Saturn's Vision for Program Management: A Different Kind of Approach

Lisa W. Churitch, Saturn Corporation
Denis P. Couture, Integrated Management Systems, Inc.
Clement L. Valot, Integrated Management Systems, Inc.

PMI *Proceedings*, 1992, pp. 74–80

Introduction

In 1985 Saturn Corporation was founded to produce an American-made car to compete head-on with Japanese vehicles in the areas of cost, quality, function, and service. General Motors (GM) knew it needed, "a different kind of company" with a different kind of approach to the business of developing and manufacturing cars.

Saturn team members came from all corners of the GM organization. They adopted and adapted business processes that would help them meet Saturn's objectives, recognizing that improving how the product was developed would improve the product itself.

Like other domestic car makers, Saturn is organized into funct teams, including powertrain, body systems, marketing, and finance. agement of product development programs is coordinated by fun managers *and* by cross-functional teams—Saturn corporate and p management teams—who accommodate planning and coordinatio tivity within and between functional groups respectively (see Figure

Individual development teams translate concepts into cars. ability to provide these teams with clear direction based on integr is important. Making them accountable for success is essential.

All Saturn team members share program objectives for proc cost, and timing. While the matrix organization structure can b mean to manage these objectives, it often presents special cha veloping plans and resolving problems when "local" and prog jectives are in conflict.

Saturn needs a program management approach that will a the complementary roles of program and functional manage The approach will be successful only if it supports:

- planning integration within and between functional teams
- providing clear direction to development teams
- rapid, effective problem identification and resolution
- practical use of project management methods and systems.

The challenges associated with developing and implementir a large, disparate organization are considerable. Introducing a p agement approach at Saturn is no different. After several years attempts at standardizing an approach, a strategy was put in pl

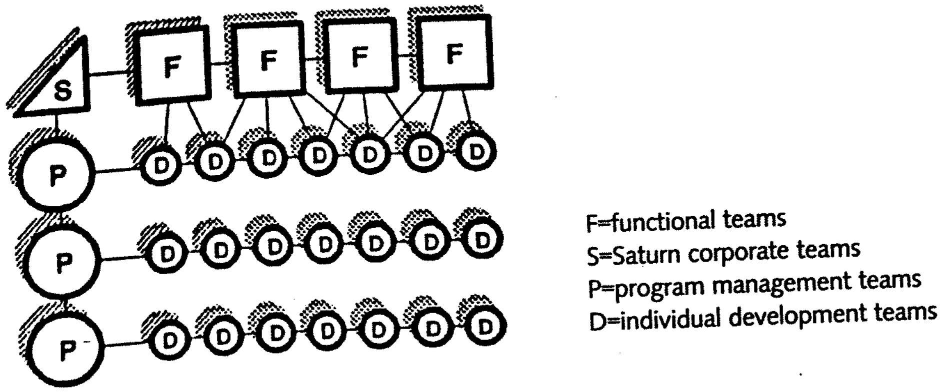


FIGURE 1

long-term vision. The strategy described the construction of an approach from the ground up, one block at a time. Saturn is implementing the strategy and, in the process, fine-tuning the vision itself.

This paper provides a snapshot of Saturn's vision for program management: its organization and how work breakdown structures and schedules will serve its needs. The paper will also describe the implementation strategy, progress to date, and some challenges faced. And what makes this approach different.

ORGANIZATION

Saturn's product development activities are in Troy, Michigan; its manufacturing facility is in Spring Hill, Tennessee. Between these two operations, Saturn has constructed an organization focused on a single mission:

> Market vehicles developed and manufactured in the United States that are world leaders in quality, cost, and customer satisfaction through the integration of people, technology, and business systems and to transfer knowledge, technology, and experience throughout General Motors.

All Saturn members are assigned to functional teams. Functional teams assign members to various cross-functional teams.

Functional Teams

Functional teams are either business or resource teams.

Business	Resource
Body systems	Marketing
Interior systems	People systems
Electrical	Materials
HVAC	Finance
Powertrain	Program planning
Chassis	Proto build and test

Business teams are primarily responsible for product development and manufacturing, resource teams for supporting business team and corporate operations.

