The New Zealand Maritime Pilots' Association

GOOD PRACTICE GUIDE FOR PILOTS

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INTRODUCTION

Background

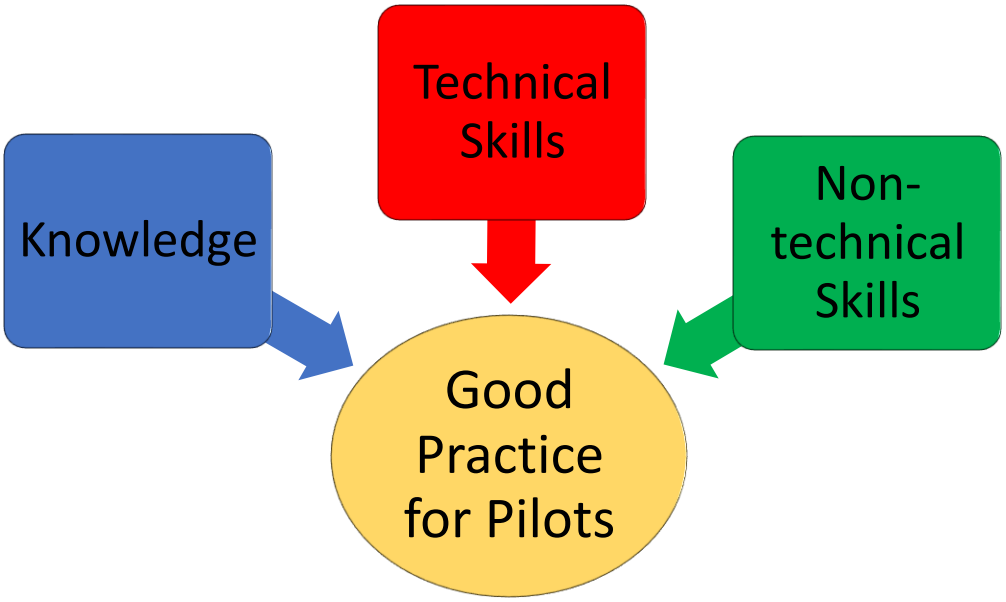
Maritime pilots perform a vital role within the New Zealand transport chain to manage safe and efficient movement of ships within our ports and harbours and thereby facilitate the maritime trade system on which our communities rely.

Regulation provides minimum standards for pilot operations, training and licensing, but until now there have been no resources available that describe good practice in the execution of the pilot's role on board the vessel. To address this lack of guidance, the New Zealand Maritime Pilots' Association (NZMPA) has published this first edition of the *Good Practice Guide for Pilots*.

The *Good Practice Guide for Pilots* has been developed by experienced New Zealand pilots with input from ship handling and human factors experts in consultation with the pilot membership of the NZMPA.

What is Good Practice?

NZMPA defines good practice for maritime pilots as *the possession of knowledge and the execution of those skills most likely to contribute to safe and efficient pilotage.* The knowledge, technical skills and non-technical skills described in this Guide represent a level of expertise that NZMPA believes all pilots should aim to achieve and maintain.



While encouraging these good practice principles NZMPA acknowledges that pilots operate in the real world and the real world is imperfect. The systems and organisations, the management and co-workers, and the ships and port infrastructure that pilots interact with, vary widely in their capability and performance. Such imperfect operations and operating cultures are factors that pilots will frequently be required to work with.

However, the application of due diligence in pilotage practice is of paramount importance. Stakeholders and communities expect no less. Despite the challenges faced by pilots and common instances of minimal support in carrying out their responsibilities, the application of the principles described in this Guide will assist pilots to achieve the best possible outcomes.

Using this Guide

The Guide is comprised of three sections:

1. Knowledge - the technical and non-technical subject matter that pilots must know and understand.
2. Technical Skills – the tasks directly related to controlling the navigation, manoeuvring and mooring of ships in pilotage waters that pilots should be capable of performing during the conduct of pilotage.
3. Non-Technical Skills – the cognitive and behavioural skills that pilots should employ during the conduct of pilotage.

Each section is broken down into further elements. These elements are supported by a list of *behavioural markers*. These markers are examples of good practice related to each specific element. The markers illustrate how the reader can infer good practice from the relevant skill or knowledge element, they do not constitute a complete description of good practice.

The order of presentation of the three sections and the elements is not intended as a heirachy of importance. It cannot be stressed enough that workload management and the prioritisation of tasks, as described in Section 3, is fundamental to good practice pilotage. A pilot's highest priorities must always be control of the vessel and situational awareness.

