

# **TREK**

## **COMMAND MANAGEMENT**

### **TUTORIAL**



**November 2012**

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## 1 What You Need To Know Before You Read This Document

Before reading this document you should be familiar with the material in the TReK Getting Started Guide (TREK-USER-001), the TReK Command Tutorial (TREK-USER-020) and the TReK Command Applications Tutorial (TREK-USER-021). The Command Management capability is based on TReK's basic commanding features. You need to be familiar with these features before proceeding with this tutorial. If you have not read these documents, you may have difficulty with some of the terminology and concepts presented in this document.

We assume you are an experienced Windows user. Information about how to use a mouse or how to use Windows is not addressed in this user guide. Please see your Windows documentation for help with Windows.

## 2 Technical Support

If you are having trouble installing the TReK software or using any of the TReK software applications, please try the following suggestions:

Read the appropriate material in the manual and/or on-line help.

Ensure that you are correctly following all instructions.

Checkout the TReK Web site at <http://trek.msfc.nasa.gov/> for Frequently Asked Questions.

If you are still unable to resolve your difficulty, please contact us for technical assistance:

TReK Help Desk E-Mail, Phone & Fax:

|            |   |
|------------|---|
| E-Mail:    | trek.help@nasa.gov                                |
| Telephone: | 256-544-3521 (8:00 a.m. - 4:30 p.m. Central Time) |
| Fax:       | 256-544-9353                                      |

TReK Help Desk hours are 8:00 a.m. – 4:30 p.m. Central Time Monday through Friday. If you call the TReK Help Desk and you get a recording please leave a message and someone will return your call. E-mail is the preferred contact method for help. The e-mail message is automatically forwarded to the TReK developers and helps cut the response time.

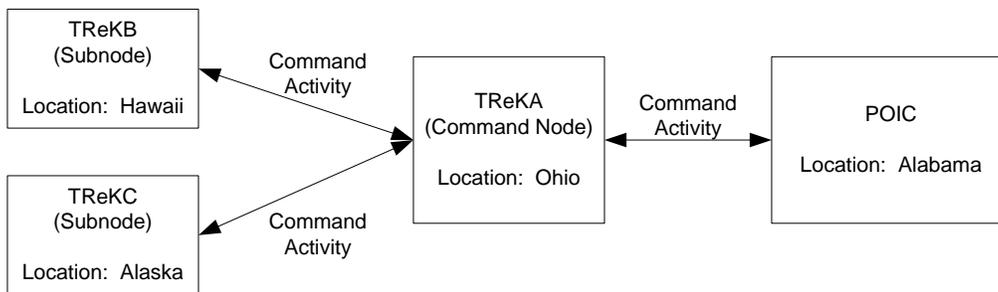
## 3 Introduction

The purpose of this tutorial is to introduce you to TReK's Command Management capability. This capability provides a way to manage a multi-platform command

environment that can include geographically distributed computers. It is intended to help those teams that need to manage a shared on-board resource such as a facility class payload. This capability provides a way for one individual to manage all the command activities associated with a payload that can be commanded by multiple individuals or groups.

Maybe the best way to understand this capability is to look at an example. Let's say there is a payload on-board the ISS that will be used by three groups of scientists. One group is located in Ohio, another in Hawaii, and the third in Alaska. The group in Ohio is responsible for managing all the command activities associated with the payload. Therefore, the groups in Hawaii and Alaska will send all their command requests through the group in Ohio.

Figure 1 below shows how the three groups could use the command management capability to create a command environment to meet their needs. Since the group in Ohio will be managing all the command activities, they will make all the command requests to the POIC. The other two groups will send their command requests to the group in Ohio who will either accept the request and send it on to the POIC or reject the request.



**Figure 1 Command Management Example**

Let's take a closer look at how this works. In Figure 1 you see three TReK computers and the POIC. The TReKA computer is located in Ohio and it will communicate with the POIC. We will call this TReK computer a "command node". It is called a command node because it will be used to manage all the command activity with the POIC. Both the TReKB computer and the TReKC computer will communicate with the TReKA computer. Each of these TReK computers is called a "subnode". They are called subnodes because they are attached to a TReK command node.

In this configuration the group in Ohio can now manage command activities on their computer and the command requests initiated by the groups in Hawaii and Alaska.

## 4 Command Management Concepts

If you're familiar with TReK commanding concepts, then you already know most of what you need to know to understand command management. There are just a few more concepts to learn. In this section we're going to highlight some of the key concepts and features associated with the command management capability. Later in the Command Management Tour you'll see the step-by-step details associated with these features.

### 4.1 Setting up your TReK system as a Command Node

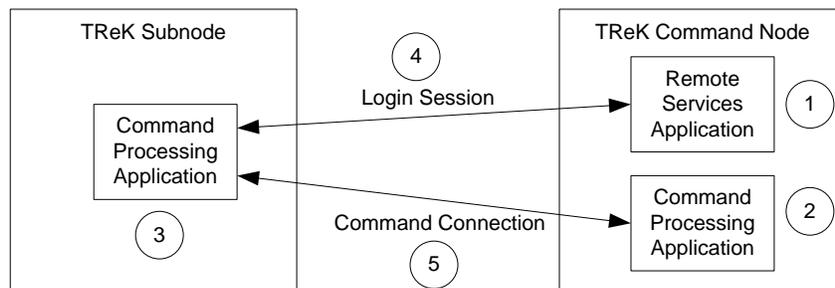
To set up your TReK system as a command node you will use the Remote Services application and the Command Processing application. The Remote Services application is used to configure TReK to accept remote connections from external TReK systems. Using this application you can configure security settings, create user accounts, and track remote connections. The Command Processing application is used to create command destinations. When you add a destination to the destination list, you can configure specific destination properties so the destination can be "shared" with other TReK systems. This is called "managing" the destination. And as you'll see later, any destination (POIC, Suitcase Simulator, PRCU, etc.) can be managed (shared).

### 4.2 Setting up your TReK system as a Subnode

Setting up your TReK system as a subnode is as simple as adding and activating a destination. In this case it's a TReK destination. That's because your destination is another TReK system. TReK destinations are very similar to POIC destinations. You may remember that when you add and activate a POIC destination you actually create two connections: 1) an ERIS Login session and 2) a command connection. The same thing happens when you add and activate a TReK destination. You will create two connections: 1) a TReK Login session and 2) a command connection. Working with a TReK destination is just like working with other types of destinations.

### 4.3 Subnode to Command Node – Making the Connection

Figure 2 shows five circles representing the task areas and steps needed to configure the command node, configure the subnode, and create the subnode to command node connections.



**Figure 2 Subnode to Command Node – Configuration and Connections**

### Step 1

The command node user sets properties in the Remote Services application to allow incoming connections from remote TReK systems.

### Step 2

The command node user adds and activates a destination in the Command Processing application. The destination properties are set such that the destination will be managed (shared). This destination will most likely be connected to the POIC. However, any type of destination can be managed so it could be a Suitcase Simulator destination, a PRCU destination, or even a TReK destination.

### Step 3

The subnode user adds and activates a TReK destination in the Command Processing application. During activation the connections shown in step 4 and step 5 are established.

### Step 4

During activation of the subnode's TReK destination, a TReK login session will be established. This login session will be used to communicate login information and service request information to the command node. This is how the subnode identifies itself and requests to use the command node's destination.

### Step 5

Once the subnode's login session has been successfully accepted, a command connection will be established between the TReK destination on the subnode and the destination on the command node. At this point, the subnode's TReK destination is essentially linked to the command node destination. When the subnode sends a command request, this request will flow along the command connection to the destination on the command node. The destination on the command node will either accept and carry out the subnode's command request or will reject the subnode's request.

## **4.4 More About Command Nodes**

Here are a few more things to note about command nodes:

- The Command Node (while called a command node) can perform all TReK functions. We just label it as a command node to clarify its role when discussing command management.
- The Command Node serves as the primary interface to the final destination (which could be the POIC, a Suitcase Simulator, a PRCU, etc.).

- The command node can be configured to accept connections from other TReK systems located in different geographic locations. Up to 255 subnodes can connect to a command node.
- The command node can be configured in one of three different security configurations which each support different levels of security checks (more about this later).
- A command node can contain multiple destinations in its destination list and each destination can be configured independently (some may be managed and some may not be).
- When a destination is created on the command node it can be configured to be accessible by one or more remote TReK systems. By accessible we mean that the remote TReK systems (subnodes) can "attach" to the destination and send command function requests to the destination.
- When configuring a destination on a command node, the destination can be configured to perform user provided command validation checking. When this option is enabled, TReK provides a mechanism that allows user-provided software to check the contents of a subnode provided command before the command node forwards the command to its final command destination (POIC, etc.).
- When a command node receives a command uplink request from a subnode, the command node will perform all the checks associated with that request and then if all checks are successful will send the command to its final destination (POIC, etc.). Any command responses that are returned from the final destination are passed back to the subnode that sent the command uplink request.
- A command node can enable/disable subnodes.
- A command node can track/record/view all command activity performed by the command node on behalf of the subnodes connected to the command node.

#### **4.5 More About Subnodes**

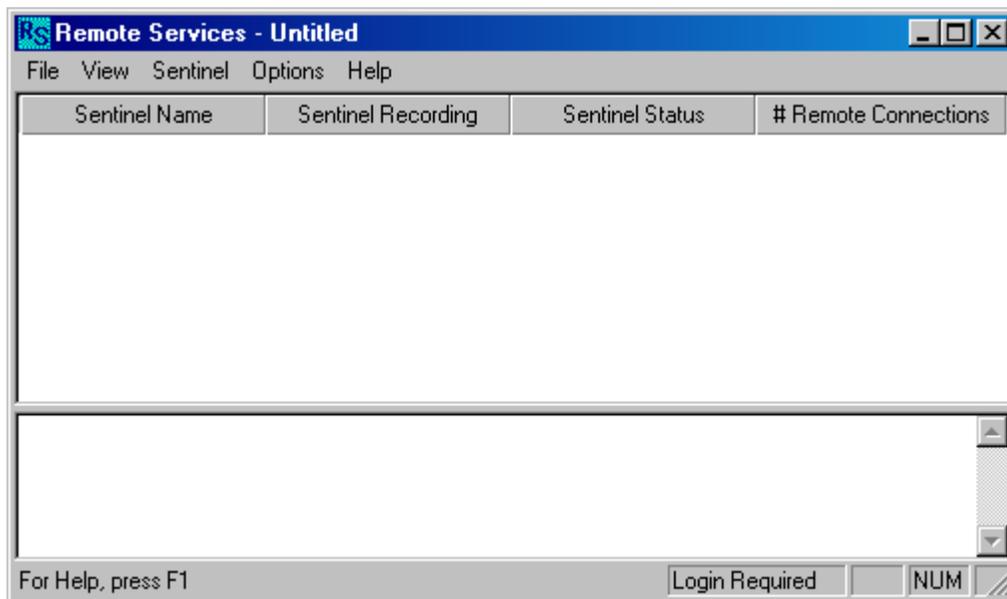
Here are a few more things to note about subnodes:

- A TReK subnode can perform all TReK functions. We just label it as a subnode to clarify its role when discussing command management.
- A subnode can create a TReK Destination that is used to connect to a TReK system.
- When a subnode connects to a command node, the subnode will receive a list of destinations that it is allowed to "attach" to.

- A subnode can make several different types of command requests to a command node including: Uplink User Command Request, Uplink POIC Command Request, Uplink TReK Command Request, Update POIC Database Request, and Update Command Node Database Request.
- A subnode can display status/configuration information about its connection to a command node.
- A subnode can receive and display command response information from the command node.
- A subnode will receive an additional command response called a TReK Receipt Response (TRR).

#### 4.6 Remote Services and Security

In order to set up your TReK system as a command node you need to configure TReK to provide remote services. You do this using the Remote Services application. The Remote Services main window is shown in Figure 3.

