Bang Rachan Class Minehunter mission system upgrades: lessons learnt

Authors:
Lead author: Paul Creswell, *MCM Portfolio Manager Thales UK*
Co-author: Ian McFarlane BSc AMRINA, MIMarEST, *Export Sales Manager Thales UK*

Synopsis:

The Royal Thai Navy Bang Rachan Class Minehunters have been upgraded within a 3 year programme to provide a 15 year life extension with works performed in Royal Thai Navy Dockyard in Phra Chulachomklao, Bangkok.

The life extension of the platforms includes: replacement Mission System, upgraded Machinery control and automation for the main engine together with generator overhauls and a new electrical distribution system. Extensive hull and deck repairs on the 1980's Lürssen built wooden hull minehunters was an essential activity to ensure success to the life extension. The mission system replacement provides new suit of; sonar, command & control system, autopilot, radar and communications (internal and external). In addition to the platform works, a new signature range was supplied to allow acoustic and magnetic ranging pre and post upgrade, to ensure signature compliance.

Lessons learnt on the programme broadly fall into 2 categories, those pre-contract in the bidding and negotiation phase and those during the execution of the contract.

A taut bid timeline denied the ability to fully identify the required specifications and boundaries of the task associated with the platform. This early lack of clarity cascaded through the project.

The key lessons learnt during the programme execution were:

- Ensuring clear communications across language barriers between all parties
- Defining exact supplier specifications and supply chain timescales and ensuring the supplier understood and accepted these
- Accessing appropriate levels of skilled personnel for the technically demanding aspects of the programme
- Managing and planning for emergent work caused by the aging nature of the platforms, particularly their wooden construction.

Some of the methods used to counter and solve issues encountered were:

- Open communication particularly when problems arise, early flagging of issues usually means they can be fixed before they develop
- Ensuring well understood and accepted scope of works providing known boundaries and interfaces (both with companies and equipment)
- Ongoing use of 'plan on a page' to provide communication up and down the supply chain, and internally, allowing everyone to understand the current status, short term plans, and their delivered value to the programme
- Close scrutiny of suppliers:– key to understanding bought in equipment / services, maturity, and where necessary embedding Thales staff where challenges were being encountered
- Rigorous integration and test strategy for acceptance prior to delivery, and then adoption of an incremental acceptance strategy with the customer before final handover
- Introduction of suitably qualified and experience personnel and appropriate in country training
- Adopting an approach of "spend to save" early in the programme – something that proved to be far cheaper and quicker to realise costs early solving issues before they became major problems later in the project
- Continual consideration of signatures (acoustic, magnetic, electromagnetic) and the impact of any tasks or decisions on these.

Keywords:
Minehunting, contract lessons learnt, deployment overseas, Mission Systems, upgrades to platforms, sonar, MCM command and control

Biographies:

Paul Creswell is the Head of the Maritime Counter Measures (MCM) Conventional Systems portfolio for Thales UK. An IPMA qualified Programme Manager with 19 years' experience predominantly with Thales UK including a 5-year secondment with Thales Australia delivering complex maritime programmes.

Ian McFarlane leads the Mine Hunter Refurbishment and Above Water Systems sales and business development function in Thales UK. Ian holds a BSc in Naval Architecture (small ships) from SIHE, as well as a Maritime Business Management Diploma from Lloyds Maritime Academy. He has worked internationally for over 20 years on surface and subsurface craft, in naval and merchant marine industries.

1 Introduction

The two Bang Rachan Class mine countermeasure vessels (MCMs) in the Royal Thai Navy (RTN) entered service in the late 1980's. Designed and built by Lürssen in Germany the vessels were well maintained in a 'close to original' configuration. By the mid 2010's required a general overhaul and a sonar and command

 https://doi.org/10.24868/issn.2515-818X.2020.008

and control (C2) system upgrade to ensure they remained able to prosecute the: detect, classify, localise, neutralise chain.

