STK/Scheduler Tutorial

CONTENTS

Introduction

This tutorial will introduce and familiarize you with the basic functions and features of STK/Scheduler; you will start the STK/Scheduler module, specify a planning period, define various tasks and the resources that they require, import access data and event reports from STK to help define task scheduling opportunities, and solve the scheduling problem using two of the available deconfliction and optimization algorithms. In addition, you will exercise the various controls for on-screen schedule viewing and generate task and resource-based ASCII reports. This tutorial generally takes a little more than one hour to complete.

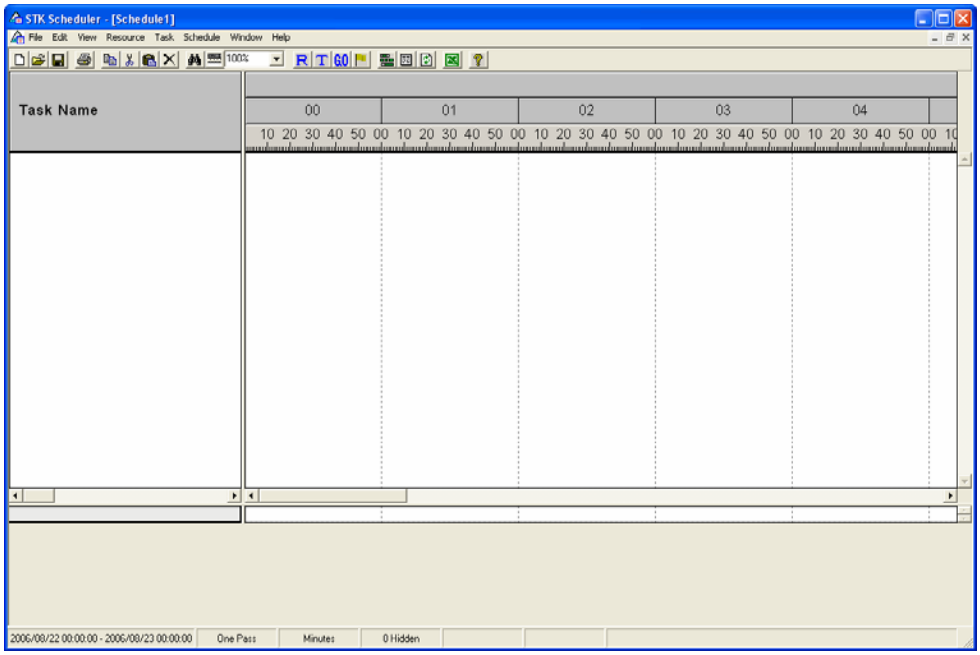
Licenses Needed

This tutorial requires that you have STK/Scheduler installed and licensed (version 3.2 or higher). STK version 6.0 or higher and STK/Connect are also required.

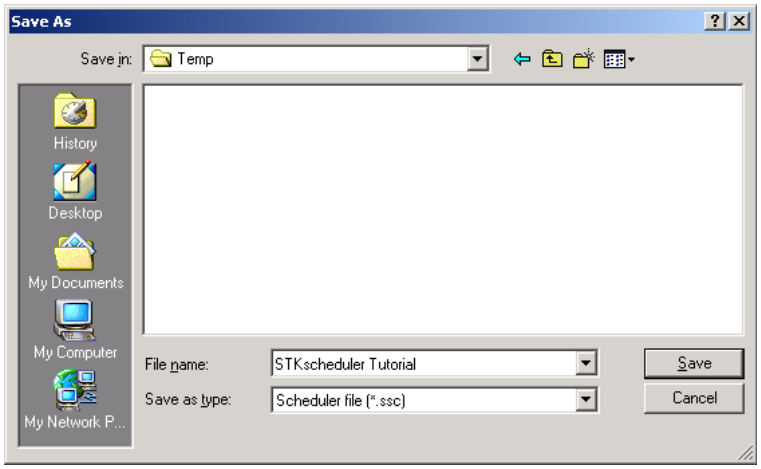
If you would like additional information about any of the options and fields on any STK/Scheduler form as you go through this exercise, please use the form-specific STK/Scheduler HTML Help available by clicking on the "?" button on any form.

Setup

Start the STK/Scheduler module by double-clicking on the STK/Scheduler icon on the desktop. The following STK/Scheduler blank main Gantt view window will appear. Resize the window to make it larger, if desired:

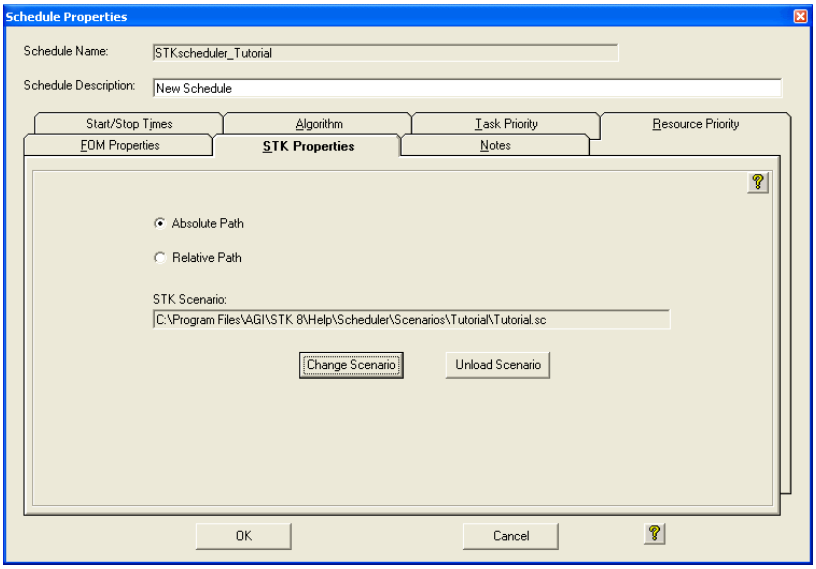


STK/Scheduler works with schedule files, similar to the way Microsoft Word works with document files: Everything about a scheduling problem (including its solution) is saved in a schedule file. Give the current blank file a name so that you can save your work and come back to it later; select ***File > Save As. . .*** . Enter the filename "***STKscheduler Tutorial***" and browse for the directory where you want to save it, then click Save:



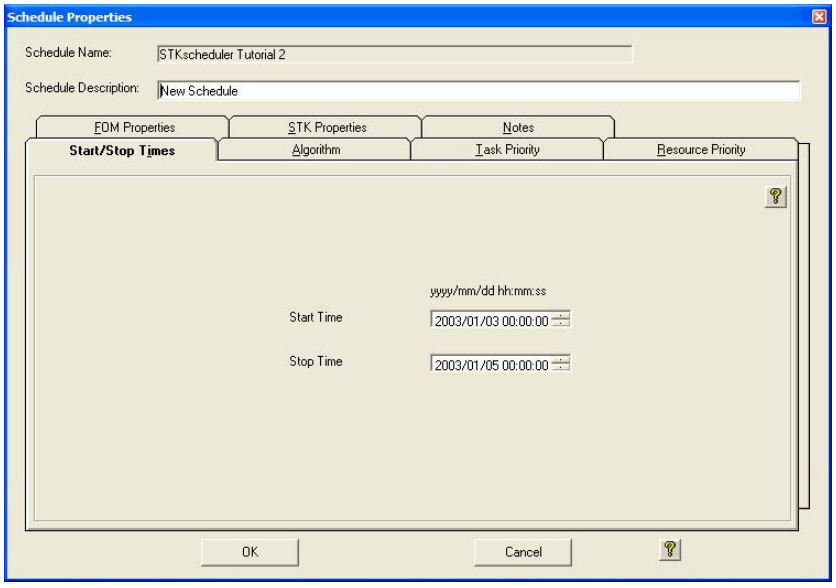
In order for STK objects and related access data and event reports to be applied to the scheduling problem definition (and solution), you need to associate your STK/Scheduler planning file with a specific STK scenario file. Select ***Schedule > STK > Load STK Scenario. . .*** , click Change Scenario, and select the ***Tutorial.sc*** scenario file from the:

[Installation Drive]:\Program Files\AGI\STK 6.0\ Help\Scheduler\Scenarios\Tutorial directory:



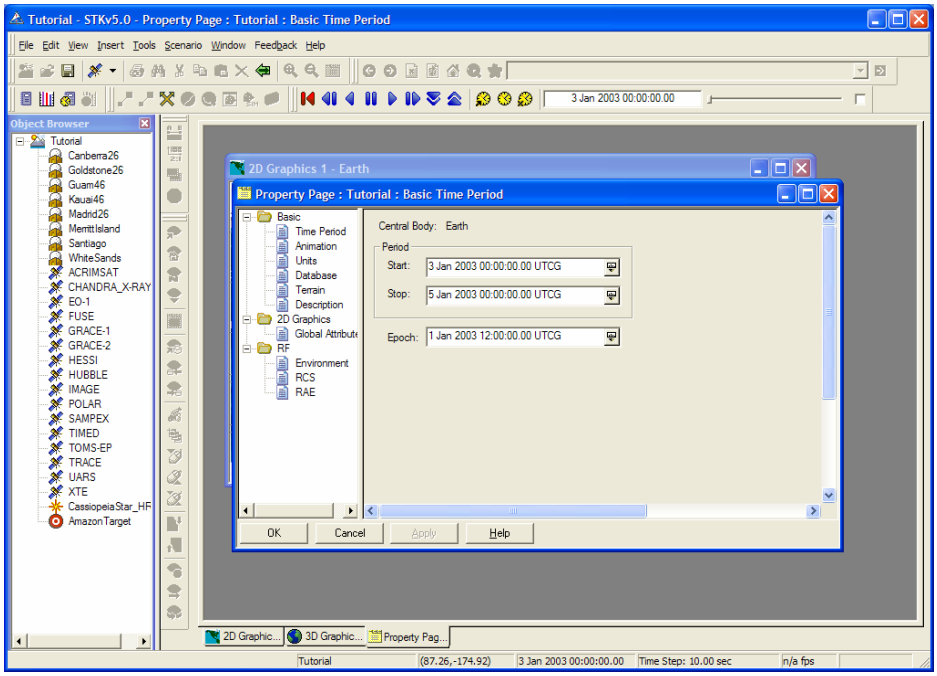
Click OK; STK/Scheduler will start STK and load the selected scenario. After the scenario loads, go ahead and minimize the STK forms or bring the STK/Scheduler form to the front.

Next, set the schedule period start and stop times. Select ***Schedule > Define Start/Stop. . .*** and the following form will appear:



Set the ***Start Time*** to ***2003/1/03 00:00:00*** and the ***Stop Time*** to ***2003/1/05 00:00:00*** and click OK. This sets a two-day period for scheduling for this planning file. All recurring tasks, access calculations and other time-related information will be bounded by the start and stop times defined for the schedule file. The schedule file schedule time period is shown in the lower left corner of the main STK/Scheduler form at all times.

Verify that the STK/Scheduler software has updated the STK scenario times to match the schedule start/stop times by right-clicking on the ***Tutorial*** scenario object in the ***STK Object Browser***, and selecting ***Properties Browser***: (verify start and stop times):

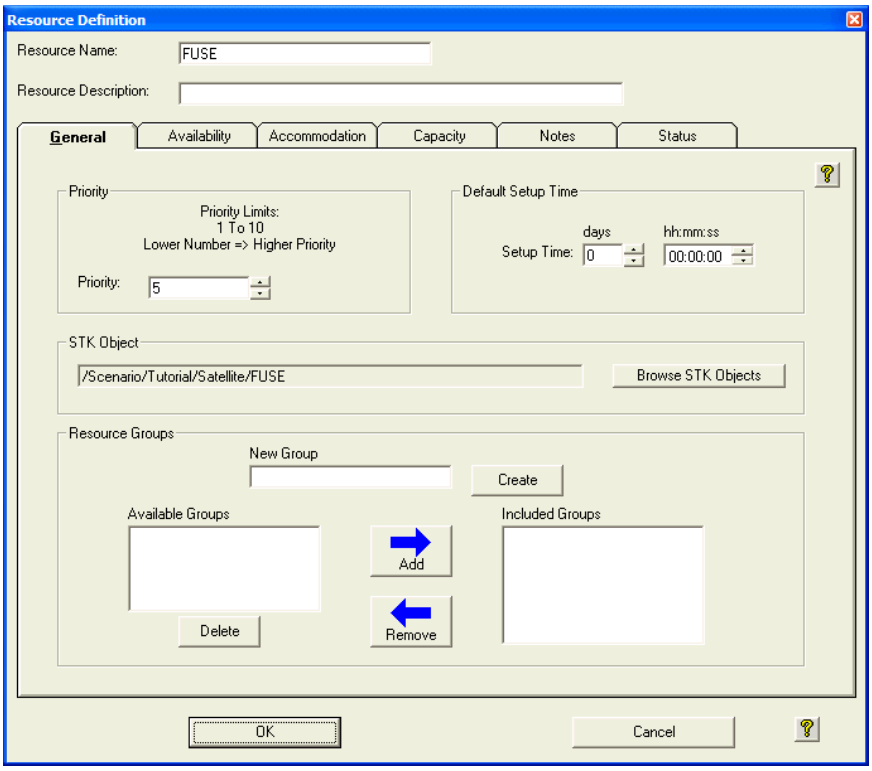


Close the Basic Properties window and minimize the STK window.

Defining Resources

STK/Scheduler solves task scheduling problems related to limited resources. Before tasks can be defined the resources that they require must be defined. This portion of the exercise defines seven resources that will be used as resource options to support the tasks defined in the next section of the exercise. Expect this section of the tutorial to take about 20 minutes to complete.

To define a new resource select ***Resource*** > ***New/Insert***. This will bring up the Resource Definition form, General tab:

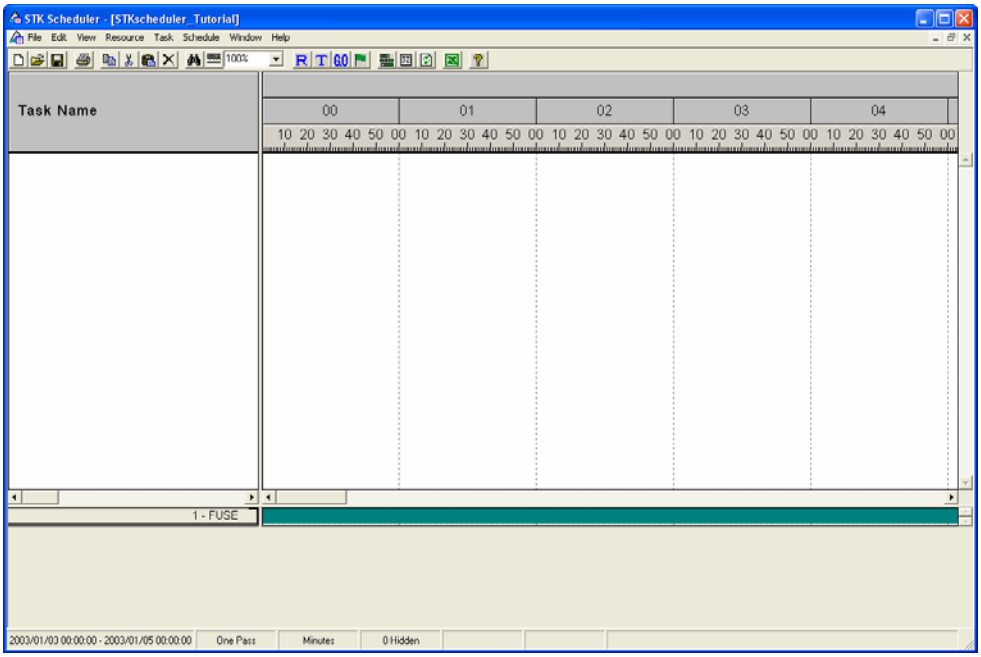


Type ***FUSE*** in the Resource Name field and click on Browse STK Objects to select the ***FUSE*** satellite object from the available STK scenario objects. This will associate the FUSE resource in the STK/Scheduler schedule file with the FUSE satellite object in the associated STK scenario for the purposes of access calculations and event reports.