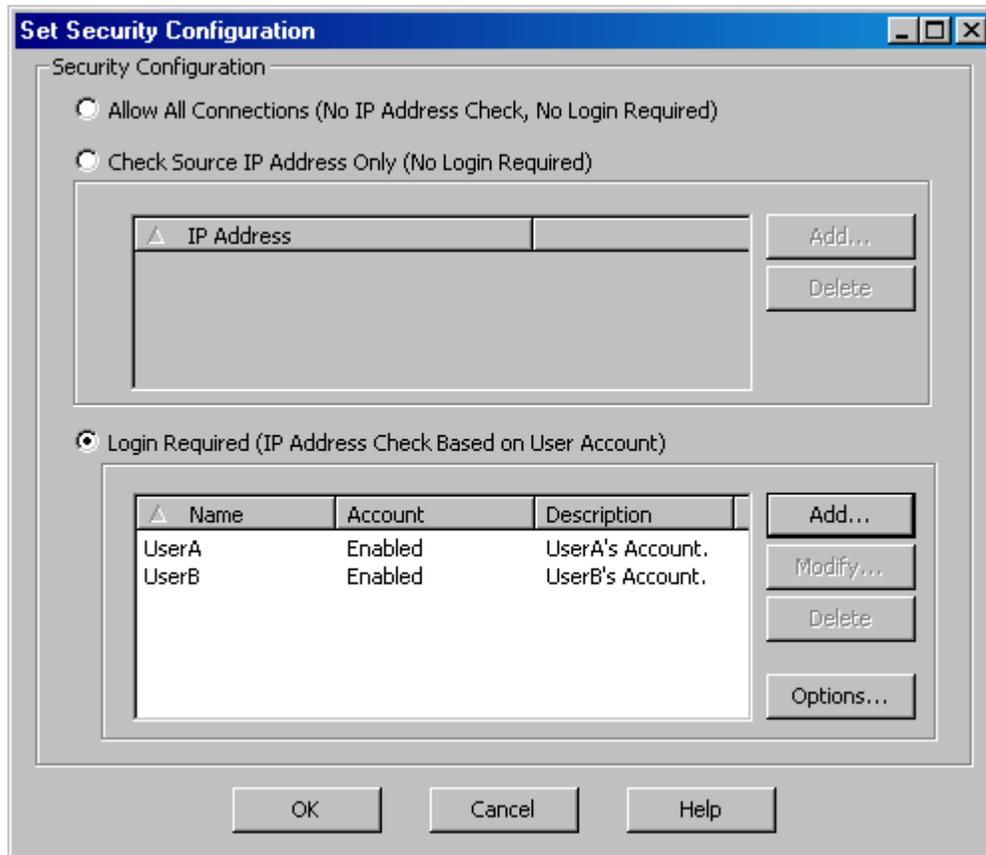


**Figure 3 Remote Services Main Window**

While the Telemetry Processing application has a packet list, and the Command Processing application has a destination list, the Remote Services application has a sentinel list. In a conceptual sense a sentinel is both a guard and a gateway. You create a sentinel to allow remote TReK users to connect and use your TReK services (such as command destinations). As a guard the sentinel evaluates each incoming connection and

only accepts the connection if it meets the current security configuration criteria. As a gateway, the sentinel provides the passageway for incoming connections and requests for services. In a technical sense a sentinel is basically a network socket (TCP listener socket). It is possible to create multiple sentinels and you can define which network card to use when you create a sentinel. Each sentinel can support multiple remote connections. Each time a remote user connects to a sentinel, the sentinel uses the current security configuration to determine whether to accept the connection. If the connection meets the security criteria the connection is accepted. If not it is rejected. There are three security configurations each offering various levels of security: Allow All Connections, Check Source IP Address Only, and Login Required.

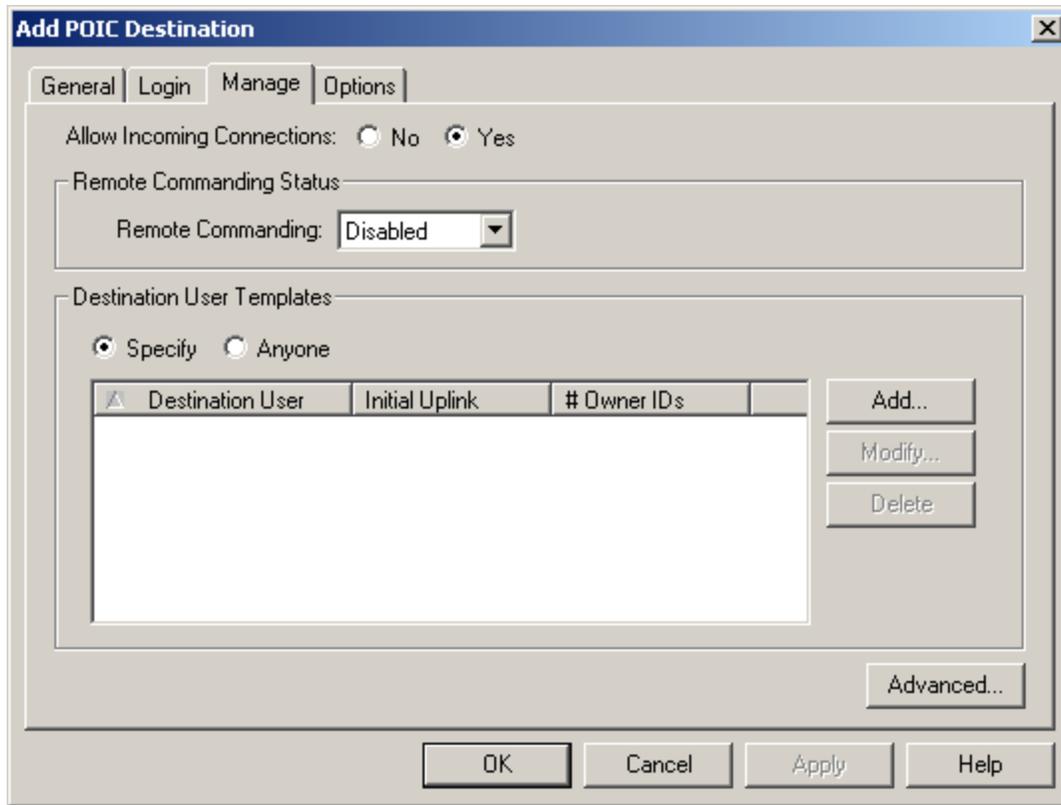
Figure 4 shows the Set Security Configuration dialog from the Remote Services application. This dialog provides a way to set the security configuration that will be used for all incoming connection requests. TReK supports three levels of security. The lowest level of security is “Allow All Connections”. This configuration automatically accepts all incoming connections. No source IP address checks are performed and no login is required. The second level of security is “Check Source IP Address Only”. This configuration will only check the source IP address for the remote party requesting to connect. If the IP address is in the list of approved addresses, then the connection will be accepted. If not, the connection will be rejected. The third level of security (maximum level) is “Login Required”. This configuration requires the remote party to enter a username and password. The user account can be configured to check the source IP address or to allow the user to connect from any IP address. This is the safest security configuration.



**Figure 4 Remote Services Security Configuration**

#### 4.7 Managing a Destination

We've spent a lot of time talking about "managing" destinations so let's take a brief look at how this is done. Figure 5 shows the Add POIC Destination dialog. The dialog has four tabs one of which is the Manage tab. The Manage tab is used to configure the destination so that it can be used by subnodes (remote users).



**Figure 5 Command Processing's Add POIC Destination Dialog**

There are three main features to configure on this tab:

#### Allow Incoming Connections

The Allow Incoming Connections option is used to tell your TReK system whether to allow remote users to connect to this destination. The default is to not allow incoming connections.

#### Remote Commanding

The Remote Commanding option is used to set the remote commanding status. The Remote Commanding setting is used to configure the destination to accept or reject commanding requests from remote users that are connected to the destination. The options are “Enabled” or “Disabled”. If the remote commanding status is set to “Enabled”, then incoming commanding requests will be evaluated and executed if they meet the proper criteria. If the remote commanding status is set to “Disabled”, then all incoming requests will automatically be rejected.

#### Destination User Templates

This area of the dialog is used to define which remote users can use this destination. You can specify a particular list of users or you can configure the destination so that anyone can use it. If you specify a particular list of users, then only those users can use the destination. This implies that a user must login using one of the usernames on the list in

order to use the destination. For this to work the Remote Services security configuration must be set to “Login Required”. If the Remote Services security configuration is set to one of the security settings that does not require a login, then there will be no usernames associated with remote user connections and none of the remote users will be allowed to use the destination (because they are not on the list). On the other hand if you select the “Anyone” radio button this configures the destination so that anyone can use it. The remote services security configuration does not come into play with this configuration. This is because no username is required. If the security setting does not require a login then any remote user that connects can use this destination (regardless of whether they logged in with a username or not). If the security setting does require a login, then anyone logging in (using any username) can use the destination.

#### **4.8 The Interaction of Remote Services Security and Destination Security**

Command Management security is based on the security configuration set in the Remote Services application and the configuration of the properties set on the destination dialog’s Manage tab. The information below shows the results of combining different security configuration properties. Each picture in this section consists of three areas.

##### **Left Area**

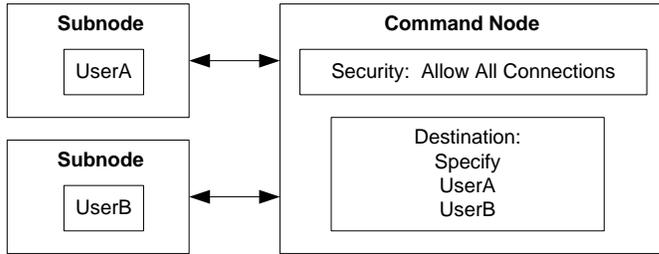
The left area shows two TReK subnode computers that will be connecting to a TReK command node computer. The Command Processing application on each subnode computer contains one TReK destination. The subnode computer boxes also show the username that will be used when the subnode logs into the command node.

##### **Middle Area**

The middle column shows the TReK command node computer. The TReK command node computer box shows two pieces of information: (1) The security configuration set in the Remote Services application and (2) Destination user information for the single destination in the Command Processing application.

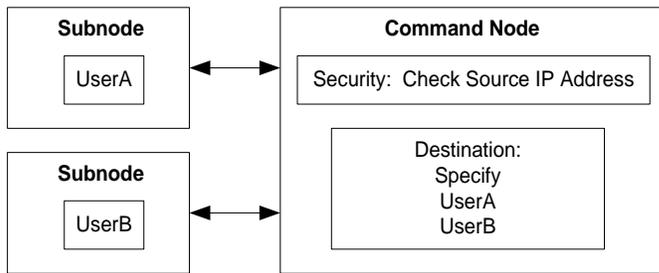
##### **Right Area**

The column on the right explains how the security rules will be applied when the subnode computers attempt to login to the command node computer and request to use the destination on the command node.



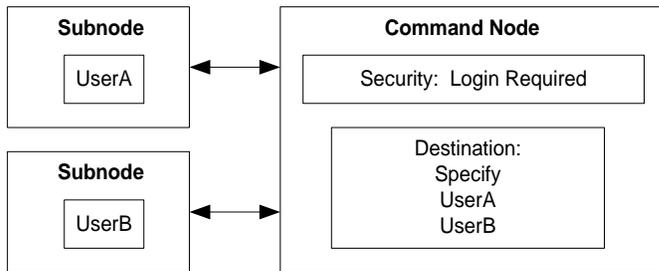
**Results**  
 Subnode UserA will not be allowed to connect to the destination. Since the security configuration does not require a login, UserA connects without a username. Since there is no username, the username does not match UserA or UserB. Therefore, subnode UserA will not be allowed to connect to the destination.

Subnode UserB will not be allowed to connect to the destination for the same reason that UserA cannot connect to the destination (because UserB has logged in with no username).



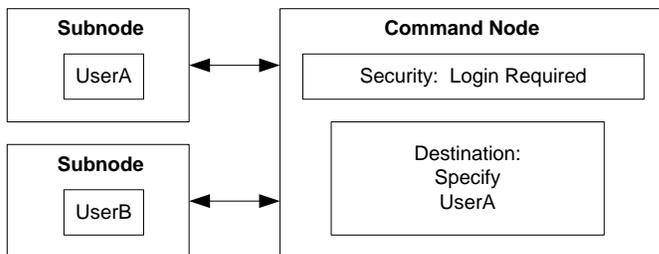
**Results**  
 Subnode UserA will not be allowed to connect to the destination. Since the security configuration does not require a login, UserA connects without a username. Since there is no username, the username does not match UserA or UserB. Therefore, subnode UserA will not be allowed to connect to the destination.

Subnode UserB will not be allowed to connect to the destination for the same reason that UserA cannot connect to the destination (because UserB has logged in with no username).