Thales UK was awarded the role of prime contractor for the upgrade of the two Bang Rachan Class minehunters (HTMS Bang Rachan and HTMS Nong Sarai) in 2016.

Thales was also responsible for the supply of a new multi-influence signature range to manage RTN ships' signatures, revised vessel design, repairs and modernisation, the procurement of equipment and the platform integration. The upgraded ships are equipped with new: machinery control system, navigation systems, upgraded communications capabilities, Sonar TSM 2022 MkIII and M-CUBE C2 (command and control).

The work was undertaken at the Royal Thai Navy Dockyard in Phra Chulachomklao, Bangkok, hand in hand with the local industry in Thailand. Thales provided training and Integrated Logistic Support (ILS) for the RTN to obtain the best operational use from the vessels, extending the operational life of these ships by over 15 years.

Figure 1. Bang Rachan Class MCM: 48m LOA at 450 Tonnes displacement

2 Pre-contract

2.1 Time

Problem

The RTN had been trying to contract for this life extension programme for approximately 2 years, and had been very close to signing a contract with another Prime Contractor until that company withdrew. The RTN were acutely aware that the carry over of the allocated budget from one year to the next would not be sanctioned. So the pressure was on for the RTN to find another Prime Contractor, engage with them, issue a request for proposal, evaluate the response, negotiate and finally contract, in around 7 months.

Time differences between the UK and Thailand posed a challenge, whilst 6 hours difference may not seem like a lot, it only provides a short window of opportunity per day for direct contact between UK based and Thai based personnel.

Lessons Learnt

The short duration from initial contact with the customer to contract award meant that due diligence on surveys, costings and proposal build up was streamlined as much as possible. This balance between meeting the timeframe, meeting customer expectations and undertaking the business governance processes was a delicate one to manage. We met the timeline, customer expectation but had to reduce some of depth and scope normal due diligence that would be usual undertaken. However without this compromise then the required timeframes would have been missed.

While there is nothing that could be done about the time difference working practices were altered to start early when working from the UK to the customer, and working late when in working in Thailand to the UK.

2.2 Ship surveys

Problem

The scope of the upgrade was shipwide, with the vessels still in the water it was impossible to conduct full hull surveys externally. This was a major concern and risk as the vessels are wooden hulled with 3 layers of planking above the waterline and 4 below (figure 2). This planking had been regularly maintained but the vessels had been in service in the tropical water for over 30 years and there was evidence of contact damage and repairs so it was known that there would be significant remedial work required.

 https://doi.org/10.24868/issn.2515-818X.2020.008

Selecting a small enough survey team to manage, but with enough capability was challenging. As too was getting everyone to the ships at the same time, working in the same location without falling over each other was difficult. The upgrades stretched from woodwork through machinery engineering to high-end electronics, including naval architecture and the deployment and operation of the new signature range (which was to be installed in waters near too the Sattahip naval base, some 4 hours by car from Bangkok).

Figure 2. Wooden hulled on stainless steel frames, with vessels in the water for over 30 years hull repairs would be necessary, using skills which were fast becoming difficult to find

Lessons Learnt

Insufficient SQEP (suitably qualified and experienced personnel) were deployed to undertake the ship surveys. Regrettably this oversight wouldn't be highlighted until well into the contract.

Initial hull surveys were not undertaken to the full extent they should have been due to the ships remaining in the water. There was no real solution to solving this issue, apart from arranging for dry-docking of the ships before bidding, which would have incurred upfront time and cost penalties. We therefore had to accept the risk.

2.3 Engaging with local Thai industry

Problem

The RTN had a desire for the prime contractor to engage and use Thai industry where possible. This aim was to enable local industry to continue to support the ships through the rest of their service life. While this was not mandated, it was a positive aspect to contract delivery.

However, time and distance constraints as well as lack of local knowledge on which companies could be approached made engagement and subsequent contacting difficult. Some companies 'oversold' their capabilities, and when it came to contract execution issues were encountered (more about that below).

