School of
Medical & Health Sciences

Surfing ICAO's USOAP CMA online database – a wipeout?

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Thank you Paul and good afternoon everyone. It has been almost exactly 40 years since the one time I surfed Bell's beach on a wave-ski and was nearly wiped out by unexpected 20-foot waves. Thankfully, surfing the internet for Accident Investigation data in ICAO's USOAP CMA online compliance database involved less physical danger but, as you will hear, still plenty of interest and surprises.

Presentation Overview

- Annex 13 & Analysis
- Methodologies, Research Rationale & 12 participants
- Analysis methodologies used by International Transportation Safety Association (ITSA) Accident Investigation Authorities (AIAs)
- Universal Safety Oversight Audit Programme (USOAP) Continuous Monitoring Approach (CMA) for Aircraft accident and incident investigation (AIG)
- Problematic USOAP CMA online audit data issues
- Recommendations, Next Steps, Acknowledgments, Q&A

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After situating the analysis in Annex 13, I will briefly define ‘methodologies’ and my PhD research project rationale. ITSA Accident Investigation Authority research participants are then listed. AIA methodologies used and reported to me are summarised in a table. I introduce ICAO’s Universal Safety Oversight Audit Programme Continuous Monitoring Approach for Aircraft accident and incident investigation, before moving to the problematic online data found as the focus of today’s presentation. I conclude with recommendations for ICAO, next steps in the research project and acknowledgments, before Q&A.

ICAO Annex 13 requirements

In Annex 13, 13th edition (2024) 'investigation' is:
*A process conducted for the purpose of accident prevention which includes the gathering, recording and **analysis** of all relevant information, the drawing of conclusions, including the determination of causes and/or contributing factors and, when appropriate, the making of safety recommendations*.

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As you know, Annex 13 defines investigation and requires, in paragraph 5.4, the gathering, recording and **analysis** of all relevant information as part of an investigation, so as to draw sound conclusions, determine causes **and/or contributing factors***, and support relevant safety action.
*[*An amendment I successfully argued for at the ten yearly ICAO Divisional meeting in 2008 despite the opposition of a key spokesman at the NTSB who did not want to dilute the US focus on 'probable cause']*

Analysis Methodologies

- Lundberg et al (2009) 'What you look for is what you find'
- I define methodology broadly to include frameworks & their underpinning models, theories & methods
- Focus on AIA methodologies that address combined human, organisational & technical aspects (beyond specialist disciplinary methods, techniques & tools)
- Includes SHELL, BowTie, Reason-based, Rasmussen-based, recent systemic (e.g., CAST, FRAM), AIA Bespoke

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Lundberg et al have persuasively argued that models, methodologies & theories used influence what you look for & therefore what you find. This underlines how important methodology choice & use can be. My research methodology focus is on the form of investigation analysis that incorporates human, organisational & technical aspects of a major aviation accident beyond narrower specialist disciplinary methods, tools & techniques such as for recorder analysis, metallurgy & survivability. Broader methodologies include SHELL*, BowTie, the Reason-based Swiss Cheese model & variants such as Tripod Beta, HFACS* & GEMS, & the Rasmussen-based AcciMap. More recent systemic methodologies & methods include Leveson's CAST* & Hollnagel's FRAM*, as well as Bespoke AIA methodologies like the TSB's ISIM, ATSB's AIMS, BEA's 'gutter' model & the NSIA Method.