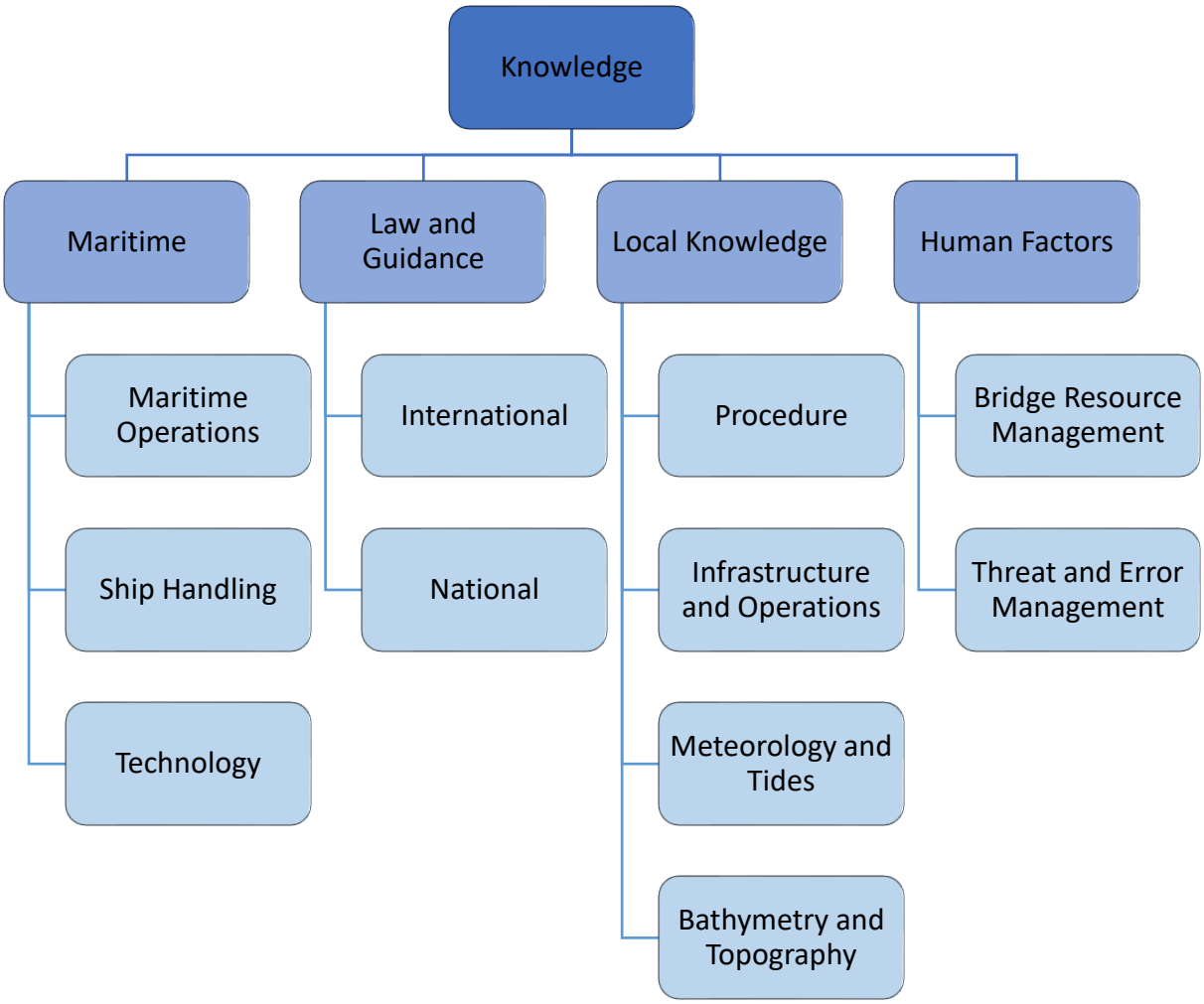
This Guide is written for pilots; its primary purpose is to provide pilots with a resource for their own guidance and professional development. Good practice in pilot training and assessment are not within the scope of this Guide as these are expected to form the subject of a future NZMPA project. However, the Guide could be used to provide a framework of content for a pilotage provider's training, proficiency and assessment plan.

In the process of developing this Guide the NZMPA has made the following assumptions:

- The relevant port and harbour Safety Management System (SMS) and contingency plans are fit for purpose.
- The relevant port passage plan is fit for purpose.
- The relevant pilotage plan is fit for purpose.

