# Canadian Aviation Writing Awards

Of interest to the contributors to our magazine and elsewhere are the awards of $1,500 to stimulate interest in aviation reporting in Canada recently announced by the Air Industries and Transport Association at Ottawa. The contest is being sponsored by the transport body in co-operation with the Canadian section of the Aviation Writers Association of America.

The competition is open to all Canadian writers and writers resident in this country, the prize money being donated by the following member firms: Canadair Limited, Canadian Pacific Air Lines, de Havilland Aircraft Company, A. V. Roe Canada Limited, Rolls-Royce, and Trans-Canada Air Lines.

There will be no restriction on the type of aviation articles submitted and point of publication may be anywhere.

Articles appearing in the twelve-month period starting September 1st of each year will be eligible for the competition. This year's contest will be retroactive to September 1st. All entries must be sent to the Association, addressed: Canadian Aviation Writing Contest, Air Industries and Transport Association, 108½ Spark Street, Ottawa.

The awards are broken into four classifications, and contestants will bid for nine prizes. The classifications are: (1) All newspapers; (2) Popular magazines, including weekend supplements of newspapers; (3) Technical, business and trade magazines, including company publications; (4) Aviation articles in French language publications.

There will be a first prize of $150 and a second prize of $100 in each of the four classifications, and a grand prize of $100 for the best story in all four classes.

Winners will be decided on a basis of story significance, interpretation, accuracy, literary quality and reader interest. The names of the successful contestants will be announced at next year's annual meeting of the Air Industries and Transport Association.



AVRO CANADA
# News
JANUARY 1952

★ **THE IMPOSSIBLE TAKES A BIT LONGER**

★ **RUSSIA'S JET PROGRESS**

IN THIS ISSUE

JANUARY 1952 AVRO NO. 44

News

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ART EDITOR · LEN THORNQUIST

## AVRO VIEWS

Our prize this month goes to Ian Morton for bringing us up to date on Russia's jet progress. He is one of our technical illustrators with a hobby of collecting data on the Soviet Air Force.

In our new magazine, "Jet Age," we hope to bring you similar authoritative material on the new revolutionary concept of flight to which Avro Canada has made such a contribution. We're also busily working on the new tabloid "Avro Canada News" which should reach you with all the latest on your fellow workers very soon.

Remember that "Avro Canada News" has changed its format to serve you better. We are depending upon the active co-operation and participation of everyone concerned to make it a good tabloid.

## COVER :

PHOTOGRAPH BY **VERNE MORSE**

Many hours of development time are represented in this busy scene in Avro Canada's flight test hanger.



## THE NEW YEAR ... the new Look

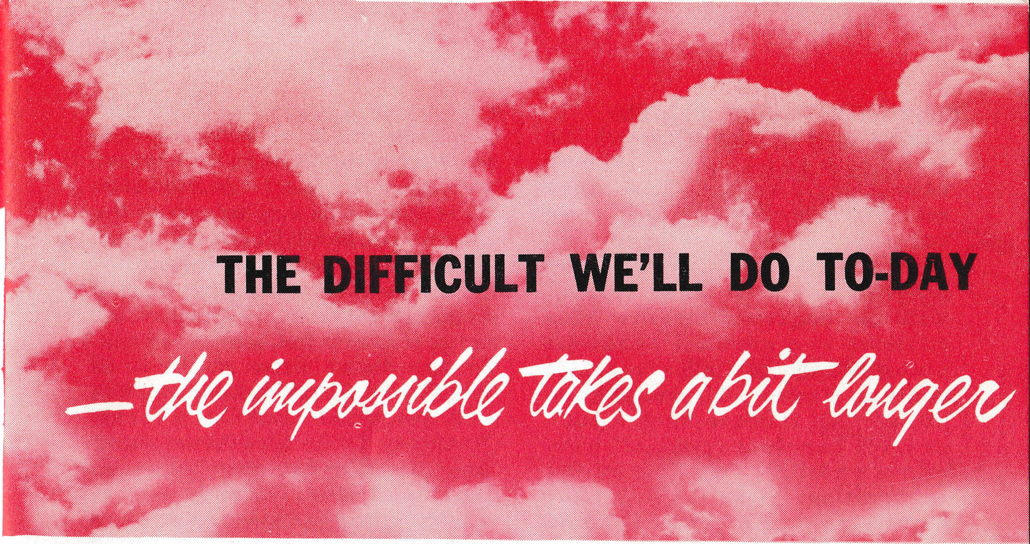

Avro Canada starts the New Year auspiciously, particularly with regard to its organization and facilities. Better to reflect the best of everything of lasting significance which happens to our company, your magazine likewise will with its next issue acquire a new name and purpose. In addition plant employees will receive a more frequent tabloid newspaper which will more fully cover plant events.

Our top management has been strengthened by the addition of such men as our new president and general manager, Crawford Gordon, Jr.; our new industrial relations director, Wm. H. Dickie; and in the newly-created position of general manager of our gas turbine division, by Thomas McCrae. Our organization is being streamlined by setting up two separate divisions, one for aircraft and the other for engine operations.

This year should see our company well established as a production organization. Last year, which saw the historic flight of our Orenda-powered CF-100 fighter, the first all-Canadian aircraft, was largely spent preparing for the difficult transition from development to production. The assignment from the RCAF to produce large numbers of CF-100 fighters and Orenda engines to power them has called for the expansion of our plant facilities and staff. We will shortly be operating from two main plants, the one devoted to engine production entirely new, and the present one for aircraft manufacture. Our staff has been gradually increased and we are now associated with hundreds of suppliers and sub-contractors in the great task of building the nation's defences.

Considerable thought has been given to the plant publications. The new magazine's name will be "JET AGE" which will better describe our subject matter than the present "AVRO CANADA NEWS", which we will continue to use for our tabloid. In the magazine we intend to continue to carry written and illustrative material about jet aircraft and engines, mainly our own. We feel we have a right to this title, being one of the few companies in the world which by its work, not only in the military but also in the commercial field, is making this a veritable Jet Age. The tabloid, on the contrary will be concerned chiefly with the people who produce our jet aircraft and engines. In both publications the company's aims, policies and activities, in which undoubtedly the reader is deeply interested, will be covered although with different approaches. The tabloid will be of chief interest to our employees and to the community.

With our two new publications, "Jet Age" and "Avro News" we will do our best to interpret to the reader, our company, and in our small way contribute to its progress. We know that a promising future is ahead for Avro Canada and we want to be capable of reflecting it.



# THE DIFFICULT WE'LL DO TO-DAY

## —the impossible takes a bit longer

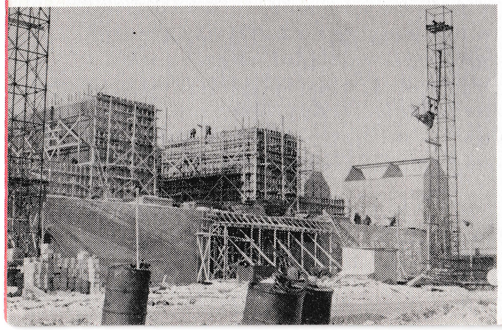
Edgar Atkin's hair has been prematurely grey for years. Only 40-odd years young, he has led the team responsible for designing the world-beating Avro Canada CF-100 fighter and Jetliner, had a lot to do easing the birthpains of such aircraft as the famous Boulton-Paul Defiant, the Avro Manchester York and Tudor as well as the R-101 airship, and he is now cudgelling his brains on new types as yet unannounced. No wonder the grey hair.

"Tommy" Atkin, as he is known to his intimates, is quick to make clear that modern-day aircraft of the performance of the CF-100 and Jetliner variety were not dreamed up over night but are the result of years of patient study and research on the part of an ever-increasing number of highly-skilled designers and engineers. He shares the credit for designing and developing the CF-100 with John Frost and the Jetliner with Jim Floyd, last year's winner of the Wright Medal, the Nobel prize of aviation. Frost and Floyd between them have worked on a galaxy of outstanding aircraft from the Lancaster and Manchester bombers to the De Havilland 108 flying wing and Vampire fighters as well as the Hengist gliders. A host of other Avro Canada engineers should also get credit for the CF-100 and Jetliner, Mr. Atkin says.

