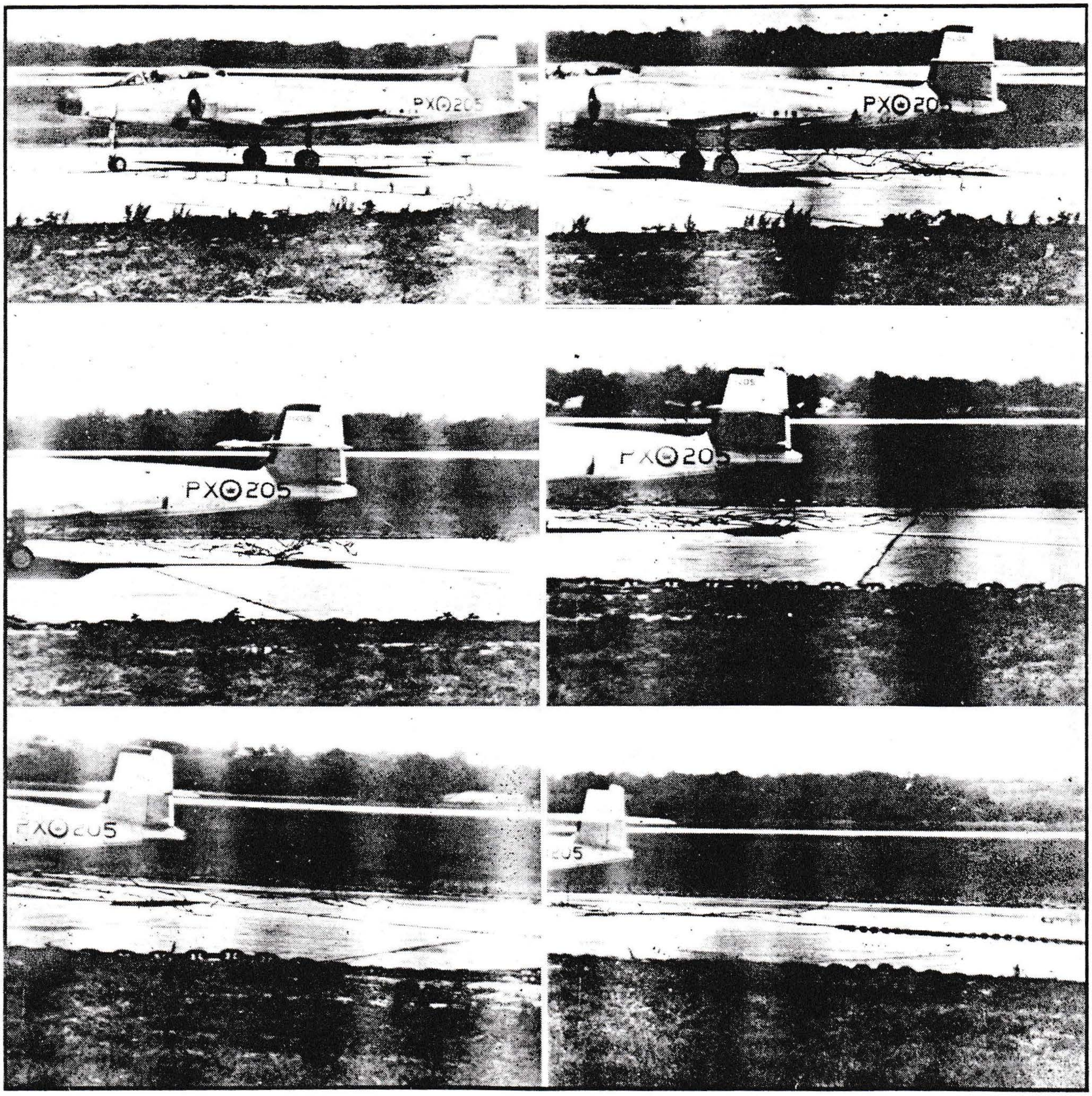
Runway Barrier Trials with the CF-100

RUNWAY BARRIER trials with an RCAF CF-100/4, conducted by the Central Experimental & Proving Establishment (Air Materiel Command), have been in progress during the past few weeks, and on November 16 a press demonstration of the device was held. Runway barriers had previously been used by the USAF for such jet aircraft as the T-33, the F-86, and the F-84, but the CF-100, with its weight of more than 34,000 lbs., is by far the heaviest aircraft used to date to test the barriers.

Preliminary crash barrier tests were made earlier this year by the RCAF using a CF-100 at the USAF's Wright Field research & development base in Ohio.

The landing of aerodynamically clean airplanes with high wing loadings necessitates the use of long runways, but even the 8,000-foot strips are inadequate for a clean airplane with faulty brakes, or during an aborted take-off.