[*SHELL: *Software/Hardware/Environment/Liveware/Liveware;* HFACS: *Human Factors Analysis & Classification System;* GEMS: *Generic Error-Modelling System;* CAST: *Causal Analysis Using Systems Theory*; FRAM: *Functional Resonance Analysis Method*]

Research Rationale

- AIA websites and accident reports typically outline generic ICAO Annex 13 investigation processes but rarely discuss underpinning analysis 'methodologies'
- ICAO methodology analysis requirements unclear
- Research/practice gap – unaware of a few discussions of methodologies in ISASI & ICAO forums and haven't directly researched AIAs
- AIAs unfamiliar with what methodologies used by peers

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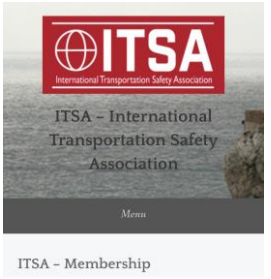
When I was scoping a potential PhD research project, I found that AIA websites typically outlined generic Annex 13 provisions and rarely discussed analysis methodologies - and final accident reports did not seem to do so either. In addition, ICAO investigation analysis framework methodology requirements were generalised and unclear. A research/practice gap seemed common - with most researchers unaware of the few discussions of investigation analysis methodologies in ISASI and ICAO forums. There was little or no published research on multiple government AIAs in relation to choice and use of analysis methodologies. In addition, AIAs seemed unfamiliar what each other was using and why.

ITSA AIA Research participants



Collaborative multi case-study
12 ITSA AIA participants:
AAIB, ATSB, BEA, DSB, JST, JTSB, NSIA, NTSB, SHK, SIAF, TAIC, & TSB

- Argentina – Transportation Safety Board (JST)
- Australia – Australian Transport Safety Bureau (ATSB)
- Canada – Transportation Safety Board of Canada (TSB)
- Finland – Safety Investigation Authority, Finland (SIAF)
- France – Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (BEA)
- India – Commission of Railway Safety (CRS)
- Japan – Japan Transport Safety Board (JTSB)
- Republic of Korea – Aviation and Railway Accident Investigation Board (ARAIB)
- Papua New Guinea – Papua New Guinea Acc. Invest. Comm. (AIC)
- The Netherlands – Dutch Safety Board (DSB)
- New Zealand – Transport Accident Investigation Commission (TAIC)
- Norway – Accident Investigation Board Norway (AIBN)
- Commonwealth of Independent States (former Soviet republics) – Interstate Aviation Committee (IAC)
- Singapore — Transport Safety Investigation Bureau of Singapore (TSIB)
- Sweden – Swedish Accident Investigation Authority (Statens haverikommission SHK)
- Chinese Taipei – Taiwan Transportation Safety Board (TTSB)
- United Kingdom – Accidents Investigation Chiefs' Council (AICC), representing:
  - Air Accidents Investigation Branch
  - Marine Accident Investigation Branch
  - Rail Accident Investigation Branch
- United States – National Transportation Safety Board

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A collaborative multi-case study was proposed to address such research issues. Initially 7 of a possible 15 eligible ITSA AIAs agreed to participate. Since 2024 I have had a very broad sample of 12 important and geographically and culturally diverse ITSA members participating. *[Two more signed up after my attendance at ISASI 2022, another two signed up around ISASI 2023 and a 12th signed up after I was invited to speak at ITSA's 2024 annual meeting. Of those eligible, only PNG, ROK & Singapore chose not to participate]*

Table 1: ITSA AIA reported methodology use

	BowTie	Reason-based	Rasmussen-based	Recent Systemic	AIA own Bespoke	Other, e.g. SHELL, 6M
AAIB	✓	✓	✓	✓		✓
ATSB	✓	✓	✓		✓	✓
BEA			✓	✓	✓	
DSB	✓	✓		✓	✓	✓
JST	✓	✓	✓		✓	✓
JTSB		✓				✓
NSIA		✓	✓	✓	✓	✓
NTSB			✓	✓	✓	✓
SHK			✓			✓
SIAF	✓		✓			✓
TAIC						✓
TSB		✓	✓		✓	

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Based on the written data AIAs reported to me, Table 1 (not published in full yet) summarises the use of methodologies by the 12 ITSA AIA participants: 5 used BowTie, 7 Reason-based, 9 Rasmussen-based, 5 'Recent Systemic' such as CAST, 7 AIAs used their own Bespoke methodologies, and 10 AIAs used at least one of various 'other' methodologies including SHELL, 6M and Bespoke methodologies developed by other AIAs (mainly the ATSB & NSIA). Every ITSA AIA (including NZ's TAIC) used more than one investigation analysis methodology, often in the same investigation. Many AIAs reported that choice of methodology depended on accident circumstances, complexity and likely safety value & that a shared team methodology was important.