SECTION 1 - KNOWLEDGE

Knowledge is the technical and non-technical subject matter that a pilot should know and understand. It is gained from a combination of prior learning, port-specific training, external sources and continual professional development.



1.1 MARITIME KNOWLEDGE

Maritime Operations

Pilots currently have or have previously held a Master Unlimited certificate of competency (STCW II/2). This establishes the foundation maritime operations knowledge for a pilot.

Examples of good practice:

- At the time of issue or revalidation the pilot's Master Unlimited certificate met the standard of STCW II/2 following the syllabus contained in Section A-II/2 of the STCW Code and was issued by a flag state from the IMO whitelist.

- If the Master Unlimited certificate is no longer valid, the pilot has completed generic ECDIS training as required by the 2010 Manila Amendments to STCW.
- The pilot follows an approved program of Continuing Professional Development as part of an approved Pilot Proficiency Plan.

Ship Handling

Pilots understand how a vessel moves in a body of water in three dimensions. They understand how that motion can be controlled by different types of propulsion, steering, thrusters, manoeuvring equipment and tugs. They understand how vessel motion is affected by environmental conditions, the load condition of the vessel as well as proximity to the seabed, fixed structures or other floating objects.

Examples of good practice:

- Understands the effects of transverse thrust from different propeller configurations and hull forms.
- Understands how steering is affected by rudder form and water flow.
- Understands how a vessel's apparent pivot point is affected by water-plane area and water speed and how this, in turn, affects the manoeuvrability of the vessel.
- Understands the modes of operation, use of and characteristic effects and limitations of azimuth propulsion units.
- Understands how a vessel's manoeuvrability is affected by its interaction with the seabed and how these effects can be minimised or managed.

Navigation Technology

Pilots understand the operational principles and limitations of all communications equipment, navigational instruments and environmental sensors on board the vessel, including portable instruments and all remote equipment available as resources that assist pilotage operations.

Examples of good practice:

- Understands the operational principals, limitations, and common errors of radar and ARPA equipment.
- Understands the source and reliability of ENC data and the navigational functions and limitations of ECDIS equipment.
- Understands the source and reliability of position, heading, speed, ROT and AIS data supplied from PPU sensors.
- Understands the navigational functions and limitations of PPU display units.

1.2 LAW AND GUIDANCE

International Law and Guidance

Pilots must understand their obligations with respect to relevant IMO guidelines and resolutions and those of the master, the crew, the port and any others with whom a piloted vessel may interact.

Examples of good practice:

- Knows and understands the content of the Convention on the International Regulations for the Prevention of Collisions at Sea, 1972.
- Knows and understands the content of:
    - IMO Resolution A.1045(27) *Pilot Transfer Arrangements.*
    - IMO Resolution A.960 *Recommendations for Training, Certification, and Operational Procedures for Maritime Pilots other than Deep Sea Pilots.*
    - IMO Resolution A.893(21) *Guidelines for Voyage Planning.*
    - IMO Resolution MSC.255(84) *Adoption of Casualty Investigation Code.*

New Zealand Maritime Law and Codes

With respect to New Zealand law, codes, guidelines and local bylaws, Pilots understand their obligations as well as those of the master, crew, port, other resources engaged in the pilotage and all other stakeholders with whom a piloted vessel may interact.

Examples of good practice:

- Understands Sections 33A – 33X of the Maritime Transport Act 1994 with respect to the functions of Regional Councils, Harbourmasters and port operators.
- Understands Section 31 of the Maritime Transport Act 1994 with respect to reporting obligations.
- Understands the objectives of the NZ P&HMSC 2020 and the roles and responsibilities of port companies and harbourmasters with respect to maritime safety.
- Understands Maritime Rule Part 90 with particular reference to:
    - Pilotage area limits.
    - Privileges of the holders of pilot's licenses and pilotage exemption certificates.
    - General requirements and currency requirements for holders of pilot's licenses and pilotage exemption certificates.
- Understands the requirements of Maritime Rule Part 53 with particular reference to:
    - Compliant pilot transfer arrangements.
    - A pilot's duties with respect to non-compliant pilot transfer arrangements.
- Understands the content of the local navigation bylaws.

1.3 LOCAL KNOWLEDGE

Procedure

Pilots understand their obligations and those of other persons engaged in the pilotage as required by the safety management systems of the port, pilotage provider and the harbourmaster.

