Purpose-

The Materials Research Laboratory houses mechanical load frames for the study of fatigue and fracture behavior of materials and the examination of component behavior under cyclic and monotonic loading for multiple programs and organizations across the center. The Durability, Damage Tolerance and Reliability Branch is continuing to upgrade the infrastructure and increase testing capacity where needed, specifically for the Advanced Composites Program. Currently, cyclic testing of smaller metallic and composite specimens has used all of our smaller test frames, requiring us to use larger test machines for these coupon-level specimens. Using these machines is less efficient and provides less reliable data at low loads. Future testing needs will require greater capacity of these small test stands than is currently available.

Two test-stand controllers are required that would specialize in low-load high-rate fatigue testing for work that is currently slated for testing in the lab. The controllers would be installed in the long-duration testing area of the facility that would allow almost continuous testing.

Item 1 –Two (2) controllers are required for use with existing test stands. It is desirable for each controller to have the capacity to control two channels (actuators) or test stands simultaneously. The price to upgrade these controllers to handle two stands is included as an option in the quotes.

The controllers shall meet or exceed these minimum requirements.

(A) Have a chassis that allows control and command generation including these abilities:

- Allow a minimum of 3 conditioned control channels per actuator. (ie. Load, Stroke, and Strain)
- Allow automatic (smooth or bumpless) control mode switching between all three possible control modes.
- Have a minimum of 1 Analog input (+/- 10 Volt and 16 bit min A/D) for Data Acquisition or provide an external command signal. Have the ability to add more analog input channels in the future if needed.
- Have a minimum of 2 Analog (+/- 10 Volt) outputs (ie. Load, Stroke and Strain). Have the ability to add more analog output channels in the future if needed. Have digital I/O for test control and automation.
- Internal function generation that allows combinations of ramps and wave forms. (sine, triangle, square, and user defined)
- Command signal compensation to ensure required loads. Compensation shall include a null-pacing for spectrum type loading and a peek valley compensator for cyclic Loading.
- Digital I/O to handle the interlock chain and E-stop of test stands.
- Output to control Hydraulic Service Manifold.
- Output to support single or dual servo valves.
- Show ability to operate with existing automated fatigue crack growth testing hardware provided by Fracture Technology Associates (FTA) inc.
- A handset or equivalent shall be provided to adjust actuators and to start and stop tests while working at the stand.

(B) A minimum of two (2) Transducer conditioners to for installation in the controller to operate one of the 3 kip single actuator servo-hydraulic test stands. The controller shall be provided with conditioners for load and stroke. One conditioner shall be used to condition strain gage based load transducers. One conditioner shall be used to condition LVDT signals for position control.

- Provide a 0-20 volt excitation signal for strain gage based transducers. (up to +/-10 Volts)
- Allow computer or controller selection of range, zero, excitation and filter options.
- Allow multiple ranges or a multi-linear (gain-linearization) calibration to allow ASTM calibration from 2% to 100% of the transducer full-scale value.

(C) Allow networking to a PC for Data Acquisition and control with the following options:

1. Software to allow reconfiguring, set-up of each controller, and basic operation remotely. (Including compensation methods mentioned above.)
2. Software to perform data acquisition (timed, peak/valley, level crossing), function generation, monitoring and control.

(D) Software to perform the following functions:

- Allow a basic interface for reconfiguration of controller, set-up simple tests and, remote operation. (Including compensation methods mentioned above.)
- Perform integrated data acquisition (timed, peak/valley, level crossing), function generation, monitoring, and control, and basic digital I/O to allow sensing of events and basic triggering.

Item 2 - Installation and verification of controllers.
The contractor shall provide installation of two (2) controllers to existing test stands in building 1205 and verify proper operation of the test stand and controller. Proof of operation shall be conducted on existing static and fatigue specimens provided by the government. If necessary, the contractor shall provide cabling to integrate controllers with test stands, including: connections to Load Cell, LVDT, Hydraulic service manifold, servo valves, pump, interlock chain and E-stop buttons. Cabling will be at least 20 ft in length.

Item 3 Calibration of test stand and controllers.
The contractor shall provide calibration for all controllers. Calibrations shall be completed to the accuracy specified in Langley's current Langley Management System (LMS) procedure. Calibration shall be conducted using National Institute of Standards and Technology (NIST) traceable standards (of appropriate range) for load and displacement. Calibration shall be provided from 10%, 50% and 100% rages for all transducers if the system uses multiple ranges or shall include calibration points between 2% and100% with a single range calibration.

Item 4 Familiarization with operations.
If necessary at the time of installation, the contractor shall provide training on basic operation of the controllers and the computer software used for remote operation.