*EXPLORER VII (U.S.) Oct. 13, 1959 to 1979-1989—Data on radiation and magnetic storms, first micrometeorite penetration of sensor in flight, detected weather patterns. 344-669 miles. 101.1 minutes.

*PIONEER V (U.S.) March 11, 1960 for 100,000 years—Set long-range communications record (22,500,000 miles), data on solar flare effects, particles and magnetic fields. Solar orbit: 74.9-92.5 million miles from sun. 311.6 days.

*TIROS I (U.S.) April 1, 1960 to 2010-2060—Took more than 22,000 pictures of cloud covers relayed by TV, data for meteorological satellite system. 429-467 miles. 99.1 minutes.

*TRANSIT I-B (U.S.) April 13, 1960-1961—Data for global navigational satellite system. 229-412 miles. 94.9 minutes.

SPUTNIK IV (USSR) May 15, 1960-Sept. 5, 1962—Tested life support systems for manned space flight. 175-305 miles. 92.3 minutes.

*MIDAS II (U.S.) May 24, 1960-1963—Tested infrared scanner system for detection of missile launchings. 297-314 miles. 94.3 minutes.

*TRANSIT II-A—GREB (U.S.) June 22, 1960-2010—Two satellites fired at once, data for navigational satellite system. Transit II-A 389-649 miles. 101.6 minutes. Greb 381-657 miles. 101.6 minutes.

*ECHO I (U.S.) Aug. 12, 1960-indefinite—First passive communications satellite, voice and telephone transmission 823-1,095 miles. 116.9 minutes.

*COURIER I-B (U.S.) Oct. 4, 1960 for several years—Data for military communications system. 611-743 miles. 106.8 minutes.

*EXPLORER VIII (U.S.) Nov. 3, 1960-1970—Data on ionosphere composition, micrometeorites. 262-1,409 miles. 112.5 minutes.

*TIROS II (U.S.) Nov. 23, 1960 to 2010-2060—Data for meteorological satellite system. TV pictures of clouds. 378-461 miles. 98.2 minutes.

*SAMOS II (U.S.) Jan. 31, 1961 for undisclosed time—Observed space, earth and its atmosphere. 295-341 miles. 94.9 minutes.

*SPUTNIK VIII—VENUS PROBE (USSR) Feb. 12, 1961—Sputnik VIII decayed Feb. 25, 1961, leaving the Venus probe in polar orbit for indefinite time, having been launched from the satellite toward Venus for long-range communication, observation of space. Solar orbit: 66.8-94.7 million miles from sun. 300 days.

*DISCOVERER XXI (U.S.) Feb. 18, 1961 for undisclosed time—For engineering, atmospheric and infrared radiation studies. Agena engine restarted in space for the first time. 154-516 miles. 95.5 minutes.

*EXPLORER X (U.S.) March 25, 1961 for uncertain time—Data on interplanetary magnetic fields. Original orbit: 100-145,000 miles.

VOSTOK I (USSR) April 12, 1961-April 12, 1961—Manned spaceship recovered after one orbit, tested man's reactions in space. 108.76-187.66 miles. 89.1 minutes.

*EXPLORER XI (U.S.) April 27, 1961 to 1962-1964—Orbited a special telescope for mapping gamma rays from cosmic sources. 302-1,113 miles. 107.9 minutes.

**TRANSIT IV-A—GREB III AND INJUN (U.S.) June 29, 1961-1962 (Transit); indefinite (Greb and Injun)—Three satellites, two not separated, data for navigational gathering satellite system, on solar X-rays and on cosmic rays. Transit 547-620 miles. Greb and Injun 548-619 miles. 103.8 minutes.

*TIROS III (U.S.) July 12, 1961-indefinite—Data for meteorological satellite system, TV pictures of clouds. 457-510 miles. 100.3 minutes.

*MIDAS III (U.S.) July 12, 1961 for indefinite time—Tested system for detection of missile launchings. 2,084-2,197 miles. 161.5 minutes.

