CIVIL AIRCRAFT DEVELOPMENT PROJECT IPT TEAM OBS DEVELOPMENT RESEARCH

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Abstract

IPT, integrated product team (IPT), is a necessary tool of civil aircraft development organization, can solve the traditional project management dilemma. The key of IPT team integration is the integration method of project organization structure. The organizational breakdown structure (OBS) of IPT can ensure the effective operation of IPT. This paper discussed the implementation of IPT can effectively solve the organizational change brought the original form of project organization predicament, and is conducive to the smooth development of the project.

0. Introduction

In the early development period of the civil aircraft X in China, a project management system based on the two general manager systems were used. Under the leadership of the general director of the project and the chief designer of the project, the project used the mechanism of project management to manage the development of the project.

Later the aircraft OEM in order to improve the efficiency and effectiveness of project implementation, started the organization reformation to set up the IPT organization as the goal of reform of organization change. The IPT organization is a product structure decomposition products work package as a core element of the IPT organization as the backbone for the entire team, with the team on task class work breakdown structure in the whole life cycle of elements, and the work breakdown structure [3] in project management and project management of the management team to set up project team.

1. Problem Describe

Before the reform of the organization, the implementation of the project management system was the implementation of the unit as the unit. The development of the project was slow, and there was no clear responsible person of onboard systems and body sections. This leaded to the difficulties in the design of aircraft level and system level at the early stage of the project.

There was a vacancy in the design of the organization. In the "main manufacturer and supplier" mechanism developed by aircraft, many work packages only participated in the design and lack of regulatory responsibility for the development and manufacture of the suppliers. The processes, tooling and trial production of the suppliers of the body parts and the airborne systems were unmanaged and inconsistent.

The development organization of the whole aircraft had not been well studied and analyzed, resulting in the lack of responsibility and main body, the responsibility was not clear, and there was no effective decision-making integration. Due to the lack and confusion in the organization, to a certain extent, the development of the model was slow and the technological progress was difficult. Based on the above problems, the aircraft OEM's leadership was relatively favorable opportunity in the project had not yet fully developed before, the reformation of IPT team organization oriented product work package.

2. Introduction of Key Concepts

In order to establish the IPT team as a target of

organizational change, and change the traditional units, departments and specialty units of the organization division principle, IPT teams is developed, based on the PBS products work package, using PBS integration, integrated product lifecycle factors, such as the basis of the three principles of product integration. The PBS, product, product life cycle, IPT concepts must be studied and elucidated.

2.1. Product and PBS

IPT is an integrated product team [2]. The integration of products refers to the product decomposition structure, that is, PBS. PBS is the top-down definition of the product tree developed for the aircraft. The PBS of the X aircraft is based on ATA100, dividing the aircraft system according to the level of "aircraft - specialty - system - subsystem". The airborne systems and body sections in PBS are the product Ps in the product IPT. The tree of PBS reflects the relationship between the function, development and assembly of the products in PBS. In this way, the energy of the whole project can be gathered together to become an aircraft development project. IPT is a product research and development organization based on the PBS structure.

In the reformation of IPT organization, it is relatively difficult to determine the structure of product and product decomposition. How the product and the PBS are divided, is more conducive to the establishment of WBS and OBS, and then forms the IPT team. Because of the physical composition of the product and PBS, it is clear and easy to divide. The product package is decomposed successfully, and the work package can also be decomposed. The product can be decomposed into parts. On this large product tree, the main layers are intercepted, which can be assembled into a product package and a PBS [1].

The principle of product package and PBS partition is that the product package is single function, simple structure and easy to implement [2]. Meanwhile, the product package can be easily integrated and assembled into the large product of the aircraft along the product PBS.

In the face of the issue of "product package and PBS division", the PBS of the type X aircraft is slightly adjusted on the basis of the section number of the ATA100, and the analysis is filled. ATA100 divides the concepts of systems and subsystems. On this basis, the aircraft level and specialty level of products have been increased. The PBS hierarchy and product tree of "aircraft - specialty - system - subsystem" were established.

