



Method

- Semi-structured, face to face interviews
 - Regulators
 - CAA
 - HSE Nuclear Installations Inspectorate
 - HSE Offshore Safety Division
 - Industry
 - Two air operators
 - Two oil companies
 - One nuclear power company



Interview topics

- Identify target group
- Relevant legislation
- Role of the regulator
- Licence checks
- Standards of competence
- Competence assurance systems
- Other performance scrutiny mechanisms/
safety monitoring systems



Civil aviation

- Well established, accepted system
(ICAO 1944)
- Annual licence check by CAA approved examiner
- Six monthly Operational Proficiency Check
- Assesses technical and non-technical skills
- Type Rating Examiners have to be qualified as Type Rating Instructors and as TRIs for Crew Resource Management (non-tech skills)
- TREs are assessed and revalidated every 3 years by RETREs



Nuclear Power



- Sites are licensed
- Unit Desk Engineers (control room operators), CR Supervisors, Shift Charge Engineers
- ‘Duly Authorised Persons’
- Standards of competence
- Two yearly simulator assessment (tech and non-technical skills) plus interview
- Company appraisal system



Offshore Oil



- Safety case legislation for installations
- Companies’ competence assurance systems e.g. for offshore managers
- Defined standards
- Three year assessment of emergency response skills - qualified assessors
- Six monthly appraisal
- Monthly performance reviews/ targets
- Non-technical skills now being introduced



Transfer caveats: industry/ healthcare

High risk industries have:

- Specific organisational cultures
- Strong management hierarchies
- Risk consequences for workers
- Size of target population
 - Much larger in healthcare
- Standard operating procedures




General principles: higher risk industries

- Independent Regulators
- Regular, confirmatory proficiency checks
 - not a default to positive
- Standards of competence
- Trained, accredited assessors
- Non-technical skills
- Management of failure
- Use of simulators
- Physical health checks
- Link competence assurance to safety

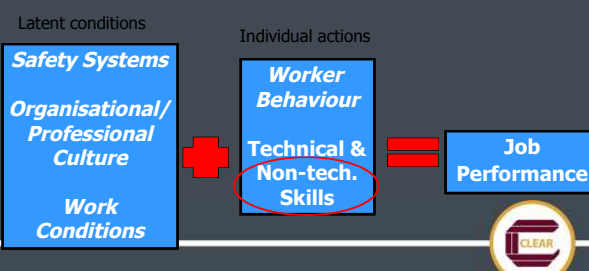


Focus on non-technical skills

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



Safe, Efficient Job Performance



Latent conditions

Individual actions

Safety Systems


Organisational/ Professional Culture

Work Conditions


Worker Behaviour

Technical & Non-tech. Skills

Job Performance




Influential Accidents for CRM/NTS




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

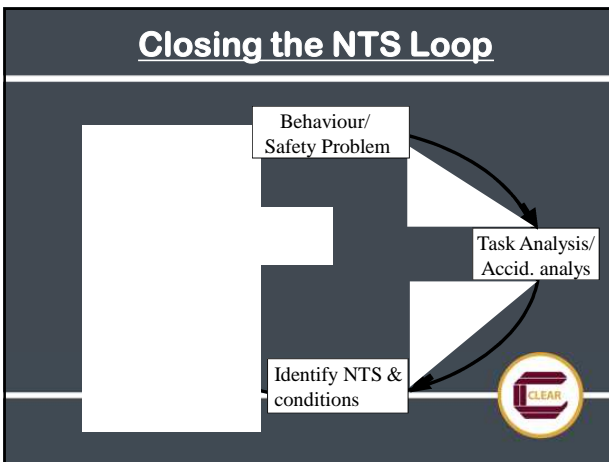
Causes: conflict resolution, assertiveness, communication situation awareness, stress
i.e. non-technical skills