Lessons Learnt

Several local Thai companies were sourced and engaged to provide support to the project. Notably a wooden ship builder was engaged to provide expertise in hull repair and modification. This was essential to install the new sonar. This shipbuilder had an impressive portfolio of wooden vessel builds and repairs from a yard in Bangkok. However this skill required supplementing through additional specialists from the UK to oversee this work over and above the 2 general supervisors which was not planned for in the bid.

2.4 Legal advice (withholding tax)

Problem

Working in Thailand for the duration of the contract (some 39 months) meant the contract was subject to various local taxes and conditions (and was under Thai law. This meant obtaining local legal advice on how

 https://doi.org/10.24868/issn.2515-818X.2020.008

to manage this. With limited time, and trying to keep the pace of proposal development up meant this advice was taken at 'face value' and not validated with other independent experts

2.4.2 Lessons Learnt

Local lawyers were engaged to provide local advice, in particular to expected local tax liabilities, and treatment of withholding tax on this contract. However they were not present at customer negotiations, and were only used at arms length to provide advice after customer interaction. This customer interaction was usually in 1 week periods at least every month during the pre-contract phase. The lawyers should have been present at key negotiation points.

2.5 Stakeholder management within Thales

Problem

Throughout the 7 month contract negotiation period the team deploying to Thailand to liaise with the customer and potential supplies in country was required to keep the back office and management team informed in the UK. Due to the size of the contract (customer had already told us the budget) and the delivery scope over two ships there was significant corporate oversight. This required careful management and information presentation to ensure all stakeholders were informed, and in agreement with decision made and approach taken.

Lessons Learnt

Regular reviews were undertaken as the prospect progressed from initial enquiry to contract, specific meetings were undertaken with the business stakeholders back in UK. These stakeholders had no direct engagement with the customer, or Thai companies selected to support the subsequent contract, and therefore could only understand what was on the written page, which needed to be carefully and succinctly worded.

2.6 Pre-Contract Issues: Conclusion

Communication is key! Before deployment to Thailand the bid team should have produced a simple 'inward' short brief to the internal business stakeholders informing them of the objectives of the customer visit, success criteria and subsequent steps. A post visit briefing note to the business stakeholders aligned with the 'inward' brief would close the reporting cycle.

Local legal support should have been taken to more of the customer meetings, particularly those covering payments and price negotiation.

More time should have been taken over ship surveys, with a greater spread of subject experts, (mechanical engineer, electrical engineer, communications specialist) this would have given sight of some of the issues later discovered on contracy. Knowing about these issues may not have necessarily changed the bid approach, but we would have gone in to contract with greater clarity.

Capabilities of local companies required further investigation / confirmation before they were selected to support.

These activities take time, time the bid team did not have. If the above activities had been undertaken / explored further (apart from perhaps the internal briefs and de-briefs) we would have missed the time window from the customer and Thales would not have secured the contract. With regards to the customer relationships, we quickly built trust by 'doing what we said we would do, when we said we would do it', which was key to securing the work.

Figure 3. The customer required multiple copies of the proposal document each time we went into a different negation phase, placing a considerable burden on local resources (as the documentation was often finalised, printed and assembled in country)

 https://doi.org/10.24868/issn.2515-818X.2020.008

3 Handover to Contract

The final contract comprised the suite of proposal documents, which detailed the scope of works completely, the timeline and the acceptance criteria. Contacts within country were passed to the project team. One failing was not bringing in the projects team into country earlier to meet with the customer and conduct a gradual hand over from sales to project delivery team. This meant that the project team had to start building the same relationships later than the sales team.