In every unit of PBS, the product unit, function, product composition, installation location, interface relationship, materials and standard parts, and specific specifications are defined. The specification of the product unit has formed the standard tree of the product, and it is also the requirement of the technology and performance of the IPT team’s output.

2.2 Product Lifecycle and IPT

The IPT team is a research and development organization for the whole lifecycle management elements of these integrated products. The lifecycle of aircraft products development covers design, engineering, manufacturing, assembly, integration testing, flight test, customer service, and airworthiness verification [2]. In order to develop aircraft products, we need to break departmental barriers and set up a mixed functional team. The elements of the research and development of aircraft products are given by the whole lifecycle elements developed by the aircraft. The responsibility and system of aircraft development can be better divided by IPT teams.

Each product unit on the PBS contains the product lifecycle elements in the project [2]. Each product unit and its parent unit include product planning, technology design, detailed design, trial production, integration testing, flight test, and airworthiness certification.

The function of the whole lifecycle of the product units is responsible for the full power of the corresponding level of IPT. IPT is responsible for all the functions of the product lifecycle of the product package at the corresponding level. The responsibilities of the IPT team are clear.

2.3. IPT

The IPT team has become the basic form of civil aircraft OEM project organization, break departmental boundaries restricting the formation of a comprehensive IPT team to solve the comprehensive product development tasks of the organization. The IPT team has become a prerequisite for the application of systems engineering and project management policies, methods, and tools [1, 2].

The full name of IPT is an integrated product team [1, 2, 3], a product development team that integrates the technology and management requirements of the whole lifecycle of the product. The product item on PBS can always find the corresponding IPT team. IPT team is a comprehensive coverage of project work, and the WBS and PBS of the project are the basis for the OBS establishment of the IPT team.

Level 0, 1, 2 and 3 products IPT, because they all solve the problem of complex product development, therefore, they all have the characteristics of life cycle elements of products and projects. From top to bottom, the structure of the IPT team is decomposed by the PBS (and the corresponding WBS) and the whole life cycle elements of the product. This decomposition is more regular, the division of the IPT team is clearer, and the R & D responsibility is also better defined.

For example, the front fuselage product package itself is an ATA100 system level aircraft component, and it is an important component of aircraft. It has the functions of bearing, generating aerodynamic force, loading passengers and luggage, and accommodating airborne system and accessories. In this way, the front fuselage products are relatively simple, mainly composed of structural components, and the product is relatively easy to implement. The IPT team of the former fuselage is mainly composed of structure, strength, material, manufacturing, testing and maintenance. The team responsibility and team structure of IPT team is relatively simple. The product of the front fuselage, the life cycle element (WBS work package) of the product, and the IPT team in the front fuselage are the same.

2.4 Other Concepts

There are also some other terms that are defined and explained here. IPT, Integrated Product Team, is an integrated product team. PBS, Product Breakdown Structure [1], is a product decomposition structure. WBS, Work Breakdown Structure, is a work decomposition structure [3]. OBS, Organization Breakdown Structure [3], is an organization decomposition structure. These concepts, all of which refer to the upside down tree structure, are the analysis of the structure and composition of the IPT team and the necessary concept for the formation of the IPT team. PBS is the backbone of the analysis, and the expansion of PBS in the dimension of the product lifecycle elements is WBS. With reference to PBS and WBS, the organization structure of the IPT team is OBS. Based on OBS, you can build an IPT team. In essence, PBS, which plays a decisive role in PBS/WBS/OBS, determines the integration of the product and the product tree.

