

Aerospace-oriented Project Management in CALT

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Abstract

China Academy of Launch Vehicle Technology (CALT) applies work breakdown structure (WBS), baseline comparison, and information system for aerospace-oriented project management and great achievement is obtained. The paper presents the research of aerospace-oriented project management in CALT. A solution is provided including the WBS-based plan development, multiple plan coordination, and dynamic control of aerospace-oriented projects in CALT. The impact of the approach is also analyzed.

Key words: Project Management, Aerospace-oriented Project, Work Breakdown Structure, Multiple Plan Coordination, Dynamic Control

1. Introduction

The aerospace industry in China has advanced and obtained huge achievement over more than fifty years, and has gradually formed a self-characterized system engineering management regulation and a series of effective aerospace-oriented project management approaches and techniques. However, with the continuous increase of aerospace-oriented projects, traditional management approaches are not suitable.

China Academy of Launch Vehicle Technology (CALT) considered the research on aerospace-oriented project

management. The research is aimed to overcome the difficulties of aerospace-oriented project management and to develop the control mechanism to obtain a solution for aerospace-oriented project management. Information system is applied to the project management of aerospace-oriented projects so as to increase the feasibility of aerospace-oriented project management in practice and to decrease the work amount and management costs.

2. Difficulties in Project Management

Aerospace-oriented projects are different from traditional projects. It is a very complicated task to control plans [8]. With the continuous increase of aerospace-oriented projects and their quality requirements, traditional management approaches are not suitable. Although, experiences have been accumulated in managing aerospace-oriented projects in China over years, many problems of traditional management approaches exist. In the situation of multiple projects, more problems appear. CALT analyzed the major problems in their aerospace-oriented project management. The problems include the following.

- Details of a plan are quite different in different levels. The relationships between the input and output of a plan and between plans of different levels are not clearly described.

- It is very difficult to coordinate multiple plans. Aerospace-oriented projects have a relatively integrative planning system. However, integrative management based on multiple projects and multiple units in fact generates the situations of multiple plans. It often appears that multiple plans do not coordinate each other. They are inconsistent and are not connected in different levels.
- Plan development and implementation control are disconnected. The research and development plan is developed by the planning department but project implementation is made by the production department. In this situation, implementation change cannot be reflected to the plan, and therefore, plan development and implementation control are disconnected.
- Paper-based plans are used for sending plans and for information feedback, which takes a long period and has low efficiency.
- Plan evaluation and adjustment cannot be on time. Project implementation is generally inspected by meetings and there are short of reliable tracking and control means.

3. Project Management Solution

Aerospace-oriented project management is large scale system engineering of multiple disciplines and multiple professions [9]. China Academy of Launch Vehicle Technology analyzed the problems and difficulties in managing aerospace-oriented projects and proposed a project management solution for managing aerospace-oriented projects. The solution includes the application of work breakdown structure (WBS), the application of information system for cross field coordination, and the application of the baseline

comparison approach for implementation control.

3.1. WBS-based plan Development

Because of the complexity and many problems in managing aerospace-oriented projects, CALT considered apply work breakdown structure to the development of the plan [6]. There are difficulties in practice. The difficulties include the following.

- There are difficulties in constructing work breakdown structure of aerospace-oriented projects. Aerospace-oriented projects are large and complicated projects. The WBS construction of these projects cannot be made simply and easily. It requires feedbacks and adjustments many times so as to obtain a structure that all units involved agree.
- There are difficulties in unifying and coordinating multiple plans. Project management processes of the aerospace-oriented project relate to multiple levels of the organization, from the academy level to the manufacturing firm level. The academy is the main driver of the project. The manufacturing firms are contractors that are in charge of research and development of subsystems or components. In convenience of management and control, all units involved in the project including all departments and firms need to make plans of different levels and retrieve them at each stage of the project.
- There are difficulties in tracking and control multiple plans. Some information systems have the project management function, which can be used to manage tasks in a single project for the academy, the institutes, the firms, and other units, and to connect tasks with product data.

There is no informatization mode to refer in project management at the academy and the institute levels. Although project management software can be introduced abroad, there are obvious differences from the indoor mode and management concepts and flows are quite different. The complexity of the organization also causes the difficulties in tracking and controlling multiple plans at the academy and institute levels in CALT. Therefore, it is very urgent to solve the problem of tracking and controlling a unified plan among multiple projects and at multiple levels.

