4.7 Bridge Resource Management for Pilots

Paul G Kirchner and Jorge J Viso

Bridge resource management (BRM) has been a major focus of mariner training and ship navigation practice since the early 1990s. BRM generally refers to practices and techniques used in the management of bridge operations to maximize the effective utilization of all available resources, including personnel, equipment and information. The essence of BRM is a management approach that facilitates communication, cooperation and coordination among the individuals involved in a ship's navigation.

Pilots around the world have been strong proponents of BRM and, in a number of countries, have modified the concept to address the particular demands and challenges of compulsory ship pilots who are not members of a ship's crew. The experience of the piloting profession in the United States is illustrative.

4.7.1 Background of BRM

BRM was derived from cockpit resource management (CRM), which was developed in the commercial aviation industry during the 1970s and 1980s. Research had shown that, despite improvements in cockpit instrumentation and expanded use of simulator training, human error continued to be a leading cause of commercial plane accidents. Many of those accidents were attributed to a loss of situational awareness and a failure to detect developing error chains by the crew. The industry concluded that a different management approach in the cockpit, one that featured better coordination and communication among the crew, could reduce human error. That approach became known as CRM, and training in CRM concepts became an aviation industry standard.

By the late 1980s, several studies of marine accidents and casualty investigation reports suggested that many of the CRM concepts might also have benefits for ship navigation. It was noted, for example, that many of the human errors found to have been a cause of ship accidents were due to poor management rather than poor ship handling or a lack of knowledge or skill. Causal factors attributed to poor management included confusion, poor decision making, preoccupation with non-critical problems, inadequate leadership skills, bad teamwork, and stress and fatigue.

In response, mariner training providers in the United States and in other countries, particularly in northern Europe, began developing BRM courses, which borrowed heavily from the well established CRM training programs. The US National Transportation Safety Board was an early proponent of BRM. In several casualty investigation reports during that period, the NTSB made recommendations about the design and implementation of BRM training for ships' crews and pilots.

It should be noted that bridge team management (BTM) has sometimes been considered a precursor of BRM. This is not correct, however, and causes some confusion. BTM was developed in the late 1980s by a number of ship operators, especially in the tanker community. It was not borne out of CRM but of quality assurance programmes then being implemented in manufacturing industries. BTM, therefore, developed on a parallel path with BRM. Its major influence was not on BRM but on the IMO's later ISM Code and the bridge operations provisions of Safety Management Systems mandated by the Code.

4.7.2 BRM Training for Pilots in the US

The American Pilots’ Association (APA) closely followed the growing interest in BRM within the maritime industry and transportation safety community. In a message to the APA membership in the July 1993 edition of the APA newsletter, the president of the association described BRM as “the hottest topic” in navigation safety. Contrasting BRM with BTM, which was opposed by the APA membership, the president announced that the APA would initiate a project to consider the development and ultimate application of BRM principles and training in the US piloting profession. By that time, the APA had already been consulting with the NTSB and with US training centers that were working on BRM courses. APA officials sat in on a number of such courses and asked both the NTSB and the training centers to outline what they thought a BRM course for pilots should include.

It quickly became apparent to the APA that, although many of the first-generation BRM courses included the interaction of the master and the bridge crew with the pilot, those courses:

- Were designed for ship crew members, not pilots
- did not adequately address the role of the pilot
would not provide suitable or effective training for pilots.

As a result, the APA concluded that BRM training for its members should address the particular functions, tasks, experiences, challenges and needs of those pilots.

In its research, the APA found that BRM courses for ships’ crews not only address subjects and concepts that are inapplicable to what pilots do on the bridge of a ship, but some of the practices they promote are actually contrary to good piloting practices. For example, BRM courses for ships’ crews typically advocate the development of standardized routines and an adherence to a uniform, constant set of operational procedures, albeit one that encourages a greater team oriented approach. That may be effective for bridge crew members who have a similar training background and work in the same bridge operating system from day to day. That is not the environment in which a compulsory, non-crew member pilot works, however. On each assignment, a pilot will typically encounter a different ship, different bridge equipment and lay-out, a different operating environment, a different set of navigation procedures and a different crew (usually one with limited English language abilities) with varying skill levels and capabilities from what the pilot encountered on the previous assignment.

