ERAWAN 2 FSO Project Management

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The offshore oil and gas industry maintains a high standard for HSSE (Health, Safety, Security and Environment) protection. IHI Aichi Works successfully executed the ERAWAN 2 FSO project to offshore standards within the approved budget and schedule, for a well-known oil major in the year 2012, almost 16 years since the last offshore project was executed in the same yard. This success is based on our efficient Project Management System. We have kept records of the lessons learned as well as areas for improvement, which will be implemented in the next project.

1. Introduction

The "ERAWAN 2 FSO," a Floating Storage and Offloading system (FSO), is the first FSO construction project in 16 years for the IHI Aichi Works. Even though the number of people with experience in offshore structures has decreased, we still have to satisfy the high demands of our clients. Consequently, a project team was organized early on, which handled the contractual demands of the project including Health, Safety, Security, and Environment (HSSE) commitments, and smoothly executed the project. In addition, by recruiting a consultant from Singapore knowledgeable about offshore projects, we were able to compensate for deficiencies in our knowledge and experience, while also sharpening the skills of project members at the same time.

Petroleum produced in offshore oil fields is brought up via a submarine pipeline and special pipes called flexible risers, which are designed to curve in response to the motion of the FSO due to tides and weather. An FSO is a large-scale floating facility that temporarily stores the oil piped up at the offshore site, and offloads oil to shipping tankers. **Figure 1** illustrates a schematic of the ERAWAN 2 FSO.

For the oil and gas companies involved in offshore projects, application of project management is an accepted practice. Although it was not explicitly required in the contract of this project, the ERAWAN 2 FSO project demanded the establishment of a dedicated project team and project activity reports, so project management was essentially required.

Meanwhile, in light of past accidents and disasters, members of the energy industry such as oil and gas companies have created their own safety management system known as HSSE in addition to the safety-related laws and regulations imposed by various nations. HSSE-related activities are the most heavily scrutinized parts of a project. For this reason, hearings and document reviews make up part of the wide array of worksite safety activities that start as early as the bidding stage, and clients also carry out audits and inspections for HSSE.

Besides HSSE-related documentation, clients ask for various other documents as part of a bid document, including ① a project management plan, ② a project organization chart, ③ an engineering execution plan, ④ a quality control plan, and ⑤ the resumes of the key project members. The bidder's ability to execute the project is then evaluated on the basis of these documents. If the documentation is insufficient, the client may decide that the bidder does not meet the requirements for participating in the project, and remove that bidder from the list of candidates.

This article discusses the project management and HSSE

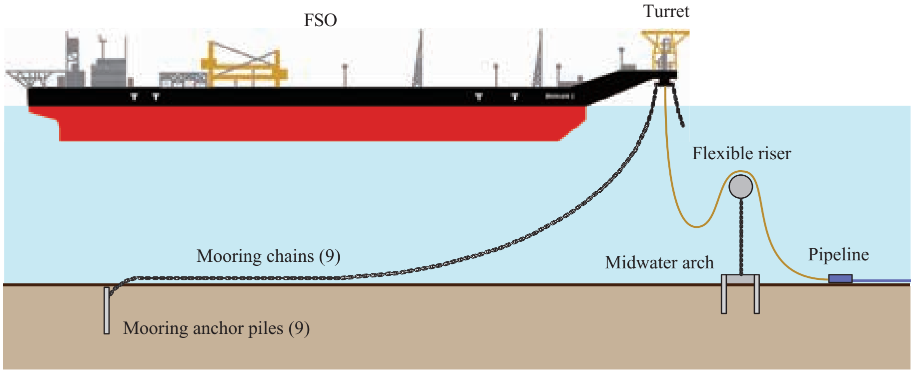


Fig. 1 "ERAWAN 2 FSO" schematic

efforts for the ERAWAN 2 FSO project, as well the lessons learned from the project that will be applied in the future.

2. HSSE activity

Following the safety first principle, HSSE is a common global commitment to prioritize safety above everything else in all activities. At the beginning of every meeting, time is always set aside for a Safety Moment, in which safety-related issues and events are shared. The order of deliberations is also structured so that HSSE-related items are handled first. This is done in recognition of the importance of having the HSSE supervisors exit the meeting after HSSE-related deliberations are concluded, so the HSSE supervisors can oversee work at the project site and prevent accidents.