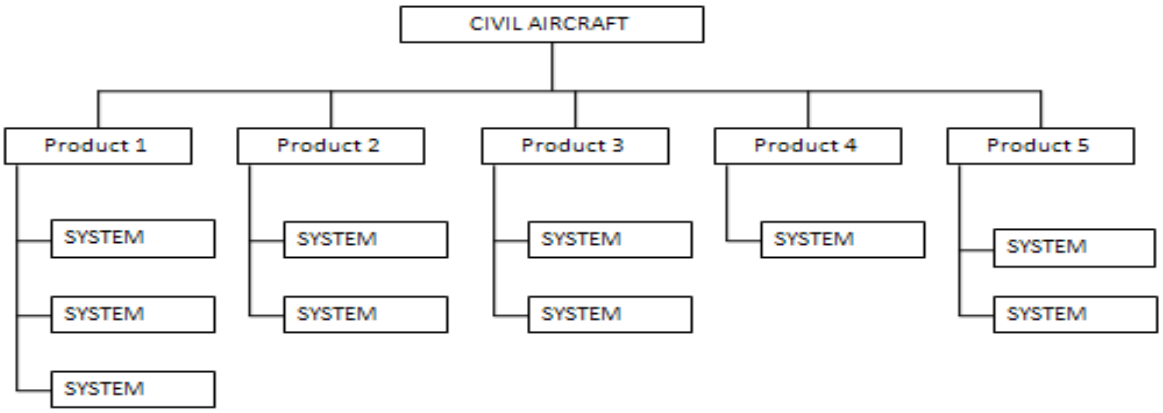

Figure 1, Product Breakdown Structure (PBS) Of Civil Aircraft Project

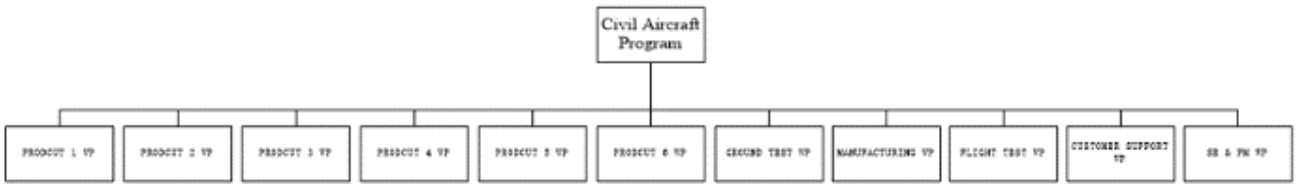

Figure 2, Work Breakdown Structure (WBS) Of Civil Aircraft Project

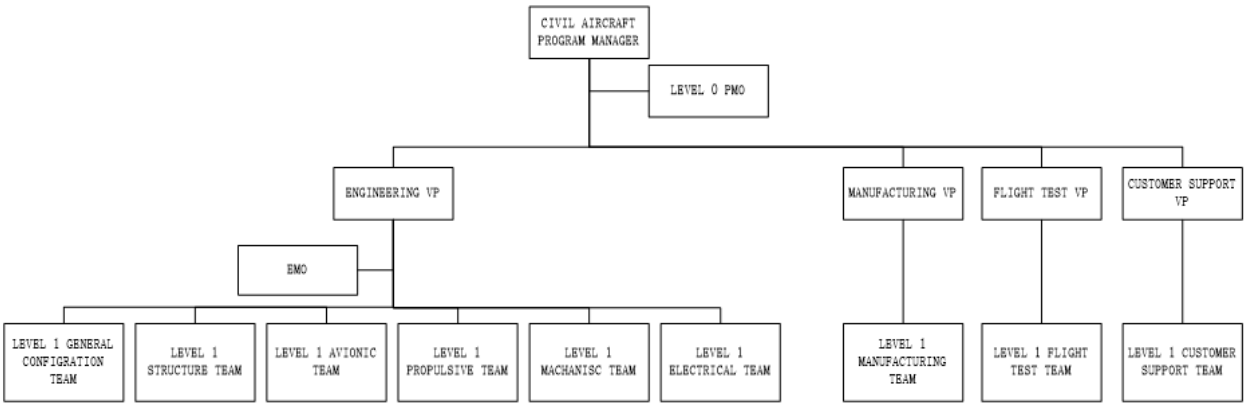

Figure 3, Organization Breakdown Structure (OBS) Of Civil Aircraft Project

3. The Problem Analysis and Solution

When the IPT team organization breakdown structure (OBS) was not analyzed thoroughly, there were some difficulties in analysis and reorganize the IPT team OBS. It looked there was no way of analysis this situation. To reorganize the team OBS, it shall analysis the end results at the beginning. The output of the whole aircraft X project will be the aircraft “aircraft X”. So analyzing the output of the organization is the method to organize the project IPT team. The product has the organization of PBS, the product development team has the organization of OBS.

