Honeywell

Parallel Kinematic Machines (PKM)

Federal Manufacturing & Technologies

R. S. Henry

KCP-613-6291

Published March 2000

Final Report/Project Accomplishments Summary

CRADA Number 99KCP1076

Prepared Under Contract Number DE-ACO4-76-DP00613 for the

United States Department of Energy

Honeywell

Federal Manufacturing
& Technologies

P. O. Box 419159

Kansas City, Missouri

64141-6159

A prime contractor with the United States

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Date: 1/10/2000 Revision: A

A. Parties

The project is a relationship between

Honeywell FM&T

2000 E 95th Street

PO Box 419159

Kansas City, MO 64141-6159

Sandia National Laboratories

P. O. Box 5800

Albuquerque, NM 87185-1380

B. Background

Manufacturing machines employ processes and tools based on serial-linked arrangements of linear and rotary axes, where each axis provides an independent degree of freedom. As component designs have increased in complexity, the constraints of these serial-linked systems have become more apparent. Complex parts require multiple manufacturing processes and setups with numerous fixture transitions, which means higher product cost. However, it is now possible to build machine tools that approach human dexterity using a parallel-linked arrangement of axes. This non-conventional, non-orthogonal approach is referred to as parallel kinematic machines (PKM). The development and application of these tools is the focus of this CRADA.

C. Description

The purpose of this 3-year cooperative research project was to develop a parallel kinematic machining (PKM) capability for complex parts that normally require expensive multiple setups on conventional orthogonal machine tools. This non-conventional, non-orthogonal machining approach is based on a 6-axis positioning system commonly referred to as a hexapod.

Sandia National Laboratories/New Mexico (SNL/NM) was the lead site responsible for a multitude of projects that defined the machining parameters and detailed the metrology of the hexapod. The role of the Kansas City Plant (KCP) in this project was limited to evaluating the application of this unique technology to production applications.

Due to budget constraints at Sandia, their funding was pulled after the first year. Without project leadership and guidance from Sandia, KCP was forced to withdraw from any further participation.

D. Expected Economic Impact

The primary reason for participation in this evaluation of PKM technology is to expedite the development of this critical technology. A new generation of machines based on PKM will soon be available and useful to private industry and government labs and plants for the fabrication of complex parts. With enhanced dexterity provided by PKM, designers will no longer be limited or biased to design orthogonal parts.

E. Benefits to DOE

The Department of Energy's need for agile small-lot manufacturing to support future weapons production and maintenance matches well with the potential attributes of the PKM machines.

F. Industry Area

Through the efforts of Giddings & Lewis, Hexel, and Ingersoll, each of which was instrumental in the early development of hexapod devices, the U.S. currently has the lead in hexapod milling machine development, and a strong cooperative effort should help U.S. machine tool builders maintain their global competitive edge in this area.

G. Project Status

The project was terminated after the first of three years.

H. Point of Contact for Project Information

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I. Company Size and Point of Contact

N/A

J. Project Examples

N/A. Project was cancelled before any machining tests on actual product could be conducted.

K. Technology Commercialization

No.