Managing the Grey

Resolving ambiguity in aviation


A CLOSE CALL
On July 7 at 11:56 p.m., an Air Canada plane almost landed on a taxiway with four planes lined up instead of the runway at SFO.
Taxiway C
Runway 28R
San Francisco International Airport
1 mile
101
101

Importance

- Review of NTSB accident reports identified a common pattern of the crew's decision to continue with their original plan in the face of ambiguous or dynamically changing conditions.[1]

- Four factors identified as contributors to these decision errors:
  - **Ambiguity of cues**
  - Risk underestimated
  - Goals conflicted
  - Consequences not anticipated (possibly due bias)

[1]Orasanu and Martin, 1998

Ambiguity

Description:

- Situations in which we are unclear about what the facts are or which facts are relevant

Causes:

- Incomplete information
- Contradictory information/cues
- Information overload

Shades of grey

- SA relies on perceiving cues in the environment and responding to them
- TEM relies on identifying threats and errors and managing them
- RM relies on identifying unknowns and managing the associated uncertainty
- These safety methodologies require clarity as to what is known and unknown
- **But how do we make effective decisions when the situation and threats are not yet clear to us?**

Premise

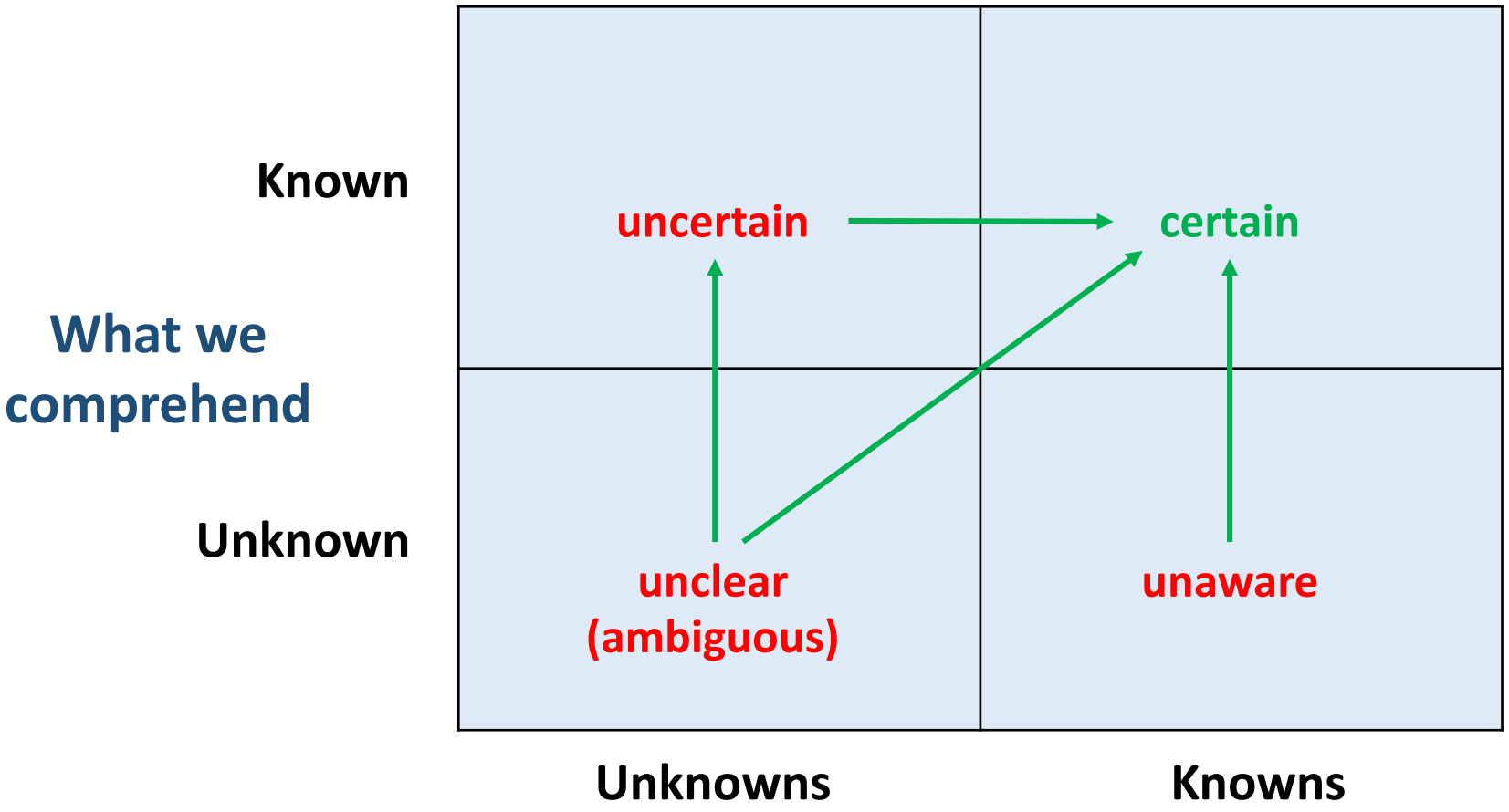
- We can ‘manage the grey’ by recognising the situation we are in (level of clarity) and applying the appropriate strategies to inform our decision-making

