CRM – What Is It For ?

Preventing Error Or Saving The Day ?

Dirk Maclean

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What is the purpose of CRM?

Much of our discussion centres on **how** to deliver CRM training, and how to improve this delivery

But this **assumes** we have a clear understanding of, and agreement over, its purpose

Do we ?

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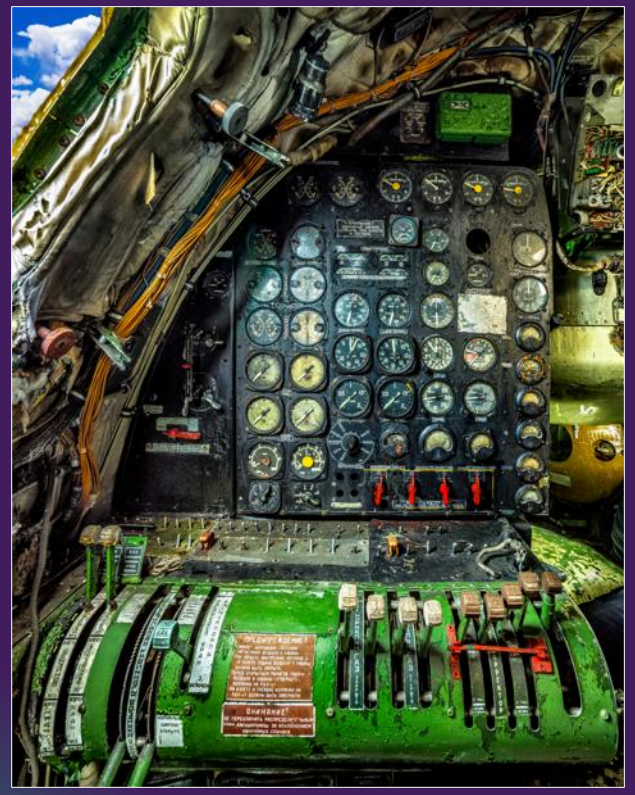
A contested space

Safety Management is not free of controversy

In fact, two very different approaches to safety currently exist and are locked into a struggle over how air operations should be run

Safety I

Safety II



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Are they really in conflict ?

In practice, most operators **combine** the two approaches to one extent or another. although Safety I is clearly dominant in ICAO and IATA thinking

So, are they really opposites ? Is there a need to **choose** between them ?

Yes

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The problem lies with Safety I

For while it is true Safety II **can** find a place for Safety I within its framework

Safety I can **not** do the same for Safety II

The dominance of Safety 1 thinking **squeezes** out Safety II, no room is allowed for thinking '**Safety Differently**'

Does this matter ?

Yes

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Different names

The contest between Safety I and Safety II goes under a number of different names

Safety Differently	Traditional safety
Resilience Engineering	Traditional safety
Mindful	Mindless
HROs	ICAO/IATA/IOSA Annexes
Human Element	Technology

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And what about CRM ?

Does the **same** division appear within the world of CRM ?

Yes

In two forms

1. The **generations** of CRM
2. **TEM** versus **NTS**

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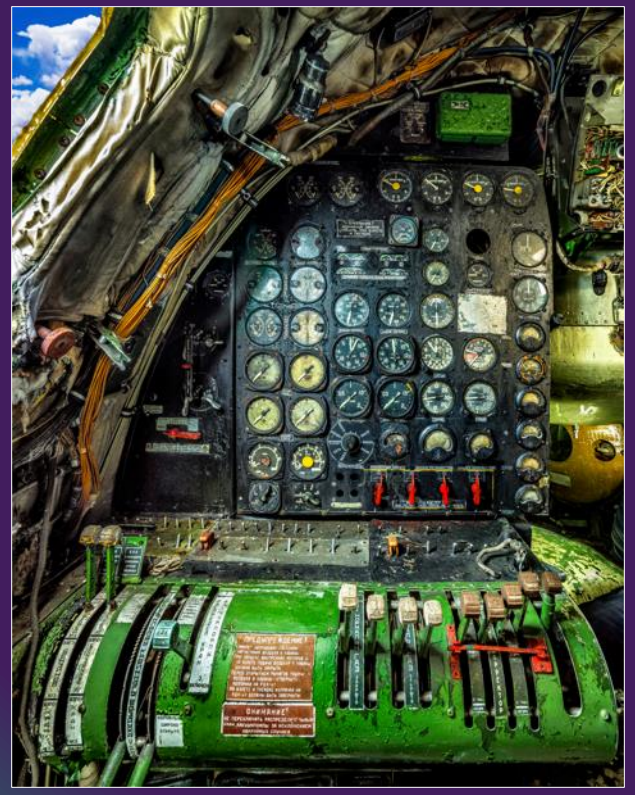
What is the difference ?

At its core, it revolves around to very different **conceptions** of safety

Safety is something we **have**

Safety is something we **do**



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Two opposite starting points