2.1 HSSE plan

An HSSE plan is required as one of the contract documents to be submitted for a project. The HSSE plan is a document that describes the HSSE-related regulations and requirements of the organization, and also details HSSE activities. The HSSE plan is not recognized as a valid document without the signatures of the top management. Many oil and gas companies make efforts to raise consciousness of HSSE in their organization, and many have adopted commendation systems to award people who have made contributions to HSSE in order to improve the safety record.

2.2 VSCC

The Vessel Safety Coordination Committee (VSCC) is a committee whose purpose is to prevent work-related accidents that may occur due to the different types of work being carried out at the same time during the construction of an FSO. For a given workday, items such as ① hot work, ② heavy object transport, ③ tank air testing, ④ scaffolding erecting or dismantling, ⑤ pipe pressure testing, ⑥ painting/coating work, ⑦ equipment start-up, and ⑧ Radiographic Testing (RT) are confirmed by the work supervisors, the HSSE supervisors, the client, and the project team, and work is rescheduled or cancelled as necessary. The VSCC must also take Permits to Work (PTW) into account, as discussed in the next section.

2.3 PTW

A PTW is a work authorization acquired before starting work, and is a typical system implemented by oil and gas companies. The flow of acquiring a PTW involves filling out necessary information on a special PTW form, and submitting the form to a PTW coordinator at least one day in advance of starting work. If the permit is granted, the work can be carried out. The PTW coordinator coordinates and accommodates submitted PTWs, and must decide which work is to be permitted or denied. For this reason, the person selected as the PTW coordinator is usually a highly experienced HSSE supervisor with deep knowledge of what each type of on-site work entails.

After acquiring a PTW, a ToolBox Meeting (TBM) is held for all workers using PTW forms before work starts, and the work supervisors must also carry the PTW form during the work itself. When work is completed, the PTW form is submitted to the PTW coordinator to complete the flow of the PTW system.

In the ERAWAN 2 FSO project, the following five types of PTW forms were used according to the different types of work. **Figure 2** illustrates a PTW form (general work permit).

(1) General work permit: for work such as pressure testing and heavy object transport
(2) Hot work permit: for work such as welding and gas cutting
(3) Confined space entry permit: for work in confined spaces where lack of oxygen is a concern, such as inside tanks
(4) Work at height permit: for work such as erecting and dismantling scaffolding
(5) Isolation certificate: when shutting off an electrical switch or pipe valve, a warning is attached with a lock and chain so that other workers do not accidently restore the switch or valve; this is called Lock-Out/Tag-Out (LOTO)

2.4 BBS/SWA

As an effort to eliminate unsafe acts and states, systems called Behavior-Based Safety (BBS) and Stop Work Authority (SWA) are implemented. These systems are based on Heinrich's Law, which holds that accidents can be decreased by decreasing unsafe acts and states.

BBS is a type of improvement practice based on behavioral science, and is intended to systematically decrease unsafe behaviors and increase safe behaviors. BBS focuses not only on work practices, but also everyday behaviors, such as remembering to hold the handrail when climbing or

Fig. 2 Application form for permit to work (General work permit)

descending a stairway. In order to reinforce safe behaviors, workers remind each other in the workplace, and stationary observation by an HSSE supervisor is also conducted periodically. BBS checks for issues like those listed below, and by analyzing statistics, identifies issues requiring stronger efforts.

(1) Is the position good? (checking for the risk of being caught between objects, pointing and calling)
(2) Are the equipment and tools appropriate? (work space, tools to use)
(3) Am I following the work procedure? (work in confined space, work at height, communication with other workers)
(4) Is the work environment good? (well-organized workspace, stable scaffolding/footholds)
(5) Am I wearing personal protective equipment? (harness, safety goggles)

SWA refers to the authority to stop work when an unsafe act or state is observed, and is granted to all persons involved with a project. With this authority, even a general worker is able to warn a client or manager about an unsafe act. If someone is performing an unsafe act, that person will be injured unless warned, so SWA is exercised so that project members can save each other.

The following cases are examples of scenes where SWA should be exercised.

(1) When an unsafe act or state is observed
(2) When an accident or disaster occurs
(3) When a serious near-miss occurs
(4) During emergency evacuation in the event of an earthquake or disaster
(5) When an alarm sounds
(6) When the work environment, work scope, or work plan changes
(7) Any other time when one feels that a worker, the environment, or equipment is in danger

Oil and gas companies recognize the number of BBS and SWA reports as a proactive statistic, and higher numbers lead to higher evaluations of HSSE efforts.