Don't worry about the other resource definition tabs for now. Default values will be assigned for Availability (always available), Accommodation (support maximum of 1 task at a time),

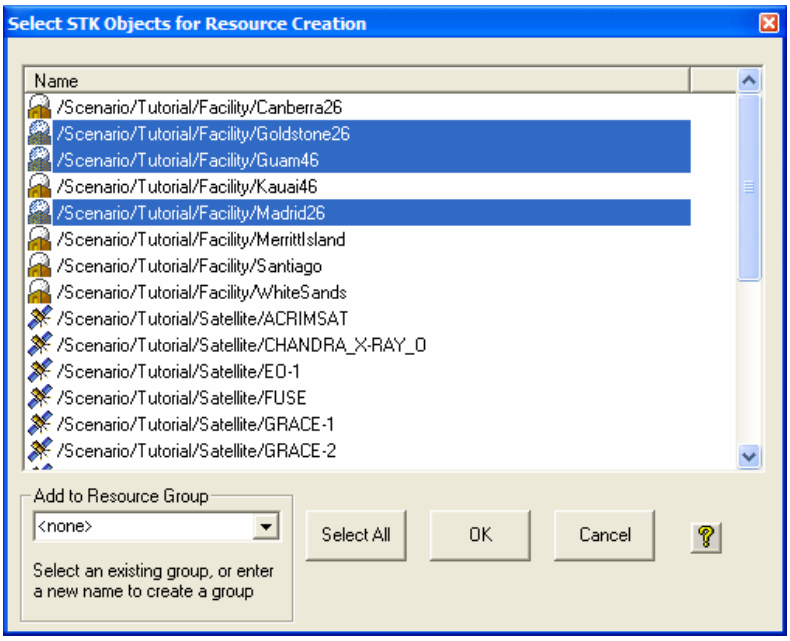
Capacity (n/a), Notes (none), and Status (blank until scheduling is performed). You will use these tabs for other resource definitions in this section.

Click OK to apply the new resource to the schedule file. You will see the resource listed in the resource availability section at the bottom of the Gantt view window:



The aqua-colored bar to the right of the resource name shows the resource availability against the schedule timeline. The line is solid since we did not change the "always available" default definition for resource availability. Note that this availability is for the resource in general and does not intend to represent STK accesses that will be applied on a task-specific basis later in this exercise.

A quicker way to define resources that are associated with STK objects is to use the STK ingest tool. Select ***Resource > Ingest from STK*** and select ***All***:



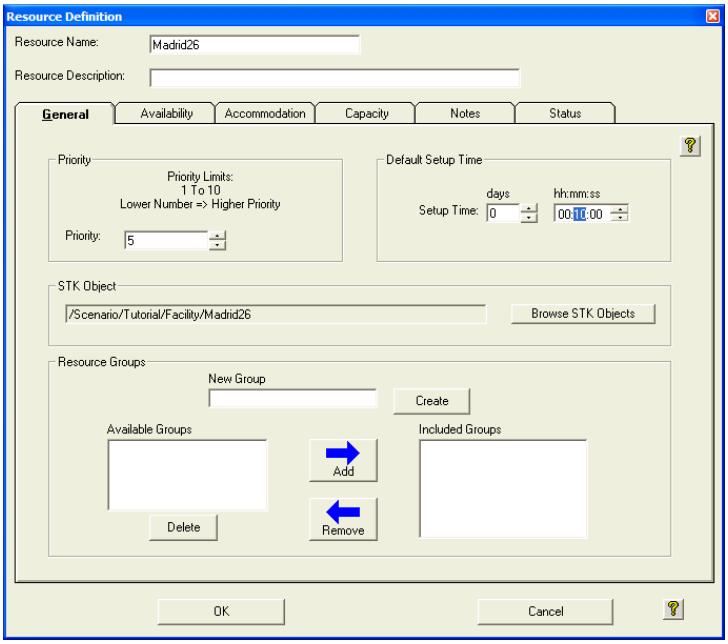
Select the following STK scenario objects from the list for ingest as planning file resources and then click OK button after all are highlighted (depress the keyboard ***CTRL*** key while clicking on each item with the mouse):

- ***/Scenario/Tutorial/Facility/Goldstone26***
- ***. . . /Facility/Guam46***
- ***. . . /Facility/Madrid26***
- ***. . . /Star/CassiopeiaStar_HR-21***
- ***. . . /Target/AmazonTarget***

Note that each of the new resources has been added to the FUSE resource at the bottom of the STK/Scheduler Gantt view. All of these new resources have default attribute values and are associated with their applicable STK scenario object.

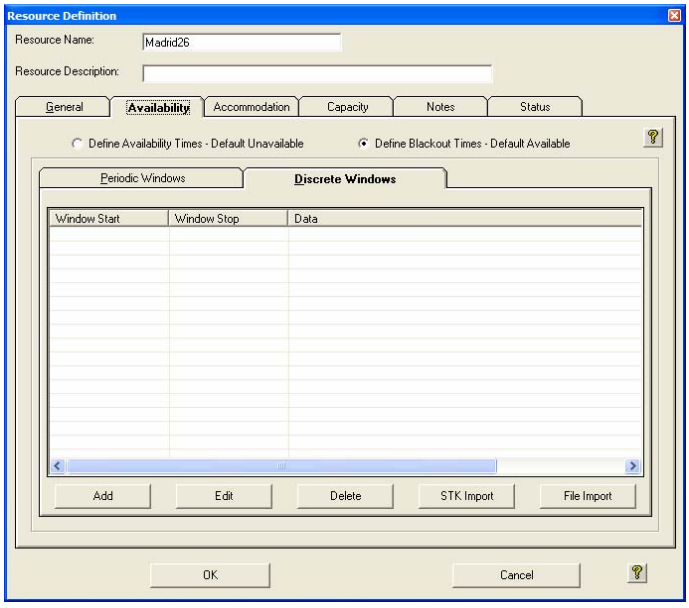
Next, we are going to edit some of the attributes of some of these new resources. Start by right-clicking on the ***Madrid26*** resource and select ***Edit*** from the resource popup menu.

On the General tab define the Default Setup Time for the Madrid ground station to be ***10 minutes***:



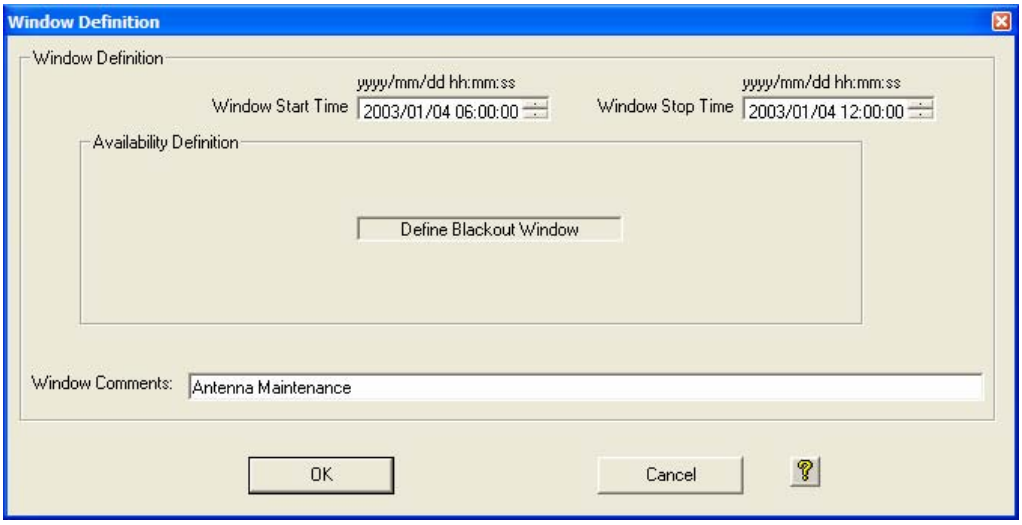
Setup time uses resource accommodation prior to a task's assigned time in the schedule. Note that full task timeslot availability is not required in order for a resource to be available for setup operations.

Next select the Availability tab:

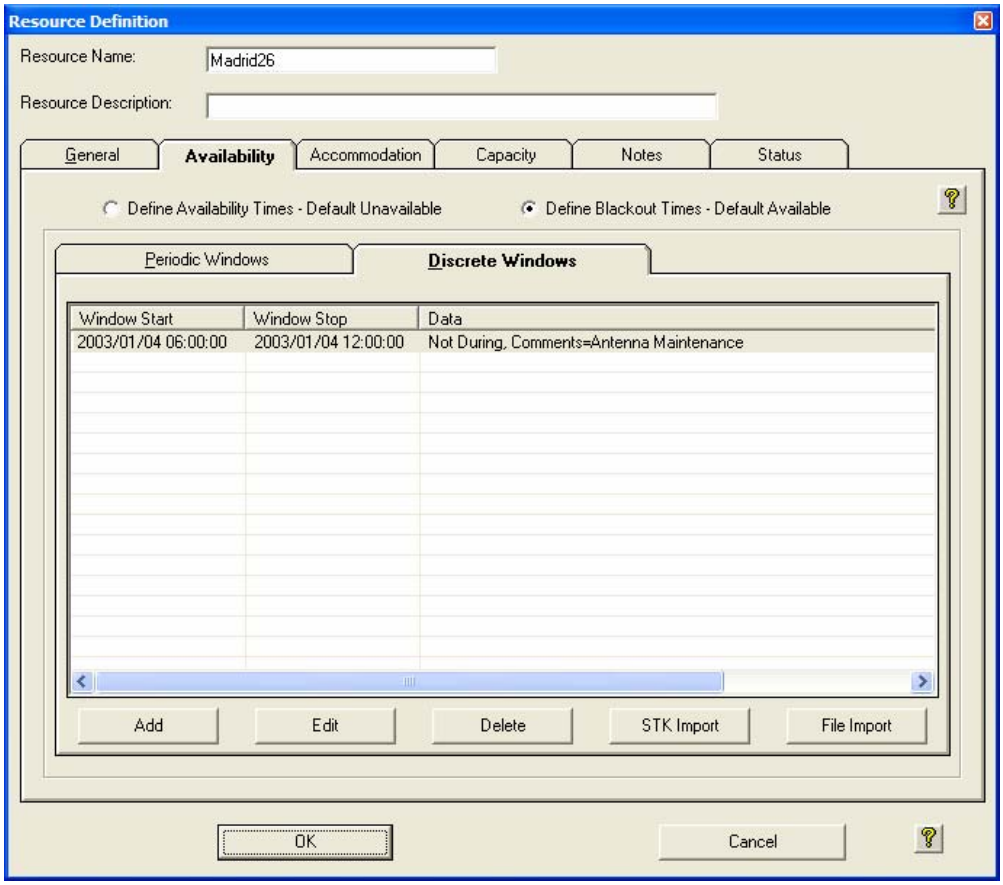


Note that the Define Blackout Times – Default Available option is selected.

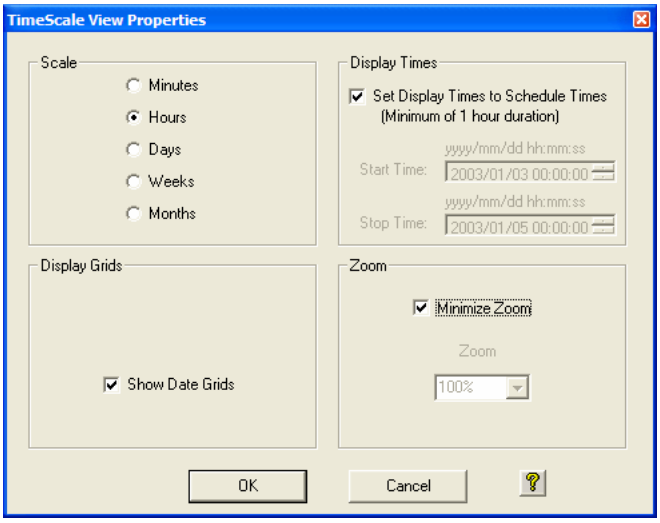
Define a single blackout period for this resource by selecting the Discrete Windows tab and clicking on Add:



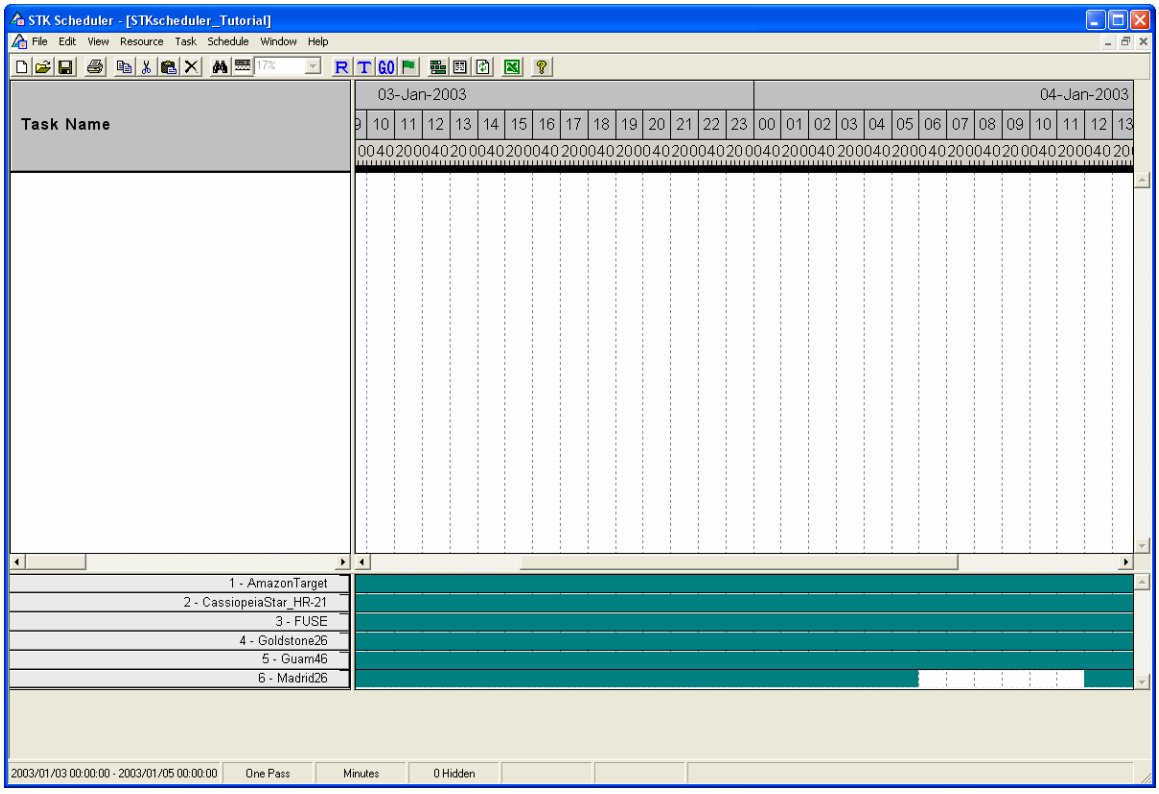
Define the Window Start time to be ***2003/01/04 06:00:00*** and the Window Stop time to be ***2003/01/04 12:00:00***. Specify in the Comments field ***Antenna Maintenance*** and click OK. The blackout period is now listed in the Availability windows list for this resource:



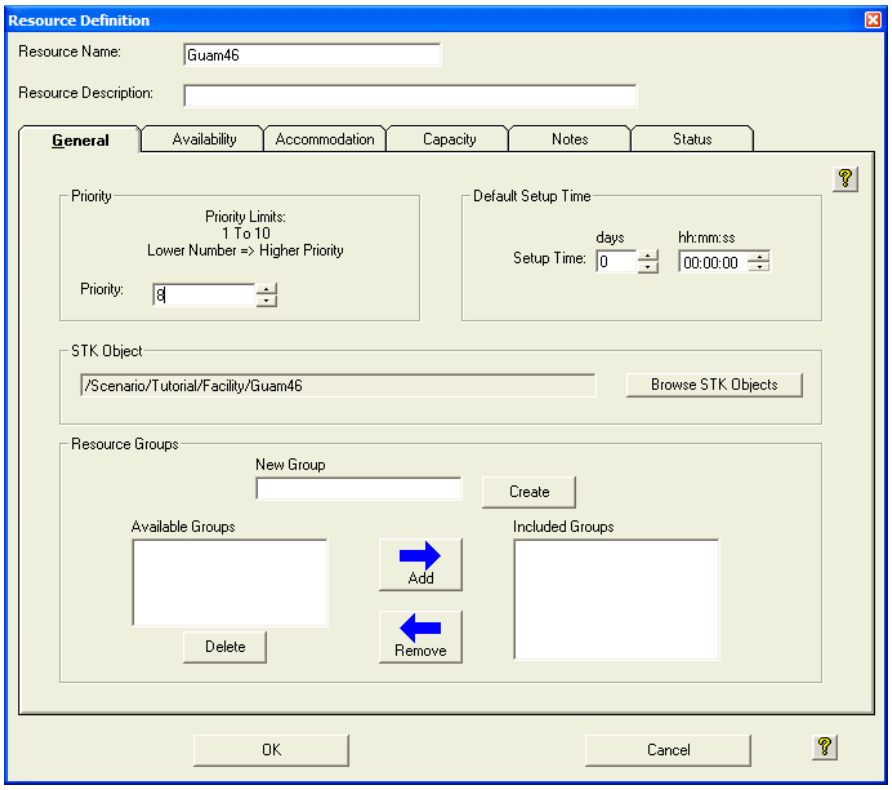
Click OK from this form to apply the change to the resource. Back on the STK/Scheduler main form select ***View > Timescale View Properties***:



Select ***Hours*** for the Scale and select ***Minimize Zoom*** checkbox in the Zoom frame and click OK. The white area in the Madrid row indicates that the resource is not available for use during that time period which you just defined:



Now we will change the priority of one of the resources. Right-click on the ***Guam46*** resource and select ***Edit*** from the resource pop-up menu.