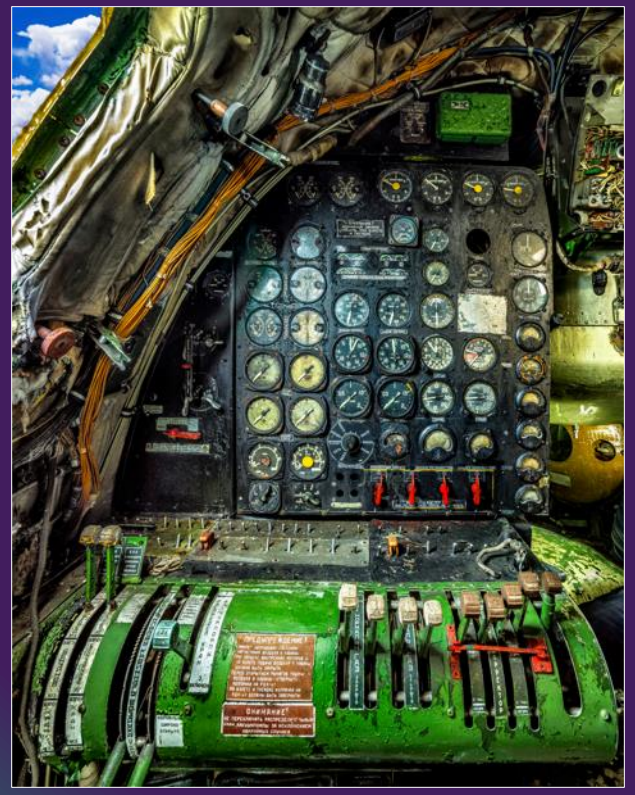
Aviation is **safe**

Safety management is about preserving our safety margin

Versus

Aviation is **not safe**

It only **becomes** safe when **we** make it so, every day, every time we fly



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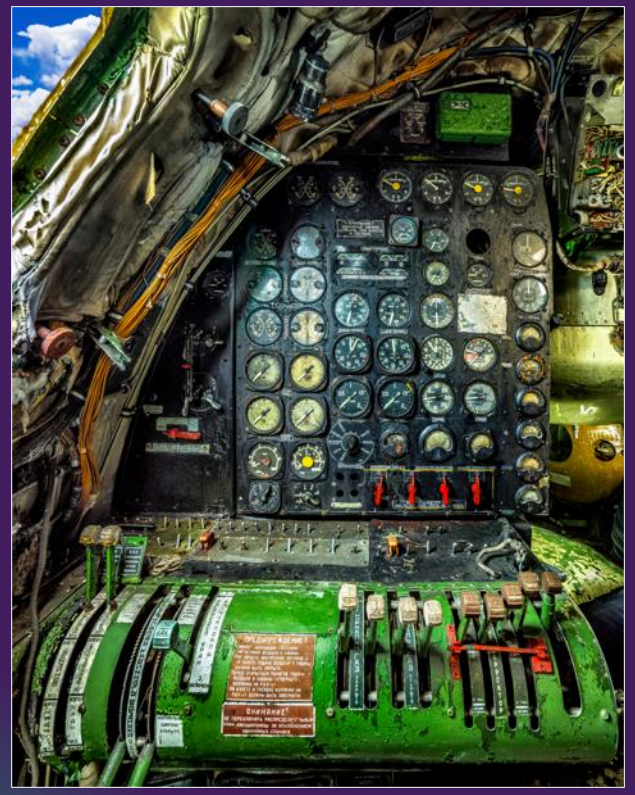
An emergency management perspective

This is why an **emergency** management or **military** background is helpful

In these contexts we know all too well, that even though we might do **everything** right, not make a **single** mistake…

We can still **lose**



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Failure is an option

The fire is just too **big**

The enemy is just too **strong**

Failure is always an option

This is the same mentality that drives High Reliability Organisations (**HROs**)

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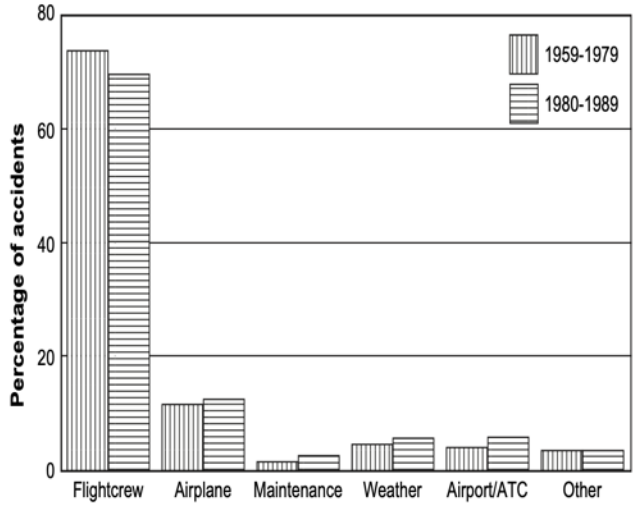
AVOIDING CATASTROPHE

What problem are we trying to fix ?

Is it this ?...

Figure 1.1 Primary causes of hull loss accidents (excluding military and sabotage): worldwide commercial jet fleet, 1959–1989. Data from Boeing Aircraft Company



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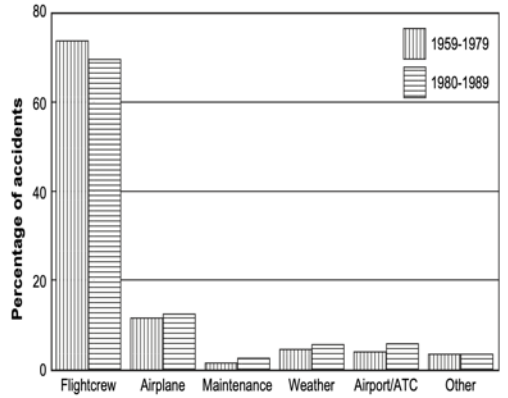
But is this the right metric ?

Not if we are interested in flight crew performance

Figure 1.1 Primary causes of hull loss accidents (excluding military and sabotage): worldwide commercial jet fleet, 1959–1989. Data from Boeing Aircraft Company



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What is the correct comparison ?

How many times did the actions taken by flight crew save the day ?

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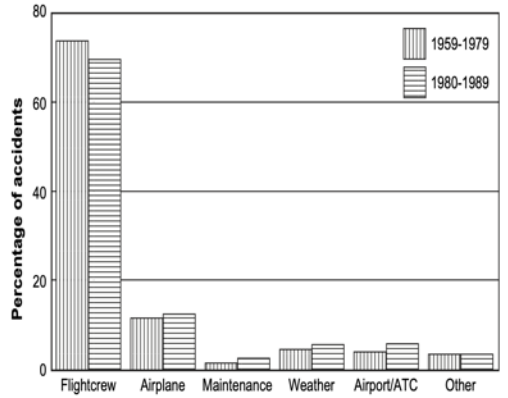

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What is the correct comparison ?

How many times did the actions taken by flight crew save the day ?

Do we have this information ?

Not to my knowledge

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Killing the Golden Goose ?

So how do we know whether efforts to minimise flight crew error are also reducing their ability to deal with emergencies and prevent these turning into accidents ?

We don't

But the signs indicate this to be a real concern

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Generations of CRM

CRM has gone through a number of generations, 5 or 6 depending how you count

That in itself is interesting

Why generations ? Why not simply an evolution over time ?

Does it perhaps reflect this underlying tension between two definitions of the problem we are trying to fix ?

Two understandings of what CRM is for ?