Functional teams serve several roles:

- participate on cross-functional teams to plan and implement product development programs
- provide technical resources and direction to product development teams through part and tool engineering, prototype builds and tests, and model changeover
- manage and implement nonprogram-related team-specific activities such as technology assessment, training, and budgeting.

Cross-Functional Teams

Functional team members are assigned to cross-functional management and development teams.

Action councils are composed of top company and functional managers. They set program objectives, allocate resources to teams, and resolve high-level conflicts. Each action council has a specific business focus, and some oversee product development programs.

Program management teams (PMTs, also called work groups) coordinate high-level program planning and management activities. Teams include members from most functional teams and the United Auto Workers (UAW). Teams are led by marketing during the development phase and by engineering and manufacturing during the implementation phases.

The PMTs establish *project centers* to coordinate detailed design, design releases, and prototype builds and tests. They include members from engineering, manufacturing, and program planning dedicated to one program.

Development Teams

Development teams can be single- or cross-functional depending on technical requirements.

Product development teams and design teams develop specific product systems (functional or vehicle—see work breakdown structure), components, or parts, and closely coordinate activities with other teams. They are responsible for meeting the objectives established by the program management teams and their functional teams.

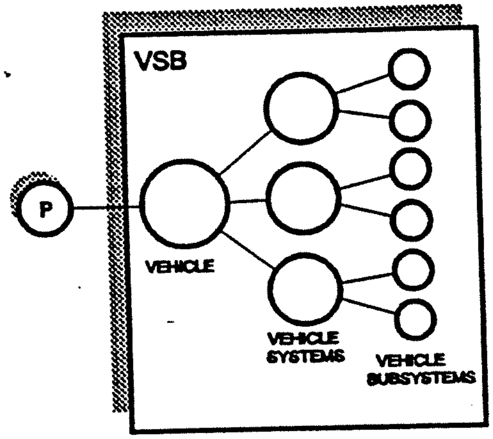
Work Breakdown Structures

Development work is organized two ways to accommodate various planning and management requirements:

- by vehicle systems, organizing the product into areas with content crossing multiple functional teams
- by functional systems, organizing the product into functional content crossing multiple vehicle systems.

For example, a door is a vehicle system that contains electronics, body panels, interior trim, and coatings, each developed by and coordinated between different functional teams. The electric locks contained in the door are part of a functional system that must be coordinated with other electronics in the vehicle.

Two work breakdown structures allow program plans to be "sliced" both ways, to view requirements from both perspectives.



Code	VEH SYSTEM/Subsystem
A	FRONT OF VEHICLE
A1	FRONT COMPARTMENT
A11	Structure, Exterior, Lighting
A12	Hood
A13	Front Bumper
A2	ENGINE COMPARTMENT
B	CENTER OF VEHICLE
B1	PASSENGER COMPARTMENT
B2	INSTRUMENT PANEL
B3	DOORS
B4	GREENHOUSE
C	REAR OF VEHICLE
C1	REAR COMPARTMENT
D	UNDERSIDE OF VEHICLE
D1	UNDERSIDE OF VEHICLE

FIGURE 2

Vehicle System Breakdown

The vehicle system breakdown (VSB) structure organizes the vehicle into four areas. Within each area there are vehicle systems and subsystems. Multiple functional teams are involved in the work associated with a given subsystem.

A coding structure provides a way to uniquely identify elements within the VSB (see Figure 2).

Functional System Breakdown

The functional system breakdown (FSB) structure organizes the vehicle according to functional, or technical, systems. Within each functional system, there are assemblies and subassemblies comprised of parts. And how these are actually defined can vary widely between functional teams. Because each functional system is designed by the same functional team across all vehicle programs, the FSB is similar to an organizational breakdown structure and is used to assign responsibility.

A coding structure provides a way to uniquely identify elements within the FSB (see Figure 3).

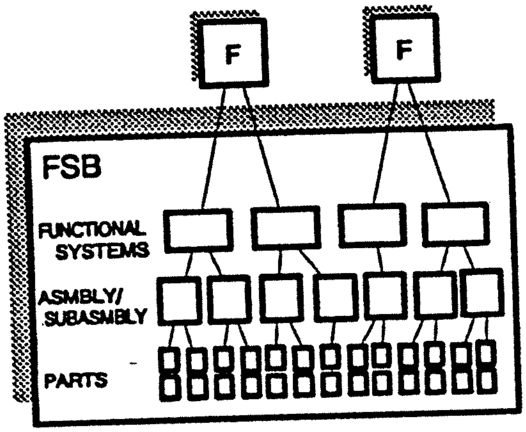
Component Definition

The VSB and FSB as described are product breakdowns. Converting these to work breakdown structures is done by defining vehicle components and the steps required to develop each. A component, for this purpose, is defined as one part or a group of parts, subassemblies, or assemblies which:

- are developed as a unit by a single functional team
- are associated with a single vehicle system or subsystem
- contain parts not included in other components.