At the moment Avro Canada is rushing the CF-100 into mass production in addition to its own-designed Orenda turbojet engines to power it. Only the urgent need by the RCAF for these aircraft has made the company temporarily postpone production of the Jetliner. Just six years ago a handful of personnel led by Mr. Atkin and his two youthful designers started from scratch from a bare floor to develop the CF-100 and Jetliner while Paul Dilworth and Winnett Boyd started work on the Orenda and its predecessor, the Chinook development engine. Few other manufacturers would have ever considered taking on three such formidable assignments, an all-weather long-range fighter with the engines to power it in addition to a medium range jet transport for Canadian domestic routes. Fewer still would have brought all three to such a successful conclusion for all have won world-wide engineering recognition. One U.S. manufacturer said his company could not develop a single product for the time and money Avro Canada has spent on the CF-100, Orenda and Jetliner.

Assembly lines are now being organized at Avro Canada where lately development work was being carried out. Scarce machine tools have had to be obtained and extra production facilities built and what facilities exist completely rearranged. The manufacturing floor area is being expanded to some 1,680,000 square feet in some 400 acres of property. The building program alone involves an outlay of millions of dollars and among the new buildings is an independent engine factory. Merely recruiting a staff, particularly on the technical side, to carry these three projects from development to production has presented major problems. Work procedures have had to be organized at the same time designs were made. When peak production is reached, it is expected Avro Canada will employ around 12,000, one of the largest labor forces in Canada. At the same time upwards of 400 Canadian manufacturers and material suppliers from Winnipeg to the Maritimes have been organized by Avro Canada so that the CF-100 and Orenda projects could be built in Canada if there were an emergency. At present the CF-100 and Orenda are largely Canadian - built from Canadian materials. It is also an important strategic fact that the aircraft engines and aircraft in which they will be used are being built side by side. It is no wonder young men like Jim Floyd who has been given the job of getting the CF-100 into mass-production but quick are developing grey hair prematurely, like Edgar Atkin.

This is all very fine, the layman may say, but what does this growing complexity of the aircraft builder's job mean to me. He vaguely realizes that the commercial transports he rides in now cruise at 300 miles an hour instead of the 180 they used to before the war. He hears that just around the corner are the jet transports of the future, the Comets and the Jetliners, which fly at speeds almost twice as fast as contemporary airliners and in incomparable comfort and safety. He may be told that the cost of development of a modern transport like the Lockheed Constellation was about $35,000,000 (that of the ultra-modern Jetliner in comparison being $9,000,000) but he perhaps puts these incomprehensible figures down to the increase in the cost of living. He little realizes that today's progress in flying is made at the expense of endless headaches and heartbreaks for the designers and manufacturers.

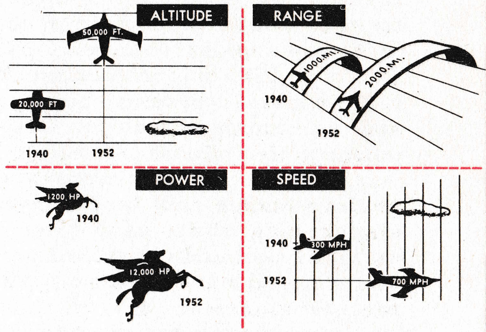


AT THE SAME TIME AS MAKING COUNTLESS OTHER PREPARATIONS, TO GET INTO PRODUCTION, AVRO CANADA HAS HAD TO BUILD SUCH FACILITIES AS THE NEW GAS TURBINE BUILDING, SHOWN HERE.

Men like Atkin, Frost and Floyd might well have, and indeed many of them do have as a motto our title: "The difficult we will do today, The impossible will take a bit longer". Men like these have been responsible for the tremendous changes brought to aviation by the advent of the jet engine little more than ten years ago. Its tremendous increase in power availability and its performance almost over night revolutionized the construction of modern aircraft. These men point out that in the few years since the end of the last war the airplane's performance has almost doubled.

Most modern fighter aircraft being produced today, and this includes the Avro Canada CF-100 and the North American Sabre being turned out by Canadair, have top speeds in excess of 600 miles an hour. Newer models now being developed will be in the 700 m.p.h. class and higher. Mr. Atkin compares these speeds with those of the fastest World War II fighter types which were in the 450 mile an hour class.

## GREATER PLANE PERFORMANCE
**(Makes Airplane Costs Higher And Production Longer)**




The sonic so-called "barrier" has been finally conquered but at considerable cost in money and time. The cost of one of the recent supersonic planes almost exactly equalled the value of its weight in gold at 35 dollars an ounce. The first prototype CF-100 was almost as expensive, the cost of the radar equipment alone in one of these all-weather long-range fighters being in itself a good deal more than the cost of the whole Spitfire fighter in the last war.

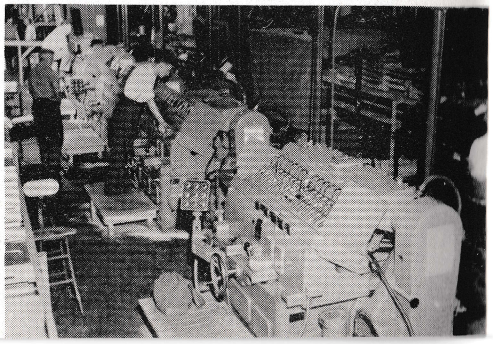
The barrier of limited service ceilings also is gradually being removed for modern fighters and bombers operate at twice the altitudes they did during World War II, up to 45,000 and 50,000 feet compared to the former 20,000 to 25,000 feet. Despite these more difficult operating conditions, modern aircraft weigh much more than they did in the last war. The CF-100, first of the breed of a new series of large post-war fighters, weighs considerably more than the doughty Dakota DC3 transport complete with passengers. Yet the CF-100 is 20 times as compact in the amount of air it displaces. The CF-100 carries as much fuel as a last war heavy bomber and armament equal in fire-power to that of a naval cruiser!

To achieve this improved performance a vast increase in engineering effort is required, as Mr. Atkin and his fellow designers well know. For example the development of the first experimental model of a typical post-war fighter required approximately $17\frac{1}{2}$ times as many engineering man-hours as its World War II counterpart. The CF-100 with its reinforced metal construction obviously is taking much more time to produce than the last war plywood De Havilland Mosquito, which is comparable in many respects, including size.

To design the aircraft structure systems alone of such an ultra-modern aircraft as the Jetliner it took some 700,000 man-hours, more than is required in designing the structure of such a large building as Toronto's Bank of Commerce. Avro Canada designers issued over 50,000 sketches and drawings to the factory boys to supply them with the necessary information for the Jetliner's construction. The drawings issued used over one and a half million square feet of blueprint paper before the aircraft even flew.

The Jetliner, despite its ease of operation and sleekness of design, is exceedingly complex. It took more engineering work from Mr. Atkin's staff to design the aircraft's electrical system than it would have to design the electrical system for a 20-storey building. In this system there are $7\frac{1}{2}$ miles of wiring, over 16,000 electrical connections and over 1200 other electrical items. The aircraft has more instruments than 20 diesel locomotives. Its wings enclose a structural frame which is stronger than most highway bridges and at the same time carries 3000 gallons of fuel. The aircraft's radio and electronic equipment would compare favorably with that of a small commercial broadcasting station. It has two complete transmitters capable of sending on 40 different frequencies and ten receivers used for various navigation and communication purposes together with a complete intercommunication system.

Avro Canada's John Frost can remember World War II days when the fighters he worked on were "simple vehicles carrying a pilot, a set of guns and the engine". Now almost three-quarters of the design time for a fighter is spent on equipment alone. The "simple vehicle" has changed to a "complicated mechanism" with radar, radio, navigation and de-icing equipment, pressurization and air conditioning, power controls and dear knows what else in addition to the pilot and crew who are virtual scientists, increased armament and motive power. In the old days the plane itself was the thing; today the plane is merely a carrier



A BATTERY OF AVRO CANADA JET BLADE DUPLICATOR MACHINES, TYPICAL OF THE EQUIPMENT AND METHODS BEING EVOLVED TO CUT DOWN PRODUCTION TIME AND INCREASE QUANTITIES PRODUCED



Avro Canada designers say that in general many factors have contributed to the additional engineering effort required for modern aircraft. The supersonic speeds of today have been made possible only by constantly changing approaches to the shape and design of the planes. Thinner wings and sweep-back of wing structures have been adopted with resulting reduction in drag and turbulence - but with attendant great increase in manufacturing difficulties.

