

DEVELOPMENT OF SERVO-MECHANISMS

DR. SOLANDT'S ADDRESS: In an address to the Association of Professional Engineers of Ontario, in Toronto, on January 28, Dr. O.M. Solandt, Chairman, Defence Research Board, discussed, among other matters, the developments in electronics which have made possible the elimination of the human operator in many simple situations. He said that the greatest impetus for the development of complex servo-mechanisms to replace human operators would come from the services, and proceeded in part as follows:

"... Servo-mechanisms that are designed to perform complex functions are, in general, very like men. They must have sense organs or receivers to collect data, nerves to transmit this data to the brain, a brain to assess the significance of the incoming information, choose the right course of action and send out impulses to muscles or servo motors that accomplish the desired result. Recent advances in science have made possible great improvements in every element of such systems and thus opened up a field of infinite possibilities for creative engineering....

SEE OBJECTS BY TELEVISION

"Consider first the data receivers or sense organs of such a servo-mechanism. They can be made to see objects by television, or by radar or infra-red rays; they can be made very sensitive to small changes in light or sound or pressure or indeed to any change in their physical environment. The only human sense that cannot be duplicated fairly well is smell. Even there some facetious optimists speak of the development of telesmell as a substitute for radar. It could detect airplanes around corners.

"Once the information is collected, it can be transmitted electrically to any required distance. Great progress has been made in converting all forms of information into electrical impulses of a readily transmittable kind and then reconverting the information at the other end. A simple example of this is the linking of two dial indicators by radio so that one will instantly follow changes in the other.

"The central brain of such a system now offers the greatest possibilities for experimentation. Calculating machines are being made that will do many things that only a good human brain could do and the machine will do them many times faster. This means that it is possible to build into the central control of a servo-mechanism almost any desired characteristics.

"The effector mechanisms or muscles of the system have also been greatly improved. Electronic control systems make possible very rapid and accurate control of large forces thus giving the mechanical man a strong back as well

as an almost infallible, though stereotyped mind.

"Lest you feel that what I have said is vague and visionary, I might remind you of the systems of anti-aircraft fire control that were actually used at the end of the war. A radar set automatically scanned the sky. When it saw an aircraft, it locked onto the aircraft and followed it. As it followed, it reported range, elevation and azimuth readings continuously to an electrical predictor or computer, which acted as the brain of the mechanism. After considering the data received, it predicted the future position of the target, applied suitable corrections for meteorological conditions and the ballistics of the shell being fired and then sent signals to hydraulic or electric motors that continuously aimed the guns in the best direction for a hit. If the shell had a mechanical fuze, the predictor put the correct fuze time on the fuze setter. In most cases a radio proximity fuze was used so that no fuze setting was required. Thus the whole operation of an eight gun heavy A.A. site could be made fully automatic....

GUIDED MISSILES

"During the next ten years the same techniques will be vastly improved and refined. One obvious application where a great deal of work is going on at present is in guided missiles. It now seems fairly certain that the first technically successful long range guided missile will be nothing more than an airplane in which every member of the crew will be replaced by a servo-mechanism which will do his job. This not only makes the plane expendable, but also makes it much simpler and smaller and hence faster or of longer range by eliminating the need for pressure cabins, oxygen supply, cabin heating, feeding arrangements and all the other complications that are required by a human crew. This pilotless aircraft will gradually fly higher and faster and will ultimately lose its wings and evolve into the inter-continental rocket of contemporary fiction....

"This tendency to replace men with machines which has already begun will spread rapidly through all the Services. All major armament will soon be fully controlled by automatic mechanisms. Navigation both in the air and on the sea will require little human intervention. The guided missiles of the future will be launched and controlled by machines. The same sort of techniques will be used for collecting, displaying, analysing and transmitting the vast mass of information that is needed for the effective conduct of a battle whether on land, or sea or in the air. All these things are possible through the use of existing knowledge...."