The organization of aircraft development project is so complex, the reason of the case is the huge scope, long time periods, many technical innovation, high risk of civil aircraft development project. So projects of the civil aircraft development are less, the effective organization format is more few, the organizing methods of different countries are different. In China, there is no knowledge of the organization method of the civil aircraft development projects in western countries. To setup an effective organization structure of the civil aircraft project, the system analysis should carry over by the coordinate from beginning to end, from top to bottom. The key point of the organization reform is build the project team OBS based on project PBS and WBS.

The first step is to solve the method of how to analysis the problem. When analysis the civil aircraft IPT team, a key concept is to study the end as the beginning of a complex matter, by this way, the organization system of the civil aircraft development project can be studied. The final deliverable of the civil aircraft project is the complete product of civil aircraft. The complete aircraft product is made of the product package of PBS content of physical configuration, software and function. The system and sub-system in ATA100, the function is simple, the structure is simple too, the realization is a little bit easy, and at the same time, the element level of the product tree is in the uniformity, and the element granularity of the product tree is in the

uniformity too, integrate the product elements the product will be a final and complete aircraft product. Based on the product element, organize the IPT team, can build the full scope, unique, and no missing IPT team structure. PBS is in the level system of "aircraft - specialty - system - subsystem". Based on PBS, to reorganize the project OBS can solve the problem of responsible lost or duplicate in the system, the method is the basic method to analysis the project IPT team organization.

Corresponding the PBS elements of system and sub-system level of ATA100, the product IPT team level is level 2/3 IPT. The level 2/3 IPT team is core component of design, engineering, suppliers management and the team of suppliers, they are the basic elements of product IPT team, is the basic format of main manufacturer and suppliers. The product IPT team is compose of design, engineering, purchasing, and supplier management to be responsible for the main manufacturer as the civil aircraft OEM. In this way, the implement element of the civil aircraft project is taken responsible of level 2/3 product IPT team.

The responsible of the product team and manager of the team in systems and segments level are clear and full scope and no absence. The product package in each level has a manager to make decision. The technique management system based on special technique and is difficult to analysis and organized in full scope. The product management system based on PBS, can be analysis in the relation in physical product breakdown, the analysis can be more clear, easier, and fuller in scope. It is much easy to build the organization structure based on the PBS.

The structure organization of PBS is the integrated relations of the decision made and coordinate of IPT. The whole product team is a pyramid with structure and hierarchy, the order transmit to lower levels, the decision power integrate to higher levels. The level 2/3 product teams can integrate as the structure relation of PBS, the responsible of making decision and management summary up followed product integrated relation upwards to the vice chief designer level, in the other words the level 1 of the IPT team structure. The vice chief designer has the technical decision and technical management power, and who is the senior project manager with the full technical responsibility of the team. The further integrated upwards team is the product team of aircraft level, that is level 0 product team. The chief designer's Product IPT team level is the level 0 product team. The chief designer has the design responsibility and he is responsible to design the entire aircraft.

The IPT team task is based on PBS, setting up in accordance of product lifecycle elements, and WBS. There are the task team in level 1/2/3 team that organize according WBS unites and product lifecycle elements. In level 1 team, except the level 1 team of general configuration technique, airframe structure, power-plant system, and airborne systems, there are level 1 tasks IPT team such as the areas of manufacturing and assembly, flight test, customer service, which exercise the responsible of aircraft level product lifecycle elements. In product IPT team, there are level 2/3 IPT teams, and they exercise the responsible of product lifecycle elements, focusing on the task of ground test (ground lab test and ground test on aircraft). Their administrative subordination belongs to upper level product IPT team. The level 2/3 task IPT teams managed by the higher team's leader - vice chief designer. In this way, the issue about technical and management problems can be managed, making decision and integrate accordingly.