4 Under Contract

4.1 Refit Location

Problem

The RTN mandated the refit at their dockyard in Phra Chulachomklao which was 1 to 1.5hrs drive from Bangkok, where suitable accommodation could be secured. This travel time was significant and needed to be factored into the working schedule. Unlike other dockyards, there was no commercial dockyard presence on site and therefore all labour and materials needed to be sourced outside of the dockyard. The dry dock was not covered and the wooden hull repairs took in excess of 6 months and extended into the rainy season.

Lessons Learnt

Thales chose to ferry the teams to and from the dockyard in comfortable minibuses departing at 7am and returning to be back at the hotel at 6pm. This gave a full working day on site and the opportunity to sleep or work on laptops during the journey. A local shipbuilding company was contracted to provide good quality workmanship and materials. A ‘village’ of portakabins (temporary offices) was set up close to the ships to house the teams, materials and workshops. Thales engaged with a contractor to tent over the whole dry dock area.

Figure 4. A tent was built over the open dry dock to protect the wood repairs from the elements

 https://doi.org/10.24868/issn.2515-818X.2020.008

4.2 In-Country SQEP

Problem

As note previously the RTN's desire to utilise local industry resulted in the contracting of a local wooden ship builder. Although their portfolio looked impressive, the workforce supplied to perform the hull repairs were under-skilled for the complexity of the job and had not been supplied with the specialist tooling required.

Lessons Learnt

Thales contracted a well-respected wooden shipbuilder from the UK to work alongside the Thai company. Training was provided to the local company and the highly complex tasks were performed by the UK SQEP. Thales equipped and supplied a container full of tooling as proposed by the UK SQEP and shipped this to Thailand where strict controls were put in place for the requisition, use and return of tools.

4.3 Thai Culture - HSE

Problem

Thailand has Health, Safety and Environment (HSE) legislation and regulations that differ from those that the UK staff are accustomed to operating within. It took additional effort to implement and comply with UK HSE intent when in Thailand, providing a duty of care to employees and subcontractors, and working within the Thai dockyard environment and its operating processes, procedures and customs. An example was the initial gangplank provided to gain entry to the ship was a single plank of wood with no handrails – something that was normal practise for the Thai dockyard but would not meet the standards required for Thales UK to be compliant with UK legislation (a Thales company requirement). It was only after the addition of reinforcement and handrails that it met both countries' HSE standards. Project working relationships were strained over other HSE topics, such as the degree of Personal Protective Equipment that was needed, the use of task-based risk assessments and having a detailed log of those staff onboard the platform (in case of fire).

Lessons Learnt

The only way to resolve this was by communication, discussion and compromise. Thales and the RTN had to appreciate each others cultures and rules – we smiled at the Thai workers wearing flip-flops in the dry dock floor and they smiled at us wearing hard-hats and overalls in the soaring temperatures!

4.4 Thai Culture – Saving Face

Problem

A feature of working in Thailand is the 'Saving Face' or 'No Blame' culture. This meant that Thales was not always aware whether tasks had been completed, when something would be delivered or whether an issue had been understood.

Lessons Learnt

Again, this required a thorough understanding of the culture and required questions to be phrased in such a way as to not cause embarrassment. Relationship forming was instrumental in order to gain trust and this allowed a little more openness albeit still guarded. Thales engaged with a training company to provide 'Working with the Thais' experience which was provided to all UK, French & German teams prior to arrival in country (sub systems were delivered by different country entities across the Thales group).

4.5 Teaming to Build SQEP

Problem

For this contract the Thales organisation stepped up from the role of supplier of Mission Systems to role of Prime Contractor. The organisation initially lacked all of the SQEP to consider the Platform Engineering aspects of the refit, i.e. how the new systems being supplied would interface both mechanically and electrically to the ship.

This resulted in significant issues in three areas:

- The fitting of a non-shock mounted Sonar onto a platform which previously had a shock mounted one. The additional stresses transmitted into the ship's structure needed to be considered
- The integration of the new equipment into the ship's electrical systems in terms of loading of existing circuits and changes to cable sizes and the integration of the new Electrical Power Management System into the existing switchboards
- The integration of the Machinery Control System (MCS) with all of the ship's sensors and actuators.

