Intelligent Scheduler, Prioritize on the Fly

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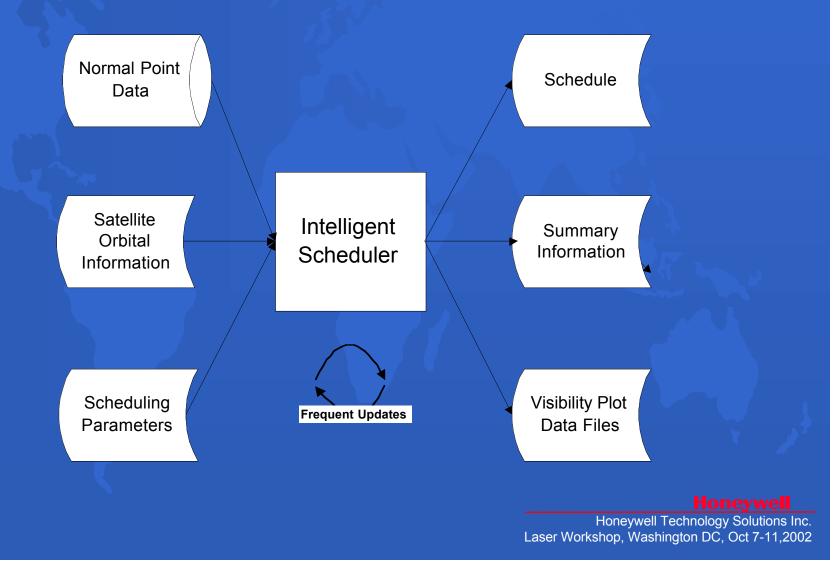
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Introduction

- ◆ Current software schedules satellites according to static priorities.

- ◆ New mission scheduling software in development
  - – Based on the scheduling software developed by HTSI for the Matera Laser Ranging Observatory
  - – New Features
    - ✦ Dynamic prioritizing of satellites.
    - ✦ Satellite position may be included in the scheduling criteria.
    - ✦ Amount of recently tracked data may be included the scheduling criteria.

Functional Diagram

Normal Point Data

Satellite Orbital Information

Scheduling Parameters

Intelligent Scheduler

Frequent Updates

Schedule

Summary Information

Visibility Plot Data Files

Current Optimization

◆ Current optimization features being implemented
  – Fine Interleaving Optimization
  – Geodetic (sky coverage) Optimization
  – Ascending/Descending Optimization
◆ Future
  – New features will be added based on need.

Scheduling Parameters

Satellite Parameters

Satellite Name: LAGEOS-1	Entry ID: 71261155
Satellite ID4: 1155	Satellite ID7: 7603901

Priority: 3

Minimum Elevation (deg.): 20
☑ Day Time ☑ Night Time

Activated
☑ On/Off

Maximum Track Time (min): 99

Minimum Track. Time (min): 2

☐ Fine Interleaving   ☑ Geodetic Optimization   ☐ Altimetric Optimization   ☐ Asc/Des Optimization

Geodetic Max. Priority: 1

Minutes Per Sky Section: 2

Geodetic Prev. Days: 14

Ascend Max. Priority: 1

Descend Max. Priority: 1

Ascend Min. Minutes: 10

Descend Min. Minutes: 10

Asc/Des Prev. Days: 14

Fine Int. Track Time (min): 5
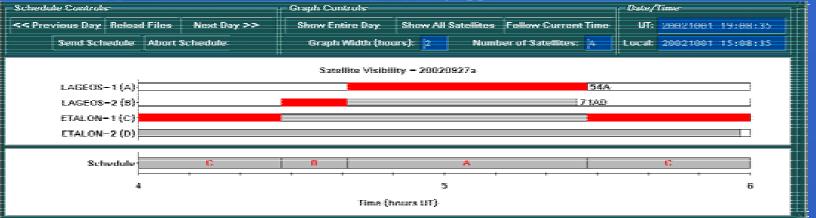
Fine Interleaving Optimization

◆ Schedule will alternate between a satellite and lower priority satellites at given time intervals.

