



# Mac-Lab/CardioLab to GE X-Ray Interface Overview and System Configuration

Mac-Lab/CardioLab Version 6.9.5

## Introduction

## Document Use

This document provides an overview of the Mac-Lab/CardioLab to GE X-Ray interface and explains how to configure the interface.

## Revision History

Revision	Date	Comments
A	15 August 2012	Internal release.
B	22 August 2012	Initial public release.

## Overview of Modality Worklist and Exam Data Export Interface

The bi-directional interface between the Mac-Lab/CardioLab Acquisition system and the Innova system uses the Modality Worklist (MWL) and the MPPS or Exam Data Export interface functions. Demographic information is queried from the Mac-Lab/CardioLab system to the X-Ray system prior to the examination using Modality Worklist, while X-Ray information is sent to the Mac-Lab/CardioLab system once the examination is completed using MPPS or Exam Data Export.

## Benefits

The customer benefits of a bi-directional interface are:

- Eliminate duplicate entry of patient demographics to reduce the likelihood of manual data entry errors and increase staff efficiency.
- Allows the Mac-Lab/CardioLab and X-Ray system to share a unique patient identifier to avoid patient mismatches.
- Provides comprehensive X-Ray documentation within the Mac-Lab/CardioLab system automatically. X-Ray information is saved as part of the patient record and can be printed as part of the case report on the Mac-Lab/CardioLab system.

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## Configurations

### Network Configuration

The X-Ray system must be connected to the Mac-Lab/CardioLab system through the network via 100BaseT Ethernet (TCP/IP).

### Product Configurations

The X-Ray system must have the MWL and either the MPPS or Exam Data Export option to communicate bi-directionally with the Mac-Lab/CardioLab system.

#### Innova

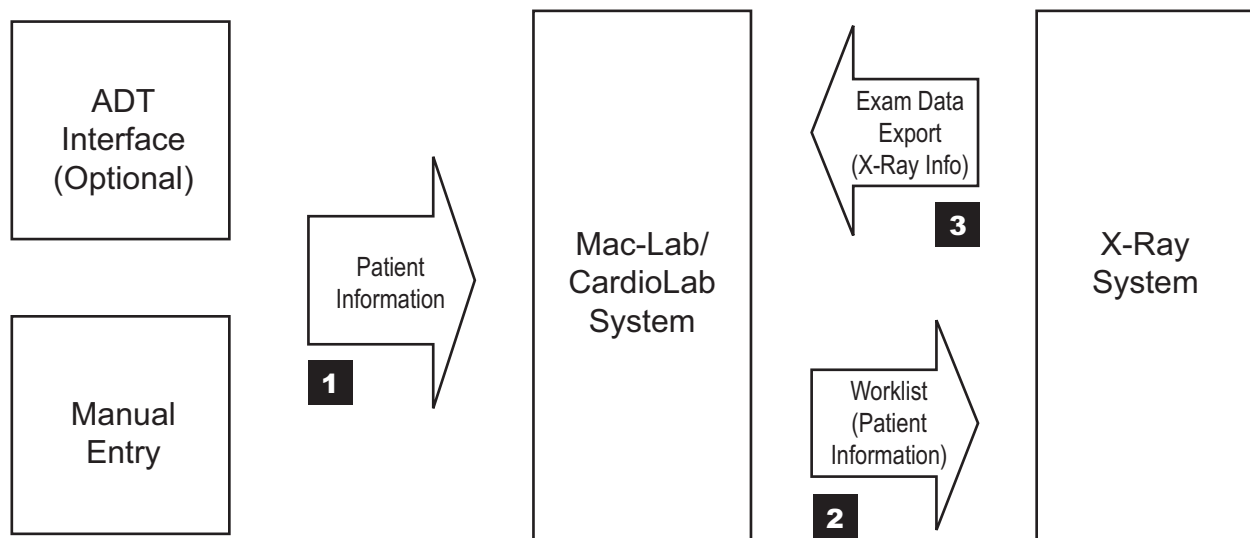
Innova System	Required Components
4100	Modality Worklist: All new systems ship with Modality Worklist Exam Data Export: Innova 4100 M4 release (for installed base and new systems)
3100	Modality Worklist: All new systems ship with Modality Worklist Exam Data Export: Innova 3100 M3 release (for installed base and new systems)
2000	Modality Worklist: <ul style="list-style-type: none"><li>■ Heroic2 M3 FMI 11491 (for installed base up to Q1 2003)</li><li>■ Modality Worklist Option part number S18721AW (for new systems)</li></ul> Exam Data Export: <ul style="list-style-type: none"><li>■ Heroic Service Pack FMI 11495 release (for installed base through 2003)</li><li>■ Heroic VCP M3 release (for new systems)</li></ul>