Examples of good practice:

- Understands the structure and componentry of the Port SMS, the Harbour SMS and associated risk assessments.
- Understands their roles and responsibilities with respect to following operating procedures.
- Understands all pilotage planning responsibilities, including operational limits for pilotage, towage, or mooring operations specified in their operating procedures.
- Understands their roles and responsibilities with respect to contingency plans and emergency procedures.

- Understands their responsibilities for reporting incidents and making safety observations as required by their operating procedures.

Port Infrastructure and Operations

Pilots understand the location, function, specifications and limitations of all port infrastructure with which they or the vessel may interact during the pilotage, including harbour radio, berths, aids to navigation, tugs and other support vessels. They also understand the location and nature of other operations within the port, including leisure activities, with which they or the vessel may interact during the pilotage. They understand the influence these operations and activities may have on the safe conduct of the pilotage.

Examples of good practice:

- Knows the structural specifications and operational limits of all wharves that may be used by piloted vessels and how this information can be quickly accessed while piloting.
- Knows the location and characteristics of visual aids to navigation and how to use them to support safe pilotage.
- Knows and understands the location, function, capabilities and limitations of the local harbour radio station.
- Understands the performance envelope of all harbour tugs and how to use them in the most effective and safe configuration.
- Knows the locations, capabilities and limitations of all meteorological and tidal information sensors and how live and historic data from these can be quickly accessed while piloting.
- Knows where local leisure activities are conducted, where information on activities can be accessed quickly while piloting and how to contact participants by VHF or other means.

Meteorology and Tides

Pilots understand the climatic, regional and seasonal influences on the weather conditions and tidal cycles at the port as well as the availability and accuracy of forecasts and predictions.

Examples of good practice:

- Knows the wind and sea conditions that can be expected at all berths, anchorages and boarding grounds within their port with respect to a regional forecast and how these conditions may be affected by diurnal or tidal cycles.
- Understands the meteorological conditions likely to produce fog at different locations within their port and how these may be affected by diurnal and tidal cycles.
- Knows approximate tidal ranges and maximum stream rates at different locations within the port across a full lunar cycle and how these are affected by the seasons and by prevailing weather.
- Correctly estimates tidal height and tidal stream at different locations within the port for a given tidal range and interval.
- Knows the location of the preferred forecast source to be used prior to commencing a pilotage, along with other sources of weather forecasting.
- Knows the source and data quality of tidal stream atlases used at the port.

Bathymetry and Topography

Pilots understand the date, type, and quality of bathymetric surveys, soundings shoaling areas and their rates of change for all relevant areas within the piloted port and harbour areas. They know all prominent landmarks and the locations and nature of any obscured features.

Examples of good practice:

- Knows the controlling depths and spot soundings along, and adjacent to, all standard routes, anchorages, swing basins and berths within the port.
- Knows the quality of the seabed and the locations of obstructions, such as submarine cables, pipelines and wrecks, in all locations within the port.
- Knows the source of hydrographic data within the port and how frequently and to which standard, surveys are undertaken.
- Knows the names of all landmarks and waterways within the port.
- Knows the locations of all prominent landmarks that are used for radar ranges, bearings and parallel indices.

1.4 HUMAN FACTORS

Pilots understand the factors that affect human physical and mental performance and how non-technical skills can improve human performance when applied effectively through Bridge Resource Management (BRM) techniques.

Bridge Resource Management

Pilots understand the elements and principles of human factors based BRM and how these can help achieve safe and efficient pilotage.

Examples of good practice:

- Understands the elements of each of the cognitive skills of *Situational Awareness* and *Decision Making.*
- Understands the elements of each of the non-cognitive skills (behaviours) of *Co-operation* and *Leadership/Management.*
- Has undergone BRM and human factors training, endorsed by the NZMPA within the past five years.