ICAO USOAP CMA

- There are no specific 'methodology' requirements in ICAO Annex 13 & other 'Accident Investigation' SARPs
- Of 84 USOAP 2020 AIG protocol questions (PQs) none require analysis methodologies. But PQ 6.380 assessed: *Has the State established and implemented guidance material to ensure that operational, human factor and organizational aspects are investigated in a thorough manner, as needed?*
- USOAP 2024 (still 84 AIG PQs effective July 2025) extends PQ 6.380 guidance including for human & organisational factors (HOF) & for systemic investigation

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There are no specific methodology and analysis requirements in Annex 13 or other 'Accident Investigation' Standards and Recommended Practices. Therefore, while the USOAP 2020 audit protocol included 84 questions for 'Accident Investigation' these did not require analysis methodologies. From July this year audit protocol question 6.380 *[shown on the slide]* will include more relevant guidance, including for human & organisational factors and for systemic investigation.

Some Research Surprises

- During literature review, unexpectedly found major authors failed to acknowledge important ideas pioneered by Barry Turner: *Safety 2023* article published to set record straight
- USOAP CMA online database safety audit results for AIG (https://www.icao.int/safety/CMAForum/Pages/USOAP-Results.aspx)

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During my phD literature review, I unexpectedly found that pioneering work published by Barry Turner from the mid-1970s on patterns among organisational accidents, accident incubation, triggers and a systems approach had knowingly been used in subsequent famous books by Charles Perrow, my then hero James Reason and by others without proper acknowledgment. Turner had died at age 59 in 1995 so I felt compelled to address an injustice. Turner's surviving widow and his close academic colleagues trusted me with additional evidence to support a detailed 2023 journal article that sets the record straight. The second major surprise, as I will explain in detail, was in relation to ICAO's USOAP CMA database. On 3 September 2022 I went online to get comparative AIG audit data for all eligible ITSA participants as research context and printed out the results. When Argentina's JST told me its first AIG audit was available, I went back to the database on 17 April 2023 to include it, with the then other 8 ITSA research participants, at the same date & found the major negative changes shown in red in Table 2.

Table 2: USOAP CMA online AIA database issues

ICAO Member State (title used in USOAP CMA online database)	Member State AIA acronym	3 Sept 2022 USOAP CMA (last Mission audit year) & AIG EI% for 12 ITSA Member States	17 April 2023 USOAP CMA (last Mission audit) year & AIG EI% for the then 9 ITSA participants	29 July 2024 USOAP CMA (last Mission audit year) & AIG EI% for 12 ITSA participants	28 Dec 2024 USOAP CMA (last Mission year) & AIG EI % for 12 ITSA participants
Argentina	JST	No AIG audit	(2022) 89.2%	(2023) 89.3%	(2023) 89.3%
Australia	ATSB	(2017) 97.0%	(2022) 96.0%	(2023) 95.0%	(2023) 95.1%
Canada	TSB	(2005) 91.0%	(2005) 91.0%	(2023) 86.6%	(2023) 86.6%
Finland	SIAF	(2018) 98.4%	**(2018) 91.5%**	(2018) 91.5%	(2018) 91.6%
France	BEA	(2020) 100%	(2020) 100%	(2020) 100%	(2020) 100%
Japan	JTSB	(2010) 96.0%	**(2010) 86.8%**	(2010) 86.8%	(2010) 86.8%
Netherlands	DSB	(2008) 72.7%	**(2008) 6.9%**	(2008) 6.9%	(2008) **68.6%**
New Zealand	TAIC	(2016) 77.8%	**(2016) 74.7%**	(2016) 74.7%	(2016) 74.7%
Norway	NSIA	(2018) 99.3%		**(2018) 94.8%**	(2018) 94.8%
Sweden	SHK	(2016) 91.2%		**(2016) 75.4%**	(2016) 75.4%
United Kingdom	AAIB	(2018) 83.0%	**(2009) 69.6%**	(2009) 69.6%	**(2022) 82.4%**
United States	NTSB	(2007) 81.3%		**(2007) 76.4%**	(2007) 76.4%