For each program, the FSB and VSB are used to develop a list of up to 200 components used for vehicle and functional planning. Component definitions vary from program to program depending on content and extent of changes from the current product (see Figure 4). Each component is developed using the GM product development process, "4-Phase Process," which was adapted to Saturn's own approach and organization.

The process describes discrete activities and events that must be completed during each development phase:



Code	FUNCT'L SYSTEM/ Assembly/Subassembly
01.	STRUCTURAL
.01	Spaceframe
.01	Body Side
.02	Framing
.03	Underbody
.02	Cockpit/FOD
.03	Door Structures
.04	Coatings, Sealants, Raw Mtls
02	EXTERIOR PANELS
03	BODY
04	-open-
05	ELECTRICAL
06	HVAC
07	INTERIOR
06	POWERTRAIN
09	CHASSIS

FIGURE 3

- Phase 0—technology and concept development
- Phase 1—product and process development
- Phase 2—product confirmation and process validation
- Phase 3—production and continuous improvement.

Each component development is defined with a standard list of twenty-three activities and events detailing Phases 0, 1, and 2. Because each component is uniquely associated with an FSB and a VSB element, the activities represent the lowest level of work breakdown for each of these structures.

SCHEDULES

Saturn has guided each new vehicle development to production using a variety of schedules maintained at different levels of detail by different parts of the organization. In the beginning, planning coordination was done informally—that is, by affected teams sitting with others to resolve specific interfaces. Because of the large number of interfaces, the need for a more formal means to coordinate schedules earlier was apparent.

This section describes the vision of how planning integration will be done at Saturn: how it will use the FSB and VSB structures to help teams plan their work and coordinate it with others'. While the schedules described exist in some form, the full vision has not yet been realized. The Implementation section of this paper describes the strategy being used; the Progress section describes where it currently stands.

Vehicle development planning is done with a schedule hierarchy based on the VSB (see Figure 5).

Vehicle Schedule

Saturn uses a vehicle schedule to plan and track major program milestone dates. The schedule consists of approximately 200 activities and twenty to forty milestones. It is structured according to major vehicle systems and reflects the relative timing of these. Critical path method (CPM) scheduling is

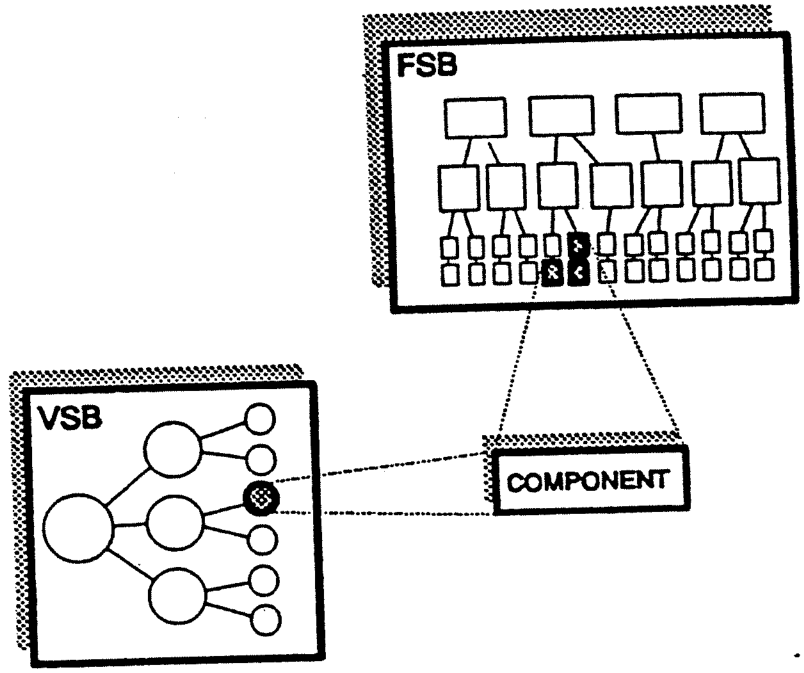


FIGURE 4

not typically used because of the complex relationship between macro-level activities.

