HELINOTS

Non-technical Skills for Offshore Transport Pilots

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Acknowledgements
The Helicopter Non-technical Skills for Offshore Transport Pilots (HeliNOTS (O)) system is a behavioural marker system developed by psychologists from the Applied Psychology and Human Factors Group of the University of Aberdeen, in association with CRM trainers and offshore transport pilots from international helicopter operators.

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Introduction

Alongside the technical aspects of pilot training, the enhancement and evaluation of pilots' non-technical skills has been a long-standing component of flight crew training and pilot licence maintenance. Fundamental variances, however, have been recognised between pilots who fly different aircraft types across a range of flight roles. Differences between helicopter and fixed-wing aircraft operation are a significant point of consideration for rotor-wing operators seeking to tailor their Crew Resource Management training, and its associated assessment methods (e.g. behavioural marker systems), to their operational needs.

Rotorcraft have a range of unique features; they possess the ability to hover, decrease airspeed without loss of altitude, and have a reduced need for ground infrastructure. It is for this reason that helicopters are well suited to the transport requirements of the offshore industry, providing passenger transit to and from offshore installations. In respect to this unique aircraft functionality and its distinct operational roles, helicopter pilots have been shown to exhibit non-technical skills differently from their fixed-wing counterparts, and also adapt these skills according to specific mission parameters.

Offshore transport pilots, consisting teams of two, undertake routine flights to and from offshore installations, providing a commercial service to oil and gas operators. Generally, a pilot undertaking an offshore transport role will be provided with broad information the day prior to flight and meet with the other crew member on the day of the flight to begin in-depth planning processes. This will involve accessing multiple systems to gain an awareness of weather states, local air activities and other notices to airmen. Offshore transport pilots operate under flight time limitations, restricting the maximum number of flight hours that can be accrued in any single period of time, yet crews are still exposed to fatigue and the stresses associated with operating within a commercial environment which can have a detrimental impact upon non-technical skill utilisation. Recently, concerns have been raised in relation to human error in the industry, with an analysis revealing that a significant proportion of offshore transport operator's accidents have been caused by operational factors, including crew errors such as erroneous decision-making.

It is essential, therefore, that operators continue to enrich non-technical skills training, specific to the domain in which the offshore transport pilot works. To that end, the HeliNOTS (O) system is the result of a range of studies exploring in detail the non-technical skills utilised by pilots during offshore transport operations. HeliNOTS (O) has been developed to provide a structured, empirical framework in which to address these skills. It provides a common language for pilots and Crew Resource Management trainers to discuss and train non-technical skills and lays a foundation on which debriefing sessions may be structured. It is expected that such a nuanced system will be ideally placed

to address the unique elements of the offshore transport pilot role and further enhance Crew Resource Management training.

What this handbook contains

This handbook contains a guide to the HeliNOTS (O) system. Part 1: Information for users outlines guidance for the use of behavioural marker systems. Parts 2: The HeliNOTS (O) system provides the full contents of the system across categorical and elemental levels, in addition to providing behavioural markers for each element. Part 3: Use of the HeliNOTS rating scale includes a description of the rating scale, and the observation /rating form associated with HeliNOTS (O). For more information on the HeliNOTS (O) system, underpinning research, and supplementary materials, please visit the website at: https://research.abdn.ac.uk/applied-psych-hf/

Part 1: Information for users

What are non-technical skills?

It is accepted that whilst technical knowledge is a core component of high-level performance, non-technical skills (NTS), encompassing interpersonal (e.g. communication) and cognitive (e.g. situation awareness) skills, are a necessity for safe and efficient practitioner outcomes (Flin, O'Connor, & Crichton, 2008). Within the aviation industry, NTS have been the focus of significant attention due to a series of fatal human-error related incidents in the 1970s. One such incident in 1977, where two airline jets collided on a runway resulting in the greatest accidental loss of human life in aviation history, is still used as a case study to highlight the catastrophic impact of lapses in NTS such as loss of situation awareness, inappropriate decision-making, and poor leadership behaviours (Weick, 1990). Subsequently, over the following decades distinct generations of Crew Resource Management (CRM) training has evolved in the industry, aimed at addressing non-technical skills and ultimately mitigating human error (Helmreich, Merritt, & Wilhelm, 1999).