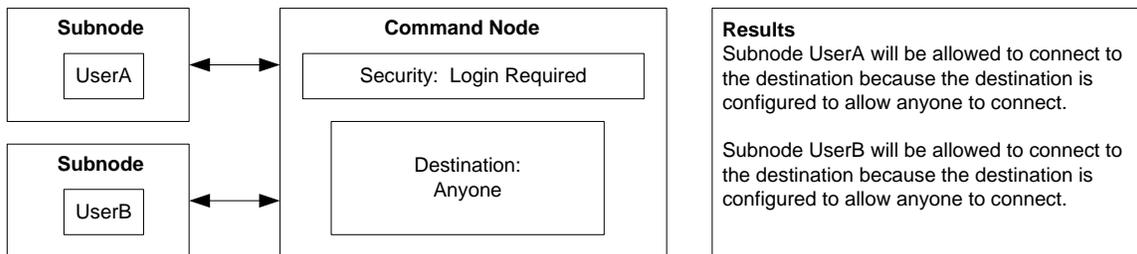
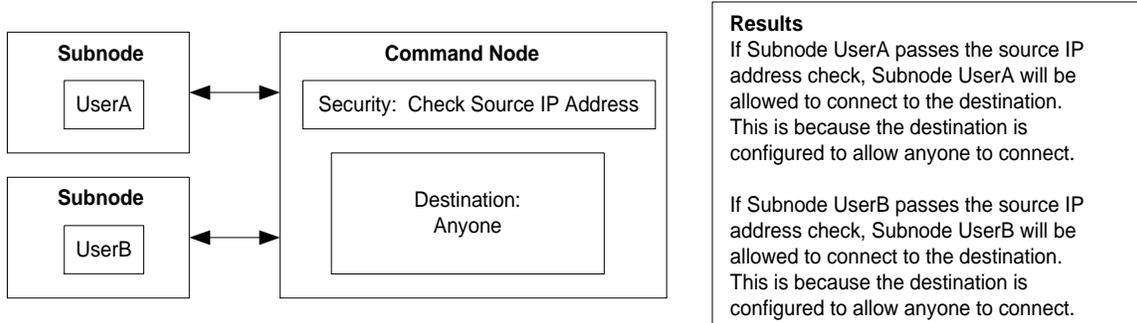
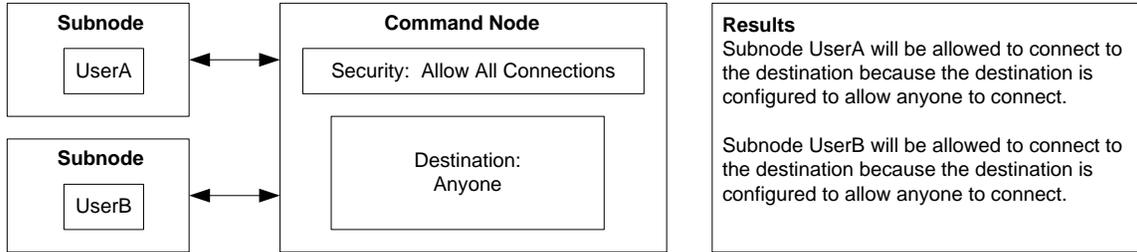
**Results**  
 Subnode UserA will be allowed to connect to the destination because UserA is in the list of users allowed to connect.

Subnode UserB will be allowed to connect to the destination because UserB is in the list of users allowed to connect.



**Results**  
 Subnode UserA will be allowed to connect to the destination because UserA is in the list of users allowed to connect.

Subnode UserB will not be allowed to connect to the destination because UserB is not in the list of users allowed to connect.

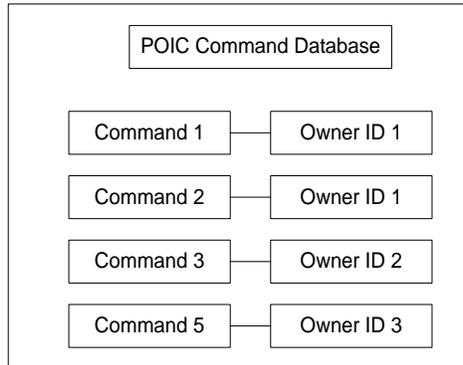


#### 4.9 Managing a Destination Part II -- Mapping Commands from the Command Node to the Subnode

Mapping commands from the Command Node to the Subnode is an important part of managing a destination. This section describes how this mapping takes place.

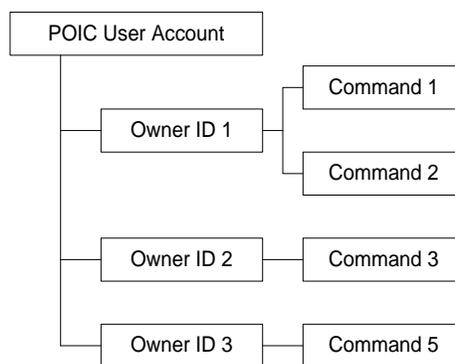
If you're familiar with TReK commanding then you know that there is a specific set of commands assigned to each destination in Command Processing. But where does this list of commands come from? Well, it depends on the type of destination. If it's a POIC destination, the command list is sent to TReK from the POIC. If it's a Suitcase Simulator or PRCU destination, the command list is created by the user when the destination is created. This is done by using the Commands Tab on the Add Suitcase Simulator (or PRCU) Destination dialog. If it's a TReK destination, the command list is sent by the command node (that the TReK destination is connected to) to the subnode.

Let's step back a moment and look at how things work with a POIC destination. When you activate a POIC destination, you log into the POIC (ERIS) and the POIC sends back a list of commands. The POIC knows which commands to allow for a user based on the User Account (login) and information in the POIC Command database. Figure 6 shows that each command in the POIC command database has an Owner ID.



**Figure 6 Command Database Command/Owner ID Mapping**

To allow a user access to a command, the POIC must allow the User Account access to the Owner ID. Figure 7 shows that each POIC User Account has one or more Owner IDs mapped to it. The commands associated with those Owner IDs are then automatically mapped to that POIC User Account. Therefore, when you log into the POIC, the list of commands that are returned to you are based on the user account that you log into, and the Owner IDs (and their associated commands) that are mapped to that user account.

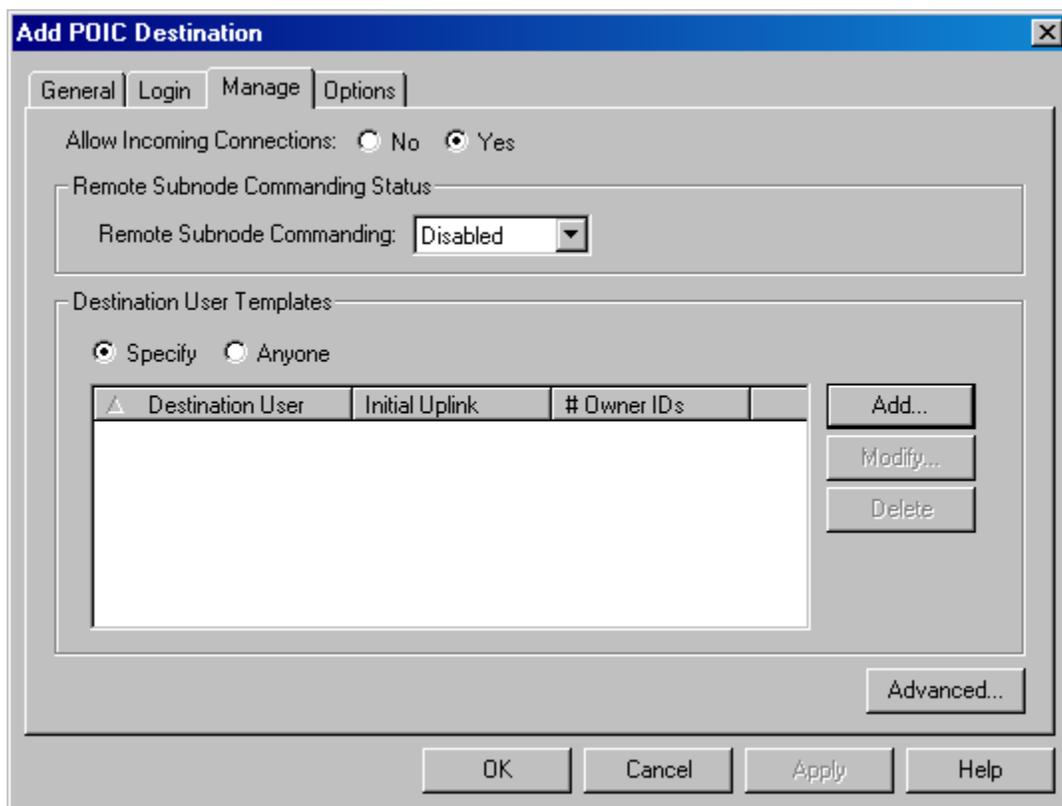


**Figure 7 User Account, Owner IDs, and Commands**

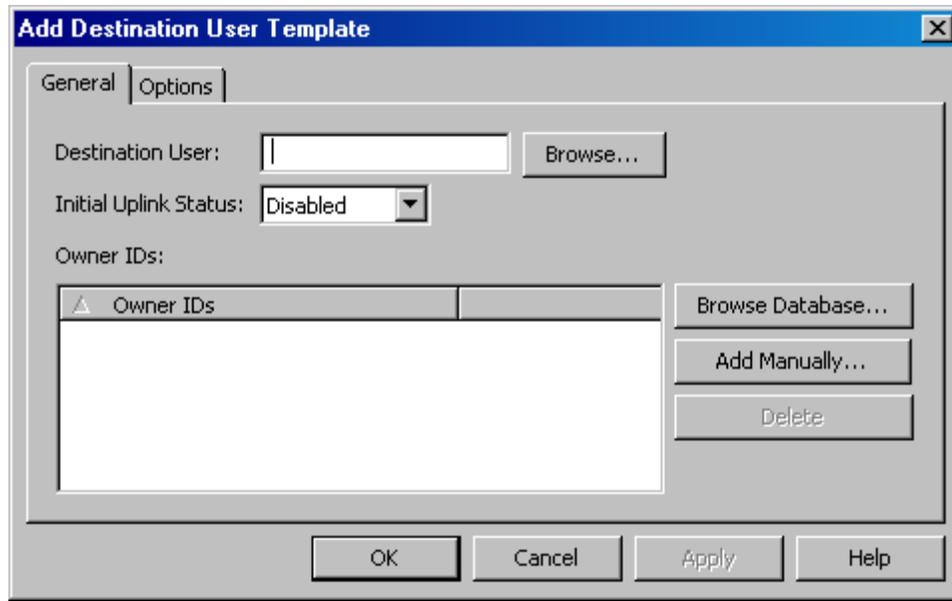
Now that we have looked at how this process works with a POIC Destination, let's look at how things work for a TReK Destination.

When you activate a TReK Destination on a subnode, you log into the TReK Command Node. During the login process you are prompted to select a destination to connect to. Both the login and the destination you select play a role in determining what command list is sent back to you.

Let's take a look at what happens on the Command Node. Take a look at Figure 8 and Figure 9. Figure 8 shows the Manage tab that we discussed earlier in section 4.7 Managing a Destination. Figure 9 shows a picture of the Add Destination User Template dialog. This is the dialog that is displayed when you push the Add button to add a Destination User Template.



**Figure 8 Add POIC Destination (Manage Tab) Dialog**



**Figure 9 Add Destination User Template Dialog**

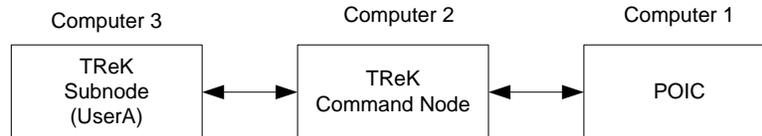
When you add a Destination User Template, you will define a TReK user account and a list of Owner IDs. The TReK Command Database is similar to the POIC Command Database in that each command has a single Owner ID. So when you assign a list of Owner IDs to a Destination User, this will automatically assign the list of commands associated with those Owner IDs to this destination user template.

Here are a few other things to note:

- When mapping commands from a command node destination to a subnode, the subnode will only have access to the commands (or a subset of the commands) that are associated with the destination. So if a command is not associated with the destination it cannot be mapped to a subnode. What happens if you specify an Owner ID that has one or more commands that are not associated with the destination? If that happens, the command(s) will not show up in the subnode's command list.
- What happens if the subnode does not provide a user login (because the security configuration does not require a login)? If that is the case, then the subnode will only be allowed to use the destination if the destination is configured to allow "Anyone" to use the destination. In this case, the command list sent to the subnode will be based on how the "Anyone" destination user template is configured (the Owner IDs list associated with the Anyone destination user template).

## 5 The Command Management Tour

Now it's time to combine everything you've learned so far. You've seen all the pieces, now we're going to put them all together. The Command Management Tour is a step-by-step example that demonstrates how to use the command management capability. During this step-by-step tour we will set up the command environment shown in Figure 10.



**Figure 10 Command Management Tour Configuration**

To accomplish this we will perform the following tasks:

1. Configure the Command Trainer application to simulate the POIC.
2. Configure the TReK Command Node
  - a. Configure Remote Services
  - b. Configure the Command Processing application with a POIC destination.
3. Configure the TReK Subnode
4. Use the Command Node to Disable/Enable Remote Commanding and Individual Subnodes
5. Send a Command Uplink Request from the Subnode to the Command Node

You may be wondering how many computers you need for this step-by-step tutorial. Three would be great. Two is next best, but one is okay if that's all you've got. The screen dumps assume that you have three computers. Even if you only have two computers the screen dumps should match your screens pretty closely. If you are using two computers one should serve as the command node and the other as the subnode. The computer that serves as the command node should also host the Command Trainer application simulating the POIC. If you only have one computer you can still go through the tutorial, but your screens won't match the ones in this document.

