User Guide for MORSEStation Range Operations Simulation

1 The MORSEStation Scenario and Mission

In sixteen hours (sixteen real minutes), NASA will launch a spacecraft. As a member of a team of three humans and MorseStation interfaces under the MORSE Command, you will monitor a station and coordinate with the other members of your team in order to ensure the safety of the launch and to decide whether it is advisable to undertake it.

You will be one of the station commanders watching a specified area of the Atlantic Ocean over which the launch vehicle will pass. You should coordinate and share resources with your team to remove incursions from the area. Your team should also deploy weather-monitoring instruments to ascertain how the weather might impact the launch. At the end of fifteen hours (fifteen real minutes), your team has a one-hour window within which to decide whether to launch or abort the mission, or whether or not to change your previous decision.

In Figure 1 below, the simulation's Global Map is shown. Included in this view are all the areas monitored from the three stations--**Alpha, Bravo and Charlie**. **Alpha** monitors the largest area, represented by the space within the green rectangle. **Bravo** monitors the area within the orange rectangle, and **Charlie**, the smallest area, within the blue rectangle. The flags (represented in Figure 1 as green circles) represent the base stations for each of the monitors—Alpha, Bravo and Charlie. The no-fly zone (irregular area within red Impact Lines (ILs)) is the area that must be kept free of incursions. Finally, the yellow line represents the trajectory of the launch vessel. It should be monitored for weather conditions. As a station monitor, you will not see this complete view, but rather only the view of your station area.

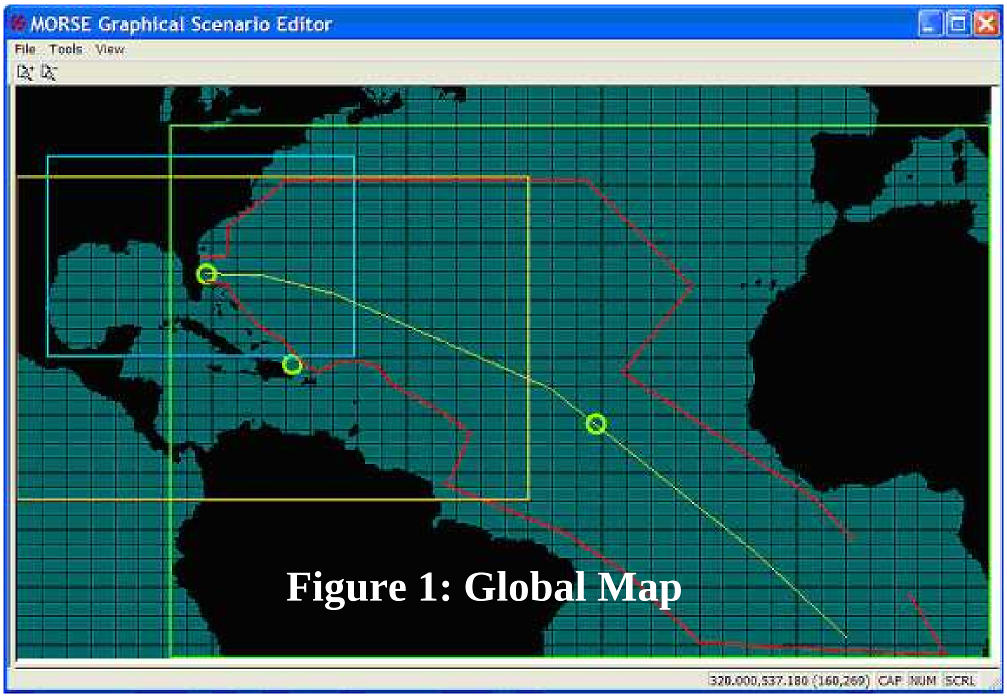

Figure 1: Global Map

1.1 Basic Operations in MORSEStation[1]

This guide is based on a scenario in which Alpha is based in the Ascension Islands; Bravo, in Antigua, the Caribbean Islands; and Charlie is located in Cape Canaveral, Florida. We use the Alpha station for our illustrations. Figure 2 represents the Alpha station as Alpha's commander will find it at the beginning of the scenario.

