



The second Arrow undergoing engine runs—with noise suppressors—at Malton. A third has already flown.

## THE ARROW STORY

—told by Avro Aircraft's Vice-President Engineering

**T**HE history, characteristics and operation of the Avro Aircraft CF-105 Arrow all-weather interceptor were due to be discussed last night, October 9, by Mr. J. C. Floyd, A.M.C.T., P.Eng., F.R.Ae.S., F.C.A.I., M.I.A.S., vice-president, engineering, of Avro Aircraft, Ltd., in the 14th British Commonwealth Lecture before the Royal Aeronautical Society.

Mr. Floyd's paper—a model of its kind—contained a considerable amount of hitherto unpublished information. It quoted the Arrow's normal combat gross weight as 64,000 lb, and a drawing showed auxiliary fuel tanks carried beneath the fuselage.

On the fire-control system Mr. Floyd said: "While it is not possible, for security reasons, to describe the integrated electronic system which is the brain and nerve centre of the Arrow weapon system, I can say that it is a very sophisticated system and provides automatic flight control, airborne radar, telecommunications and navigation, and special instrumentation and pilot displays, and can operate in either fully automatic, semi-automatic or manual environment. The system is carried mainly in the radar nose, with missile auxiliaries housed in the armament bay."

The following extracts from pilots' reports were quoted: "The nosewheel can be lifted off by very gentle movement of stick at just over 120 kt." . . . "Unstick speed is about 170 kt A.S.I., with an aircraft attitude of about 11 deg." . . . "Acceleration is rapid, with negligible correction required, and no tendency to swing." . . . "Typical touchdown speed is a little over 165 kt (the normal landing procedure is to stream the drag chute on touchdown when the nosewheel has settled)." . . . "There was no indication of stalling at the maximum angle of attack at 15 deg." . . . "Stability steadily improved with speed." . . . "Change of trim was negligible except in the transonic region, where small changes of trim were required." . . . "No attention was required by the pilot to prevent over-controlling." . . . "In turns, stick force was moderate to light, but always positive with no tendency to pitch up or tighten." . . . "In sideslip, the aircraft was a little touchy without the damper, but excellent with damper switched on." . . . "In general, the handling characteristics and performance of the aircraft agreed well with estimates."

Having referred to the accident to the first Arrow (caused by an undercarriage failure) which put the aircraft out of commission for several months, Mr. Floyd went on to report that aircraft Nos. 2 and 3 had now taken over the bulk of the flight test programme and, in proving the flight envelope, had flown at speeds

considerably in excess of those achieved by the first aircraft—which itself exceeded 1,000 m.p.h. early in its test programme.

After describing the Canadian evaluation procedure including trials at the Air Armament Evaluation Detachment at Cold Lake, Alberta, Mr. Floyd said, "With regard to our own flight testing, we have had the added problems of operating from a busy commercial airport adjacent to the plant and have to tie our flight testing in with scheduled commercial flights. However, with as many as 30 flights a day on the CF-100, we have had little problem with this, due to the excellent co-operation of D.o.T. controllers."

With recent Canadian defence decisions in mind (p. 538, *Flight*, October 3), there will be particular sympathy with Mr. Floyd in respect of his concluding paragraphs: "There were many periods of frustration, and in the early stages of the programme the project was on and off about every three months, while Government and the Service wrestled with the problems involved in managing and financing such a large project. When the programme finally got under way, and the engines scheduled for the project fell by the wayside one by one, we had to redesign our fuselage three or four times, and while the aircraft had been designed from the outset with the flexibility to make re-engining as simple as possible, it appeared to us that every engine manufacturer had gone out of his way to make things different . . .

"The R.C.A.F. naturally wanted the best and latest integrated electronic system and weapon in the aircraft, and finally chose these, after a considerable portion of the aircraft had been designed around an earlier system. This is, of course, normal to some extent in our business. However, since this is the major military project in Canada and involves almost all of the aircraft and associated industries, the whole Arrow programme is in the 'shop window' so to speak, and every setback becomes almost a national calamity. This can be quite embarrassing from an engineering point of view, especially superimposed upon the added pressures of attempting to meet what was probably the most advanced contemporary interceptor requirement."

"However, we have survived so far, and from the results of our flying to date, there is every reason to believe that Canada's biggest military venture will emerge from a state of national discussion to become a source of national pride and security, if such there can be in our peculiar but exciting time. To those of us in Canada who have been actively engaged in this project, this will be sufficient."