This section was written assuming that you are familiar with TReK commanding concepts. Explanations associated with commanding will be minimized since the focus here is on command management. We assume that you already know how to perform common commanding tasks like adding and activating a POIC destination. We also assume that you have read the earlier sections in this document including the Introduction section (section 3) and the Command Management Concepts section (section 4). If you have not read these sections, please go back and read them. They contain important information that is not repeated in this section.

As you go through the tutorial you may notice that the tutorial doesn't cover all the options available in each dialog. For more detailed information about each dialog please reference the appropriate user guide.

Since this part of the document is more like a hands-on tutorial you may want to print out this section so you have a paper copy to read while you work through the tutorial.

**Please go through the tour in order.** Most sections depend on data from previous sections.

## Configure the Command Trainer to Simulate the POIC

### **5.1 Configure the Command Trainer application to simulate the POIC**

In this section we're going to configure the Command Trainer to simulate the POIC. We aren't going to go step-by-step here since you should be very familiar with this. Go to the computer you have selected to be computer 1 and start the Command Trainer application. Add and activate a POIC trainer.

This is important: Write down the IP Address and port number you used when you created the POIC trainer. You're going to need this information when you create the POIC destination on computer 2.

## Configure the Command Node

## 5.2 Configure the Command Node

In this section we're going to perform two main tasks 1) Configure Remote Services and 2) Configure the Command Processing application with a POIC destination.

### Step-By-Step

1. Go to the computer you've selected to be computer 2 to serve as the Command Node.
2. Start the Remote Services application. The **Remote Services** main window as shown in Figure 11 will appear on your screen.

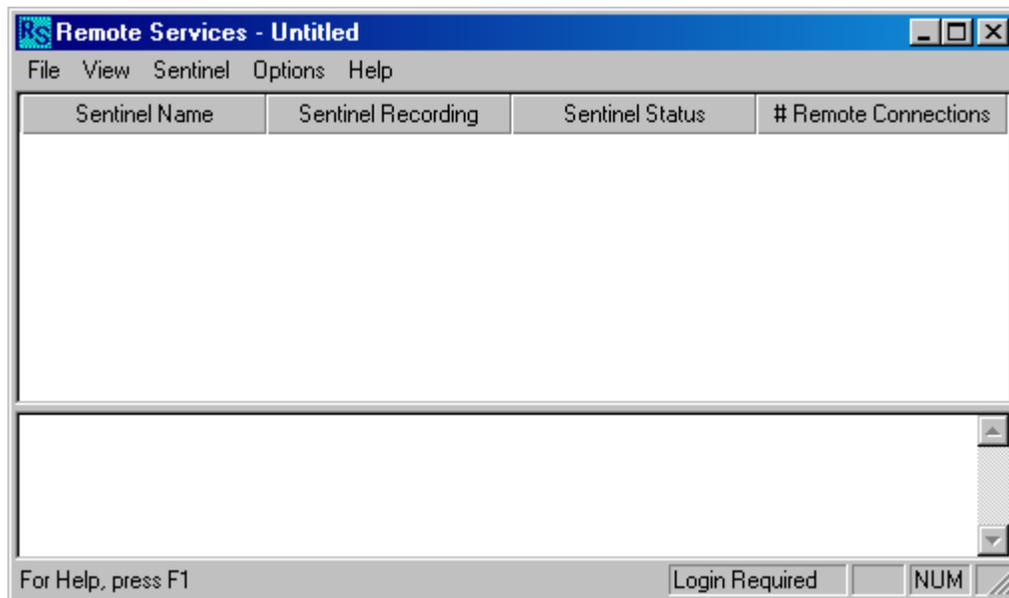
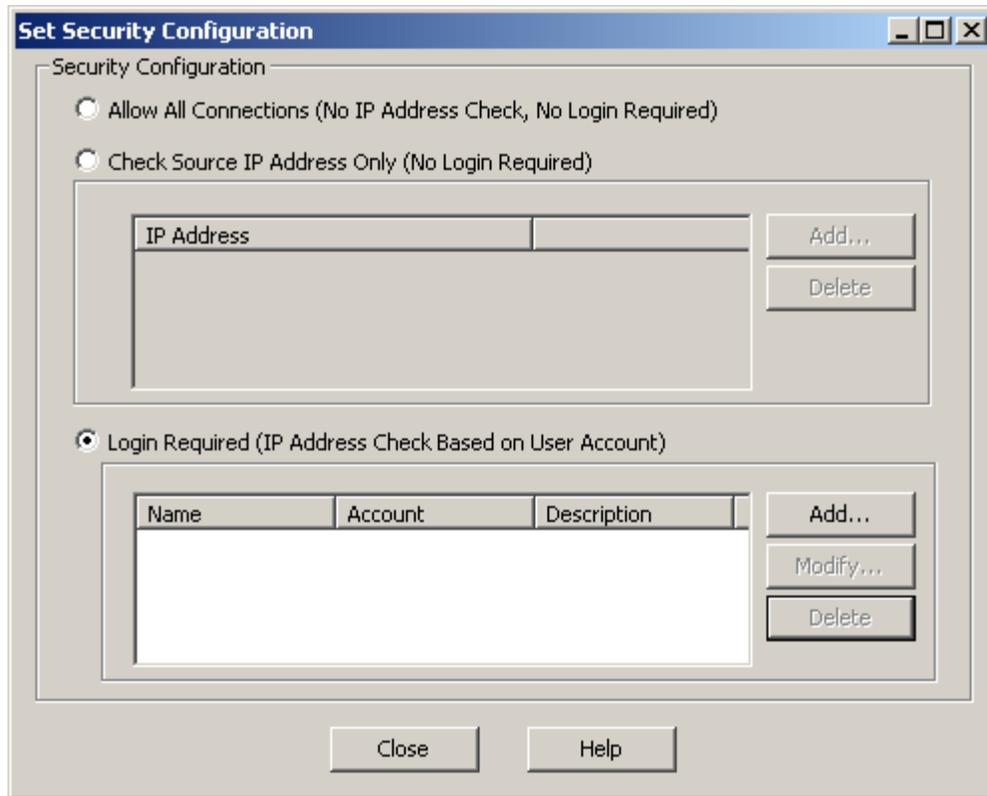


Figure 11 Remote Services Main Window

3. First let's set the security configuration. Go to the **Options** menu and select **Set Security Configuration**. You should see the dialog shown in Figure 12.



**Figure 12 Set Security Configuration Dialog**

For this scenario we're going to use the strictest security configuration which is "Login Required". This is the default configuration so it is already selected. The next task we need to perform is to set up an account for the subnode.

4. Push the **Add** button to add a new user account. The dialog shown in Figure 13 should be displayed.

**Figure 13 Add User Account Dialog**

5. Populate the dialog with the following information:

Username:            UserA  
 Password:            Hawaii5o!  
 Verify Password:    Hawaii5o!  
 Account:             Enabled  
 Description:         UserA Located in Hawaii

**Note:** The login information (username and password) is case sensitive.

Allow User To Connect From Any IP Address

Your dialog should now look like the one in Figure 14.

**Add User Account**

Username:

Password:

Verify Password:

Account:

Description:

Allow User To Connect From Any IP Address

Check User's IP Address Against This List:

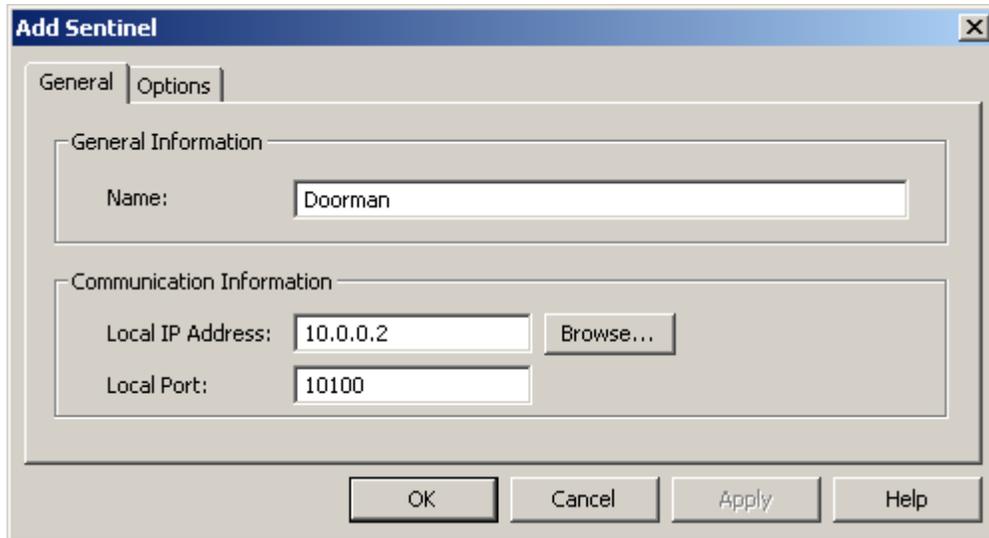
| IP Address |
|------------|
|            |

**Figure 14 Add User Account Dialog Populated**

6. Push **OK** to add the user account to the list.
7. Push **Close** to close the Set Security Configuration dialog.

Note: Whenever you make updates in the security configuration dialog the updates take effect immediately as you make changes (not when you push the Close button).

8. Go to the **Sentinel** menu and select the **Add Sentinel** menu item. The dialog shown in Figure 15 is displayed.



**Figure 15 Add Sentinel Dialog**

Make sure the Local IP Address field is set to your local IP address. Push the **OK** button to add the sentinel to the sentinel list in the Remote Services main window.

*This is important: Write down the IP address and port number you used when you created the sentinel. You will need this information when you create a TReK login session on the subnode. Remember the TReK Destination on the subnode creates a TReK login session to connect to the command node. It is this sentinel that the subnode's login session will be connecting to.*

9. Once you see the sentinel named “Doorman” in the sentinel list, select the sentinel and then go to the **Sentinel** menu and select **Activate Sentinel**. The sentinel should turn green when once it has activated. You have now created a sentinel (a network socket and other sentinel related services) which is ready to receive incoming connection requests from remote TReK systems.

Now that remote services are configured it's time to move on to Command Processing to set up the POIC destination. We aren't going to include all the steps needed to configure a POIC destination since you're already familiar with most of them. We're just going to focus on the steps associated with managing the destination.

10. Start the **Command Processing** application (you should still be working on computer 2).
11. Go to the **Destination** menu and select **Add POIC Destination**.

12. In the Add POIC Destination dialog fill out the **General** tab and the **Login** tab just as you normally would. Be sure to select the Command Database that shipped with TReK. It is called “CommandDatabase.mdb”. When you’re adding the ERIS Login session on the Login tab don’t forget to enter the IP address and port number you used when you configured the POIC Trainer on computer 1.
13. Now go to the **Manage** tab. You should see the screen shown in Figure 16.