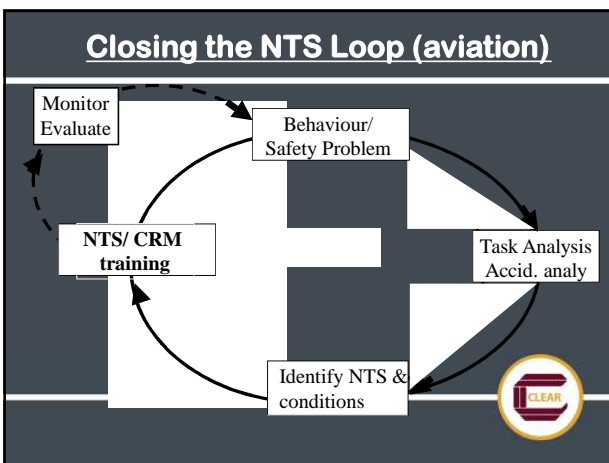


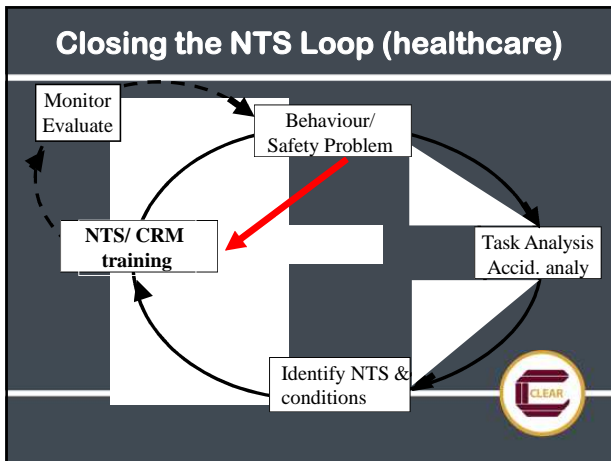
Kegworth, England 1989
47 killed

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











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.

BONNE:
I have the controls.

ROBERT:
Alright.

Bonne inexplicably pulls back on the stick, causing the plane to climb. The report issued Thursday by the Bureau d'Enquêtes et d'Analyses said Bonne'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.

BONNE:
Ignition start.

SYNTHETIC VOICE:
Stall. Stall.

ROBERT:
What is that?



BONNE:
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 ATIR engine lever thrust... Alternate law protections (low)... Wat we're losing... wing anti-ice... Watch your speed.

BONNE:



**A 'Black Box' for clinical units?
What would be on your voice recorder?**

“ ”
“ ”



Voice recorder for your clinical area?

“My way is much quicker....”
“Did she say four..?”
“No-one follows that procedure...”
“I’ve done this hundreds of times..”
“We need to get this case done...”
“I knew that was going to happen...”



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


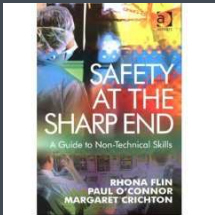
Formally trained and assessed in aviation and nuclear industries



Non-Technical/ CRM Skills


- Situation Awareness
- Decision Making
- Leadership
- Team Work

- Communication
- Managing stress and fatigue



Crew Resource Management (NTS)

- Based and updated on human factors research identifying behaviours (NTS) critical for safe performance
- 2-3 days basic training (lectures, videos, role-plays, etc.) plus annual recurrent training mandated by CAA (UK)
- Skills practised with feedback in simulator (LOFT)
- Regular formal assessment of non-technical skills for UK pilots mandated by CAA (2004)
- NTS Trainers/ examiners must be assessed as competent



Pilots' Non-Technical Skills

NOTECHS system (1998)


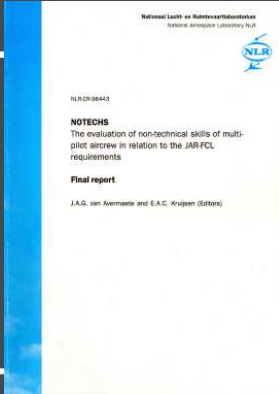
Pan-European

Behaviour rating method to assess a pilot's non-technical (CRM) skills.


Recommended by JAA/ CAA

Adopted by some airlines, adapted by others.

Flin et al (2003) *Human Factors & Aerospace Safety*, 3, 95-117



Relevance for the operating theatre?