◆ Avoids scheduling scenarios where one satellite of several similarly prioritized satellites is scheduled a disproportionate amount of time.
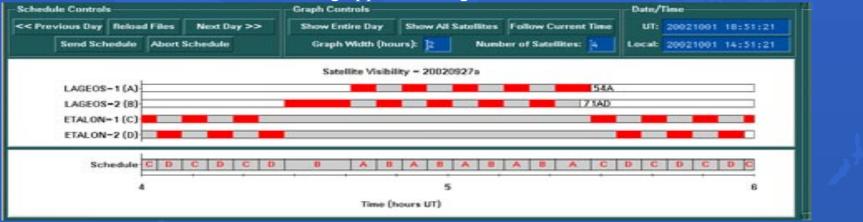
Fine Interleaving Example

No fine interleaving applied

Fine interleaving applied to Lageos-1 and Etalon-1

Geodetic (Sky Coverage) Optimization

◆ Divides sky into sections based on azimuth and elevation.

◆ Calculates amount of time satellite has been tracked in a section of the sky.

◆ Raises the priority of a satellite in a particular sky section where the amount of satellite data not reached the minimum threshold.

Ascending/Descending Optimization

◆ Calculates the amount of time a satellite has been tracked in ascending and descending nodes.

◆ Raises the priority of a satellite when the satellite is in an ascending or descending node and the amount a satellite has been tracked in that node is less than the minimum threshold value.

Ascending/Descending Example

TOPEX and Jason summary with no ascending/descending optimization applied and TOPEX at a higher priority. Notice all available TOPEX is scheduled while only 63 % of available Jason is scheduled.

```
Satellite                                 Pass
or Event    Passes      Passes            Segments    Minutes     Minutes
Name        Available   Scheduled   %     Scheduled   Available   Scheduled   %
---------   ---------   ---------   ---   ---------   ---------   ---------   ---
TOPEX          34          34       100      34          384         384      100
JASON          35          35       100      35          385         243       63


*****************************
*  JASON       *  SUMMARY  *
*****************************

Descript.                                 Pass
of Row      Passes      Passes            Segments    Minutes     Minutes
Sub-Total   Available   Scheduled   %     Scheduled   Available   Scheduled   %
---------   ---------   ---------   ---   ---------   ---------   ---------   ---
Total          35          35       100      35          385         243       63
Ascending      18          18       100      18          194         124       64
Descending     17         ▉17       100      17          191         119       62
```

Ascending/Descending Example (cont.)

TOPEX and Jason summary with ascending optimization applied to Jason (200 minutes minimum). Notice all ascending Jason is now scheduled.

```
Satellite                                   Pass
or Event    Passes      Passes              Segments    Minutes     Minutes
Name        Available   Scheduled   %       Scheduled   Available   Scheduled   %
---------   ---------   ---------   ---     ---------   ---------   ---------   ---
TOPEX           34          34      100         34          384         325      85
JASON           35          35      100         35          385         320      83


******************************
*  JASON        *  SUMMARY  *
******************************
ascending/descending optimization activated

Descript.                                   Pass
of Row      Passes      Passes              Segments    Minutes     Minutes
Sub-Total   Available   Scheduled   %       Scheduled   Available   Scheduled   %
---------   ---------   ---------   ---     ---------   ---------   ---------   ---
Total           35          35      100         35          385         320      83
Ascending       18          18      100         18          194         194     100
Descending      17          17      100         17          191         119      62
```

Summary File Information

◆ Information included.

– Total number of passes and minutes each satellite is available versus number of passes and minutes which the satellite is scheduled.

– Separated by ascending / descending node and section of the sky.

– Effects of the optimization.

✦ The schedule will be generated with and without the optimization applied, then the net effects of the optimization will be calculated and displayed.

Additional Features

◆ Sun Zone Avoidance

◆ Special Satellite Passes

– Raise priority for specific satellite passes.

Conclusion/Possible Future Developments

- ◆ New scheduler has enhanced capabilities
  - Dynamic prioritizing of satellites
  - Satellite's position is available for entire visible arc
  - Recently tracked data may be incorporated into scheduling criteria

- ◆ Several optimization applications have been developed utilizing these capabilities.

- ◆ Web based application for displaying successful tracking and current schedules.

- ◆ Multi-site optimization.
  - Use groups of stations when optimizing schedules