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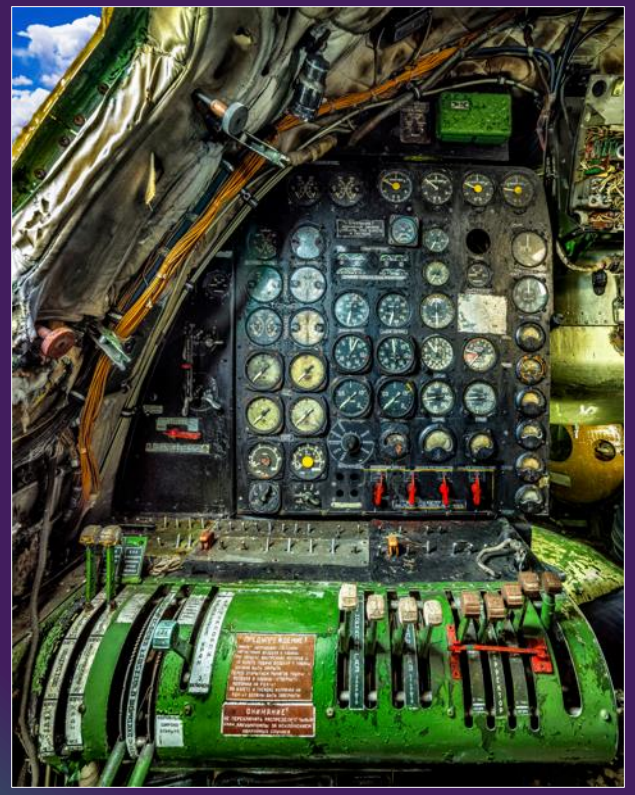
The pendulum swings back and forth

First generation CRM reflected one conception

Second and **third** generations swung the pendulum the other way

Fourth generation pulled it back again



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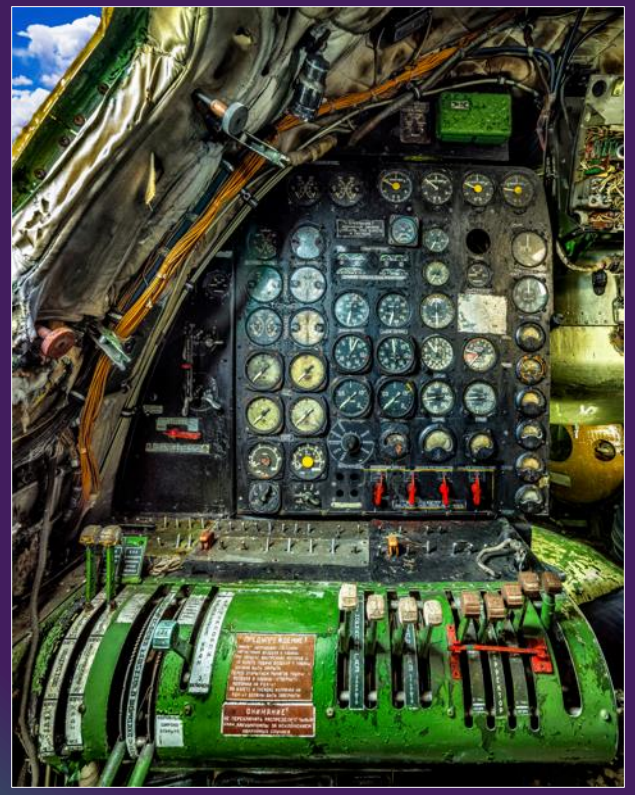
In the beginning…

"NASA research… identified the human error aspects of the majority of air crashes… CRM was applied to the process of training crews to reduce 'pilot error' by making use of the human resources on the flight deck"

Crew Resource Management : Critical Essays, edited by Eduardo Salas, et al., CRC Press LLC, 2009. p.21



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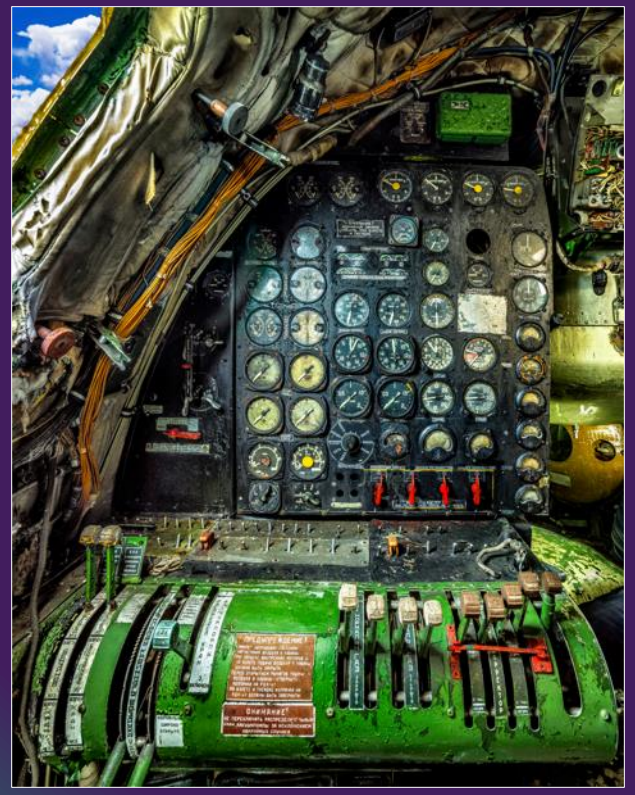
AVOIDING CATASTROPHE

And then the focus shifts…

"The resistance to initial CRM training by segments of the pilot community (Helmreich, 1992) led to a **revision** of the original approach"…

"Like the first, the second generation of CRM training aimed at preventing accidents through **improved crew performance**, and its underlying safety paradigm was that safety was a consequence of improved crew **synergy**."

Crew Resource Management : Critical Essays, edited by Eduardo Salas, et al., CRC Press LLC, 2009. p.37



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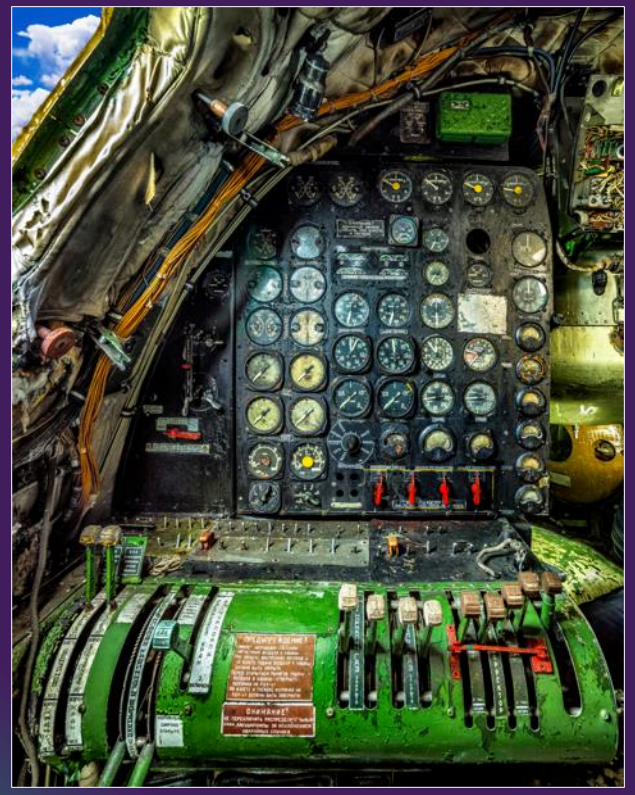
And then the focus shifts…