Threat and Error Management

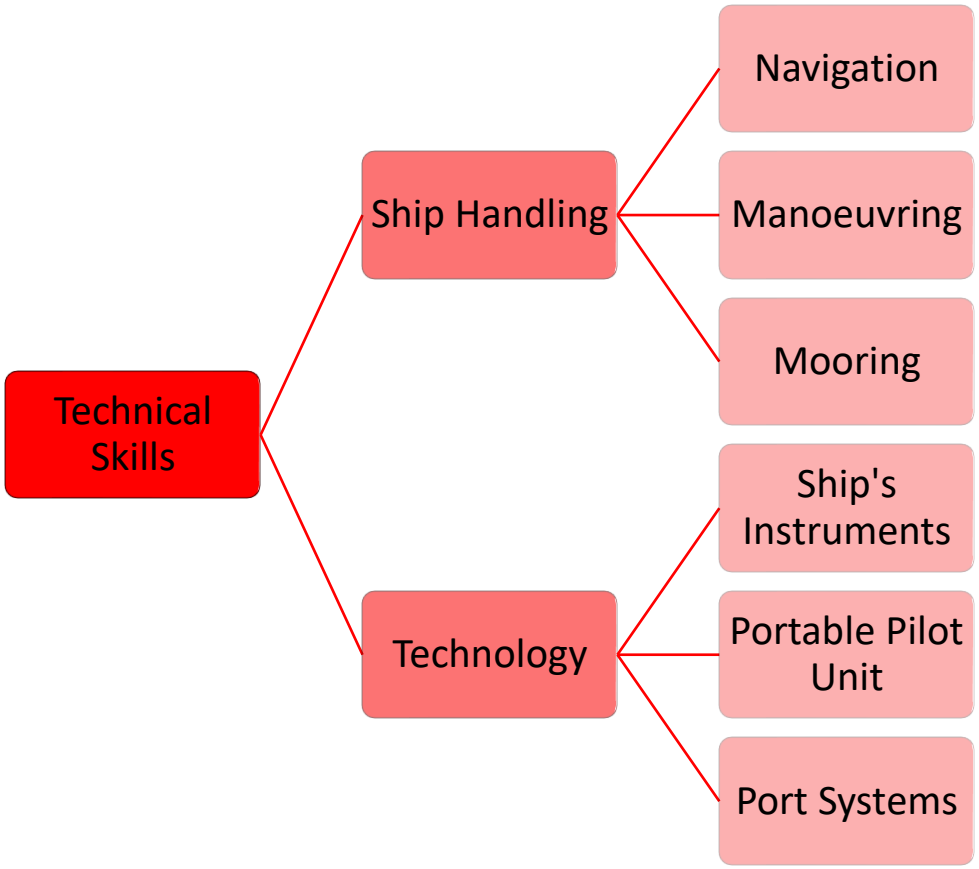
Pilots understand how to integrate threat and error management countermeasures into all phases of pilotage, including planning, execution and review, with the goal of avoiding and managing threats and errors.

- Understands how many common threats that can reduce safety margins may be identified by the BRM techniques of planning, briefing and task delegation.
- Understands how the BRM techniques of communication, monitoring, cross-checking, workload, and automation management can identify threats and avoid or trap errors that may otherwise reduce safety margins.

- Understands how the BRM techniques of thinking aloud, asking questions, assertiveness and modifying plans can manage many common threats and mitigate or trap errors that can reduce safety margins.
- Understands how latent threats can be identified by incident investigations, SMS reviews, formal safety audits and pilot assessments.

SECTION 2 - TECHNICAL SKILLS

Pilots must be capable of exercising a range of technical skills directly related to controlling the navigation, manoeuvring and mooring of vessels in pilotage waters. These include skills gained through training and experience gained on the job or from external sources.



2.1 Ship Handling

Navigation Control

Pilots control heading, speed and rate of turn at all times, so as to safely maintain the vessel's swept path within the limits of the planned route. They employ ship's propulsion, steering equipment, and tugs, where appropriate and they correctly allow for the vessel's wind profile, load condition, the effects of environmental conditions as well as interactions with other vessels and structures.

Examples of good practice:

- Controls the vessel's heading by appropriate use of propulsion and steering while allowing for swell, leeway, tidal stream and other external forces so the ship does not depart from the planned corridor.
- Controls the speed of the vessel within the planned ranges by appropriate use of propulsion, steering and tugs.
- Controls the rate of turn by appropriate use of propulsion, steering, thrusters and tugs so that planned rates of turn are maintained and the vessel does not depart from the planned corridor.

- Controls heading and rate of turn during deceleration and acceleration so that planned parameters are not exceeded.
- Maintains sufficient control of speed, heading and rate of turn during simulated emergency scenarios so the vessel does not enter *no go* areas.

Manoeuvring Control

Pilots effectively employ ship's propulsion, steering equipment, thrusters, tugs, anchors, and moorings while manoeuvring. They correctly allow for the vessel's wind profile, load condition, the effects of environmental conditions, interactions with other vessels, fixed and floating objects, and the proximity of other traffic in order to:

- Control heading, fore and aft speed, and lateral speed at all times so as to safely maintain the vessel's swept path within the limits of the planned manoeuvring areas.
- Control the vessel's swing/rate of turn at all times, such that the swing circle/swept path are safely maintained within the limits of the planned manoeuvring areas.
- Control heading, fore and aft speed, and lateral speed during final approach, landing, and initial lift-off from any berth, such that the forces applied to the fenders and berth structure are within safe operating limits.