#### Mac-Lab/CardioLab

The GE X-Ray Interface Software Option is standard on all Mac-Lab/CardioLab v6.9.5 Acquisition systems.

### Interface Operation

The following block diagram shows the flow of information between the Mac-Lab/CardioLab and X-Ray systems.



Patient demographic information is entered directly into the Mac-Lab/CardioLab system either manually or imported via an optional ADT interface (1 on block diagram). On the Mac-Lab/CardioLab system, patient information is entered on the screen below.

The screenshot shows the **Patient Information** window with three tabs: **Case**, **Contact**, and **Worklist**. The **Case** tab is active, displaying the following fields:

- \*Last name: Smith
- \*First name: Jane
- \*Middle name: Jill
- \*MRN: 0043791825
- Study date: 04/01/2009 08:17:07 AM
- Study #: 0043791825S
- Account #: 0043791825A
- \*Date of birth: 07/22/1960 Jul 22, 1960
- Age: 51 Years
- Height: 5'09" ft 176 cm
- Weight: 128 lbs 58 kg
- BSA: 1.71 m² ☐ Manual edit
- \*Gender: Female
- \*Race: Caucasian
- ☐ Send exam start notification to X-ray system

Buttons for **OK** and **Cancel** are located at the bottom right.

The Mac-Lab/CardioLab operator enters patient data in the **Case**, **Contact** and **Worklist** tabs of the **Patient Information** window. Procedure information that is to be provided to the X-Ray system is entered on the **Worklist** tab. When this data entry is complete, the operator clicks **OK** to close the **Patient Information** window. Be sure to make all required changes to the **Patient Information** data before clicking **OK** to ensure that those changes are sent to the x-ray system.

**Patient Information**

Case Contact **Worklist**

**Requested Procedure**

Description:  Identifier:

**Scheduled Performing Physician**

First name:  Last name:

**Referring Physician**

First name:  Last name:

**Scheduled Procedure**

Description:  Identifier:

OK Cancel

The procedure information on the **Worklist** tab includes the **Requested Procedure**, **Scheduled Procedure**, **Scheduled Performing Physician** and **Referring Physician**. When a study is started using data from a Modality Worklist provider, these fields are pre-populated with the data from the provider. All of the **Requested Procedure** and **Scheduled Procedure** fields must be populated, and so each of these fields is given a default value as needed. All of these fields may be modified, except that if the study was started from a Modality Worklist provider, the two **Identifier** fields are fixed and cannot be changed.

The Mac-Lab/CardioLab exam is now ready to begin. At this moment, the Mac-Lab/CardioLab system becomes a “Modality Worklist Provider” and is ready to send the information of the active patient upon a Worklist Query from the X-Ray system.

On the X-Ray system, a “Worklist Query” to Mac-Lab/CardioLab system is performed to obtain the information of the active patient. The demographic information is automatically exported to the X-Ray system via the network connection.

The patient information from the Mac-Lab/CardioLab system is automatically populated in a new patient and exam on the X-Ray system (2 on block diagram).

