SCIENCE AND YOU
by Fred McCool & Loren Bollinger

THINKING SYSTEMS FOR MISSILE GUIDANCE

Most of you have at least a nodding acquaintance with the electronic computer, or "the mechanical brain." It's a futuristic marvel with a very down-to-earth purpose--to solve quickly and accurately problems that would take a man or teams of men years to solve. For what, you ask?

For many reasons. One deals with the dawning of the pilotless missile age. Your research dollars have helped develop missiles capable of speeds that stagger the imagination--10,000 mph or 20,000!

Fantastic? That's not as fantastic as this--such missiles can be guided to a predetermined destination without carrying a pilot! Scientists predict the day when the stratosphere will pose a guided missile traffic problem.

But to come back to the present and the practical--Convair is developing an intercontinental missile for the Air Force called the Atlas. It could be used, for example to bomb a vital steel plant some 5,000 miles away. The problem is to do it.

One interesting system of guidance proposed by research engineers would use certain stars in the sky as road signs to guide the missile during flight. These might be Polaris, the North Star, or perhaps Vega or the planets Venus and Mars. The paths of these celestial bodies are well known by astronomers and their position in the sky can be calculated for years in advance.

With this information it is possible to build a "black box" that will track specific stars and, thereby, "read" the heavenly road signs as the missile flies along in space. The faint light from the twinkling star is picked up by a sensitive phototube, a device which converts light into an electrical signal. Less sensitive phototubes are used to open the doors of the store when you are ready to leave with your arms full of next week's groceries.

As the missile flies through the sky, the photocell and aiming device stay pointed at the star in question. The angles made by the photocell tracker and a fixed reference system in the missile can be measured automatically and the information sent to an electronic computer. Comparison is then made between the angles required for the missile to be "on course" and those actually measured. If there is a difference between the measured values and the "on course" angles, correction signals are sent out to turn the missile back to the prescribed course.

This system of guidance is similar to the procedure you use when you get a road map from a travel agency with the route marked. If you take the wrong road, you have to turn back "on course."

Since the stars must be visible for this type of guidance system to function properly, the missile must fly above any clouds or haze. However, in any long-range flights, missiles would fly many miles above the surface of the earth where the air resistance is practically nil. Even in the daytime the sky is a very deep blue, almost blac, so that the stars and planets stand out vividly at all times.

Almost without doubt this system of celestial navigation will be used to guide the first rocket-powered space ship to Mars or Venus.

Other types of guidance systems are applicable when the missile has to fly only a few tens or hundreds of miles. The NIKE, an Army anti-aircraft missile, fits into this class. This missile is launched from the ground and then controlled so that interception takes place with the invading airplane.

The enemy aircraft would be detected first by one of the radar detection networks such as the DEW (Distant Early Warning) line located in northern Canada. If the airplane is not destroyed before it reaches one of our industrial cities, the local anti-aircraft base takes over the job. When the aircraft nears the city, a local radar station locks onto it and follows the plane continuously.

Information regarding the flight path, derived from the tracking radar, is fed into a computer which then calculates the path an anti-aircraft missile must follow to allow a direct hit.

Suppose that an invading aircraft has flown down from the north and is nearing one of our important industrial centers. The local base, warned in advance by DEW line detection or by the Ground Observer Corps, goes into a state of readiness. When the local radar picks up the plane, the computer starts to calculate the best path that the missile, ready to be launched at the base, should follow.

As soon as the enemy plane is within range of the anti-aircraft missile, a NIKE or similar weapon, is launched.

Inside the "bird", as the missile is termed, a radio, tuned to the base transmitter, receives signals from the computer on the exact path that the missile must take. Since the radar can now track both the "bird" and the enemy aircraft, interception-path correction signals are transmitted continuously as the invader goes through evasive maneuvers.

With this type of beam-riding guidance it is possible to lead the enemy plane and, thereby, increase the probability of a kill. This procedure is the same that a hunter follows when he aims slightly ahead of the leader of a flock of geese.

Only an automatic computer, a "mechanical brain" which is man-made, can calculate the flight path of the intercepting missile and guide it to its target within the few seconds between the time of missile launching and interception.

Photo Caption: Giant radar antenna used in tracking missiles launched at the Missile Test Center on the east coast of Florida

(We are securing another print of this picture.)