Because of those circumstances, pilots need to assess quickly the nature and quality of the resources available for each pilotage assignment and then adjust their practices to get the most out of those available resources. This calls for flexibility and adaptability rather than rigid adherence to a standardized routine. The APA determined, therefore, that BRM courses for pilots should address strategies and techniques for evaluating the capabilities of the ship’s crew and equipment and then establishing and maintaining the best, mutually supportive working relationship with the bridge crew in light of those capabilities. These are not alien or radical ideas for pilots. In fact, pilots have been routinely doing these things for many years – long before BRM was ever recognized as a concept. In traditional hands-on training under the guidance of senior pilots, junior pilots learn about effective communication techniques, bridging cross-cultural barriers, and productive interaction with bridge watch personnel.

4.7.3 The APA’s BRM-P Program

On 5th October 1993, the Board of Trustees of the APA formally adopted a program of BRM training for its member pilots. It had two components.

First, the APA established a system for approving and certifying BRM courses specifically designed for pilots (referred to as ‘BRM-P’ courses). The courses must meet guidelines developed by the APA in consultation with training centers and the NTSB. The NTSB, in particular, provided valuable comments and suggestions on early drafts of the guidelines. The final version calls for a two-day (14-16 hours) course with a curriculum that includes training in the following subject areas:

- Situational awareness
- Error chains
- Human factors
- Dynamics of group performance
- Special problems in pilot-bridge crew interaction
- Communication techniques
- Command/leadership skills.

The objectives of the course are listed as:

- An increase in situational awareness skills
- Improved abilities to foresee and prevent errors and to detect developing error chains and intervene before an accident becomes unavoidable (error trapping)
- A more developed concept of the appropriate roles of teamwork and leadership in the navigation of a ship
- A greater regard for the importance of communication, an understanding of the common barriers to effective communication, and an awareness of how BRM practices can improve communication
- An enhanced ability to evaluate quickly the resources available for each pilotage assignment and to adjust practices to utilize those resources most effectively.

The guidelines call for interactive ‘workshop’ instruction methods, involving discussion groups, exercises, etc. Case studies are especially encouraged, so long as the BRM focus is maintained. For case studies, the APA recommends that the instructor uses an approach in which the pilot participants are invited to analyze the facts of actual casualties (taken from the factual portions of official casualty reports), make their own causation findings, suggest how

---

the casualty could have been avoided, and propose lessons learned that could be used to improve their own piloting practices.

The second component of the BRM-P initiative was a resolution by the Board of Trustees recommending that all APA member pilots should take an APA-approved BRM-P course and take a refresher BRM-P course every three years; all pilot associations should provide or require BRM-P courses for their training and as part of their continuing training programs; and pilot licensing authorities should require completion of a BRM-P course as a prerequisite for an initial pilot license and completion of a refresher BRM-P course within three years of license renewal.

Following the announcement of the BRM-P program, four training providers in the US quickly submitted BRM-P courses to the APA for review and approval. The courses were ultimately approved although, in each case, the provider was required to make certain modifications recommended by the APA. The first classes offered by the approved providers were audited by APA officials, who typically made additional suggestions for improvements. In this process, the courses and the APA oversight of the program continued to develop and evolve as experience was gained.

In December 1993, the president of the APA participated in a BRM course offered at the SAS Flight Academy in Stockholm, Sweden. The SAS course was developed by a group of 7 maritime organizations and companies in Northern Europe, including the Norwegian and Danish Shipowner Associations and the Dutch Maritime Pilots’ Corporation, and was being offered to both ships’ crews and pilots. Unlike the APA-approved courses then offered in the US, the SAS course relied in large part on computer-based training, although supplemented with workshops and ‘reinforced’ in a two-hour exercise carried out in a bridge mock-up. This was a useful and interesting experience, which added to the APA’s knowledge base about BRM training. In particular, it confirmed the APA decision to require courses designed specifically for pilots.

In 1998, the APA adopted guidelines for renewal BRM-P courses. By that time, most US pilots had taken an initial BRM-P course and were approaching, or had already approached, the end of the recommended 3-year cycle for BRM-P. The APA recognized that pilots would not want to simply repeat an initial BRM-P course and would get little of value from that. Instead, the APA asked that BRM-P providers develop courses designed for pilots who have already taken a BRM-P course and offer separate initial and renewal courses, each of which would be APA-approved. According to the guidelines, the two-day renewal courses should expect that the pilots already have an understanding of basic BRM concepts such as situational awareness, error chains and error trapping, and human factors affecting communication, cooperation and pilot-bridge crew interaction. Those concepts should be briefly reviewed and then updated or supplemented with more recent developments. That would leave time for more extensive treatment of BRM-related subjects that might not have been addressed in depth in the initial course.