The following patient and exam information is transferred from Mac-Lab/CardioLab system to the X-Ray system:

Innova Field	Mac-Lab/CardioLab Field	Mac-Lab/CardioLab 6.9.5
Patient ID#	MRN (Medical Record Number)	X
Patient First Name	First Name	X
Patient Last Name	Last Name	X
Patient Birthdate	Date of Birth	X
Patient Gender	Gender	X
Patient Height*	Height	X
Patient Weight*	Weight	X
Accession Number*	Accession Number	X
Physician Name*	Admitting Physician	
Exam Type*	Procedure Type	
Study ID Number*	Study Number	
	Home Phone	X
	Requested Procedure Description	X
	Requested Procedure Identifier	X
	Scheduled Performing Physician	X
	Referring Physician	X
	Scheduled Procedure Description	X
	Scheduled Procedure Identifier	X
* Fields manually editable at the Innova system.		
** Fields sent from the <b>Orders</b> window on the Mac-Lab/CardioLab system		

The exam on the X-Ray system is started manually by selecting the exam previously retrieved from the Mac-Lab/CardioLab system and pressing the **Start Exam** button. The exam started on the X-Ray system must always be the same exam that is active on the Mac-Lab/CardioLab system. If a different exam is started, the exam data export will fail.

The patient remains active on Mac-Lab/CardioLab throughout the examination. Any changes made to the Mac-Lab/CardioLab patient demographics during the examination will not update the X-Ray patient information.

The fluoro time and the dose information of the X-Ray acquisitions performed on the X-Ray system are stored in the X-Ray database along with the exam information. The dose information is characterized by the Total Dose and the Total/Fluoro/Record Dose Area Product (DAP).

This information is displayed on the Exam Browser at the end of the exam. After each record acquisition (Cine run) performed on the X-Ray system, the run information is stored in the X-Ray database along with the exam information, and displayed on the X-Ray Sequence Browser.

After closing the X-Ray exam by pressing **End Exam**, the information of the exam is sent automatically to the Mac-Lab/CardioLab system (3 on block diagram). It is displayed on the **Radiology** window, in the **Study** menu.

The X-Ray information passed from the X-Ray system to Mac-Lab/CardioLab includes the following fields. Abbreviations used in the **Radiology** dialog window are shown in brackets.

X-Ray Parameter	Mac-Lab/CardioLab 6.9.5
Exam Fluoro DAP* (cGycm <sup>2</sup> )	X
Exam Total DAP* (cGycm <sup>2</sup> )	X
Exam Cine DAP* (cGycm <sup>2</sup> )	X
Total Runs	X
Total Fluoro Time (minutes)	X
Run time [Time]	X
Run number [Run]	X
Plane [PL] or [Plane]	X
Angulation [ANG] or [RAO/LAO]	X
Rotation [ROT] or [CRA/CAU]	X
Number of frames [Frames]	X
Frames per second [FPS]	X
Kilo-volts [kV]	X
Milliamps [mA]	X
Milliseconds [mS]	X
Focal Distance [SID (cm)]	X
Image Intensifier mode [FOV (cm)]	X
*DAP = Dose Area Product	

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## Worklist Limitations

- The **Admitting Physician**, **Reading Physician**, **Referring Physician** and **Operator Name** fields are not filled by the Mac-Lab/CardioLab system.
- The Mac-Lab/CardioLab system uses default values for the Requested Procedure Description, Requested Procedure Identifier, Scheduled Procedure Description and Scheduled Procedure Identifier. To send different values for these fields to the X-Ray system, enter those values into the **Worklist** tab of the **Patient Information** window before retrieving the worklist on the X-Ray system.