The vehicle schedule is used during program planning to:

- establish key program milestones, based on program content and objectives and past performance
- do strategic what-if analysis
- do macro-level budget and staff planning
- provide a framework for the development of the system schedule.

It is used during program implementation to:

- provide a hammock for updated system schedules
- use as a management reporting tool
- assess program status
- assess impacts of changes.

Vehicle System Schedules

Vehicle system schedules are used to plan and integrate all aspects of vehicle development activity and to coordinate systems and subsystems activity. Major components are included when their specific visibility is required.

A summary four-phase subnetwork for the work within each system, subsystem, and component is created. Constraints between these subnetworks reflect the general relationships between development teams based on experience and trust. No attempt is made to articulate detailed interfaces between teams. These are either defined in other Saturn business processes or too complex to capture effectively.

Vehicle system schedules consist of 500 to 1000 activities and events, each coded according to the VSB. The schedule reflects a viable means to achieve the milestones established in the vehicle schedule.

The vehicle system schedule is used during program planning to:

- validate vehicle schedule
- coordinate systems, subsystem, and selected component schedules

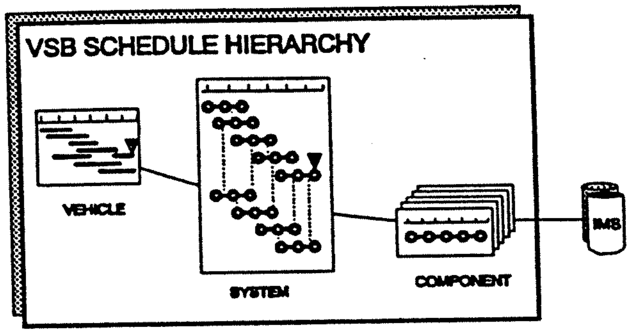


FIGURE 5

- do tactical what-if analyses
- provide a framework for component schedule development.

It is used during program implementation to:

- provide a hammock for updated component schedules
- assess program status
- assess impacts of changes.

Component Schedules

Component schedules are developed based on dates in the vehicle systems schedule. They are constructed using the twenty-three activities described in the Component Definition section. This provides a framework, not a replacement, for detailed planning. Development teams are responsible for planning their work within this framework, coordinating technical interface, and advising when the framework is untenable.

Component schedules also provide a means to establish part-level target dates prior to detailed planning. These are loaded in the information management system (IMS) in which parts readiness dates are maintained. (Data are transferred via an upload from the project management software to IMS on the corporate mainframe.) Standard CPM network models were developed for the eight major functional systems. These models enable the rapid, consistent development of these schedules. As indicated earlier, a new program may have up to 200 components. Models are selected and adapted to component-specific requirements.

Because planning integration was done in the vehicle system schedule, component schedules are maintained independently. No constraints between component schedules are formally maintained.

Component schedules are used during program planning to:

- validate the system schedule
- provide specific direction to development teams
- provide target dates to the IMS.

They are used during program implementation to:

- provide a hammock for updated design schedules
- assess component status
- assess "local" impacts of detailed changes
- provide updates to the IMS.

Component schedules also provide the basis for functional team planning. Another schedule hierarchy is developed using the FSB (see Figure 6).