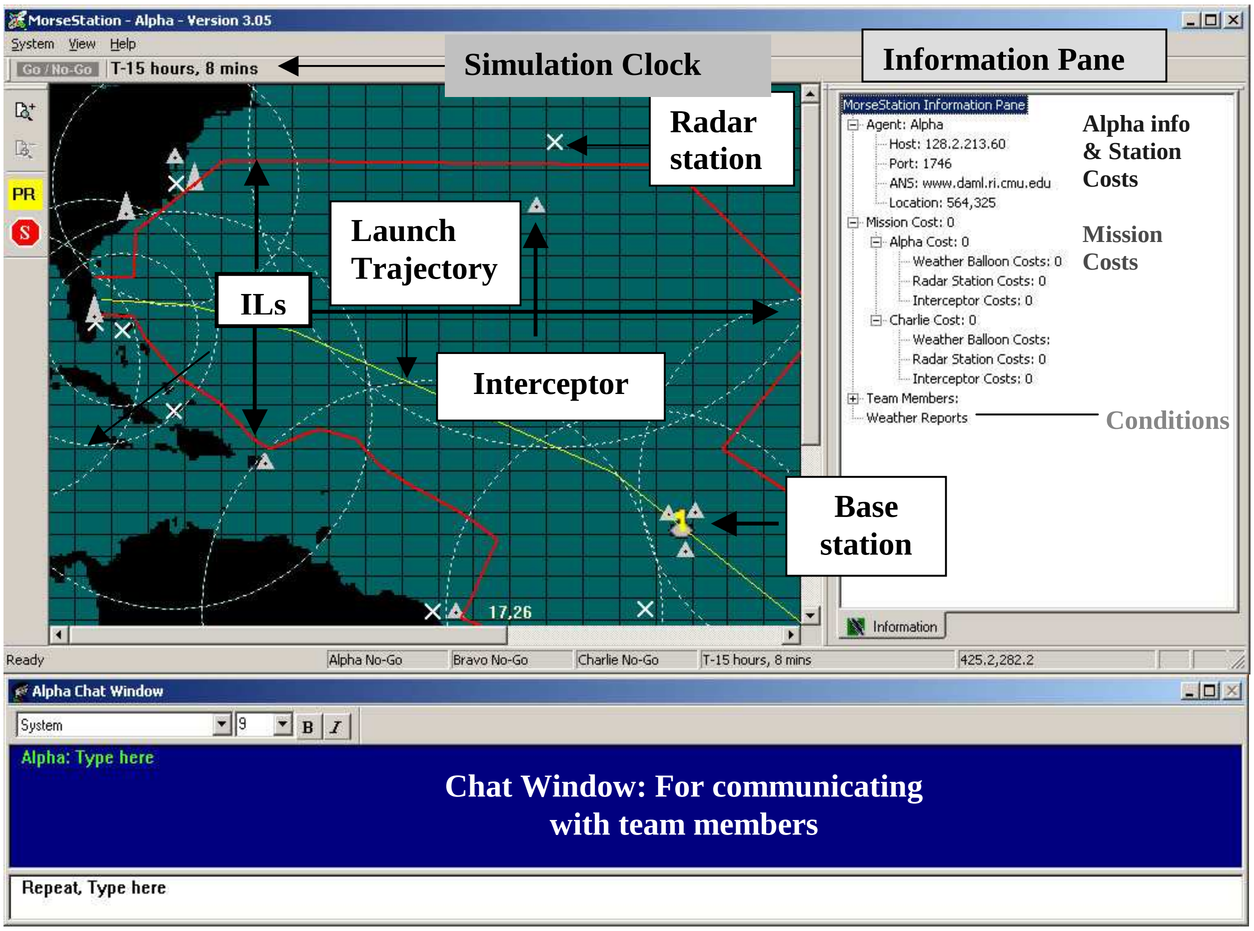

Figure 2

1.1.1 Opening and Activating Radar

To see incursions, you must first activate radar. When you mouse-over the radar, the name, location and range of the radar are shown, as in Figure 3, below.