3. Project management

With project management, the success or failure of a project is measured according to whether or not the demanded quality, schedule, budget, and client satisfaction are being met. This is a management technique that is not swayed by the experience and intuition of supervisors or veteran staff, but instead utilizes systematic techniques and knowledge to achieve consistent success.

3.1 Project

A project is a temporary endeavor undertaken to create a unique product, service, or result.[1] In contrast, general work on a line is categorized as routine work, and is defined as a function of an organization that continuously executes an activity such as producing the same product or repeatedly providing a service.[2] In other words, whereas a project is unique and temporary, routine work is repetitive and ongoing.

3.2 Project management

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements.[3] In order to manage a project, it is important to ① identify requirements, ② accommodate the various needs, concerns, and expectations of the stakeholder, and ③ strike a balance between competing constraints. Periodic review of the project is also necessary.

Balancing constraints is particularly important, and the constraints that must be emphasized differ depending on the type of project. These constraints are such that if one element changes, at least one other element is affected. In addition, care must be taken to remember that the element considered to be the most important may differ for each stakeholder.

3.3 Project management processes

The Project Management Institute (PMI) defines 42 project management processes, which are classified into nine fields of knowledge required for project management (knowledge areas), and five groups along the project timeline (process groups). However, the processes are not all applied uniformly, and it is important to select the appropriate processes required to achieve project goals. **Table 1** illustrates a project management process map.[4]

4. Schedule control

Offshore-related companies outside Japan employ a dedicated schedule controller, typically called a planner, who is responsible for schedule control. In the ERAWAN 2 FSO project, a planner joined the client's project team provides advice on schedule creation, control, and evaluation techniques.

Previously, a schedule would be created in Excel and progress updates would be carried out on paper, but with this project, Microsoft Project was used to conduct schedule control at the client's request.

4.1 Microsoft Project

Microsoft Project is a commercial software program designed as a general-purpose project management tool, and it enables costs and resources to be centrally managed on the basis of the Critical Path Method (CPM). Microsoft Project is a very useful software program that enables the creation of accurate plans, real-time progress monitoring, project member load adjustment, and effective recovery from project delays.

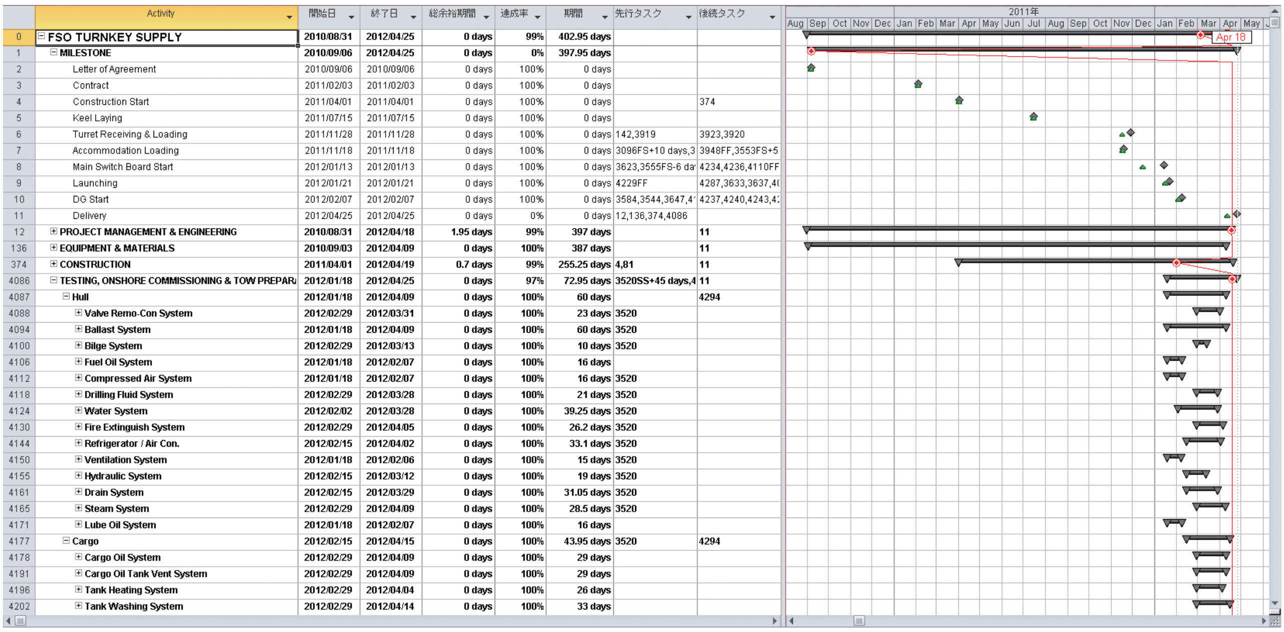
As a project management tool, Microsoft Project has the following advantages over Excel for schedule control.