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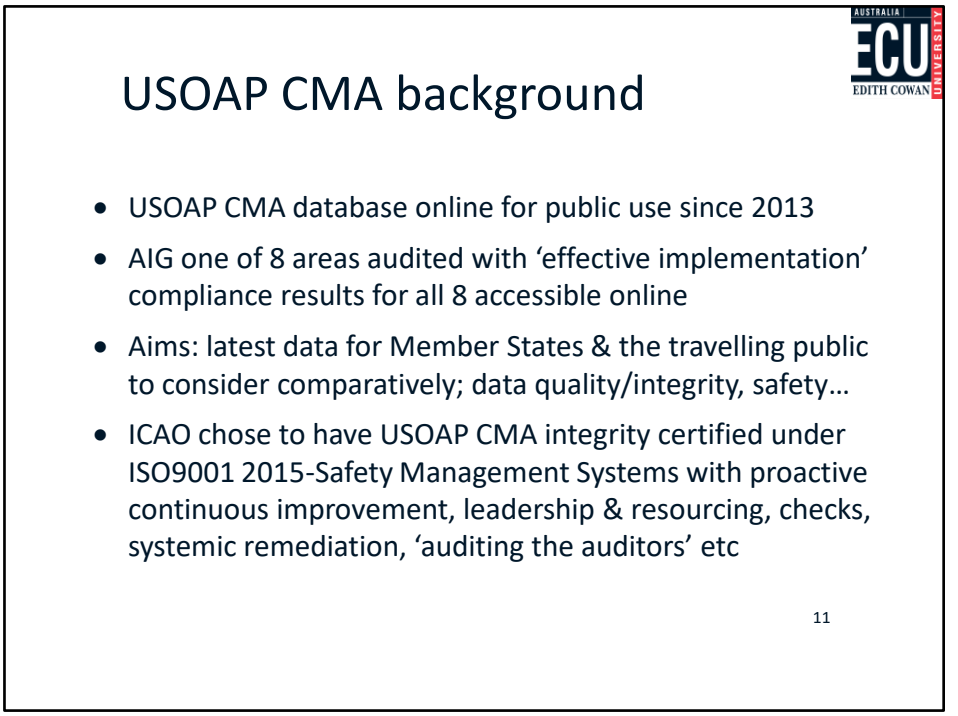
Column 4 highlights initial bolded red problematic data issues involving the AIG effective implementation scores for USOAP CMA compliance audits for 5 of 9 ITSA participants, with the last Mission audit year as stated online shown in brackets. The Netherlands result fell from 72.7% to 6.9% with the same 2008 last Mission audit year, and the UK result fell from 83% to 69.6% but its last Mission audit year went backwards from 2018 to 2009. Later all three of the most recent AIA participants had problematic issues in their public data as shown in column 5 in red. It looked like a potential USOAP CMA database wipeout. I will give you some additional background before returning to the Table.



USOAP began a decade earlier than the augmented CMA online database publicly available from 2013. 8 USOAP audit areas are now accessible online with 'effective implementation' compliance results for each displayed for 187 audited ICAO Member States and a global average for each audit area. ICAO's original stated principles and aims for USOAP CMA were to provide transparent and high-quality compliance data to Member States and the travelling public to allow comparison and improvement in the interest of global aviation safety. ICAO chose to have the integrity of USOAP CMA certified and recertified under International Standard ISO 9001 – Safety Management Systems. This standard required appropriate ICAO leadership, management, resourcing, proactive continuous improvement, checking and responding to concerns, risk-based systemic remediation, and 'auditing the (USOAP) auditors' as stated by ICAO's Council President.

