self-**directed**
LEARNING

essential**education**

Fluoroscopy:
Mobile Unit Operation and Safety

asrt
American Society of Radiologic Technologists

Fluoroscopy: Mobile Unit Operation and Safety

Chris Young, BS, R.R.A., R.T.(R)

Fluoroscopy is a branch of radiology that allows physicians to see dynamic processes. Mobile fluoroscopic units, commonly referred to as "C-arms," help make fluoroscopy available throughout a medical facility. To successfully operate this equipment in a variety of situations, the radiologic technologist or radiologist assistant must have in-depth knowledge of mobile fluoroscopy equipment.

This article discusses components that are common to most mobile fluoroscopy units. The operation of these units involves understanding specifics about the source, detector, optics and indicator systems. In addition, operators should be familiar with features of mobile fluoroscopy equipment that limit radiation exposure to patients and clinical personnel.

After completing this article, readers should be able to:

- Describe the various components of a mobile fluoroscopic unit.
- Summarize the physical properties of mobile fluoroscopy image production and display.
- Position the mobile fluoroscopic unit to limit radiation exposure to the patient and medical staff.
- Discuss dose limits and radiation safety concepts related to mobile fluoroscopy imaging.

Conventional radiography provides remarkable diagnostic information on static anatomy. However, if used to demonstrate a dynamic process, standard radiography produces a blurry image with motion artifact. Fluoroscopy provides real-time visualization of dynamic processes. The first recorded fluoroscopic procedure was performed with a cardboard box fluoroscope invented by Wilhelm Conrad Roentgen in 1895. Thomas Edison then developed conventional fluoroscopy in 1896, using a newer type of fluorescent screen. In 1937 Irving Langmuir was awarded the first patent for a fluoroscopic image intensifier. This initial design did not provide enough image intensification for clinical use and was modified by JW Coltman in 1948. Coltman's modifications resulted in a brightness gain of more than 1,000.

The first commercial image intensifier was produced by Westinghouse in 1953.[1] The addition of the image intensifier to the fluoroscope paved the way for the widespread use of fluoroscopy. The image intensifier allowed the operator to perform the procedures with photopic vision and decreased the amount of radiation exposure necessary to produce a diagnostic image. In 1955 the medical C-arm, which consisted of an image source and image receptor, was introduced.[2]

As fluoroscopy utilization increased, so did the desire and necessity to use the technology in areas of the hospital other than the radiology department, for example, in the surgical suite. In its company medical history, OEC Medical Systems Inc states that "… in the early 1970s, OEC introduced the first real-time [mobile] fluoroscopic imaging equipment in the United States … ."[3] The use of mobile fluoroscopy became popular in the early 1980s when mobile C-arms were used in the operating suite for select orthopedic procedures.[4] Mobile C-arms are used today throughout the world in a variety of settings, such as hospital operating suites or outpatient clinics, to provide fluoroscopic guidance during orthopedic, neurologic, endovascular, urologic, neurovascular, spinal and cardiac procedures.[2] In addition, mobile fluoroscopy equipment can be operated by a variety of professionals, including radiologist assistants (RAs) and radiologic technologists.

Fig. 1. *A typical mobile C-arm unit in the clinical setting.*

Mobile Fluoroscopy Units

Each mobile fluoroscopic assembly is made up of several components, including a control panel, C-arm and monitor. Typically, the mobile fluoroscopic unit consists of 2 separate pieces: a C-arm and a control panel with monitors (see Figures 1-3). The operator inputs patient information and alters imaging factors that affect C-arm function at the control panel. Some smaller C-arm systems, such as those used in orthopedic distal extremity cases, may consist of only 1 unit. These units are designed so that a small C-arm attaches to the control panel and monitor assembly. The 2 components communicate with one another via a cable that connects the C-arm to the control panel and monitors.

Control Panel

Control panels are located on both the monitor assembly and the C-arm to facilitate positioning the mobile fluoroscopy unit. Although control panel layout may vary by manufacturer, each control panel performs the same basic functions. For example, equipment manufactured by GE Healthcare (Waukesha, Wisconsin) organizes the C-arm control panel into 5 main categories: orientation, collimation, contrast, generator and workstation.

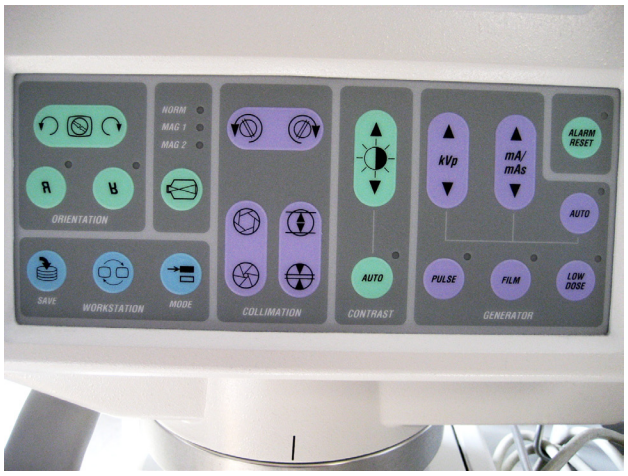

Fig. 2. *Above. Mobile fluoroscopy control panel. This control panel is separated into 5 different categories: orientation, collimation, contrast, generator and workstation.*

Fig. 3. *Right. The monitor displays the images produced by the mobile fluoroscopy unit.*

The operator can manipulate image orientation by rotating the image or altering the position in which the image is displayed on the monitor. The image may be rotated clockwise or counterclockwise by pushing the buttons with an open-circle arrow. Image display position may be altered by pushing the buttons that display "R" in various positions. Manipulating image orientation is useful because patient position varies. By manipulating image orientation, the operator can ensure