Lessons Learnt

Thales contracted with specialists in required areas: a Naval Architecture company to calculate the additional stresses that the platform would be subjected to from the non-shock-mounted Sonar if subjected to an underwater explosion and to design any structural changes required. A leading power management company was engaged to design, manufacture and set to work new switchboards which although outside of the original bid scope of work and therefore estimates, it was perceived to be cheaper and provide a through life prospect than trying to integrate with the original switchboards which lacked documentation and were not fully understood. Thales Australia were contracted to modify the power distribution design and were instrumental in ensuring that the ships power management system was safe and could service the requirements demanded. The

 https://doi.org/10.24868/issn.2515-818X.2020.008

supplier of the MCS was retained in-country much longer than originally planned in order to ensure successful integration:– originally excluded from the suppliers contract.

4.6 *Standalone Subcontracts*

Problem

Due to the short timeframe allowed for the bid and changes made during negotiations, it was difficult to keep the subcontractors' offers aligned with Thales' offer to the RTN. This resulted in unfunded gaps for equipment, training, spares and support to installation and acceptance.

Lessons Learnt

Negotiation both with the RTN and suppliers was needed in order to narrow the gap, but ultimately it was necessary to raise additional orders on the subcontractors. A lesson identified was for the flow down of requirements / back to back contracts from the prime contract to the subcontractors.

4.7 Multi Influence Range System

Problem

As part of the Contract offer Thales a proposed a Multi Influence Range System (MIRS) to measure and record the magnetic and acoustic signatures of the ships. The system was an existing product, portable in nature and designed to be deployed at different depths depending on whether the acoustic or magnetic signature was being measured. This replaced a previous system the RTN had used which was permanently deployed at a single depth. Due to its re-deployable nature, the MIRS design was a compromise between ruggedness and portability and was therefore recommended to be deployed where the seabed was unobstructed and free from sharp objects. The previous system was designed for the hostile seabed at the range site. RTN wanted to deploy the MIRS at one depth for both acoustic and magnetic measurements the Thales signature experts identified an optimal depth for each of these activities. Consequently, as the MIRS was deployed, recovered and re-deployed for each ranging exercise, damage was inflicted on the cables which needed either repairing or replacing. The RTN expected Thales to provide these replacement cables under warranty.

Lessons Learnt

Thales provided additional training, recommendations and written procedures to assist the RTN to deploy and recover the MIRS with minimal damage. Although many of these were implemented by RTN, inevitably the cables continued to be damaged. Thales should have identified the RTN's real requirements in terms of the way they operate and seabed condition, and supplied a more robust system suitable for the environment that the Customer wanted to operate in.

4.8 Training Fade

Problem

The contract was very specific as to when and where the training should take place. The majority of this was performed at the supplier's site for each subsystem at a relatively early stage of the contract. By the time the ships were handed over to the RTN following Sea Acceptance Trials much of the training had either been forgotten or totally lost due to changes in ships' personnel. Thales requested contract changes in order to provide a more timely training solution but this was rejected by the RTN.

Lessons Learnt

Although some in-country refresher training was contracted for, Thales provided further 'on the job' training during the setting to work and acceptance of the ships. A lesson identified was that training needs to be scheduled much closer to the point at which crews take over the operation and maintenance of the equipment.

4.9 Bridge Console

Problem

The refit required a significant quantity of equipment to be replaced in the Bridge Console alongside systems that were not being upgraded by Thales. The proposed solution was to replace the fixed console facia with a new modular version designed to accommodate all of the required equipment. However, the complexity of this solution was not fully understood at the outset.