The runway barrier was first conceived by the USAF in Korea, where jet fighters were operating out of short fields, and constantly faced with the



The photo sequence above (from left to right, top to bottom) shows a CF-100/4 flown by Flight Lieutenant Bill Lawler engaging nylon barrier and towing heavy drag chain behind as it decelerates quickly to a stop.

hazards of landing crippled aircraft after fighter operations, or taking off with full operational load in varying weather and runway conditions.

Following its early successes, the USAF proceeded with further refinement in Japan, and subsequently commenced full scale development trials in the U.S. The object of more recent experiments has been to develop a runway arrestor capable of stopping any type of jet aircraft with a minimum elapsed time for resetting the barrier.

Slippery Business: RCAF interest was aroused through the problems encountered by Air Defence Command during its winter operations of all-weather fighters. Landing a serviceable aircraft on ice or snow-covered runways represents an additional complication to high landing speeds, and accordingly it was decided to investigate the potentialities of the USAF barrier.

The barrier consists of three main assemblies: a triggering mechanism which is actuated by the nose oleo leg; the arresting gear which engages the main oleo legs, and a remote control which enables the control tower to raise or lower the barrier with a maximum of six seconds response time.

The triggering is achieved by a nylon webbing assembly which is stretched between two stanchions, one on each side of the runway, and located at the end of the runway hardtop, at the start of the 1,000 foot gravel overshoot area. The webbing consists of a horizontal adaptor—which is approximately 2 ft. 6 in. above the runway—from which hang a number of nylon risers about 4 ft. 6 in. apart. The risers are fastened to pins embedded in, and flush with the runway surface, and are designed to hold the arresting cable about 18 in. from each anchor pin on the upstream side of the pins.

Induced Drag: The arresting assembly consists of the arresting cable, lying on the runway, threaded through each riser strap, with the cable ends fastened to masses of ship-type anchor chain, stretched on each side of the overshoot strip downstream from the webbing adaptor for approximately 400 to 500 ft. Each running foot of this type of chain weighs more than 100 lbs., so its drag effect is quite obvious.

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Upon contact with the barrier the aircraft nose oleo engages the horizontal webbing adaptor causing each vertical riser to be stretched between its anchor point and the horizontal adaptor. During the initial contact the nose wheel runs over the arresting cable and as the vertical risers stretch, the cable is lifted off the runway surface behind the nose wheel. Further stretching of the risers causes the loops to open, thus releasing the arresting cable.

The cable travels upward and slightly forward, but due to the aircraft motion, it strikes the underside of the fuselage in the vicinity of the main oleo legs and eventually bears against the main legs. As the cable is being loaded, the nylon webbing shears its end fittings and remains draped around the nose oleo leg. An initial tension of the arresting cable is achieved by steel pendants attached to the cable ends and the bottom of the appropriate stanchion. When the cable load reaches 6,000 lbs. the pendants release

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and the cable picks up the chain, peeling it forward a link at a time, directing it towards the centre line of the overshoot strip, and streaming it behind the aircraft. Ultimately, the friction work of the chain arrests the aircraft within the confines of the overshoot area.

This whole sequence of events takes place in a matter of seconds, of course, as the aircraft is usually travelling at approximately 100 mph. when it first contacts the barrier. There is a noticeable deceleration of the aircraft as all the slack in the barrier system is taken up and the chain begins to drag.

Problem of Weight: The arresting distance is a function of aircraft weight and engaging velocity for a given mass of chain, and although considerable experimental work has been done by the USAF, very little of it has been with aircraft weights of the order of the CF-100. As a consequence, the RCAF is concentrating its trials on obtaining the best chain configuration that will provide minimum arresting distances with negligible loads imposed on the aircraft.

CEPE hopes that eventually the energy absorption will be achieved by mechanical or electro-mechanical means, thus eliminating the lengthy and difficult task of replacing the chain in preparation for the next arrestment.

Pilot of the CF-100 used in the Uplands trials thus far has been Flight Lieutenant W. R. (Bill) Lawler. F/L Lawler has been attached to Central Experimental & Proving Establishment for the past couple of years and most recently has been engaged as an instrument check pilot at CEPE's Rockcliffe base. He joined the RCAF in 1946 and since graduating as a pilot has been engaged in paratroop and supply dropping, flying instructing, and accepting and ferrying aircraft. He also carried out CEPE's flight trials on the T-34A Mentor.

Project engineer for the barrier trials is Flight Lieutenant W. M. McLeish. Educated at McGill University and the University of Michigan, F/L McLeish served in the Air Force as a pilot for four years during World War II and re-enlisted in 1952 as an aero engine technician. Now an engineer with CEPE at RCAF Station Rockcliffe, he is charged with the planning, testing and evaluation of the barrier for the RCAF.