But this was not ‘like the first’ at all, it represented a fundamental shift

We see this more clearly when we look at the next generation that followed…



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Third Generation Consolidates this Shift

"The major step forward in the third generation of CRM was a change in its underlying safety paradigm: Safety was now considered to be a proactive rather than reactive endeavour, and the consequence of a **healthy system and its effective performance**."

Crew Resource Management : Critical Essays, edited by Eduardo Salas, et al., CRC Press LLC, 2009. p.38

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And then it gets messy

With the arrival of CRM's fourth generation, the space becomes contested. Practice reflects this by mixing up the two approaches

One of the key battlegrounds consists of Line Oriented Safety Audits (LOSA)

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LOSA according to Helmreich

"At the heart of LOSA is the non-jeopardy, systematic assessment from the aircraft jump seat of operational **threats** and cockpit crew **errors** and their management."

Crew Resource Management : Critical Essays, edited by Eduardo Salas, et al., CRC Press LLC, 2009. p.194

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And according to Pereira

"[LOSA] acquires direct, first-hand data on the successful **recovery** from errors by flight crews during normal line flights. [It] is aimed at collecting data on **successful** human performance; and this is indeed a **first** in our industry, since aviation has traditionally collected data on failed human performance, such as an accident or incident investigation."

Crew Resource Management : Critical Essays, edited by Eduardo Salas, et al., CRC Press LLC, 2009. p.194

Costa Pereira was the Secretary General of ICAO at the time (2000)

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Enter TEM

At this point the Safety I faction sought to reimpose its dominance through the introduction of Threat and Error Management (TEM)

CRM was to be conceived within this framework, both in terms of its purpose, and execution

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TEM…

Proceeds from the assumption that aviation is **safe**, **unless**…

Someone makes an **error**

Something **extraordinary** presents itself as a **threat**

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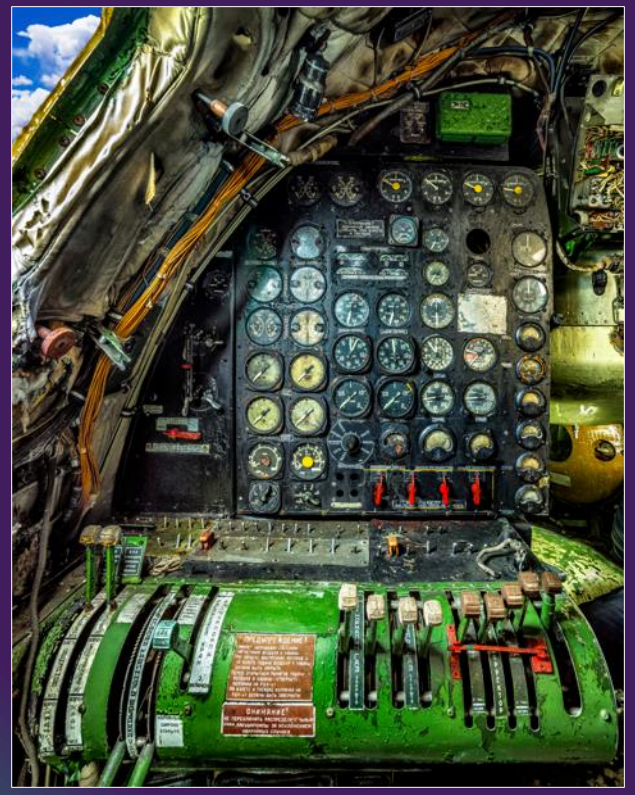
Mindless

This is exactly what Karl Weick had in mind when he contrasted mindless with mindful operations

Without the presence of a threat or an error, we can simply put our feet up, chill, there is nothing we really need to do

This is also a classic example of technological thinking where the human element plays a minimal role

It encourages a climate of deskilling and automation



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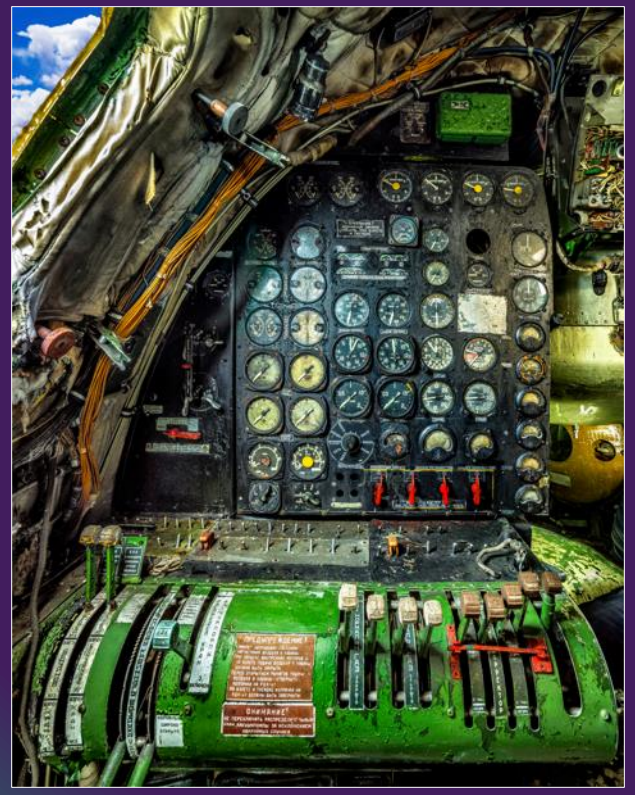
What's the problem with TEM ?