Pilots include the use of anchors or moorings appropriately in planned or emergency scenarios to assist slowing/stopping, swinging, and controlling heading and speed during manoeuvring, landing or lifting-off, so the safe operating limits of mooring equipment are not exceeded.

Pilots configure tugs to maximise their effectiveness and flexibility as manoeuvring aids in conjunction with the vessel's manoeuvring equipment, while not exceeding the safe operating limits of the tug or ship's deck fittings. They use tug power efficiently to assist the planned manoeuvre.

Examples of good practice:

- Manoeuvres the vessel within planned manoeuvring areas and positions the vessel to allow for environmental conditions and contingencies.
- Deploys tugs to maximise their effectiveness and flexibility in line with the planned manoeuvre and uses tug power efficiently.
- Controls heading, speed and rate of turn within planned ranges by appropriate use of propulsion, steering, thrusters, tugs and anchors where appropriate.
- Adapts or aborts the planned manoeuvre appropriately due to unplanned conditions or events.
- Lands and lifts off berths at safe angles and speeds, relative to the displacement and hull form of the vessel, so that fendering and wharf structures are not overloaded.
- Controls the vessel's movement by appropriate use of propulsion, thrusters, tugs and moorings while alongside and while running or heaving moorings.

Mooring

Pilots advise the ship's master and shore based mooring crew during mooring and unmooring to co-ordinate the operation and minimise the risk of harm. They maintain full control of the vessel's motion during mooring and unmooring operations by the appropriate use of the vessel's manoeuvring equipment, tugs, anchors and moorings. They ensure that the vessel lands and lifts off the berth as

planned and the forces applied to the vessel's mooring equipment and berth do not exceed operational limits.

Examples of good practice:

- Communicates mooring sequences clearly to bridge teams and shore crews.
- Advises shore crews and tugs/support vessels of any changes to mooring plans.
- Relays critical information between shore crews, bridge teams and tug/support vessel crews such as presence of moorings in the water.
- Minimises the effects of propulsion, thruster, or tug wash on the mooring operation, while maintaining full control of the vessel's motion.

2.2 Technology

Ship's Instruments

Pilots interrogate and correctly interpret all communications equipment, navigational instruments and environmental sensor displays on the vessel. They correctly interpret propulsion, steering and manoeuvring equipment indicators.

Examples of good practice:

- Optimises radar performance for the ambient conditions, recognises common errors and correctly interprets own ship AIS and ARPA information from a radar, ECDIS, or Integrated Navigation System display.
- Efficiently manipulates VRM, EBL, and parallel index lines on a radar, ECDIS, or Integrated Navigation System display.
- Correctly interprets own ship information from compass/gyro repeaters, rudder indicators, speed logs, propulsion indicators/tachometers, echo sounders and conning information displays.

Portable Pilot Unit

Pilots set up, interrogate, interpret, trouble-shoot and maintain PPU for optimal performance during pilotage.

Examples of good practice:

- Enters ship's particulars, antenna offset position and selects a standard route.
- Correctly interprets own ship information from the PPU display and monitors PPU performance.
- Creates and edits standard routes.
- Updates charts and permits.
- Replays and reviews historic PPU tracks.

Port Systems

Pilots interrogate and interpret communications equipment, navigational sensors, environmental sensor displays and other equipment used to plan, execute, monitor or review the pilotage.