## Exam Data Export Limitations

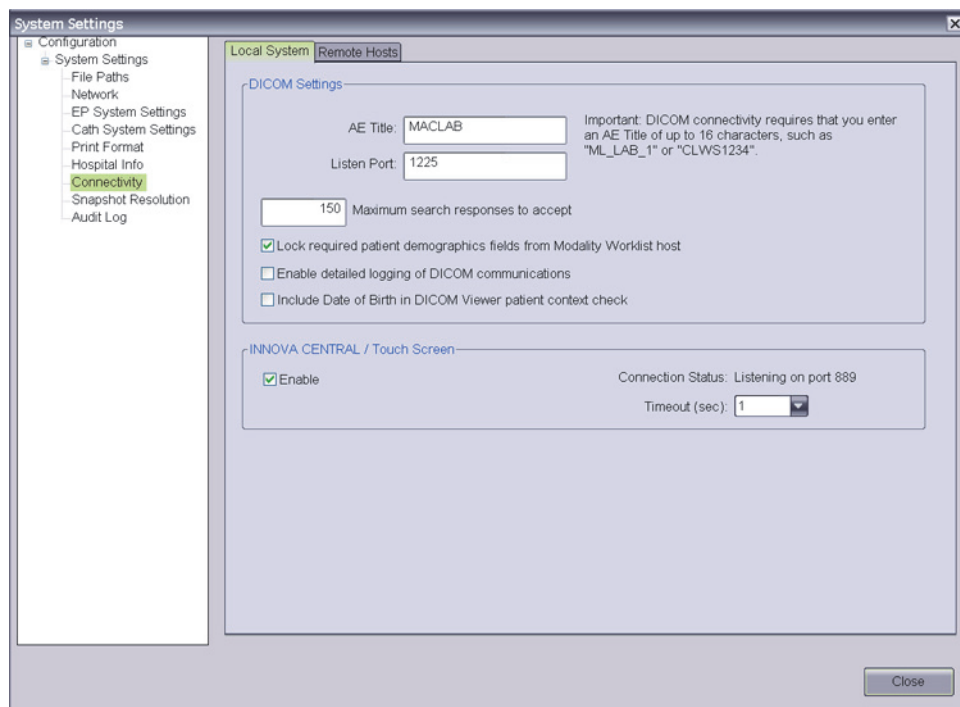
- The Cine Frames field in the **Radiology** Window of Mac-Lab/CardioLab system does not get auto-populated from the Innova. It displays as a blank but is editable.
- The Milliamps (MA) field may not be populated by Innova in some of the Innova2000 versions, and shows up as "0" on the Mac-Lab/CardioLab system **Radiology** Window.
- The dose information sent from Innova is estimated from the X-Ray acquisition parameters. The estimation model is accurate at  $\pm 30\%$ .
- The angles are displayed as signed in the Mac-Lab/CardioLab system, while in Innova they are always positive and followed by the indication of LAO, RAO or CRA, CAU. In the Mac-Lab/CardioLab system, LAO and CRA angles are displayed as positive values, while RAO and CAU angles are displayed as negative values. For example, if the primary angle is displayed in Innova as 30 RAO, it is displayed in Mac-Lab/CardioLab as -30.
- If there is a Dose Measurement Device connected to Innova, the display and storage of the estimated dose may be disabled and the dose data will not be sent to the Mac-Lab/CardioLab system.
- If some sequences are deleted on the Innova system before the end of the examination (that is, before pressing the **End Exam** button), the information related to the deleted sequences will not be transferred to the Mac-Lab/CardioLab system. However:
  - ◆ The number of Total Runs will contain all the runs acquired during the examination, including the deleted runs.
  - ◆ The Cine Dose and Total Dose information will contain the dose delivered during the examination, including the dose of the deleted sequences.

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# Procedures

## Configure Mac-Lab/CardioLab System

1. Log on to the Acquisition system as an Administrator.
  - a. Press **Ctrl + Action + Del** and click **Log Off**.
  - b. Click **OK** at the log off message and immediately hold down the **Shift** key to stop the auto-logon sequence.
  - c. Log on to the Windows XP operating system as **mlcltechuser**.
  - d. Log on to the Mac-Lab/CardioLab Custom shell as **mlcltechuser**.
2. Double-click **Mac-Lab CardioLab** on the desktop to launch the Mac-Lab/CardioLab application.
3. Select **System Settings** from the **Administration** menu.
4. Click **Connectivity** in the **System Settings** window. The following window is displayed:



5. On the **Local System** tab, enter the following settings:

**DICOM settings:** These settings are for this Mac-Lab/CardioLab system.

- **AE Title:** The DICOM name for the Mac-Lab/CardioLab system. An AE Title may only contain letters, numbers and the underscore character, and must be 16 characters or less.