TEM was introduced into LOSA as early as 1996. A decade later it yielded some interesting **statistics**, which in turn could be used to challenge its underlying **assumptions** about flight safety and the purpose behind CRM



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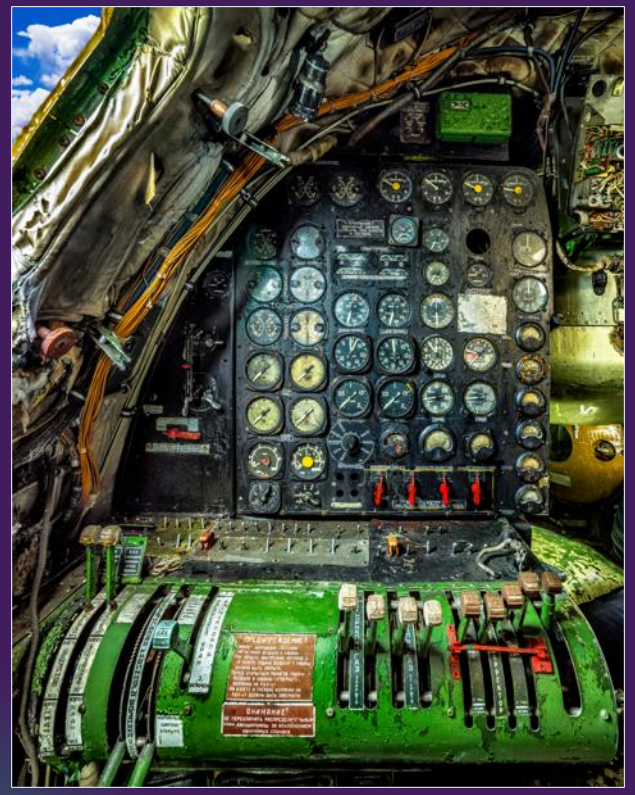
Deviations

The very **definition** of error rests on its own set of assumptions

“error is a crew action or inaction that leads to a deviation from crew or organizational intentions or expectations.

Merritt, A., & Klinect, J. (2006). Defensive Flying for Pilots: An Introduction to Threat and Error Management, p.8



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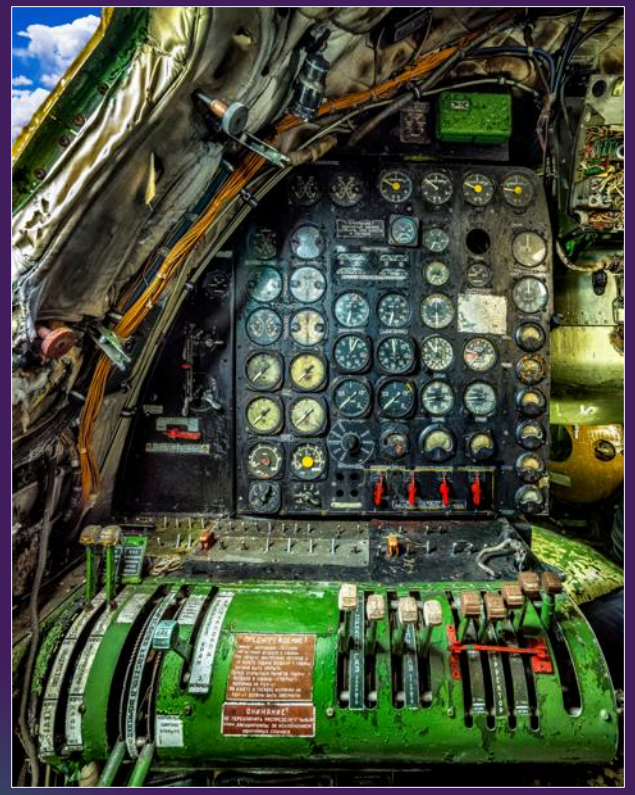
But why is this a bad thing ? Maybe the **expectation** was wrong, or the intention misplaced ? The 'error' was in fact a **correction** for mistaken SA, or a poorly set objective ?

Do we know ? No, its an assumption



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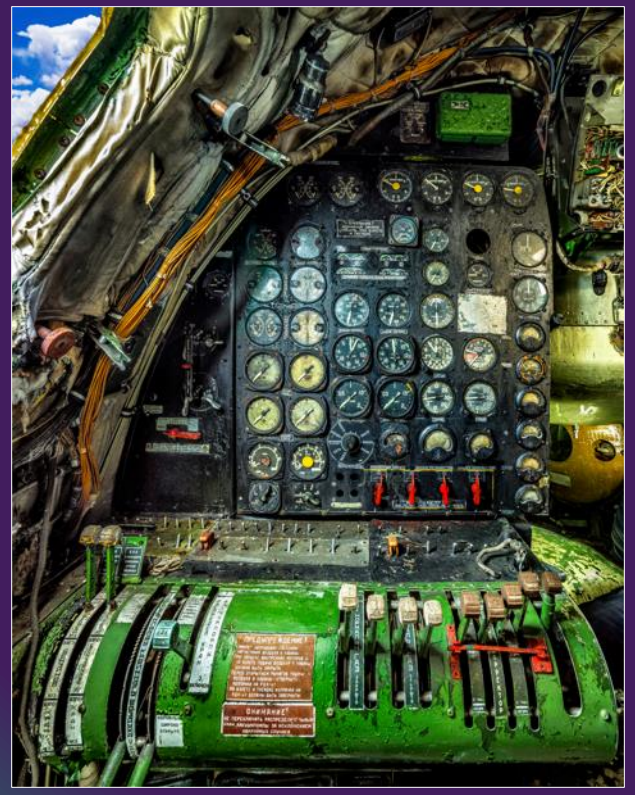
Do errors even matter ?

"45% of errors go undetected"

Merritt, A., & Klinect, J. (2006). Defensive Flying for Pilots: An Introduction to Threat and Error Management, p.10

This can be interpreted as a call for more vigilance through the application of CRM, or…



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Do errors even matter ?

"45% of errors go undetected"

It may be that those errors were overlooked because they simply did not matter

Or that the situation demanded attention be placed elsewhere, there were more important things to be doing

Do we know ? No, the assumption that these undetected errors matter is simply that, an assumption

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Consequences

So what happens with these undetected errors ?

“6% of all errors lead to additional error”

Merritt, A., & Klinect, J. (2006). Defensive Flying for Pilots: An Introduction to Threat and Error Management, p.12

Doesn’t this mean that **94%** don’t ?

Could this be **why** they were left ‘unmanaged’ ?

