Overview

• Introducing non-technical skills
• Crew Resource Management
• Input factors
• Non-technical skills in agriculture
• Tractor driver situation awareness

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Part 1

INTRODUCING NON-TECHNICAL SKILLS
HUMAN ERROR

Errors are a result of a combination of active failures and latent conditions.

Reason Swiss Cheese model

Reason: Human as hazard and hero

Workers can make mistakes, or violate procedures. They can also innovate and problem solve.

Error traps

Certain conditions are always likely to produce errors:
universal hazard, local error traps & drivers.

Dekker: Human error just the start

Identifying human error is not a question of apportioning blame, it is the start of an investigation to determine what led up to that error occurring.
PERSON VERSUS SYSTEM APPROACH

Person approach

• Focus on people at the ‘sharp end’
• View accidents as caused by carelessness, inattention, negligence.
• Actions: Disciplinary action, threat of litigation, writing additional procedures.

System approach

• Focus on systemic factors.
• Accidents caused by aspects such as high workload, time pressure and poor equipment.
• Actions: Examine how barriers have failed, implement training, ensure workers supported.
Human Error in Flight Operation

Distraction
A crew, distracted by a malfunctioning landing gear light, failed to notice that the automatic pilot had disengaged, resulting in a crash into a swamp.

Communication breakdown
Captain, co-pilot and air traffic control failed to communicate clearly about the aircraft fuel state (pilots failed to emphasise critical fuel level) leading to fuel exhaustion and a crash.

Failure to gather information
Crew failed to review instrument landing charts and navigation system, resulting in a crash into the mountainside.
Crew Resource Management

‘The effective utilisation of all available resources (for example, crew members, aircraft systems, supporting facilities and persons) to achieve safe and efficient operations’.

(Flin et al., 2003)
CRM & NTS DEVELOPMENT
(Helmreich, Merrick & Wilhelm, 1999)

**Aviation disasters**
1960s
Introduction of reliable jet aircraft introduced in 1950’s.
Accidents continued to occur, but with no obvious technical cause.

**NASA workshop**
1979
Identified human error aspects of crashes.
Coined term ‘Cockpit Resource Management’.
Highlighted importance of interpersonal skills.

**Aviation research**
1970s
NASA led research reported flight crew behaviours were major causal factor in 70% of aviation accidents.
Team based failures could lead to airworthy aircraft being crashed by technically proficient crews.
Programmes began to focus on team behaviours (communication, leadership, teamwork) of entire crew. Introduction of aviation specific concepts and modular system.

1989

Crew Resource Management

NOTECHs development

A multinational research group was developed to produce a methodology for effectively assessing pilot CRM skills. The result was the NOTECHS behavioral marker.

1990s

Regulations

CRM becomes mandatory for commercial airline pilots.
Training needs must be assessed and met.

1981

Cockpit Resource Management

Individual airlines begin to develop their own CRM training programmes – all focused on pilots.
Focused on individual behaviours.
Over the next decade the concept of non-technical skills became an important area of research in Healthcare. Several new behavioural markers were developed to assess these skills in surgeons, nurses and anaesthetists.

Non-technical skills in multiple industries

Non-technical skills have now been examined across a wide range of industries, including offshore drilling, nuclear power, rail and agriculture.

Non-technical skills

The social (teamwork, communication, leadership), cognitive (situation awareness, decision-making, cognitive readiness, task management) and personal management (stress and fatigue management) skills that, alongside technical knowledge, enable safe and effective work performance.
Social skills

- Co-ordination: Sharing a task among a team, working together to achieve goals.
- Support: Helping team members where required, monitoring other team members to identify potential issues.
- Conflict resolution: Managing disagreements, mediating disputes, reducing incivility

- Sharing information: Making sure everyone has the information they need to complete the task.
- Sharing status: Updating team members on progress, sharing information related to location and status.
- Handover: Communicating relevant information, including highlighting risks, to the next shift or team working on a task.

- Directing task: Allocating team roles and tasks, maintaining overview to ensure task completed.
- Training: Ensuring all team members have the training necessary for their role, arranging training to meet additional needs.
- Leading by example: Illustrating commitment to safety through task behaviours.
Cognitive skills

Situation awareness

- Perception: Awareness of surroundings, recognition of relevant information.
- Comprehension: Collate perceptual information to form a picture of what is going on and the meaning of various signals.
- Anticipation: looking forward to anticipate the consequences of actions and to recognize future problems.

Decision-making

- Identifying options: Assessing a situation to identify potential options and actions.
- Risk assessment: Ability to assess hazards in the workplace in order to identify potential dangers.
- Risk management: Selection of the safest course of action.