Modern aircraft must be able to withstand temperature unthought of a few years ago. The pilot of an airplane flying at 670 miles per hour, the current published world speed record, could not live without refrigeration because of the heat generated by the friction of the airplane as it passes through the air.

To reach the altitudes necessary for modern flight elaborate pressurization and cooling systems are required. At 55,000 feet, without pressurization, water vapor in the human body would boil; the blood itself would boil at 63,000 feet. Pressurization equipment is complicated and expensive to develop, particularly for military planes. One of the units for cooling the Jetliner's air has a cooling capacity of over 200 refrigerators, and yet weighs only 30 pounds. The Jetliner is provided with an air conditioning system which will regulate the temperature and maintain better ventilating conditions than a de luxe theatre. It has a cabin in which sea level pressures are maintained automatically up to five miles above the earth. It is designed to operate over a wide range of temperature changes, from about 65 degrees below zero to 120 degrees above.

On a flight to Winnipeg by the Avro Canada Jetliner a temperature of -88°F was encountered at 35,000 feet. Most war-time aircraft ran into serious difficulties at temperatures lower than 30°F and in fact were often totally unserviceable at that temperature.

To increase structural strength of the airplane, needed for the higher speeds and greater power, stronger materials have been required. Consequently, there is a constant search for ways of reducing the weight in materials. However these new alloys have not yet been fully developed.

Modern high speed fighter aircraft must have pilot ejection seats since at high speeds of combat operation the pilot in many instances would otherwise be unable to get out of his airplane and clear the tail assembly. The pilot no longer flies by the seat of his pants in a haywire and cotton contraption but sits in a maze of complicated navigational and flight instruments which require literally years of training and experience to master.

Present-day high speeds and altitudes of flight require expanded and increased use of elaborate research and development facilities. At Avro Canada and elsewhere research has been conducted in the fields of aerodynamics and thermodynamics which were unploughed territory before the advent of the jet engine. The designers of the CF-100, Orenda and Jetliner were dealing with performance characteristics for which there was no precedent.

In addition, such aircraft companies as Avro Canada are confronted with serious problems in keeping pace with developments in aircraft manufacturing methods. The design of the new aircraft for high speeds requires shapes, curves and smoothness which are new and can only be produced with expensive new equipment. At the same time, new machines and equipment are opening new vistas in manufacturing methods in the aircraft industry which will reduce costs and greatly increase efficiency. The Avro Canada tracermatic duplicator, for example, which was developed in conjunction with Modern Tool, can produce a dozen of those scarce jet engine blades where only one was produced before.

It is hard enough to design and develop a modern airframe but your difficulties are enormously increased when you try to produce a jet engine as well to power that airframe.

It has been well said that there is no device as simple in conception and as complicated in resolution as the aircraft gas turbine engine. Manufacturing methods are highly complex and rigidly governed in the thermodynamic mechanical and metallurgical aspects of the work. Several prototype engines, constructed with simple tooling by 'job-shop' methods, had to be built in order that development problems of the Orenda might be attacked in parallel. Large and expensive testing facilities had to be engineered to develop individual components. At Nobel and Malton, Avro Canada now possess research facilities which of their kind are equal in efficiency to any in the world. By the use of existing facilities the cost was only a fraction of those elsewhere.

Meanwhile the race for jet supremacy continues whether it be for a better defence weapon or for a better commercial airliner. At Avro Canada, now turning its energies to production problems, new types in both fields are not being neglected. Its management realizes that production lines take years to build. The production lines of the future are now being foreseen on the drawing boards of Mr. Atkin and his men.



# Rockets Away!

**By: S. ALLEN, CHIEF COMBUSTION ENGINEER, ARMSTRONG SIDDELEY MOTORS LTD., FELLOW OF THE BRITISH INTERPLANETARY SOCIETY**

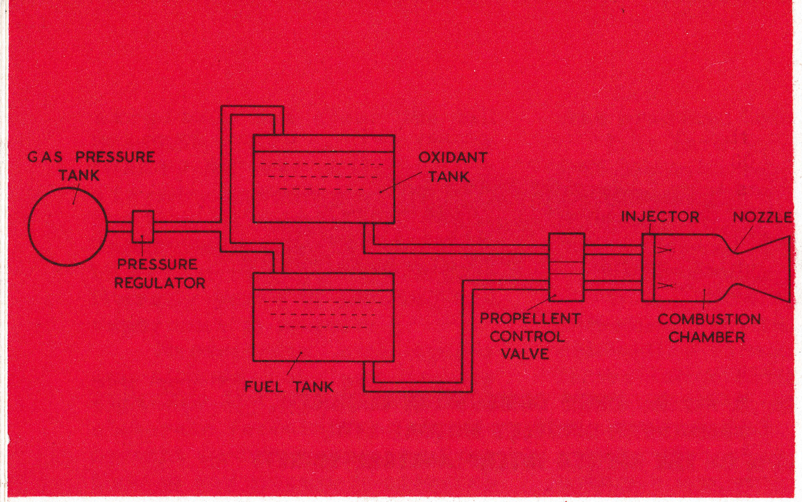
The application of liquid fuel rocket motors to aircraft propulsion is by no means a new idea, but in the past there has been a tendency to look upon a rocket motor as a rather dangerous conjuring trick. In addition, the extremely high specific fuel consumption has been regarded as prohibitive.

In spite of its various shortcomings, however, the rocket motor has a definite place in the field of aircraft propulsion which cannot be filled by any other known prime mover. In what follows, an attempt has been made to explain in simple language the advantages and disadvantages of the rocket motor and, as far as security considerations allow, how these have been balanced in the recently announced Armstrong Siddeley Snarler motor and its application to the Hawker P.1072 fighter.

Firstly, let us consider how the rocket develops its thrust. In its most simple form shown diagramatically the liquid fuel rocket motor is but little more complicated than a soda water siphon. The propellant or propellants are expelled from the tanks by gas pressure and forced, usually in the from of spray, into a reaction chamber where chemical reaction takes place, giving rise to the evolution of a large quantity of heat, and the production of a large volume of gas. This gas escapes at high velocity through a nozzle. The pressures needed in rocket chambers are invariably such as to give sonic velocity at the throat of the nozzle, so it is usual to provide an expanding portion making the nozzle a De Laval or convergent-divergent type.

As might be expected, there is a wide range of rocket propellants to choose from. Leaving for the moment considerations of the physical properties of available propellants, we find there is a fairly wide variation in the possible performance of each.

To generalize, we may say that for a given expansion

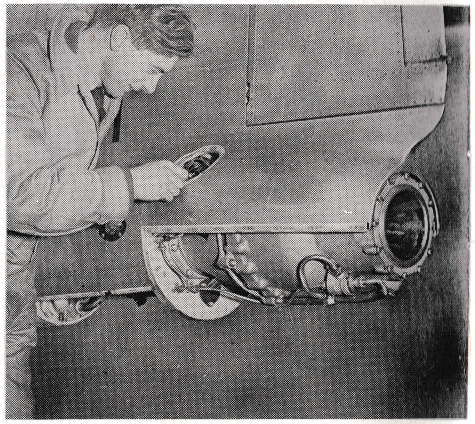



PRINCIPLE OF THE SNARLER ROCKET

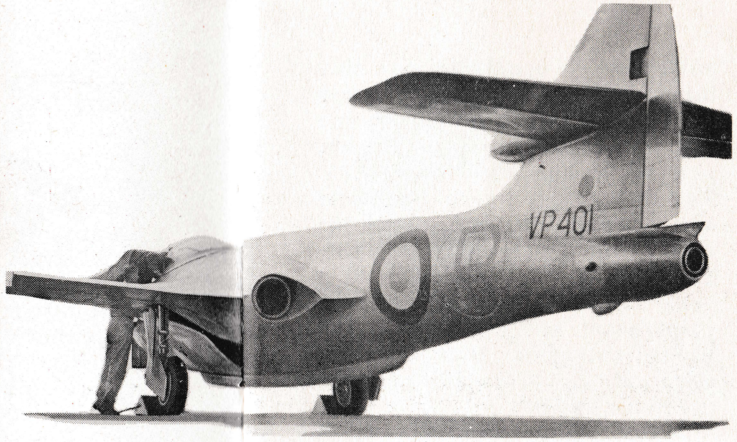
ratio - that is the ratio of the combustion pressure to pressure at exhaust - the velocity of the jet increases as the square root of the temperature within the chamber, and decreases with the square root of the molecular weight of the exhaust gases. Thus our best propellant combination will be that which gives the highest flame temperature and the lowest molecular weight of the exhaust gases. In choosing a rocket propellant, we must also think of such things as ease of handling, safety, availability in time of war, and cost; the latter factor would of course have less influence as the other factors became more advantageous.