In this way, based on product work package of PBS, setup the level 0/1/2/3 product IPT teams; based on the elements of product lifecycle or unites of WBS of product package in each PBS level setup the task IPT teams in each level of PBS; at level 0 and level 1 setup the level 0 PMO and level 1 PMO, to do the function of project management and engineering management; internal management of level 2/3 project teams complicate by project manager and his assistant. Based on PBS and WBS, build the OBS of project IPT team, deploy the manager, reorganize the IPT team, this is the viewpoint and analysis path of the IPT team organization reform.

4. The benefit from the IPT team reformation

4.1 IPT teams promote the progress of project

IPT team OBS structure coincides the project PBS and WBS, IPT OBS structure and team content meet the project requirement. Setup IPT team, based on the logical and work package of PBS and WBS. The scope of team cover 100% work content and deliverables, and make the right people decide and do the right things. And at the same time, IPT can make the project decision faster and more scientific, make the right person do the right decision. The coupling point of PBS/WBS/OBS is the point to do the decision make. A good PBS, WBS and OBS, can make sure the team do the suitable decision, and implement the decision right, and get the right result.

4.2. The decision making point and integrated collection of product lifecycle elements

The Product lifecycle element, include of design, engineering, manufacturing, flight test and customer service. In the PBS tree of the aircraft development, there are product lifecycle elements at the aircraft level, such as design, engineering, manufacturing, flight test and customer service. The responsible of Aircraft level Product lifecycle management elements, in IPT organization, realized by product level 1 IPT, manufacture level 1 IPT, flight test level 1 IPT, customer service level 1 IPT. The responsible of product lifecycle management elements of section of airframe and systems of aircraft is covered by suppliers and the level 2/3 IPT. The level 2/3 IPT exercise the responsibility of manufacturer, manage the development activities of section of airframe and systems of aircraft, manage the relation between manufacturer and suppliers. In this way, the responsibility and decision point is integrated to level 1/2 IPT team, based on product lifecycle element requirement.

4.3 The decision making point and integrated collection of product / organization breakdown structure

The level 2/3 product IPT team, are responsible for the development of section of airframe and systems of aircraft. The right to make technical decision is integrated based on PBS and OBS structure. The technical decision right is belong to chief designer and vice chief designer, the vice chief designers are the senior project managers in the same time.

The PBS level of “aircraft - specialty - system - subsystem” is the basis of IPT design. The vice chief designer of each specialty can make the right decision. The designer system is made of by chief designer and vice chief designers, make the technical decision of the project.

4.4 The decision making point and integrated collection of Product design and ground test

The level 1 IPT team is a product lifecycle team of product specialty. Product design and ground test, are the elements of product team. The flight test is aircraft level testing, and the ground lab test is system level, at the same time. So flight test IPT team is level 1 team, and ground lab test team is level 2 IPT team, belongs to system level 1 IPT. In the comprehensive trial manufacture phase, the requirement of product design and the product of design output, needs verification by the ground test. In flight test phase, the problems which are founded in flight test, need to be repeated the fault and solve the fault in the ground test procedure. So the ground test team is to be placed under the level 1 product IPT team as a level 2 sub-team.

4.5 In flight test phase, flight technical integrated IPT team and airworthy technical and verification integrated IPT team be separated as level 1 IPT team.

After entering flight test phase, the main task of team is flight test and airworthy certification. To focus of work timely, breakdown the general technical integrated level 1 IPT team, setup flight technical integrated IPT team and airworthy technical and verification integrated IPT team, to complete the task of flight test and airworthy certification, to promote the task plan complete and countermeasures.

5. Conclusion

After the organization reformation and making the adjustments, the OEM company setup the IPT team based on Product and PBS, and Product Lifecycle Element/WBS. The IPT team clearly defined the work division and responsibility, and clarify the integrated decision power, improving the implement and decision of the aircraft X project. IPT team resolved the difficulty from the original project organization and promoted the project progression.

Product Breakdown Structure (PBS) and Work Breakdown Structure (WBS), are the analysis tools and setup basement of IPT organization breakdown structure (OBS). Analysis first, and decide and implement later, make sure the right decision points and integrated of decision, and the right decision path, in this way make sure the effective project integration. Based on the structure and content of PBS and WBS, build the organization breakdown structure (OBS), setup the IPT team, is the key of organization reform.

Reference

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