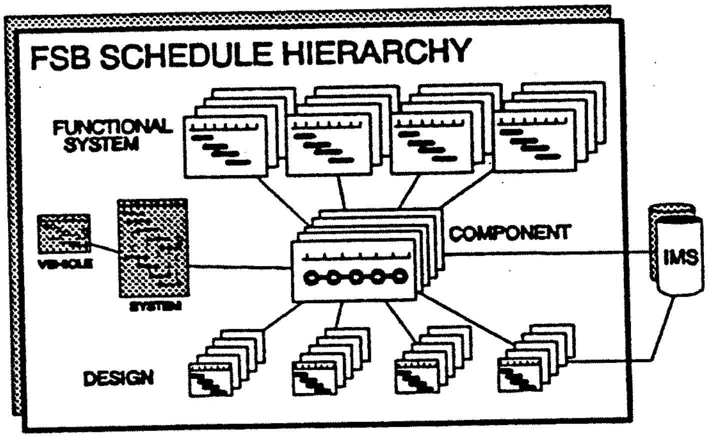


FIGURE 6

Functional System Schedules

Functional system schedules are developed by functional teams to coordinate the activity across vehicle systems. While the vehicle system schedule was used to coordinate different functional teams' activities for a given subsystem, the functional system schedule is used to coordinate activity for a given functional system across multiple vehicle systems. The functional and vehicle systems schedules are developed in parallel, since changes to one may cause a conflict in the other.

To return to an earlier example, the electric door lock development may be delayed to coordinate it with other door design activities in the vehicle system schedule; however, it may result in a problem for the team developing the security and electronics systems, whose activities are coordinated in a functional system schedule.

Functional system schedules may also contain activities not covered by supporting component schedules. As a result, a resorting or summarization of component schedule activity is not adequate.

Functional system schedules are used during program planning to:

- validate the vehicle system schedule via the component schedules
- coordinate work between component schedules and other functional team activity, including other programs
- aggregate resource requirements within and across programs.

They are used during program implementation to:

- assess component and functional team status
- assess impacts of changes.

Design Schedules

Design schedules are when "the rubber meets the road," where plans are turned into action. Component schedules normally describe the development of groups of parts, each of which must be designed and engineered, each requiring specific tooling.

Standard component networks are often inadequate to plan and track these activities in detail. Design schedules are developed to provide this detail, based on component schedule requirements. The detailed design process varies widely between functional systems. They are developed to meet the "local" needs of the design leaders and designers.

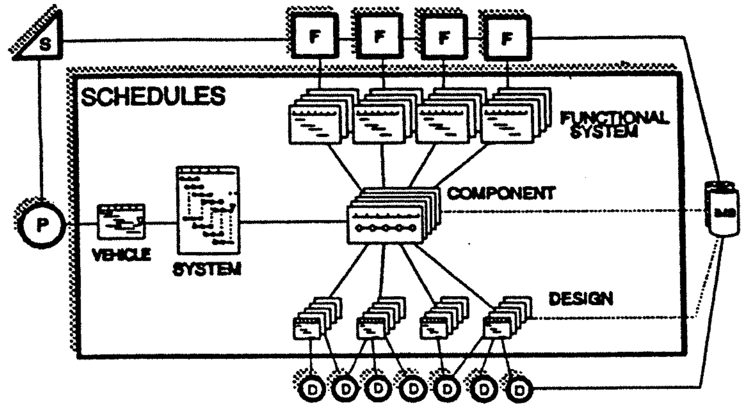


FIGURE 7

Design schedules are used during program planning to:
- validate component schedules
- provide specific targets to development teams and members.

They are used during program implementation to:
- assess pert and component status
- assess local impacts of detailed changes
- provide updated promise dates to the IMS.

SCHEDULE ADMINISTRATION

Management and development teams develop and use schedules to serve their complementary roles. Individual schedules are not created or maintained in a vacuum (see Figure 7).

- System-level schedules provide a framework for component and design schedules.
- Design and component schedules are used to validate system-level and vehicle schedules.
- Vehicle system and functional system schedules are used to coordinate the same work from two perspectives.

As a result, how they are administered is important to their consistency and integration throughout program planning and implementation.

Schedule Ownership

Schedules are owned by teams who are responsible for their development and maintenance, and tacitly for their completeness and correctness. The following matrix outlines ownership responsibilities.

Schedule	Owner (P) – Primary (O) – Operational
Vehicle	Saturn action councils (P) Program management team (O)
Vehicle system	Program management team (P) Project center (O)
Functional system	Functional teams
Component	Development teams
Design	Development teams
IMS (each part)	Development teams

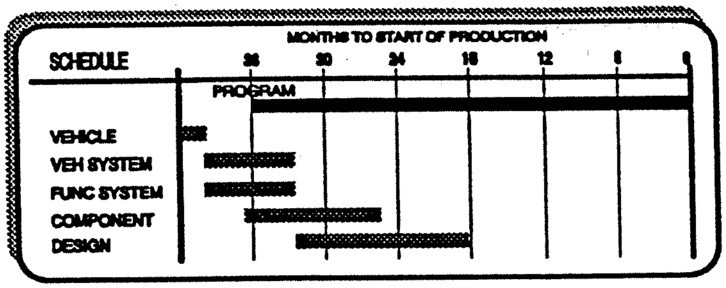


FIGURE 8

Schedule Development

New program schedules are developed "top-down," with the vehicle schedules providing the basis for vehicle system and functional system schedules. These are developed concurrently to enable coordination between them before component and design schedule development (see Figure 8).

