TECHNOLOGY

ICBM Facts Revealed

Missile development, including propellants and the materials that go into a missile, is expanding together with new techniques of interception and defense.

➤ THE UNITED STATES needs more different kinds of missiles than it already has.

ICBM's (intercontinental ballistic missiles) were made practical by the development of light-weight H-bomb warheads.

Jamming of a missile in flight can be combatted by using the enemy's jamming itself as a guidance system.

An ICBM, once in production, will be cheaper to make than a bomber.

These and other facts about this nation's much-criticized and much-publicized missile program are made known by Dr. R. Rollefson, professor of physics at the University of Wisconsin, and formerly chief scientist of the Department of the Army.

Three important factors in our missile program indicate that "the number of different types of missiles" will increase rather than decrease in the future, Dr. Rollefson says in the *Bulletin of the Atomic Scientists* (Oct.).

These factors are the great and varied number of uses for missiles, such as ground-to-ground, ground-to-air, and air-to-air, the fact that we must have more than one kind for each use to thwart countermeasures, and the additional and costly fact that missiles become outdated so fast.

The scientific principles involved in missile making, Dr. Rollefson says, "are well-understood and no breakthroughs are required to make missiles practical; they have already reached that stage.

"The difficulties arise from the extraordinary demands which we put on missile performance and the limitations imposed by the physical and chemical properties of available materials."

Dr. Rollefson, in discussing the ICBM, revealed these facts about it:

The ICBM's, because of the serious mechanical complications involved in their guidance before striking a target, will be primarily weapons of mass destruction.

With respect to guidance of an ICBM, the development of light-weight thermonuclear warheads made the "ICBM practical."

We will produce better propellants and lighter materials for the missile's framework and mechanical parts.

Once the development of a satisfactory missile is completed, "construction should not be nearly as expensive as for bombers."

"The defense against the ICBM is extraordinarily difficult. The difficulty is essentially that the warhead of an ICBM, which is all that would approach the target, is much smaller and harder to detect than a bomber, and since its total time of flight is about 30 minutes, only a few minutes are available for its destruction."

One ICBM can be stopped with expensive and elaborate equipment now conceivable, but salvos of ICBM's make the problem "much more difficult."

In discussing some of the other problems for countermeasuring missiles fired by the enemy, Dr. Rollefson points out that "a promising method" of combating jamming is to use the jamming radiation to direct the flight of the missile to home in on the jamming signal, which presumably would be in enemy territory.

Dr. Rollefson also suggests that in addition to the best active defenses we can come up with, we should explore "energetically the so-called 'passive' means of defense: namely, dispersion and strong, deep shelters."

Science News Letter, October 26, 1957

PUBLIC SAFETY

Study Air Shock Waves Like Those in H-Bombs

➤ DETAILED STUDIES of air shock wave movements, such as those that might follow A- and H-bomb explosions, are under way at the University of California at Los Angeles.

The research, under the direction of Dr. Benedict Cassen of the UCLA's Atomic Energy Project, is possible through use of a photographic technique known as a "spark shadowgraph" that freezes action in less than one-millionth of a second.

Refraction by air density along the shock wave front causes the wave to appear in photos as a dark line followed closely by a white one. As the shock wave dissipates the line becomes fainter.

Shock wave effects on tiny models of skyscrapers, shelter trenches, terrain features and civilian bomb shelters in an experimental blast tube were photographed.

Shock waves were shown to "bounce off" model skyscrapers but then to continue through with lessened intensity. They penetrated down into trenches even with parapets in front. The bottom of a shock wave going up a hill becomes a "Mach" jet that darts out in front of the wave's main line.

Studies with "doorless" models of civilian bomb shelters indicated that U-shaped shelters with ramps and narrow doorways broke up the primary shock into tiny, less formidable shocklets. Sharp corners in the model shelter, however, produced tornado-like effects.

Whether these tiny tornadoes would injure humans or not is a question that deserves further study, Dr. Cassen said.

Science News Letter, October 26, 1957

If the year's supply of medical *oxygen* were evenly distributed, every American could breathe it for an average of 71 minutes.

BIG LIFT—The nuclear fuel charge lifting job for the 58-ton core of the nation's first full-scale atomic-electric generating plant is shown here in one of its final stages. The glistening multi-million dollar core is being lowered into the pressure vessel or steel container. The Westinghouse Electric Corp. designed and developed the nuclear portion of the Shippingport, Pa., plant, which will be operated by the Duquesne Light Company. (See SNL, Sept. 14, p. 172.) Within the core is where the "hot" nuclear reaction, or fission process, will take place.

MANPOWER

Government Scientists Continue to Increase

➤ THE NUMBER of scientists and engineers working for the Federal Government increased more than seven times in the period 1931 to 1954, the National Science Foundation has reported.

In 1931 there were less than 14,000 working in all fields of science and in 1954 the number had jumped to more than 102,000.

Outside the Federal Government, there was less of an increase in employment in these fields. Employment of engineers, for example, climbed from about 218,000 to approximately 607,000; but this was only one-fifth the percentage increase that took place in the Government.

Between 1931 and 1938, years of depression and recovery programs, the great demand was for engineers, agricultural scientists and social scientists.

But during World War II the greatest increase was in the physical and mathematical sciences. After 1947, the increase continued because of the pace of weapons research.

Science News Letter, October 26, 1957