Non-Technical Skills

Rhona Flin
Aberdeen Business School, RGU
School of Psychology, Aberdeen University
SFRM Behavior Elements

The goal of the SFRM program is to reduce human errors in Space Flight Operations.

Space Flight Resource Management

**Situation Awareness:**
The capability to identify, process, and comprehend the critical information regarding what is happening with the team and situation with regards to mission success. Simply put, sensing what is going on around you (including identifying disconfirming info and predicting effects).

**Conflict Management:**
The ways individuals and teams identify and manage differences in opinion, perception, technical knowledge, personality, etc. to complete a task or mission.

**Leadership:**
Directing a team or individual toward a common goal, developing and motivating team members as appropriate to tasks.

**Followership:**
Following the leader’s direction, while assessing individual and team behavior elements and providing input to best support the leader to reach the common goal.

**Communications:**
To express oneself in such a way that one is readily and clearly understood. This is accomplished by active listening and allowing for non-verbal actions.

**Cross-Cultural:**
Considering the effects of various cultures (nationalities, professions, heritage) on the workplace and people’s actions.

**Teamwork:**
How individuals cooperate with each other to achieve a shared goal, including accepting accountability and responsibility for actions.

**Decision Making:**
The cognitive process leading to selecting a course of action, including an assessment of options and risks.

**Team Care:**
How healthy the person or team is on a psychological level. This can be influenced by various personal factors such as: stress, fatigue, boredom, training, sickness, etc.
Non-technical skills

• Formally trained and assessed in aviation, nuclear and other industries
• Cognitive and social skills to reduce error/ enhance safety
  – e.g. decision making, situation awareness, team coordination, leadership
• Behaviour rating systems eg NOTECHS for pilots
• These have now been introduced for anaesthetists (ANTS), surgeons (NOTSS), scrub (SPLINTS) and anaesthetic practitioners (ANTS-AP), emergency physicians etc.

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Influential Accidents for CRM/NTS

Tenerife, 1977
Two Boeing 747s (Pan Am; KLM) crashed on the runway
- 583 killed

Causes: conflict resolution, assertiveness, communication, situation awareness, stress
i.e. non-technical skills

Kegworth, England 1989
47 killed
The pilots mistakenly shut the working engine when the other was on fire. This was such a strong demonstration that human error and teamwork failures were contributing to fatal accidents, that the UK CAA took the view that CRM (non-technical skills) training had to be introduced.
Pilots’ Non-Technical Skills

• Term non-technical skills first used in European civil aviation (1990s).

Non-technical skills are the cognitive and social skills that complement technical skills, and contribute to safe and efficient task performance.

Aka: Crew Resource Management (CRM) skills

Formally trained and assessed in aviation and nuclear industries
Identifying Pilots’ Non-Technical Skills

• Task analysis from 1979
  – Flight deck or simulator observations
  – Interviews with pilots
  – Surveys of pilots’ attitudes, experiences
  – Confidential safety reporting systems
  – Accident analysis, especially analysis of cockpit voice recorder
Air France AF447

Crash into Atlantic

2009

Autopilot disconnection warning sounds.

One of the plane's externally-mounted sensors has iced over, which automatically turns off the auto-pilot.

BONIN:
I have the controls.

ROBERT:
Alright.

Bonin inexplicably pulls back on the stick, causing the plane to climb. The report issued Thursday by the Bureau d’Enquêtes et d’Analyses said Bonin’s attitude in the minutes leading up to the autopilot being disengaged added to their highly-charged emotional reactions. "Three seconds after the autopilot disconnection, surprise was a pilot's natural reaction," the report read.

BONIN:
Ignition start.

SYNTHETIC VOICE
Stall, Stall.

ROBERT:
What is that?

BONIN:
We haven’t got a good... We haven’t got a good display of speed.

ROBERT:
We’ve lost the, the, the speeds so... engine thrust ATHR engine lever thrust... Alternate law protections (low)... Wait we’re losing... wing anti-ice... Watch your speed.

BONIN:
Air Florida Flight 90

• Crashed in 1982 killing 70 passengers and 4 crew members.

• Before take-off the captain and first officer discussed snow and ice accumulation on the wings but continued to begin take-off procedures.

• During take-off the first officer spots a problem with the instrumentation:

  First Officer: “Ah, that’s not right”  
  Captain: “Yes, it is, there’s eighty”  
  First Officer: “Nah, I don’t think it’s right. Ah, maybe it is.”  
  Captain: “Hundred and twenty”  
  First Officer: “I don’t know”.
• The following scenario was given to captains and first officers:

You notice on the weather radar an area of heavy precipitation 25 miles ahead. The pilot is maintaining his present position even though thunderstorms have been reported in the area and you encounter severe turbulence. You want to ensure that the aircraft doesn’t penetrate the area.

What do you say to the pilot flying?

• Captains would issue a direct statement: “Turn 30 degrees right”

• First officers would hint: “That return at 25 miles looks mean”

The NOTECHS (pilots) framework

Non-technical skills

Co-operation

Team building & maintaining

Leadership & management skills

Considering others

Situation awareness

Supporting others

Decision making

Conflict solving

Category

Element

Behaviour

Helps other crew members in demanding situations

Offers assistance


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Closing the NTS Loop

- Behaviour/Safety Problem
- Task Analysis/Accid. analys
- Identify NTS & conditions
AF447 crash - Startle Effects

- Distinction: startle/surprise with fast recovery and startle with associated fear response
- High emotional component from fear disrupts cognition
- Ongoing research into this topic applied to pilots
- Martin, W. - Virgin Australia 777 pilot/CRM instructor. PhD Griffiths University ‘Pathological Behaviours in Pilots During Unexpected Critical Events: The Effects of Startle, Freeze and Denial on Situation Outcome’
- Latest EASA guidance (2015) on CRM – has to include startle effects
Closing the NTS Loop (aviation)

Monitor
Evaluate

Behaviour/
Safety Problem

CRM/NTS
training

Task Analysis
Accid. analy

Identify NTS &
conditions
Closing the NTS Loop

- Task Analysis
  - Accid. analy
- Monitor Evaluate
- CRM/ NTS training
- Behaviour/ Safety Problem
- Identify NTS & conditions
  - #PPFE16
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Why focus on non-technical skills in OR?