CRM courses involve the modular, classroom-based training of NTS by certified CRM trainers. These programmes have been adopted globally as the training of knowledge and skills relating to human performance have become a mandated component of flight training by all major air operators worldwide (ICAO, 2010). In the UK, both fixed-wing and helicopter operators are subject to CRM training regulations from the Civil Aviation Authority (CAA) which stipulate that pilots should receive training and assessment on non-technical skills (see Flin, 2019). Indeed, it is outlined that a marker of effective training is that there is a degree of role-specificity in CRM courses (CAA, 2017).

What are behavioural marker systems?

Behavioural marker systems are rating scales based on skill taxonomies and are used to identify observable, non-technical behaviours that contribute to superior or substandard performance. They consist of two parts: a skills taxonomy with examples of positive and negative behavioural markers allied to each skill, and a rating

system. Behavioural marker systems are context-specific and are developed in the domain in which they are to be used, and can be utilised to structure observations, ratings and feedback, as well as to identify practitioner' training needs. They can also form the basis for NTS training. One of the earlier behavioural marker systems in the European aviation industry is NOTECHS (Flin et al., 2003), comprising four NTS categories and a five-point rating scale. Since its inception in the early 2000s, NOTECHS has been used and adapted by a number of operators (fixed and rotor-wing) for assessing the NTS of aviators and is the only method named by the European regulator. Other operators have moved towards a competency-based approach to training and assessment through EBT (evidence-based training). In cases where a European operator has approval for an ATQP (Alternative Training and Qualification Programme) they are permitted to construct their training programmes and assessments based upon their own evidence (EASA, 2016).

Recently, a series of studies with search and rescue and offshore transport helicopter pilots identified differences in how helicopter pilots utilise their NTS based upon mission parameters and the factors which influence these NTS (Hamlet, Irwin & McGregor, in press; Hamlet, Irwin, Flin, & Thomson, 2019; Hamlet, 2020). The research identified the nuanced aspects of how offshore transport pilots applied their NTS. Based on these findings, the HeliNOTS (O) behavioural marker system, specific to the offshore transport pilot role, has been developed.

What is the HeliNOTS (O) systems?

Helicopter Non-technical Skills for Offshore Transport Pilots (HeliNOTS (O)) is a behavioural marker system developed by psychologists from the Applied Psychology and Human Factors Group of the University of Aberdeen, in association with CRM trainers, and offshore transport pilots from international helicopter operators. The system allows for the observation, rating, and feedback of offshore transport pilots' NTS performance.

HeliNOTS (O) describes the core NTS categories specific to the offshore transport pilot role. It has been designed for use by qualified CRM trainers in accordance with established technical aircraft knowledge in order to allow for the observation and subsequent rating of offshore transport pilots' NTS against a structured framework. The system is recommended for use in the simulator but may also be used as a debriefing tool post-flight.

HeliNOTS (O) has been developed on the basis that all system behaviours are directly observable or may be identified though communications between crew members. The system applies a rule of parsimony, where a broad range of NTS behaviours are described in as few distinct elements as possible, and has been designed to be in a terminology recognisable and applicable to offshore transport pilots and trainers. The system is comprised of three levels, with skill categories, elements, and associated behavioural markers. HeliNOTS (O) is made up of five core NTS categories and 15 associated elements (see Table 1).

Definitions of the categories and their associated elements are provided in this handbook, alongside examples of positive and negative behavioural markers for each element. These behavioural markers were developed in consultation with experienced pilots from international offshore transport operators and are intended to give examples of typical behaviours rather than provide an exhaustive summary of behaviours.

