Missiles and Spaceflight . . .

On August 2 a B-52 successfully fired a GAM-77 Hound Dog down the Atlantic Missile Range. The weapon "hit its target 500 miles down-range with extreme accuracy."

Several solid-propellant engines for the USAF Minuteman ICBM have been successfully fired at Tullahoma in simulated space conditions. This is the first time that an engine of this size and character has been statically fired in a space environment.

On July 30 the US Secretary of Defense called a meeting of 56 ICBM contractors at which he exhorted them to "tighten up" their operations. Labour disputes have already put the deployment of the Atlas behind schedule, and recovering the lost time will take "the rest of this year and possibly longer."

It was noted on this page on June 24 that the first of the "operational prototype" Titan ICBMs had then just been delivered to Cape Canaveral. Known as the J-series, the first two of these ICBMs have been only partially successful. The first had to be destroyed shortly after leaving the pad on July 1, and the second suffered premature first-stage shutdown and fell in the sea about 50 miles offshore.

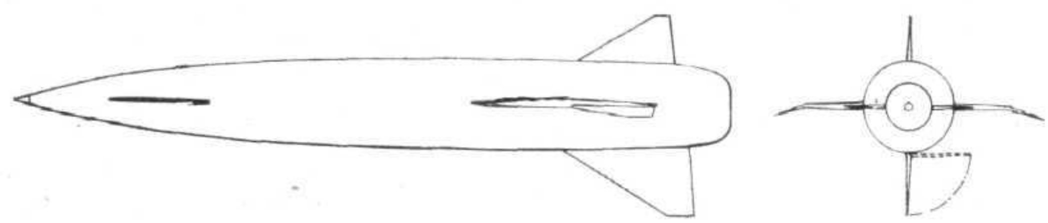
Flight testing of Nike Zeus is making telemetry demands which cannot be met by existing systems, say the Leach Corp, who have developed a new instrumentation system to record wide-band h.f. data. The equipment has been built around a magnetic-tape recorder housed in a recoverable aluminium case carried in the nose of the missile. The device incorporates precise timing oscillators and a frequency reference.

According to Dr Richard Mose, director of US Army Research and Development, Atlas ICBMs fired from Vandenberg will next year be used as targets for the Nike Zeus system "which can distinguish between dummy warheads and those armed with nuclear weapons." The Zeus emplacements are now being constructed at Kwajalein Island in the Pacific, and other Zeus teams are at present based on Ascension Island at the end of the Atlantic Missile Range.

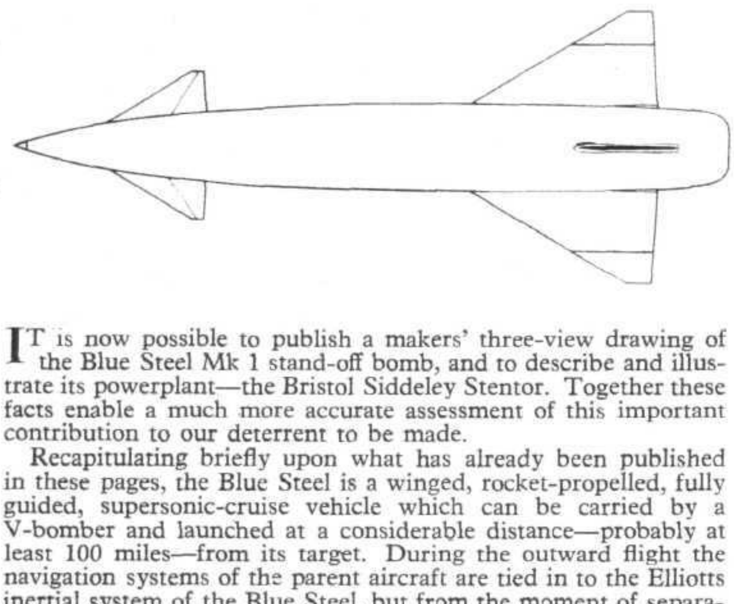
It was announced by Bristol Siddeley Engines on August 2 that the BSRJ.824 is a new ramjet intended for operation at high altitude and high supersonic speeds. The BSRJ.824 has been fully evaluated in the company's high-altitude test plant at Patchway, with very satisfactory results. One of these new engines, with a diameter of 18in and a length of 99.6in, will be on Bristol Siddeley's stand at Farnborough next month.

The National Aeronautics and Space Administration has selected Lockheed Aircraft Corp and the Martin Co with whom to negotiate six-month study contracts on the requirements of a nuclear rocket flight-test programme. The scope of each of the $100,000 studies will include system preliminary design, development programming, planning of test and tracking facilities, schedules and safety factors. Lockheed will be assisted by the Rocketdyne division of North American Aviation.