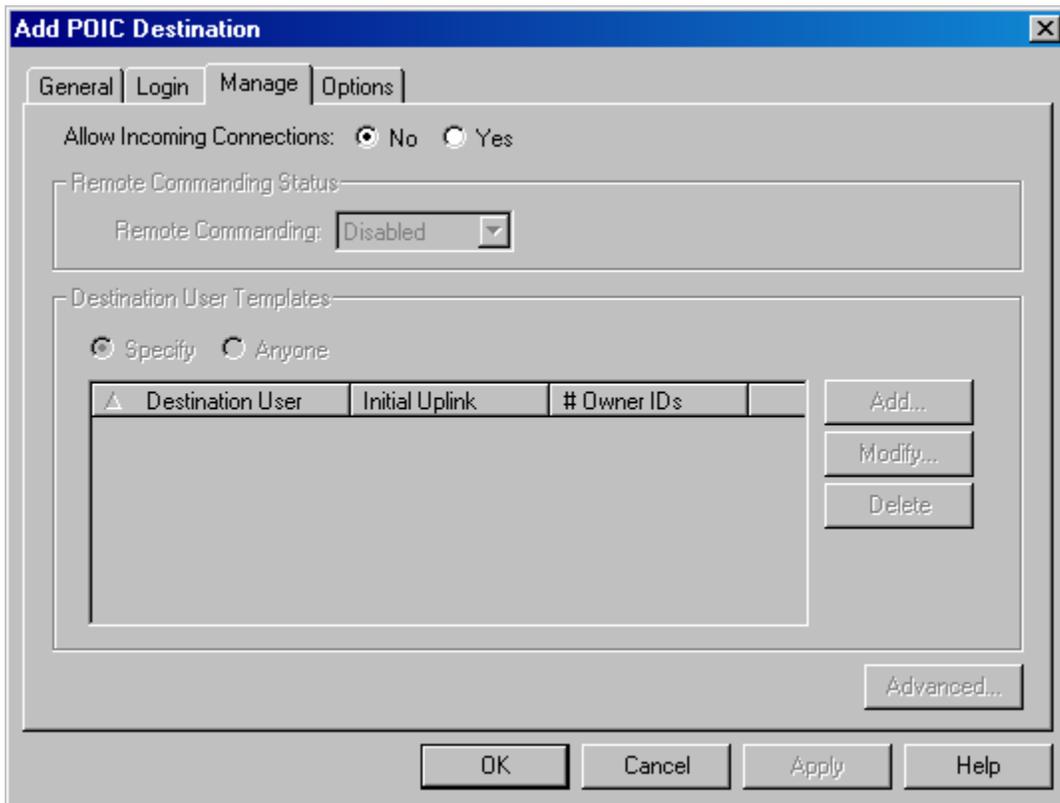
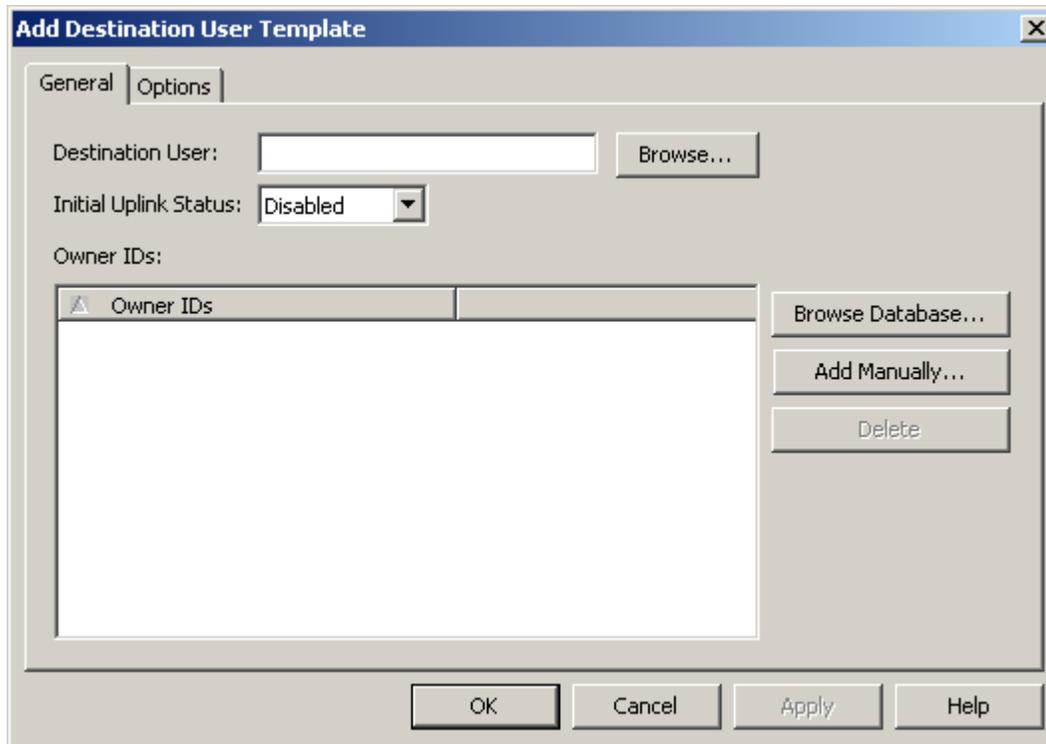


Figure 16 Add POIC Destination (Manage Tab) Dialog

14. Select **Yes** to allow incoming connections.
15. Leave the **Subnode Remote Commanding** status set to **Disabled**.
16. Go to the Destination User Templates area and select the **Add** button to add a destination user. Since we want to allow Subnode UserA to use this destination we need to create a user template for UserA. When you push the Add button you should see the dialog shown in Figure 17.

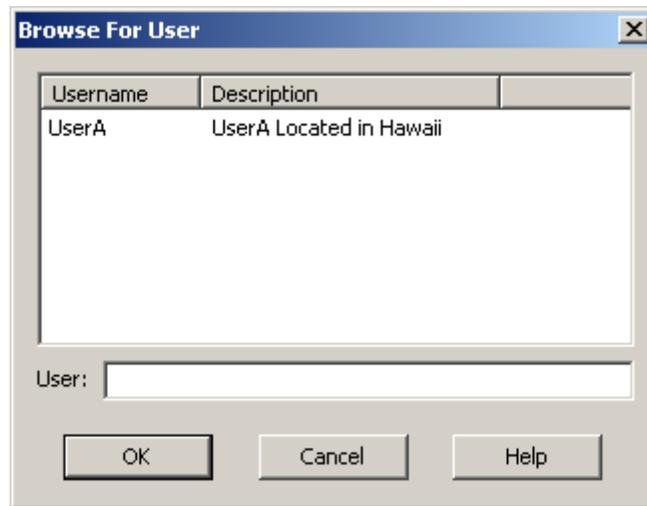


**Figure 17 Add Destination User Template Dialog**

This dialog is used to define the default properties associated with a destination user. You should think of a destination user as a template. This template is used in two different ways: 1) it identifies the characteristics of a remote user who is allowed to connect to the destination, and 2) it defines a specific set of default properties that will be associated with that user when they connect to the destination. These properties include the user's initial uplink status, the initial list of owner ids associated with the user (which defines the commands the user can update/uplink), and initial recording and viewing properties associated with the user's connection.

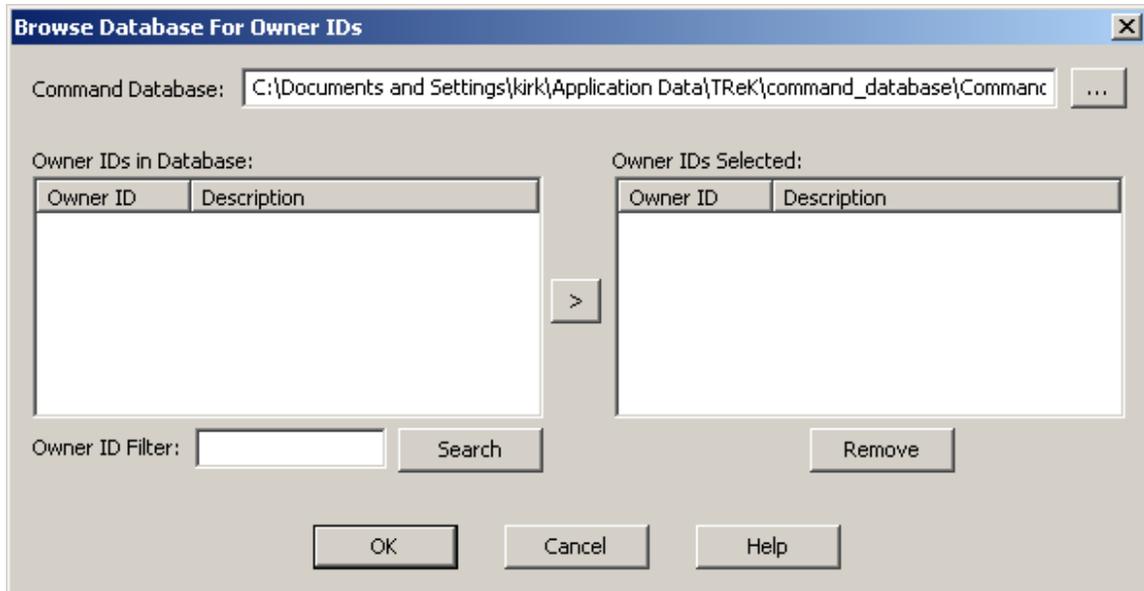
It's very important to remember that this is a template and these are default properties that are assigned when the user connects to the destination. Once a user is connected to the destination, changing these properties will not change the properties associated with the connection. They will only change the default properties associated with this template thereby affecting the next remote user that connects matching this template (username). The Manage Subnode Connections dialog is used to change the realtime properties associated with a specific unique connection. Therefore, if you wanted to change the uplink status or recording properties for a specific remote user (subnode) connection you would do this using the Manage Subnode Connections dialog (not the Destination User Template dialog). The Destination User Template dialog only changes the template that is used when a user first connects to the destination.

17. Push the **Browse** button to browse the list of user accounts that were created in the Remote Services application. You should see the dialog shown in Figure 18.



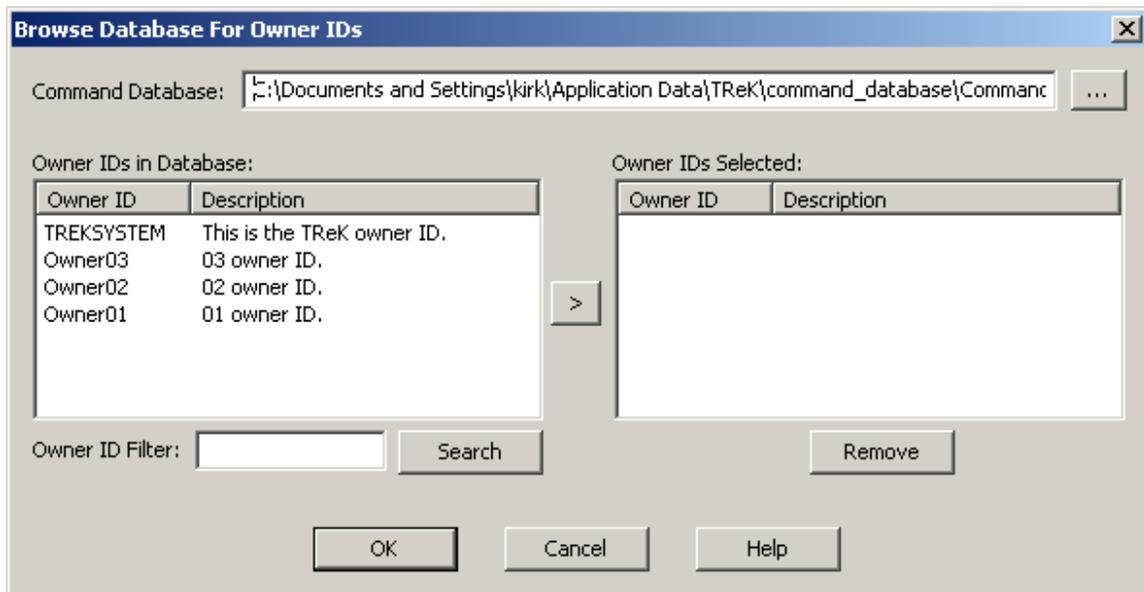
**Figure 18 Browse For User Dialog**

18. Select **UserA** and push **OK**.
19. Leave the **Initial Uplink Status** set to **Disabled**.
20. Now we need to add some command owner IDs to the list. This is how this destination's commands will be mapped to this subnode user. This subnode user will only be able to update/uplink commands that correspond to these owner IDs. Push the **Browse Database** button. The Browse Database For Owner IDs dialog shown in Figure 19 will be displayed. This dialog provides an easy way to search a TReK Command Database to select a specific set of owner IDs.



**Figure 19 Browse Database For Owner IDs Dialog**

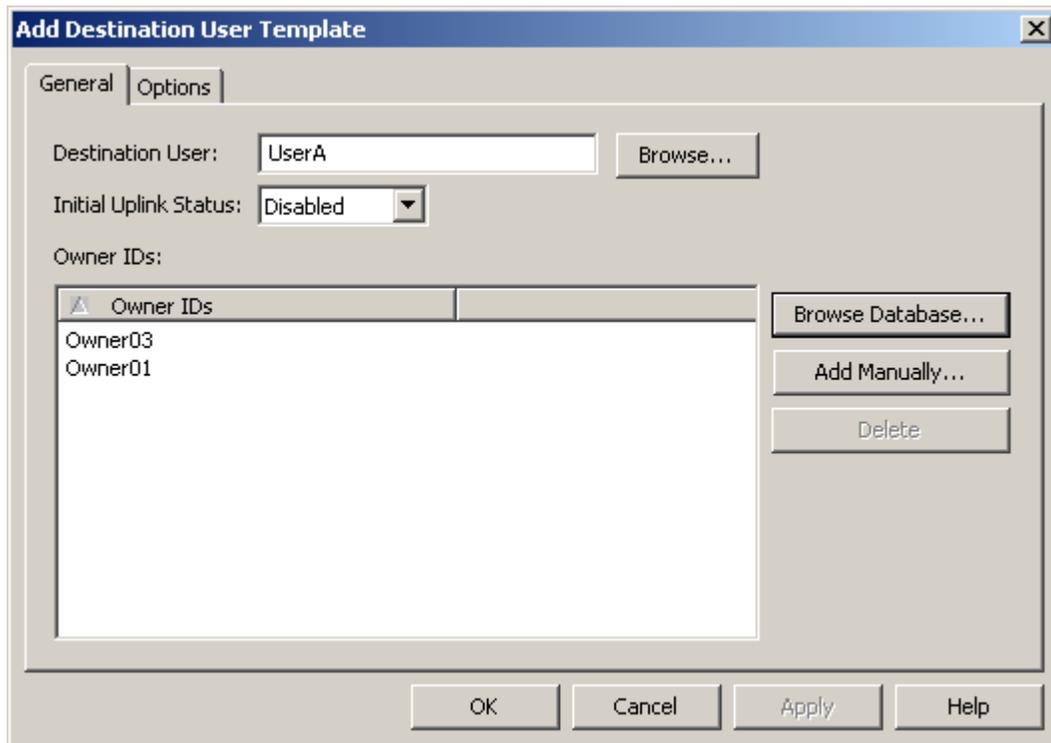
21. Push the **Search** button to see a list of all the owner IDs in this Command Database. You should see several owner IDs in the list as shown in Figure 20.



