AMERICAN NEWSLETTER

Pigeons as missile pilots

from JOHN LEAR, our American correspondent

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WHEN man masters enough of the navigation problems of the solar system to be ready to try to land a spaceship on Earth's neighbour planets, the United States Navy may dust off and use the findings of a research project which has been classified secret for the last six years under the code name ORCON.

ORCON is a contraction of the two words "organic control", which are in turn an esoteric way of saying that Project ORCON was concerned with the use of animals to guide missiles to floating or airborne targets.

The animals actually employed in the research were pigeons.

"Though it may seem like a venture into science fiction," the Navy assures its own and other scientists in revealing the long-hidden facts in the September issue of *Naval Research Reviews*, "ORCON was a serious investigation, and one which produced surprisingly good results."

With such a strange story as this one, it is best to begin at the beginning. That was in the early days of World War II. All missiles then were guided by some sort of "homing" device. Inside the weapon was a sensing element which "felt" the heat or the magnetic field of the target or "heard" sounds the target emitted. Later bombs were controlled by radio. But whatever the "homing instinct" was, it soon turned out to be susceptible to interference by the enemy.

Was there a kind of sense that could not be countered? If so, the use of it was imperative. Dr. Vannevar Bush's wartime Office of Scientific Research and Development was willing to try anything. Since no one had come up with a "death ray" capable of killing a living organism from a safe distance, there was one undeniable possibility: the senses of a living thing.

Dr. B. F. Skinner, who is now at Harvard, was then head of a group of psychologists at the University of Minnesota. He was given a research grant by O S R D to examine the practical means of using a live guide for a missile without wasting the manpower the Japanese risked in their one-man submarines.

Pigeons were Dr. Skinner's choice because they were light in weight, easily obtainable, and known to be trainable. The species tested were "homing" pigeons, but that had no significance to the experiment. The pigeons were not called upon to use their "homing" instincts; they were merely invited to peck at a spot of something easily distinguishable from a contrasting background. If the birds accepted the invitation and pecked, they were immediately rewarded with a few grains of corn.

These Minnesota experiments proved that pigeons could be persuaded to peck. Dr. Skinner and his fellow scientists then proposed several apparently practical ways of employing this organic capability to guide a missile from a miss-the-target to a hit-the-target course. They actually built a missile simulator and tried out several birds in it. But the war ended before a pigeon was actually fired in anger.

In 1948, the Naval Research Laboratory was assigned the task of taking up the investigation where Dr. Skinner had left off, and to continue until a clear-cut recommendation could be made either to implement organic control as a workable scheme of guidance or to drop the idea entirely. The problem was given to a group of engineering psychologists under Dr. F. V. Taylor.

How do you fit a pigeon into a weapon?

The principle is the same one a photographer adopts in taking pictures with a camera equipped with a ground glass. The camera is pointed in the general direction of the object to be photographed, and the photographer looks at the ground glass to see what the picture will look like. If the desired object is off-centre on the glass, the photographer shifts the camera until the object is centred.

In an ORCON missile, the pigeon takes over the photographer's function, with one variation: the bird doesn't know what it's doing.

There is a lens in the missile's nose, and a ground lens to receive the image of the target as the missile nears the target. The pigeon is behind the glass, pecking away at any image that appears on the glass. The glass is cross-hatched with wires to measure off the distance from centre, up and down, right and left. An electrical contact is cemented to the pigeon's beak. Every time the bird pecks at what it sees in the glass, the electrical connection indicates how far the missile was pointed away from the target, and in what direction. The signal of error is automatically transmitted to the missile's steering mechanism, and the weapon "homes" on the target.

So much for theory. The practice depended on the inherent capability of pigeons.

The first experiments took place in a primary trainer, a simple box in which the pigeon was suspended in a jacket before a window in front of which a square piece of metal was moved mechanically back and forth. At first, the target was moved slowly, and the bird was rewarded with corn for every hit it scored. Gradually the target movements were speeded and the rewards were stretched out until the pigeon was pecking away for eighty seconds at a target jumping back and forth at a speed of five inches per second. The pecks approximated four per second, 80 to 90 per cent. of the pecks were either on bullseye or within a quarter of an inch.

In the next experiments, the pigeon's target was a picture of an actual ship at sea. The pictures were movies taken by a jet plane diving on a destroyer and a freighter travelling full speed in moderate seas. The target movements now were in two dimensions instead of one, up and down as well as right and left. Of course all that the pigeon actually saw looked something like a night moth fluttering in front of a lighted window.

Eight pigeons were tested in ninety-six trial runs. Of these, 55.3 per cent. were successful. The pecking rate was considered sufficient to steer a missile travelling 300 yards per second. Four of the pigeons averaged 79.2 per cent. successful flights, so a high probability of hits presumably could be expected if the better trackers were chosen for the missile assignments.

Under ideal conditions, pigeons apparently could serve as missile pilots. But ideal conditions are seldom realizable in actual battle. Clouds, waves, shadows and the like would introduce elements confusing to the birds.

So, after six years of secrecy, Project ORCON has been brought into the light and put on the shelf until, in the Navy's words, "the experience gained and the knowledge acquired . . . may have some use in the future—perhaps in homing a space vehicle on a distant planet".