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Measuring performance

If we use these same figures to measure actual pilot performance, we get –

55% of errors were picked up

97.3% were dealt with successfully, either being rectified or ignored

Our problem area is just 2.7%

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Undesirable aircraft states

Of this 2.7%, 19% led to an “undesirable aircraft state” (p.12)

So we only have an actual problem in 0.51% of cases, 1 in 200

Furthermore, this chain of events only accounts for 30% of ‘UAS’

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Nothing to say

It turns out that TEM has nothing to say for

99.49% situations where error is involved

70% of undesired aircraft states

Is it really wise, from a **risk** perspective, to **ignore** these ?

How do we know our remedies won't affect **them** negatively ?

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And what does TEM have to say ?

"Planning countermeasures—planning, preparation, briefings, contingency management—are essential for managing anticipated and unexpected threats.' (p.16)

In other words…

Flight planning is a good idea

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And what does TEM have to say ?

"Execution countermeasures—monitor/cross-check, taxiway/runway management, workload and automation management—are essential for error detection and error response." (p.16)

In other words…

If you are doing something, do it right

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And what does TEM have to say ?

"Review/Modify countermeasures—evaluation of plans, inquiry—are essential for managing the changing conditions of a flight, such as undesired aircraft states. (p.16)

In other words…

You might have to be a pilot sometimes

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What value does this add ?

So as well as being irrelevant for the vast majority of aircraft operation, TEM at best offers basic platitudes

Don't make mistakes, that's not good

Keep an eye on each other

Is this the best we can do ? Is this all that CRM training can offer ?

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An element of truth

TEM does contain an important element of truth, which is why it has managed to persist

The risk environment is dynamic, the threat of failure, the possibility of error, can change dramatically during flight operations

It is absolutely correct to take this into account, to apply counter-measures when risk levels are increasing, to be extra alert

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This is what CRM is for

And it is precisely in such situations that CRM comes into play, where it has something of substance to offer

More than simply stating the obvious, 'do your job properly, it matters'

To understand this, lets turn our attention to Non-Technical Skills (NTS)

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Non-Technical Skills

NTS has its origin in the desire to take CRM **beyond** the trivial

It emerged as a reaction by European pilots to the reduction of cockpit processes to 'speak up, don't be shy'

Its focus is not on managing errors, but how to fly an aircraft safely and effectively, under conditions where **team processes** and **human interventions** make all the difference

In other words, where **technology**, and technological **thinking**, are not enough

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The Human Element

NTS are needed because technical systems can fail, and situations can arise where only the application of **human** judgment can determine what has to be done

Sometimes this means rules need to be **broken**, items skipped on a checklist

This is **why** we have pilots in the cockpit

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Four key areas

NTS identified four key areas where team processes are critical. They are so because the situation can not be handled simply by following procedures or taking routine actions

Doing so is likely to lead to disaster

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Is there a decision to be made ?

We can see this by looking at the category of **decision making**

If the situation is covered by a procedure, and this is **appropriate** for the circumstances, then in what sense is a decision **required** ?

What **challenge** does decision making present ? Do we really need to **dwell** on it ?

We don't need CRM for this

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Is there a decision to be made ?

This applies to all four of the key elements within NTS. None of them play a critical role where everything is going according to plan, nothing special is happening

- Cooperation
- Leadership and Management Skills
- Situation Awareness
- Decision Making

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What's missing ?

The list is interesting because something is missing

- Cooperation
- Leadership and Management Skills
- Situation Awareness
- Decision Making

Where is communication ?

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Communication is not an end in itself

It drives the others

- Cooperation
- Leadership and Management Skills
- Situation Awareness
- Decision Making

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Inputs and outputs

And neither are team processes, they are inputs that deliver certain outputs

mutual understanding…
generates information flows

Information flows…
generate situation awareness

SA…
underpins situation understanding

which in turn drives the optimal use of time, the setting of objectives…

and then decision making to achieve those

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This in turn provides us with performance metrics

The first to investigate team performance in this way was the TADMUS research project

What do high performing teams look like ?

What are the dimensions of team performance ?

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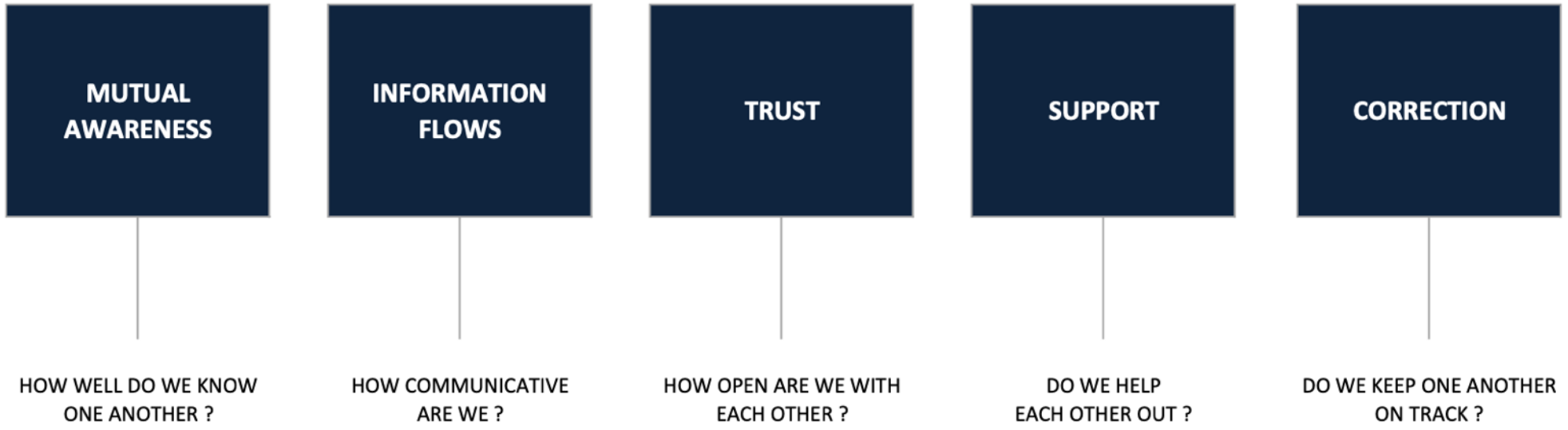
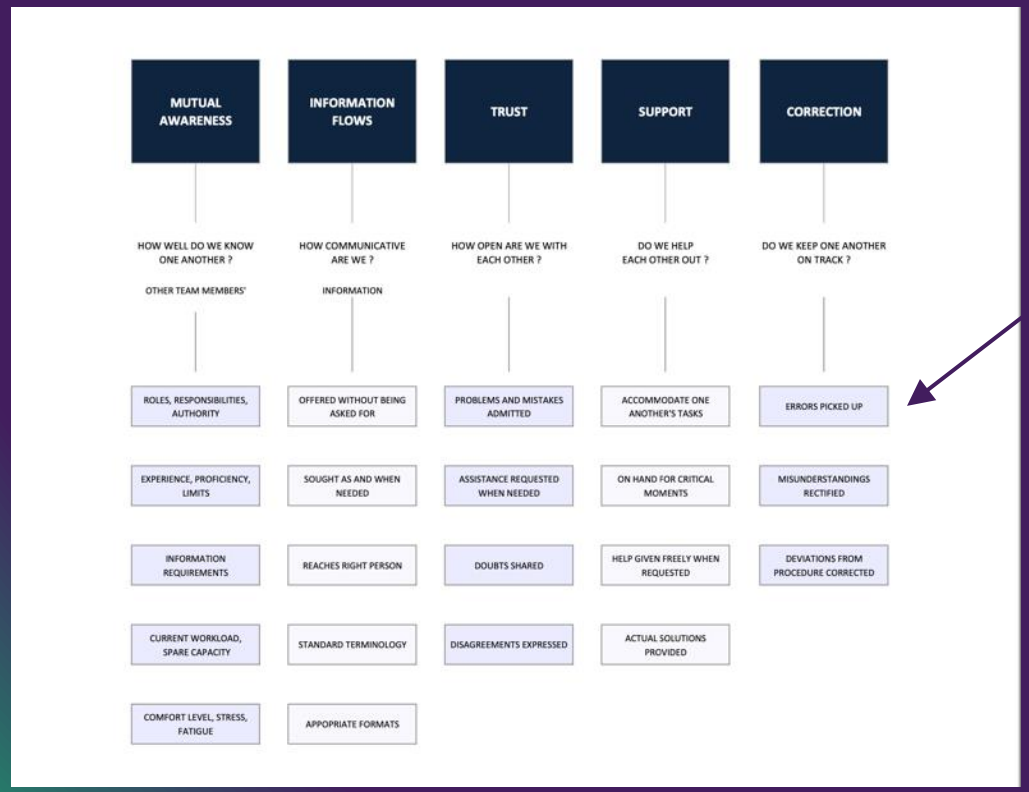
TADMUS Team Dimensions