**Figure 20 Browse Database For Owner IDs Dialog with Owner IDs Listed**

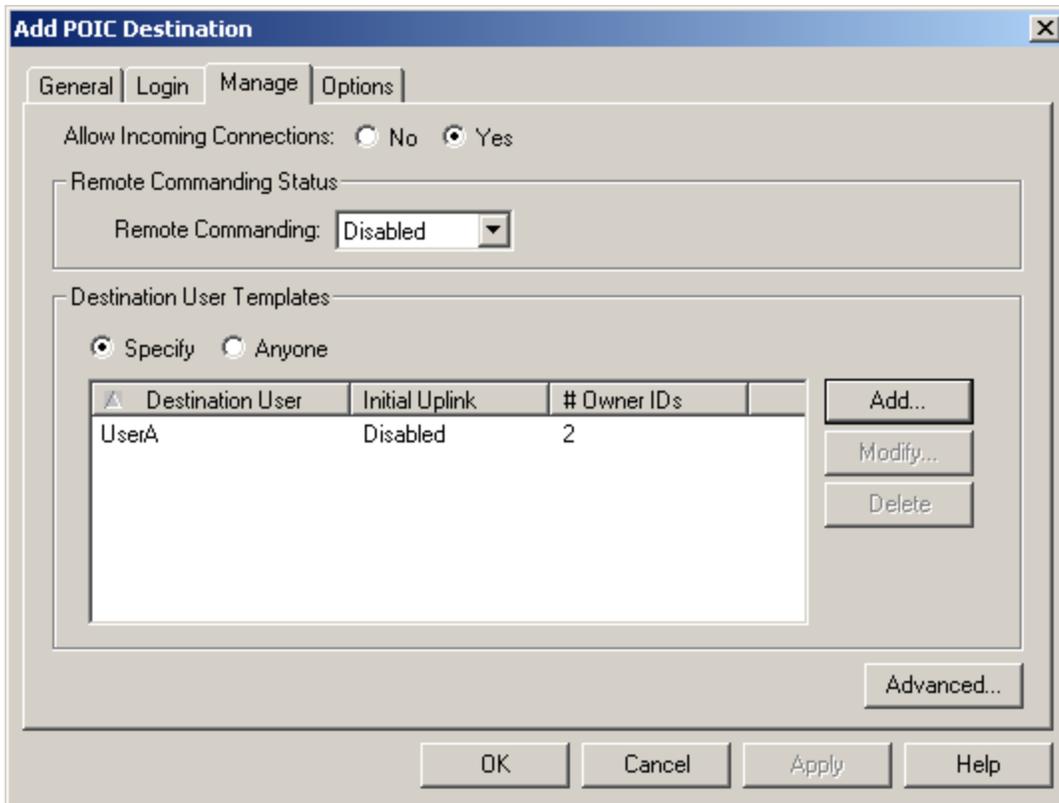
22. Select **Owner03** and **Owner01** from the list (you can hold down the Ctrl key to select multiple items) and push the > button (located between the lists). The Owner03 and Owner01 items should now be in the Owner IDs Selected list on the right. Push the **OK** button.

23. The Add Destination User dialog should now look like Figure 21. If you wanted to set recording and viewing properties associated with this destination user template you could do this on the Options tab. For now we'll just leave recording and viewing with their default values.



**Figure 21 Add Destination User Template Dialog Populated**

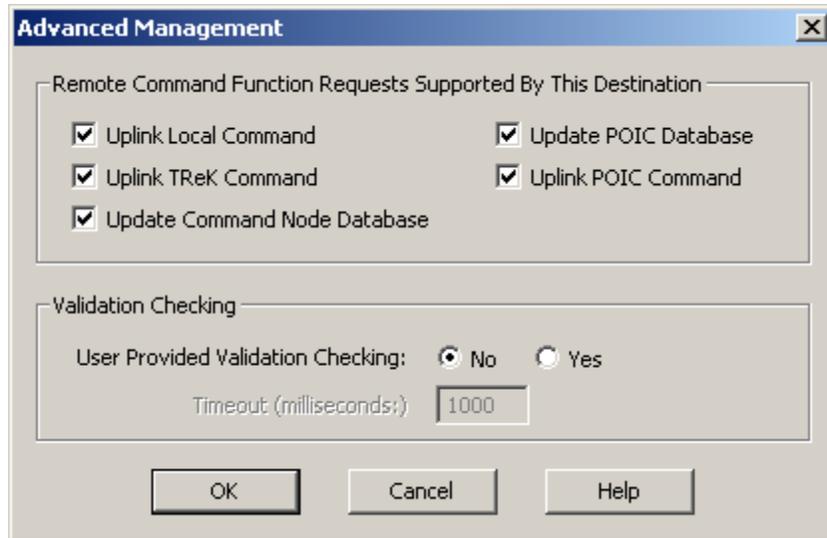
24. Push the **OK** button in the Add Destination User Template dialog. The Manage tab should now look like Figure 22.



**Figure 22 Manage Tab Populated with one Destination User Template**

Before we continue let's stop for a second and think about what we've done. We have now created a destination user template for UserA. The UserA template identifies that UserA is allowed to use this destination and identifies the configuration information that should be used when UserA connects to the destination. Please remember that these are "initial" configuration properties and will be used each time UserA connects. (That's right UserA can connect to the destination multiple times). This is why it is called a destination user template.

25. Push the **Advanced** button. The Advanced Management dialog shown in Figure 23 will be displayed.



**Figure 23 Advanced Management Dialog**

The Advanced Management dialog is used to configure specific management properties associated with this destination. These properties will be used for all subnodes (remote users) that connect to the destination. As you can see, you can set the command functions that will be supported for remote users and configure user provided validation checking. For this tutorial we're going to leave these properties set to their defaults.

26. Push the **OK** button to close the Advanced Management dialog.
27. Push the **OK** button on the Add POIC Destination dialog to add the destination to the destination list. Activate the destination. When prompted to login you can use the following username and password:

Username: captain  
Password: kirk

Mop Selection: Select any mop.

We're almost ready to go to the subnode machine, but let's take a look at two more features in Command Processing application that will help you manage subnode connections.

28. Go to the **View** menu and select **Configure Destination List Columns**. Add the "Allow Conn" column and the "# Subnode Conn" column. Now you can see that your POIC destination is allowing connections and you will be able to see the number of active subnode connections. Your main window should look similar to the main window shown in Figure 24.

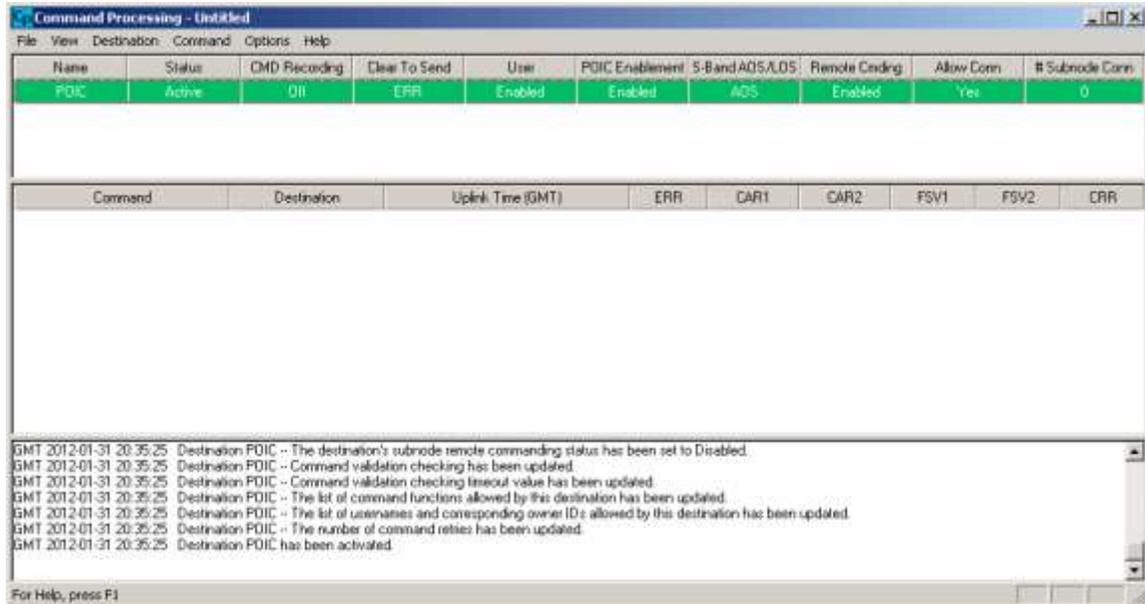


Figure 24 Command Processing Main Window with POIC Destination

29. Go to the **Options** menu and select **Manage Subnode Connections**. The dialog shown in Figure 25 is displayed.

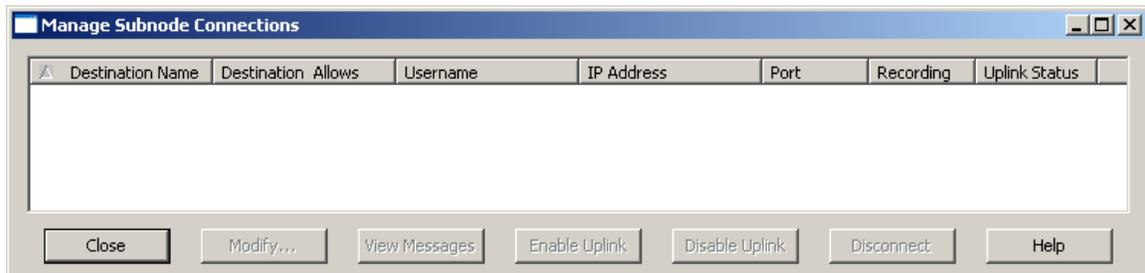


Figure 25 Manage Subnode Connections Dialog

This dialog will display each remote user connection for each destination that is allowing connections. This is the dialog you will use to change real-time properties associated with a remote user connection. This is how you enable and disable remote users and how you would modify remote user connection properties (such as recording properties and viewing properties.)

This dialog is empty right now because there are no remote user connections. But this won't be true for long. Next we're going to configure the subnode. Leave this computer as is and move to computer 3.

## Configure the TReK Subnode

### 5.3 Configure the TReK Subnode

In this section we're going to configure the subnode.

