THANKS in large measure to the pioneer design and development work of the Martin-Baker Company in England, the emergency ejector seat has now passed beyond the laboratory stage and is being safely used by British and American jet pilots up to true air speeds as high as 550 m.p.h. This successful escape technique offers proof that the catapulting of the human body has so far kept abreast of contemporary military aircraft performance. Nevertheless, in the light of recent transonic trespassing, it is evident that a great deal of further laboratory research and design development must still be devoted to high-speed-safety engineering, for as we approach the jet-cam-rocket band of the spectrum, the human factor becomes increasingly critical and may seriously limit the mechanical possibilities. Fig. 1, graphically illustrating American "chairodynamic" trends, shows how the emphasis is now shifting from the ejection seat to the complete cockpit capsule.

**Lockheed Ejector Seat.**—Dealing first with what might fairly be called the Martin-Baker technique of airborne chairmanship—i.e., accelerated exit "over the top" by means of an explosive-fired catapulted seat—a series of U.S.A.F. flight tests made last year gives a very good idea of the progress made and the safety attained when operating current jet fighters in the 600 m.p.h. class. These tests were done with a Lockheed TF-80C (T-33) two-seater jet trainer fitted with a Lockheed-designed ejector seat equipped with the M-1 Aircraft Personnel Catapult and Cartridge, the seat being modified by the U.S.A.F. to incorporate stabilizer flaps, knee guards, a parachute container and devices for both automatic and manual operation of the parachute and safety-belt equipment. To permit ejection of the rear seat and occupant, a special cut-out was tailored in the rear part of the cockpit canopy.

Cameras were mounted at various vantage points on the test aircraft for recording the motion of the seat and reaction of the occupant, while two other jets (an RF-80A and a TF-80C) flew alongside for photographic recording of the tests. A third aircraft, a Sikorsky H-5H helicopter, was also used to obtain motion-picture records of the ejection and the descent and pick-up of the human subjects. The helicopter was further useful in establishing the altitude target area at which ejection would occur.

As modified by the U.S.A.F., the seat was provided with hinged stabilizer flaps, roughly a foot square, on each side of the head-rest; these flaps, which look something like elephant ears, function as stabilizing wind-vanes upon exit of the seat into the airstream, thereby permitting a favourable attitude for deployment of the seat-stabilizer parachute, which is stowed in the upper part of a container, or deployment bag, behind the head-rest. Both wind-tunnel and flight tests showed that without the flaps the aerodynamic forces tend to produce a tumbling motion of the seat, whereas the use of them creates an aerodynamic restoring moment which aids the seat in maintaining a stable position. Another important stability criterion is that the c.g. of the seat should be located as low as possible.

In addition to the small 40-inch diameter stabilizer parachute for steadying the seat in the first part of its trajectory, there is also a larger retarder parachute of 16ft diameter stowed in the deployment bag at the back of the head-rest. The function of this is to prevent collision of the empty seat with the pilot's personnel parachute opening below it, in line of the seat trajectory. Tests conducted without this retarder parachute clearly show the possibility of such collision. Release of the retarder parachute occurs approximately five seconds after ejection of the seat.

The pilot's personnel parachute assembly combines both a back-type pack and a reserve seat-type pack. (In all the tests so far there has been no occasion to use the latter.) Operation of the rip cord for either pack can be accomplished manually, as well as automatically on release of the automatic lap belt, the action for which is initiated by the stabilization parachute. As a matter of record, it might be mentioned at this point that in several of the tests the automatic equipment did not "auto-mate" as intended, but fortunately the pilot was in full possession of all his faculties and experienced no difficulty in releasing