(1) Critical paths can be easily distinguished.
(2) If a delay occurs in part of the work, the effects on the entire schedule can be judged immediately.
(3) Once a schedule is created, it is easy to modify the schedule.
(4) Schedule simulation (what-if scenario analysis) is possible.

Microsoft Project's biggest strength is the ability to rapidly handle risks such as schedule delays and additional work by using schedule simulation. **Figure 3** illustrates the schedule input screen for the ERAWAN 2 FSO project.

Table 1　Project management process map

Knowledge areas	Project management process groups				
	Initiating	Planning	Executing	Monitoring/controlling	Closing
Project Integration management	Develop project charter	Develop project management plan	Direct/manage project execution	- Monitor/control project work - Perform integrated change control	Close project or phase
Project scope management		- Collect requirements - Define scope - Create WBS		- Verify scope - Control scope	
Project time management		- Define activities - Sequence activities - Estimate activity resources - Estimate activity duration - Develop schedule		Control schedule	
Project cost management		- Estimate costs - Determine budget		Control costs	
Project quality management		Plan quality	Perform quality assurance	Perform quality control	
Project human resource management		Develop human resource plan	- Acquire project team - Develop project team - Manage project team		
Project communication management	Identify stakeholders	Plan communication	- Distribute information - Manage stakeholder expectations	Report performance	
Project risk management		- Plan risk management - Identify risk - Perform qualitative risk analysis - Perform quantitative risk analysis - Plan risk responses		Monitor/control risks	
Project procurement management		Plan procurements	Conduct procurements	Administer procurements	Close procurements



	Activity	開始日	終了日	総余裕期間	達成率	期間	先行タスク	後続タスク
0	FSO TURNKEY SUPPLY	2010/08/31	2012/04/25	0 days	99%	402.95 days		
1	MILESTONE	2010/09/06	2012/04/25	0 days	0%	397.95 days		
2	Letter of Agreement	2010/09/06	2010/09/06	0 days	100%	0 days		
3	Contract	2011/02/03	2011/02/03	0 days	100%	0 days		
4	Construction Start	2011/04/01	2011/04/01	0 days	100%	0 days		374
5	Keel Laying	2011/07/15	2011/07/15	0 days	100%	0 days		
6	Turret Receiving & Loading	2011/11/28	2011/11/28	0 days	100%	0 days	142,3919	3923,3920
7	Accommodation Loading	2011/11/18	2011/11/18	0 days	100%	0 days	3096FS+10 days,3	3948FF,3553FS+5
8	Main Switch Board Start	2012/01/13	2012/01/13	0 days	100%	0 days	3623,3555FS-6 da	4234,4236,4110FF
9	Launching	2012/01/21	2012/01/21	0 days	100%	0 days	4229FF	4287,3633,3637,4
10	DG Start	2012/02/07	2012/02/07	0 days	100%	0 days	3584,3544,3647,4	4237,4240,4243,4
11	Delivery	2012/04/25	2012/04/25	0 days	0%	0 days	12,136,374,4086	
12	PROJECT MANAGEMENT & ENGINEERING	2010/08/31	2012/04/18	1.95 days	99%	397 days		11
136	EQUIPMENT & MATERIALS	2010/09/03	2012/04/09	0 days	100%	387 days		11
374	CONSTRUCTION	2011/04/01	2012/04/19	0.7 days	99%	255.25 days	4,81	11
4086	TESTING, ONSHORE COMMISSIONING & TOW PREPAR	2012/01/18	2012/04/25	0 days	97%	72.95 days	3520SS+45 days,4	11
4087	Hull	2012/01/18	2012/04/09	0 days	100%	60 days		4294
4088	Valve Remo-Con System	2012/02/29	2012/03/31	0 days	100%	23 days	3520	
4094	Ballast System	2012/01/18	2012/04/09	0 days	100%	60 days	3520	
4100	Bilge System	2012/02/29	2012/03/13	0 days	100%	10 days	3520	
4106	Fuel Oil System	2012/01/18	2012/02/07	0 days	100%	16 days		
4112	Compressed Air System	2012/01/18	2012/02/07	0 days	100%	16 days	3520	
4118	Drilling Fluid System	2012/02/29	2012/03/28	0 days	100%	21 days	3520	
4124	Water System	2012/02/02	2012/03/28	0 days	100%	39.25 days	3520	
4130	Fire Extinguish System	2012/02/29	2012/04/05	0 days	100%	26.2 days	3520	
4144	Refrigerator / Air Con.	2012/02/15	2012/04/02	0 days	100%	33.1 days	3520	
4150	Ventilation System	2012/01/18	2012/02/06	0 days	100%	15 days	3520	
4155	Hydraulic System	2012/02/15	2012/03/12	0 days	100%	19 days	3520	
4161	Drain System	2012/02/15	2012/03/29	0 days	100%	31.05 days	3520	
4165	Steam System	2012/02/29	2012/04/09	0 days	100%	28.5 days	3520	
4171	Lube Oil System	2012/01/18	2012/02/07	0 days	100%	16 days		
4177	Cargo	2012/02/15	2012/04/15	0 days	100%	43.95 days	3520	4294
4178	Cargo Oil System	2012/02/29	2012/04/09	0 days	100%	29 days		
4191	Cargo Oil Tank Vent System	2012/02/29	2012/04/09	0 days	100%	29 days		
4196	Tank Heating System	2012/02/29	2012/04/04	0 days	100%	26 days		
4202	Tank Washing System	2012/02/29	2012/04/14	0 days	100%	33 days		