Liquid propellants are divided into two main classes, monopropellants and bi-propellants. Briefly a mono-propellant is a single substance or mixture of substances of which the main bulk can be stored in one tank, and can be squirted into the rocket chamber through one system of holes. The liquid is such that when annoyed in some particular manner it dissociates into a gas or gases with an evolution of heat. In passing it may be mentioned that the less particular the substance is about the kind of annoyance which

CLOSE-UP OF SNARLER'S COMBUSTION CHAMBER








THE HAWKER P 1072 WITH THE ARMSTRONG SIDDELEY SNARLER ROCKET IN THE TAIL

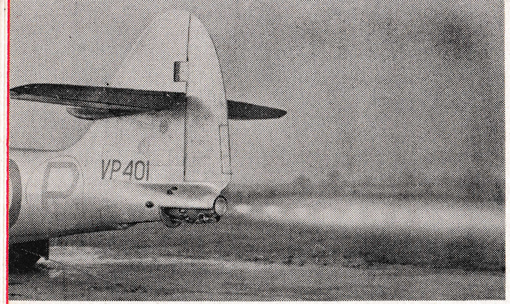
starts the dissociation, the less safe it will be, while the more particular it is the more difficult it will be to dissociate it efficiently and rapidly in the rocket chamber.

Bi-propellants usually consist of a fuel and an oxidant, which of course have to be stored in separate tanks and fed to the rocket chamber by separate injection systems. The more amenable and common combinations consist of an oxidant which is very rich in oxygen, and a fuel which is either an alcohol or a hydrocarbon.

The choice of a fuel is fairly easy as hydrocarbons and alcohols are plentiful and comparatively safe and easy to handle. The main difficulty therefore lies in the choice of the oxidant. If all the witches' brews that have been tested and proposed were listed it would fill this paper from end to end. Some are so sensitive that they are liable to detonate if spoken to sharply. Of others, only a few pounds exist in the world. As we are severely practical people, we will confine our consideration to those propellants which are reasonably obtainable, and which could conceivably be handed over to instructed but non-technical personnel to handle. Of the liquid oxidants which fulfil these conditions there appear to be only three - concentrated nitric acid, concentrated hydrogen peroxide and liquid oxygen. Liquid air is ruled out because the amount of oxygen present is insufficient.

The question now arises, why should we use a motor which consumes approximately 18 times as much propellant for a given thrust as a gas turbine, and why is the rocket motor apparently so inefficient? The answer to the first question is that the rocket motor carries its atmosphere with it and is thus completely independent of the external atmosphere. For this reason its thrust, instead of decreasing with altitude, as does that of the gas turbine, actually increases slightly as it climbs.

Regarding efficiency, for every pound of fuel a gas turbine burns, it uses approximately 65 pounds of air. Thus on the basis of total propellants the gas turbine has a consumption approximately 3.5 times as great as that of the rocket motor; or looked at another way, the rocket has a specific impulse of 200 while that of the




DIAMOND-SHAPED SHOCK WAVES FROM THE SNARLER

gas turbine is only 55. In short the price of maintaining thrust at all altitudes is that of carrying our atmosphere with us. This penalty is lightened to some extent by the circumstance that no turbine driven compressor is needed in the rocket. The necessary work has been done on the ground before we start, either as the mechanical work which has been expended in liquefying the oxygen, or the chemical energy which has been put into the nitric acid and the hydrogen peroxide.

This means that for a given thrust the rocket motor is considerably lighter than a gas turbine, the figures for a rocket motor being about 0.1 pound per pound thrust while the gas turbine is about 0.34 pound per pound thrust.

Having now given a very rough outline of rocket motor operation and rocket motor propellants, let us consider how the Snarler differs from the simple rocket layout shown in the diagram. The main item of difference lies in the manner in which the propellants are forced into the combustion chamber. The Snarler was designed to run for several minutes and to pressurize tanks containing sufficient propellants for this length of run to the very high pressures required, would entail extremely heavy tanks and pressurizing gas containers. For this reason the propellants are pumped, so that comparatively light tanks may be used. The pumps are mounted on a gear box driven from the main powerplant and from them the propellants pass through various control valves to the combustion chamber.

The fuel passes around the chamber cooling jacket before entering the injector; and there is thus no loss of heat from the jacket.

The main hazard in a rocket motor is the starting process. Due to the extremely potent nature of the propellants and to the high rate of flow, any delay in ignition would allow the combustion chamber to become charged with a highly explosive mixture, as in the absence of ignition the propellants would remain in the liquid state. If when this has occured, ignition does take place, the pressure in the combustion chamber can rise to disastrous proportions.

In order to avoid this, ignition is initiated in a small pilot chamber and only when this is injecting a tongue of flame into the combustion chamber is the main flow of propellants admitted. When the main chamber is operating smoothly the flow of propellants to the pilot chamber is cut off.

The Snarler was designed and developed by a small team at the Ansty Test Station of

(CONTINUED ON PAGE 18)



AVRO CANADA EMPLOYEES NEWS

# No Longhairs Need Apply!

*by Len Thornquist*

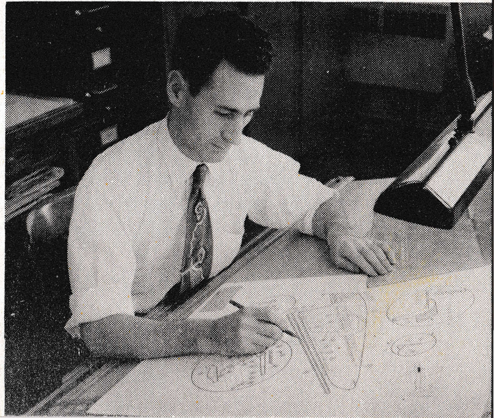
Ever wonder what the suspicious looking character with the sketch pad and pencil is doing around an aircraft plant? Chances are he's a technical illustrator gathering notes for illustration of an assembly or a system.

There is an increasingly important part played by these artists in industry today. Apart from the producing of illustrations for spare parts, maintenance and a host of other manuals these technical illustrators prove their worth in many ways.

Very often they are called upon to produce scaled perspectives of structures for study by the designers, or prepare highly finished illustrations of proposed new aircraft designs for study by officialdom. Their ability to visualize and draw a complete mechanical assembly from blueprints makes it possible to have illustrations ready even before the product is manufactured. This is very important in the case of consumer goods such as automobiles, where all advertising material is co-ordinated to hit the market with the finished product.

In time of war or preparedness, the technical artist assumes a more urgent role.

REG. SMITH CHECKING AIRCRAFT PARTS ILLUSTRATION



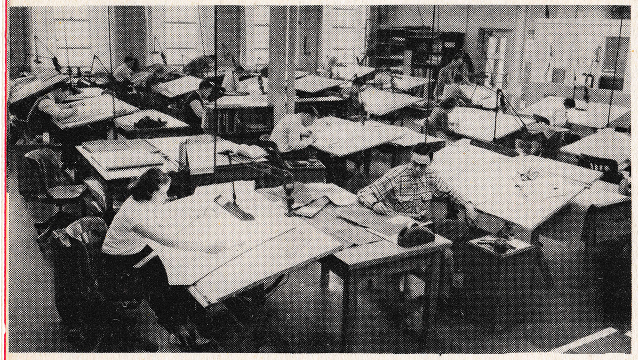


ILLUSTRATION SECTION—TECHNICAL GROUP

His job is to interpret blueprints of equipment before the final assembly stage is reached in order that the armed forces have the reference material required to service and repair the various types of equipment from time of delivery.

Training of maintenance crews is another phase where perspectives and schematic charts are required and the old adage of a picture being worth a thousand words comes into its own.

Most facinating of illustrations to the layman is the perspective breakaway. Here the illustrator labors with countless blueprints and other reference matter to draw and ink section by section, piece by piece all the parts necessary to produce a functional illustration. As these drawings are produced for a multitude of purposes, they must be correct and easily understood in every detail, and of excellent reproductive quality.