Concepts

What we comprehend	Unknowns	Knowns
Known	Things we are aware of but don't understand **uncertain**	Things we are aware of and understand **certain**
Unknown	Things we are neither aware of or nor understand **unclear (ambiguous)**	Things we understand but are not aware of **unaware**

What there is to know

Concepts


Known
What we comprehend
Unknown
uncertain
certain
unclear (ambiguous)
unaware
Unknowns
Knowns
What there is to know

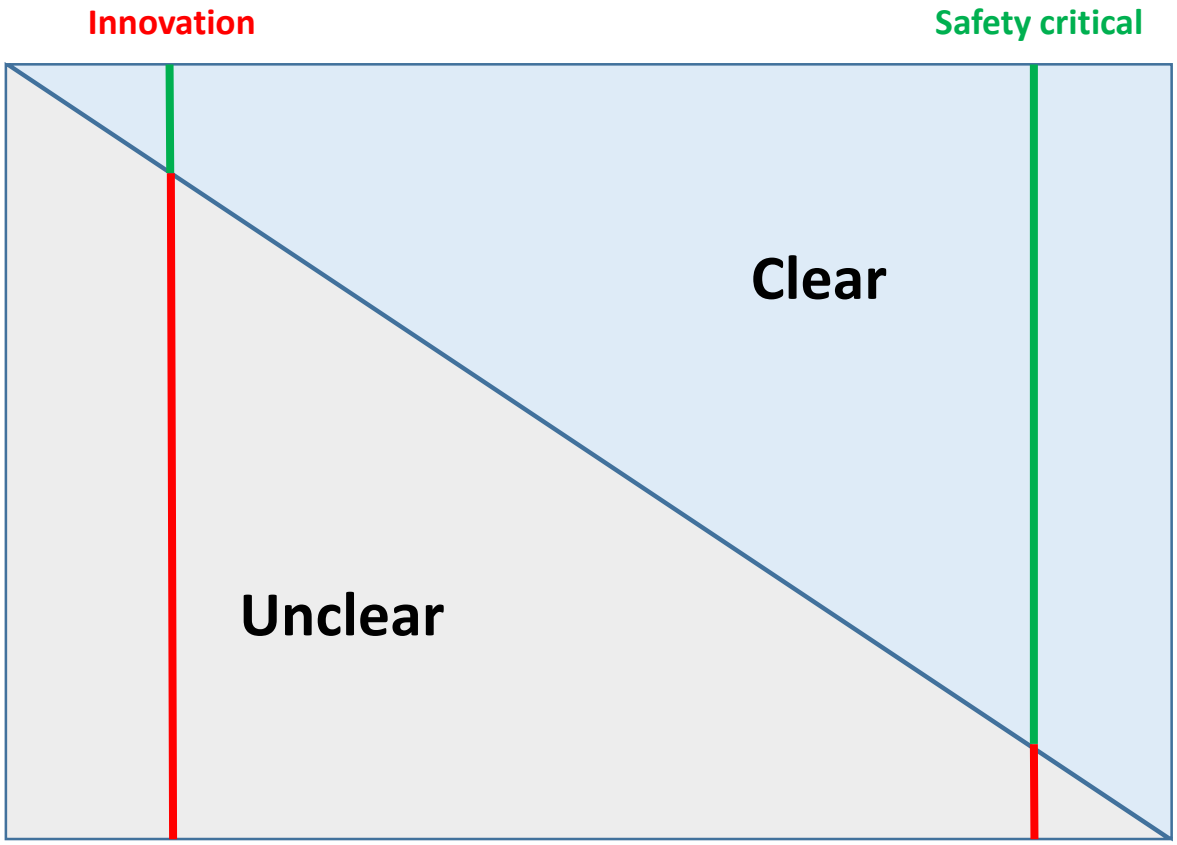
Indicators

- Vague/unclear statements
- Incomplete information
- Conflicting information/cues
- Can’t make sense of situation
- Non-standard (outside procedure)
- Probability of success unclear
- Context
- Signals/red flags
- Concern expressed
- Emotional response (e.g. unease)

Response

Category	Management strategies (recovery)
Resolve ambiguity • No unknowns	• Resource management • Seek/share information • Closed loop communication • Shared mental models
Reduce ambiguity • Less unknowns; greater clarity	• As above, plus: • Iterative and incremental processes
Achieve uncertainty • Known unknowns	• As above, plus: • Risk management