Fig. 3　Microsoft Project schedule

4.2　Work breakdown structure

When creating a schedule, the specific tasks to be executed are identified by decomposing the work into smaller components. The hierarchical breakdown of work to be executed is called the Work Breakdown Structure (WBS).

Layers in the WBS are called levels. Larger level numbers mean a more detailed breakdown of the work into smaller components. Schedules also correspond to each layer of the WBS, and are expressed as the Level 3 Schedule, for example. The schedule for the ERAWAN 2 FSO project was divided into seven levels, and decomposed into approximately 4 300 specific tasks. **Table 2** illustrates a summary of the WBS for this project collapsed to Level 2.

A finer hierarchical breakdown is able to clearly specify required tasks, but on the other hand, it would lead to allotting an exorbitant amount of time to checking tasks that are not very important, so stopping at around Level 5 is recommended.

Table 2 Work breakdown structure (Level 2)

Level 0	Level 1	Level 2
ERAWAN 2 FSO construction project	Milestones	Issue agreement
		Contract
		Start construction
		Keel laying
		Launching
		Delivery
	Project management and engineering	Project management
		Design (hull structure)
		Design (hull outfitting)
		Design (machinery)
		Design (electrical and instrument)
		Design (living quarters)
	Procurement	Turret (mooring system)
		Equipment
		Client-furnished equipment
	Construction	Structure
		Living quarters
		Upper deck structures
		Deck machinery
	Testing, commissioning and towing preparations	Hull
		Cargo
		Living quarters
		Equipment
		Launching
		Inclining experiment
		Structure test
		Classification approval
		Towing preparations

When a schedule is created using Microsoft Project, it is necessary to set logic links (dependence relationships) for each task, and define the task order. Except at the beginning and the end, all tasks and milestones must be linked to at least one predecessor task and one successor task. In so doing, a schedule network diagram is assembled, making it possible to apply the critical path method.

4.3 S-curves

In the case of a project, the slope of the progress curve starts off gently, then becomes steeper, and becomes gentle again at the end. Since the shape of this curve resembles the letter S, the name “S-curve” is used. In this project, in addition to the actual progress, two types of planned progress were computed and S-curves were created on the basis of the early start and end dates (forward pass) and the late start and end dates (backward pass) derived with the critical path method. **Figure 4** illustrates the S-curves for this project.