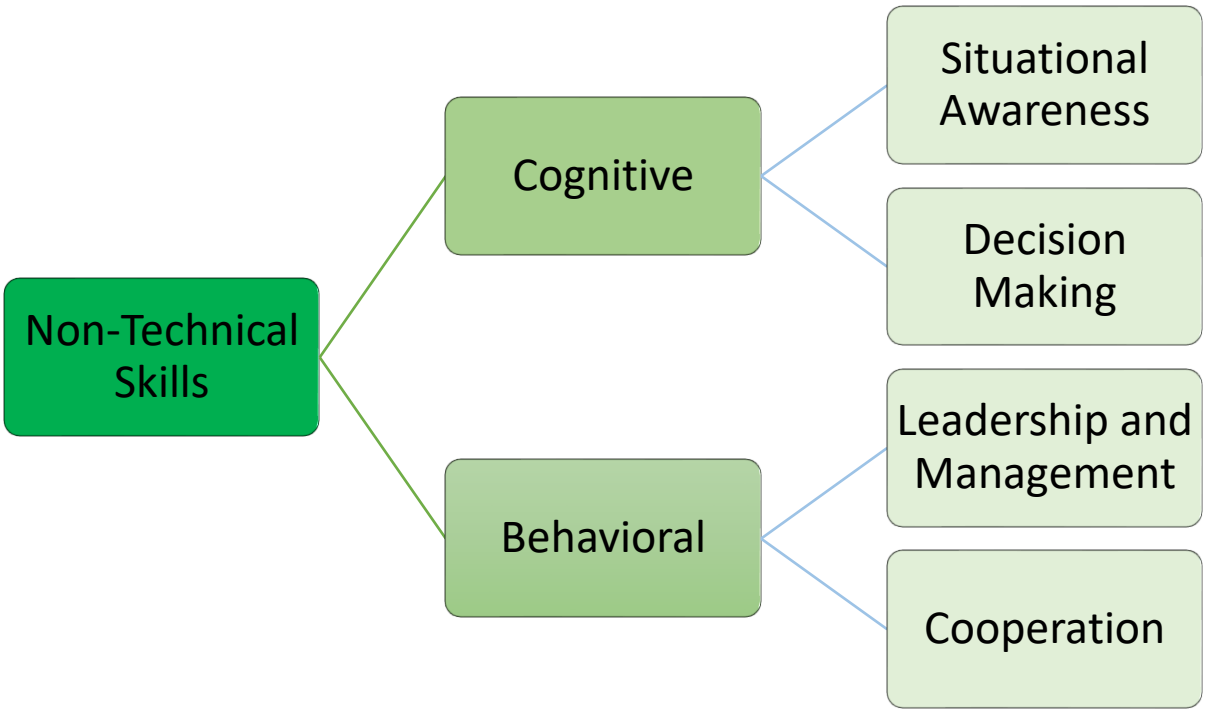
Examples of good practice:

- Accesses all live and historic weather, sea and tidal information from port sensors.

- Accesses live traffic information from port systems.
- Uses a port's DUKC prediction and monitoring system correctly and efficiently.
- Uses standard routes from the port passage plan and plans speed ranges and rates of turn for the vessel based on the vessel's draft, displacement, wind profile, manoeuvring information, standard operating procedures and the forecast conditions.
- Prepares the pilotage plan using port's planning systems and documentation.

SECTION 3 - NON-TECHNICAL SKILLS

Pilots must be capable of exercising a range of cognitive and behavioural skills to avoid or trap threats and errors that may reduce safety margins. Non-technical skills can be gained and enhanced through training and experience gained on the job or from external sources.



3.1 Cognitive Skills

Cognitive skills are the mental processes by which a person makes sense of what is happening around them. The cognitive skills related to pilotage are grouped into two main elements: *situational awareness* and *decision making*.

Situational Awareness

Pilots monitor visual references, monitor and interrogate communications equipment, navigational sensors and PPU as well as resources outside of the ship in order to gain and maintain situational awareness of:

- The vessel's position, relative to the pilotage plan.
- The vessel's motion.
- Environmental conditions and traffic in the immediate and wider geographical area.
- Operating modes and performance of propulsion, steering and manoeuvring equipment for the vessel, tugs, or any other outside resources.
- The level of engagement and performance of the bridge team.
- An awareness of all the above, projected into relevant future timeframes.

Examples of good practice:

- Monitors the vessel's position and motion, relative to the pilotage plan, by a combination of visual observation, ships instruments and PPU.
- Monitors traffic visually using radar, AIS information and by monitoring VHF communications.
- Monitors the environmental conditions using visual reference, ship's instruments and from remote sensors.
- Monitors the correct operation and performance of propulsion, steering, thrusters and other manoeuvring equipment by monitoring ship's indicators and visual reference where appropriate.
- Monitors the passage of time with reference to the pilotage plan and other operational and environmental factors.

Decision Making

Detection and Diagnosis
Pilots use their situational awareness to identify anticipated and unanticipated threats or errors.

Generating Options
In response to detected threats or errors, pilots identify appropriate actions that are consistent with their own capabilities and available resources, the environmental conditions, regulations, procedures and contingency plans.

Assessing Risk and Choosing Options
Pilots assess the risks associated with the actions identified and choose an option that best avoids the detected threat and does not result in further threats being generated.

Reviewing Outcomes
Pilots continue to monitor the effectiveness of the chosen option until the threat has passed.