The renewal course guidelines suggest that particular attention could be given to:

- Recent developments in technology and information resources
- casualty reports from the preceding three or five years
- new research on fatigue, cognitive science and other human factors
- regulatory requirements governing the respective duties of the master/bridge crew and pilot
- potential impact of ISM Code and STCW measures on the competence and practices of masters and bridge crews
- positions and proposals of other organizations on master-pilot interaction, bridge team management, bridge procedures with pilot aboard, etc.

Given the range of subjects approved for a renewal course, providers have considerable leeway in developing their own curriculum and the APA encourages providers to offer their own unique versions of BRM-P that are consistent with basic BRM principles addressed in the guidelines. For example, some APA-approved BRM-P renewal courses are focused more on the proper use of advanced navigation technology, and others are focused more on human factors. Encouraging provider innovation keeps the BRM-P program current and responsive to changes in ship navigation encountered by APA member pilots. It also offers the US piloting

profession choices when selecting the most desirable or useful BRM-P courses for continuing training.

In 2000, the APA changed its recommended BRM-P training renewal cycle from every 3 years to every 5 years. The major reason for the change was to align the cycle with the 5-year term of US Coast Guard mariner licenses and STCW certificates and the training requirements of those credentials. In addition, experience with the program by that time had shown that there was no need for, and little benefit to, the shorter 3-year cycle. BRM concepts and subjects do not change that quickly, and pilots have considerable exposure to the BRM subject in the normal course of their professional activities.

By any measure, the APA’s BRM-P program has been successful. By 2013, many of the APA member pilots had taken four or more BRM-P courses in their careers. Pilots are very familiar with BRM concepts. Training centers continue to offer APA-approved BRM-P courses, and proposed new courses continue to be submitted for approval. As of 1st July 2013, 7 training centers in the US and one in Canada offer APA-approved BRM-P courses. The APA keeps in regular touch with the training centers, passing on items of interest, such as APA guidance documents, casualty reports, safety alerts, and recommendations from the NTSB, the US Coast Guard, the IMO and other entities involved in navigation safety matters.

The BRM-P program is dynamic and continues to evolve to meet the needs of pilots and safety.

4.7.4 BRM Today: Challenges and Problems

Despite the widespread acceptance of BRM in the maritime community, there are some problems surrounding it today. Among other things, there is considerable imprecision in how the term ‘BRM’ is used and how the concept is interpreted and applied.

First, BRM is sometimes erroneously portrayed as a set of required procedures or tasks or of specific duties of members of the bridge crew and the pilot. There is a difference between BRM principles and bridge procedures, however. The former is an approach or a management style. It is more aspirational than prescriptive, more of a safety attitude than a list of required tasks and activities.

Second, as noted previously, BRM is not the same thing as BTM, although the two terms seem to be used interchangeably. The two concepts and their training programmes may share a number of practices and objectives, but BTM is more about getting all members of the bridge crews to understand clearly their duties and their collective responsibility for the safe navigation of the ship under the direction of the Master (the ‘team leader’). Despite its name, a BTM system is highly structured and hierarchical and relies heavily on documentation, such as checklists and reports.

The team oriented doctrine that is at the centre of BTM and is often promoted, as a general matter, in BRM courses, is not an essential component of BRM implementation. It is merely one approach that a BRM-proficient pilot or master might use, depending on the circumstances. In comments made on a draft of the APA’s BRM-P guidelines in 1993, the NTSB human factors experts observed:

“[T]eam approaches to vessel operations are not always the best way to structure or organize watchstanders. Even when the crew complement of the piloted vessel is domestic and adequate technical proficiency has been demonstrated to the pilot or the master, a team response incorporating all of the best team attributes may actually impede the timely execution of a crucial decision”[3].

Third, an unfortunate recent development has been a growing tendency to use BRM as a standard of care against which to compare the performance of mariners. Casualty investigations today often use BRM deficiency as a general term for human error. Not all human errors on the bridge of a ship are BRM errors, however. Where, in the past, a master or other member of the bridge crew or the pilot may have been described as practicing poor seamanship, violating navigation rules or procedures, or failing to carry out assigned tasks, investigation reports today cite ‘failure to follow BRM principles’ or ‘deficient BRM’ as a cause of a casualty. This practice rests on a misunderstanding of BRM and often fails to give mariners useful information about specific errors to be avoided.

It also affects the way in which mariners view BRM. When BRM is used to criticise a mariner’s performance, it discourages the mariner from embracing BRM as a positive and helpful approach to his or her job – an approach for a pilot that reinforces best practices and techniques.

Despite these challenges and problems associated with BRM today, it will continue to be a major focus of mariner training and ship navigation for the foreseeable future, and pilots will be at the forefront of the efforts to use BRM to improve safety by reducing the potential for human error.

---