As successive levels of schedules are developed, they are used to validate more summary schedules. Changes may result to any schedule if:

- inadequate time has been allotted for design work
- critical development team interfaces have been omitted
- resources are unavailable
- the scope of work or milestone dates have changed.

Schedule Updating

Schedules are updated "bottom-up" based on progress against design schedules. Design and component schedules are updated biweekly; vehicle and functional systems schedules, bi-weekly; and vehicle schedules, bi-weekly. A comprehensive updating cycle will be completed as in Figure 9.

Each schedule owner is responsible for providing input to others. Like the schedules themselves, updates are only approximations that need to be evaluated and adjusted to reflect as nearly as possible the owner's current status and intent to complete.

IMPLEMENTATION

During the early stages of Saturn's start-up, several planning approaches were tried with local success, but none was widely accepted. In 1990, a strategy was developed to construct the approach according to the vision one block at a time as described in the Schedules section. It was designed to roll-out the approach no faster than the organization could reasonably absorb it, given the numerous other challenges that it faced on other fronts.

Strategy

The strategy consists of three phases. During each phase at least one type of standard schedule is developed and implemented; meanwhile, existing planning methods are maintained on current vehicle programs.

Phases contain the following goals:

Phase 1

- Develop the FSB and VSB structure.

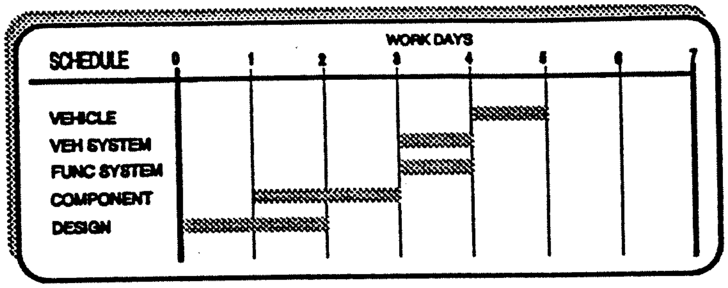


FIGURE 9

- Develop standard component schedule format and content.
- Develop generic network models and applications based on development team input.

Phase 2

- Develop standard design schedule format and content.
- Develop generic network models and applications based on development team input.
- Develop interfaces between IMS, component schedules, and design schedules.

Phase 3

- Develop standard functional system schedule format and content.
- Develop standard vehicle system schedule and vehicle schedule format and content.
- Develop generic network models for the above, based on functional manager and program management team input.
- Develop interfaces between these and component schedules.

Progress and Challenges

After two years into the implementation of the strategy, Phase 2 was complete, and Phase 3 is under way. Detailed planning, by way of the component and design schedules, is being done consistently by most development teams. The dates in the IMS database are being maintained based on this level of planning.

The integration of component schedules continues to be done informally through the experience of functional managers. Phase 3 will embed much of this experience in the vehicle and functional systems schedules. It is recognized, however, that the approach will *never* be able to capture the full experience of these managers and that the approach needs to accommodate this experience on each new program.

Various challenges faced during this process are highlighted below.

- **Resistance to change.** Development teams have seen it all before and are rightfully skeptical about the value of the latest approach to anything. Saturn team members have come from many parts of the corporation which have implemented project management methods in some fashion. If previous experiences were positive, they expected the same approach applicable or not; if negative, they needed encouragement and active support. In either case, the need to show early success, albeit local, was important.
- **Systems.** Large mainframe systems were tried before 1990 and failed for reasons related more to lack of a clear approach and strategy than the systems

themselves. The current approach uses PC-based software because it is easier to "sell," adapt, and use "in-the-trenches" and it avoids the high cost of larger systems. Too much early standardization and cost can unduly burden the implementation of ideas and crush them before they can take root.