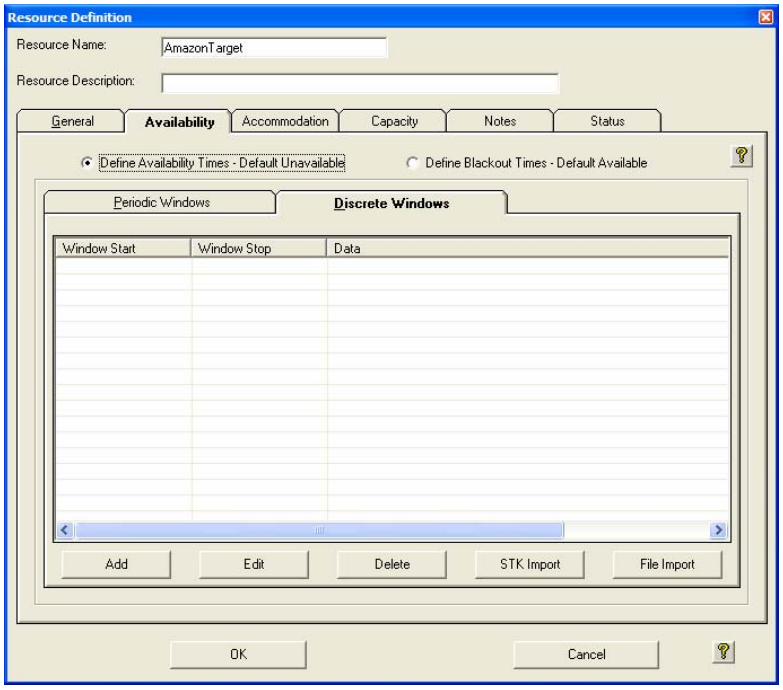


On the General tab change the Priority to ***8*** and click OK. This will make the Guam ground station a lower priority than Goldstone or Madrid (both still set at the default priority value of 5 (middle of 1-10 default range)). The deconfliction algorithms take resource priority into account when multiple resource options are available for a task. Changing Guam to a priority of 8 essentially makes Guam a backup to Goldstone and Madrid (it is a less desirable assignment). Global resource priorities can be overridden on a task-by-task basis.

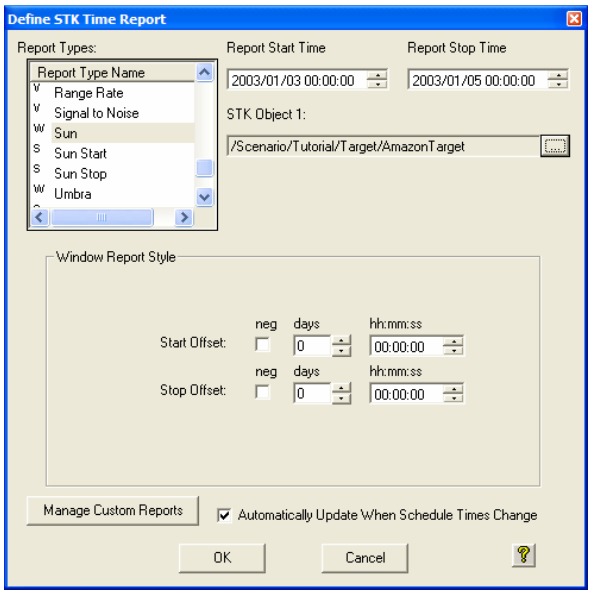
Note

The range and convention for task and resource priority schemes within STK/Scheduler are configurable by the user under the ***Schedule > Properties*** menu, Task Priority and Resource Priority tabs.

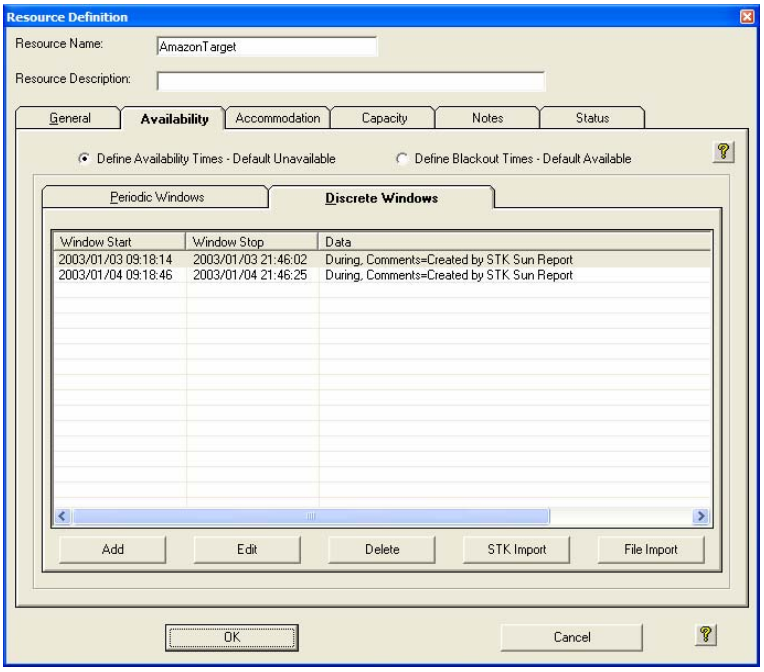
Next we will apply an STK report to help specify the general availability of the Amazon resource. Right-click on the ***AmazonTarget*** resource at the bottom of the STK/Scheduler main Gantt form view and select ***Edit***. Go to the Availability tab:



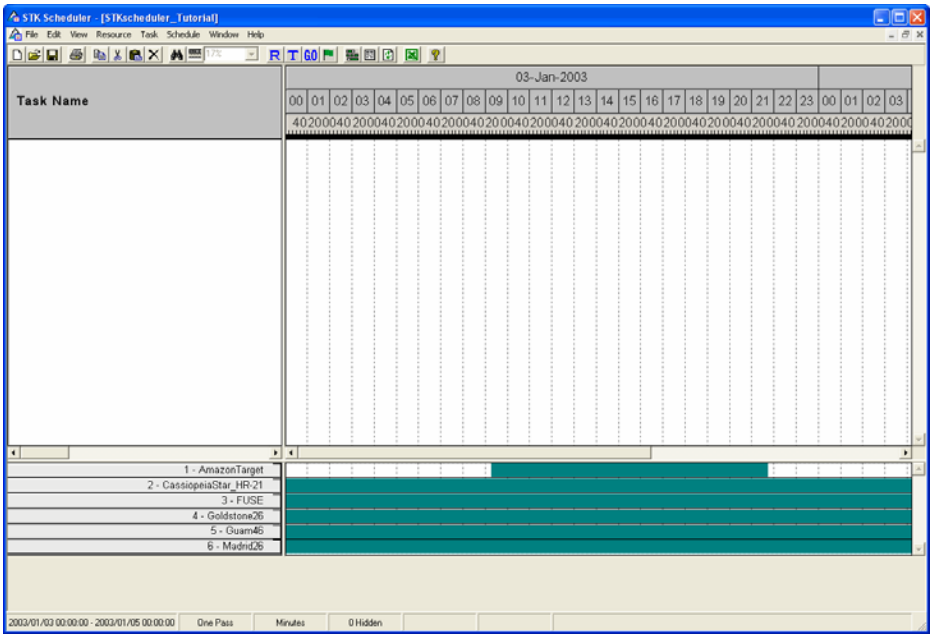
Select the ***Define Availability Times – Default Unavailable*** option. Select the Discrete Windows tab and click on STK Import. The STK Report Definitions form will appear (and will be blank because you have not defined any reports yet). Click Add to bring up the Define STK Time Report form:



Select the ***Sun*** Report Type and ***AmazonTarget*** for STK Object 1. Click OK to accept the report definition and OK again to confirm that this is the only report to apply, and then confirm that the target sunlight windows for the defined two-day period are returned in the Availability windows area:



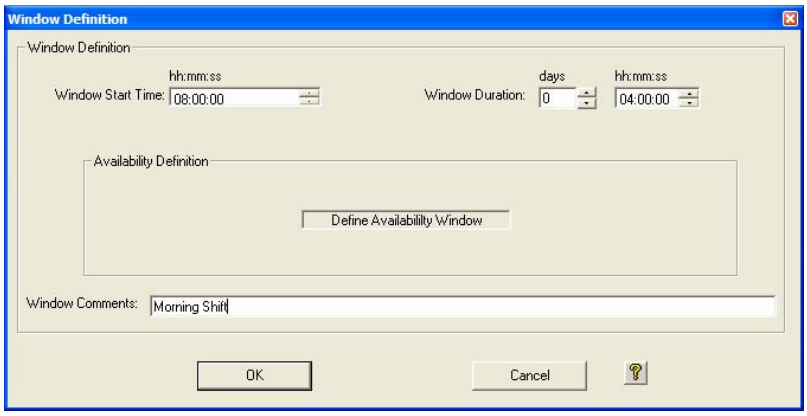
These sunlight windows were retrieved from the STK software. Click OK again and note that the Amazon resource now has two defined availability periods (colored aqua bars) corresponding to the times when it is in the sun.



Another we are going to define is a mission operations team and is not associated with an STK object. STK/Scheduler is not limited to STK resources; any kind of resource can be defined and used as a task requirement.

Select ***Resource > New/Insert***. Under the General tab define the Resource Name as ***OpsTeam***. Select the Availability tab and choose ***Define Availability Times – Default Unavailable***. Select the Periodic Windows tab and click on Add to bring up the Periodic Definition window and define the periodic times during which the OpsTeam will be available (when the controllers are in the control center):

For Frequency select ***Daily***, then click Add to specify specific times during the day when the OpsTeam resource is available:

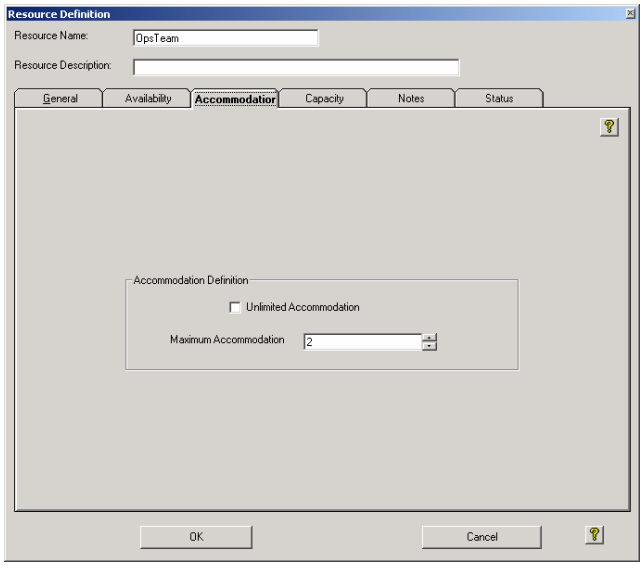


Define the window with start time to be ***08:00:00*** and the duration to be 4 hours. Click OK to apply the window. Then click Add again to define another window. Specify the start time

of the window to be ***13:00:00*** with a duration of 4 hours, and click OK to apply this second window. Two windows are now defined in the Periodic definition for the OpsTeam.

These morning and afternoon shifts will be applied each day of the planning file period.

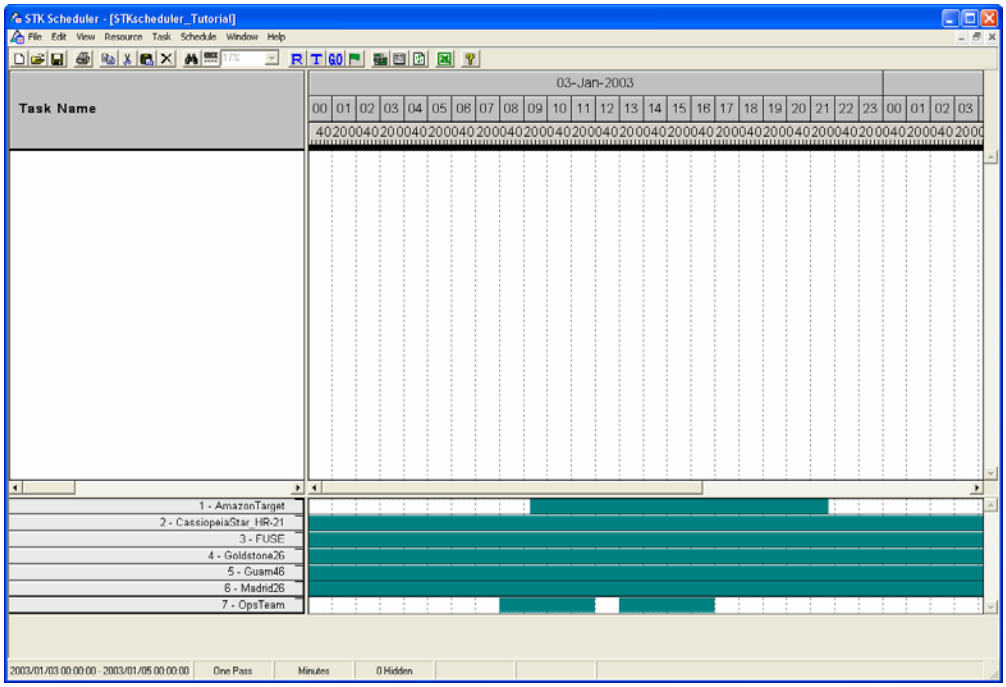
Click OK for the Periodic Definition tab, select the Accommodation tab and note that the default accommodation is 1 (number of simultaneous tasks that can be supported by the resource).



Change the Maximum Accommodation to ***2*** for the OpsTeam. This indicates that the OpsTeam resource can support up to 2 tasks simultaneously: They can do two things at once.

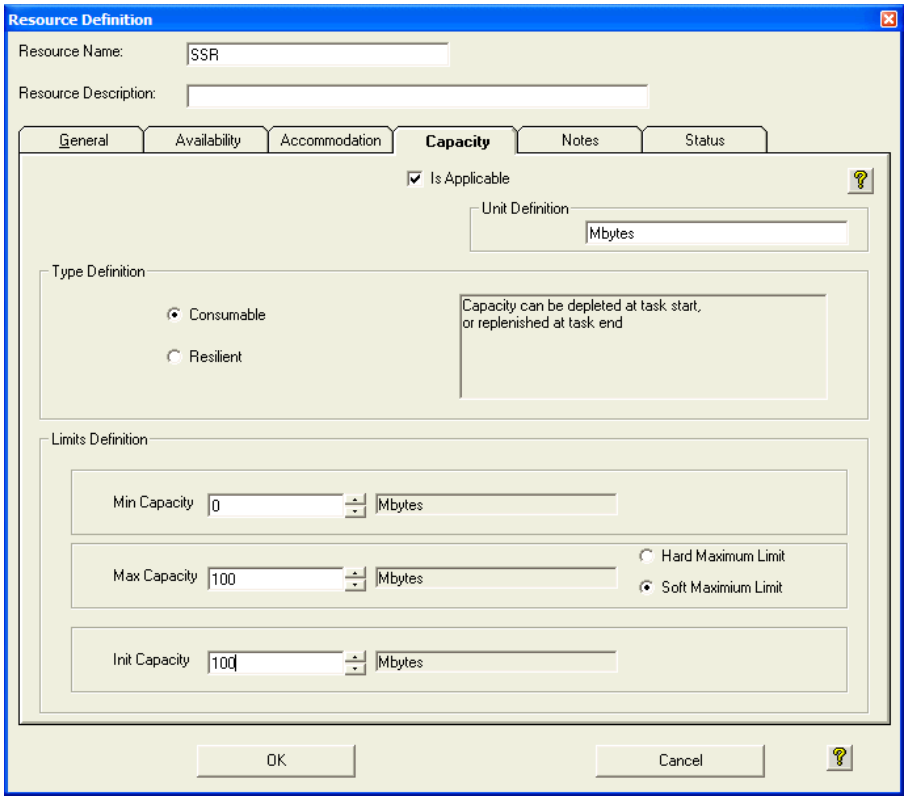
This will allow the OpsTeam to write a report and support a satellite contact at the same time, for instance.

Click OK again and confirm the OpsTeam resource on the main Gantt form and the expected shift times shown as aqua-colored bars (2 pairs of 4-hour periods, 1 pair for each day).



The last resource we will define is an onboard solid-state-recorder (SSR). This resource will help demonstrate the use of the resource capacity attribute in task scheduling. Again select ***Resource*** > ***New/Insert***, will bring up the Resource Definition form, General tab. Name the resource "***SSR***", and then click on the ***Capacity*** tab (we are going to leave all other attributes in their default state).

