SECTION II:
REQUEST FOR PROPOSALS

AUTOMATED FABRICATION CELL

OPPORTUNITY

AME470 Inc. has been requested to propose a new concept for an automated fabrication cell (AFC) that will perform a number of machining and assembly tasks. The customer has indicated that it is imperative that the system be full autonomous, safe, clean and inexpensive to maintain. The AFC will have three main subsystems. The first subsystem (STEP1) will perform an automated cutting and machining operation on a piece of bar stock. The bar stock will be fed to the system in a bulk-loaded queue. The second subsystem (STEP2) will perform an automated cutting operation on a piece of rod stock and an automated assembly operation using the resulting component and a component provided by the STEP1 subsystem. The rod stock should be fed into the system in a bulk-loaded queue. The third subsystem (CLEANUP) is the machine-process-residue management system. Any residue, scrap or waste, from the machining and assembly must be automatically collected and stored for eventual disposal. High throughput and clean operation will be considered as key objectives for this system and various geometries of the resulting components must be on-line, user-selectable.

This product development project will involve the concept definition, concept engineering design studies, documentation and proof-of-concept prototype fabrication for a variety of subsystem concepts. AME470 Inc. will develop various concepts for STEP1, STEP2 and CLEANUP that are compatible with each other and able to interface in order to provide a complete AFC. A demonstration of the various concepts for the complete AFC using the "proof-of-concept" prototypes for each of the subsystems will be part of this development project.

PROJECT REQUIREMENTS: Each design team must:

1. Develop a design for one of the subsystems (STEP1, STEP2 or CLEANUP) of an AFC concept and document the design in the form of a detailed engineering proposal. The greatest measure of merit will be associated with meeting all project scheduling and cost goals and demonstrating a robust design. The design must be based upon sound engineering analysis and simulation of the system's performance and operation. The results of this project must be presented in a Critical Design Review and the performance of the prototype presented at a Summary Presentation at the completion of the project.
2. Fabricate a "proof-of-concept" prototype for the subsystem described by the proposal. The subsystem prototype must be capable of demonstrating fully autonomous operation. The prototype will also be used to demonstrate the operation, durability, reparability, and portability of the proposed design.
3. Be prepared to demonstrate the operation of the subsystems and a complete AFC on or about Dec. 1, 2000.

4. Follow established procedures for collecting and reporting time spent on the project, maintain and return all issued equipment, follow safety guidelines and submit cost accounting records for the entire project.

SPECIAL CONSIDERATIONS AND SYSTEM PERFORMANCE REQUIREMENTS:

1. Each subsystem must be independently powered by electric or stored mechanical energy.
2. Each STEP1 subsystem must be compatible with each STEP2 and all possible combinations must be compatible with the CLEANUP subsystem and when combined they must operate as a fully autonomous AFC.
3. The raw bar material is nominally 2”x2”x24”.
4. The raw rod material is nominally 5/16” diameter by 24” long.
5. The pieces cut from the bar stock (BLOCKS) should be user selectable with the following sizes; 2”X2”X2”, 2”X2”X2.5”, 2”X2”x3” (i.e. 2”x2”xN”).
6. The pieces cut from the rod stock (RODS) should be user selectable with the following sizes; 2.5”, 3.0”, 3.5”.
7. The RODS should be force-fit into the BLOCKS such that the rod will not move under subsequent handling operations.
8. The RODS will be inserted into the BLOCKS such that the ROD is normal to a “2xN” face, centered between the two N-length edges and the centerline of the ROD is 1” from a 2” edge. One end of the ROD should be flush with one of the two the 2xN faces.
9. All dimensional tolerances should be less than +/- 0.05 inches.
10. CLEANUP should be able to separate machining process residue (cutting and drilling) from scrap material.
11. All combinations of STEP1, STEP2 and CLEANUP (i.e. the complete AFC) must fit within a space that is 3 feet deep, 5 feet wide and 2 feet high. This volume must include all raw material queues and waste/scrap material storage.
12. Waste material handling must be completely automated. Scrap material should be loaded in to a hopper that will be manually removed from the AFC. Machine process residue should be loaded into a manually removable container of your choice. The system should be able to function for 30 minutes without the need for manual scrap or waste removal.
13. The complete AFC should be able to operate for 30 minutes without replacing any of the stored energy sources.
14. All electronic components (i.e. motors, servos, computers, wiring, circuit boards, etc.) must be able to be removed from and reinstalled into the individual prototype subsystem in 20 minutes by one person with manual hand tools only.

SPECIAL CONSIDERATIONS FOR THE PROTOTYPE AND PROOF-OF-CONCEPT DEMONSTRATION

The prototype system for the proof-of-concept demonstration should satisfy the following:

1. 1.Total project costs cannot exceed $300. - The total cost includes the $200 provided by ME470, Inc. and up to $100 that can be collected from the design team. The total cost includes all out-sourced parts, raw materials, tools, administrative costs (copying, viewgraphs, etc.) and expendable supplies (glue, wire, etc.).
2. Component parts can be either fabricated in-house or purchased from outside vendors (out-sourced). All out-sourced parts must be accounted for in the overall cost at their full retail value. Groups cannot “out-source” fabrication processes.
3. All “in-house” parts must be fabricated by the design team using the facilities provided in B19, Fitzpatrick Hall.
4. Any "moving parts" must be protected from inadvertent contact with the operator. Any moving blades must be shielded for safety.
5. The completed prototype and all “scrap” materials are the property of the AME department.
6. Any prototype parts made from wood must be sanded, sealed, primed and painted.
7. No steel or any other metal “harder” than aluminum can be used on the prototype without explicit written approval of the management team.
8. All "components" provided by management must be able to be removed using simple hand tools and must in to way alter the operation or characteristics of the components.