To overcome the difficulties, CALT applies WBS based on an entire project life cycle, makes the plan by breaking works, forming the logic relationships among works, predicting project life cycles of projects, assigning resources, and signing and verifying projects. The research and development mode of aerospace-oriented projects are based on WBS that forms unified product data management mode with the center of products.

A functional structure tree and a product structure tree are also formed [1]. The functional structure tree dissolves system requirements to functions. Each function is dissolved to sub functions to form hierarchical levels, and then the structure is formed according to technology requirements and complements. The product structure tree is formed after the formation of the functional structure tree. The product structure tree is formed by the tree structures of systems, sub systems, and so forth. The system structure is determined according to the system composition of sub systems, groups, components, and so on. An example of the WBS platforms is illustrated in Fig. 1.

| 任务号 | WBS | 任务名称 | 工期 | 开始时间 | 持续时间 | 创建 完成 | 责任单位 |
|-----|-------|-----------------------------|-----|-------|-------|-------|------|
| 0 | | | | | | | |
| 1 | 1 | XX系统XX子系统研制 | 3 d | ***** | ***** | | XX单位 |
| 2 | 1.1 | XX系统XX子系统设计 | 3 d | ***** | ***** | | XX单位 |
| 3 | 1.1.1 | XXX XX系统XX子系统研制任务书 | 1 d | ***** | ***** | 4 | XX单位 |
| 4 | 1.1.2 | XXX XX系统XX子系统设计详细规格书(设计) | 1 d | ***** | ***** | 5 | XX单位 |
| 5 | 1.1.3 | XXX XX系统XX子系统验收报告 | 1 d | ***** | ***** | 4 | XX单位 |
| 6 | 1.1.4 | XXX XX系统XX子系统研制项目总结 | 1 d | ***** | ***** | 5 | XX单位 |
| 7 | 1.1.5 | XXX XX系统XX子系统设计与开发建议书 | 1 d | ***** | ***** | 5 | XX单位 |
| 8 | 1.2 | XX系统XX子系统生产 | 1 d | ***** | ***** | | XX单位 |
| 9 | 1.2.1 | XXX XX系统XX子系统交付验收(具体描述) XXX | 1 d | ***** | ***** | 12 | XX单位 |
| 10 | 1.3 | XX系统XX子系统试验 | 1 d | ***** | ***** | | XX单位 |
| 11 | 1.4 | XX系统XX子系统验收 | 2 d | ***** | ***** | 8 | XX单位 |
| 12 | 1.4.1 | XXX XX系统XX子系统验收报告 | 1 d | ***** | ***** | 6 | XX单位 |
| 13 | 1.4.2 | XXX XX系统XX子系统验收报告 | 1 d | ***** | ***** | 12 | XX单位 |
| 14 | 1.5 | XX系统XX子系统转产(定型鉴定) | 3 d | ***** | ***** | | XX单位 |
| 15 | 1.5.1 | XXX XX系统XX子系统转产鉴定报告 | 1 d | ***** | ***** | 6 | XX单位 |
| 16 | 1.5.2 | XXX XX系统XX子系统转产鉴定报告 | 1 d | ***** | ***** | 6 | XX单位 |

Fig. 1: WBS for outdoor unit development.

The structure tree of the aerospace-oriented projects is formed considering project plans, functional systems, product category, and delivering products, and is formed from top to bottom [4]. The structure tree is built according to standard product structure [4]. The WBS is classified as project levels, research and development levels, system levels, sub system levels, product category levels, module levels, 1st level components, 2nd level components, 3rd level components, and parts [2]. The WBS structure of the projects can be formed from these.