• Good non-technical skills can lead to positive outcomes for the team and patient
  – Edmondson (2003) – effective leadership
  – Moorthy et al (2005) – team skills in operating theatre simulator

• Adverse events in surgery are primarily caused by failures in perception, judgement, communication and teamwork
NTS development method (SPLINTS)

Task analysis (2008-2009)
- Literature, survey, observations, interviews: nurses and surgeons
- List of skills emerged

Taxonomy design and development (2010)
- Skills sorted by panels of nurses
- Taxonomy and behavior markers written

Evaluation (2011)
- Reliability - using video scenarios (n= nurses)
- Usability testing in theatre

Implementation (2012 - )
- SPLINTS debriefing in theatre and theatre simulators
- Develop SPLINTS curriculum
Non-Technical Skills for Anaesthetists (ANTS)

Flin, Fletcher, Glavin, Maran, Patey

British Journal of Anaesthesia (2003; 2004; 2010)

www.abdn.ac.uk/iprc/ants
Non-Technical Skills for Surgeons (NOTSS)

Flin, Yule, Maran, Paterson-Brown, Rowley, Youngson


www.abdn.ac.uk/iprc/notss
## Non-Technical Skills for Surgeons (NOTSS)

<table>
<thead>
<tr>
<th>Categories</th>
<th>Elements</th>
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<tbody>
<tr>
<td>Situation Awareness</td>
<td>Gathering information, Understanding information, Projecting and anticipating future state</td>
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<tr>
<td>Decision Making</td>
<td>Considering options, Selecting and communicating option, Implementing and reviewing decisions</td>
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<tr>
<td>Communication and Teamwork</td>
<td>Exchanging information, Establishing a shared understanding, Co-ordinating team</td>
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<tr>
<td>Leadership</td>
<td>Setting and maintaining standards, Coping with pressure, Supporting others</td>
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Situation Awareness: Developing and maintaining a dynamic awareness of the situation in theatre based on assembling data from the environment (patient, team, time, displays, equipment); understanding what they mean, and thinking ahead about what may happen next.

Gathering information — Seeking information in the operating theatre from the operative findings, theatre environment, equipment, and people.

**Good behaviours:**
- Carries out pre-operative checks of patient notes, including investigations and consent
- Ensures that all relevant investigations (e.g. imaging) have been reviewed and are available
- Liaises with anaesthetist regarding anaesthetic plan for patient
- Optimises operating conditions before starting e.g. moves table, lights, AV equipment
- Identifies anatomy/pathology clearly
- Monitors ongoing blood loss
- Asks anaesthetist for update

**Poor behaviours:**
- Arrives in theatre late or has to be repeatedly called
- Does not ask for results until the last minute or not at all
- Does not consider the views of operating room staff
- Fails to listen to anaesthetist
- Fails to review information collected by team
- Asks for information to be read from patient notes during procedure because has not been read before operation started
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* 1 Poor; 2 Marginal; 3 Acceptable; 4 Good; N/A Not Applicable

1 Poor: Performance endangered or potentially endangered patient safety, serious remediation is required
2 Marginal: Performance indicated cause for concern, considerable improvement is needed
3 Acceptable: Performance was of a satisfactory standard but could be improved
4 Good: Performance was of a consistently high standard, enhancing patient safety; it could be used as a positive example for others
N/A: Not Applicable
Implementation

College of Surgeons Edinburgh
NOTSS Masterclass: 2 days theory/practice

Australia, Hong Kong, USA, Denmark, Oman
NOTSS training courses

Controlled trial of NOTSS in Japan

“NOTSS in a box” online training for UK ISCP trainers

Feedback in theatre/ simulator, self- reflection, incident investigation, Morbidity and Mortality analysis
Scrub Practitioners (SPLINTS)

- Non-technical skills for scrub nurses/ODPs SPLINTS

- www.abdn.ac.uk/iprc/splints

ANTS-AP
for anaesthetic nurses/ ODPs
Rutherford, Flin, Irwin et al
(2012;2013) BJ
(2015) Anaesthesia; JPP
www.abdn.ac.uk/iprc/ants-ap
Is the culture toxic for safer behaviours/NTS?

Unit culture

Worker behaviour
Culture for beginners

• Start to establish safe behaviours/culture at the undergraduate level
  – by teaching about patient safety, human factors, non-technical skills and using simulation
  – by modelling behaviours that should be copied
Further reading on NTS

Flin, Youngson & Yule (Eds) (2015)
CRC Press

Flin & Mitchell (Eds) (2009)
Ashgate

Flin, O’Connor & Crichton (2008)
Ashgate
Further information

Further information   r.flin@abdn.ac.uk

- www.abdn.ac.uk/ANTS
- www.abdn.ac.uk/ANTS-AP
- www.abdn.ac.uk/NOTSS
- www.abdn.ac.uk/SPLINTS