BLUE STEEL AND ITS ENGINE



Dimensions of the Avro Blue Steel Mk 1 include: overall length, 35ft; foreplane span, 6ft 6in; wing span, 13ft; distance from fuselage to start of anhedral, 4ft 10in; fuselage diameter, 4ft 2in; distance from fuselage axis to fin tips, 4ft 6in (upper) and 5ft 4in (lower, extended)



IT is now possible to publish a makers' three-view drawing of the Blue Steel Mk 1 stand-off bomb, and to describe and illustrate its powerplant—the Bristol Siddeley Stentor. Together these facts enable a much more accurate assessment of this important contribution to our deterrent to be made.

Recapitulating briefly upon what has already been published in these pages, the Blue Steel is a winged, rocket-propelled, fully guided, supersonic-cruise vehicle which can be carried by a V-bomber and launched at a considerable distance—probably at least 100 miles—from its target. During the outward flight the navigation systems of the parent aircraft are tied in to the Elliotts inertial system of the Blue Steel, but from the moment of separation the latter is completely self-contained, and can fly along any previously chosen flight path or altitude profile to its target while the parent bomber returns to base. Blue Steel is obviously intended to carry a thermonuclear warhead with a megaton yield.

Prime contract for its development was placed with the Weapons Research Division of A. V. Roe & Co Ltd, at Woodford. During the past three years a vast amount of work has been done by this division in developing the basic Blue Steel Mk 1 and preparing the way for future developments. An outline of the early part of the flight-test programme was published in our issue of March 11, wherein it was noted that up to that time there had been numerous launchings of small-scale models to prove the basic aerodynamics, control and elements of the guidance and propulsion systems, and of full-scale vehicles powered by de Havilland Double Spectre engines which superficially resemble the operational weapon. These test vehicles were originally launched from the RAE Aberporth (with partially filled tanks to keep the vehicle within the limited confines of the Cardigan Bay range) and are now being flown as fully "hot" rounds from Valiants and Vulcan B.1s at the WRE Woomera (with full tanks).

Originally there was to have been a Blue Steel Mk 2, but this completely redesigned vehicle would not have been in service with RAF Bomber Command for several years, and in the view of the Ministry of Defence would have been unduly vulnerable by the time it went into service. Little has been said about it, but some reports suggest that it would have been propelled by ramjets in order to achieve a substantially increased range. Nevertheless, it would be ridiculous if nothing was done to "stretch" the existing Blue Steel Mk 1 and wring out of it all that can quickly and relatively cheaply be obtained in the way of improved performance. This is now to be done, and unofficial reports state that the improved missile will be known as the Mk 1★.

All Blue Steels are intended to be compatible with both the Vulcan B.2 and with the limited number of Victor B.2s currently on order (see page 208). As the new general-arrangement drawing confirms, the Mk 1 missile has a folding ventral fin, which extends after the parent aircraft has taken off. The outboard panels of the wing are tilted downwards in order that the weapon shall not foul any part of the parent aircraft; the limiting factor appears to be the flaps of the Victor B.2, which are swept down to pass under the jetpipes of the engines. After release the missile falls freely for a few seconds; then the engine lights up and the Blue Steel accelerates ahead, climbs, and runs home at high supersonic speed. Its radar cross-section is certainly much less than that of a V-bomber, and it retains all the capability of a manned aeroplane to feint, manœuvre and change its flight profile in any desired manner.

Propulsion in the Blue Steel Mk 1 is provided by the Bristol Siddeley Stentor ASSt.1-1, illustrated (p. 215) for the first time. Like the Snarler, Screamer and Gamma—all pump-fed liquid-propellant rocket engines developed to a high degree of reliability—the Stentor has been developed at what is today Bristol Siddeley's Power Division, at Ansty, Coventry. The Ansty rocket design team, directed by Sidney Allen, chief engineer of the Power Division, is now one of the most experienced in the world in the field of complete rocket engine packages for supersonic propulsion, and they were the first to develop a fully controllable engine for aircraft use. The latter, the Screamer, used liquid oxygen, but all their most recent units have employed high-test peroxide as oxidant.

Few details of the Stentor may be published, but it can be stated that this engine operates on HTP and kerosine. It has two chambers, both rigidly fixed to the airframe, one having roughly four times the thrust of the other (perhaps 16,000lb and 4,000lb at sea level would not be wildly out as guesses at the sea-level ratings of the two chambers). During the starting cycle HTP is expelled from a starting tank by nitrogen pressure and is decomposed in a catalytic steam generator to supply superheated steam to drive the main turbopumps. When the latter have run up to an adequate speed—at something less than the full operating speed, and perhaps reached in less than a second—the turbine is fed by the delivery from the HTP pump, and the starting system is cut out of circuit.

HTP from the turbopump unit is fed through numerous axial passages formed in the wall of both chambers, according to a