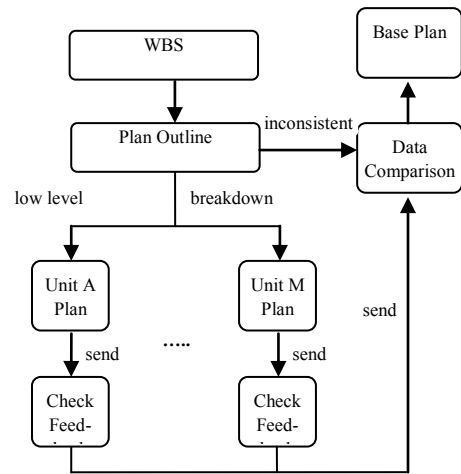
3.2. Cross Field Coordination

The plans for aerospace-oriented projects can be classified as long-term plans, middle-term plans, and short-term plans according the length of plans. Long-term plans are generally five-year, ten-year, twenty-year, or even longer plans. They are strategic plans. Middle-term plans are generally the plans within two to three years. They are formed according to the strategic objectives and requirements of long-term plans and based on practical situations in planning periods. Short-term plans are generally within one year, including yearly plans, monthly plans, and weekly plans.

CALT adopts the AVPLAN system and achieves coordination across fields [3,7]. The AVPLAN system is a Web-

[illegible]

The AVPLAN system supports product coordination development and concurrent engineering over organizations, and track project plans with feedback on time to support the project development. The plan of aerospace-oriented projects can be made coordinative and concurrent by the use of the system. Fig. 3 illustrates the flow of the coordinative and concurrent plan development in CALT. The science and technology department of the academy, the project office, and the science and technology department of the firms involved form a unified plan all together at the beginning of each year and each quarter. The approval of the plan is also coordinative and concurrent.



By using the technology of data synchronization of the AVPLAN system, data can be synchronized at the academy level as well as at the institute and the firm levels so as to realize plan sending, low level specification, and implementation information feedback automatically, and to realize coordination across fields.

The aerospace-oriented project plan is a rolling plan. The plan adjusts the previous plan according to practical implementation at each fixed rolling period so as to assure the realization of the objective. The project management of the aerospace-oriented projects adopts the baseline comparison approach [5]. After implementation and adjustment of the plan at each rolling period, the implementation of the project is compared to the baseline plan and makes information feedback. If they are inconsistent, the reason is analyzed and the plan is adjusted. The plan is saved as the baseline after adjustment each time and is used for control in the next rolling period. Fig. 4 illustrates the

flow of dynamic control of aerospace-oriented projects in CALT.

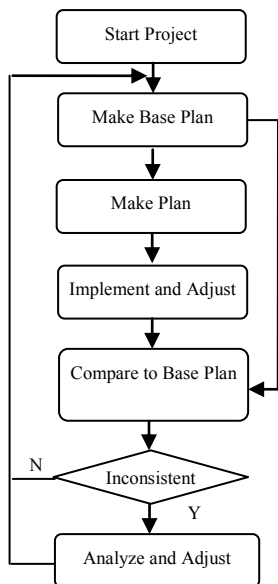


Fig. 4: Flow of dynamic control.

4. Impact

China Academy of Launch Vehicle Technology made practical applications of the project management approach. The approach provides a practical application approach for the academy. The impact of the approach is summarized in the following aspects.

- The approach makes the aerospace-oriented project plan modular and standardized. CALT applied the WBS structure as the base for making a plan, and used the product structure tree as the main string and the research and development flow as the support. The plan is made according to the WBS structure and standard modules so that the aerospace-oriented project plan can be made modular and standardized to reduce blindness.

- The project management of aerospace-oriented projects is made based on a unified plan. CALT used the paper plan previously. The paper plan is replaced by the computerized and unified plan.
- The implementation of aerospace-oriented projects in CALT is made coordinative and concurrent at different stages, at different levels, and in different areas. Comprehensive balance between multiple projects and multiple tasks can be achieved. Also, key resources are managed effectively so that multiple projects and tasks can be balanced in total, which cannot be achieved by previous plans.
- Supervisory control of aerospace-oriented projects in CALT can be made on time and dynamically. Information feedback loops are adopted so as to realize dynamic control of the projects.

5. Conclusion

The aerospace industry in China has advanced intensely. However, there are many problems of traditional management approaches. Aerospace-oriented projects are quite different from ordinary projects and are very complex to control.

This paper presents the research of aerospace-oriented project management in CALT. CALT applied work breakdown structure, baseline comparison, and information system for the aerospace-oriented project management and the impact of the application is great. The research provides a practical approach for aerospace-oriented project management in CALT. The research could also provide a reference for aerospace-oriented project management for other related organizations.

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