Select the ***Is Applicable*** checkbox at the top of the tab. Capacity is not applicable to all resources, just those that have capacity that can be depleted or replenished (like a recorder). Define "***Mbytes***" in the **Unit Definition** field. This will help the user employ consistent units when defining tasks that use this resource capacity. Under ***Type Definition*** select ***Consumable***. This means that resource capacity is permanently depleted (or replenished) by a task. The alternative, ***Resilient***, means that resource capacity is depleted/replenished only for the duration of the task. Specify ***Min Capacity*** as **0**, and ***Max Capacity*** and ***Init Capacity*** as **100**. Lastly, select **Soft Maximum Limit** for resource Max Capacity . . . this will allow for partial replenish activities even when the resource capacity is not fully depleted. Refer to the window snapshot on the next page to confirm your SSR capacity definitions. Now click **OK** to complete your SSR resource definition.



Some resources, especially passive resources like targets, are often best defined as having Unlimited Accommodation (they never get "used up"). Edit the AmazonTarget and CassiopeiaStar_HR21 resources and note that their Accomodation is already set to ***Unlimited Accommodation*** (checkbox on Resource Accomodation tab). As a default, resource Accomodation for Stars, Planets, Point Targets, and Area Targets ingested from STK (using the Resource > Ingest from STK function or via the API) is set to Unlimited. For all other STK object types and for all resource definition through the GUI (Resource > New) regardless of STK object type, default accomodation is 1.

You have now defined eight resources for use in this planning file: 3 ground facilities (Madrid, Goldstone, and Guam), 1 satellite (FUSE), an ops team (OpsTeam), a ground target (AmazonTarget), a star (CassiopeiaStar_HR-21), and an onboard recorder. Madrid, the ops team, and the ground target have limitations on their availability specified.

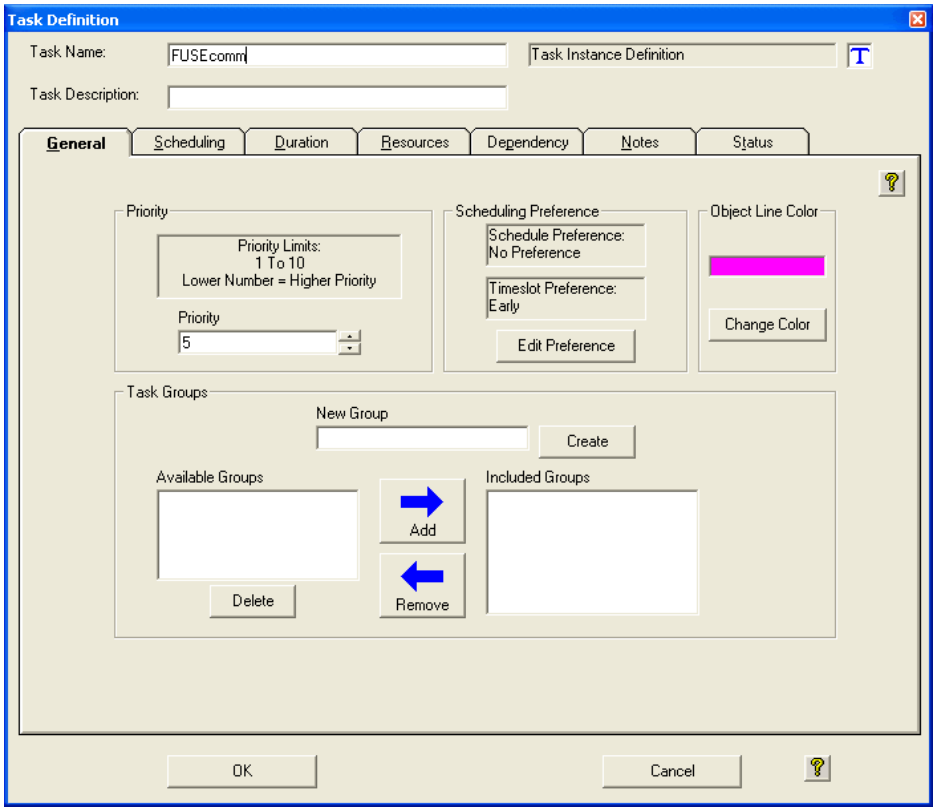
Now is a good time to take a break and stretch your legs. Select ***File > Save*** to save your work if you have not done so already. After your break, continue on with the Defining Tasks section to define and deconflict tasks that use the resources you have defined here.

Defining Tasks

In this section you will define 5 separate tasks with differing constraints and resource requirements including: 1) a recurring satellite to ground station communications task, 2) a daily management report task that requires no STK resources, accesses, or reports, 3) a single instance task to take a picture of a ground target with a satellite while the target is in sunlight, 4) a single instance task to make an observation of a star with a satellite during satellite umbra, and 5) a satellite attitude calibration task that occurs once an orbit within 30 minutes of the ascending node crossing. Expect this section to take about 30 minutes to complete.

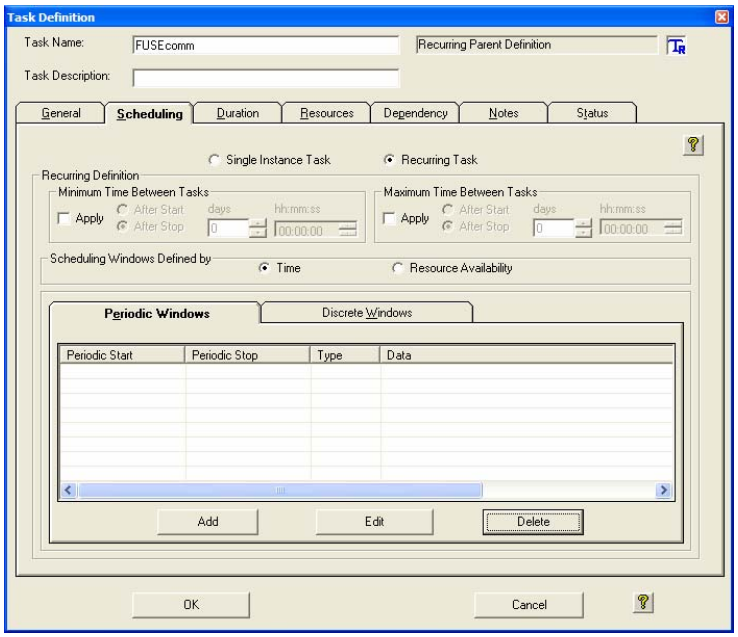
FUSEcomm Task

Select ***Task > New/Insert. . .*** to define a new task, and the Task Definition form (General tab) will be displayed:

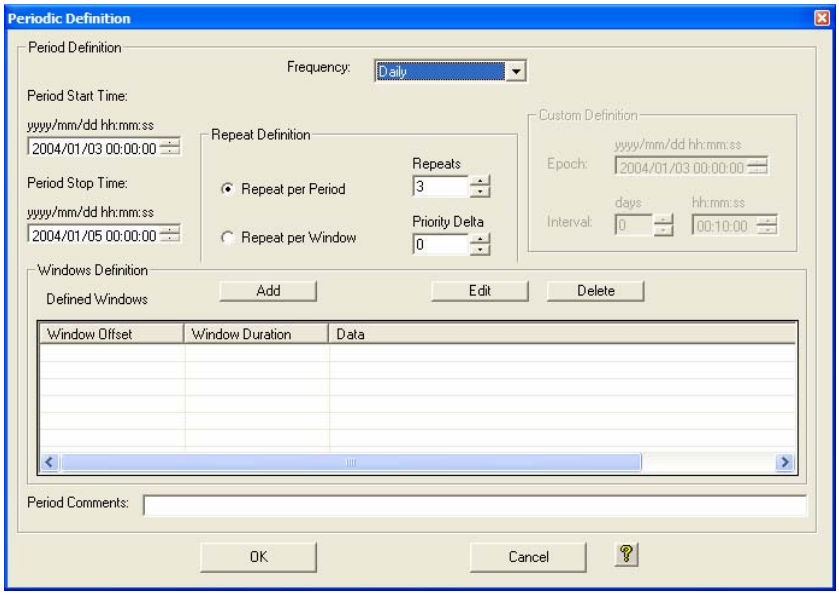


Enter ***FUSEcomm*** in the Task Name field. For this task on the General tab keep the default values; leave the Priority at the default of 5 (middle of range), keep the Scheduling Preference as No Preference, and do not specify any Group memberships.

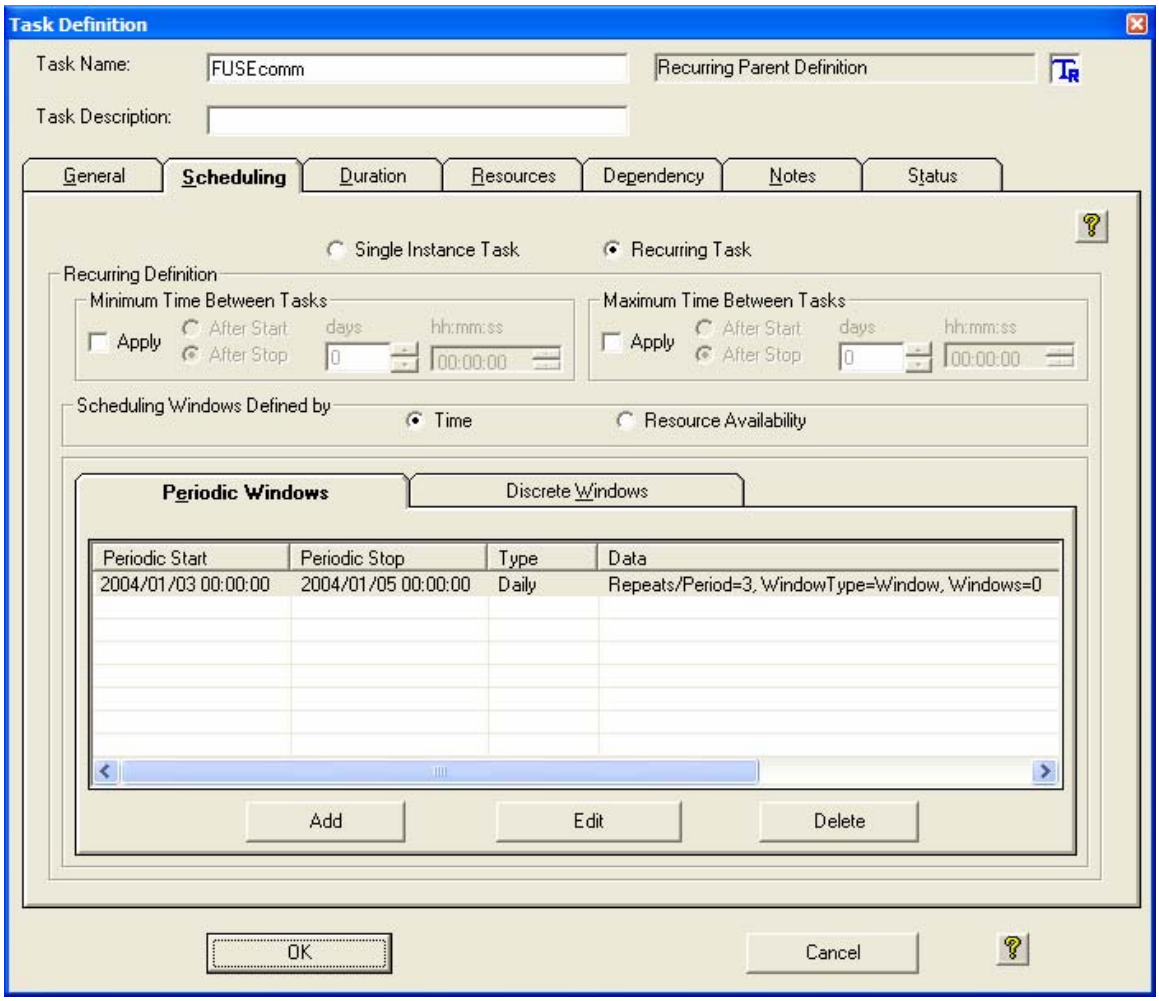
Select the Scheduling tab and choose ***Recurring Task***, then choose ***Time*** for Scheduling Windows Defined by (as opposed to windows defined by Resource Availability which would be used for a task that occurs every time a satellite sees a ground station, for instance). You will see a pair of tabs at the bottom of the window that allows the user to define the time-based recurring nature of the task:



Select the Periodic Windows tab and click Add to define the periodic windows during which you would like this task to be scheduled:



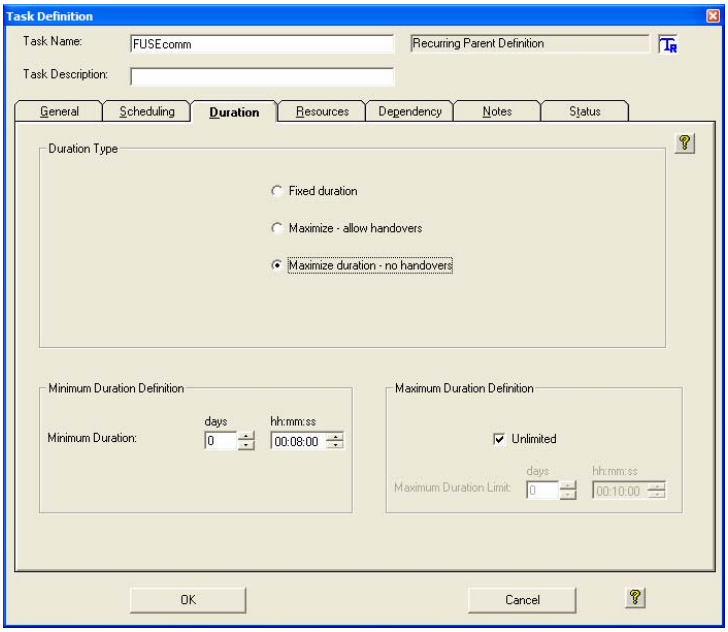
Select a Frequency of ***Daily*** and specify ***Repeats per Period*** as ***3***. Leave the periodic start and stop times as the default (planning period start and stop). This specifies that the task should be scheduled 3 times a day for the duration of the planning period. Additional restrictive scheduling windows could be specified using the window definitions option at the bottom of this tab, but leave this undefined for now; we'll the let the deconfliction engine do the hard work for us later. Click OK for the Scheduling window definition.



Note

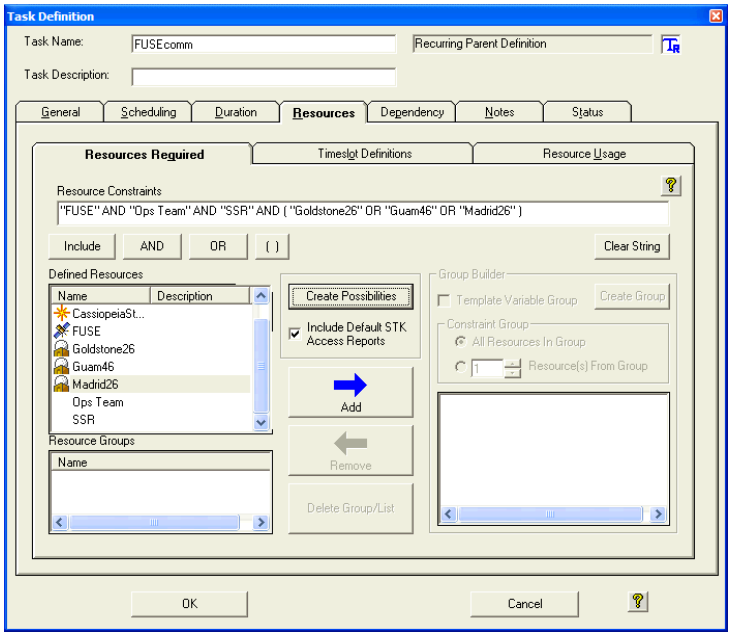
Several periodic definitions could be specified for a single recurring task, and the user could also specify discrete windows during which the task should also be attempted. The software will attempt to schedule an instance of the task during each and every window defined by the user the specified number of times (which can vary for each window defined).

Now that the windows during which the FUSEcomm task should be scheduled are defined, select the Duration tab to specify the duration of each instance of the task itself:



Select ***Maximize Duration – no handovers*** and specify a Minimum Duration of ***0 days, 00:08:00*** (8 minutes) at the bottom of the tab. Leave the maximum duration as the default value of Unlimited. This will maximize the duration of the task assignment within the window of a single resource set (no handovers to another ground station).