VOSTOK II (USSR) Aug. 6, 1961-Aug. 7, 1961—Manned spaceship, studied effects on man of long orbital flight, recovered in 18th orbit. 110.3-115.3 miles. 88.6 minutes.

*EXPLORER XII (U.S.) Aug. 15, 1961-indefinite—Data on solar wind, interplanetary magnetic fields, particles in space, Van Allen belts. 165-47,858 miles. 26 hours and 24 minutes.

*MIDAS IV (U.S.) Oct. 21, 1961- —Polar orbit achieved and West Ford dipoles ejected. Perigee and apogee, not available. 172 minutes.

*DISCOVERER XXXIV (U.S.) Nov. 5, 1961- —Polar orbit achieved but capsule not recovered due to on-orbit malfunction. 134-637 miles. 97.2 minutes.

*TRANSIT IV-B (U.S.) Nov. 15, 1961—5 years estimated lifetime—Two satellites orbited: Transit, to develop all-weather navigation system, investigate earth's shape; *TRAAC, to test gravity system for attitude control and obtain data on inner Van Allen belt. SNAP nuclear non-fissionable power supply furnished current for two Transit transmitters. Transit: 582-700 miles; 105.6 minutes.

MERCURY-ATLAS V (MA-5) (U.S.) Nov. 29, 1961-Nov. 29, 1961—Provided two-orbit ride for space chimpastronaut Enos to test all Mercury systems. 99.6-147.5 miles. 88.5 minutes.

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MILITARY SCIENCE

ABC's of U.S. Missiles

➤ MISSILES, upon which the United States and the Free World have pinned their hopes for security, vary in size, kind and power. From A (Alfa) to Z (Zuni) and from the depths of the ocean to outer space, these swift-moving vehicles are on guard 24 hours a day against an enemy attack.

Much talked about, they are, however, little known and often misunderstood. Following are some of the questions most frequently asked about missiles and the answers.

What is a missile?

Technically, a rock, bullet or arrow or any weapon thrown or propelled through space is a missile. But the missiles spoken about today are those vehicles which have in common an airframe, a fueled power plant, a guidance system and a payload capacity.

What kinds of missiles are used for military purposes?

There are two basic kinds of missiles: ballistic and air-breathing.

How do these differ?

A ballistic missile has its own oxidizer for fuel combustion and does not rely upon aerodynamic surfaces to produce lift. It follows a ballistic trajectory (like a bullet from a rifle or a shot fired from a cannon). It does not have fins or wings. It can operate beyond the atmosphere.

An air-breathing missile has an engine requiring the intake of air for combustion of its fuel and cannot operate in outer space.

What kinds of ballistic missiles are there for military use?

There are ICBM's (Inter-Continental Ballistic Missiles), IRBM's (Intermediate Range Ballistic Missiles), mobile MRBM's (Medium Range Ballistic Missiles), and ALBM's (Air Launched Ballistic Missiles), as well as short-range ballistic missiles.

What are the characteristics of an ICBM?

It is a missile with sufficient range to strike a strategic target such as an industrial site, a missile base or a military installation from one continent to another. Its minimum range is about 5,000 miles. U.S. ICBM's include the Atlas, Minuteman and Titan. All are operational and deployed at various bases in the United States. The Atlas and Titan I are propelled by liquid rocket fuel and are surface to surface missiles. The Minuteman is solid fueled and can be launched from underground silos.

What distinguishes an IRBM?

The range of an IRBM is limited to from 300 to 1,500 nautical miles (345 to 1,725 statute miles). U.S. operational IRBM's are Thor, Jupiter and Polaris. The Thor and Jupiter are both liquid fueled and surface to surface. Thors are deployed in England. Jupiters are in Italy and Turkey.

The Polaris, underwater and surface to surface, is solid fueled. Sixteen operational Polaris missiles are deployed on five submarines.

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ABC's of U. S. Missiles

(Continued from page 383)

What are MRBM characteristics?

They can be launched from mobile platforms. Two-stage solid-propellant MRBM's currently are under development and are designed to have the IRBM range. They will be deployed in Europe and the Far East. The Soviet MRBM's are operational already.

What characteristics distinguish the ALBM?