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[1] This manual assumes that the user has already started a MorseStation session, which also requires starting Morse Command. See User Guide for Morse Command Simulation Setup and Running Instructions for starting MorseStation and Morse Command: http://www-2.cs.cmu.edu/~softagents/morse/Morse_Command.PDF.

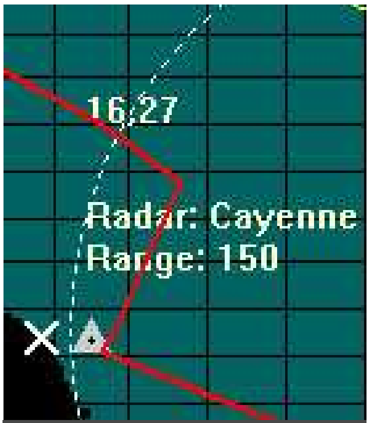

Figure 3: Radar Info

The white X represents the center of the radar. The X will also be bracketed in red brackets (not visible in screen shots).

Click on the center of the radar you wish to activate. A colored line will appear under the X in all maps that include the radar, as in Figure 4, indicating that the radar is now active. (The color underlining the radar varies with the station. Active radars in Alpha are underlined in light green, active radars in Bravo are underlined in orange, and, in Charlie, active radars are underlined in light blue).

Figure 4: Activated Radar

You will begin to see red triangles moving on the map. These are incursions in the ranges of the radars (solid circles). Incursions within the ILs must move out or be intercepted before the launch. (Coordinate with your team members for the interception of incursions. See section 2 below).

1.1.1.1 Radar Properties

Radars are distributed on the map according to the scenario. Some members may share radars, and others will be hidden from some members. Radars cover varying diameters and may overlap. In coordination with the team, members should decide what radar to deploy from their station. See Teamwork section, below.

1.1.2 Activating Interceptors

Before you can intercept an incursion, you must first activate an appropriate interceptor. Click on the gray triangle for the interceptor you wish to activate. When activated, the interceptor will turn into a light color and will be encircled as in Figure 5, below. (The colors are light green in Alpha, orange in Bravo, and light blue in Charlie). The selected interceptor will be used to intercept selected incursions (see below).

Figure 5: Activated Interceptor

1.1.3 Intercepting Incursions

Activate the desired interceptor to intercept an incursion. When you mouse-over an incursion, you will see its information (location, name, speed and direction) displayed along with crosshairs over the vehicle, as in Figure 6, below. (The crosshairs are not visible in the screenshots).

Figure 6: Incursion Info

Click on the incursion. The selected interceptor will map a route for interception of the incursion, meet it, and escort it outside of the ILs, as in Figure 7. If the incursion will move out of the IL area on its own before it can be intercepted, then the message as seen in Figure 6a, will be seen:

Figure 6a: Incursion exits lst

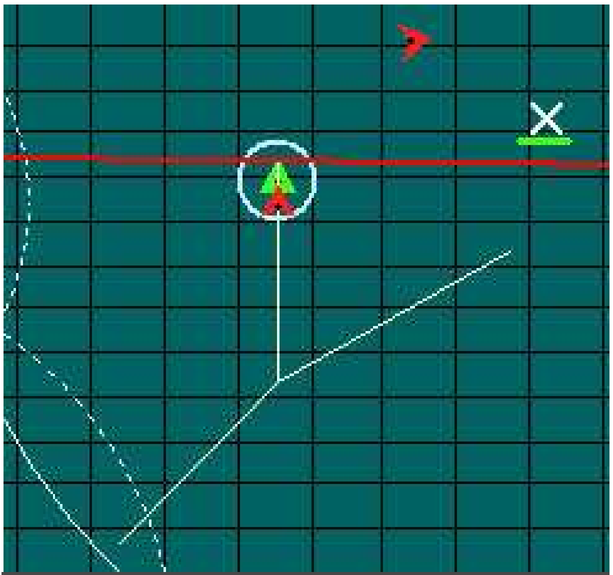

Figure 7: Incursion Escorted outside ILs

1.1.3.1 Interceptor Properties

Two types of interceptors exist: fast and slow interceptors. Fast interceptors are larger than slow interceptors. When possible, you should use the fast interceptors for fast incursions, otherwise your interceptor might not be fast enough to intercept them.