Examples of good practice:

- Maintains situational awareness by all appropriate means and inform others, where possible, of detected threats and errors.
- Where appropriate, immediately adopts countermeasures to manage threats or errors and informs relevant parties of their actions.
- Where appropriate, generates one or more viable options to manage a threat or error and consults with the bridge team or relevant parties on any risks associated with each option.
- After consultation, chooses options that manage the threat or error and informs relevant parties.
- Where required, adapts pilotage plans, follows contingency plans and informs relevant parties.
- Incorporates modified plans into their situational awareness and continues monitoring.

3.2 Behavioural Skills

Behavioural skills are sometimes referred to as social skills. They are the way in which pilots conduct themselves and the pilotage. Behavioural skills differ from cognitive skills in that they are observable by others. Behavioural skills can be grouped into two main categories: *leadership/management* and *co-operation*. Each of these two categories is further divided into a number of elements.

Leadership and Management

Planning and Co-ordination

Pilots prepare thoroughly prior to the pilotage. They create a vessel specific pilotage plan comprising route, manoeuvring and berthing plans for the planned time, in the expected conditions.

Pilots lead a bridge team briefing outlining the pilotage plan and operational limits. The objective of the briefing is a shared mental model of the pilotage, including critical information on the route, manoeuvre and berthing plans, limits, timings, environmental conditions and forecasts and the expected traffic situation.

Pilots delegate tasks, including BRM countermeasures to avoid or detect errors and define processes for communication, challenge and intervention.

Authority and Assertiveness

Pilots display an even and assertive temperament when engaged in pilotage. They communicate information and instructions relating to the pilotage in good time to all others engaged in the pilotage using clear and appropriate language.

Setting and Maintaining Standards

Pilots comply with regulations and procedures, whenever it is safe and practicable to do so. When necessary, pilots communicate and advocate required standards of compliance and behaviour to the bridge team and external parties.

Workload Management

Pilots prioritise control of the vessel, their situational awareness and that of the bridge team at all times. They ensure that sufficient bridge team and external resources are engaged in the pilotage. Pilots look for signs of stress or high workload in themselves and others. They react accordingly by reprioritising or delegating tasks and taking steps to allow more time for decision making.

Examples of good practice:

- Prioritises control of the vessel and situational awareness over all other matters.
- Uses detailed route plans based on the SOPs, vessel's characteristics and the forecast conditions.
- Plans ETA at critical points to maintain UKC requirements or to stay within tidal stream limits, or for any other operational reason.
- Plans manoeuvres based on the forecast conditions, tugs and the vessel's characteristics. Manoeuvring plans show operational limits, where tugs will be engaged and how they will be deployed.
- Plans berthing operation based on the vessel's characteristics, forecast conditions, configuration of mooring bollards and any other operational constraints.
- Includes all bridge team members in the bridge team briefing and invites them to contribute and to confirm their understanding of the plan and their roles.
- Communicates to the bridge team the details of where and when critical turns and speed changes will be initiated.
- Communicates to the bridge team the details of maximum off-track limits and speed ranges for the different stages of the pilotage.
- Ensures bridge team members carry out their delegated roles and all critical actions are cross-checked by those team members responsible for monitoring.
- Is approachable and responsive to bridge team questions and feedback.

- Communicates clearly. Uses closed-loop communication techniques and standard marine communications phrases where appropriate.
- Follows procedures and expects the same of all other persons involved in the pilotage.
- Delegates tasks appropriately within the bridge team and outside, to maintain navigational control and situational awareness.

Co-operation

Building and Maintaining the Team

Pilots establish open and interactive communication within and outside the bridge team that encourages input, feedback and intervention.

Considering Others

Pilots listen to other bridge team members. They assess, so far as they are able, the experience, skill and engagement levels of other team members through dialogue and observation.

Conflict Resolution

Pilots avoid engaging in interpersonal conflict and de-escalate such where necessary.

Examples of good practice:

- Establishes an open, interactive atmosphere with the bridge team.
- Encourages and responds to feedback from others.
- Observes the level of understanding of the bridge team.
- Observes levels of stress or fatigue among the bridge team.
- Observes personal interactions within the bridge team.
- Considers the effects of culture (national, safety, professional and organisational) on implementation of BRM.
- Assists bridge team members with tasks they have difficulty with and asks for assistance where necessary.
- Where personal conflicts occur, tries to refocus individuals on navigation control and situational awareness.

SECTION 4 – RESOURCES

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- NZ Maritime Pilots' Association Executive.
- NZ Maritime Pilots' Association Pilotage Advisory Panel.
- *NZ Port and Harbour Marine Safety Code* Working Group

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