

POPULAR SCIENCE

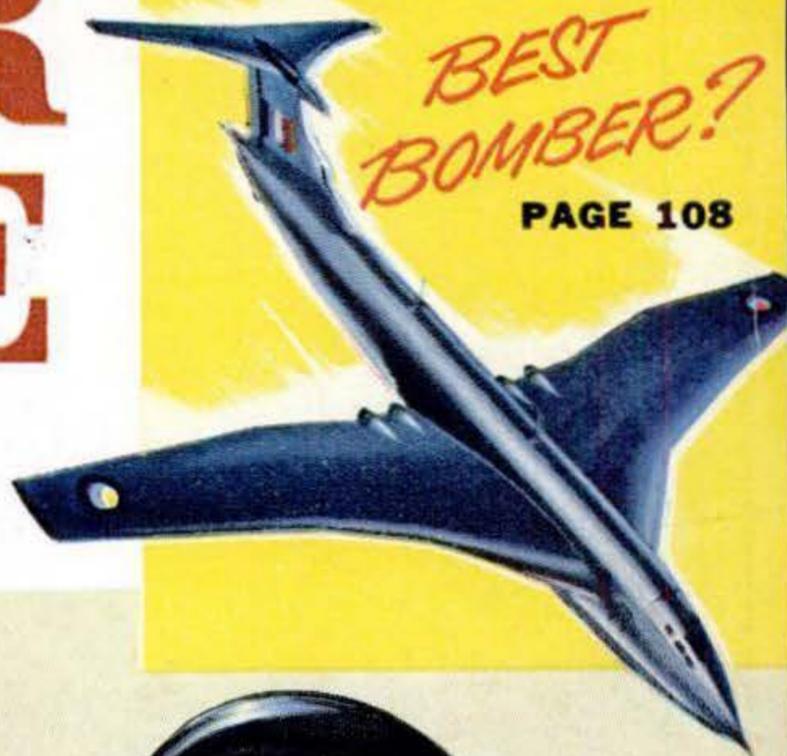
MONTHLY

MECHANICS - AUTOS - HOMEBUILDING

Who Is Building the

*BEST
BOMBER?*

PAGE 108



25¢ April

All About
18 Little Cars
PAGE 118



Saucers on Radar?

... an Expert's Verdict

Those blips on the scopes were as real as rainbows, and nothing new, says Harvard astronomer.

By Dr. Donald H. Menzel

DURING World War II, a cruiser in the Mediterranean suddenly noted a mysterious spot on its radarscope, within the range of its guns. A rapid check on the identification system failed to get any signal return, so the captain ordered the crew to open fire on the mysterious vessel. They checked their gunfire with radar, watching the projectiles seemingly strike the target again and again, without any effect.

They started to close in. The target stayed where it was, like a sitting duck, while they emptied their store of ammunition in a futile effort to sink it. Finally, curiosity overcame them and they cautiously crept forward, with the target still showing clearly on the screen. As they came into position where the target should be, their eyes could see nothing but a broad expanse of ocean.

The answer proved to be a mirage. Radio waves, like light waves, are sub-

ject to bending. They had been trying to sink the island of Malta. At last report, the island was still afloat.

In July, 1952, headlines proclaimed the sighting of a saucer armada flying over the nation's capital—saucers seen by eye, saucers registered by radar, saucers sighted simultaneously by eye and radar. Various airline pilots flying through the saucer areas were asked to check, and most of them drew blanks. Jet planes screamed into the regions, to find them empty. Most newspapers spoke of radar mirages as if they were a new or unlikely phenomenon. They did not know of the many difficulties that such mirages produced in World War II.

Flying saucers are real—as real as a rainbow, and no more dangerous. Men have recorded them throughout history. Although I have examined a number of reports of radar saucers, not one seems the least bit convincing. The operators fail to take into account the possibility of mirage. The sets record automatically and cannot distinguish between a real blip and a mirage blip.

How Radar Works

To understand the problem, we must know something of the way radar works. Radar is a device that sends out short, sharp pulses of radio waves. These radio pulses bounce off solid objects and give echoes that enable us to measure how far away the object is. Radar waves travel with the speed of light—186,000 miles a second. An echo returning after an interval of 1/1,000 second has traveled 186 miles, 93 miles out to the object and 93 miles back. The radar automatically measures the delay, and marks the returning signal on the surface of a "scope,"

DR. DONALD H. MENZEL, well known to PSM readers for previous articles on astronomy and books on science for the layman, is Professor of Astrophysics at Harvard University and Acting Director, Harvard College Observatory. In the Navy in World War II, he worked on radar mirages.

