

What Missiles Can Do And What They Can't

By JOHN GELLNER

The great Avro Arrow controversy that has exercised people's minds so much in recent days, has confused the issue of missile against manned fighter rather than clarified it. Anybody who read more than one newspaper, or listened to more than one speaker on the subject, must have become thoroughly bewildered.

Yet the problems involved are not so complex that the average citizen, who after all

Mr. Gellner is a retired Air Force Wing Commander, who in the last three years of his service was an instructor at an RCAF Staff College.

pays the bill whether the Government buys Bomarcas or Arrows, could not provide himself with enough information to form his own, unprejudiced opinion. The important thing is to cut through the maze of claims and counter-claims — many exaggerated — and to recognize what, in fact, a missile can and what it can not do.

First of all, it must be firmly borne in mind that a missile can not tolerate the malfunction of any of its parts. It can not take emergency action and it can not improvise, the way human operators do.

Thus, the more complicated the missile, the less its reliability. An ICBM, for instance, contains thousands of critical parts; if a single one fails, the whole firing is a failure. That so many launchings are successful is the result of the very careful engineering which goes into the production of missiles, and of the minute testing before they are fired. The latter requirement, at least, will not be so easy to fulfil under wartime conditions.

A missile also can not tolerate any uncertainty in its guidance. This is a serious handicap if the missile is guided to its target by electronic means, as all present-day surface-to-air (and some air-to-air) missiles are. They are vulnerable to electronic counter-measures (ECM), like "jamming" or "decoying".

Here again, a radar operator may be able to make some sense of a confused picture on the radarscope, or he may use counter-ECM to combat enemy "jamming." A missile follows the strongest signal, whether it is legitimate or fake.

The main objection to the

means going against the present trend in missilery which is away from radar-guided weapons, because ECM is so effective.

Ballistic missiles, which are inertially guided, and some of the big air-breathing surface-to-surface missiles, which use celestial navigation, can not be "jammed". Their problem is accuracy, because of the very complex and delicate instrumentation which they require. A slight error fed into a computer before firing, or caused by an inaccuracy in one of the instruments is, of course, magnified with the distance over which the missile travels.

At a recent full-range firing, an Atlas ICBM reportedly fell within 30 miles of the target, after a flight of 6,300 miles. This is a high degree of accuracy — the bombing error was only $\frac{1}{2}$ of 1 per cent of the range. But in practice, if this missile, carrying a thermonuclear warhead, had been fired at Toronto, the city and its population would not have been harmed—provided we had at that time passive (civil) defense worthy of that name.

Inertially or celestially guided missiles, with nuclear warheads and fired over comparatively short ranges, would, of course, be accurate enough to cause terrible destruction. It is this which makes the Big Powers seek bases close to a potential enemy, and to develop submarine-borne ballistic missiles.

Many of the missiles carried in manned fighters remain unaffected by ECM, either because they are unguided like the nuclear-warhead Genie, or because they rely on what is called "passive homing", like the heat-seeking Sidewinder which proved so effective in the air battles over Quemoy and Matsu.

Statements like, "The missile has become the principal instrument of air power," or, "There is no possible defense against the ICBM," or, "The Arrow is useless"—we have heard them all in recent days—have the common fault that they are too pat, too doctrinaire. The truth is that missiles are potent weapons, but that they have their limitations; that the ICBM is as little the "ultimate weapon" as were other devices of destruction which have been called that in the past; that man is still irreplaceable in warfare, not only in the rear, at the push-button, but also up front, in the fighting