ROCKETS and R.A.T.O. . . .

had mainly used nitric acid, either with aniline or petrol. This work could be regarded as still within the experimental phase, but the standard Aerojet solid propellant unit (1,000lb thrust for 12 seconds; empty weight 115lb) had seen widespread operational use. It had been certificated by the C.A.A., and was used by airlines on freight operations; it was also regularly fitted on American military and naval aircraft when a specially short take-off run was demanded.

The view was sometimes expressed that aircraft should not, in any case, require assisting into the air. Certainly, it would be most undesirable to initiate a design trend (by airworthiness regulations or otherwise) which encouraged the regular delivery into the air of aircraft which were, thereafter, deficient in performance or handling in the event of engine failure. There remained, however, the question of emergency operation; take-off from small airfields, carrier decks, and the operation of turbine-powered aircraft from tropical or high-altitude airfields.

As compared with competitive forms of take-off assistance, the rocket method had the following clear advantages:—

(1) It required no extensive and expensive permanent ground installations as demanded, for example, by catapult schemes. If the assisting rockets were fitted not to the aircraft but to a launching trolley (e.g., with the object of dispensing with an undercarriage) then the ground installation would be simplified.

(2) It could provide assistance at the point where it was most needed—toward the end of the run, or even at the start of the climb. Whilst it was true that the benefit to take-off was roughly proportional to the total impulse (thrust-time integral) provided, it was usually preferable to concentrate this into the part of the run made at higher forward speeds when the available thrust corresponded to a higher useful thrust horsepower. Such a policy was also favourable in connection with piloting techniques, the rockets being fired after passing the critical speed for engine failure during period of take-off.

(3) It could provide unlimited amounts of assistance, which might be required on certain extreme applications. In this respect, the rocket had an advantage over any scheme for temporarily boosting the thrust of normal engines.

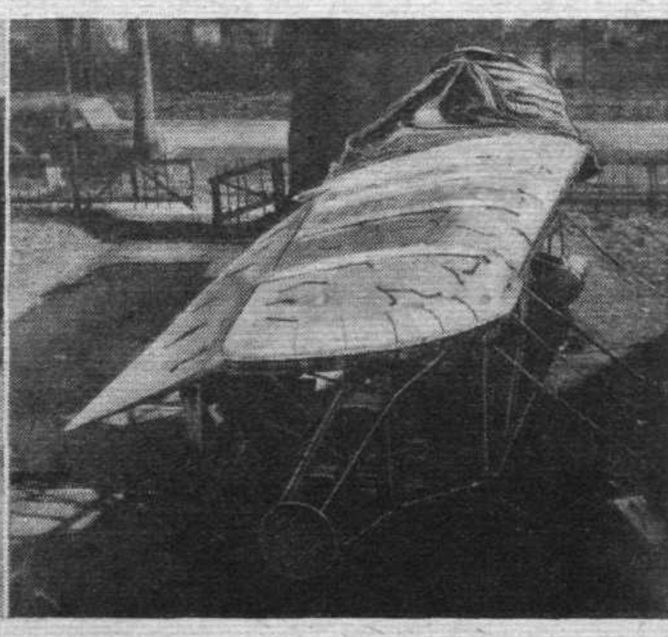
The last point would assume greater force if the current trend toward higher wing loadings (especially manifest in America) was continued. The Boeing XB-47, for example, employed 18,000lb of rocket thrust in addition to the 24,000lb of its main turbojets; its wing loading was of the order of 100lb/sq ft. As even more extreme examples of rocket take-off assistance for military aircraft, some of the war-time German projects were worthy of recall, e.g., the Natter intercepter, the 13-ton winged A-9 missile and Sänger's design for a rocket-propelled bomber of global range. Without going quite so far into the realm of visionary developments, these examples could still be accepted as indicative of what rocket assistance could provide if called upon, even for aircraft of rather more conventional form, and irrespective of the type of main propellant. The possibilities of rockets for the take-off acceleration of future ramjet aircraft (or winged missiles) up to the air speeds at which they were self-accelerating, perhaps constituted one such extreme field of application which might become very important.

THE CARLAT HELICOPTER

An Interesting American Experiment in Applied Aerodynamics

IT is common in human nature to concentrate on immediate problems and, in so doing, the specialist is frequently so concerned with recent trends of thought that he fails to look sufficiently far back to see what the work of very much earlier experimenters has to offer. Every now and then, however, someone applies a well-established but half-forgotten theory to modern needs, and the results are sometimes startling. The Carlat helicopter now in process of development in the United States is a case in point, and although it would be too sweeping to state that it has so far shown startling results, the whole basis of the design, and the results which have already been experimentally obtained, are certainly interesting.

Shortly after the war, five engineers who shared a belief that boundary-layer control could be made to produce dividends in wing performance grouped together to form the Carlat Development Corporation in New York City. They built themselves a low-speed wind tunnel with a 22in-square working section, wherein they tested a variety of aerofoils, to which they applied differing means of boundary-layer control. A wing was evolved which, apparently conventional, differs from accepted practice in that the leading edge is formed with a narrow full-span slot venting upward. Air under pressure is ducted to the slot, and in escaping to atmosphere, flows over the top surface of the wing and so creates an area of reduced pressure near the leading edge. This system is clearly an adaptation of the Baumann proposals for achieving boundary-layer control by ejection, and there can be little doubt that the initial flow form is on the lines suggested by M. Henri Coanda for augmenting fluid flow. The effect of the boundary-layer-control aspect of the design was established by tunnel tests which showed the wing to be capable of creating lift even at an angle of attack of 50 deg. This in itself is not, of course, a discovery in the real sense; many years ago, the N.A.C.A. succeeded (by boundary-layer suction, i.e., by the Prandtl method) in maintaining a steady and unbroken flow over the upper surface of a thick aerofoil at an angle of attack of 58 deg. However, the Carlat engineers also found, somewhat to their astonishment, that the action of the ejection slot was also to create a forward pull on the aerofoil. On this basis—perhaps, to some extent, unrealistically—they visualized an aircraft of flying-wing type,



In its present guise, the Carlat helicopter is an overweight test machine to prove the preliminary characteristics of the wing. The whirling-arm test-rig may be seen in the background. In the view on the right the narrow leading-edge slot can just be discerned. The tip slots are stated to be of use chiefly in the suppression of tip vortices, and contribute little to rotation.

Levy-Ship Photos!