Task management

- Planning: Formulating a plan of action which encompasses any potential risks and hazards.
- Time management: Organising activities to meet deadlines.
- Maintaining standards: Ensuring a task is completed in line with standards and protocols.
Personal management

- **Stress management**
  - Recognition: Knowledge of the signs and symptoms of stress. Recognition of these symptoms in self and others.
  - Support: Seeking support where needed and providing support to others.
  - Management: Knowledge of stress management techniques including relaxation, recognition of the potential impact of stress on safety, enhanced work-life balance.

- **Fatigue management**
  - Recognition: Awareness of the causes and signs of fatigue at work.
  - Management: Engagement with practices to minimize fatigue.
  - Safety: Recognition of the adverse impact of fatigue on safety. Speak up about fatigue and remove self from work if necessary.
INPUT FACTORS (Helmreich & Foushee, 2019)

Individual
- Attitude
- Personality
- Knowledge
- Mood

Group
- Structure
- Norms
- Climate

Organizational
- Culture
- Norms
- Resources
- Procedures

Regulatory
- Regulations
- Training
- Evaluation
- Facilities

Environmental
- Condition of aircraft
- Equipment
- Weather
NTS Failures: Sumburgh

Incident
August 2013 Super Puma helicopter impacted the sea on approach to Sumburgh airport (Shetland Islands).
No technical faults.

Situation awareness
- Cockpit instruments were not monitored effectively.
- Low speed not recognised.
- Cloud cover prevented visual checks on approach.
- High workload may have distracted crew.

Decision-making
- Commander did not adjust approach to suit conditions: expected to see runway.
- Selected approach that required high workload, alternative was available.

Teamwork
- Pilots did not share mental model of ideal approach.
- Linked to ill-defined guidelines and lack of communication.
- Cockpit gradient: Co-pilot deferred to commander decisions without questioning them.
NTS Failures: Elaine Bromiley case

**Incident**
- 2005, Elaine Bromiley died during a routine operation.
- Elective nasal surgery
- Could not insert airway device during anaesthesia procedure.

**Communication**
- Nurses recognized gravity of situation and engaged in two key tasks: provided emergency tracheostomy kit and arranged ICU bed.
- Did not communicate effectively.
- Hierarchy prevented nurses from challenging surgical team.

**Situation awareness**
- Tunnel vision: Team became overly focused on inserting tube.
- Failed to realize length of time passing.
- Confirmation bias: Nurses expected surgeons to be in control of situation.

**Teamwork**
- No clear team leader.
- Staff engaged in unilateral tasks.
- Lack of co-ordination and lack of shared mental model of situation.
Part 2

NON-TECHNICAL SKILLS IN AGRICULTURE
What We Do

Our Research
Applied Psychology and Human Factors approach to safety: Why do people behave the way they do?

Our Goal
Produce relevant research that provides insight into the utilization on non-technical skills in different industries: aviation, farming, healthcare

Our Mission
Use our research findings to produce educational materials and design interventions to improve safety
Why farmers?

Fatalities & Hazards
• Most hazardous industry in the UK
• 39 fatalities in the last year
• Little change to fatality rate over past 10 years

NTS training
• No NTS training for farmers currently
• NTS training could improve safety

The research
• Identify NTS important to farming
• Develop tools for specific tasks
Our Research Projects

1. Interview study examining non-technical skill use in agriculture
2. Survey study examining predictors of non-technical skills in farmers
3. Scenario based study examining decision-making strategies when operating tractors
4. Scenario based study examining decision-making strategies when handling livestock
5. Survey study examining situation awareness requirements when operating tractors
Situation awareness

Driver awareness

• Environmental conditions, tactical tasks, navigation.

• Attentional resources are limited

Factors influencing SA

• Fatigue

• Distraction

• Stress

Tractors

• Approximately 20% of fatalities linked to vehicles

• Aim: Investigate SA requirements for safe operation
Project 5: Situation awareness in tractor driving

Research Questions
• Main SA requirements
• SA lapses
• Causal factors

Method
Qualitative survey
Open-ended questions about driving tractors, perceived risks and safety procedures

Results 1
Situation awareness requirements included: mental map of farm, vehicle status, task management

Results 2
Factors leading to lapses in situation awareness included: distraction, fatigue, stress, poor visibility
Support: Checklists

01 Research
Identify situation awareness requirements and lapses

02 Collaborate
Work with Lantra, Teagasc, Elizabeth Creed, IOSH and Women in Agriculture to design checklist

03 Usability test
50 copies of checklist and guide sent out to farmers

04 Edit and develop web-app
Checklist will be edited on basis of feedback. The online web version will then be developed.
Part 3

ILINCA’S RESEARCH: MANAGING LIVESTOCK