AIR-BRUSH ARTIST BILL WILLIAMS PUTS FINISHING TOUCHES TO ENGINE PARTS ILLUSTRATION

In World War II the scarcity of skilled help developed a new field for technical artists, namely production illustration. Here the artist illustrates an exploded view in the sequence in which parts fit together. These illustrations are blueprinted and supplied to the shop benches on a production line as an aid to speed assembly.

One of the major problems for the chief technical illustrator today is the selection of artists with the turn of mind suitable for technical art. As this field is relatively new in Canada the source of supply for this type of personnel is limited and our only alternative is to train promising artists or to import them.

The common belief that artists as a rule are not technically-minded appears to be true. Certainly the average art school student abhors working with scales, french curves, elipse templates, etc., and considers it stifling and suicidal. Fortunately there are exceptions, who look on every stack of blueprints as a challenge, and bury themselves so deep in concentration that it would require an atomic blast, or the mention of money, to distract them.

While many experienced technical illustrators have come from the U.K. in recent years, there are still good opportunities for Canadians in this field. The development of local talent has shown good results to date and judging by the quality of their work they may look to their future with confidence.

ANNE HAINSWORTH CONSTRUCTING LANCASTER RIBS AND FORMERS DIAGRAM ON PERSPECTIVE DRAWING BOARD

# Our Wandering Reporters

*by Boyd Ferris*

London, England - Once you ve resigned yourself to looking in the wrong direction every time you cross the street, life in England's not too bad after all.

Somehow the rain doesn't seem as wet when you can avoid it by diving into a picturesque little pub for a thoughtful pint,

nor a city as dirty when there is a woman selling flowers on the street corner.

Life here has an easier, slower pace. There seems to be time for the things you've always wanted to do, whether it's sleeping in late in the morning or delving into some obscure subject like the home life of the oyster. Perhaps it's the slower pace that fosters the Englishman's habit of taking a long steady look at what's going on around him before he lets himself be talked into anything, perhaps it works the other way around. At any rate if that's what produces such refreshing reporting as you find in newspapers like the "Manchester Guardian" then I'm all for it.

London isn't at all self-conscious about being the largest city in the world; its size isn't even apparent unless you happen to see the city from the air or roam its streets on foot. The average Londoner contrives to go about his business without the distracted air and harried bustle so familiar to the cities of North America today. Cosmopolitan though London may be, it is still a city of individualists, and I think that accounts for much of its distinctive character. Walk down Regent

Street wearing a turban and spats, an umbrella hooked over your arm, and chances are that the only person who will turn around for a second look will be a tourist.

One of the most pleasent features of living in London is

the variety of entertainment that is offered to you. If your tastes run to theatres and concerts you can always have a wide choice every night in the week - and that for less than the price of a firstrun movie if you don't mind perching in the gallery.

As far as everyday living is concerned, austerity is little more than a myth in England these days - if you have plenty of money. But if you're living on an English salary and paying English income tax, things take on quite a different aspect. With reasonable care you can live comfortably on your salary but unless you happen to win a football pool your chances of saving enough for a home or a car are pretty slim.

The food problem is not one of quantity so much as variety, and as a result the poor housewife is the one who suffers most. She has to tax her imagination to camouflage today's food so it looks different from yesterday's lunch and tomorrow's dinner. The meat ration, of course, is small by Canadian standards but generally speaking rationing imposes no real hardship.

Needless to say, we like it over here. Sometimes, though, we find ourselves thinking wistfully of autumn in Muskoka when there's a hint of wood smoke in the air, or longing for a crisp, still winter night when a peasouper is blanketing London, but at times like that we have only to turn on the radio. An evening devoid of soap flakes and singing commercials is a luxury which can't be underestimated.

# personality Parade

*by Fred Lawrence*

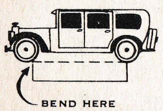
Audrey Underwood, Secretary to Mr. Crawford Gordon Jr., our new President and General Manager, comes to Avro Canada from Ottawa. However it is really a move "back home" as Audrey originally came from Toronto. While in Ottawa, Audrey worked as Mr. Gordon's secretary when he was Co-ordinator of Defence Production under the Rt. Hon. C.D. Howe. Previous to that, she was with Mr. Gordon when he was Executive Vice President of the John Inglis Company and President of the English Electric Company.

In reply to the question of what it's like working for the "boss", Audrey pointed out that it was mostly a case of being prepared for any eventuality and trying to establish answers before questions are asked! That doesn't exactly sound easy. Mr. Gordon, as we are coming to realize, is dynamic to say the least, and of course his tempo in no small way effects that of his secretary. Audrey does not appear to be lacking in this respect as she vigorously pursues the variety of duties that befall one in such a position. She says Mr. Gordon has a wonderful sense of humor and makes great decisions quickly and wisely.

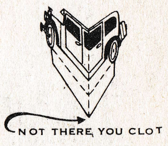
In the hobby department, Audrey specializes in tennis, swimming, golf, badminton, skiing and sewing (strictly spare time). On one of her skiing escapades, Audrey had the great "misfortune" of being snowed in at a Laurentian Lodge for two days. Needless to say a good time was had by all.

Jack Lidicoat, of the Maintenance Department, celebrated his 50th Wedding Anniversary recently, and all at Avro Canada join in extending our heartiest congratulations. Jack and Mrs. Lidicoat were married in Devonshire, England, and came to Canada in 1912. He has been at Malton since 1940 when he entered the employ of the National Steel Car Company. The Lidicoats boast two sons in Toronto and a daughter located in Seattle, Washington.

WE WELCOME TOM McCRAE, AN OUTSTANDING AERO ENGINEER, TO AVRO CANADA IN THE NEWLY-CREATED POSITION OF GENERAL MANAGER OF THE GAS TURBINE DIVISION.




# Ye Old Avro Game of Patience & Fortitude

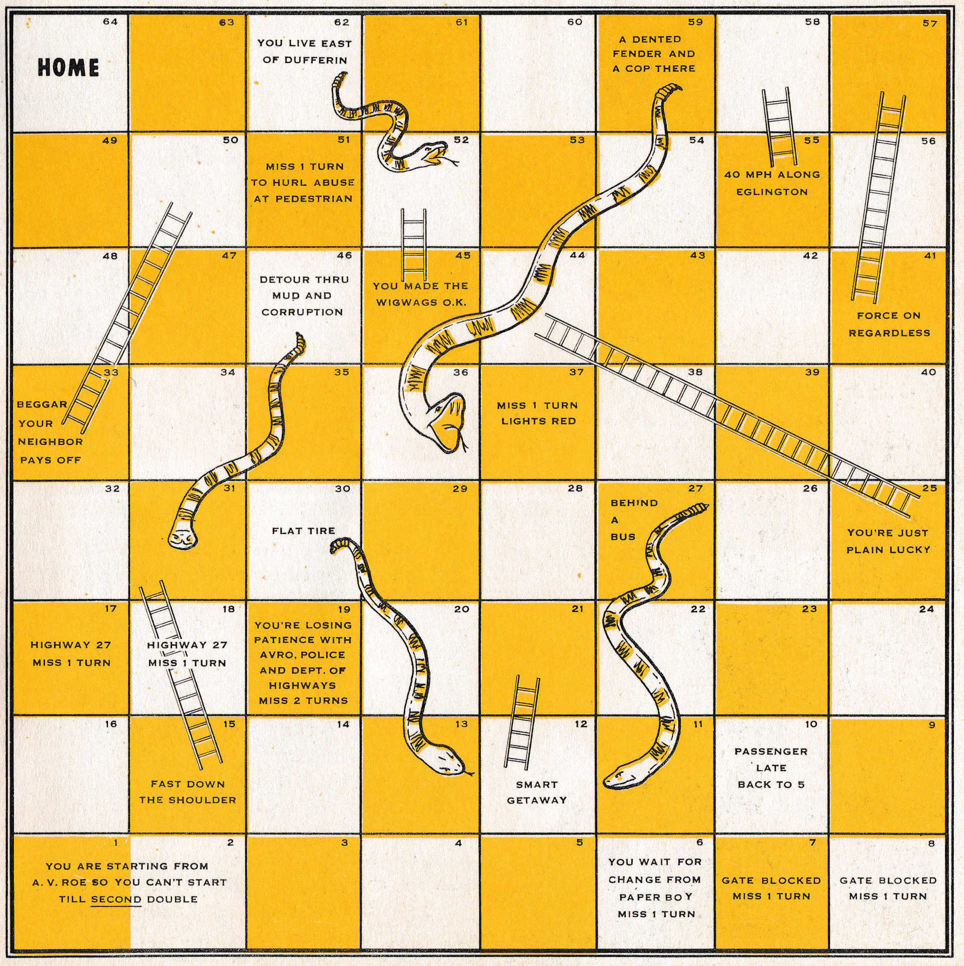



**( HOW TO GET HOME UNHAMPERED BY TRADITION )**

**THIS IS A DICEY GAME OF CHANCE**

*by Ian Scott-Buccleuch*

TWO DICE ARE REQUIRED AND AS MANY PLAYERS AS WILL THOROUGHLY CLUTTER THINGS UP. AS THIS IS AN AVRO GAME YOU MUST NOT START TILL YOU THROW YOUR SECOND DOUBLE