Table 1. HeliNOTS (O) taxonomy v1.0

Category	Elements
Communication	- Exchanging information - Giving instructions - Providing feedback
Leadership and Teamwork	- Guiding task behaviours - Sharing task activities - Monitoring other crew member - Setting and maintaining crew atmosphere
Workload Management	- Maintaining standards - Coping with task demands - Prioritising duties
Situation Awareness	- Gathering information - Comprehending informational elements - Anticipating future states
Decision-making	- Identifying and selecting options - Reviewing course of action

Using the HeliNOTS (O) system

The HeliNOTS (O) behavioural marker system is intended to be used as a rating tool to assess offshore transport helicopter pilots' NTS performance and give feedback in a structured manner immediately after the flight. In this regard, HeliNOTS (O) may also be utilised as debriefing tool post flight or simulator session. It is recommended that users first observe performance while taking note of any specific behaviours or omissions.

Assessments should be based solely on behaviours that are observed or directly communicated. Using these observations, a rating may first be made at an element level, then at the more general category level. The associated five-point rating scale should be used to determine the level of performance achieved, with a non-applicable option for skills that could not be observed within the current situation. The HeliNOTS (O) rating form can be viewed on page 17. It is essential that users of HeliNOTS (O) receive proper instruction on observation, assessment / rating, and the application of the system prior to use.

As with other behavioural marker systems, it may require repeated use of the system for assessors to become familiar and competent with the HeliNOTS (O) system. Training and practice should help facilitate this process.

- HeliNOTS (O) assessment should not interfere with flight performance; use of the system should cease immediately should circumstances dictate.

- Formative assessment and feedback on HeliNOTS (O) should occur routinely in both in-flight and simulated environments.
- HeliNOTS (O) should be utilised primarily to structure beneficial feedback to pilots on the state of their NTS. It is therefore essential that the system is used in a non-threatening and educational manner.

User selection and training

- Training is required to learn how to rate behaviours using HeliNOTS (O). This should include an understanding of:
  - Non-technical skills, human performance and error management so that constructive, directive feedback can be given to pilots
  - Principles of using psychometric tools for rating performance
  - The contents of the HeliNOTS (O) system and how it relates to flight performance
  - Observing NTS and rating behaviours with the system
  - Providing constructive feedback.
- If HeliNOTS (O) is to be used for assessment, users should be appropriately trained and calibrated to ensure all assessors provide consistent ratings for the same behaviours.
- Regular updates may be required, so recurrent training and calibration programmes should be developed.
- It is recommended that a group of experienced CRM trainers be selected from an operator to become HeliNOTS (O) trainers/assessors.

Pilot selection and training

- Pilots should receive training on human performance and error management to support development of their NTS.
- Pilots should receive their own copy of this HeliNOTS (O) booklet.
- HeliNOTS should be used appropriately for the level of experience of the pilot:
  - For junior / trainee pilots, HeliNOTS (O) can be used as a tool for discussion on NTS and their importance to safe and effective flight performance
  - For experienced pilots, HeliNOTS (O) can be used to observe, rate, and provide feedback upon NTS behaviours.
- CRM trainers should explain to pilots why the structured rating of NTS are important, and why HeliNOTS has been developed for this purpose.

Suggested functions for HeliNOTS (O)

- To assess pilots' NTS in accordance with operators' CRM assessment regulations.
- To guide discussions of HeliNOTS (O) and the role of NTS in flight.
- To provide a basis for debriefing discussions and to encourage less experienced crew members to participate in debriefs.
- To allow for trainers and crew members to discuss NTS in relation to case studies and CRM issues.

Practical tips and recommendations:

- Use HeliNOTS (O) in a variety of simulated flight settings as appropriate for CRM assessment.
- It is recommended new users work at an elemental level, as behaviours may be more directly observable.
- If HeliNOTS (O) is being used for assessment purposes, it is recommended that:
  - Users take notes about observations during the assessment if possible (e.g. observed or omitted expected behaviours), then make assessments based on these notes post-observation
  - Users take notes about specific circumstances of observed case and pilot's experience (e.g. type of simulated flight, simulated hazards / emergency scenarios, pilot new on aircraft type)
  - Pilots receive feedback and a debriefing session directly after the observation session, with element level observations / ratings to give feedback on specific skills and the categorical rating to describe general performance
  - The HeliNOTS (O) system has been designed for use during CRM sessions and assessments, but focus should be applied to areas of weakness identified.