**NOTE:** AE Titles are case sensitive.



- **Listen Port:** This is the port number that the Mac-Lab/CardioLab system listens for connections from the X-Ray system. The default is 1225, and should not be changed.
6. Select the **Remote Hosts** tab.

The screenshot shows the 'System Settings' dialog box with the 'Remote Hosts' tab selected. The left sidebar lists various configuration categories, with 'Connectivity' highlighted. The main area is divided into four sections: 'X-Ray System Settings', 'Ultrasound System Settings', 'Modality Worklist Host', and 'MPPS Host'. Each section contains fields for 'AE Title', 'Hostname or IP Address', 'Port Number', and 'Text Encoding'. The 'X-Ray System Settings' section also includes checkboxes for 'Automatic Exam Start' and 'Append Mode'. The 'Modality' field for X-Ray is set to 'XA', and for Ultrasound, it is set to 'US'. The 'Text Encoding' for all sections is set to 'Latin-1 (ISO-IR 100)'. A 'Close' button is located at the bottom right of the dialog.

7. On the **Remote Hosts** tab, enter the following settings:

**X-Ray System Settings:** These settings apply to the GE X-Ray system.

- **AE Title:** The DICOM name for the X-Ray system. This is found in the X-Ray system's configuration settings (the default is "TERRA" for the Innova system).
- **Hostname or IP Address:** This is the network name or IP address of the X-Ray system.
- **Port Number:** This is the port number on which the X-Ray system listens for connections from the Mac-Lab/CardioLab system.
- **Modality:** This is the imaging system's modality. The default is XA, and should not be changed.
- **Text Encoding:** This is how text sent to the X-Ray system is coded. The default is Latin-1, and should not be changed.
- **Automatic Exam Start:** Check this option only if the x-ray system supports the Automatic Exam Start feature and you want Mac-Lab/CardioLab to trigger the automatic start of the x-ray exam when starting a new Mac-Lab/CardioLab study.
- **Append Mode:** When this option is unchecked, the Mac-Lab/CardioLab system will discard and replace previously received dosage and run information when new dosage and run information is received. When this option is checked, the Mac-Lab/CardioLab system will add to any previously received dosage and run information when new dosage and run information is received. If the Mac-Lab/CardioLab system will connect to an Innova system with the "MPPS" feature, this option should be checked. For any other X-ray system, including an Innova with the "Exam Data Export" feature, the option should not be checked.

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**NOTE:** *Ultrasound System Settings*, *Modality Worklist Host* and *MPPS Host* settings refer to other systems and do not need to be modified for the GE X-Ray interface configuration.

8. Click **Close** to save the new settings.
9. Restart the Mac-Lab/CardioLab system to initialize the system with the new configuration.
10. Allow the system to auto log on to the Windows XP operating system. At the Mac-Lab/CardioLab custom shell, log on as **mlcluser**.

## Configure the Innova X-Ray System

This setup procedure applies to the Innova 2000/3100/4100 DL.

1. Log on to the DL box using **Dlservice** account. If necessary:
  - a. Select **Start > Shutdown**.
  - b. Select **Close all programs and log on as a different user** and click **Yes**.
  - c. Hold down the **Shift** key to stop the auto logon process.
  - d. Log on as **Dlservice** (password **HEROIC**), at the windows logon screen.
2. Right-click **Network Neighborhood** and select **Properties**.
3. Record the computer name at the Identification tab.
4. Highlight **TCP/IP** and select **Properties** from the **Protocols** tab.
5. Select **adapter #2** in the adapter drop-down box.
6. Record the X-Ray system IP information.
7. Click **OK** to the **Microsoft TCP/IP Properties** window.
8. Click **OK** to the **Network Properties** window.
9. Log off and log on to Windows as **DL** (password **innova**).  
Wait until the application has fully loaded.
10. Click **Service** and select **Service** from the list in the main application screen.



12. If the system is an Innova 2000, click **System > Options** from the left pane and check the **Worklist Option** check box from the list.

