Force bases on the borders of Mexico, there is a broad, sweeping system that spans the continent from coast to coast.

This great organization has one objective — to detect a raiding bomber and despatch a weapon to kill it. It is impossible to make such an interception unless the whole system is developed and attuned to its job. Thus it

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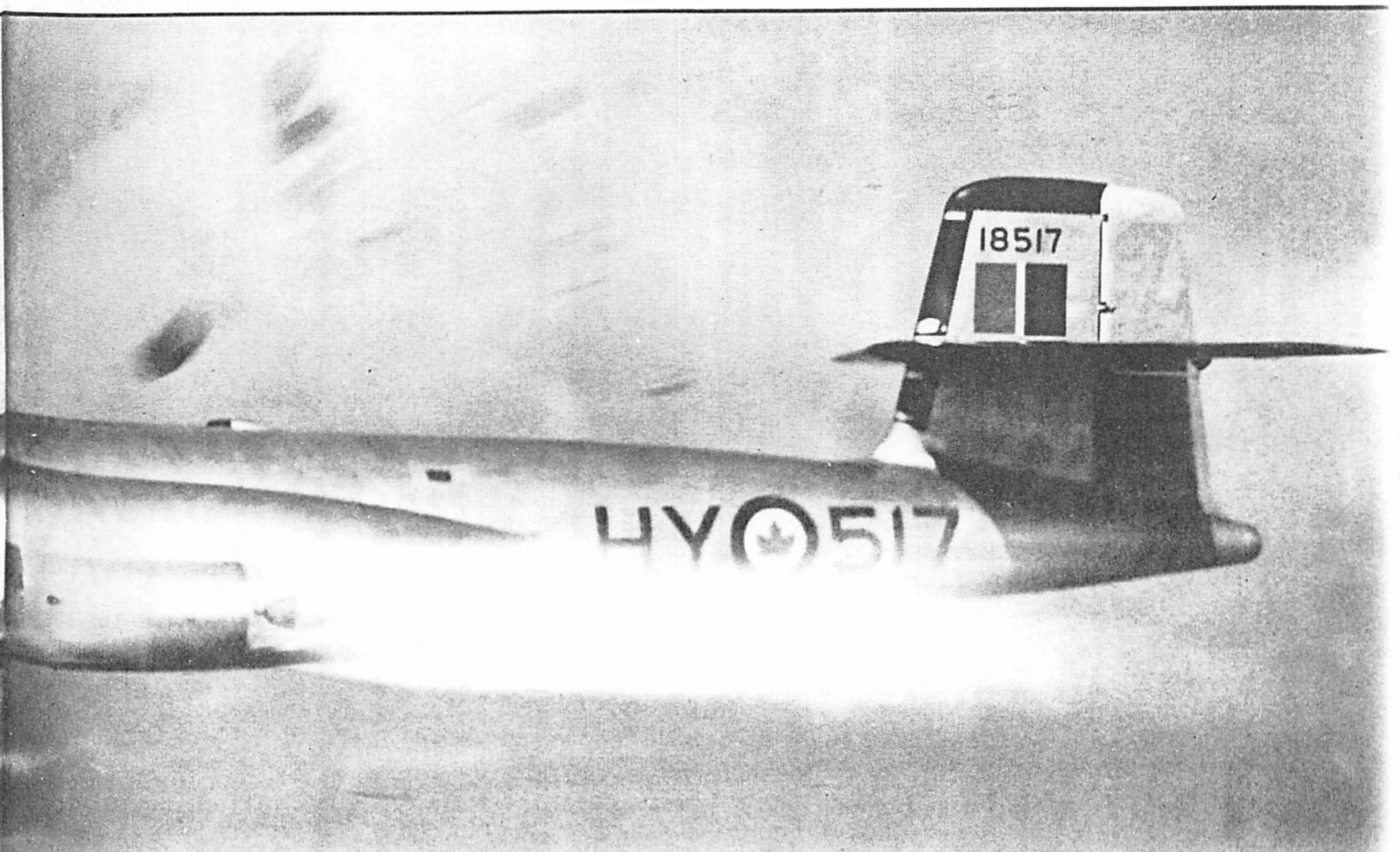
Fighters like the CF-100 can become really effective weapons only as components of an overall weapons system.



can be seen that the weapon, be it an armed airplane or a ground-to-air missile, is only one small part of the whole.