1.1.3.2 Reallocating Interceptors

To move an interceptor to a new location, click on it so that it is selected. The interceptor will have a white circle around it as in Figure 7. Then, click on the map location to which you want to move the interceptor. The interceptor will then migrate to the designated location. Follow this same procedure to remove interceptors from the area within the ILs prior to the launch (see section 2.1.5, below).

1.1.4 Launching Weather Balloons

Right click on the map at location desired for Weather Balloon and select “Deploy Weather Balloon,” as shown in Figure 8, below. Only Weather Balloons deployed along the launch trajectory (see Figure 2) will provide weather reports.

Figure 8: Deploy Weather Balloon

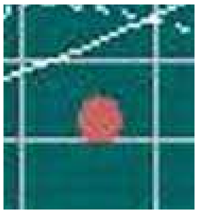

Figure 9: Deployed Balloon

Weather balloons begin traveling (traveling balloons have a tail) from the base station (see Figure 2) and head to the point selected at deployment (the point of right-clicking). The balloon will be visible for four simulation minutes (see Figure 9) and, when deployed along the launch trajectory, provide a weather report displayed in the right information panel, as shown in Figure 10, below:

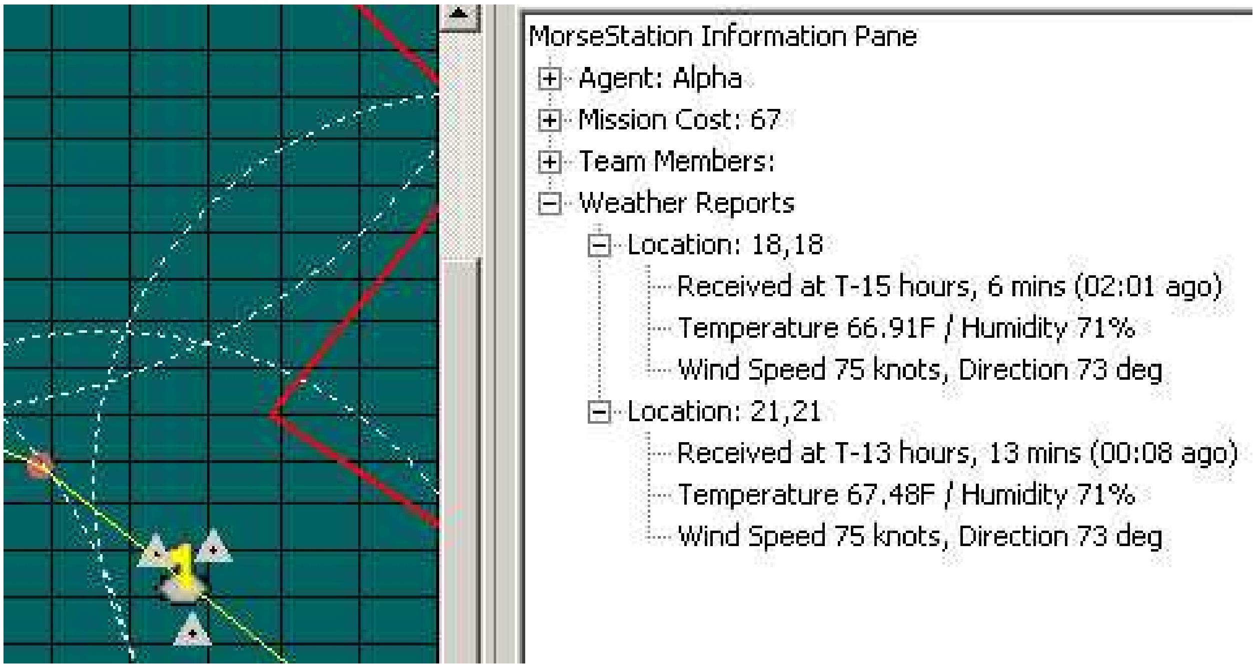

Figure 10: Weather Reports

2 Teamwork and Strategies in the Simulation

Some tasks should be performed in a coordinated team effort. Some resources, such as radar and interceptors, are limited. Team members can communicate using the chat window.