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Part 2: The HeliNOTS (O) System

Communication: Exchanging task relevant information with others and ensuring information has been received and understood.

Exchanging information – Providing appropriate information to the other pilot and being receptive to information provided.

Positive behavioural markers	Negative behavioural markers
• Asks clear questions when update is required or where there is misunderstanding • Communicates intention and / or status through briefs • Provides suitable amount of information relative to task (e.g. simple and clear) • Quickly shares any new information with other pilot • Utilises hand signals to convey information where necessary (e.g. signalling to air marshals)	• Asks indirect, or closed, questions when update is required • Acts before communicating intention or status • Shares inappropriate amount of information • Reacts to new information without sharing information with the other pilot • Exhibits unclear, or fails to be receptive to, hand signals

Giving instructions – Being clear and concise when requesting action from the other pilot.

Positive behavioural markers	Negative behavioural markers
• Speaks clearly when giving or questioning instructions • Explains in a sufficient detail what is required or expected • Updates instructions as task / situation progresses	• Acts in a submissive manner when giving instructions • Communicates in an unclear or vague manner when giving directions • Provides instruction but does not update as task / situation progresses

Providing feedback – Giving an opportunity to raise questions and seeking to address any misunderstandings in communication.

Positive behavioural markers	Negative behavioural markers
• Provides an appropriate response in relation to requested action • Asks questions when meaning of communication has been unclear • Responds to brief and indicates information has been understood • Regularly raises opportunity for other pilot's questions and takes the time to respond to the questions asked	• Accepts instructions blindly • Proceeds without questioning unclear communications • Does not clarify what has been briefed or fails to acknowledge information • Shuts down questions asked by others

Leadership and Teamwork: Overseeing the flight, coordinating with the other pilot, and making sure he /she is managing their tasks.

Guiding task behaviours – Taking oversight of a flight, action / series of actions, and ensuring teamwork effectiveness.

Positive behavioural markers	Negative behavioural markers
• Facilitates crew coordination by allocating and delegating tasks so that both crew members have appropriate input • Oversees pilot activities and decision-making processes • Ensures compliance to briefed action	• Demonstrates a misunderstanding of crew workload balance (e.g. Takes on all tasks / gives away all tasks) • Fails to provide oversight of decisions and activities • Allows task actions to drift from briefed actions

Monitoring other crew members – Ensuring others in crew are coping and performing appropriately.

Positive behavioural markers	Negative behavioural markers
• Checks on other pilot to assess their capacity on task (e.g. influences of stress and fatigue) • Recognises when other pilot is overloaded by monitoring responses to check-up • Steps in to correct actions / understanding where required	• Pays little attention to capacity of other pilot • Exhibits a lack of recognition when other pilot is demonstrating cues of distress • Fails to correct actions / misunderstanding when inconsistency is found in crew

Sharing task activities – Maintaining input into team tasks and providing support to the other pilot when they are under pressure.

Positive behavioural markers	Negative behavioural markers
• Seeks input of, and includes, other crew member in team processes (e.g. planning, comms) • Ensures both pilots are clear on role and associated activities • Assists other pilot when he/she is overloaded • Highlights any detected discrepancies in task plan	• Acts in isolation from other pilot (e.g. fails to ask for input) • Takes over other pilot's activities when unneeded (e.g. taking over radio communications, looking at instruments) • Does not offer assistance to other crew members despite recognition of overloaded state • Fails to question discrepancies with the plan

Setting and maintaining crew atmosphere – Setting the tone for an effective crew environment.