Select the Resources tab to define the resource requirements and options for the task:



All of the resources defined in this planning file are listed under the Defined Resources list on the left. Resources associated with an STK object have their STK object symbol next to them (satellite, facility, target, star, etc.). To define the logical resource requirements formula for the FUSEcomm task:

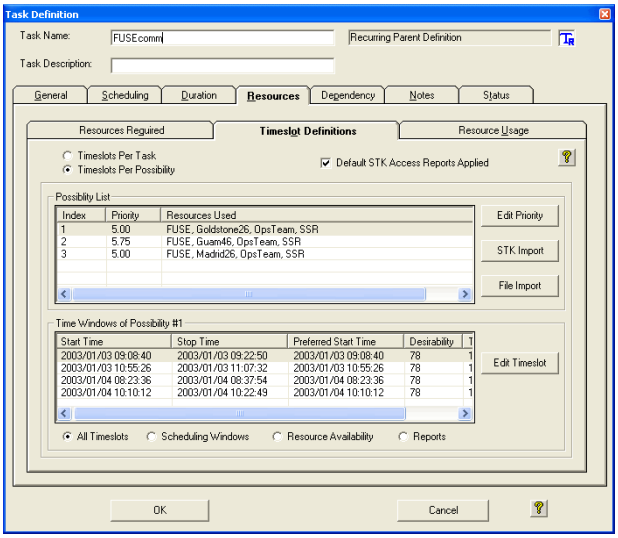
- Double-click on the ***FUSE*** resource in the Defined Resources listing
- Click on the AND button
- Double-click on the ***OpsTeam*** resource
- Click on the AND button
- Double-click on the ***SSR*** resource
- Click on the AND button
- Click on the ( ) button (parenthesis)
- Double-click on ***Goldstone26*** resource
- Click on the OR button
- Double-click on the ***Madrid26*** resource
- Click on the OR button
- Double-click on the ***Guam46*** resource

The Resource Constraints formula defines the resource requirements and options with a logical AND/OR statement. The FUSEcomm formula specifies that the task always requires the FUSE and OpsTeam and SSR resources, plus any one of three ground station resources (Guam, Madrid, or Goldstone).

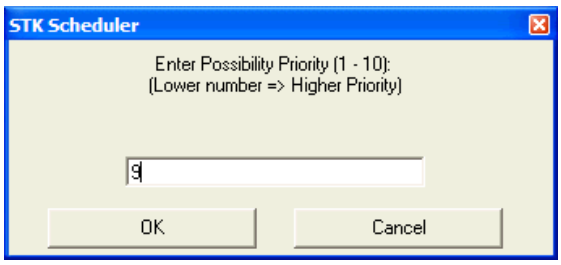
Note

Any level of parenthesis nesting is allowed, and there is no limit on the length of the formula.

Click Create Possibilities and the software will determine all of the individual resource string options (Possibilities) that could be used to accomplish the task and will apply appropriate STK access constraints (since the checkbox is selected). Select the Timeslot Definitions tab to view information about each resource possibility string:



Note the three Resource Possibilities for the FUSEcomm task based on the defined Resource Constraints formula from the previous tab. The Possibility Priority values are calculated based on the priority of each resource in the individual Possibility string. To manually edit the task-specific Priority of a Possibility, highlight the ***FUSE, OpsTeam, SSR, Madrid26*** possibility option and click Edit Priority:



Enter a value of ***9*** and click OK. Note the change in Priority value for the FUSE, OpsTeam, SSR, Madrid26 possibility.

Note

Note that the range and convention for Possibility priority is the same as that for Resource priority.

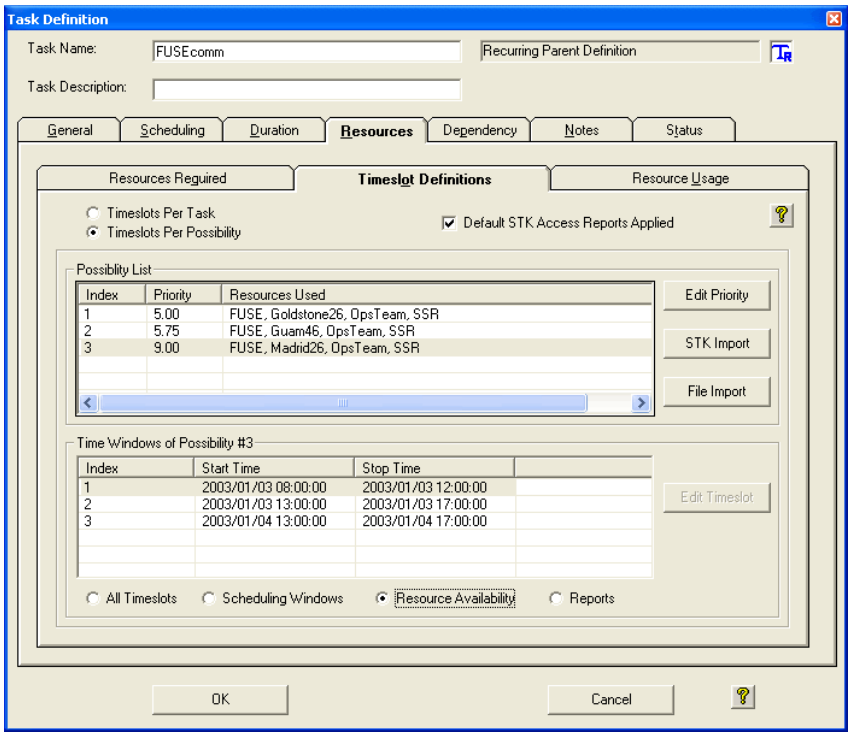
As a default, constrained accesses will be required between any STK object-related resources in each resource possibility string. Access calculations are requested from STK and applied by the STK/Scheduler software during the Create Possibilities step.

Note

Accesses between ground objects in the same possibility string are not applied. Individual accesses may be deleted from the automatically generated list by clicking on the STK Import button.

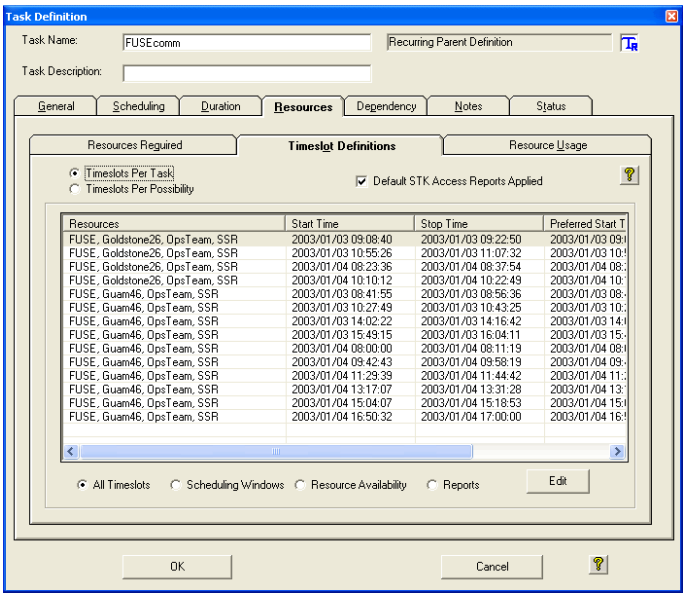
To view the affects of resource availability constraints vs. access opportunities and how they combine to define the final "timeslots" (scheduling opportunities) for the task, click on the ***Reports*** radio-button at the bottom of the form (shows STK accesses for the highlighted possibility string). Click on another possibility string to see the STK accesses related to this option. Other STK reports (and/or external time files) may be applied by the operator as required. Only when all reports (and file times) are satisfied (report overlaps) will report windows be created for the possibility.

Click on the ***Resource Availability*** radio-button to display the times during which all resources in the highlighted possibility string are available at the same time. Click on each of the possibility options and note that the one containing Madrid is missing one of the resource availability windows (because the Madrid facility has a blackout period defined that covers the entire morning shift of the OpsTeam on day two of the schedule):



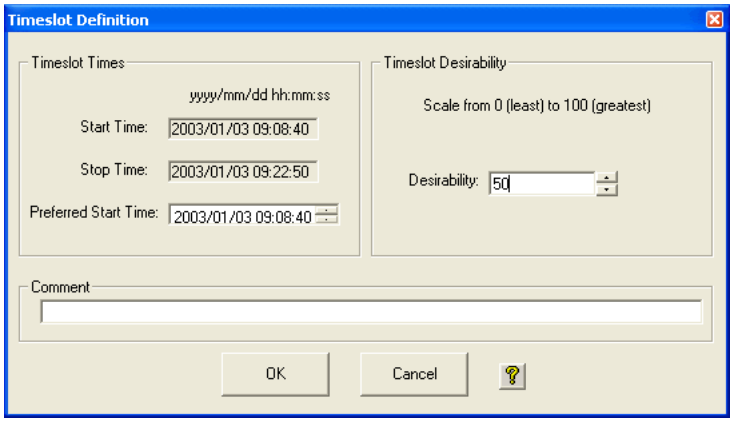
The Click on the ***All Timeslots*** radio-button option to see when the resource availability and accesses overlap (these are the final timeslot options). Select each possibility option in turn to see the final timeslots for each.

Next, click on the ***Timeslots Per Task*** radio-button option at the top of the tab to see a listing of each final task timeslot regardless of the resources involved (resources supporting each timeslot are listed in the table):



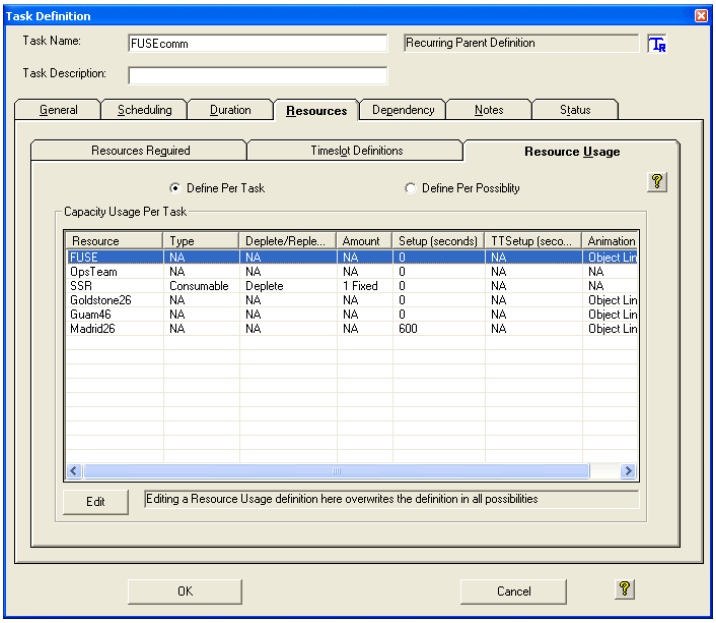
Adjust the column widths or scroll to the right so that the timeslot Desirability column is visible. Timeslot Desirability is a measure of the desirability of a specific timeslot vs. other timeslots for that task, and is taken into account by the deconfliction algorithms when scoring different schedule solution options against each other. The Desirability of a specific timeslot is calculated based on the related Possibility priority and the Scheduling Preference for the task (see the Task Definition window General tab), and is scaled from 0 to 100, with 100 being the highest preference.

Calculated timeslot desirability scores can be manually adjusted by the user. Highlight a specific timeslot row in the Timeslot Definitions window at the bottom of the page and click Edit to bring up the Timeslot editing window:

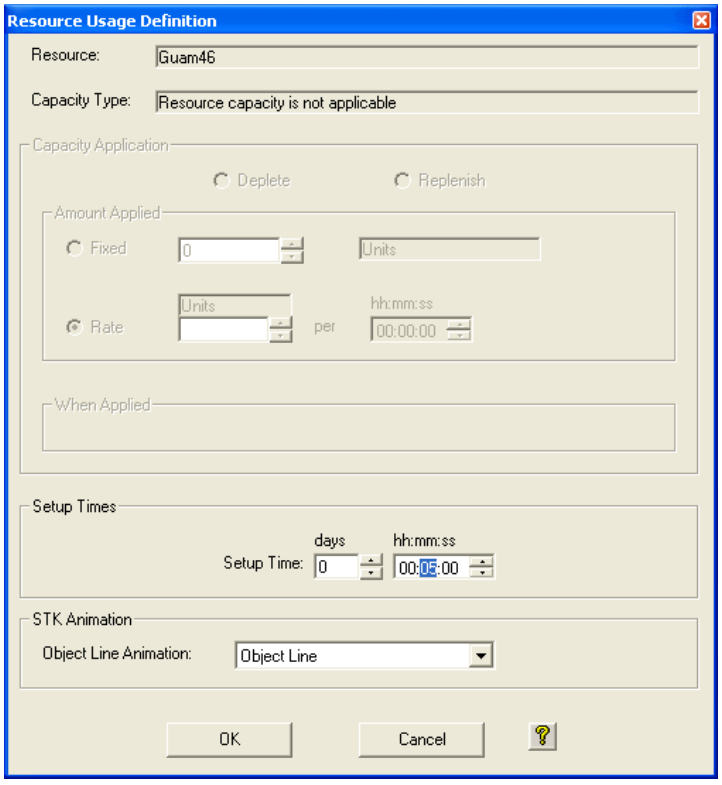


Change the Desirability value to ***50*** and click OK. Note the updated timeslot desirability value in the timeslots window. This change makes this particular timeslot option less desirable than the others.

Select the Resource Usage tab and confirm the ***Define Per Task*** radio-button option:

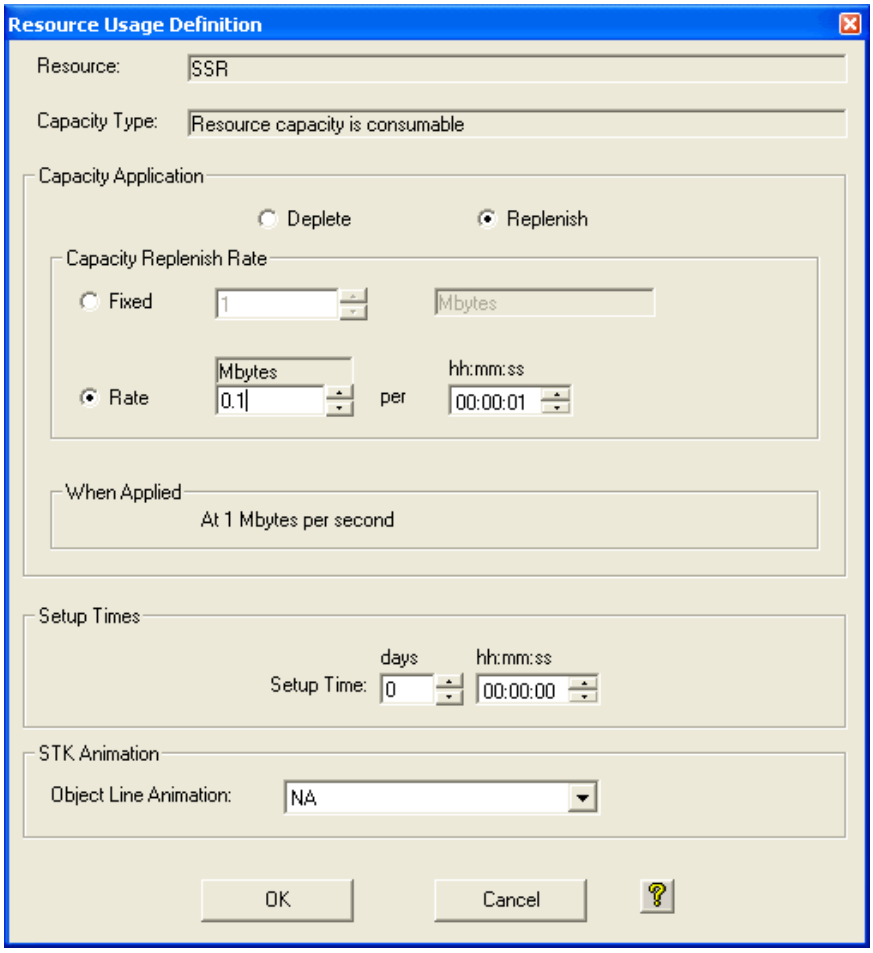


Specify a Setup time of 5 minutes for each of the ground station resources (Guam, Goldstone, and Madrid) by clicking on each resource in turn to highlight it, clicking Edit, and filling in 5 minutes (***0 days, 00:05:00***) under Setup Time at the bottom of the form:



Click OK each time to return to the Resource Usage tab. For Madrid, this task-specific resource setup time will override the default Madrid setup time defined in its resource definition (but only for this task).

Next, select the SSR resource, click Edit, and specify that the FUSEcomm task **Replenishes** the SSR resource at a ***Rate*** of **0.1** Mbytes per second and click OK. Refer to the window snapshot below to confirm the settings.