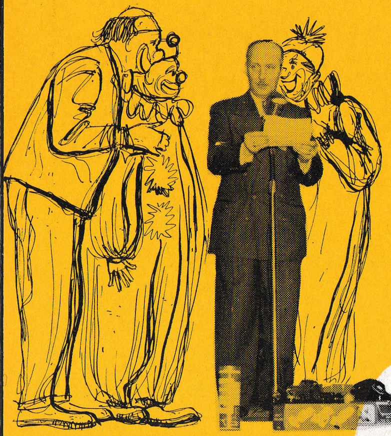

PATENTS APPLIED FOR AND REFUSED

# CHRISTMAS parties

RECREATION CLUB
SUPERVISORS ASSOCIATION
FINANCIAL DIVISION

SANTA CLAUS - AND FRIEND

DICK SMALLMAN - TEW, PRESIDENT OF THE SUPERVISORS' ASSOCIATION, INTRODUCES SOME OF THE EXECUTIVES OF THE COMPANY TO THE "SERGEANTS MESS"



JACK HILTON OUTDOES HIS PRODUCER NAMESAKE BY ACTING AS M. C.

THE WINNERS - KAY WHITLEY, BERNIECE MELNYCK AND BILL MELNYCK

# RUSSIA'S JET PROGRESS

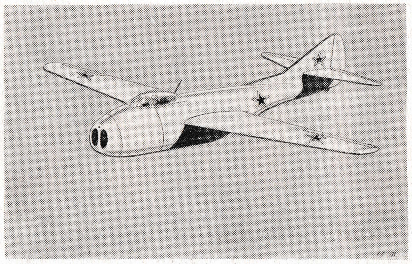
WRITTEN AND ILLUSTRATED

*by Ian C. Morton*

With the handing over to the R.C.A.F. of Canada's own designed jet fighters, many Canadians are questioningly turning their aviation eyes eastwards (or northwards) to the U.S.S.R. Has Russia any aircraft comparable to the CF-100? What kind of equipment has the Red air force? How far has she progressed in the jet field? In an attempt to answer these questions, the following review of Soviet aviation is presented, dealing with Russia's part in the jet race.

Since the end of World War II, the U.S.S.R. has been particularly careful not to give away details of aeroplanes and engines used by her fighting forces. However, captured newsreels from Korea, photographs taken by correspondents in Germany, and descriptions and sketches by Allied pilots have enabled astute Western observers to form a fair idea of Stalin's air strength - or weakness.

Russia's jet history started in the spring of 1945, when an aircraft known as the MiG-7 flew for the first time. This experimental machine was a "lash-up" in the true sense of the phrase, consisting simply of a standard piston-engined



MIG-7

MiG-3 airframe, sans motor, "married" to a modified German Jumo 004 turbojet, and faired in. Data obtained from this experiment enabled Soviet technicians to make a speedy start on the design of the MiG-9, a twin-engined jet fighter of similar aerodynamic form, which entered service later in 1945.

It was about this time that Russia received unexpected aid from Great Britain in the shape of a consignment of 55 jet motors and spares. During 1947 and early 1948, 30 Rolls-Royce Derwent 5's and 25 Nene 1's were delivered into eager Soviet hands. Much to the annoyance of the United States, the British government even invited Soviet technicians to undergo a course in jet maintenance at the Rolls-Royce plant in Derby.

From then on, steady progress was made. Under the direction of designer N.B. Chelomy, the power output of the Nene was progressively stepped up from 4,500 lb. static thrust to its 1951 rating of 5,500 lb. High-speed fighters, such as the MiG-15 and La-17, are powered by M-45 units, as they are designated, and operations in Korea suggest that these Russian turbojets are extremely efficient under combat conditions. Reliable reports indicate that the M-45 is now being modified to obtain 6,000-6,500 lb. static thrust, and new versions will be in production very soon.

During the period when the centrifugal-type Rolls-Royce engines were being delivered, Russia had already been working for three years to design and produce German axial-flow units using the captured BMW 003A-2 and the Jumo 004B-4 as a basis for developments. Re-designated M-003E and M-004H, they had their power output increased from 1,760 lb. and 1,980 lb. thrust, to 3,750 lb. and 4,000 lb. respectively. Early Red aircraft powered by these turbojets provided Stalin's air force with a much-needed morale booster at a period when other nations were forging ahead with jet propulsion. Present production is now concentrated on the M-012 (6,600 lb. thrust), and the M-018 (8,000 lb. thrust), two of the most powerful turbojets in the world.

In the field of rocket power-plants, Russian designers have made further use of German data by producing a development of the Walter HWK 509C liquid-fuel rocket (rated at 4,400 lb. static thrust in 1945) which powered the Junkers Ju-8-248, an improved version of the Messerschmitt Me-163 tailless fighter of World War II. With an aggregate thrust of something like 6,600 lb., the Soviet "rocketjet" has been under test for some time in the Yak-21, a diminutive experimental interceptor-fighter of obvious German parentage.

Soviet designers would appear to be giving the highest priority to thrust augmentation for their current production turbojets. For a time, long afterburners were not favored by the U.S.S.R., but several high-speed swept-wing jets seen at the annual Moscow air display at Tushino airport in July of last year, would indicate a complete reversal of policy.

Liquid-fuel rocket assisters have not been neglected, and future Soviet developments of the 2,500 lb. thrust German BMW 718 should compare favorably with the new British Armstrong Siddeley Snarler and other Allied units.

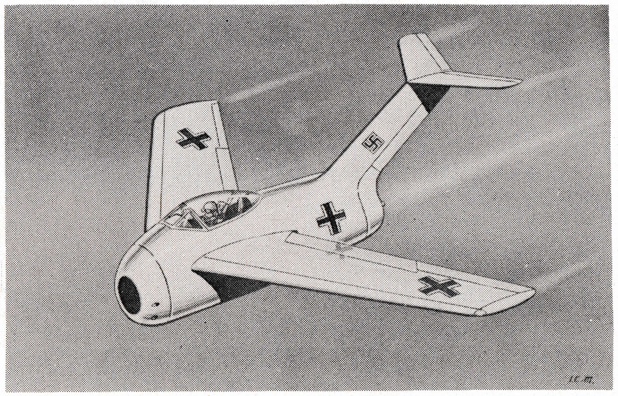
Thus it can be seen, that Russia's present policy is to concentrate on three main types of turbojet, namely the M-45, the M-012, and the M-018, together with various forms of augmentation to increase available power output.

It is reassuring, however, to remember that the downfall of Germany's Luftwaffe came from over-standardization of equipment.

## PRODUCTION JETS OF THE RED AIR-FORCE

### MiG-9 1945

Designed jointly by Artem I. Mikoyan and Mikhail I. Gurevich, the MiG-9 was a direct development of the early MiG-7, and had the honor of being the first series-production jet aircraft to go into service with the Soviet Air Force. Its meagre performance with two M-003 axial turbojets of about 2,000 lb. static thrust each soon resulted in production being tapered off in favor of the single-engined Yak-15 fighter. MiG-9's, however, are still in service in small numbers with the East German and other satellite air forces.