Positive behavioural markers	Negative behavioural markers
• Demonstrates a tone for other pilot to follow (e.g. facilitates flat cockpit gradient, ensures rapport) • Identifies differences of opinion or conflict • Sets an open atmosphere with other pilot (e.g. supports other pilot's confidence, encourages other pilot to take initiation) • Is open to, and engages in, conflict resolution (e.g. does not assign blame, but attempts to find solution through discussion / brief)	• Sets inappropriate tone (e.g. shuts down other pilot, creates hostile atmosphere) • Allows standards to drop in order to avoid conflict • Shuts down other pilot's inputs • Reacts inappropriately to conflict (e.g. disregards other pilot trying to solve issues)

Workload Management: Organising the required flight activities to achieve goals and maintain quality and safety. Managing competing pressures and demands including scheduling and passenger requirements.

Maintaining standards – Ensuring flight safety through adherence to SOPs and organisational guidelines.

Positive behavioural markers	Negative behavioural markers
• Performs appropriate flight checks prior to take-off • Adheres to standard operating procedures • Maintains use of standard phraseology to ensure clarity • Uses relevant checklists to support activities where appropriate	• Rushes through pre-flight checks and / or breaches checking guidelines • Violates standard operating procedures regularly • Uses non-standard phraseology • Applies incorrect, or fails to use, checklists

Coping with task demands – Managing pressures and difficulties in order to meet flight requirements with the minimum level of stress.

Positive behavioural markers	Negative behavioural markers
• Remains calm when exposed to adverse conditions in flight (e.g. bad weather, technical malfunction) • Employs strategy for coping with stressors (e.g. drinks coffee, maintains conversation) • Manages additional requests (e.g. unexpected passenger pick-up) and is prepared for refusal of additional workload where necessary • Prepares to switch / halt tasks when necessary (e.g. delays, holding patterns)	• Panics or acts in distressed manner when exposed to adverse conditions • Shows no response to mitigate stressors • Indicates reluctance to take on / dismiss additional requests and prefers not to vary from original plan • Becomes frustrated / stressed when tasks need to be adjusted

Prioritising duties – Recognising and ensuring prompt response to key tasks.

Positive behavioural markers	Negative behavioural markers
• Ensures primary tasks are attended to promptly • Shows an understanding of the order in which tasks should be completed (e.g. gear down before landing) • Provides enough time to conduct all necessary actions (e.g. checks, communications) • Shows awareness of time and manages planned tasks and activities	• Demonstrates a lack of awareness of primary tasks • Undertakes incorrect sequence of actions during tasks (e.g. proceeds through checks in non standard order) • Spends too much time on individual tasks (e.g. slow to decide on course of action) • Spends inappropriate amount of time on tasks potentially leading to scheduling difficulties

Situation Awareness: Perceiving and monitoring one's surroundings, establishing an understanding of the environment, and projecting a picture of future events based on this understanding.

Gathering information – Establishing awareness of cues from the environment internally and externally to the helicopter.

Positive behavioural markers	Negative behavioural markers
• Monitors aircraft instrumentation / systems regularly to get relevant information and ensure awareness of warning indicators • Frequently scans external environment • Demonstrates an awareness of when something in environment changes (e.g. seeks to communicate change) • Maintains awareness of surroundings despite task distractions (e.g. bad weather, radio calls)	• Sporadically scans instrumentation or underutilises systems when gaining awareness • Rarely scans external environment • Carries on without realising something has happened (e.g. missing calls, missing cues) • Becomes fixated on task distractions

Comprehending informational elements – Recognising the significance and meaning behind cues perceived to form a mental picture.

Positive behavioural markers	Negative behavioural markers
• Recognises what information gained from environment means • Acknowledges and seeks to share what has been comprehended / changed in environment, prior to action • Reacts appropriately to potential risks associated with comprehension of environment	• Demonstrates a misunderstanding of what information gained from environment means • Acts based on a comprehended / change in environment but fails to share comprehension with other pilot • Continues with typical actions despite demonstrating an acknowledgement of risk in environment

Anticipating future states – Projecting understanding of situation in order to predict future events.

Positive behavioural markers	Negative behavioural markers
• Plans for contingencies based upon comprehension of situation • Reacts in a manner suggesting preparedness for other pilot's actions and changes in environment (e.g. remains calm / communicates call backs) • Prioritises primary tasks before taking secondary actions	• Proceeds with action without engaging in contingency planning • Demonstrates a surprised response (e.g. distressed communication / sudden reflex) to other pilot's actions or change in environment • Fails to recognise a change in priority by continuing with secondary actions

Decision-making: Weighing up and selecting approach to task in consideration of relative risk and confirming input of, and acceptance by the other pilot.