Accept ambiguity • Opportunity and risk	• Awareness • Test assumptions / trial and error • Check progress against objectives • Agility
Do not accept ambiguous situation • No ambiguity tolerance	• Cease activity • Choose conservative/known action

Assumptions



Low ← **consequence** → High

High ← **opportunity** → Low

Cognitive biases

- Ambiguity is a threat
- Ambiguity effect
- Decision paralysis (inaction)
- Plan continuation error
- Confirmation bias
- Expectation bias
- Attention tunnelling

System level - contributors

- Multiple participants
  - Conflicting goals / expectations
- Regulation
  - Performance based regulations
- Regulator ↔ Participant interactions
  - Different goals
  - Unclear expectations
  - Just culture
- Accident investigation
- Ambiguous threats
  - e.g. cyber security

System level – example 1

Volcanic ash

- ❑ **Iceland 2010**
- ❑ **Chile 2011**

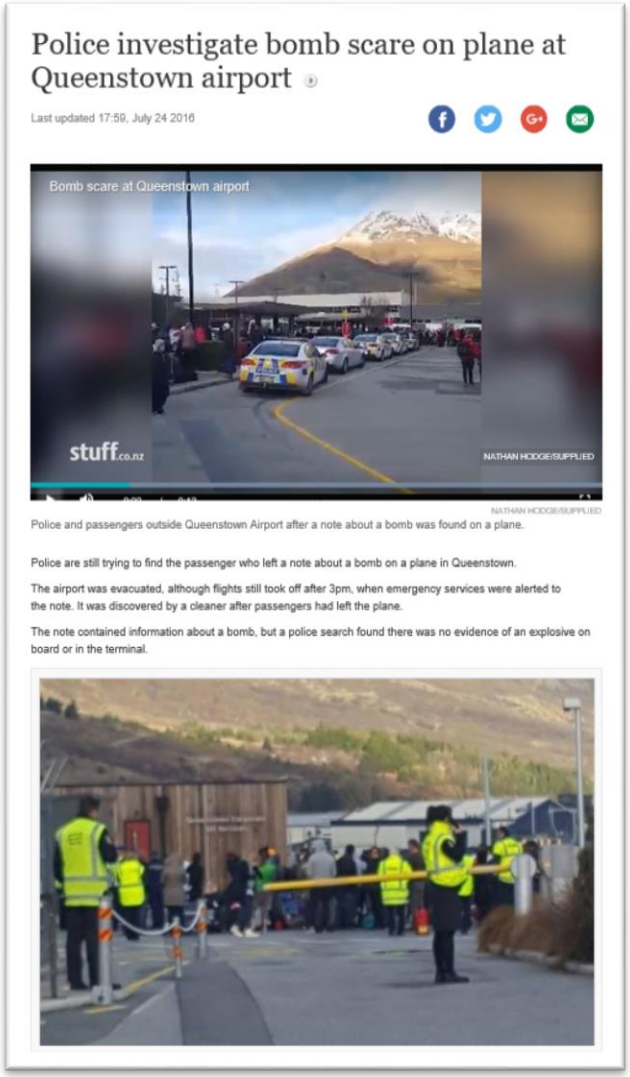
- Conflicting information regarding level of ‘tolerable’ ash
- Forecasting vs actual
- Operator risk assessment and controls quite different
- Regulatory capability