TADMUS identified 7 -

- Communication
- Feedback
- Monitoring
- Coordination
- Team initiative/leadership
- Back up behaviour
- Situation Awareness

The HCD Framework has 5





Error Management is there

But only as one of 26 key performance metrics

The other four dimensions need to be in place for errors to be picked up consistently and reliably

Even more so with violations

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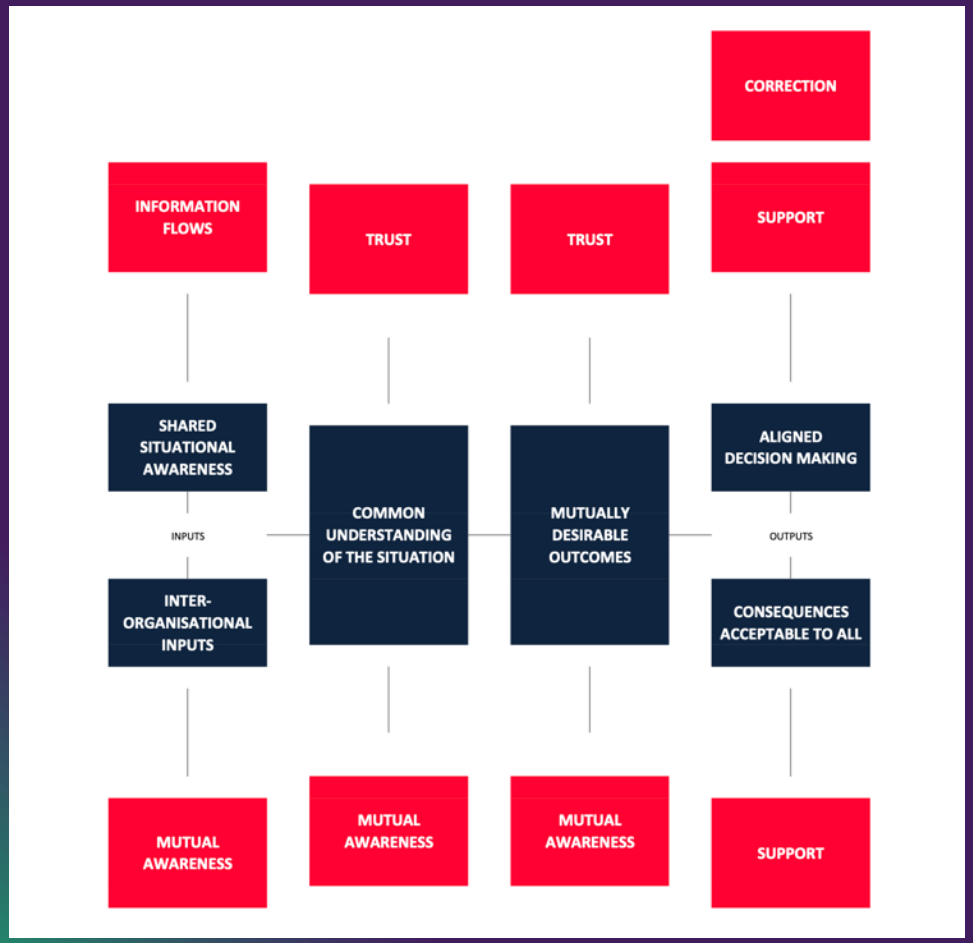

Not ends in themselves

Team processes serve a purpose. They contribute to the successful navigation of complex and dangerous situations, where the human element is decisive

And this element is not individual, but made up of interactions between team members, including from different organisations

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When do we need CRM ?