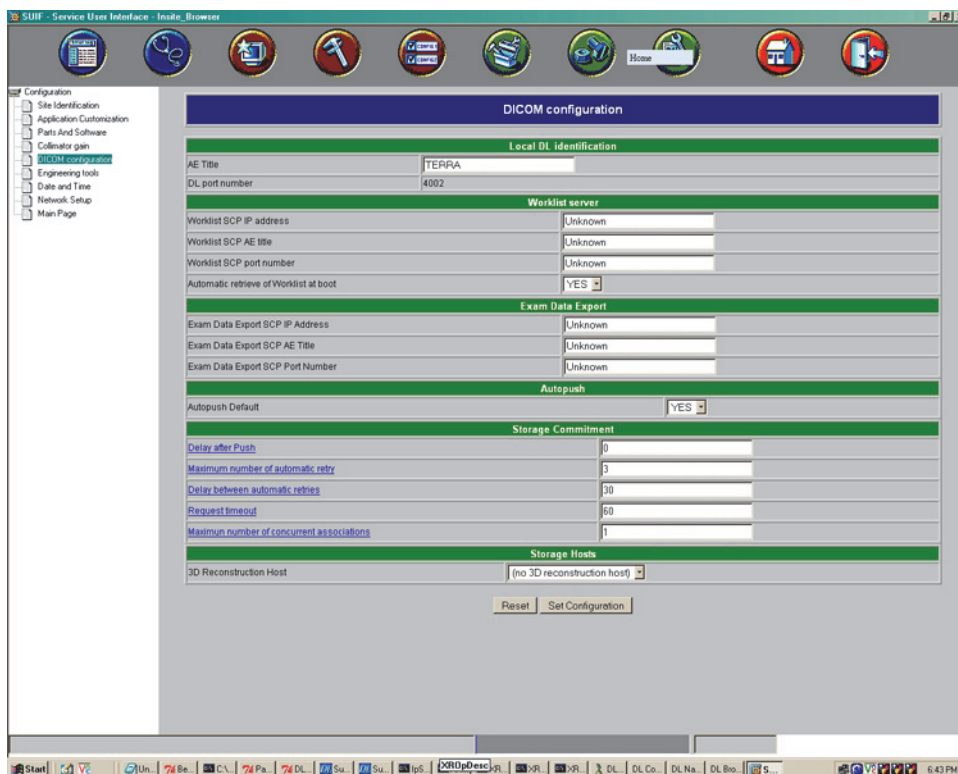


13. Select **DICOM Configuration** from the list on the left.

**NOTE:** If the system is an Innova 2000 Pre SVC Pack, the following screen will be displayed:  
**Exam Data Export not enabled** (below).



**NOTE:** All other systems will display a screen similar to the *Exam Data Export enabled* screen (below).



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14. Record the system's AE title and port number as listed under Local DL Identification.
  15. Record the following under the **Worklist server**:
    - Select **TRUE** from the list in the **Enable worklist** field.
    - Enter the Mac-Lab/CardioLab system IP address in the **Worklist SCP IP address** field.
    - Enter the Mac-Lab/CardioLab system **AE Title** in the **Worklist SCP AE Title** field.
    - Enter the Mac-Lab/CardioLab listening port (1225) in the **Worklist SCP port number** field.
    - Select **YES** from the list in the **Automatic retrieve of Worklist at boot**.
  16. Enter the following in the Exam Data Export section:
    - Select **TRUE** from the list in the **Enable Exam Data Export** field.
    - Enter the Mac-Lab/CardioLab system IP address in the **Exam Data Export SCP IP address** field.
    - Enter the Mac-Lab/CardioLab system **AE Title** in the **Exam Data Export SCP AE Title** field.
    - Enter the Mac-Lab/CardioLab listening port (1225) in the **Exam Data Export SCP port number** field.
  17. Click **Set Configuration** when complete.
  18. Click **Exit**.
  19. Restart the Innova system.

The system will reboot, auto-logon, and begin loading the application. Wait until the application is fully loaded.

