

Pre-Flight



A Publication of the Aerospace Heritage Foundation of Canada
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The Way It Was:

*a look at those not-so-distant years, so full of promise,
a glimpse of the people then, the aircraft they designed, built and flew,
and a lesson to those who lived in later years.*

The following article was taken from Avro
Canada 'Jet Age', Summer 1952.

PARTNERS IN PRODUCTION

by
L. F. McCaul

This article, written almost half a century ago, is a reminder of just how difficult and complex was the construction and design of a modern, for that time, Canadian interceptor. The author had experience in subcontracting going back to WW I, when he was in charge of outside production for the Curtiss Aeroplane Company in Buffalo. During WW II he was both the production and procurement manager at Victory Aircraft, Avro's predecessor, and in charge of all subcontracting.

Dozens of Canadian engineers fresh from graduation exercises take a second look at job possibilities in their own country. A machine shop in a quiet Ontario town gets an order to make some Canadian designed tools for the first time. A Winnipeg firm announces plans to take on 500 more men. A Montreal car dealer invests \$500,000 in new equipment. Manufacturers across the country tool up to produce bearings, fuel boxes, airplane tires and other items never before made in Canada. Throughout Canada the steel work for new, permanent manufacturing plants arises.

Seemingly unrelated, these events and others are actually a result of a closely coordinated master plan to make Canada self-sufficient in the air. It is a plan which also will have far-reaching effects beyond the present emergency. Canadian industry now has a new field for private enterprise and native skill of tremendous scope. Accelerated by the Korean war, the program is now well under way to produce in quantity the first truly Canadian aircraft—homemade and designed in its entirety, including its complicated jet engines. The brains and nerve-centre of the country-wide program are at Avro Canada at Malton Airport near Toronto. The aircraft and engine being produced is the company's CF-100 long-range, all-weather fighter and its power plant, the Orenda turbojet, each a recognized

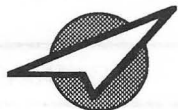
leader in its field. This is the aircraft given the assignment by the RCAF, of defense against enemy bombers. In addition the battle honored Lancaster bomber, produced during the last war by the same factory, is being converted by Avro Canada for an interim defense role. Many of the parts for what is really a new aircraft are subcontracted. Some 30,000. Canadians will be working on the CF-100 program when it reaches its peak soon. This working force is over and above the 15,000 employees at Avro Canada. Some 450 Canadian plants from the prairies to the Maritimes have been organized as a result of the policy of the Canadian Government and Avro Canada to set up Canadian sources of supply for this vital undertaking. During the last war, it often was difficult to

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The Aerospace Heritage Foundation of Canada (AHFC) is a federally-chartered not-for-profit organization. The current emphasis is on Avro and Orenda and the Foundation is actively trying to locate former employees of these companies.

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Membership Matters

By the time you will have read this, we will have entered the Third Millennium - without incident, we hope. And AHFC has completed ten years of operation. It is thanks to you, the committed membership, because of your interest, encouragement and support, that our Foundation has been able to continue focusing on its special projects, like the Malton CF-100, the Underwater Recovery, archiving Canadian aerospace achievements, producing our newsletter, informing the public about the work of AHFC, and on and on. You, the members, have offered not your moral but also financial support with your generous contributions and quick renewals. A very special thanks to all of you, for without your support, none of this would have happened. As your Membership Secretary, I look forward to serving you. If you find any discrepancies with your membership, income tax receipt, or any other questions, please contact me at our mailing address.

Nick Doran
 Membership Secretary

Partners, cont'd from p. 1

get parts for Canada's aircraft program from the UK or USA so it was decided to make this country's aviation industry truly self-sufficient.

Because of the complexity of modern aircraft and engines, re-armament in the air is necessarily a slow-starting process. Fortunately, Canada's aviation-industrial is already in the vanguard of defence mobilization. The necessary preliminary steps have been taken and the experienced team mates of World War II, which made Canada the leading producer of aircraft per capita in the western world, are now working together again to build new and more modern aircraft.

No better example of this team work in defence can be found than in the Avro Canada organization for producing the CF-100. Today over 55 per cent of all production procurement funds, received from the Department of Defence Production, for component parts for Avro Canada CF-100 fighters, is passed along to other Canadian companies. Of these funds about 50 per cent is diverted to subcontractors; the remainder goes to suppliers of finished parts, equipment and raw material suppliers. It should be pointed out that a large portion of this appropriation goes directly to the manufacturers of Government-furnished property such as embodiment loan items. This money, of course, does not pass directly through Avro Canada.

A total of some \$36 million is being allocated to Avro Canada's sub-contractors on the CF-100 airframe alone. This includes work orders ranging from three dollars for a few special spun metal parts made in a Toronto shop by a foreman and three workers in a few minutes, to \$6 million for a large quantity of main body components manufactured over a period of time by a thousand-odd men in an Ontario town. To make the airframe, millions of dollars are being spent by these sub-contractors for labor costs alone. Avro Canada is spending an equal amount.