If the actual curve is closer to the early plan curve, it means that there are fewer delays, whereas if the actual curve is closer to the late plan curve, it means that there are more delays. Although simplistic, the slope of the most recent actual curve can also be used to predict future progress. Since the late curve is the planned progress for a schedule with absolutely no leeway, falling below this curve even slightly represents a delay in the project. If the actual curve is predicted to fall behind the late plan curve, it is necessary to promptly devise a recovery plan.

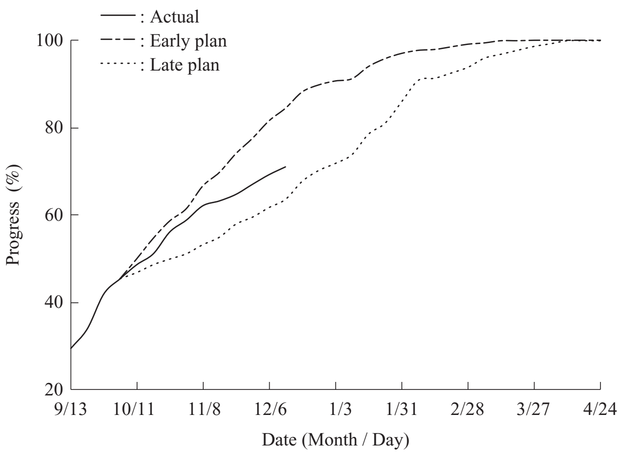


Fig. 4 Project progress S-curve

4.4 Recovery plan

If the schedule is delayed, tasks that are directly related to the critical path are focused on, and a recovery plan is devised. Tools and techniques for devising a recovery plan include the following.

(1) Performance review

Schedule performance such as the actual start and end dates, work progress, and remaining duration for work in progress are measured, compared, and analyzed.

(2) Schedule compression

① Crashing

Attempts are made to achieve the maximum compression with minimal additional costs, such as by adding additional workers. However, costs do increase.

② Fast tracking

Compression is attempted by taking successor tasks and executing them in parallel. However, this increases risks.

(3) Lead/lag adjustment

Successor work is started ahead of time without waiting for the predecessor work to complete (lead). Alternatively, the start of successor work is delayed, even though the predecessor work has completed (lag).

5. Communication

Communication is recognized as the biggest factor determining the success or failure of a project. Communication in a friendly atmosphere leads to superior teamwork and high performance. It also improves relationships between project team members, and fosters mutual trust.

5.1 Communication plan

Besides the daily VSCC described in **Section 2.2**, coordination meetings among managers as well as monthly and weekly meetings for reporting project activities were also convened as a venue for communicating with the client. At the monthly and weekly meetings, a teleconferencing system was utilized to achieve timely communication even with clients who could not physically attend the meetings due to geographical constraints. Additionally, communication among in-house staff was promoted via weekly follow-up meetings for pending issues and daily morning meetings.

Effective communication must take the following factors into account.(5)

(1) The information that should be conveyed (language)

(2) The reason for distributing the information

(3) The timing and frequency of distributing the information

(4) The person or group receiving the information

(5) The means and technique for conveying the information

Communicating carefully when providing or receiving information is also important to avoid creating a communication gap. Furthermore, for offshore projects, the common language of communication with the client is English. In addition to English reading and writing skills, English conversation skills are also important, and gestures also greatly aid communication.

5.2 Project activity reports

For the ERAWAN 2 FSO project, we created and updated documents such as weekly and monthly activity reports and action tracking. The activity reports created for the project include items related to ① HSSE, ② Quality Assurance/Quality Control (QA/QC), ③ engineering, ④ procurement, ⑤ construction, ⑥ contract administration, and ⑦ other pending issues. Since quantitative evaluation of progress is also demanded for non-construction items as part of the project performance analysis, the indices listed below were reported for each item in the activity reports.

(1) HSSE

The no accident record, number of accidents, total working hours, predicted/actual number of attendees for various training sessions, etc.

(2) QA/QC

Predicted/actual block inspection and pressure testing, punch list totals, number of issues, etc.

(3) Engineering

Number of drawing approvals received from client and classification society, total number of drawing issues raised by classification society, and number of issues resolved

(4) Procurement

Delivery status for major equipment and piping, etc.

(5) Construction

Progress in block fabrication and assembly, erection, outfitting, electrical, mechanical, commissioning, construction of living quarters, etc.

