

## Robotic System

A complicated design project, successfully carried out by a New York manufacturing consultant with help from the NASA-sponsored New England Research Application Center (NERAC), has resulted in a new type of robotic system being marketed for industrial use.

Consultant Robert Price, operating as E.S.-I (Enlightened Self-Interest), Albany, New York, was awarded a contract by Watervliet Arsenal, Watervliet, New York to develop an automated tool and the necessary software for deburring the inside of eight-inch breech ring assemblies for howitzers produced by the arsenal. The assembly is a 450-pound unit with complex, stepped internal threads needed to hold the breech block in place when the howitzer is fired. Deburring involves smoothing, or finishing, hundreds of small steel burrs in edges of the teeth of the breech ring. Formerly the burrs were removed by hand grinding, with some hazard to workers from noise, metal fragments and dust. The arsenal wanted a more efficient, hazard-free way of doing the job. This required design of a special tool called an end effector to go inside the breech ring bushing. Additionally, Price's contract called for development of a computer program that would enable an operator to direct the cutting tool over the very complex contours of the breech ring.

Price sought help from NERAC, which conducted a computerized search of the NASA data base and six others; this work was co-sponsored by the Small Business Administration Technology Assistance Program. The NASA data base yielded basic information on robot off-line programming methodology. NERAC's research also identified university and industry sources that provided additional information on which Price could base his work.

Price designed a system consisting of a standard industrial robot arm (top)—manufactured by ASEA, Milwaukee, Wisconsin—with a specially engineered six axis deburring tool fitted to it, a microcomputer and a computer program to direct the tool on its path through the breech ring. To assemble the hardware and provide software assistance, Price enlisted the help of a subcontractor—Henderson Industries, West Caldwell, New Jersey. The resulting robotic deburring tool, or end effector, is shown in the center photo; a graphic display unit, such as the one shown at right, allows Watervliet Arsenal personnel to monitor the deburring operation. E.S.-I. is now marketing the system to aerospace and metal cutting industries for deburring, drilling, routing and refining machined parts.