System level – example 2

SMS – risk management

- Operator risk acceptance
  - Participant vs. participant
  - Regulator vs. participant
- Criteria may not be well defined
- Risk assessment
- Effect of controls

System level – example 3



Police investigate bomb scare on plane at Queenstown airport

Last updated 17:59, July 24 2016

NATHAN HODGIE/SUPPLIED

Police and passengers outside Queenstown Airport after a note about a bomb was found on a plane.

Police are still trying to find the passenger who left a note about a bomb on a plane in Queenstown.

The airport was evacuated, although flights still took off after 3pm, when emergency services were alerted to the note. It was discovered by a cleaner after passengers had left the plane.

The note contained information about a bomb, but a police search found there was no evidence of an explosive on board or in the terminal.

Emergency response – bomb threat

- Individual response plans
  - Aerodrome operator
  - Airline
  - ATC
  - Police
  - Avsec
  - CAA
- Conflicting objectives/actions

System level - strategies

- **System:**
  - Information sharing
  - Coordinated decision making
  - International: compliance; recognition; harmonisation
- **Performance Based Regulation (PBR):**
  - Describe desired performance and what needs to be demonstrated
  - Industry and regulator common understanding
- **Regulator – participant interactions:**
  - Transparent
  - Acknowledge common/different goals

Just Culture

- **CAA Vector Magazine – May/June 2016**

Just Culture and Reporting

Many employers in aviation try to follow 'Just Culture' principles, and it is an issue often discussed. But how does the Civil Aviation Authority apply Just Culture principles? The Director, Graeme Harris, explains the regulator's approach and gives an assurance.

So what, exactly, are Just Culture principles in the view of the CAA?

"They recognise the difference between human error," says Director of Civil Aviation Graeme Harris, "at-risk behaviour, and recklessness, and treat them differently.

"If an incident has resulted from human error, it's pointless to punish the person involved. It's human to make mistakes, we all do it. So the CAA's approach is to support the person, learn from the information provided, improve the system if we can, and move on.

"A single at-risk action is up the line a bit from a pure mistake. But it's not unusual, for a range of reasons, for people to drift from compliance. The normal response to a single at-risk action is coaching, and examining the system that allowed that at-risk action to occur.

"Just Culture principles balance individual and system accountability."

The Director is frank about why he is talking about Just Culture at this time.

"We want to increase reporting. The recent risk profile of the Part 135 sector, Air Operations – Helicopters and Small Aeroplanes, has highlighted that a number of operators and pilots are not reporting occurrences because they're worried about the CAA's response to those reports."

The Director says when participants don't report, the results are two-fold, neither of them good.

"If someone fails to report an occurrence, everyone else in the industry is denied the benefit of learning from it, and acting on the lesson.

"For the CAA to build a picture of flying conditions, and where most risk lies, and to do something positive about that, we need to hear from those who deal every day with the coalface conditions of aviation in New Zealand.