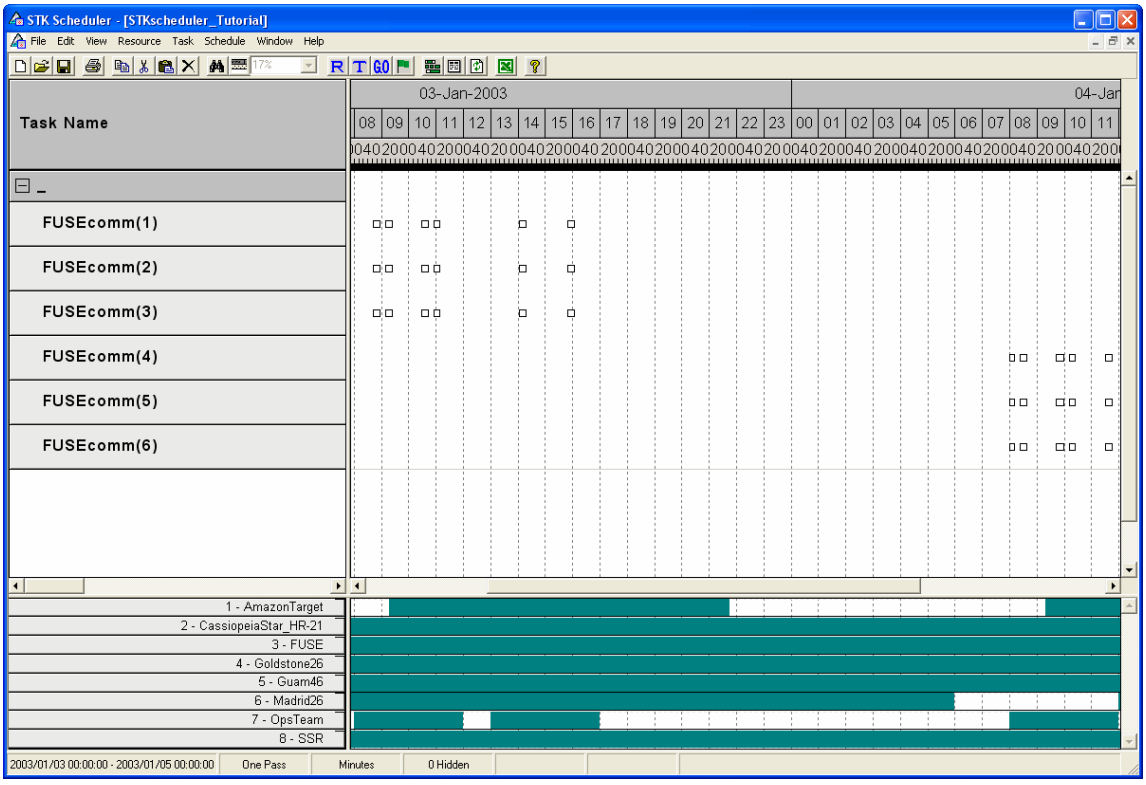


Click OK to apply the task definition. Six tasks (plus a recurring task Parent definition) will be added to the STK/Scheduler main window Gantt view.

Note

FUSEcomm is attempted 3 times a day for a 2-day scheduling period, so the software treats it as 6 separate tasks

De-select ***View > Show Task Parent Definitions*** to hide the Parent task definition.



The timeslots for each task are shown in the Gantt schedule area in the associated task row. Note that no scheduling has been done yet. The displayed windows are simply the times when the task could be accomplished based on resource availability, scheduling window times, and STK accesses (if applicable).

Place the mouse cursor/pointer over one of the timeslot windows in the Gantt view and a popup form will appear that specifies the resources supporting that timeslot and the start time, stop time, duration, and resources associated with the selected timeslot.

Management Report Task

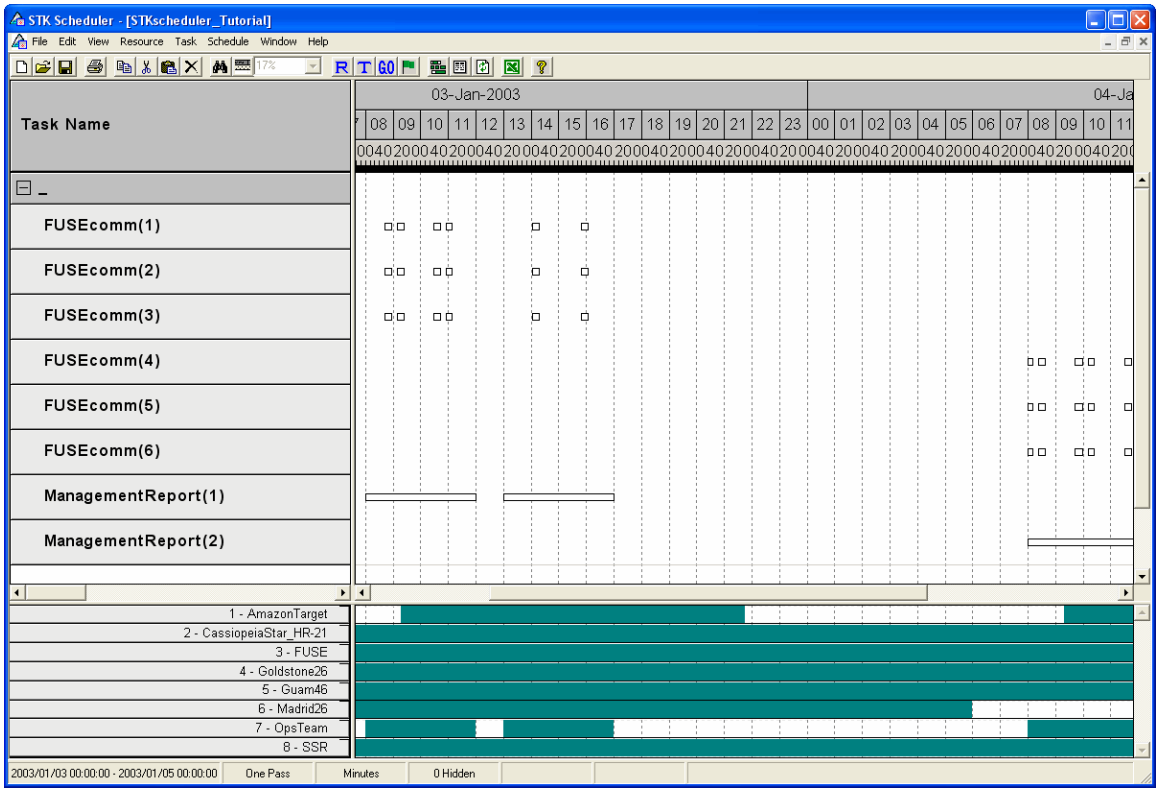
Select ***Task > New/Insert***. On the General tab of the Task Definition form specify the Task Name as ***Management Report***. Leave all else on the General tab as default values.

Select the Scheduling tab and select the ***Recurring Task*** radio-button option and ***Time*** as the recurring basis. Select the Periodic tab and click Add. Select a Frequency of ***Daily*** and click OK (leave Repeats per Period in its default value of 1).

Select the Duration tab and select the ***Fixed*** duration option. Specify the duration as 2 hours at the bottom of the form (***0 days 02:00:00***).

Select the Resources tab and double-click on ***OpsTeam*** from the Defined Resources list (OpsTeam should appear in the Resource Constraints formula field). Click on the Create Possibilities button and then click OK.

Two daily management Report tasks should appear in the Gantt window with timeslots corresponding to the periods when the OpsTeam is on duty:



FUSEground Task

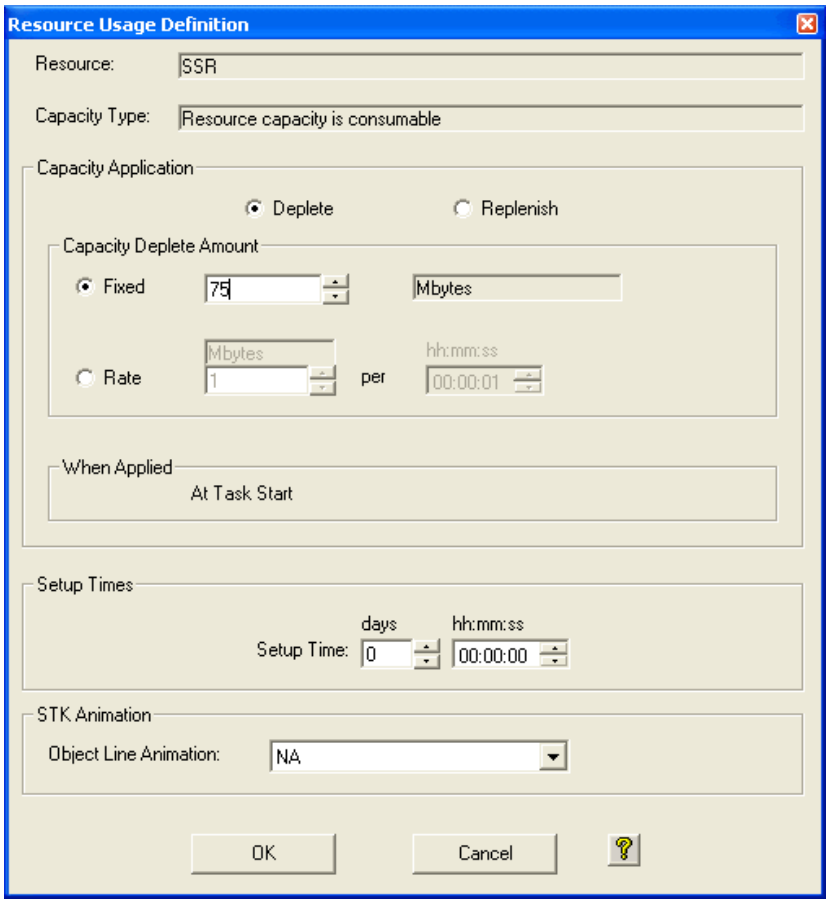
Select ***Task > New/Insert***. On the General tab of the Task Definition form specify the Task Name as ***FUSEground***. Leave all else on the General tab as default values.

Select the Scheduling tab and select the ***Single Instance Task*** radio-button option.

Select the Duration tab and select the ***Fixed*** duration option. Specify the duration as 1 minute at the bottom of the form (***0 days 00:01:00***).

Select the Resources tab and double-click on the ***FUSE*** resource from the Defined Resources list, then click AND, double-click on the ***SSR*** resource, click AND, and finally double-click the ***AmazonTarget*** resource from the Defined Resources list. **"FUSE" AND "SSR" AND "AmazonTarget"** should appear in the Resource Constraints formula field. Click on Create Possibilities.

Select the Resource Usage tab and then select the ***SSR*** resource and Edit. Specify that the FUSEground task ***Depletes*** the SSR Capacity by a ***Fixed*** amount of ***75*** Mbytes (see window snapshot below), and click OK.

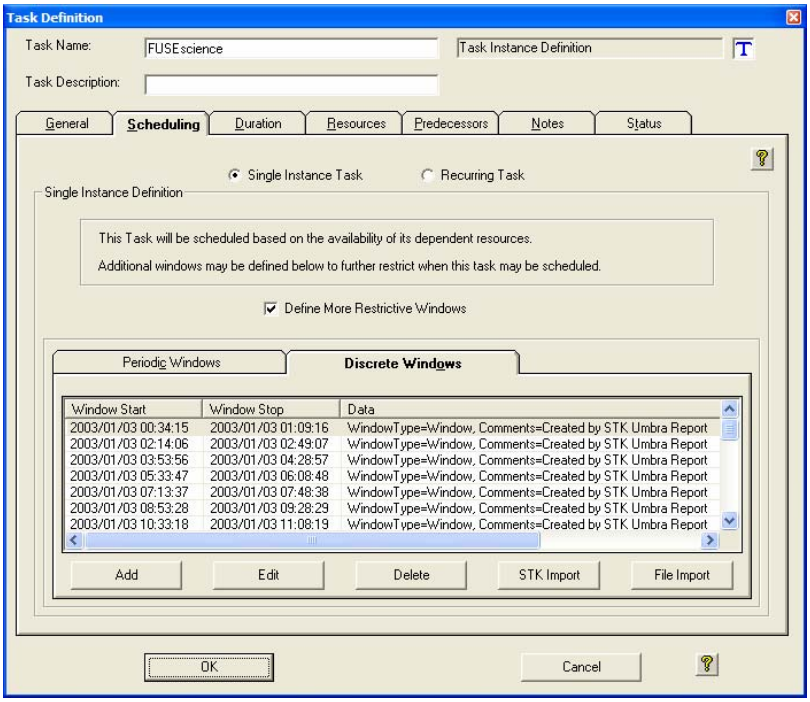


Click OK to apply the task definition. A single FUSEground task should be added to the Gantt window with 5 or 6 scheduling opportunities (timeslots) appearing on each day.

FUSEscience Task

Select Task > New/Insert. On the General tab of the Task Definition window specify the Task Name as ***FUSEscience***. Leave all else on the General tab as default values.

Select the Scheduling tab and select the ***Single Instance*** radio-button option and select the checkbox ***Define More Restrictive Windows*** in the middle of the form. Select the Discrete Windows tab and click on STK Import, then on Add. Select the ***Umbra*** report type and ***FUSE*** for STK Object 1. Leave everything else as the default value and click OK, then OK again. The umbra periods for the duration of the planning period should now be listed in the windows area at the bottom of the form:

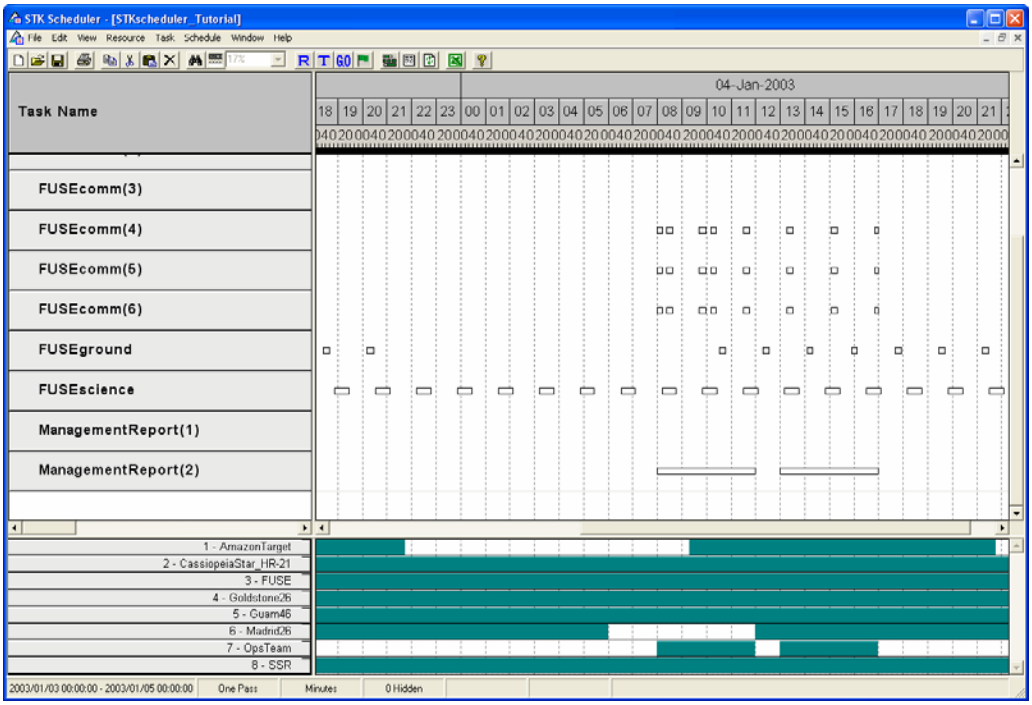


The FUSEscience task will only be scheduled once (single instance task), but it is constrained to only be scheduled during the umbra windows determined by STK.

Select the Duration tab and select the ***Maximize – Allow Handovers*** duration option. Specify the ***Minimum Segment Duration*** as ***5 minutes*** (***0 days 00:05:00***), the ***Minimum Total Duration*** as ***40 minutes (0 days 00:40:00)***, and the ***Maximum Duration*** as ***50 minutes*** (***0 days 00:50:00***) at the bottom of the window. This duration option allows handovers between resources as well as non-contiguous task continuation as required to complete the full task duration. None of the FUSE to star access windows are 40 minutes long, but the task can be completed in segments, and this task duration option allows that.

Select the Resources tab and double-click on the ***FUSE*** resource from the Defined Resources list. Then click AND. Finally, double-click the ***CassiopeiaStar_HR-21*** resource from the Defined Resources list. "FUSE" AND "CassiopeiaStar_HR-21" should appear in the Resource Constraints formula field. Click on Create Possibilities, then OK.