## Interface Testing

### Enter Patient Information on the Mac-Lab/CardioLab system

1. At the Mac-Lab/CardioLab system, double-click **Mac-Lab CardioLab** to launch the application.
2. Click **New Study** to open a Mac-Lab or CardioLab study (either may be selected).
3. Enter the appropriate patient demographic information, then click **OK** to close the **Patient Information** window

To also transfer the Accession Number data, enter this data into the **Orders** dialog (under the **Study** menu).

### Test with the X-Ray System

#### Innova DL

1. The main window displays a Patient Browser window and a Worklist browser window.

The screenshot displays the Mac-Lab/CardioLab software interface. At the top, there are tabs for 'Patients', 'Exams', 'Sequences', 'Photos', and 'Net'. The 'Patients' tab is active, showing the 'PATIENT BROWSER' window. This window contains a table with columns: Name, Identification #, Date of Birth, Sex, and Status. Two patients are listed: 'LUCAS, BILLY' with ID 123 and birth date 14-Feb-1980, and 'SANDERSON, SHELLY' with ID 123 and birth date 02-Feb-1982. To the right of the table are buttons for 'New Patient', 'New Exam', 'Delete', 'Info', 'Network', 'Refresh', 'Settings / Search', and 'Add to Database'. Below the 'PATIENT BROWSER' is the 'WORKLIST BROWSER' window, which has a similar table structure with columns for Patient Name, Identification #, Date of Birth, Sex, Accession Number, and Date & Time. At the bottom of the interface, a status bar shows 'Last query returned no match.' and 'Send To: AW1406E'.

Name	Identification #	Date of Birth	Sex	Status
LUCAS, BILLY	123	14-Feb-1980	M	
SANDERSON, SHELLY	123	02-Feb-1982		

Patient Name	Identification #	Date of Birth	Sex	Accession Number	Date & Time
Req. Proc. Description	Req. Proc. ID	Proc. Step Description			

Last query returned no match.  
Send To: AW1406E

2. Click **Settings/Search**.

The screenshot shows the 'Define Worklist Settings' window. At the top, there are tabs: 'Patients', 'Exams', 'Sequences', 'Photos', and 'Net'. The 'Patients' tab is selected. Below the tabs, the title 'Define Worklist Settings' is displayed. The main area contains three sections: 1. 'MODALITY WORKLIST' with two checkboxes: 'This room' (checked) and 'This modality' (checked). 2. 'DATE' with three radio buttons: 'Today' (selected), 'Tomorrow', and 'Any date'. Below these are two input fields for 'From (dd-mm-yyyy)' and 'To'. 3. 'PATIENT SEARCH' with four input fields: 'Patient Last Name', 'Patient First Name', 'Patient Identification', 'Accession Number', and 'Req. Proc. ID'. A 'Clear' button is located to the right of the search fields. At the bottom of the window are three buttons: 'Refresh Now', 'Apply', and 'Cancel'.

3. In the **Modality Worklist** section, verify both the **This room** and **This modality** checkboxes are checked.
4. Verify that **Today** is selected in the **Date** field.
5. Click **Refresh Now**. The patient will be listed in the **Worklist** Browser.
6. With the patient selected, click **Add to Database**.
7. Click Start Exam at the **Patient Information** window.
8. Acquire X-Ray images (create a fluoro sequence).
9. Click **End Exam**.

**NOTE:** Always close the study on the X-Ray system before closing the study on the Mac-Lab/ CardioLab system so the run information can be transferred.

MPPS information should now be populated into the Mac-Lab/CardioLab study. At the Mac-Lab/CardioLab system, verify that the data from the X-Ray system is transferred by opening the **Radiology** dialog under the **Study** menu and clicking **Refresh**.

This information can also be included in the Mac-Lab/CardioLab report by adding the "X-Ray Run Information" section to the report format. Refer to the Mac-Lab/SpecialsLab Operator's Manual (PN 2063076-001) or the CardioLab Operator's Manual (PN 2063076-002) for additional information on Report Formats.

10. Close the study on the Mac-Lab/CardioLab system.