Portions of this article are reprinted by permission of the publishers from *Flying Saucers* by Donald H. Menzel, published by Harvard University Press, Cambridge, Massachusetts. Copyright 1953, by the President and Fellows of Harvard College.



which resembles the face of a television tube.

The beam of radio waves rotates like an airport searchlight, sweeping over a circular area centered about the antenna in from two to 10 seconds. Any echo shows as a bright point—a “blip.”

Sometimes the focusing action caused by a peculiar atmospheric condition introduces serious and unlooked-for complications. The radar is sending out pulses at from 500 to 1,000 times a second. It records each returning blip as if it were an echo of the pulse last sent out. But it may be the echo of some earlier pulse returning after being reflected from some very distant object.

We have seen that a pulse reflected from an object 93 miles away returns in 1/1,000 second. If we are sending out 1,000 pulses a second the echo returns just as the new pulse is leaving. But an object 186 miles away would also be returning an echo at the same moment from the next earlier pulse, and so on for other pulses.

Cool Air Makes Mirages

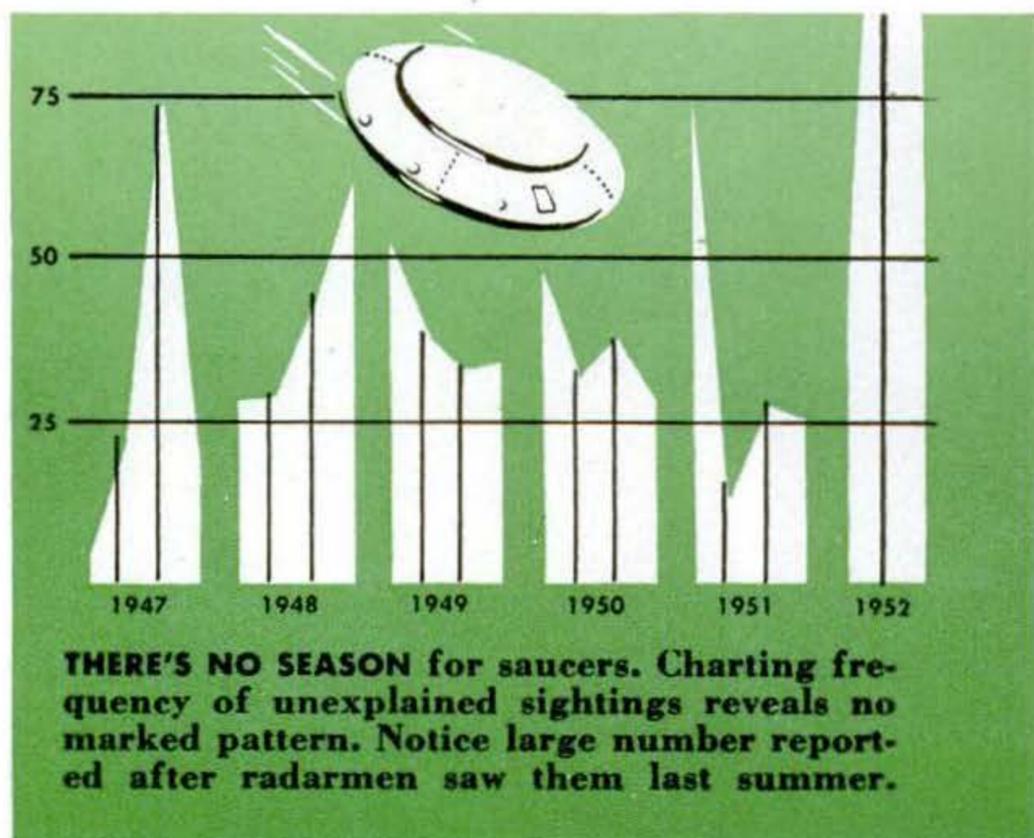
Although the conditions that produce radio mirages are complicated, they have many factors in common with ordinary mirages. An unexpected phenomenon makes possible the reception of reflections from very distant objects.

