Abstract
One of The Aerospace corporation’s responsibilities for the United States Air Force (USAF) is to provide independent launch readiness and assessment. SpaceTEC Telemetry Acquisition and Reporting System (STARS) is comprised of multiple tools and applications to assist engineers in providing reliable, timely and accurate assessment. JavaSTARS is an application that is used in the STARS User Room (SUR). It was designed and developed by The Aerospace Corporation. JavaSTARS is used for telemetry monitoring. It provides multiple graphical components to display real time data (dial chart, bar chart, trend plot, and alphanumeric readout), and allows easy development of desired displays. The Senior Design Project participants will design and develop schematics display capability for the JavaSTARS application. These schematics will graphically illustrate and animate the physical objects such as liquid propellant tanks, valves, pipes and other physical mechanisms to indicate their state or function.

Background
JavaSTARS is being extensively used at The Aerospace Corporation to support all USAF and commercial Satellite launches. It acquires real-time space launch vehicle data from the Data Reduction Center (DRC) and provides multiple display options for the user. Multiple display options (chart types) have been developed. Each chart type in JavaSTARS can be looked at as a module of the overall software system. The different chart types can be used to show telemetry in different styles to give the user the freedom to choose the right type of chart for each sensor. One of the major additions to JavaSTARS that has been requested is to provide users with a “schematics view” chart type. This chart type will allow users to be able to display sensors graphically and provide a “bigger picture” of how those sensors are connected together to form the subsystem of the physical launch vehicle.

Project Objectives
Design, develop and demonstrate an application that displays and gives the user the ability to manipulate objects that are common in the space launch vehicles such as tanks, valves, and pipes (an extended list will be provided). The users shall be able to import an image of a schematic on display and overlay the desired objects on the image. The user shall also have the option to resize the object, move the object anywhere on the display, specify text to indicate state and change the colors of the object.

Current Status
The project currently meets all objectives stated above:
• Incorporated schematics display capability into existing JavaSTARS application.
• Can import schematic images
• Representations of physical objects have been created for pipe, pump, tank and valve
• Object information is defined in its Properties window
• User can right click on the object to move it or left click to resize it.
• Animation of the object is accomplished by dragging real time data from the Measurands tree in the JavaSTARS window (shown above) onto the object.
• The state of the object is defined in the properties for the measurand which is accessed by selecting Charts/the object/the measurand then select the Limits tab

The project currently exceeds the objectives:
• Tool tips are displayed for each measurand contained in the object by hovering mouse over the object
• All objects can be selected (indicated by magenta dashed line) by pressing ctrl + left mouse button to move or resize the entire group.
• Pipe and Tank objects can be rotated
• Valves can be snapped together

Future Objectives
• All widgets animated based on their associated measurands
• Ability to rotate all widgets
• Widget color changes based on its measurand limits for all widgets
• Provide users the capability to remove an imported image of a schematic from the modeling window (JavaSTARS Display)
• Providing the capability to connect widgets and display connecting points on widgets within range of each other.
• Tank widgets shall display 2 or fewer measurands actually filling the tank. More than 2 measurands shall display in a rectangle on top of the tank.
• Pipe widgets shall display flow rate
• All widgets shall generate a text field chart for each of its measurands and a line connecting them to the widget
• A bug-free schematics display application
• User Manual tested by someone unfamiliar with JavaSTARS
• Test Procedure documentation tested by someone unfamiliar with JavaSTARS
• A generic schematic model that tracks all widgets based on assertions built by the user (i.e.: If pipe measurand is changing value then connected tank measurand should also be changing value.)
• Grouping functionality for all chart types (dial, bar, slider, text, etc.).
• Multiple permutations of widget types (pipe, pump, tank and valve).