"The second thing that happens as a result of non-reporting, is that it exposes those involved to increased risk of enforcement action if the CAA does learn about the event."

Graeme is aware there's an 'urban myth' behind much of the failure to self-report: that reporting an occurrence means the person involved will likely end up in court.

"The stats, however, don't bear that out. Over the last five years, the CAA has received about 32,500 reports and complaints, from the public, from industry, from CAA personnel. In that time there have been just 79 prosecutions.

"I don't believe there is any rational basis for a pilot, for instance, to worry about sanction if they report an incident they caused.

> *"If somebody fully, frankly, and in a timely fashion, reports their involvement in an incident, the CAA will apply Just Culture principles when it looks at what contributed to that event."*

"I cannot recall any prosecution taken over an incident during the last five years, where the CAA learned about it only through a report by the person involved.

"If anyone knows from personal experience of such a case, I invite them to email me."

To try to chip away at the urban myth, and improve reporting, Graeme is offering an assurance.

"If somebody fully, frankly, and in a timely fashion, reports their involvement in an incident, the CAA will apply Just Culture principles when it looks at what contributed to that event.

"We will not apply those principles, however, where there's no self-reporting and we learn about the incident from some other source."

Graeme says there's a good reason why self-reporting of incidents, and non-reporting, are treated so differently by the CAA.

"Frankly, it's carrot and stick. We want to improve the reporting we otherwise wouldn't be aware of. So we undertake to apply Just Culture principles only to self-reporting."

With regard to repeated at-risk actions, or recklessness, Graeme says everyone would understand why they might be more likely to attract a penalty.

There is also another type of occurrence where Just Culture principles may not apply – an accident where harm results.

Graeme illustrates why, using the following scenario.

"A car drives through a red traffic light due to human error. There's no conflicting traffic and the car proceeds safely on its way. A second driver does exactly the same thing, even again due to human error, but this time a van carrying the local pre-school group goes through the conflicting green light and is "T-boned" by the first car. The car driver survives but four toddlers are killed and a number seriously injured. You're the local road traffic safety authority and you learn about the two events. What action do you take with respect to each of the two drivers? Is it the same, or is it different?"

Graeme explains that in a pure Just Culture environment, the drivers would be treated the same. They would be consoled, and the traffic safety authority would look for system fixes to prevent a recurrence.

"But in countries like New Zealand, the legal framework doesn't support such an approach. There's a limit to which regulators can commit to ignoring the consequences, of an action, even one caused by human error.

"People dying or being seriously injured does drive regulator response. That's why whenever a regulator announces with fanfare that they are henceforth applying Just Culture in all their dealings, you really do need to look for the fine print.

"But I've tried to be clear and honest about the limited scope of Just Culture as applied to occurrence reporting, so there is no fine print for aviation participants to worry about." ■

The easiest way to report an occurrence is online, www.caa.govt.nz/report, or use the Hiwi and Now app.

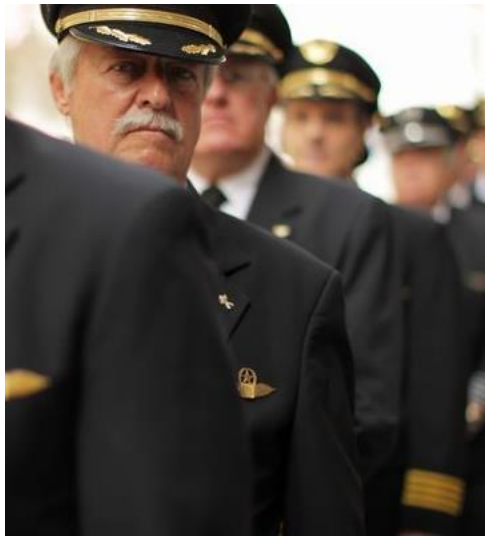
Look up Part 1 of the Civil Aviation Rules to read definitions of an accident, serious incident, and incident.