Cool air close to the earth's surface, surmounted by a warmer layer, is ideal for production of radar mirages as well as optical mirages. One of the most spectacular and at the same time most frightening experiences came off the coast of Japan in 1944. I was a lieutenant commander in the U. S. Navy, charged with trying to resolve reports from our submarines about mysterious ghostlike images that seemed to be flitting all over the Nansei Shoto area.

The reports went something as follows: The radar operator, sitting in front of his scope, was checking on possible targets, with the submarine cruising slowly just below the surface and the radar antenna lying just above the surface. Suddenly the radar operator

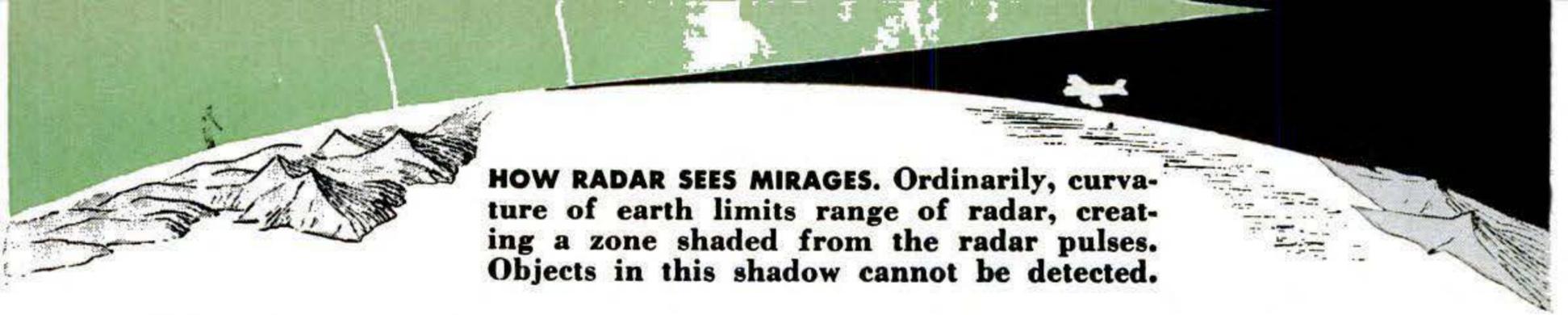
would become aware that one—sometimes more than one—of the bright patches of light on the radar screen was heading directly toward the submarine, on a course designed to intercept it. If he called for a change in course, the image on the screen would change course also. An officer would scan the sea through the periscope, trying to detect this mysterious vessel. And just when everyone expected the mysterious enemy craft to show up in the periscope as well as upon the radar screen, the image would vanish—like the ghost that it was. And thus came its name, the Galloping Ghost of Shoto.

The Galloping Ghost was a mirage.