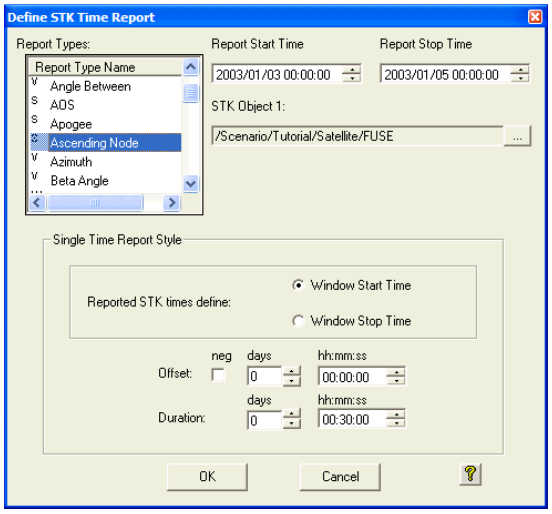
A single FUSEscience task will be added to the Gantt view with repeating windows of opportunity on every orbit (constrained to umbra windows and times during which the Earth is not occulting the line of sight from the satellite to the star). Note that none of the windows are 40 or 50 minutes long (hover the cursor over a timeslot to get the popup details).



FUSEattitude Task

Select ***Task > New/Insert***. On the General tab of the Task Definition form specify the Task Name as ***FUSEattitude***. Define the Priority as ***10*** (making this a low-priority task). Leave all else on the General tab as default values.

Select the Scheduling tab and select the ***Recurring*** task radio-button option and select the ***Time*** option for the recurring basis. Select the Discrete Windows tab and click on STK Import and Add:



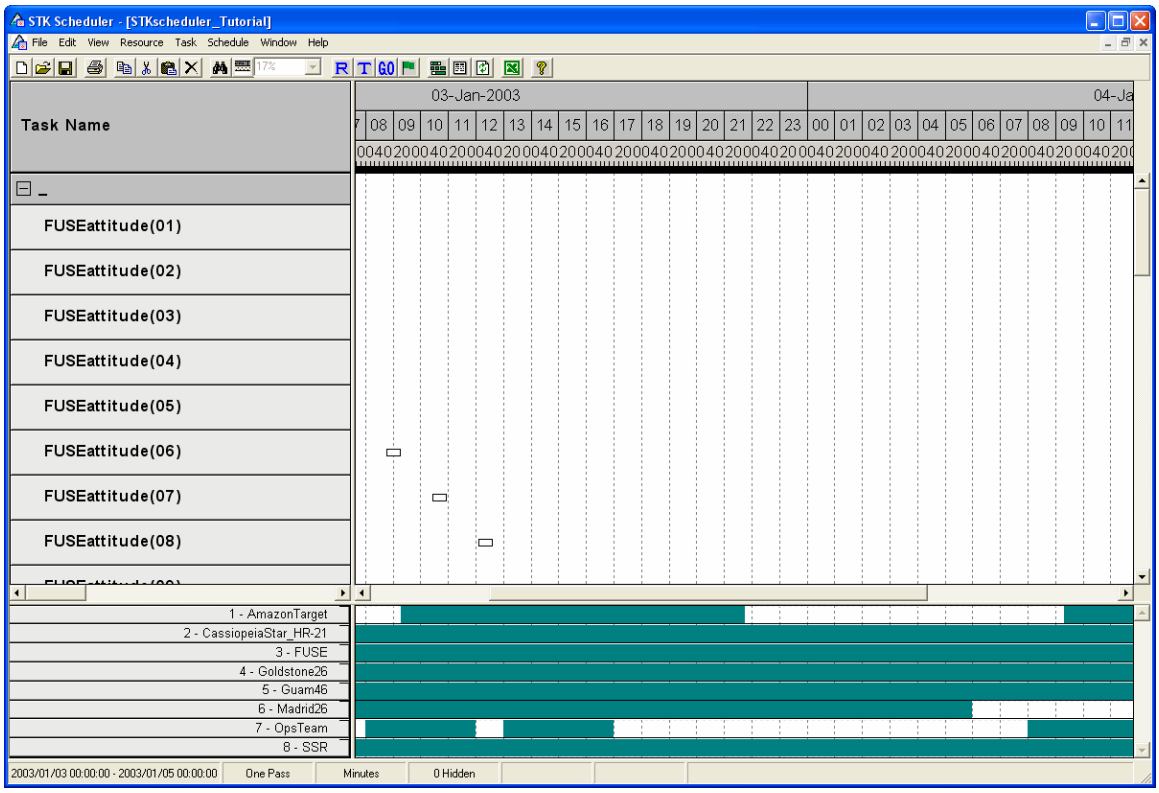
Select the Ascending Node report type, ***FUSE*** for STK Object 1, and verify that the ***Window Start Time*** radio button is selected, and enter a ***Duration*** of 30 minutes. Click OK and OK again. 30 minute windows beginning at each FUSE ascending node will be listed in the windows area of the tab.

Select the Duration tab and select the ***Fixed*** duration option. Specify the duration as 15 minutes at the bottom of the window (***0 days 00:15:00***). This means that each orbit, sometime within 30 minutes of the FUSE ascending node crossing, the software will attempt to schedule this 15 minute recurring task.

Select the Resources tab and double-click on the ***FUSE*** resource from the Available Resources list. "FUSE" should appear in the Resource Constraints formula field. Click on Create Possibilities.

Click OK to apply the task.

29 FUSEattitude tasks will be created (one for each orbit) and added to the Gantt window with a single 30-minute opportunity on every orbit. Scroll down through the new tasks using the scrollbar on the right-hand side of the window:

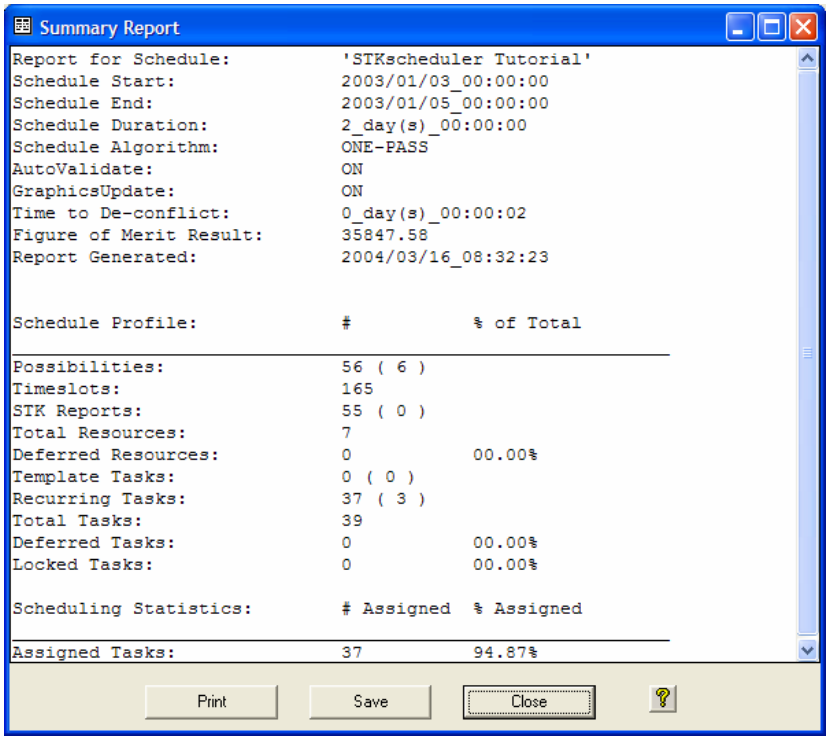


Select ***File > Save*** to save your work before moving on to the next section where you will get down to doing some scheduling.

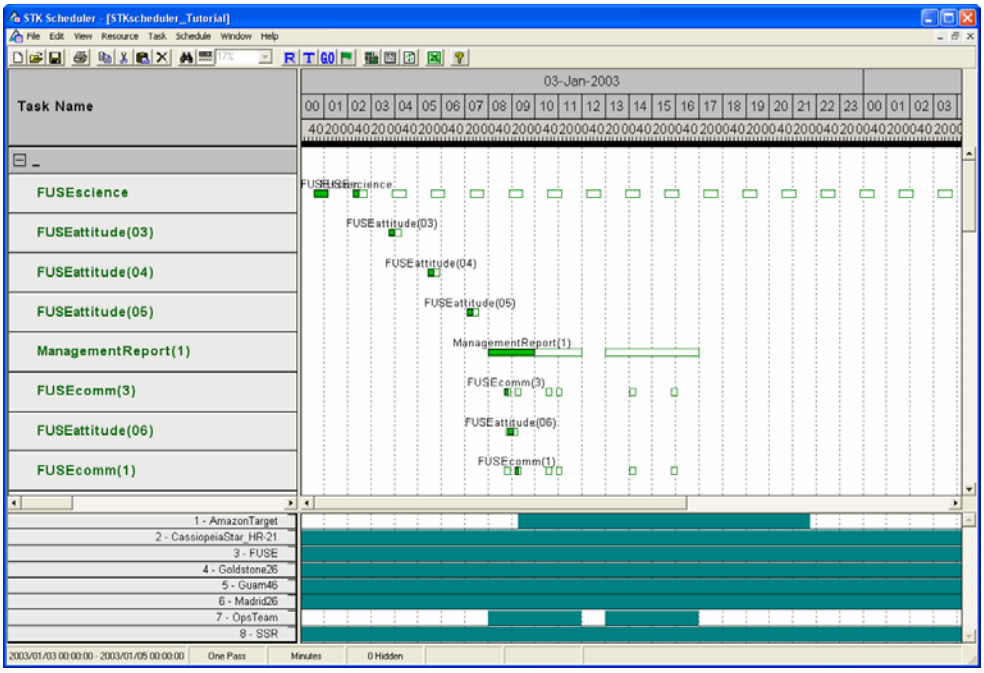
Scheduling & Analysis

Now that you have several tasks defined it is time to solve the schedule! Generate deconflicted schedule solutions using one or more of the deconfliction algorithms available in STK/Scheduler. Expect this section to take approximately 15 to 20 minutes to complete.

Select ***Schedule*** **>** ***Select Algorithm*** and choose ***One-Pass***. Click GO on the main window toolbar to initiate the scheduling run using the One-Pass scheduling algorithm. Click OK when the Scheduling Status popup window indicates that the scheduling process is complete. A Summary Report form will provide an overview of the scheduling problem and the results of the scheduling run:



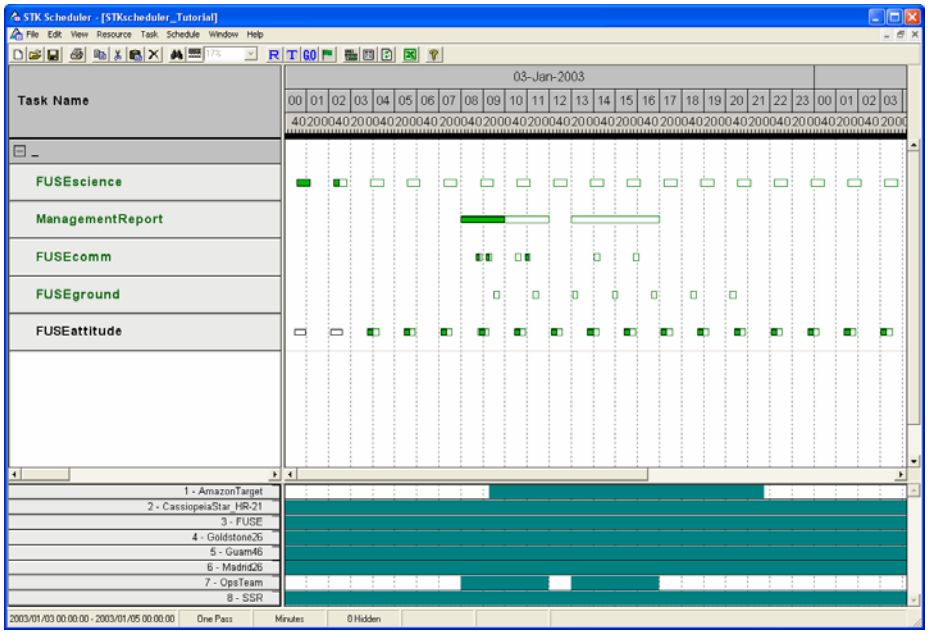
Click on the Summary Report Close button and review the Gantt form. Note that scheduled tasks are shown as green bars at the time they were assigned by the scheduling algorithm:



Tasks are shown in the Gantt view in time order. Unscheduled tasks are moved to the bottom of the form. This default organization can be adjusted by the user through menu option selections under the View menu.

Select ***View > Show Timeslots*** to toggle off the display of timeslots; now only the scheduled task bars are shown. Turn the timeslots back on by selecting ***View > Show Timeslots*** again.

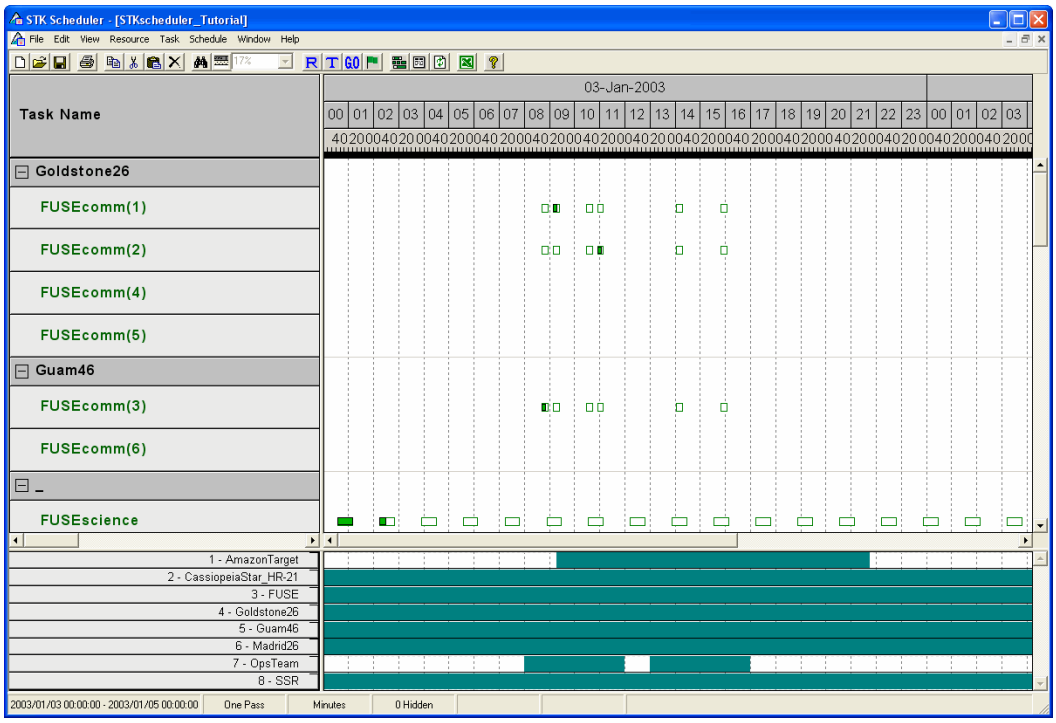
Roll up recurring tasks onto a single line by selecting ***View > Rollup Tasks > Rollup Recurring Tasks***. Remove task labels by de-selecting ***View > Show Task Labels***.



Break out each recurring task instance by again selecting ***View > Rollup Tasks > Do Not Rollup Tasks*** and re-selecting ***View > Show Task Labels***.

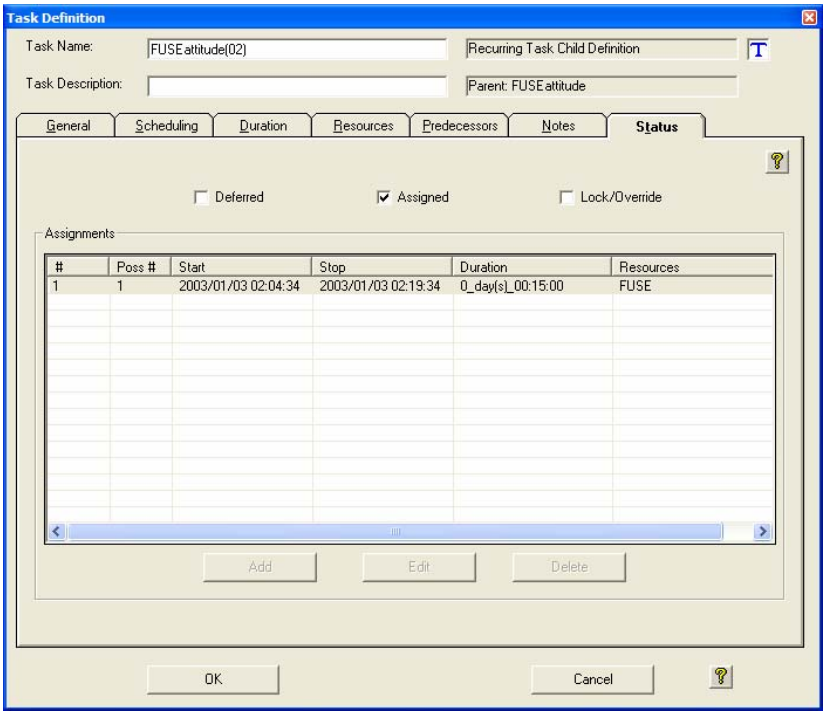
To quickly find a single task in a long task list, click on the ***binoculars icon*** on the toolbar. Select the desired task and click OK. The view will shift to place the selected task at the center of the Gantt window if the task is not already in the window.