We don't need it under **normal, routine** conditions where everything is running the way it is supposed to

In fact, CRM, as we saw with TEM, adds **very little** of value if its focus is purely on the prevention of and management of error

'Don't make mistakes'

'Do your job properly'

In **emergencies**, however…

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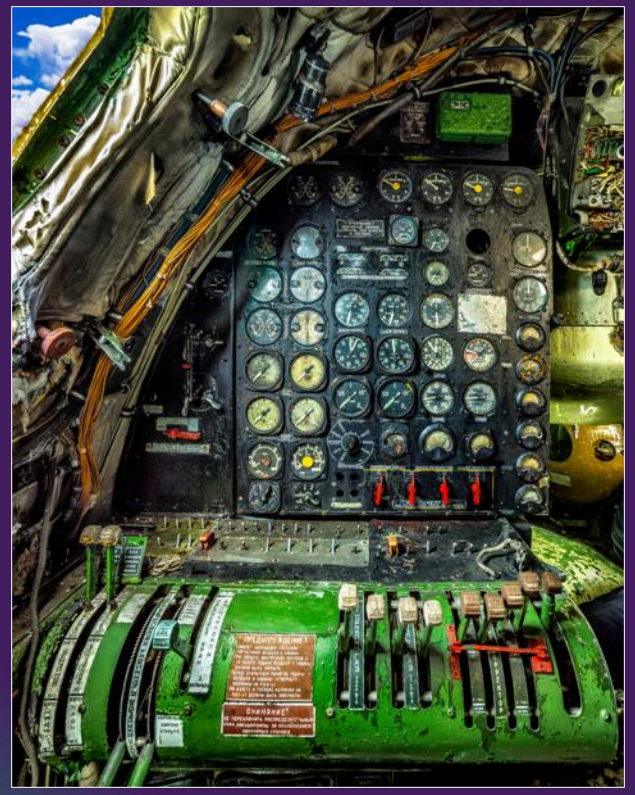
Emergencies are the benchmark

CRM comes into its own when we have non-routine, abnormal conditions that call for human judgment

These exist on a spectrum, but can best be seen in full-on emergency situations

This is why CRM training should focus on emergencies, it is here that it is needed the most



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Skills development

The ability to deal with extreme situations can also be applied during less demanding but also potentially dangerous ones

And for taking advantage of opportunities to exceed average performance, to attain operational excellence

Using case studies centred on the most severe emergencies allows for skills development that can be applied every day

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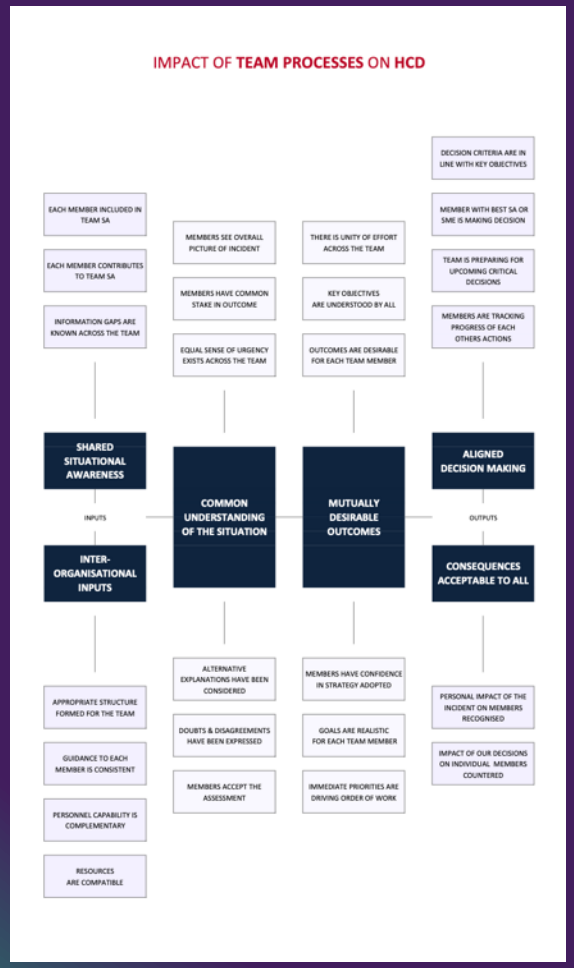
Raising expectations

Focusing on the skills required to handle extreme emergencies also allows to set a higher standard, to raise expectations of team performance

Revisiting accidents such as United 232, Sioux City allows for a rich discussion of what is required under abnormal conditions



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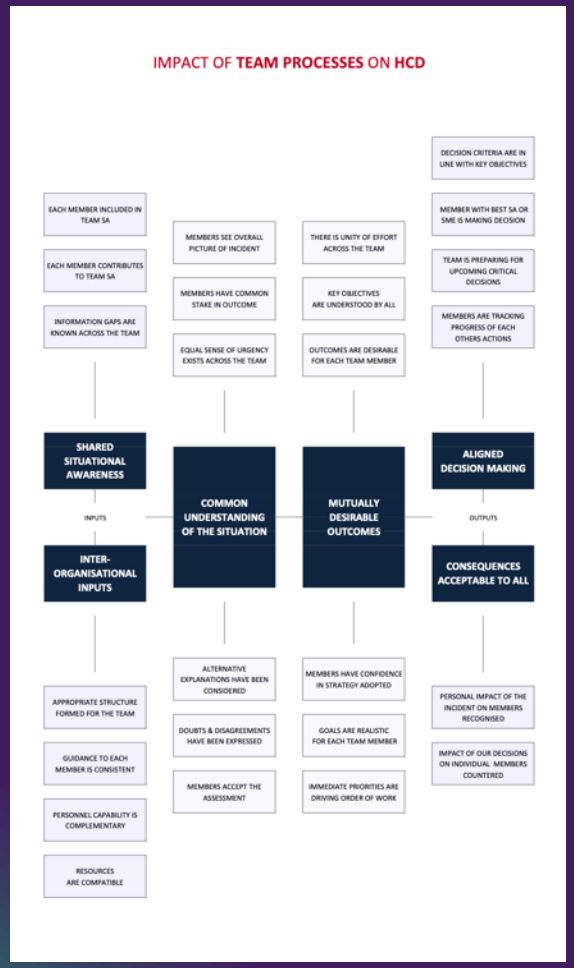
Setting a higher standard

We can highlight some of the key competencies involved in such situations, 25 in this framework

And aim to do better in future as a result



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Saving the day

This is where CRM has real **value** to offer, in developing the critical skills and capabilities that can **save the day**, when either **technical systems** or **technological thinking** have failed and are inadequate to the task

This is what CRM is **for**

Courses

All Courses

Thank you for **listening**

All Courses

Shoot, Don't Shoot - 1 The View From The Cockpit

16 Lessons | $99.00

All Courses

Shoot Don't Shoot - 2 Set Up To Fail

17 Lessons | $99.00

All Courses

Shoot, Don't Shoot - 3 Setting Up To Succeed

20 Lessons | $99.00

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