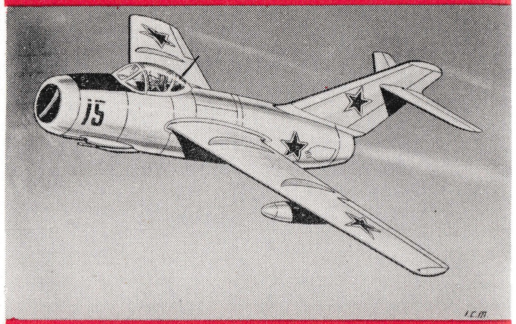


FOCKE-WULF TA-183/11

## MiG-15    1947

The MiG-15 first gained notoriety in Korea, when its astonishing rate-of-climb and high maximum speed gave United Nation's pilots many a headache until the F-86 Sabre was introduced.

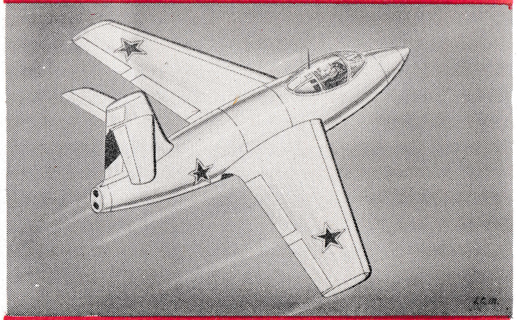
Generally speaking, the MiG-15 is considered a better all-round aircraft than the Sabre, and, like most other modern fighters of the Soviet Air Force, carries large-calibre cannon as standard equipment. Meanwhile, the R.A.F. and the U.S.A.F. still cling to 20 mm. and .5 in. weapons of World War II vintage, long out-dated by the rapid advances in air armament during the past six years.



THE MiG-15

## YAK-21    1948

Another strategic-area defender is the Yak-21, the post-war Russian version of the German Me-163 and Ju-8-248 rocket interceptors. With its HWK-509C development, this swept-wing fighter is said to be capable of speeds up to 900 m.p.h. for short periods. It is believed to be in limited production.



THE YAK-21

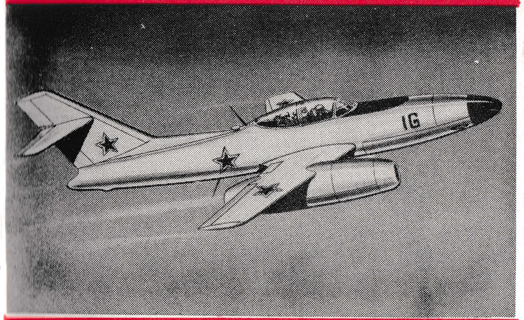
## LA-15    1948

Semyon A. Lavochkin's La-15 is roughly the equivalent of the CF-100 fighter. It owes its basic design work to German World War II designer, Willy Messerschmitt. His Me-262 "Sturmvogel" was designated the La-13 by the Soviet Union, and put into limited production. A modified version known as the La-15, and fitted with Russian-built M-004 axial turbojets, followed. Latest production night-fighter variants incorporate swept-back wing and tail surfaces, and are powered by two 6,600 lb. static thrust M-012H engines.

Most recently reported armamént are two 32 mm. cannon and two 12.7 machine guns, the attack-escort-fighter version carrying an all-cannon battery in the nose.

Pilots over Korea are rumored to have sighted a machine similar to the La-15, but no official confirmation of this fact can be obtained.

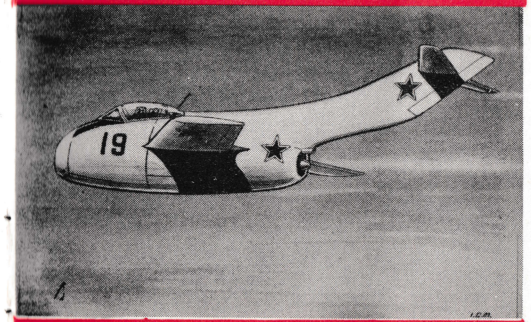
Rising production inside Russia itself indicates that this aircraft will form the nucleus of the U.S.S.R.'s night defence organization.



THE LA-15

## MiG-19    1951

Big Russian surprise of this year was the introduction of a new fighter bearing a very close resemblance to the German Tank-designed Ta-183 of World War II. It is likely that the MiG-19 was one of the high-speed 'all-swept' jets shown at the July, 1951, Moscow air display.



THE MiG-19

## LA-17 1944

Like the MiG-15, the La-17 was based on the German Focke-Wulf Ta-183/11, an advanced fighter designed in 1944 by Kurt Tank, currently working in Argentina. Experience gained in squadron service made the Soviet air force cut back production in favor of the more controllable MiG-15. Many La-17's are still in service, and radar "snoots" have been noticed on some versions flying in Germany.

## YAK-15 1945

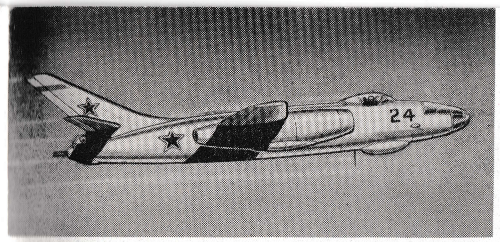
Similar in layout to the MiG-9, the Yak-15 is another early piston aircraft rework of about the same period. The 4,000 lb. thrust M-004H axial turbojet exhausted under the fuselage causing the loss of many tailwheels in early versions. This design defect was remedied by fitting a tricycle undercarriage.

Numerous variants of this little fighter have appeared, including a two-seat jet conversion trainer after the style of the Canadair-built Lockheed T-33

Production of the Yak-15 is now believed to be complete.

## IL-24 1949

Latest Soviet tactical bomber in quantity production is the 580 m.p.h. Il-24, more commonly designated the Tu-10. Comparable in size to Britain's English-Electric Canberra, latest variants of the Il-24 are reported to be fitted with Shvetzov-developed M-018 axial



IL-24

turbojets. With afterburner fitted, a static thrust of about 7,700 lb. is attained for each unit. Early bomber and trainer versions were powered by two Chelomy-Nenes (M-45's) of over 6,500 lb. static thrust each.

## YAK-25 1949

Reputed to be the fastest and best Red swept-wing fighter, the Yak-25 is now entering quantity production, and soon may be the standard first-line offensive and defensive weapon of the Soviet Union.

Unconfirmed reports from Korea state that the Yak-25 is of conventional design and uses a liquid-fuel rocketjet for increased thrust.

## LA-26 1950

Tentatively designated the La-26, this latest Soviet medium bomber is at present in the process of being delivered to operational units. Aerodynamically similar to the U.S.A.A.F. B-26 Marauder, the La-26 is reputed to be Russia's short-range atom carrier. Naval units are also interested in this type as torpedo-bomber replacement for the piston-engine Il-4. Sergei Vladimirovich Ilyushin's experience in this field might be a corroboratory factor for the designation Il-26, quoted by some observers.

# Rockets Away!

CONTINUED FROM PAGE 12

Armstrong Siddeley Motors in England. A first effort, the Snarler was designed with the emphasis very strongly on safety and reliability, with high performance and minimum weight a secondary consideration when they conflicted with the main aims. The difficulties, which have been overcome by the industry and good team work were rather formidable. For instance the problem of pumping to high pressures a liquid which boils at - 183°C, and to obtain instantaneous priming of the pump gave considerable food for thought.

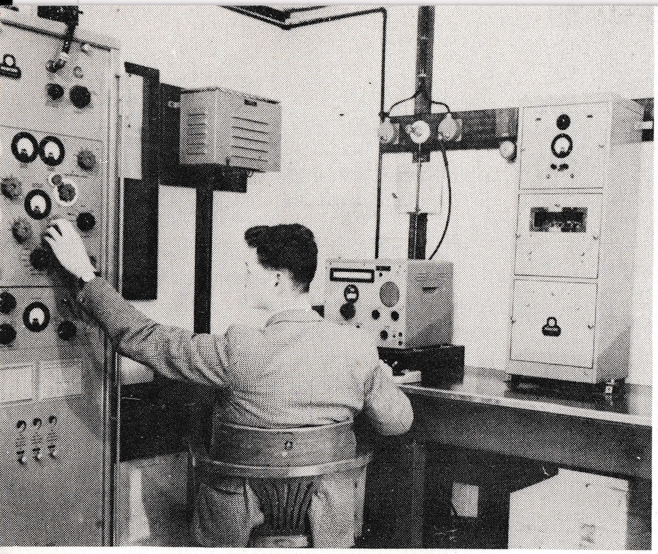
The propellants which were chosen as long ago as 1947 in consultation with the Ministry of Supply, are liquid oxygen and methanol/water. We have had no reason to regret this choice. The choice of liquid oxygen as a propellant still appears to us to be the correct one for aircraft propulsion. Liquid oxygen is comparatively safe. A bucketful can be thrown on the ground and within half a minute it will have disappeared. If the same thing is done with either nitric acid or hydrogen peroxide, not only will it still be there after half a minute, but it will be extremely dangerous. The danger from accidental leaks in an aircraft is obvious.