Tasks may be grouped on the Gantt view based on their assigned STK object type. Select ***View > Task Groups > by STK Facility***:

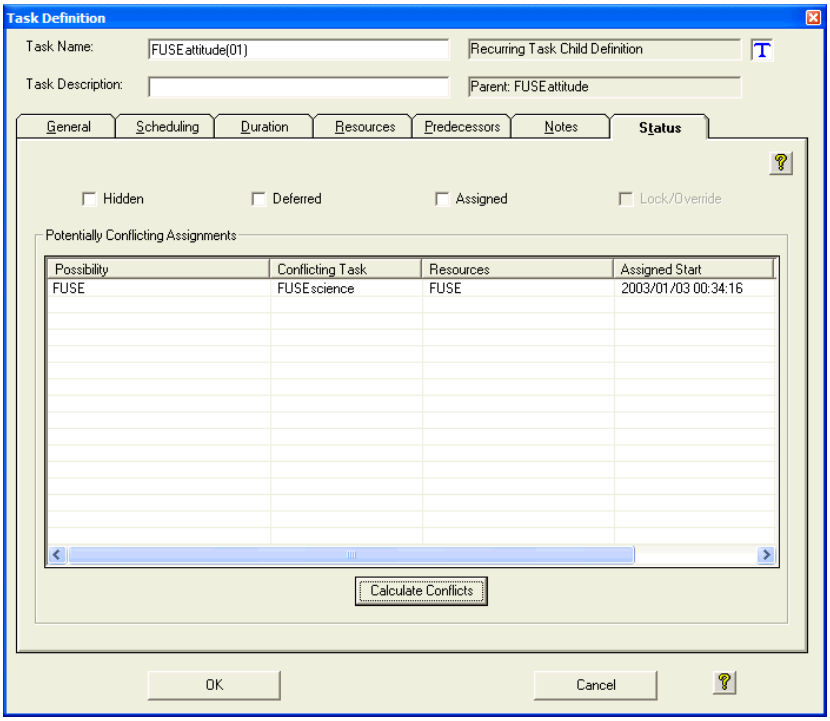


Note that the tasks with scheduled assignments to STK facility objects have been grouped according to their assignment. Tasks without STK facility assignments are in the Ungrouped section at the bottom of the Gantt view (in time order). Select ***View > Task Groups > Ungrouped*** to return to the normal time-ordered task view.

Right-click on a task name or task row for a scheduled task to bring up a menu of task options. Select ***Edit*** to bring up the Task Status tab of the Task Definition form. Note the information on start time, stop time, duration, and assigned resource option. Click Cancel to close the window.



Scroll down to the bottom of the Gantt view and left click (to clear other task selections) then right-click on an unscheduled task. Select ***Edit*** to bring up its Status tab. Click on **Calculate Conflicts** to display specific conflicts that caused the scheduling problem(s) for the task.



Any scheduled task using a resource option for the unscheduled task during any timeslot for the unscheduled task will be listed here. In addition to these direct conflicts, indirect conflicts due to resource setup times and consumable resource capacity are also listed. This provides conflict analysis data for unscheduled tasks. Click Cancel to close the window.

De-select ***View > Show Unassigned Tasks*** to remove unassigned tasks from the Gantt window.

Tasks may be manually dragged to a new time on the Gantt view. In order to drag a task it must be Locked (which indicates a manual override for scheduling purposes). Right-click on one of the scheduled ***Management Report*** tasks and select the ***Lock/Override*** option. The task bar will turn blue, indicating that it is Locked. Next, click-and-drag the task bar to a new time (perhaps during a different timeslot or maybe during no timeslot at all). Run a validity check by selecting ***Schedule > Validate*** and note any violations in the log under ***Help > Log***.

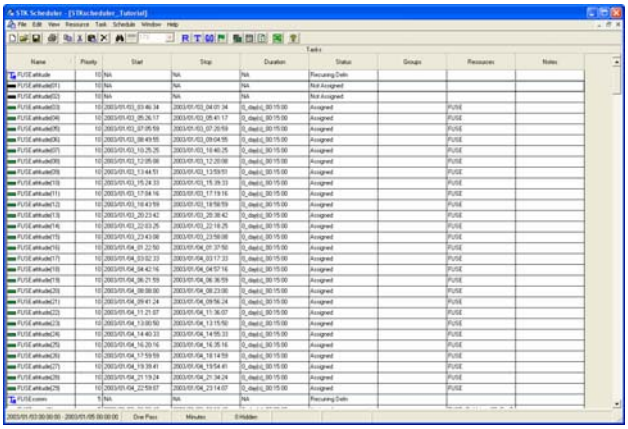
Note

The user risks over-subscribing a resource by locking and dragging a task manually. Validity checking can confirm that manual changes have not violated task or resource attributes.

The Task Lock feature is a manual override so the user can place a task anywhere (even outside task timeslots). Task validity checking is NOT performed on locked or deferred tasks, though related resource impacts are checked for locked tasks.

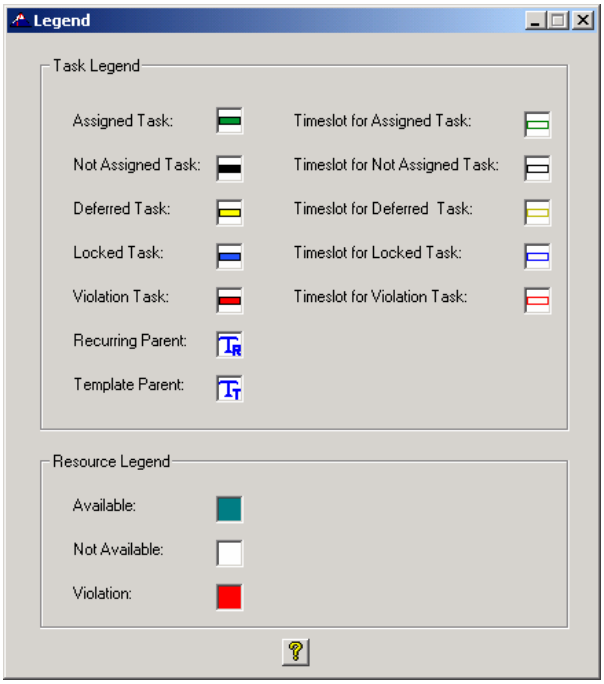
Note that locking a task and dragging it to a new timeslot does NOT change the resource assignment for the task. The resource assignment may be manually selected on the task's Task Definition form Status tab.

Select ***View > Main View > Table*** or click on the table button on the toolbar to bring up the table view of the schedule:



Click on column headers to sort by the values of the data in that column. Click on the column header again to reverse the sort. Sort by the ***Status*** column to bring unscheduled tasks to the top; this is a quick way to consolidate the unscheduled tasks on the table view.

Select ***View*** > ***Show Legend*** to help decipher the symbols used for the different status levels and task object type definitions:

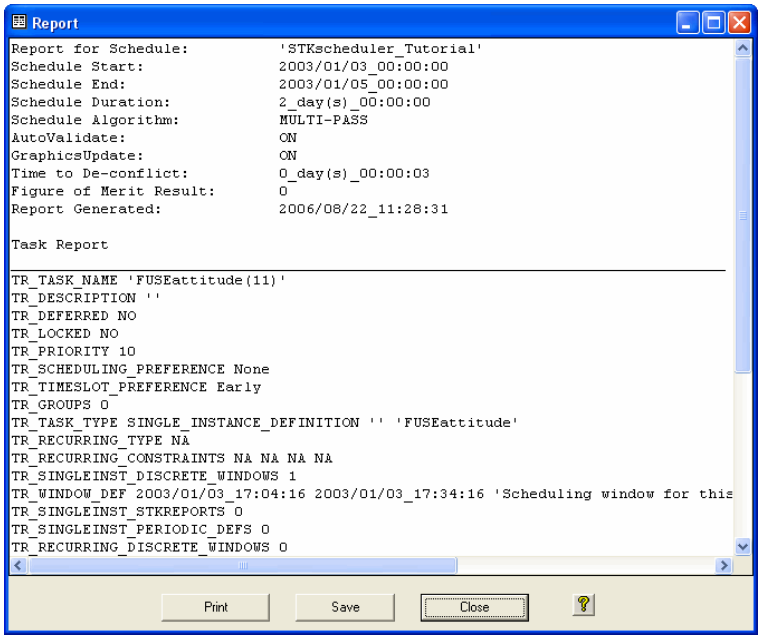


Close the Legend form. On the table view, Click-and-Drag a column header left or right to reorder the columns as desired, and resize the columns per your preference.

Right-click on a scheduled task and select the Lock option from the pop-up menu. The task status bar will turn blue and it will be brought to the top or bottom of the list if the table is still sorted by Status. A locked task (and the resources it uses) will not be changed if the schedule is re-solved. Unlocked tasks and new tasks are scheduled around locked tasks.

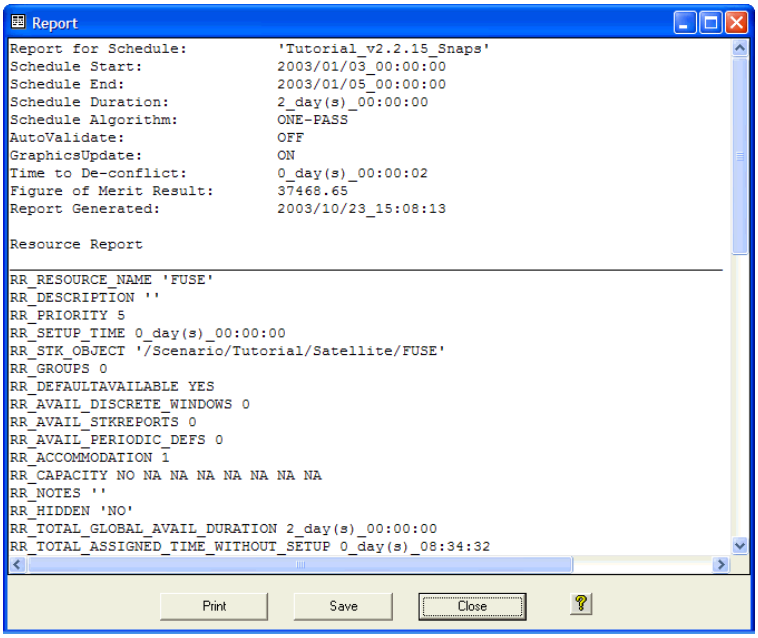
Unlock all tasks and Select ***Schedule*** > ***Select Algorithm*** > ***Multi-Pass*** and then hit GO to resolve the schedule. Perhaps this algorithm did better than the One-Pass algorithm. The Summary Report should tell you how it did, or you can sort by the Status column in the Table view.

Highlight a group of tasks in the table view by selecting them with the mouse and using the ***SHIFT*** or ***CTRL*** keys. To select all, ***CTRL-A***. To get a Task-based ASCII report for the selected tasks, select ***Task*** > ***Report***.



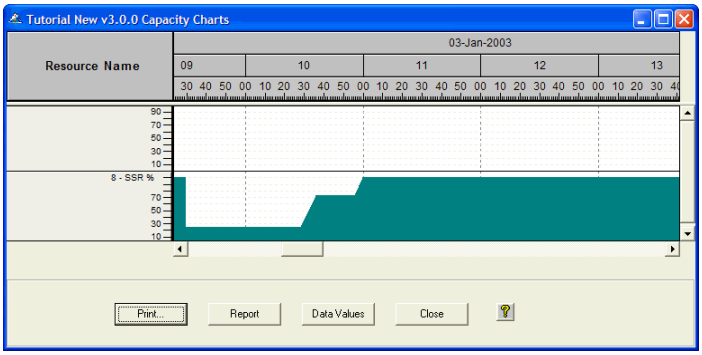
All task timeslots as well as the assigned timeslot and resources are listed for each task. Save the task report for later use by clicking Save and selecting a filename and the directory location.

To get a Resource-based report select ***Resource*** > ***Report***. With the mouse select the resource or resources you would like a report on and click OK.



Review the Resource report on the screen. Note that resource duty cycle is calculated and all supported tasks are listed under each resource.

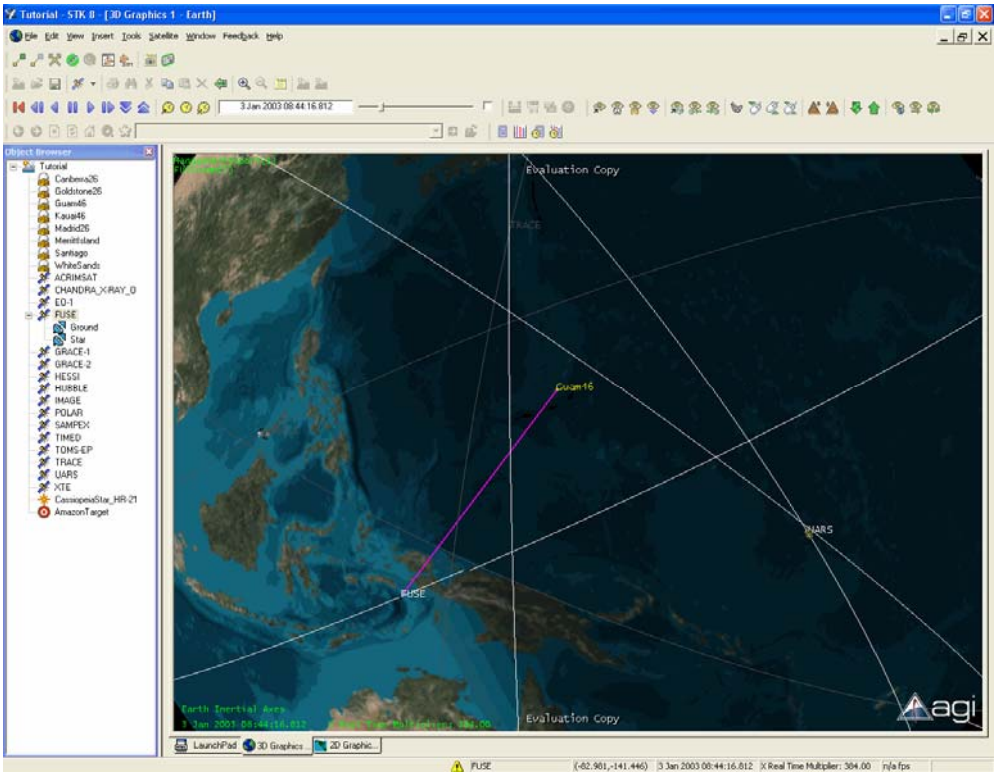
To assess resource capacity usage select ***Resource > Chart > Capacity***. Zoom in on the main Gantt View first to see a closer view of the chart (the main Gantt View zoom setting is used to drive the chart zoom level). The SSR depletion and replenishments are shown.



For operator/planner situational awareness, STK/Scheduler also comes with a schedule animation feature. To help focus in on this schedule's animation, select FUSE as the focus of the VO View. Look at the Gantt view of STK/Scheduler to find the start time of the FUSEcomm task. Select ***Schedule > STK > Animate***, bring the STK/VO window to the front (animation starts automatically), and use the VO window controls to fast-forward the animation to just prior to the start of the task, and then slow it down to run at a reasonable speed.

Note the magenta line that appears, connecting FUSE with its assigned target (the facility object) during the scheduled task time. These are not just access lines; they are displayed only when a task is scheduled, and only shows accesses assigned by the scheduling algorithm to support defined and scheduled tasks.

The loaded STK scenario is modified to display accesses between STK objects that are being used to support scheduled tasks during their tasks' scheduled times.



Tutorial Complete

This concludes the STK/Scheduler tutorial. To save this schedule file select ***File*** > ***Save***. The saved schedule file includes all of the information about all of the tasks and resources, scheduling options, timeslots, and other data necessary to bring the planning session back so you can start where you left off. Note that resources and tasks are unique to and not shared between schedule files, even though they might be associated with the same object in the same STK scenario.

Please feel free to experiment by adding to the schedule file you built here or by creating a new file from scratch. Remember that form-specific HTML Help is just a mouse click away to provide more information about any field or parameter.

If you have any questions regarding STK/Scheduler, other STK modules, or this tutorial, please email STK technical support at support@stk.com or contact technical support by phone at 888-785-9973 (weekdays between 8am and 8pm, Eastern Time).