I am giving the safety briefing!


Relevance to OR?

Research has shown adverse events in surgery primarily caused by failures of teamwork, judgement:

- Gawande et al (2003; 2004) – insurance claims in the US
- Sevdalis et al (2007) – interruptions in theatre
- Way et al (2003) – 97% of bile duct injuries had perception failures
- Wilson et al (1999) Communication breakdown in 43% of surgical errors

Positive outcomes for the team and patient through good non-technical skills

- Edmondson (2003) – effective leadership
- Healey et al (2004) – observing teamwork in surgery




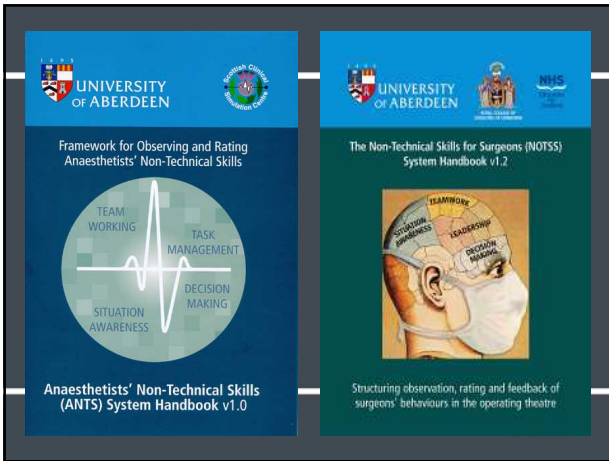
Yule, et al., (2006). Non-technical skills for surgeons: a review of the literature. *Surgery*, 139, 140-149

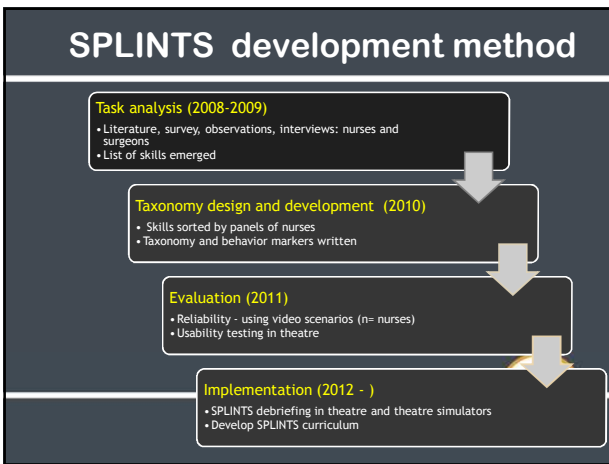
Non-technical skills for doctors in OR

“The cognitive, social and personal resource skills that complement technical skills and contribute to safe and efficient task performance”

- Communication
- Teamwork
- Leadership
- Situation awareness
- Decision making
- Managing stress and fatigue








Method – task analysis

- Review of literature n=13 papers
- Observations n=24;
- Interview: nurses n=25; 3 hospitals mean experience 15yr; SD 9.38; range 2-33yr consultant surgeons n=9; 4 hospitals

Mitchell, L. & Flin, R. (2008) *Journal of Advanced Nursing*, 63, 

Nurses' interview data

"You just know when something is going wrong, it's either... you can physically see that something's happened but sometimes you can't see. You can just recognise the surgeon's body language or see them clenching their jaw .. that things are not going well."

"...when they [surgeons] ask for something and you give them what you think it is that they need and it's not the thing they said but you know it is what they actually want."

"The surgeon said "give me the buzzy thing.."