From the point of view of supply, liquid oxygen is obviously the best choice. The problems of its production and transport have been solved. Liquid oxygen can be produced in mobile plants which can be sited in any part of the world and operated wherever gas turbine fuel is available.

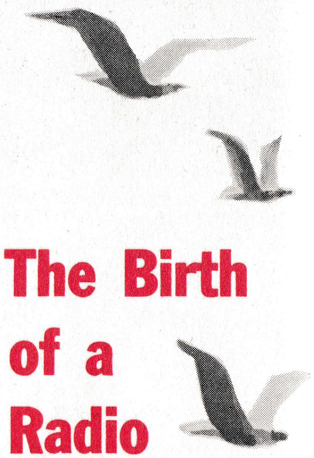
In effect gas turbine fuel is poured in at one end and liquid oxygen comes out at the other.

Turning to the installation of the Snarler in the Hawker P 1072, the accompanying photographs show that Hawker Aircraft Limited have made an extremely neat job of this - especially when it is remembered that the aircraft was not originally designed for a rocket motor.

Unfortunately for this article the effect of the Snarler's extra push at altitude must remain veiled in secrecy, but to quote Wimpey Wade on his return from his first climb to 35,000 ft. "It goes up like a bloody rocket".



THE RADIO CABIN AT THE HAMBLE MARINE RADIO SCHOOL IS LAID OUT EXACTLY AS THE CABIN IN MANY SHIPS. HERE A STUDENT IS OPERATING THE MARCONI OCEAN SPAN TRANSMITTER.



# The Birth of a Radio Sailor

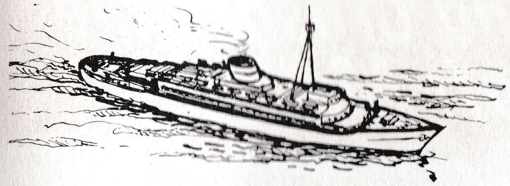
What school boy has not thrilled to the oft-told story of the ship's wireless operator who remained at his post and sent out the all important distress signal when his ship was ablaze and sinking? There is something deeply stirring and romantic in the idea of a career as a ship's radio officer.

Yet mercantile marine radio officers are essentially serious-minded, steady and highly-skilled men whose basic training and subsequent experience fit them for their life of great responsibility, not only in emergency but in their daily round of duty. That their life is one of travel and, in many cases, extreme comfort in their few leisure hours, is only fair compensation for the long hours of exacting work which is their lot.

There are many schools to which young men can go in order to study to be a radio sailor, but few are as well-equipped and competently staffed as the School of Marine Radio and Radar at Hamble, England. It is run by the Hawker Siddeley Group, the biggest group of aircraft and aero engine manufacturers in the world, of which Avro Canada is an independent member. Situated on the outskirts of this picturesque yachting centre, the school is ideally sited on Southampton Water, up which daily steam the élite of the world's merchant navies.

For a modest fee, the boy who comes to Hamble is trained

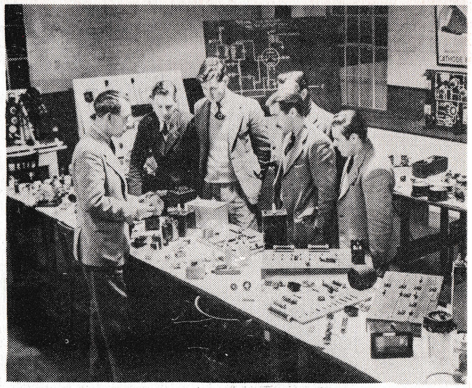




from A to Z in theory and practice of marine radio. The course lasts a year and fits the student not only to pass the necessary examinations but to understand and perform all his duties, both technical and administrative.

Comfortable accommodation and excellent messing is provided and opportunities exist for boys to take part in all forms of sport.

On successful completion of the course for the straightforward marine radio certificate, students may, if they so desire, go on to take a comprehensive course in the operation and maintenance of marine radar on the very latest equipment.



IN THE SCHOOL'S DEMONSTRATION ROOM, EVERY CONCEIVABLE RADIO COMPARTMENT IS SECTIONED AND CAN BE STUDIED IN DETAIL.

THE SMELL OF THE SEA IS IN THE STUDENT'S NOSTRILS FROM THE TIME HE ARRIVES AT THE GROUP'S SCHOOL FOR RADIO SAILORS. SOUTHAMPTON WATER IS ON HIS DOORSTEP, AND SMALL AND LARGE CRAFT PASS ALL THE TIME.

# De Havilland Crashes the U.S. Aircraft Market

PHILIP C. GARRAT, MANAGING DIRECTOR OF THE DE HAVILLAND AIRCRAFT OF CANADA, LTD. AT THE CONTROLS OF THE FIRST BEAVER L-20-A DELIVERED TO THE U.S.A.F.

For the first time in its peace-time history, the United States of America accepted delivery last November 13th of a foreign-made military aircraft.

The ceremony was at Downsview Airport, Toronto, where in the presence of a large gathering of high ranking Air Force Officers and industrial leaders, Canada's Defence Production Minister, the Right Honorable C.D. Howe, turned over the first de Havilland Beaver L-20-A to the United States Government.

"We have here", he said, "an example of co-operation between the United States and Canada in the strengthening of our own defence against aggression."

The aircraft was accepted on behalf of the United States Government by Major General Mark E. Bradley, Director of Procurement and Production, U.S. Air Materiel Command, (Wright-Patterson Air Force Base, Dayton, Ohio).

Said Major General Bradley, "No single nation can pick-up the entire world on its military and economic shoulders and carry it......We must work with each other for the common good of all".

During the second World War, Canada produced in quantity for the U.S. Armed Forces, three types of aircraft - the Curtiss Hell Diver, the Cornell primary trainer, and the Noorduyn Norseman.



But never before, and never since, had the United States gone outside its own boundaries for the procurement of military aircraft. The purchase of Beavers from de Havilland is a significant departure from traditional policy and a new milestone in Canadian-American relations.

Early in 1947 de Havilland Aircraft of Canada decided to design and build a rugged bush airplane for commercial use in Canada's Northland. It had to be designed to operate on floats and skiis as well as wheels. It had to be sturdy and strong, simple to maintain and able to survive extremes of climate ranging from blistering heat to sub-zero cold.

Performance was of vital importance, to be able to use the small lakes and rivers and crude landing strips in the bush. Quick take-off, fast climb, good flying qualities, and low stalling speed were designed into the aircraft, by the de Havilland team, taking advantage of their combined experience to select a good wing with an extremely efficient high lift flap.

The Beaver first flew in August of 1947 and carried out seaplane tests for its Certificate of Airworthiness before completing the landplane tests.

Production followed quickly, the first aircraft being delivered in April of 1948. Since then over 150 Beavers have been sold in the commercial market in many different parts of the world. The original gamble of some one million dollars in the design and development of this Beaver airplane has just begun to pay off. The decision to go ahead in 1947, without Government support, is indicative of the free enterprise and foresight of this Canadian company.

Beavers are operating for Canadian air carriers, in charter work, aerial photography, forest fire detection and suppression, geological surveys, crop spraying and dusting, and every day transportation of people and cargo. They are in every province of Canada from Newfoundland to British Columbia, and in the North West Territories and the Yukon. They are in service in Central Africa, the United States including Alaska, Great Britain, Peru, Colombia, Brazil, Indo China, New Zealand, Finland, Indonesia, Argentine, Malaya, Dominica and Chile.

After many contacts and much spade work on the part of the company in the United States, a Beaver was demonstrated to the U.S.A.F. at Wright Field and later to the U.S. Army at Fort Bragg. The outstanding performance immediately attracted attention, and showed possibilities as an ambulance plane for transporting casualties from forward areas, as well as many other liaison aircraft jobs.

The Beaver was officially entered in a competition with six other aircraft in December of 1950, and after extensive tests was chosen by the U.S.A.F. and the U.S. Army as their L-20-A Liaison Airplane.