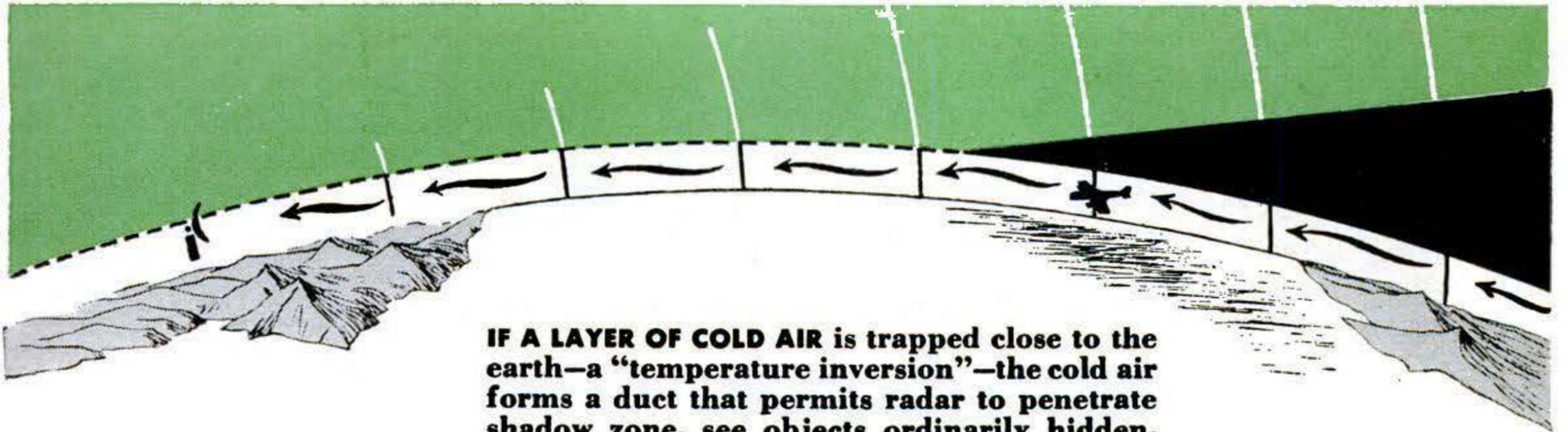


A low-lying layer of cold air, close to the surface of the sea, entraps the radar waves, keeping them from going on to higher levels. These radar pulses then bounce around from ship to shore and ship to ship, with remarkable intensity. Sometimes they are reflected more than once by the same moving object, including the submarine that sent them out originally. Thus, a beam that has suffered several reflections will seem to move at the combined speed of all the objects and hence several times faster than we should expect any surface craft to move.

Had we been expecting flying saucers, we should undoubtedly have seen them by the dozens.



HOW RADAR SEES MIRAGES. Ordinarily, curvature of earth limits range of radar, creating a zone shaded from the radar pulses. Objects in this shadow cannot be detected.



IF A LAYER OF COLD AIR is trapped close to the earth—a “temperature inversion”—the cold air forms a duct that permits radar to penetrate shadow zone, see objects ordinarily hidden.

Some of the modern radarscopes record only moving objects. One of those used at the Washington Airport during July, 1952, was of this type. The blips that seemed to be an armada of saucers represented some sort of motion. But if the air layers responsible for the changes are in motion, the image of even a distant house or factory can appear to move.

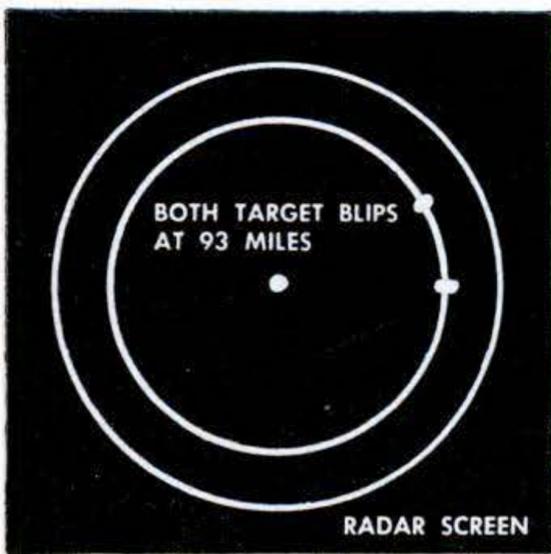
Air “Sandwich” Causes “Saucers”

The meteorologic data are incomplete and the most significant information of all—namely, the temperature and mois-

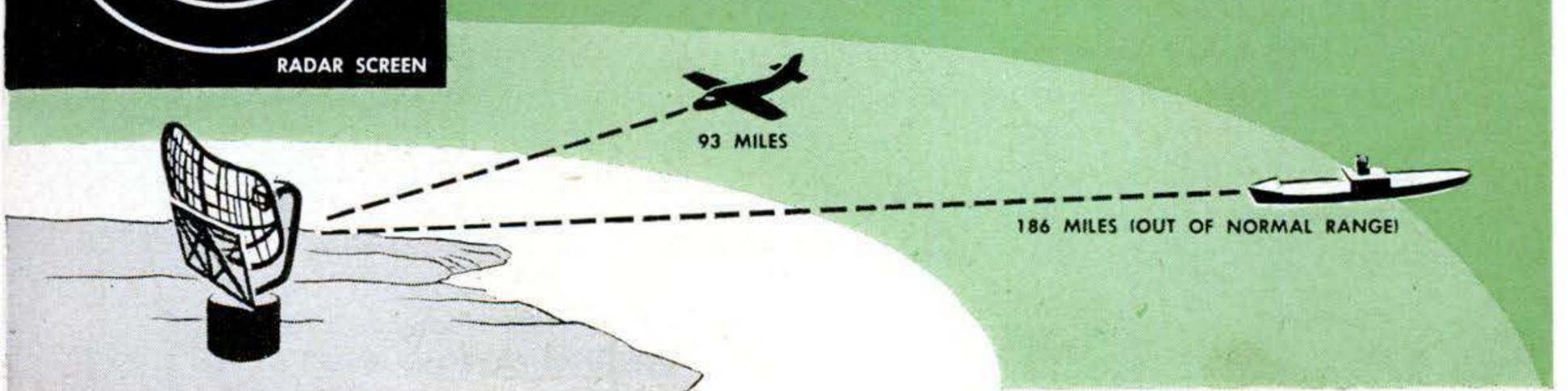
ture conditions within 100 feet of the ground—is entirely lacking. There is some evidence, however, for a temperature inversion. In addition, July and early August of 1952 were months of severe drought and prolonged heat. Maj. Gen. John A. Sanford of the Air Force Technical Intelligence Center finally confirmed the theory here presented: that a sandwich of cold and warm layers of air caused the saucers, both visual and radar sightings.