To enable a visual understanding of the project status, activity reports contain project progress photos in addition to the above items. As a result, stakeholders who are not resident on-site can more easily grasp the project progress, and information can be conveyed more accurately.

6. Project organization

For this project, in response to client demand, a dedicated project team independent of the regular line organization was established, and this team has undertaken the project management. Project organization frameworks include ① functional organization, ② matrix organization, and ③ project organization. For this project we applied a matrix organization positioned midway between a functional organization and a project organization.

We believe that this project team lacked certain posts that were in fact necessary to a dedicated project team, such as a dedicated HSSE manager. Taking project organizations used abroad as a reference, we propose for the future the following minimum staff and their posts for a project team, assuming a matrix organization. **Figure 5** illustrates a project team organization chart.

(1) Project manager

Responsible for the overall project

(2) HSSE manager

Responsible for HSSE

(3) Project controller

Responsible for interfacing and coordinating with the client, coordinating in-house staff, and reporting

(4) Cost controller

Responsible for cost management

(5) Schedule controller (planner)

Responsible for schedule management

(6) Quantity surveyor

Responsible for scope management (including change orders)

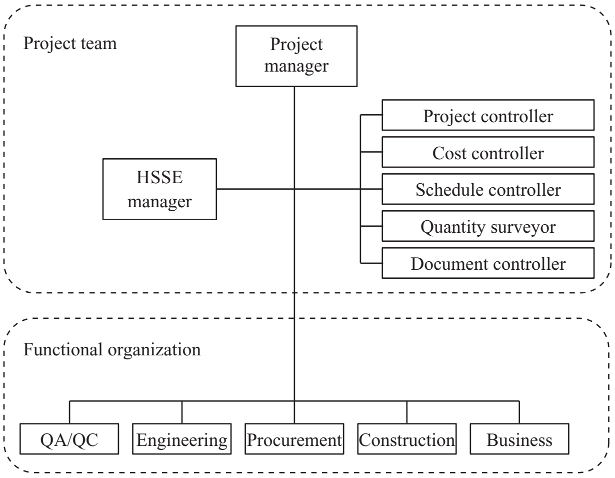


Fig. 5 Project team and functional organization chart

(7) Document controller
Responsible for document control

In addition to these seven posts, we believe that persons responsible for engineering and overseas procurement should also be considered for inclusion in accordance with the characteristics of the project.

7. Closing phase

A project is not considered to be closed unless it is confirmed that the client has accepted the outcome of the project. In order to officially close a project, it is necessary to carry out a process of collecting project logs, examining the successes or failures of the project, gathering the lessons learned, and storing project information so that the organization can make use of it in the future.

7.1 Organizational process assets

The organizational process assets refer to the process-related assets of organizations involved with a project, and these assets can be utilized to contribute to the success of other projects. These process assets may be formal or informal, and include ① plans, ② policies, ③ procedures, ④ guidelines, and ⑤ completed projected schedules, for example.[6] In addition, the process assets also include the organizations' knowledge base, such as lessons learned and historical information. By using lessons learned from past projects in a new project, the project's trend may be predicted, and the lessons learned from past projects can also be used as a reference to prevent failures in future projects.

In the ERAWAN 2 FSO project, a lessons-learned workshop was held after delivery of the FSO to the client. During this workshop, the manager of each project team, HSSE, QA/QC, engineering, procurement, construction, and business shared points for reconsideration and problems in their own division, and reported on proposed countermeasures for the next project. These lessons are saved on a shared server so that anyone can review them.

8. Results of efforts

8.1 Reduced schedule delays

In regular project meetings, problems affecting the schedule and risks that could exert effects in the future were highlighted, and awareness of the importance and urgency of these issues were shared. By promoting the investigation of countermeasures at the client, engineering, procurement, and construction levels, and by monitoring the implementation of such countermeasures, delays in the schedule were minimized. Examples of problems that actually occurred and their solutions are introduced below.

(1) In response to delayed approval of design drawings from the client, the client recruited an additional design engineer of their own.
(2) In response to delays in pipe pressure testing due to delays in the fabrication of tie-in spools, partial testing was carried out using blind flanges.
(3) In order to avoid pipe pressure testing during the daytime, when many constraints are imposed for safety, testing was carried out at night using a chart recorder.