Among the sub-contractors working on the various sections of the CF-100 are many familiar names in Canadian industry. The parts they produce embody Avro Canada design and engineering and the manufacturing is done according to Avro Canada specifications. Including rivets and other small standard items, but excluding the Canadian-designed and produced engines and other Government-supplied equipment, there are about 30,000 separate parts and assemblies in a CF-100 fighter. These myriad parts have to be put together into a mechanism as finely fitted as a watch. The most difficult of these parts, some 10,000 in all, are made by Avro Canada, but the bulk are subcontracted. Some 35 per cent of the airframe weight is made by other companies.

Sub-contracting, of course, is a means to get the badly-needed CF-100's on to the runways of RCAF bases more quickly. Production expenses, costs of new plants, expansion of existing facilities are thereby reduced considerably. The prime contractor is also relieved of some of the need for expansion of his own facilities to meet requirements that may only be temporary. Another advantage of sub-contracting is that it helps to avoid overtaxing one plant or community by diverting work to plants and communities which can conveniently handle it. There is also an important consideration in spreading the job so if one plant is bombed or sabotaged, the others will be able to carry on the program.

Production speed is obtained by building many of the pieces and components of the airplane away from the home plant, switching emphasis there from overall construction to assembly. Already Avro Canada has had experience in this type of manufacture although the present operation is a completely new one. During the war many Lancaster components and parts flowed to the same plant for assembly from branch plants in England and numerous sub-contractor plants in Canada. Unfortunately most of the present sub-contracting firms have had to be reorganized from scratch with an almost completely new labor force which has had to be trained in this type of work.

Sub-contracting is today much more difficult because of the increased complexity of modern aircraft. The CF-100, for example, is about one third of the all up weight of the Lancaster bomber made during the last war but both these aircraft require practically the same number of man hours to manufacture. Much more intricate equipment has been added to a smaller work area in the aircraft and the tolerances and standards required are infinitely more exacting.

Some of the largest and most progressive industries in the world, such as the automotive and machine tool industries in the United States and England, have used the sub-contract method of manufacture for years with much success. In this field, co-operation is a requisite for success because the interests of both the prime contractor and the sub-contractor are identical. Mutual assistance is the keynote. Avro Canada's self-contained

aircraft sub-contract department tries to handle, directly and efficiently, all dealings with outside manufacturers of components and parts. Each month its expeditors drive some 12,000 miles through Ontario alone in the aim of assisting its sub-contractors.

Avro Canada's sub-contracting is carried out by men accustomed to getting help from other departments in the company. These contract men, both technical and follow-up, have to work with shops both large and small, as well as with business executives, and so they cannot be handicapped by preconceived ideas regarding any one department. These would make it difficult for them to adapt themselves to the wide variety of conditions under which the sub-contract department must work.

In sub-contracting, these men soon learn there are few places to go for help; few publications to keep them up-to-date; almost no text books with practical advice on immediate problems. They are in a large part on their own and they must invent the means and devise the methods by which they can attain their goal.

Ideally, Avro Canada would like to turn over the drawings of CF-100 parts to a sub-contractor and in due time receive the parts according to specifications. In actual practice the process is more complicated. Constant liaison, adjustments and planning are required. In many cases Avro Canada uses to advantage sound and economical production, methods supplied by sub-contractors. Actually, more extensive work is turned over to those companies which demonstrate this co-operation.

Once a decision is made to sub-contract, trained men are sent out by Avro Canada for areas where labor and know-how for the job are known to be available. A personal visit to the selected plant follows, to assess equipment, staff, its type of organization and to ensure that all requirements will be met.

When liaison is established, the prospective sub-contractor normally sends men to Avro Canada to learn what is required on the job. Technical data or other technical facilities required by vendors are provided if necessary. These include all lofts, loft reproductions and part drawings on an up-to-date basis. Any required technical information in regard to detail part tooling, sub-assembly or main assembly is also provided. Raw materials are supplied by Avro Canada but the sub-contractor, if possible, makes his own tools. In some instances Avro Canada has given the prospective component sub-contractor ten sets of parts for tool proving. He is then expected to produce a further 25 sets from his own parts enabling him to quote a firm competitive production price. The contract is made on the basis of this price.