Where strong temperature inversions

[\[Continued on page 268\]](#)



WHY DISTANT OBJECTS SEEM CLOSE. Radar gauges range by timing the interval between transmission of a pulse and reception of its echo from the target. An interval of 1/1,000 second would mean a target 93 miles away. But an echo of the *next earlier* pulse from a “mirage” target twice as far off could be recorded at the same time. Since the scope shows each echo as belonging to the last pulse sent, it will show the mirage at 93 miles.



EASY WAY TO PEEL OFF OLD WALLPAPER



EASYOFF remover
saves up to \$15 per room

This is the simplest, most economical known method of removing wallpaper. You just mix EASYOFF with warm water and brush, sponge or spray on. It penetrates the paper and dissolves the paste,

so all the old wallpaper can be peeled right off. Will not injure wall surface or woodwork.

If your paint or wallpaper dealer doesn't have EASYOFF, mail \$1.00 for 6-oz. bottle that makes 3 gallons of remover—enough to remove paper from one large or two small rooms. Money-back guarantee.

THE KLEAN-STRIP CO.
2366 S. Lauderdale, Memphis 6, Tenn.
Makers of Highest Quality Removers

New LUFKIN MITI-MITE

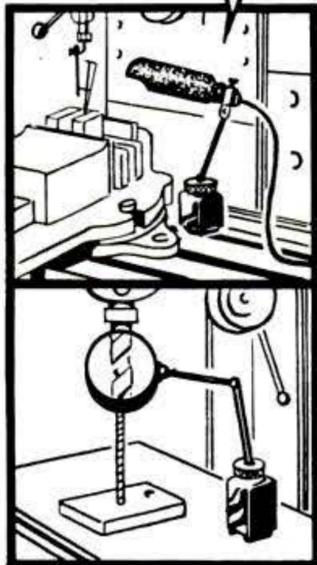
MAGNETIC PRODUCTS HAVE
HUNDREDS OF USES IN
HOME AND SHOP!



Attach Instantly to Curved or Flat Surfaces to Give You —

- **LIGHT**
in more hard-to-see places.
- **MAGNIFICATION**
4x magnifier can be put in almost any position.
- **INDICATOR HOLDER**
sensitive positioning without cumbersome clamps.

200
HANDI-LITE
\$8.50



BUY LUFKIN TOOLS
AT YOUR HARDWARE
OR TOOL STORE.

FREE
MITI-MITE
BOOK

LUFKIN RULE CO., Saginaw, Mich. DEPT. PS

RUSH ME YOUR FREE BOOKLET DESCRIBING
LUFKIN MITI-MITE MAGNETIC PRODUCTS.

Name _____

Street _____

Ad 239 City _____ State _____

Saucers on Radar?

[Continued from page 171]

give rise to the galloping-ghost saucers, temporary fluctuating patches of warm air can produce an even more spectacular phenomenon. Lacking precise meteorological data, I must base my interpretation on experiments made during World War II.

Atmosphere as Rough as Sea

During the early stages of short-wave communications, studies of the transmission demonstrated the occurrence of strong "scintillations," or changes in intensity of the received signal. The phenomenon was akin to "fading" of the broadcast waves, so familiar to users of radio sets 20 or more years ago.

These studies during World War II indicated the source of the trouble. During or after a hot day, the air suffers from inequalities of heating. Here we find an ascending patch of warm air; there we note a falling mass of cold air. The atmosphere is often as rough as a choppy sea—though its transparency often keeps us unaware of the irregularities. At night, however, exceptional twinkling of the stars can reveal the presence of highly agitated layers of air—and such twinkling was often noted while the saucer armada was "invading" Washington skies. A long, hot, dry spell set the stage for the saucer apparition.