The current level of system use can be expanded as the ability of the organization to use it cost-effectively increases. With the completion of Phase 3, system requirements will be reviewed.

- **Nature of product development work.** Application of CPM to plan this work is sometimes a forced fit. Design work is not as linear as planners want it to be. A-B-C is often, in reality, A-B-A-B-C-B-C depending on the general evolution of the product itself. Saturn's program management approach had to be structured to accommodate the dynamic nature of the design process—that is, to be flexible enough to respond to change, but specific enough to provide targets and direction. The disconnection of systems schedules and component schedules will provide this compromise.

What's the Difference?

Saturn is committed to the concept of team-member participation. Its functional and cross-functional teams play important, complementary roles that all contribute to program success. The intent of Saturn's program management approach is not to be different, but to meet the needs of a different kind of organization.

When finally put in place, there will be differences that simply support Saturn's mission.

Organizational

- **Distributed planning.** Plans and schedules are developed by teams for work under their purview. Each successive level of detail is developed locally, within the framework created by overall program schedules, not dictated specifically in detail.
- **Development team responsibility.** Development teams are provided with timing objectives for their "piece." They are responsible for detailed planning, validation of program plans, and identification of technical interfaces with other teams. This avoids the "Big Brother" syndrome which removes control and responsibility from the front lines.
- **Two hats.** Because each functional team is represented on relevant cross-functional management teams, technical issues cannot be "lobbed" over the wall. There is no wall. The team is responsible for seeing each issue from a Saturn *and* functional team perspective.
- **Technical coordination.** Technical coordination is done by vehicle system and by functional system. These two views of work activity are complementary and decrease the risk of errors and omissions.

Technical

- **Component definition.** Components can be defined flexibly allowing large variations in program content and approaches.
- **Schedule integration.** Program planning is integrated at the systems level, allowing the technical relationships between vehicle subsystems and between components to be expressed generally. This avoids the nightmare of

massive networks that are too complex for anyone to understand. Detailed constraints are managed between development teams.

- **Work breakdown structures.** The ability to associate a component schedule to both functional schedules and vehicle schedules through the FSB and VSB allows faster turnaround in updating and less risk of inconsistent date.
- **Systems use.** Because schedules are kept smaller and more localized, systems can be smaller and less expansive. They can be increased incrementally in size and complexity based on need and the ability to add value.
- **Evaluation of change impacts.** Changes to program requirements can occur at a part level or program level. The functional and vehicle systems schedules provide a "middle level" of detail for assessing overall impact to program milestones and to component level targets.

SUMMARY

Saturn's approach to program management is intended to make program planning the responsibility of each development team and manager. The approach recognizes that program and functional management teams have complementary roles in providing direction to and coordinating the activities of development teams.

The schedule hierarchies support this approach. By distributing the planning process, each part of the organization develops and maintains the schedules it uses. By integrating plans across vehicle systems and functional systems, schedule conflicts can be resolved before detailed design work is started.

The implementation plan reflects a practical method to embed the approach into the way Saturn does business.

Study Questions

SATURN'S VISION FOR PROGRAM MANAGEMENT: A DIFFERENT KIND OF APPROACH

1. The case mentions some of the shortcomings of a matrix organization structure including troubles in developing plans and resolving problems when "local" and program-wide objectives are in conflict. Define the meaning of a matrix organization structure and list its disadvantages.

2. This case defines Saturn's program management, but seems to focus on scheduling. How are Saturn's cross-functional teams used in the development of schedules?

3. The matrix organization structure emerged in the early 1960s as an alternative to the functional structure. This organizational form enjoyed popularity in the 1970s and early 1980s. What are its main advantages?

SYNOPSIS

This case describes Saturn's organizational structure based on functional, cross-functional, and development teams. The author illustrates how work breakdown structures are used to accommodate planning and management requirements by functional systems (function) and by vehicle systems (project). The case offers a view of the development and management of schedules and how these are developed by each center of interest

LEARNING OBJECTIVES -"SATURN'S VISION FOR PROGRAM..."

This case will allow the participants to realize the growing importance of teams. From reading the case and answering the questions provided, the class should:

- understand the matrix organization, its advantages and disadvantages
- the wide application of project management concepts
- gather better understanding of the Saturn corporation
- the importance and management of schedules