Identifying and selecting options – Weighing up multiple options and settling on appropriate option.

Positive behavioural markers	Negative behavioural markers
• Considers appropriate response to situation and alternative solutions • Discounts inappropriate options • Demonstrates appropriate response to mitigate risk • Seeks to contribute to decision-making with other pilot • Ensures agreement on appropriate course of action	• Moves forward with task before considering additional options • Selects or fails to recognise inappropriate options • Proceeds with potentially risky course of action (e.g. heading into poor weather) • Shows reluctance to contribute to group decision-making • Proceeds without agreement of other pilot

Reviewing course of action – Revisiting and assessing the outcomes of the decision made

Positive behavioural markers	Negative behavioural markers
• Confirms with other pilot what has happened and whether it has met decision goal • Identifies if anything has been missed by selecting option • Decides on further action if necessary	• Shows unwillingness to revisit decision • Does not communicate what has happened based on decision • Continues without assessment of further action

Part 3: Use of the HeliNOTS rating scale

The HeliNOTS rating scale may be used at both the elemental and categorical levels, though it is recommended the user starts by grading elements before proceeding to assign a category score. For the purposes of assessment, pilots should be evaluated in a simulated flight environment. Before making ratings, it is suggested that notes be taken on observed behaviours and any on omissions of behaviours that should have been observed, thereby reducing the possibility of missing key behaviours. All skill elements and categories should be scored using the same five-point rating scale described in Table 2. This five-point scale design was chosen in consultation with subject matter experts (CRM trainers / examiners).

The HeliNOTS (O) rating form is provided in the rear of this handbook.

Table 2. HeliNOTS System Rating Scale

Rating	Description
5 – Very good	Behaviour optimally enhances flight safety; no areas of improvements can be identified
4 - Good	Behaviour is of high standard and enhances flight safety
3 - Acceptable	Behaviour does not endanger flight safety but could be improved
2 – Marginal	Behaviour indicates cause for concern and could, in other conditions, endanger flight safety
1 – Poor / sub-standard	Behaviour was unacceptable and directly endangered flight safety; remedial action is required
N/A – Not Applicable	Skill / element was not required in this case

Ratings should only be made on observed behaviours to achieve a grade of 2 (marginal) – 5 (very good). A grade of 1 (poor / substandard) can be given based upon the observation of unacceptable behaviours or the absence of behaviours that were required.

It is important to note that not all skill elements are required or appropriate in any given scenario, therefore the rating of N/A should be made in such circumstances - this judgement is to be made by the HeliNOTS user.

HeliNOTS (O) v1.0 Rating Form

Location..... Trainer name..... Date.....

Pilot name..... Aircraft type .....

Category	Category rating	Element	Element rating	Feedback on performance / debriefing notes
Communication		Exchanging information		
		Giving instructions		
		Providing feedback		
Leadership and Teamwork		Guiding task behaviours		
		Monitoring other crew members		
		Sharing task activities		
		Setting and maintaining crew atmosphere		
Workload Management		Following procedure		
		Coping with pressure		
		Prioritising duties		
Situation Awareness		Gathering information		
		Comprehending informational elements		
		Anticipating future states		
Decision-making		Identifying and selecting options		
		Reviewing course of action		

1 – Poor / sub-standard Behaviour was unacceptable and directly endangered flight safety; remedial action is required
2 – Marginal Behaviour indicates cause for concern and could, in other conditions, endanger flight safety
3 – Acceptable Behaviour does not endanger flight safety but could be improved
4 – Good Behaviour is of high standard and enhances flight safety
5 – Very good Behaviour optimally enhances flight safety; no areas of improvements can be identified
N/A – Not applicable Skill / element was not required in this case

O.Hamlet, A.Irwin, & R.Flin, University of Aberdeen, 2020

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