Signal Deflected

If moving masses of warm air can make the light rays wobble and twinkle they can do much the same with short radio waves. Hence radar or television signals can bounce from one of these hot air clouds, like light waves from a wobbling mirror. Hence a radar signal that would ordinarily be useful only for tracking a plane high in air, can be deflected earthward, there to be reflected from a distant building or tank.

Television reception displays similar characteristics. Receivers in "fringe areas" suffer most from changes in the weather. Last summer, friends at the

[Continued on page 296]

Saucers on Radar?

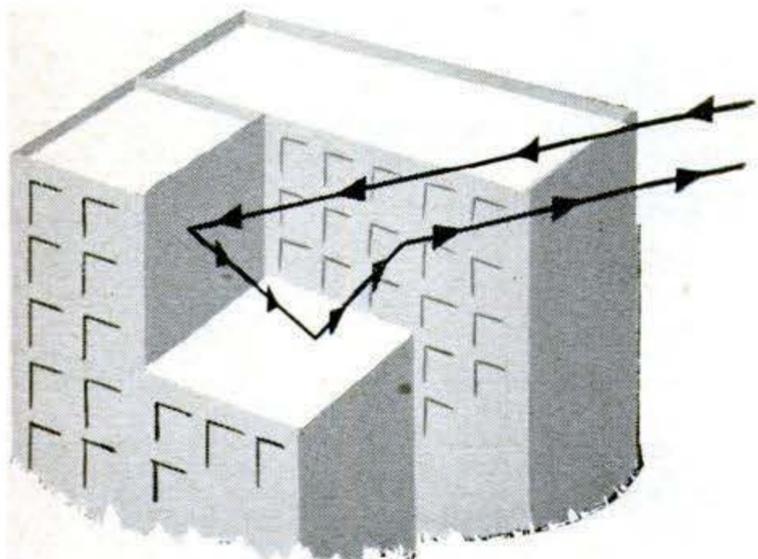
[Continued from page 268]

beach complained that they had the poorest reception when they were most interested in using their set, namely when the weather was so stormy that they could not enjoy the out-of-doors. The differential between good and bad weather would be even more marked were it not for the automatic volume control built into the TV receiver specifically to correct for the unavoidable scintillations.

A meter that I have had built into the AVC of my Zenith receiver clearly shows the heavy scintillations and also the long-distance reception associated with the warm, dry weather.

Building Bounces Waves

I believe such atmospheric conditions caused the darting "saucers" seen by the Washington radar operators. The signal beam from the rotating radar antenna strikes a patch of warm air, which turns the beam back to the earth where it strikes some building. If the building has upper stories in the form of two wings that meet at right angles above a roof, the adjacent walls of the wings form, with the roof, a natural example of what radar operators term a "corner reflector."



A radio wave coming down and striking one wall will bounce successively off the roof and the other wall, to travel back essentially along the path from which it came. Buildings that possess these natural reflectors stand out sharply as radar targets among those structures that do

not have the corners. Thus, the operator who is unaware of the effect of the warm air may think the building is a flying saucer.

10 Miles per Minute

But what about those reported rapid motions? Speeds up to 600 miles an hour, or 10 miles per minute! Certainly the building isn't moving! No, but the hot-air layer is rocking, tilting and shifting—so that each time the beam from the rotating antenna sweeps past it at intervals of from 15 to 20 seconds, the reflected ray picks up a new corner reflector. The radar operator, accustomed to interpreting moving blips in terms of an actual target, becomes excited and interprets the whole phenomenon as a speeding saucer.

The reported behavior of the "objects" is the final pay-off. The Washington saucers were observed to "move" in straight lines and then execute sharp right-angle turns. Here the saucer may disappear, or it may reverse itself sharply over its right-angle course, returning to its initial position.

Nothing to Intercept

Any conventional plane would sweep out a curve, since right-angle turns defy all laws of mechanics, to which even flying saucers would be subject if they were vehicles or moving objects. Only reflections can veer thus sharply. The right-angle array is the not infrequent lining up of large buildings along streets or highways.

No wonder that jet planes, screaming into the night, found nothing to intercept!

END

Animals Live Without a Drink

KANGAROO rats, pocket mice, prairie dogs, gazelles and dozens of other desert animals pass their whole lives without touching a drop of water. The liquid necessary for their bodily needs is obtained through chemical action in their digestive tracts, which changes some of the starchy parts of their food into water.

OK