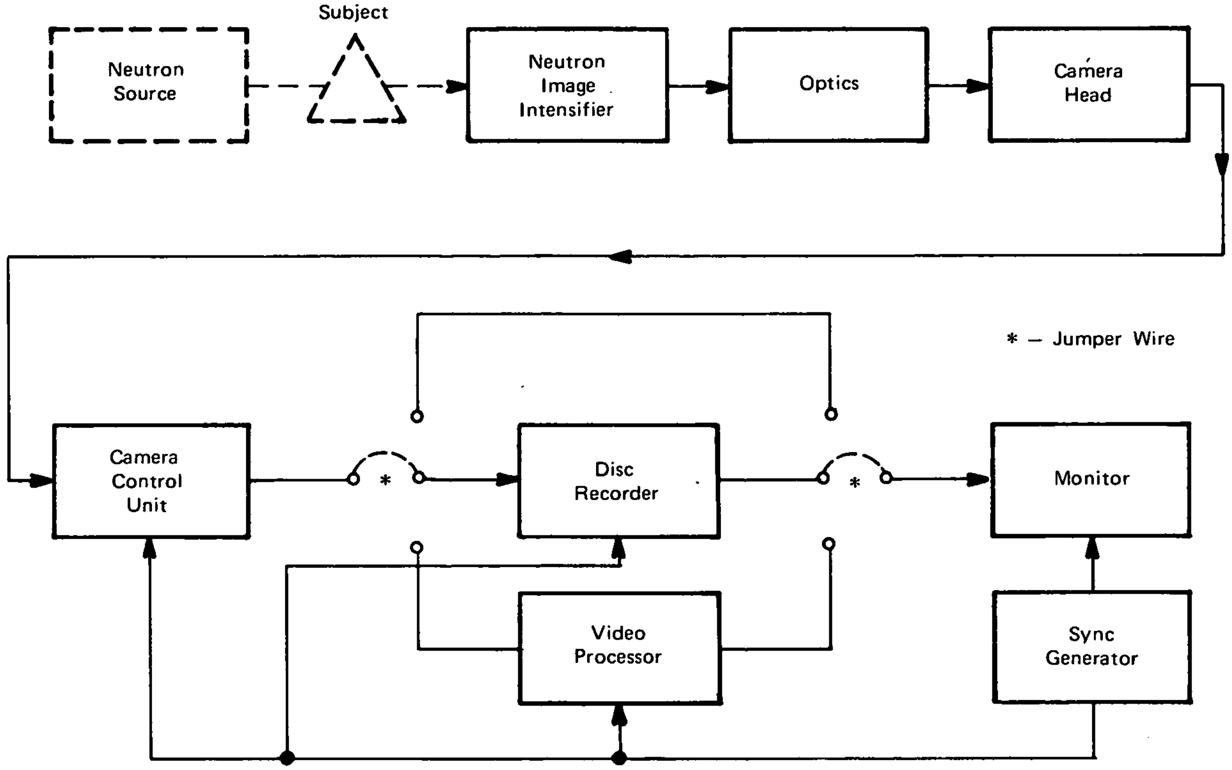
NASA TECH BRIEF

Marshall Space Flight Center

Neutron Radiographic Viewing System



Neutron Radiographic Viewing System

Although commercial neutron radiographic services are available, they are generally associated with a nuclear reactor and require that the specimen be brought to the reactor. Almost all neutron radiographs made in the past (and currently) were made by a conversion screen technique. A special conversion screen is made radioactive either by bombardment with thermal neutrons, or by a direct conversion technique wherein the thermal neutrons are converted into some other form of radiation such as light or electrons and then are used to activate photographic film. Besides the problem of cost, these techniques are time-consuming and usually require a large reactor source if the radiograph is to be made in less than one hour.

A neutron radiographic viewing system (see figure), has been designed for use in nondestructive testing applications. It consists of two sections, a camera head and a control processor. The camera head, located in the test cell, consists of a neutron-sensitive image intensifier system, a power supply, and a SEC vidicon camera head. Both systems, with their optics, are housed on a test mount. The control/processing section is mounted in a rack capable of being located at least 23 m (75 ft) from the test cell. This rack contains a power supply, sync

(continued overleaf)

generator and test signal generator chassis, TV monitor, video processor, and video disc recording system. External to this rack is a remote control box used to optimize the performance of the neutron image intensifier tube.

Neither the thermal neutron source nor the specimen is supplied with this system. The remaining equipment is located either in the camera head section or in the control rack section. The neutron image intensifier tube converts the neutron flux into light scintillations with considerable light gain compared with a conversion screen. The light coming from the output screen of the image intensifier tube passes through optics to the SEC vidicon camera tube which stores the light intensity of each scintillation over an operator-controlled period varying from 1/30 of a second up to several hours. The video output of the SEC vidicon is, at the operator's discretion, sent over a 23-meter isolation cable to the SEC vidicon camera control unit. A second cable, connected to a bias control box from the neutron image intensifier tube, allows the operator to remotely peak the performance of the neutron image intensifier tube. A higher voltage power supply for the neutron image intensifier tube is located in the camera head section of the system.

The video signal emanating from the SEC vidicon camera head is amplified, processed, and mixed with a sync signal from the sync and control circuits in the camera control unit. The outputs, located in the remote control rack of the camera control unit, are in the form of a composite video signal and a readout control signal. The sync and control circuits provide those signals required to insure proper operation and synchronization of the total system. The sync is normally obtained from stable, crystal-controlled oscillator circuits. Under some forms of alternate usage, a line sync can also be obtained from this equipment.

The purpose of the video disc recorder is to provide a nondestructive readout storage for the neutron image stored on the SEC vidicon. Since the total readout signal from the SEC vidicon is only one television frame for a period of approximately 1/30 second, a continual replay of this single frame is essential to allow visual observation of the neutron image. The output of the video disc recorder is a composite video signal which is sent to the video processor. The video processor allows the operator to expand the grey scale range over a selectable portion of the raster. The processing of the video in this manner may allow increased ease in the investigation of the neutron radiograph. The output is sent to a standard 525-line 17 inch TV monitor.

Notes:

1. Information concerning this innovation may be of interest to the medical field.
2. Requests for further information may be directed to:
   Technology Utilization Officer
   Code A&TS-TU
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B72-10468

Patent status:

No patent action is contemplated by NASA.

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