

PLANNING AS A PRECURSOR TO SCHEDULING FOR SPACE STATION PAYLOAD OPERATIONS DRAFT COPY

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ABSTRACT

Contemporary schedulers attempt to solve the problem of best fitting a set of activities into an available timeframe while still satisfying the necessary constraints. This approach produces results which are optimized for the region of time the scheduler is able to process, satisfying the near term goals of the operation. In general the scheduler is not able to reason about the activities which precede or follow the window into which it is placing activities. This creates a problem for operations which are composed of many activities spanning long durations (which exceed the scheduler's reasoning horizon) such as the continuous operations environment for payload operations on the Space Station. Not only must the near term scheduling objectives be met, but somehow the results of near term scheduling must be made to support the attainment of long term goals.

For operations of extremely long duration, it is impractical to force the scheduler to reason about the entire time interval. The size of the problem space has a direct impact on

the quality and timeliness of the scheduling solution. Approaches which depend on increasingly "fuzzy" descriptions of future activity requirements and constraints are awkward to implement and use.

This paper discusses the concept of planning, which is a straightforward analytical process different from and a precursor to scheduling. Planning is used to organize the inputs to scheduling so that the intermediate and long term goals of an operation can be satisfied by a scheduler which only has knowledge of the near term goals. It accomplishes this by analyzing goals for the entire operation in conjunction with the results of previous schedules and reorganizing the inputs to the next scheduler process. The mission operation concepts from Spacelab and Space Station are used to provide examples of why this capability is needed.

1. BACKGROUND

This section will contain:

History of how mission operations were scheduled for Spacelab

Concept of continuous operations for Space Station; how this creates a need for planning

Definition of scheduling horizon, planning horizon; concept of different goals for each horizon

2. SCHEDULING

This section will contain:

Basic description of scheduling from an input-process-output viewpoint; objective is to be able to contrast planning with scheduling [example Figure 2-1 showing dataflow]

3. PLANNING

This section will contain:

Description of planning from input-process-output viewpoint [example Figure 3-1 showing dataflow]; how planning operates as a precursor to scheduling

Contents of the plan

Contrast planning with scheduling [Figure or Table?]; benefits of planning

Products derivable from planning

4. SUMMARY

A planning function for Space Station continuous operations will provide several useful capabilities:

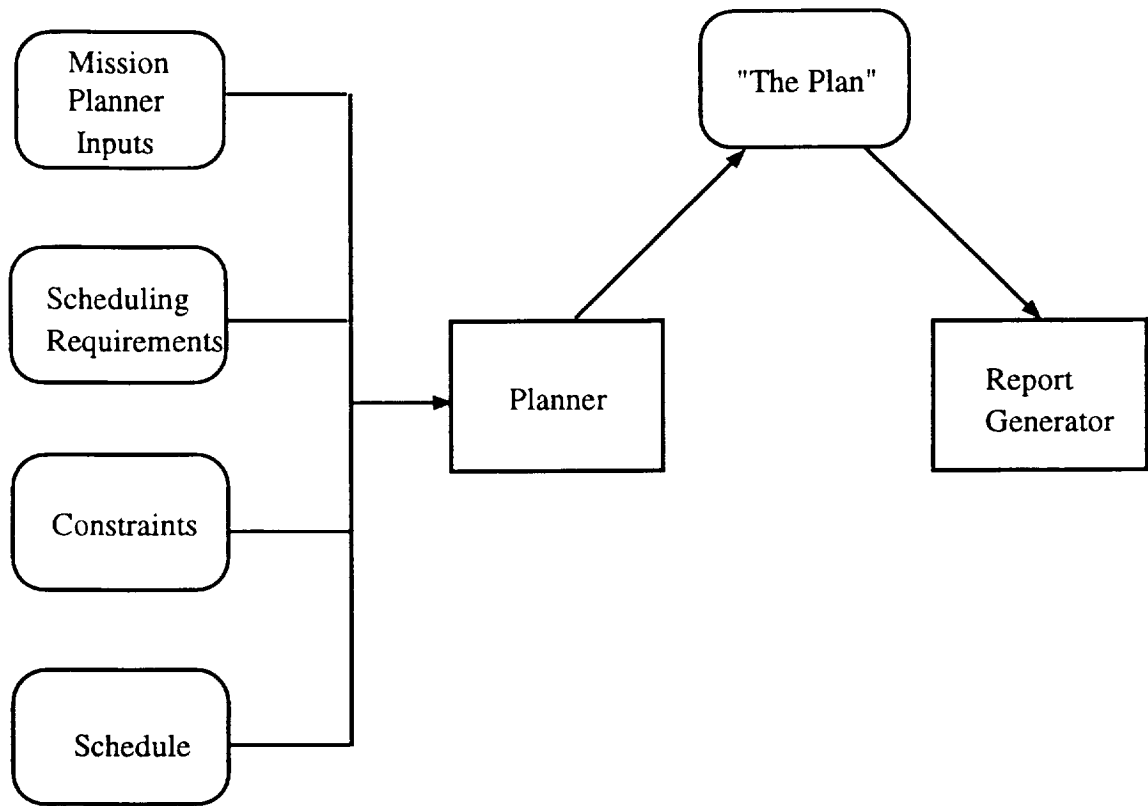
- a means for meeting long term objectives with a near term scheduler
- a quick method for generating high level plans when detailed timelines are not needed
- a way to increase operational flexibility by deferring detailed scheduling decisions until the last possible moment

- A convenient way to apply additional constraints to scheduling without changing any activity requirements.