Lessons Learnt

Once all of the equipment had been stripped out of the console, templates were designed and prototyped onto the console chassis. This highlighted where the chassis need cutting out and where the holes for the mounting fixtures needed drilling. The fitting of the equipment onto the new facia was straight forward (see figure 5) and could be done in an air conditioned workshop. However, the wiring loom of the console took a number of months with technicians working in sweltering conditions, mainly sitting or laying down on the deck. Further difficulty was experienced setting the console to work and tracking down wiring errors. Lessons were learnt were to supply and installed a new entire Bridge Console, manufactured and tested under controlled conditions in a factory (which is what we have done subsequently).

 https://doi.org/10.24868/issn.2515-818X.2020.008

Figure 5. Templates being assessed on the existing Bridge Console Chassis

Figure 6. The Refurbished Bridge Console

 https://doi.org/10.24868/issn.2515-818X.2020.008

4.10 Deck Repairs

Problem

The approach to the deck repairs was to cut out and replace the rotten / damaged areas. However, as the work progressed it became apparent that the surveys performed during the bid phase were not sufficient. The assessed level of repair was inadequate, due to the layered composition of the deck the damage extended far beyond that expected.

Figure 7. The layered nature of the Deck construction masked the extent of the water damage

Lessons Learnt

Thales had to procure additional wood in order to complete the deck repairs. The cost of the additional wood was compounded by the significant additional manpower required to perform the complex patching repairs and in most cases whole sections of deck were replaced rather than repaired. The lesson identified was that future bids need to consider the cost effectiveness of replacing the entire deck both in terms of wood and manpower.

5 Conclusions: The Charter for Future MCM Upgrade Taskings

Some of the methods used to counter and solve the issues encountered during the contract (and adopted subsequently as a guideline charter for future work) are:

- Open communication particularly when problems arise, early flagging of issues usually means they can be fixed before they develop

 https://doi.org/10.24868/issn.2515-818X.2020.008

- Empowerment of the Project Team to enable rapid but well considered decisions when faced with difficult situations. Delays in decision making often leads to increases in costs
- Ensure the appropriate subject matter expertise provides input at the bid phase, ensuring dependencies, assumptions and customer furnished equipment (covered dry dock for example) are captured, detailed and agreed
- Robust well understood and accepted scope of works, these provide known boundaries and interfaces (both commercially and technically with companies and equipment)
- Ongoing use of 'plan on a page' to provide communication up and down the supply chain, (and internally to the project team), allowing everyone to understand the current status, short term plans, and their delivered value to the programme
- Scrutiny of suppliers, this is key to understanding bought in equipment / services, maturity, and embedding Thales staff in poor performing suppliers to assist with their delivery challenges
- Rigorous integration and test strategy for Thales' acceptance prior to delivery and incremental acceptance strategy with the customer before final handover
- Early introduction of SQEP and appropriate in country training
- Spend to save early, it is far cheaper and quicker to realise costs early to solve issues later in the project
- Continual consideration of signatures (acoustic, magnetic, electromagnetic) and the impact of any tasks or decisions upon these
- Create and maintain a winning team with a can do attitude who provide support both professionally and personally during difficult times when working long periods away from home.

6 Acknowledgements:

Thales Thailand in country team, in particular Mr Kenny Baxter as Key Account Manager
Viriyakit Thailand, who remain Thales' key industrial partner in the country, in particular Ms Chollada Promdejpaibul
The Royal Thai Navy for their support to get the project to successful completion

7 References:

Project documentation, bid team and project team inputs 2015-2019

Glossary:

HSE	Health and Safety Executive
HTMS	His Thai Majestys Ship
ILS	Integrated Logistic Support
IPMA	International Project Management Association
LOA	Length Over All
MCM	Mine Countermeasures
MCS	Machinery Control System
MIRS	Multi Influence Range System
PPE	Personal Protective Equipment
RTN	Royal Thai Navy
SQEP	Suitably Qualified and Experience Personnel
TSM	Thales Sonar

Word Count (excluding Synopsis, Glossary and Attribution Licence): 3976

 https://doi.org/10.24868/issn.2515-818X.2020.008