Surgeons' interview data

- if I'm really concentrating hard on a task I'll forget the names of instruments I use every day
- a lot of what you need arrives in your hand without you actually having got as far as asking for it, it's almost telepathy, it's smooth, it runs
- they [scrub nurses] need to have the ability to be quite focused on the procedure and not be distracted by what else is going on

Coding Interview Transcripts

How do you keep track of the status of an operation?
You know by the surgeon's voice, by his actions. Just by what he asks for, you know if he's come upon things he's not expecting(1). You have a procedure you follow and there are certain things you expect to happen(2) so you just go on and you go on and then when something isn't right, you know it isn't right because, if you can't see, which often you can't, he'll ask for something you're not expecting(3). At that point he usually says something to his assistant or to the anaesthetist(4) so you just gauge it. Or perhaps it's the anaesthetist who has recognised something on the monitor, and you can hear it sometimes, different to the way it should be(5). It depends on the experience of the surgeon too, because if you have an inexperienced surgeon when things like that change they'll maybe get a bit hot under the collar and you've got to be the one to keep it calm(6). The junior surgeons do look to you(7), mostly although some of them can get a bit stropky in his voice and in his manner, those who want to remain in charge and you think, right, things aren't going to plan here. But most of them will say something like, "what do they normally use here?" or "what does Mr X use here?" so they look to you to tell them that(8). So, that's when you know that it's not going clockwork(9).

- Cognitive skills e.g. situation awareness, decision making
- Social/ Interpersonal skills e.g. communication, teamwork, leadership
- Task Management skills e.g. planning and preparation, prioritising
- Stress/Fatigue management skills

Emerging skill set...

Literature review
communication, teamwork, situation awareness
No leadership or decision making


Interviews (25 nurses, 9 consultant surgeons)
communication, teamwork, situation awareness, task management, coping with stress

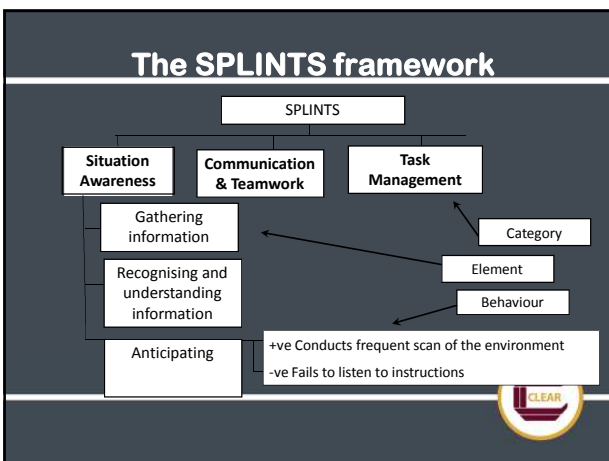
Less: leadership, decision making, managing fatigue



Developing the SPLINTS framework Mitchell, Flin et al (2013)

- Panels of experienced theatre nurses n=4; from 3 Scottish hospitals
- Reduced original list from 7 categories containing 27 elements to 3 categories with 9 elements
- Taxonomy guidelines followed;
 - observable behaviours
 - generic to all surgical specialities
 - simple structure; easy to use in theatre
- Provided labels/ examples of good and poor observable behaviours to describe those skills





SPLINTS taxonomy	
Category	Element
Situation Awareness	<ul style="list-style-type: none"> •Gathering information •Recognising and understanding •Anticipating
Teamwork and Communication	<ul style="list-style-type: none"> •Acting assertively •Exchanging information •Co-ordinating with others
Task Management	<ul style="list-style-type: none"> •Planning and preparing •Providing and maintaining standards •Coping with pressure

NON-TECHNICAL SKILLS FOR SURGEONS

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

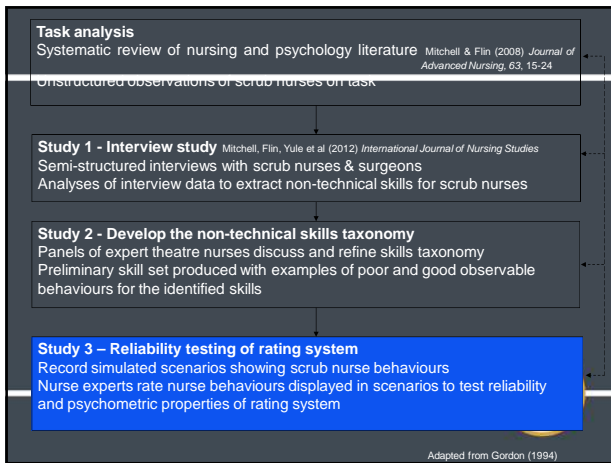
Poor behaviours:

- 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

SPLINTS rating form v1.0				
Hospital		Trainer Name		Date
		Junior Name		Operation
Category	Category rating*	Element	Element rating*	Feedback on performance and debriefing notes
Situation Awareness		Gathering information		
		Recognising and understanding information		
		Anticipating		
Communication and Teamwork		Acting assertively		
		Exchanging information		
		Co-ordinating with others		
Task Management		Planning and preparation		
		Providing and maintaining standards		
		Coping with pressure		

* 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



Testing the SPLINTS scale

- Record simulated scenarios to test prototype SPLINTS rating system

SPLINTS reliability Study 3 Method

Full day sessions; n=7
Scottish teaching hospitals; n=5
Experienced scrub practitioners; n=34

Basic human factors training including introduction to non-technical skills


Detailed input on SPLINTS taxonomy including definitions and behavioural markers to guide ratings of good and poor performance

**-Inter-rater agreement (r_{wg})
Element level**

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Mean
1. SA								
Element 1	0.7	0.75	0.53	0.88	0.85	0.46	0.67	0.69
Element 2	0.7	0.78	0.51	0.91	0.88	0.48	0.7	0.71
Element 3	0.69	0.8	0.64	1	1	0.41	0.59	0.73
2. C&TW								
Element 1	0.7	0.73	0.61	0.91	0.82	0.5	0.65	0.7
Element 2	0.66	0.75	0.6	0.88	0.84	0.58	0.69	0.71
Element 3	0.72	0.76	0.51	0.91	0.86	0.46	0.65	0.7
3. TM								
Element 1	0.64	0.79	0.53	0.91	0.91	0.49	0.6	0.7
Element 2	0.64	0.74	0.55	0.85	0.83	0.51	0.5	0.66
Element 3	0.64	0.75	0.39	0.82	0.73	0.58	0.67	0.65
Scenario								
Mean	0.68	0.76	0.54	0.9	0.86	0.5	0.64	


Test results

- Acceptable ratings
- Better agreement at the category than element level
- Scenario differences
 - Nurses generally positive about the system
 - Need training to use system



JAN REVIEW PAPER
Non-technical skills of the operating theatre scrub nurse: literature review
Ann Bevilacqua, Rhona Flin

SPLINTS Papers



SPLINTS interest



www.abdn.ac.uk/iprc/splints

- Australia
- Canada
- China
- Denmark
- England
- Italy
- Japan
- Kenya
- Korea
- Majorca
- Norway
- Scotland
- Singapore
- Sweden
- Switzerland
- USA



Uses for SPLINTS


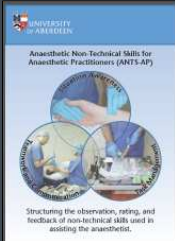
- Provides a common language/terminology for discussing non-technical skills/ issues
- Assist training and assessment of non-technical skills in junior scrub staff
- A structured framework to identify/ rectify ongoing training needs




ANTS-AP for anaesthetic nurses/ ODPS

Rutherford, Flin, Irwin et al
(2012;2013) *BJA*
(2015) *Anaesthesia*;


www.abdn.ac.uk/iprc/ants-ap




Non-technical skills for beginners



- Start to establish safe behaviours and a safety culture at the undergraduate level
 - by teaching about patient safety, human factors, non-technical skills
 - using simulation for demonstration, practice and reinforcement




Further reading on NTS



Flin, O'Connor & Crichton (2008),
Aldershot: Ashgate




Flin & Mitchell (Eds) (2009)
Farnham: Ashgate



Professional issues

- Ab initio education of NTS concepts
 - Cf *Human Performance Limitations for Pilots*
- Training NTS
 - Qualification of NTS trainers
 - Single discipline before multi-discipline?
- Competence assessment
 - Qualification of NTS assessors
 - Cf *CRM instructors/ examiners in aviation*



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Further information

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• www.abdn.ac.uk/iprc
lists of projects and papers and reports