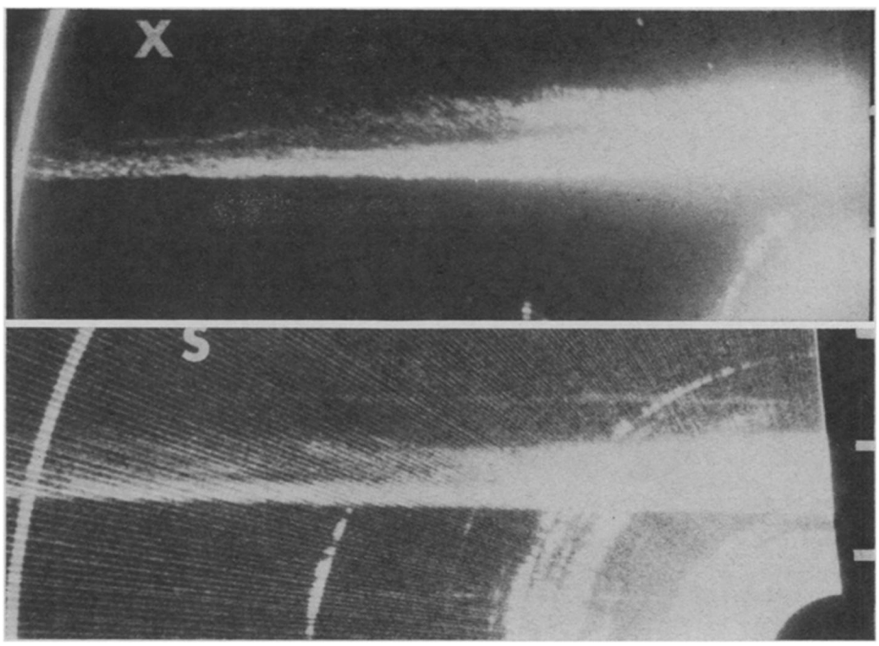

TROPOPAUSE ON RADAR SCREEN—The top photograph shows a radar screen for an antenna scanning at a wavelength of 3.2 centimeters, the X-band. A cloud layer starting at a height of about four miles above Wallops Island, Va., is clearly visible. The bottom photo shows a radar screen for an antenna simultaneously scanning at 10.7 centimeters, the S-band. Above the cloud layer is a faint streak at a height of about eight miles. This is the invisible tropopause.

GEOPHYSICS

Atmosphere Seen Anew

➤A REVOLUTIONARY way of looking at the first few miles of earth's atmosphere has been discovered.

Radar waves bounced back to ultrasensitive receivers are the key to the new method for probing the structure of invisible layers in the atmosphere.

The method could be used to detect high-altitude clear air turbulence, or CAT—the unseen cause of unexpected bumping of high-flying airplanes when the sky is blue. CAT is not the usual turbulence associated with storms, but freakish vertical updrafts and downdrafts that occur without warning at the altitudes used by jets.

No fatal crashes have yet been attributed directly to CAT.

The system can also be used to determine the best paths for sending radio communications the longest distance with the least power.

The use of radar waves as delicate probes of previously undetected layers in the atmosphere is an "exploding field," Dr. David Atlas of the University of Chicago told SCIENCE SERVICE. He said the reason meteorologists did not discover the invisible layers before is because radar sets they were using were not sufficiently sensitive.

Dr. Atlas suggested that radar waves from ground-based antennas could be used to set up a practical system of detecting CAT. This system would work on the basis of "forward scattering" of the radar waves.

Forward scattering of radar waves could also be the key to finding the best method of radio communications over long distances, Dr. Atlas said. The reason, he explained, is that the exact levels of the disturbed layers of the atmosphere carrying radio messages by forward scatter can be determined from radar waves.

Dr. Atlas and four co-workers discovered the promising possibilities in the forward scattering of radar waves by detecting the way radar waves are reflected from unseen layers in the weather-making part of earth's atmosphere. For the first time in the Western world and for the second time anywhere, they spotted certain atmospheric levels associated with CAT, using ultrasensitive radars at Wallops Island, Va.

The association between reflected radar waves and a turbulent layer in the atmosphere has been detected six times this year. The studies were made by Dr. Atlas, Dr. Kenneth R. Hardy and Kenneth M. Glover, while they were all at the Air Force Cambridge Research Laboratories, Bedford, Mass., with Isadore Katz and Thomas G. Konrad of Johns Hopkins University, Baltimore, Md.

Details of the tropopause experiment were reported in Science, 153: 1110, 1966. (Photograph courtesy of Science.)

ASTROPHYSICS

Outer Atmosphere Emits Laser-Like Light

➤ THE EARTH'S outer atmosphere acts like a giant laser, trapping and amplifying radiation, then releasing it in huge bursts. Lasers in earth-bound laboratories emit the most intense visible light beams known.

The radiation from the high atmosphere, however, is not visible nor are the impinging particles causing it. The frequency of this far-out radiation depends on the kind of charged particle trapped in the Van Allen belts.

Low-energy protons cause radiation at frequencies of one cycle per second, while electrons give frequencies in the audible range, which is from 20 cycles to 15,000 cycles per second.

The low-energy protons trapped in the Van Allen belts could be said to constitute a "HASER," an acronym standing for Hydromagnetic Amplification by Stimulated Emission of Radiation. The suggestion that charged particles in the Van Allen belts may act as huge lasers was made at a joint meeting of the American Physical Society, the Mexican Physical Society and the Canadian Association of Physicists in Mexico City.

Dr. John M. Cornwall of the University of California, Los Angeles, reported that computers are now being used to calculate characteristics of the emitted radiation so that the laser-like electromagnetic waves could be detected on earth.

Charged particles trapped in the Van Allen belts are automatically arranged by the earth's magnetic field so that they are more capable of emitting radiation than absorbing it. In a laboratory laser, an atomic system such as a ruby crystal is carefully prepared so that there are more atoms capable of emitting light than of absorbing it, resulting in the intense light beam.

SPACE

Super-Signal Needed For Live TV From Mars

➤ THE PICTURES of Mars from Mariner IV's flyby were excellent and thrilling, but live television would require a system as much as 1,000 times more powerful, a space engineer said in Seattle.

Ordinary TV uses VHF (Very High Frequency) signals. An increased number of TV channels are being assigned space in the U(Ultra)HF part of the electromagnetic spectrum. It is this area that is used for spacecraft communications, and it will never do for live TV from other worlds, said W. D. Nason of Douglas Aircraft Company.

Power requirements for spacecraft transmission increase even faster than distance from the receiver.

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