In this day of intricate electronic gadgetry it takes a long time to develop the weapon alone. Consider the case of an all-weather interceptor for the air defence of Canada, such as the supersonic CF-105 that is now being designed and built by Avro Aircraft Ltd. of Malton, Ontario, for the RCAF.

From a statistical study of today's airplanes, jet fighters take about eight years from the time the Air Force issues the specification to the time that it finally receives the weapon in fighting trim fit for war. On the same time scale bombers take longer, nine years, while supporting system airplanes, small jet trainers, small transports, or large transports, take four, four and a half, and seven years respectively.

Integration: The problem for the systems thinker, then, is to fit this development time scaling of the weapon into the time scaling of the whole system. And this may even mean a build up of the supporting systems, such as training and air transport, to make the actual air power system really effective. Suppose, for example, a potential enemy threatened our shores for the rugged ice cap of Greenland. A lodgement of this enemy is possible in the wastes of our Arctic northland. We must build up a bombing system to counter this threat.

After a careful operational analysis we decide that a manned bomber is required. By swinging circles on a map of our future air bases, and gauging the possible positions and defences of our potential enemy, we can define the range, altitude and striking power of the bomber in a specification. A contractor is selected, his engineering department starts to work on the basic layout drawings, and slowly the details start to flow to the shop as the bomber takes shape.

With our present knowledge we know that it will take nine years before we can expect to get a truly operational bomber delivered and poised for striking. So in this period, or even before, we must get started on the air bases, with their hangars, protective screen, runways and other necessities. We must develop the electronic bombing gear, missiles, armament, and

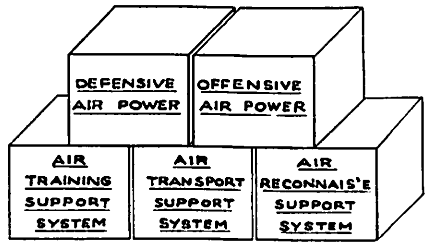


FIGURE 1

TYPICAL AIR POWER SYSTEMS & AIR SUPPORT SYSTEMS.

other equipment to go into the bomber. We must develop the training aids, and the ground servicing equipment. We must build the ground navigation system, if one is required, so the bomber can find its way unerringly to the target. And, most important, we must look on the bomber as part of a striking force that may require the development of special counter measures aircraft to accompany the force so it can penetrate the enemy's electronic defences. In other words, it must be a properly timed, air power bombing system (Figure 2). For what good is a skeleton bomber force, emanating from a group of "flying machine" thinkers, if it can't get through and spread fire and destruction to the heart of the enemy?

Engineer Shortage: Moreover, in our present age, all the nations of the Western world are plagued by a shortage of engineering talent. We can no longer afford to fritter away our meagre design and development resources on useless flying machine projects. About three years before World War II the British diverted a part of their time, money and manpower in a weird transport concoction, the Short-Mayo "composite aircraft". This aircraft was composed of two separate airplanes. The largest one was a version of the well known, civil flying boat, the Short

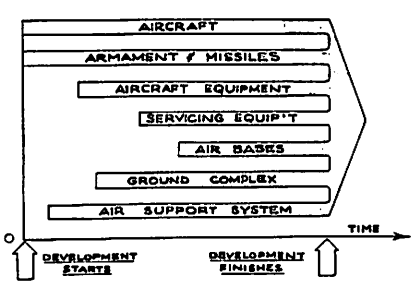


FIGURE 2

DIAGRAMMATIC PHASING OF AN AIR POWER SYSTEM

"Empire" boat. Perched on the top of this was a twinfloat transport airplane, the "Mercury".

The basic idea of this composite aircraft was to take off with the heavily loaded Mercury on the back of the lightly loaded flying boat. Once it was safely in the air the Mercury cast loose and rose away from the mother ship. By this means the Mercury could get airborne with a greater load than if it had to take off under its own power from the sea. It was an interesting technological experiment. Reports were written, wind tunnel tests analyzed, graphs prepared — all to ensure the right water stability of the combination on take off, the right air stability once it was airborne, and the right aerodynamic equations that would ensure separation and not collision when the Mercury was released.