#### Step-By-Step

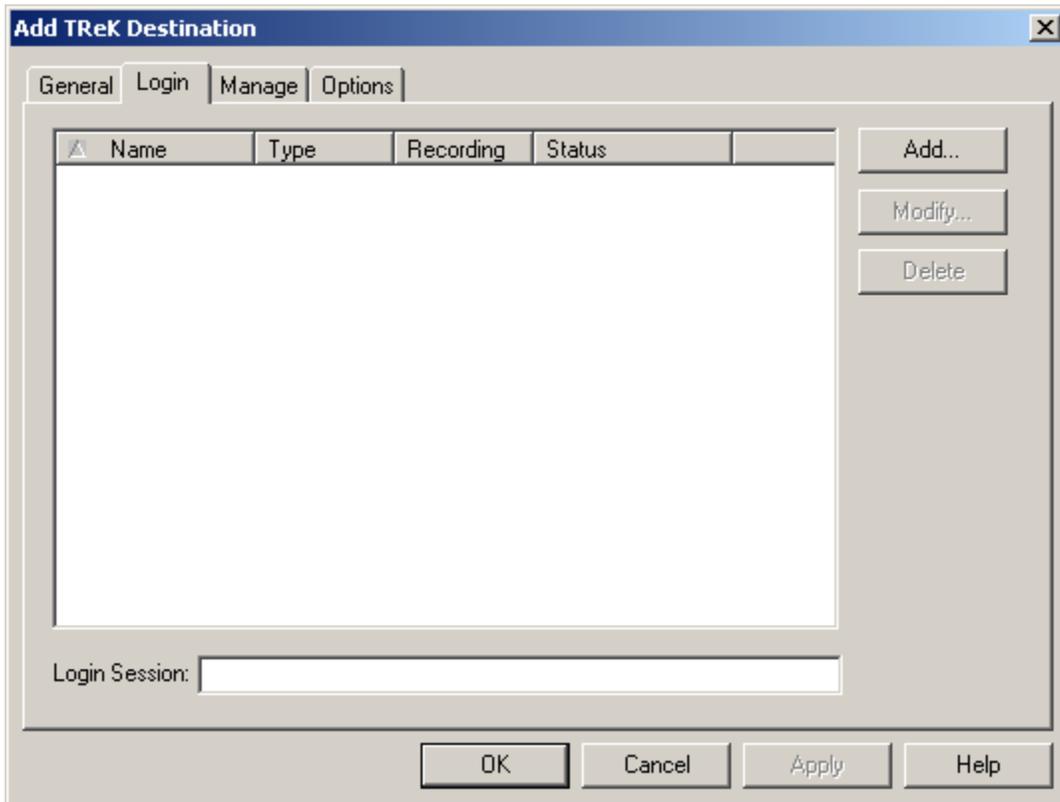
1. Go to the computer you have selected to be computer 3 and start the Command Processing application.
2. Go to the **Destination** menu and select **Add TReK Destination**. The Add TReK Destination dialog shown in Figure 26 is displayed.

**Figure 26 Add TReK Destination Dialog**

This dialog is very similar to the Add POIC Destination dialog. Note that even a TReK destination can be managed.

3. On the General tab add the “CommandDatabase.mdb” database that ships with TReK.

4. Go the Login tab. This is shown in Figure 27.



**Figure 27 Add TReK Destination (Login Tab) Dialog**

Note that this tab is identical to the Login tab in the Add POIC Destination dialog. The main difference is that you will be adding a TReK Login Session instead of an ERIS Login Session.

5. Push the Add button to add a TReK Login Session. The dialog shown in Figure 28 is displayed.

The screenshot shows a dialog box titled "Add TReK Login Session". It has two tabs: "General" and "Options". The "General" tab is selected. Inside the dialog, there is a "Name" field containing "TReK\_login". Below this is a section titled "Communication Information" which contains three input fields: "Remote TReK IP Address" with the value "10.0.0.2", "Remote TReK Port" with the value "10100", and "Username" which is empty. To the right of the "Username" field is a "Password" field, also empty. At the bottom of the dialog are four buttons: "OK", "Cancel", "Apply", and "Help".

**Figure 28 Add TReK Login Session Dialog**

6. Go to the **Remote TReK IP Address** field and enter the IP Address you used on computer 2 when you created the Sentinel in the Remote Services application. Remember, that when you activate this TReK destination, it is going to attempt to login to the command node (by establishing a connection with the sentinel). Be sure you also enter the correct Remote TReK Port. If you didn't change the port when you added the sentinel then default value of 10100 shown here will match the sentinel's default port of 10100. When you're done push the **OK** button to add the TReK Login Session.
7. Once you've finished filling out the General tab and the Login tab you're ready to add the TReK destination. Push the **OK** button on the Add TReK Destination dialog to add it to the destination list.
8. Select the TReK destination in the main window destination list. Go to the **Destination** menu and select **Activate Destination**. This will start the activation process.
9. You should now see the Login dialog shown in Figure 29 requesting your login information to login to the command node.



**Figure 29 Login Dialog**

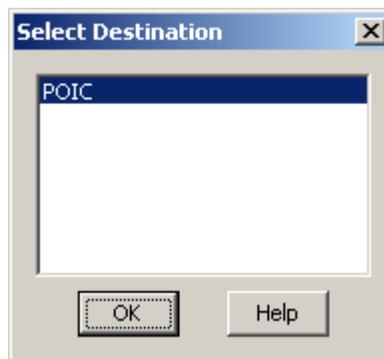
10. In the Login dialog enter the following information:

Username: UserA  
 Password: Hawaii5o!

*Note: The login information is case sensitive.*

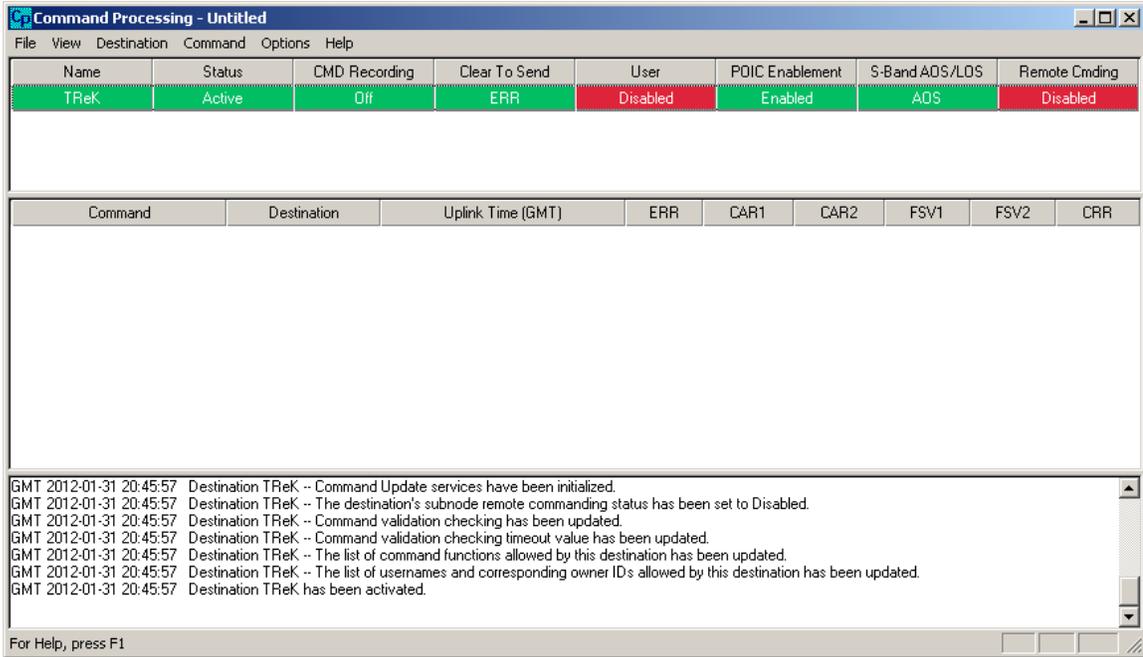
11. If you entered the correct information for the UserA account on the command node you should now see a prompt to select a destination as shown in Figure 30.

*Note: If you entered the wrong information in the Login Dialog then your login failed and you're probably wondering what to do now. Don't worry all you need to do is select Activate Destination to try again.*



**Figure 30 Select Destination Dialog**

12. In the Select Destination dialog select **POIC** and push the **OK** button. Once you do this the TReK Destination will finish activating and your main window should look like the one shown in Figure 31.



**Figure 31 Command Processing Main Window with TReK Destination**

13. You should notice two things right away: 1) User is disabled and 2) Remote Commanding (Remote Cmding) is disabled. You actually set these properties when you configured the POIC Destination on the command node. Remember the Remote Commanding Status on the Manage tab? This corresponds to the Remote Cmding column you see here. Remember the Initial Uplink Status on the Destination User Template dialog? This corresponds to the User column here. If you were to attempt to send a command to the TReK destination at this point the command node would reject the command immediately. This is because you are disabled at both the remote commanding level and the user level. Let's fix that problem by going over to the command node and enabling both of these properties. We can also find out what changed on the command node while we were working over here on the subnode.

## Use the Command Node to Enable Remote Commanding and Individual Subnodes

## 5.4 Use the Command Node to Enable Remote Commanding and Individual Subnodes

In this section we're going to modify the Remote Commanding property of the POIC Destination on the Command Node to enable remote commanding. We're also going to enable UserA.

### Step-By-Step

1. Go back to the Command Node computer (computer 2). There have been a few changes since you left. Note the following:
  - a. The Manage Subnode Connections dialog now shows a remote user connection. You can now see that UserA is logged in.
  - b. The Command Processing main window now shows that the POIC Destination has 1 subnode connection.
2. Let's start by enabling the POIC destination's subnode remote commanding property. Select the POIC destination in the destination list. Go to the **Destination** menu and select **Enable Remote Subnode Commanding**.

*If your subnode computer isn't too far away from your command node computer sneak a peak at the Command Processing main window on the subnode. You should now see that remote commanding is enabled for the TReK Destination on the subnode.*

3. Now let's enable UserA. Go to the **Manage Subnode Connections** dialog. In this dialog select the UserA connection. Push the **Enable Uplink** button to enable UserA.

*Again if your subnode computer isn't too far away from your command node computer sneak a peak at the Command Processing main window on the subnode. You should now see that the user column now shows enabled for the TReK Destination on the subnode.*

Great! Now the subnode is ready to make some command requests.

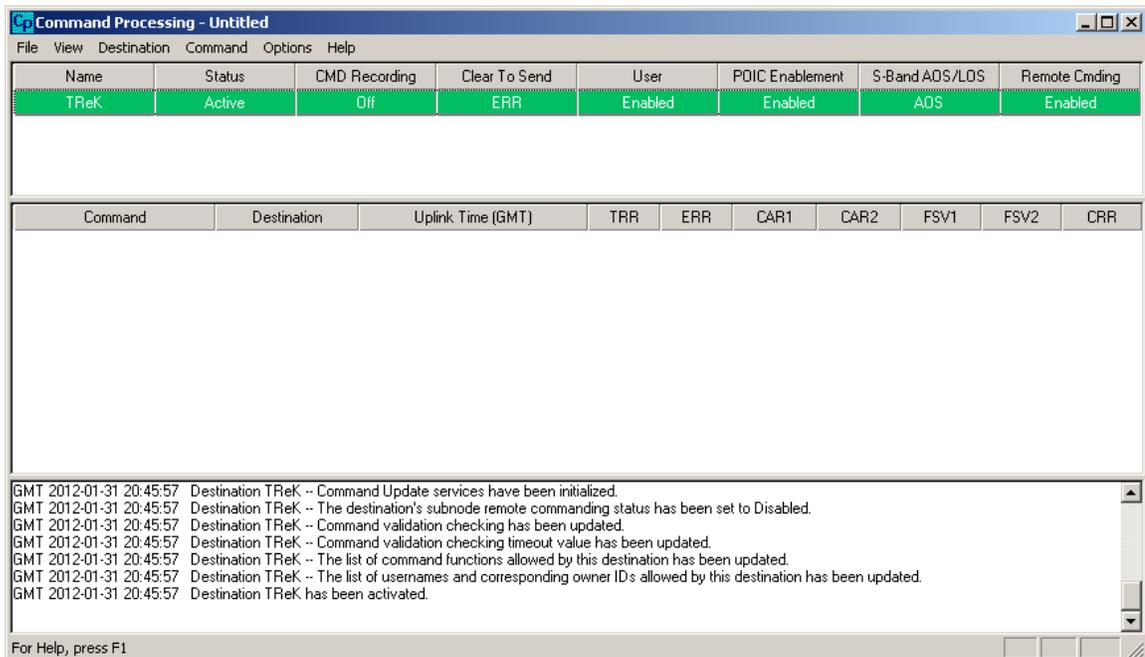
## Send a Command Uplink Request from the Subnode to the Command Node

## 5.5 Send a Command Uplink Request from the Subnode to the Command Node

In this section we're going to send a command uplink request from the subnode to the command node.

### Step-By-Step

1. If you haven't moved over to your subnode computer it's time to head that way. Before we send the command there's another feature in Command Processing that is helpful if you're a subnode. Go to the **View** menu and select **Set Main Window Command Track Preferences**. In this dialog turn on the TReK Receipt Response (TRR) column. Push **OK** to close the dialog. Your main window should look similar to the one shown in Figure 32.



**Figure 32 Command Processing Main Window with TRR Column**

You should now see a new column called TRR in the command track area (it's the 4<sup>th</sup> column from the left). Since you're already familiar with command responses you can probably guess what this is all about. When you send a command to a TReK destination it will respond with a TReK Receipt Response. This will let you know that the TReK system (command node) received your command request and whether it was accepted or rejected. As you might guess you can use the View Realtime Commanding Messages dialog to see the information in the TRR.

2. We're finally here, let's send a command. You know what to do. Go to the **Command** menu and select **Commands**. In the **Commands** dialog, select the **CAMERA\_MODE** command and push the **Uplink POIC Command**. This will request the command node's POIC destination to make a request to the POIC to uplink the **CAMERA\_MODE** command stored in the POIC database. Let's see what happened.