2.1 Tasks to Perform

2.1.1 Activate Radar

Radar is necessary for seeing incursions. (See instructions in section 1.1.1 for activating radar). There are a number of radar units available. The group can decide what radar units to activate from what stations, and decide on who will activate shared radars. The simulation includes a radar-running-time charge.

2.1.2 Check for and Remove Incursions

Your team should check for incursions to be sure that the danger area is incursion-free at the time of the launch. All interceptors and incursions must be moved out of the ILs so that there is no chance of their colliding with debris during the launch.

As stated above, there are two types of incursions - fast (large) and slow (small) and each incursion has a "nose" that indicates its direction. For intercepting a fast incursion, a fast interceptor must be deployed. Fast interceptors will intercept slow incursions as well, however. If an incursion will be out of the danger area before an interceptor will reach it, or before the launch time (T-0), MorseStation will give you a notice saying that an interceptor will not be deployed against it. The team may decide what interceptors should be deployed, based on interceptor proximity, resource availability and allocation, cost incurred, and interceptor properties.

Note: Incursions only appear on active radar.

2.1.3 Check Weather Conditions

Weather conditions impact the launch. The "weather rules" for launching in Morse are as follows:

2.1.3.1 Temperature

- The launch should not be commenced if the temperature at any point along the trajectory goes below 41^{o}F at the time of launch.
- The launch should not be commenced if the temperature along the trajectory goes above 99^{o}F for more than 5 hours.
- The launch should not be commenced if the temperature at any point along the trajectory goes below 41^{o}F for more than any 5 hour simulation period.

2.1.3.2 Wind Speed and Direction

- The launch should not be commenced if the wind speed is above 30 knots at any part along the trajectory at the time of launch. ("Time of launch" is any time during the launch window).
- The launch should not be commenced if the wind direction is between 100 and 260 degrees (due North is zero degrees) *and* the wind speed is above 24 knots at the Kennedy base station at the time of launch.
  - For example, if the wind direction is 90 degrees and the wind speed is 25 knots, launching is appropriate. If however, the wind direction is 105 knots and the speed is 25 knots, launching incurs a penalty. All launches ordered when wind speed is above 30 knots at any point along the trajectory during the time of the launch incur a penalty.

Weather information is gathered by deployed weather balloons. Each station has an unlimited supply of balloons available, but each balloon incurs a cost. Balloons are deployed to a designated area along the launch trajectory. Once the balloon reaches its destination area, a reading is taken and transmitted to the station that deployed it. The reading gathered by a balloon will last on the information pane of the station that deployed it, but the balloon icon will only stay on the map for 4 simulation hours (4 minutes).

Balloons travel from the station bases. The team must consider coverage of the weather over the entire trajectory of the launch vehicle.

Since the weather balloons only transmit to the stations that deployed them, team members should communicate weather findings to their teammates.

2.1.4 Remove all Interceptors Before Launch

The area within the ILs must be cleared of all vehicles, including interceptors, before launch. In order to remove interceptors from within the IL area, click on the interceptor, and then click on an area of the map outside the IL. The interceptor will then travel to the designated area on the map.

2.1.5 Launching the Spacecraft

When one (1) hour (one (1) real minute) remains in the simulation, you must decide whether or not to launch the spacecraft. A red Launch button will appear in the upper left hand corner of the station, and a message will be displayed across the top of the station, indicating that the window for launching is now open (see Figure 11). The launch must take place before time runs out (or within one minute from notification).

Figure 11

If all stations decide to launch, all of the station monitors must click on the Launch button before the simulation clock expires in order to complete the launch.

Once the launch has been selected, the launch button becomes green and a check mark replaces the X, indicating that a launch has been ordered by this station (see Figure 12).

Figure 12

If the launch has been successfully ordered, a message window will be displayed, indicating that the launch has occurred and that the mission has been completed, as in Figure 13, below:

Figure 13

If the vehicle is not launched, a message window will appear indicating that the launch has not been completed within the launch window and that the mission is terminated, as in Figure 14, below.

Figure 14