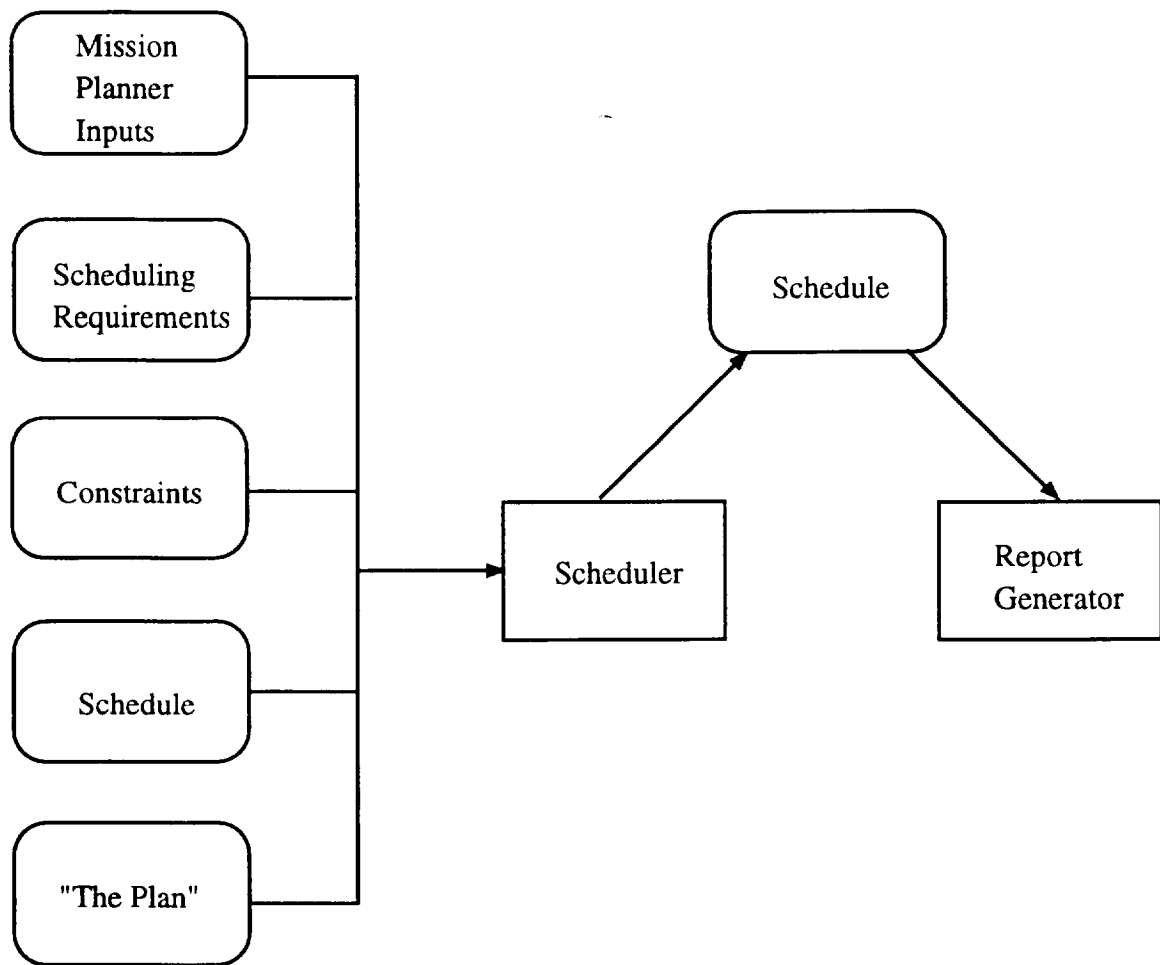
There are possible extensions of this capability into the tactical and strategic planning domains of the Space Station as well.

5. REFERENCES

1. Payload Planning System (PPS) System Specification (SS); SW683-70256-1.
2. Segment Specification for the United States Ground Segment (GSS); SSP 41161.
3. Mission Planning Operations Concept Definition (MPOCD) Update: Final Report, Informal; D683-10686-1.
4. Concept of Operation and Utilization (COU) Volume III; SSP 50011.
5. Hagopian, J.; Maxwell, T.; Reed, T.: "A Distributed Planning Concept for Space Station Payload Operations", Third Symposium on Space Mission Operations and Ground Data Systems, Greenbelt, MD., Nov. 15-18, 1994.



Example Figure 3-1 Planner Dataflow



Example Figure 2-1 Scheduler Dataflow