The *How to Report Occurrences* booklet is available free by emailing info@caa.govt.nz.

Management level - contributors

- Business
  - Competing goals – safety vs profitability
  - Geographical distribution
  - Hierarchical structures
- Threats
  - Change (technological)
  - Safety data
  - Weak signals
- Decision-making
  - Incomplete information
  - Qualitative risk management
  - Groupthink (social/emotional factors)

Management level – contributors (cont'd)



- Leadership
  - Unclear policies, SOPs
  - Drift
  - Actions in response to unsafe behaviours
- People
  - Cultural and status differences
  - Labour unrest
- Crew member
  - Performance
    - training vs line environment
    - rater reliability
  - Pilot wellness

Management level - example

Non routine flight operations

- Acceptance & post-maintenance flights

- Objective
- Roles
- Status of aircraft
- Threats/risks
- Airspace
- Weather
- Competency of crew
- Procedures
- Mindset / approach

Management level - strategies

- Culture
  - Management commitment
  - Reporting; communication
  - Learning; inquisitiveness
  - Foster constructive challenge
- Data
  - **(caution)**
  - Explore/amplify weak signals
  - Sharing; feedback
- Decision-making
  - Build effective teams
  - Collaborative problem id.
  - Collective ‘sense-making’

Management level – strategies (cont'd)

- Training
  - Evaluate effectiveness of CRM/HF programmes
  - Automation philosophy/policy
  - Realistic scenarios
    - Ambiguous cues
    - LOFT
  - Go-around decision-making
  - UPRT

- Mindset/approach
  - Navigate ambiguity
  - Vigilance
  - Resilient processes/people
  - Flexibility

Operational level - contributors

- Crew Member
  - Fitness to fly
  - Authority gradient
  - Cultural differences; language barriers
  - Differences in experience/training
- Pilot-ATC comms
  - Non-standard phraseology
  - Unusual clearances
    - Accounts for 11% of threats
- Technology
  - Autoflight mode
  - Information overload
- Operations
  - Runway condition reporting
  - Weather (e.g. turbulence)

Operational level – example 1

Pilot – Controller

Ambiguity inducing situations

- Weather avoidance/deviations
- Conditional clearances
- Declaring an emergency
- Go-arounds VMC
- Speed instructions
- Runway change
- Fuel state
- TCAS vs ATC commands

➢ Different interpretations
➢ Different expectations
➢ Failure of coordinated decision-making

Operational level – example 2

Pilot – cabin crew

- [occurrence report] “Taxiing for runway I heard what I thought was the cabin secure signal. I overturned the ‘Cabin Secure’ card, the Before Take-off Checklist was completed, and ATC clearance was received for an ‘immediate take-off’. Just prior to lining-up a single chime was heard in the flight deck which I answered. I thought the call was to confirm that we had heard the ‘double-ding’, whereas the CS was checking that we had heard the 3 chimes as there was an event taking place in the cabin. I realised that the cabin was not secure, but TO/GA had been pushed and take-off power was being set. The take-off was continued.”

Operational level - strategies

- Management
  - Operational control
  - Information management
- Crew
  - Resource management
  - Team SA; shared mental models
  - Briefings, regular updates
  - Advocacy, assertiveness, challenge
    - Defined escalation procedure
- Pilot-ATC
  - Standard phraseology
  - Read-backs, hear-backs
  - Familiarisation (other roles)

Crew decision-making

Naturalistic Decision Making (NDM)

1. Intended outcome
2. **Situation assessment**
   - **problem, risk, time**
3. Course of action selected
   - Recognition primed; rule based; multiple options

If problem not well defined:

- Procedural management
  - (e.g. follow emerg. process steps)
- Diagnosis
- Creative problem solving

Summary

- Recognise indicators of ambiguity
- Different strategies to manage:
  - Ambiguity
  - Lack of situational awareness
  - Uncertainty
- Employ practical steps to ‘manage the grey’ at system, management and operational level to enhance decision-making and **safety**


Thank you