INFLUENCE OF THE GUIDANCE DESIGNER ON WARFARE

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INTRODUCTION

The role of the guidance designer in warfare is to give intelligence to a weapon. In the evolution of mankind, the development of weapons began with the simplest possible means for applying brute force. As the ability to project this force to greater and greater distances has evolved, the need to guide, control, and direct it has had to be satisfied; and in the process, the art and science of the guidance designer has appeared.

This paper traces the influence of the guidance designer on warfare. "Guidance" is here taken to include those functions between the sensory apparatus which locates the target and the weapon which strikes the target. It thus includes "fire control," "data processing," certain phases of navigation, and machine means for command and control.

It is in this general area that Charles Starke Draper and the M.I.T. Instrumentation Laboratory under his direction have made outstanding contributions [2 to 5, 7, 8]; it is in this field that the most sophisticated machines of war have been created.

The influence on nonmilitary functions of developments of military guidance designers has been great. As the scope of machine systems for the control of weapon system complexes grows to include methods for controlling, limiting, and monitoring in peace the conditions which lead to wars, it may be the guidance designer who, in the long run, will provide the technology for an enduring peace.

ELEMENTS OF A WEAPON SYSTEM

A weapon system may be considered to consist of four major elements: the weapon itself, which accomplishes the lethal damage to the target; the sensory means for detecting the target and determining its position; the data processing, computing, guiding, and controlling devices, which convert the target information to instructions for the weapon and provide the weapon commander with information for its control; and the commander and human operators who control and operate the system. Figure 1 shows the interrelationships of these major elements with the target complex.

Initially all these functions reposed in the men themselves, and the first augmentation of human capabilities consisted in the use of clubs, spears, and knives as weapons

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which can be made on the basis of established policy may conceivably be performed by the computer.

However, the present state of the art of computer programming is such that there is a serious danger of inflexibility in computer operation because of the length of time required to reprogram present computers. In addition, the interface between the computer, its display and controls, and the human operators represents the most serious discontinuity in the whole system. One may conjecture that future developments will initially be concerned with improving the compatibility of man and machine. One may, in fact, imagine a machine which can be reprogrammed con-

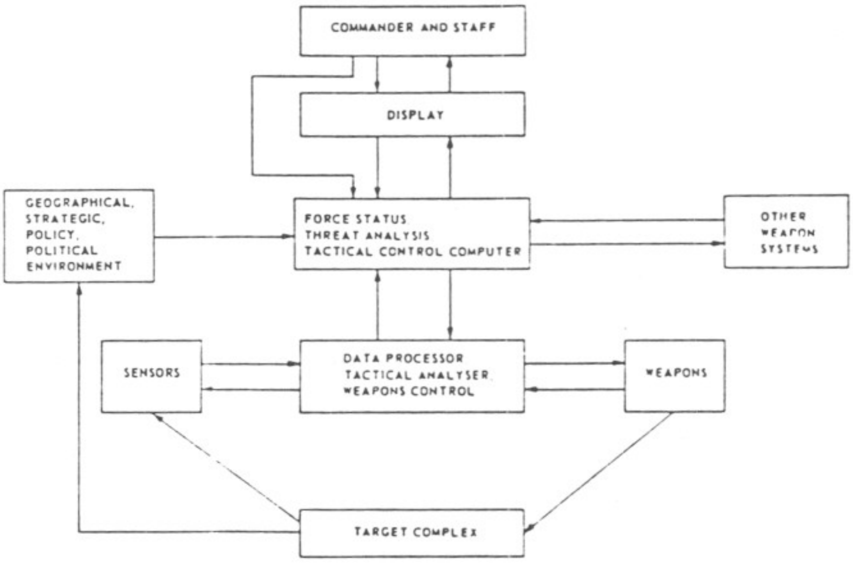

FIG. 25. Weapons control circa 1970.

tinuously, based upon the considered deliberations of the system commander and his staff to the flow of information as it is presented to them, and that a portion of the machine itself will serve as a staff capable of rapidly analyzing data and presenting tentative hypotheses to the human operator. Inputs to the machine would then be in the nature of policy directives which would establish matrices of reactions rather than detailed instructions regarding computational procedures [50].

In the long run, one may imagine the "interface" between man and machine to substantially disappear, with many of the machine functions in complete "symbiosis" with the man. The first indications of this development are beginning to appear. Already miniaturized control devices to stimulate heart performance have been sewed into the bodies of patients whose normal heart regulation has been imperfect. Astronauts will be completely instrumented with miniaturized sensors which record their heartbeat, brain waves, blood pressure, breathing rate, and so on, and transmit these automatically back to earth. Computers have been suggested to measure the alertness and physiological needs of the astronaut and correct his environment accordingly.

The channels of sensory input and output to and from the human body are many. A commander, presented by his command and control system with a series of possible

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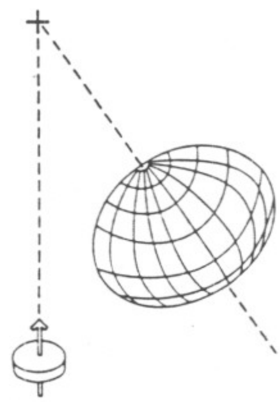

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