The composite aircraft was built to the order of Imperial Airways. In leafing through the magazines of the era I came across a statement by the late C. G. Grey, editor of the British magazine "The Aeroplane". Said Grey, "I am not convinced that it has any real usefulness." He went on to point out that the idea was very old and advances in technology, like double slotted flaps, and variable pitch propellers, would soon produce the single, large transport airplane that would make the Atlantic crossing an everyday occurrence. Anyway, who would want to ride in such a contrivance as the composite aircraft?

Clear Thought: Grey was right. His words were a break of clear thinking in an overcast of technology. The Short composite airplane first flew in February, 1938. Soon the black clouds of World War II were gathering on the horizon. Britain rushed to press all her technical manpower into the development of air power. Wasted time had to be feverishly caught up. In September, 1939, the German war machine rolled over the plains of Poland. The might of the Nazi air force was unveiled for all to see. In another year it would attempt to inundate the island kingdom in the Battle of Britain. And Churchill's "so few" of the RAF would barely be able to muster enough strength to stem the tide.

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squadrons while others sailed back on the S.S. Homeric. But not all travelled on the Homeric. Completing the circle, ground crew members of No. 410, once again boarded the HMCS Magnificent, this time for the return journey. And again, they took their aircraft with them. These are Sabre 5's, recently replaced by the more powerful Mark 6 models, and now slated for use by reserve squadrons in Canada.

CF-100 Preparations: Several months ahead of the arrival of the CF-100's, the Field Technical Training Unit (FTTU) located at No. 3 Fighter Wing, Zweibrucken, Germany, added CF-100 training equipment to its Sabre gear and began classes. Complete mock-up panels, with actual component parts of every system in the aircraft, from electrical to armament, line the walls to aid the instructors.

The FTTU was originally set up to convert ground crews to the new marks of Sabre engines and airframes, as well as to give refresher courses to new arrivals. Since its beginning in 1953, the nine instructors have processed more than 5,000 students.

Until all the CF-100's arrive, the FTTU is giving refresher courses to airmen who have previously worked on that aircraft but who have since been maintaining Sabres. These men will augment squadron personnel that come over from Canada with the CF-100's.

Once the four units are established on the continent, the training school will operate courses parallel to those now run for the Sabre technicians, keeping the CF-100 crews current on their machines.

Consolidation: In a recent address Air Vice Marshal Godwin very concisely summed up the Air Division activities for the year 1956. "The past year has been mainly one of consolidating our position. Our fighter squadrons have been striving for perfection in their air tactics, and groundcrews, whose work is now more vital than ever before, rank among the best anywhere. In other words, the growing pains have ceased.

"The addition of the CF-100's will no doubt create more problems until they have properly settled in. But by this time, I feel that the Canadian Air Division has enough operational experience to treat any obstacles more or less as a matter of routine.

"We are now a hard-hitting and efficient fighting force. The CF-100's are adding more flexibility and power to the Air Division and to the NATO air defences of Western Europe. I don't think there is any doubt that we will continue to rank among the top operational commands of the Allied powers."

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In those days when Hurricane and Spitfire figthers could be designed and developed with a relatively small technical effort, the waste of manpower on such oddities as the composite aircraft was, perhaps, not too serious. Yet it no doubt added its small bit to the flood that swept the British nation to the brink of disaster from the air. In modern times, however, it takes millions of technical man hours, spread over many years, to design and develop these air power systems. Thus, we can no longer afford to by-pass our technical resources into such wasted by-waters.

We will, of course, still have research aircraft such as the Bell and Douglas airplanes that were built for the USAF to explore the supersonic speed ranges. But these are what the U.S. Navy's Admiral S. B. Spangler has called "feet-on-the-desk" type of research projects. In other words, they are directed to probing a particular technological frontier. The results are planned to achieve a break-through into a true air power system, of which the supersonic airplane or missile will play its part.

In the development of air power, then, we must get over our heritage of "flying machine" thinking. We must concentrate all our technical resources and planning along "systems thinking" lines. "Be ye transformed by the renewing of your mind," as the Bible says, or we of the West may find ourselves with plenty of airplanes, but a dearth of air power, as Seversky has warned.