You should now see some command track information in the main window. All columns are marked OK meaning the following:

1. The command was successfully sent from the subnode to the command node's POIC destination.
2. The command node's POIC destination performed all the necessary checks and then forwarded the command request to the POIC.
3. The POIC processed the request and forwarded the command to JSC.
4. The command went through all the other hops to make it to your payload and all the typical responses came back (CARs, FSVs, etc.).
5. The command node sent all the command responses it received back to the subnode.

**Yee Ha! It really works!**

So that's it in a nutshell. The basics of how you use the command management capability. For more information please reference the Remote Services User Guide and the Command Processing User Guide. Have fun and be nice to your subnodes.

## Appendix A Glossary

Note: This Glossary is global to all TReK documentation. All entries listed may not be referenced within this document.

|  |  |
|--|--|
| Application Programming Interface (API)                      | A set of functions used by an application program to provide access to a system's capabilities.  |
| Application Process Identifier (APID)                        | An 11-bit field in the CCSDS primary packet header that identifies the source-destination pair for ISS packets. The type bit in the primary header tells you whether the APID is a payload or system source-destination. |
| Calibration  | The transformation of a parameter to a desired physical unit or text state code.   |
| Communications Outage Recorder                               | System that captures and stores payload science, health and status, and ancillary data during TDRSS zone of exclusion.   |
| Consultative Committee for Space Data Systems (CCSDS) format | Data formatted in accordance with recommendations or standards of the CCSDS.   |
| Consultative Committee for Space Data Systems (CCSDS) packet | A source packet comprised of a 6-octet CCSDS defined primary header followed by an optional secondary header and source data, which together may not exceed 65535 octets.  |
| Conversion   | Transformation of downlinked spacecraft data types to ground system platform data types.   |
| Custom Data Packet   | A packet containing a subset of parameters that can be selected by the user at the time of request.  |
| Cyclic Display Update Mode                                   | A continuous update of parameters for a particular display.  |
| Decommutation (Decom)  | Extraction of a parameter from telemetry.  |
| Discrete Values  | Telemetry values that have states (e.g., on or off).   |

|                              |   |
|------------------------------|---|
| Dump                         | During periods when communications with the spacecraft are unavailable, data is recorded onboard and played back during the next period when communications resume. This data, as it is being recorded onboard, is encoded with an onboard embedded time and is referred to as dump data.                                     |
| Enhanced HOSC System (EHS)   | Upgraded support capabilities of the HOSC systems to provide multi-functional support for multiple projects. It incorporates all systems required to perform data acquisition and distribution, telemetry processing, command services, database services, mission support services, and system monitor and control services. |
| Exception Monitoring         | A background process capable of continuously monitoring selected parameters for Limit or Expected State violations. Violation notification is provided through a text message.  |
| Expected State Sensing       | Process of detecting a text state code generator in an off-nominal state.   |
| EXPRESS                      | An EXPRESS Rack is a standardized payload rack system that transports, stores and supports experiments aboard the International Space Station. EXPRESS stands for EXpedite the PRocessing of Experiments to the Space Station.  |
| File transfer protocol (ftp) | Protocol to deliver file-structured information from one host to another.   |
| Flight ancillary data        | A set of selected core system data and payload health and status data collected by the USOS Payload MDM, used by experimenters to interpret payload experiment results.   |

|   |   |
|---|---|
| Grayed out                                  | Refers to a menu item that has been made insensitive, which is visually shown by making the menu text gray rather than black. Items that are grayed out are not currently available.  |
| Greenwich Mean Time (GMT)                   | The solar time for the meridian passing through Greenwich, England. It is used as a basis for calculating time throughout most of the world.  |
| Ground ancillary data                       | A set of selected core system data and payload health and status data collected by the POIC, which is used by experimenters to interpret payload experiment results. Ground Ancillary Data can also contain computed parameters (pseudos).  |
| Ground receipt time                         | Time of packet origination. The time from the IRIG-B time signal received.  |
| Ground Support Equipment (GSE)              | GSE refers to equipment that is brought in by the user (i.e. equipment that is not provided by the POIC).   |
| Ground Support Equipment Packet             | A CCSDS Packet that contains data extracted from any of the data processed by the Supporting Facility and the format of the packet is defined in the Supporting Facility's telemetry database.  |
| Huntsville Operations Support Center (HOSC) | A facility located at the Marshall Space Flight Center (MSFC) that provides scientists and engineers the tools necessary for monitoring, commanding, and controlling various elements of space vehicle, payload, and science experiments. Support consists of real-time operations planning and analysis, inter- and intra-center ground operations coordination, facility and data system resource planning and scheduling, data systems monitor and control operations, and data flow coordination. |

|  |   |
|--|---|
| IMAQ ASCII                                   | A packet type that was added to TReK to support a very specific application related to NASA's Return to Flight activities. It is not applicable to ISS. It is used to interface with an infrared camera that communicates via ASCII data.   |
| Limit Sensing                                | Process of detecting caution and warning conditions for a parameter with a numerical value.   |
| Line Outage Recorder Playback                | A capability provided by White Sands Complex (WSC) to play back tapes generated at WSC during ground system communication outages.  |
| Measurement Stimulus Identifier (MSID)       | Equivalent to a parameter.  |
| Monitoring                                   | A parameter value is checked for sensing violations. A message is generated if the value is out of limits or out of an expected state.  |
| Parameter                                    | TReK uses the generic term parameter to mean any piece of data within a packet. Sometimes called a measurement or MSID in POIC terminology.   |
| Payload Data Library (PDL)                   | An application that provides the interface for the user to specify which capabilities and requirements are needed to command and control his payload.   |
| Payload Data Services Systems (PDSS)         | The data distribution system for ISS. Able to route data based upon user to any of a number of destinations.  |
| Payload Health and Status Data               | Information originating at a payload that reveals the payload's operational condition, resource usage, and its safety/anomaly conditions that could result in damage to the payload, its environment or the crew.                           |
| Payload Operations Integration Center (POIC) | Manages the execution of on-orbit ISS payloads and payload support systems in coordination/unison with distributed International Partner Payload Control Centers, Telescience Support Centers (TSC's) and payload-unique remote facilities. |

|                                   |  |
|-----------------------------------|--|
| Payload Rack Checkout Unit (PRCU) | The Payload Rack Checkout Unit is used to verify payload to International Space Station interfaces for U.S. Payloads.  |
| Playback                          | Data retrieved from some recording medium and transmitted to one or more users.  |
| Pseudo Telemetry (pseudo data)    | Values that are created from calculations instead of directly transported telemetry data. This pseudo data can be created from computations or scripts and can be displayed on the local PC.                               |
| Remotely Generated Command        | A command sent by a remote user whose content is in a raw bit pattern format. The commands differ from predefined or modifiable commands in that the content is not stored in the POIC Project Command Database (PCDB).    |
| Science data                      | Sensor or computational data generated by payloads for the purpose of conducting scientific experiments.   |
| Subset                            | A collection of parameters from the total parameter set that is bounded as an integer number of octets but does not constitute the packet itself. A mini-packet.   |
| Super sampled                     | A parameter is super sampled if it occurs more than once in a packet.  |
| Swap Type                         | A flag in the Parameter Table of the TReK database that indicates if the specified datatype is byte swapped (B), word swapped (W), byte and word swapped (X), byte reversal (R), word reversal (V) or has no swapping (N). |
| Switching                         | A parameter's value can be used to switch between different calibration and sensing sets. There are two types of switching on TReK: range and state code.  |

|  |  |
|--|--|
| Transmission Control Protocol (TCP)        | TCP is a connection-oriented protocol that guarantees delivery of data.  |
| Transmission Control Protocol (TCP) Client | A TCP Client initiates the TCP connection to connect to the other party.   |
| Transmission Control Protocol (TCP) Server | A TCP Server waits for (and accepts connections from) the other party.   |
| Telemetry                                  | Transmission of data collected from a source in space to a ground support facility. Telemetry is downlink only.  |
| Telescience Support Center (TSC)           | A TSC is a NASA funded facility that provides the capability to plan and operate on-orbit facility class payloads and experiments, other payloads and experiments, and instruments.  |
| User Application                           | Any end-user developed software program that uses the TReK Application Programming Interface software. Used synonymously with User Product.  |
| User Data Summary Message (UDSM)           | Packet type sent by PDSS that contains information on the number of packets sent during a given time frame for a PDSS Payload packet. For details on UDSM packets, see the POIC to Generic User IDD (SSP-50305).   |
| Uplink format                              | The bit pattern of the command or file uplinked.   |
| User Datagram Protocol (UDP)               | UDP is a connection-less oriented protocol that does not guarantee delivery of data. In the TCP/IP protocol suite, the UDP provides the primary mechanism that application programs use to send datagrams to other application programs. In addition to the data sent, each UDP message contains both a destination port number and a fully qualified source and destination addresses making it possible for the UDP software on the destination to deliver the message to the correct recipient process and for the recipient process to send a reply. |

|              |   |
|--------------|---|
| User Product | Any end-user developed software program that uses the TReK Application Programming Interface software. Used synonymously with User Application. |
| Web          | Term used to indicate access via HTTP protocol; also referred to as the World Wide Web (WWW).   |

## Appendix B Acronyms

Note: This acronym list is global to all TReK documentation. Some acronyms listed may not be referenced within this document.

|            |  |
|------------|--|
| AOS        | Acquisition of Signal                                      |
| API        | Application Programming Interface                          |
| APID       | Application Process Identifier                             |
| ASCII      | American Standard Code for Information Interchange         |
| CAR        | Command Acceptance Response                                |
| CAR1       | First Command Acceptance Response                          |
| CAR2       | Second Command Acceptance Response                         |
| CCSDS      | Consultative Committee for Space Data Systems              |
| CDB        | Command Database   |
| CDP        | Custom Data Packet   |
| COR        | Communication Outage Recorder                              |
| COTS       | Commercial-off-the-shelf                                   |
| CRR        | Command Reaction Response                                  |
| DSM        | Data Storage Manager                                       |
| EHS        | Enhanced Huntsville Operations Support Center (HOSC)       |
| ERIS       | EHS Remote Interface System                                |
| ERR        | EHS Receipt Response                                       |
| EXPRESS    | Expediting the Process of Experiments to the Space Station |
| ES         | Expected State   |
| FAQ        | Frequently Asked Question                                  |
| FDP        | Functionally Distributed Processor                         |
| FSV        | Flight System Verifier                                     |
| FSV1       | First Flight System Verifier                               |
| FSV2       | Second Flight System Verifier                              |
| FPD        | Flight Projects Directorate                                |
| FTP        | File Transfer Protocol                                     |
| GMT        | Greenwich Mean Time  |
| GRT        | Ground Receipt Time  |
| GSE        | Ground Support Equipment                                   |
| HOSC       | Huntsville Operations Support Center                       |
| ICD        | Interface Control Document                                 |
| IMAQ ASCII | Image Acquisition ASCII                                    |
| IP         | Internet Protocol  |
| ISS        | International Space Station                                |
| LDP        | Logical Data Path  |
| LES        | Limit/Expected State                                       |
| LOR        | Line Outage Recorder                                       |
| LOS        | Loss of Signal   |
| MCC-H      | Mission Control Center – Houston                           |
| MOP        | Mission, Operational Support Mode, and Project             |
| MSFC       | Marshall Space Flight Center                               |

|        |  |
|--------|--|
| MSID   | Measurement Stimulus Identifier                    |
| NASA   | National Aeronautics and Space Administration      |
| OCDB   | Operational Command Database                       |
| OS     | Operating System                                   |
| PC     | Personal Computer, also Polynomial Coefficient     |
| PCDB   | POIC Project Command Database                      |
| PDL    | Payload Data Library                               |
| PDSS   | Payload Data Services System                       |
| PGUIDD | POIC to Generic User Interface Definition Document |
| POIC   | Payload Operations Integration Center              |
| PP     | Point Pair   |
| PRCU   | Payload Rack Checkout Unit                         |
| PSIV   | Payload Software Integration and Verification      |
| RPSM   | Retrieval Processing Summary Message               |
| SC     | State Code   |
| SCS    | Suitcase Simulator                                 |
| SSP    | Space Station Program                              |
| SSCC   | Space Station Control Center                       |
| SSPF   | Space Station Processing Facility                  |
| TCP    | Transmission Control Protocol                      |
| TReK   | Telescience Resource Kit                           |
| TRR    | TReK Receipt Response                              |
| TSC    | Telescience Support Center                         |
| UDP    | User Datagram Protocol                             |
| UDSM   | User Data Summary Message                          |
| URL    | Uniform Resource Locator                           |
| USOS   | United States On-Orbit Segment                     |
| VCDU   | Virtual Channel Data Unit                          |
| VCR    | Video Cassette Recorder                            |
| VPN    | Virtual Private Network                            |