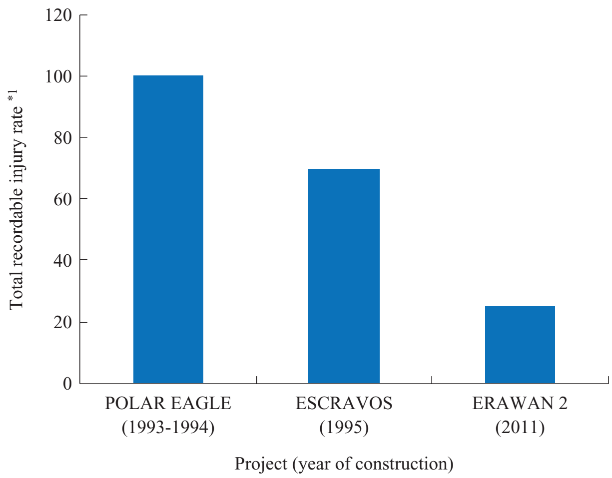
8.2 Improved the safety record

Figure 6 illustrates the change in the total recordable injury rate expressing accident frequency (the number of recordable injuries normalized per 1 000 000 working hours) for this project and previous offshore projects carried out at the Aichi Works. We think HSSE activities have been effective at reducing the number of accidents and improving the safety record during the project.

9. Points for reconsideration and future solutions

9.1 Project management theory and practice

When attempting to apply the project management techniques discussed above to an actual project, there are a variety of hindrances, and things often do not proceed according to theory. Particularly, in the case of a project, uncertainties and constraints are complexly intertwined and they create issues such as sudden tasks that must be taken care of, specification changes right before a deadline, and rework. These issues lead to a situation in which all persons concerned become swamped with day-to-day work which



(Note) *1 : POLAR EAGLE normalized to 100

Fig. 6 Total recordable injury rate for offshore projects

quickly becomes a hotbed of new problems, potentially creating a vicious cycle.

In switching from conventional project management techniques targeting Quality, Cost, and Delivery (QCD) to another form of project management, we believe the following Japanese thought patterns will make the transition more difficult.

(1) Japanese people do not want to change how things are done.

(2) Japanese people shift to being listeners during communication, and become non-assertive.

(3) Japanese people are overly reserved and modest.

For offshore projects, most clients are from Europe and North America, and possess thought patterns in sharp contrast to those of Japanese people. In the face of clients' persuasive communication, we are less likely to express our own thoughts and counter-arguments, and become liable to accepting proposals that are disadvantageous for us. It is necessary for us to exercise appropriate communication, and thereby weaken such influence of Japanese thought patterns and achieve smooth project management.

9.2 Incorporating the global standard of HSSE

Under client guidance, we are incorporating the HSSE activities of the oil and gas companies while incrementally improving conventional Japanese health and safety management. We have successfully accumulated valuable process assets, such as PTW and SWA, that can also be utilized in future projects.

At the same time, however, we have been unable to close the gap with the client on some issues. For example, the safety harness used during work at heights. A torso belt is accepted under Japan's health and safety laws, but is forbidden by oil and gas companies, who instead require a full body harness. When regulations and laws differ between Japan and abroad in this way, it is necessary to analyze those gaps and reconcile opinions with the client prior to starting the project.

At the oil and gas companies, it is necessary to assign a dedicated HSSE manager for each project, and in addition, the HSSE manager must have a broad range of knowledge and experience with respect to not only HSSE, but also engineering, construction, commissioning, and various testing methods. Furthermore, high level communication skills is also necessary to allow for tough negotiation in English with clients who are native speakers. Finding human resources within Japan who fulfill the above conditions is not easy. For this and other reasons, employing HSSE experts from overseas and furthering human resources development by On-the-Job Training (OJT) via actual projects is a pressing issue.

10. Conclusion

This article has discussed the incorporation of project management and HSSE activities in the ERAWAN 2 FSO project, as well as points for reconsideration and future solutions. The experience of project management and HSSE activity in the style of the oil and gas companies has increased the project-executing capability and HSSE awareness of the Aichi Works, and significantly improved our competitiveness in the global offshore market. The acquisition of these advantages that can be applied to the next project order are also a major accomplishment.

The accumulated process assets will be utilized to enhance planning and advance projects with proper communication, and accumulate new process assets to be applied to the next project. By repeating this cycle over and over, project management will continue to develop. In order to strengthen and maintain our competitiveness in the global offshore market, we will continue to strive for sustained improvements in project management and HSSE.

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