It is designed to be launched from U.S. B-52's and British Vulcan bombers. Skybolt, the U.S. ALBM, still is in the research stage and is scheduled for operational deployment in 1964. It will have a range of more than 1,000 miles. It is not known whether the Russians have any ALBM's.

What are short-range ballistic missiles?

These are solid or liquid rocket-powered missiles that operate on the ballistic principle but do not have the full range of the IRBM's. Some have a ceiling within the earth's atmosphere. Others can operate to the lower levels of the IRBM.

Honest John, Little John, Redstone and Pershing are among the larger U.S. family of shorter range ballistic missiles. All are operational and deployed in Europe. The Pershing, which ultimately will replace the Redstone, has a range of 300 miles and can, in fact, be considered an IRBM. Honest John and Little John have a range of 12 miles and are artillery type surface-to-surface missiles usable on special mobile launchers and air transportable.

The Navy's Alfa and Zuni also are ballistic-type missiles. Both are operational. Alfa operates from surface to underwater from destroyers and cruisers. Zuni is used on aircraft.

What air-breathing missiles are in the U.S. arsenal?

Currently in use are turbojet- and ramjet-powered missiles. Expulsion of hot gases under extreme pressure through a combustion chamber gives thrust to these missiles. The turbojet is characterized by fan-type moving parts which accelerate and compress the air. The ramjet lacks these moving parts and forward speed of the engine packs or rams the air into a special duct which is the compression chamber.

The Air Force Snark, Slam, Mace and Matador Bomarc and the Navy Talos are ramjet-type missiles. All are operational and tactical weapons deployed here and overseas.

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PUBLIC SAFETY

Ski Injuries Estimated

➤ AN ESTIMATED 10,000 of the million or more skiers on the snowy slopes of this country are expected to be injured badly enough to require medical attention in the coming year.

Beginners and women will probably be injured in greater numbers than experienced men. The average skier's age is in the 20s and most skiers are unmarried, but the age limits go from 6 to 60.

A New England doctor who helped treat 684 injuries at the Mount Snow, Vt., ski resort last year suggested that a scientifically adequate attempt be made to investigate the causes of these accidents. As a result, the first adequately "controlled investigation of any type of recreational accident" appears in Public Health Reports, 77:975, 1962.

Every 50th person who obtained a ski ticket at the resort on the four consecutive Saturdays and Sundays from Jan. 28 through Feb. 19, 1961, was interviewed, and the injured, on arrival at the Mount Snow medical facility, were asked the same questions by either physicians or medical students. A sampling of 446 persons took part in the ski census.

Questions included self-rating as a skier, history of previous injury, height, weight, hours of sleep during each of the previous two nights, ownership of equipment in use, and place and time of the last binding adjustment. The type of binding was recorded and individual skis were measured.

Bindings were classified by inspection into release and non-release types, the investigators reported. Many persons believe that "release" bindings reduce the risk of accidental injury. A release binding is so designed that it is supposed to become unfastened from the ski boot under forces exceeding those ordinarily encountered.

It was discovered that there were significantly fewer injuries among males using release bindings, but not among females who wore them. The researchers attributed the difference to the belief that the forces "required to disengage ski boots from these bindings tended to exceed the injury thresholds of females, but not those of males."

Release bindings, effective only on injuries to the lower extremities, should be improved so that they will give more protection to males as well as females, this study suggests.

Injuries to the head and shins might be reduced through use of protective devices.

The overall injury rate among Mount Snow skiers was 5.9 per 1,000 ski-man-days, a figure consistent with a Sun Valley (Idaho) study showing that it is likely that the overall ski-accident rate approaches one per cent per day.

Sprains, the most frequent injury, with fractures, made up 78 per cent of the total number of 684 injuries reported by Dr. Arthur E. Ellison of Williams College, Williamstown, Mass., who suggested the study and collaborated in it. Assisting in the investigation were Drs. William Haddon Jr. and Robert E. Carroll, both of the New York State Health Department, and collaborating in the clinical study, which accompanied the report of skiing injuries, was Dr. Milton Wolf of Wilmington, Vt.

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