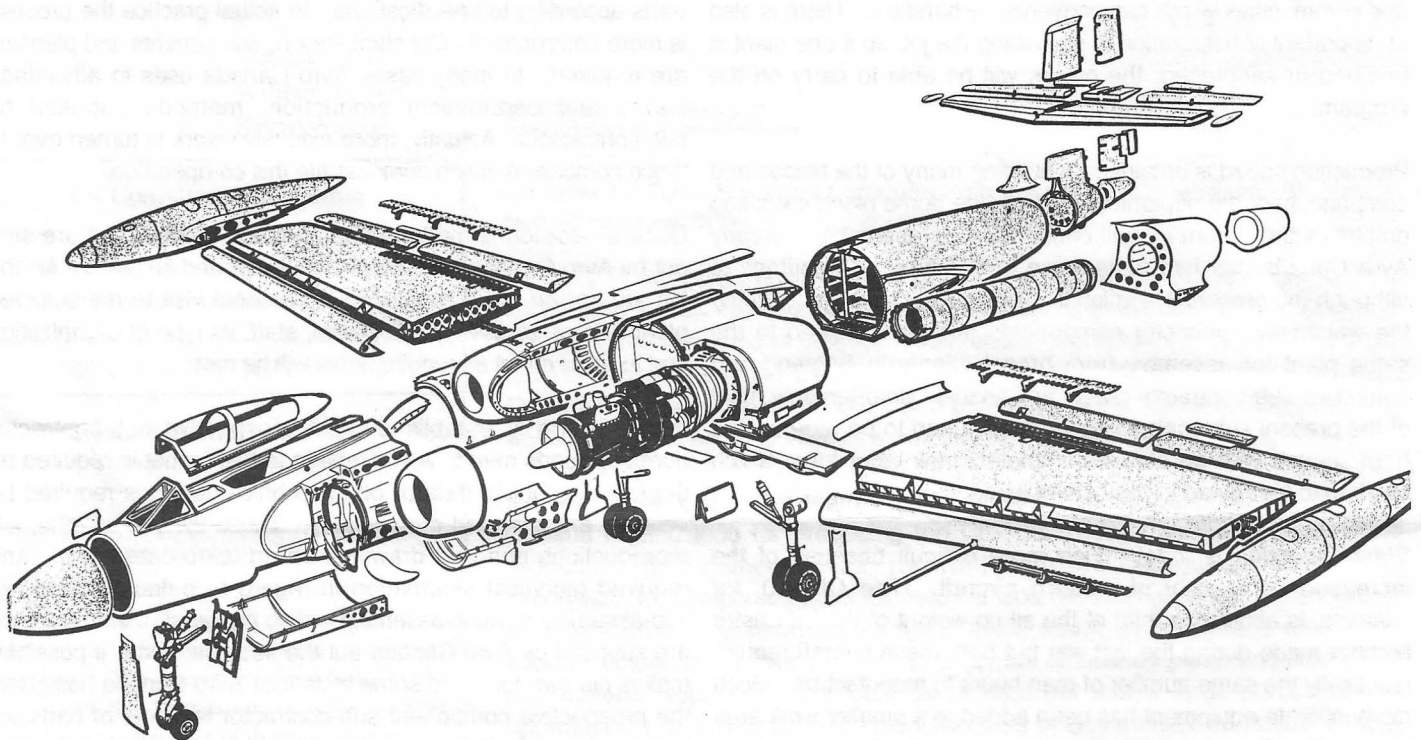
Detailed cost information is maintained on all Avro Canada aircraft orders. A close check is made to ensure that the costs of labor for sub-contracting is in line. Comprehensive cost records are maintained and analysed in relation to agreed prices. Queries resulting from additional price claims from vendors are investigated.

Countless separate purchase orders are placed to obtain the myriad separate parts for the aircraft. When purchased, the trick is to get all these items to arrive at Avro Canada at the right time for final assembly.

This delivery control involves the distributing and recording of purchase orders and the maintenance of suitable performance records and delivery schedules. All outside expediting personnel are controlled by Avro Canada and some of them have offices in the company itself. Production parts lists and material assessments are maintained on a current basis and transmitted to the sub-contractor. Master material schedules are maintained as well. In general, adequate records are maintained to enable rapid and accurate information to be at all times available regarding material assessed, scheduled and supplied to vendors. This laborious paper work is necessary so that each of the thousands of parts will be ready at the point and time needed. The company's inspection staff

throughout the operation maintains direct relations with the sub-contractor's chief inspector to keep up to the required standards of the RCAF.

In sub-contracting the CF-100, Avro Canada realizes only too well the tremendous task and responsibility it has taken in getting the aircraft into production. The company necessarily has to face up to the problems a rapid advances in aviation design. It recognizes the necessity of close technical liaison with its suppliers and renders every possible assistance to achieve the desired results. As far as Avro Canada is concerned costs at all times must be of prime consideration and delivery schedules met. Avro Canada is obtaining the degree of co-operation from all sub-contractors and others associated in this partnership of producing the CF-100. Having had the successful experience of producing the mighty Lancaster bomber and other aircraft during the last war, the Avro Canada plant may justly be confident of fulfilling its present important assignment.



In the distribution of DDP Funds, the major portion of the defense dollar allocated to Avro Canada, is turned over to its chain of sub-contracting companies. The simplified, exploded drawing breaks the CF-100 into its major component sections. Those shaded are subcontracted and supplied by a network of Canadian firms. The unshaded, more difficult sections, are built at Avro Canada.