USOAP CMA AIG data issues

- AIA changes shown in red (except UK) occurred despite an unchanged last Mission audit year
- Only one 'last' Mission audit year was used for all 8 USOAP CMA audit areas even when some areas like AIG had been out-of-scope in that 'last' audit
- Also issues with ICAO's subscription AIP USOAP datasets

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The bolded red data issues were only provable because I had printed out the results because historical data is not accessible in this public dynamic database. A further issue found is that AIG was out-of-scope for some years when the same 'last' Mission audit year was shown for all 8 audit areas, including AIG with an associated EI score. This is obviously a systemic problem. ICAO also publishes a subscription Application Programming Interface (API) data service including USOAP AIG Effective Implementation datasets. I registered and found that some results were inexplicably different from each other and with the online public data for the same last Mission audit years.

Table 3: USOAP CMA AIG EI Global Averages

1 January 2019	57.3%
31 December 2021	53.9%
3 September 2022	57.1%
17 April 2023	53.4%
17 April 2023 (a few minutes later)	54.0%
17 April 2023 (a further few minutes later)	54.6%
29 July 2024	54.2%
29 July 2024 (ten minutes later)	54.7%
29 July 2024 (five minutes later still)	54.2%
28 December 2024	55.8%
28 December 2024 (43 minutes later)	55.3%
1 May 2025	54.9%
12 May 2025 (also 31 May)	55.4%

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ICAO reported that the AIG EI global average of the 187 audited Member States fell from 57.3% to 53.9% in the 3 years to 31 Dec 2021 (the top tow roes with black date text). Online, on 3 Sept 2022 I found it to be 57.1% and on 17 April 2023 it was 53.4%, 54% and 54.6% within minutes. On 29 July 2024 it was 54.2%, 54.7% and 54.2% again. On 28 December 2024 it was 55.8% and 55.3%. On 1 May 2025 it was 54.9% and on 12 May (and yesterday) it was 55.4%. Even without access to underpinning data, this variability was unexpectedly high and problematic.

Liaison with AIAs & ICAO

- From April/May 2023 I liaised with AIAs & ICAO. In late 2023 ICAO suggested an explanation linked to new PQs but it didn't stack up and I immediately told them this
- I had hoped that like an ATSB investigation I could encourage safety action and report it in my thesis
- In mid-2024 when 3 more ITSA participants also had USOAP issues, I tried again with ICAO - but still no explanation. I researched & drafted a manuscript and first provided it to USOAP & then in November to the oversighting Deputy Director but still with no reply

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When the issues were first discovered in April 2023, I liaised with participant AIAs & emailed ICAO's USOAP section. The AAIB provided a UK explanation suggesting ICAO error. DSB & AIGP's chair advised of unpublished changes to the way ICAO publicly displayed data for States with overseas territories like Netherlands & UK. A former AIG official helped gain assistance from AIG to eventually obtain a USOAP response to my concerns in November 2023. It stated that the revised 2020 audit Protocol Questions (implemented from 1/1/22) might have led to a decrease of 1.53% in the EI global average. I responded that this did not make sense of the data found, and I hoped that remedial action would occur. When all three recent ITSA AIA participants had online data issues sampled in mid-2024 I tried again with ICAO but no explanation was forthcoming. Last November I provided a draft journal manuscript on the issues to the ICAO Acting Deputy Director with responsibility for MAC & USOAP. I have received no reply to date.

Possible explanations

- Types of policy & other 'drift' (eg Rasmussen)
- Change issues from USOAP field audit missions to CMA with online reporting poorly considered from outset – policy, statistical, management & IT may be implicated (perhaps initially all audit areas were in scope so no last mission audit year variance)
- Lack of ongoing resourcing/oversight, unresponsiveness to problems & complaints contrary to ISO 9001: 2015

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Some issues may involve 'policy drift' or Rasmussen-type migration drift. A move from comprehensive USOAP field audits (with all areas normally in scope) to some out-of-scope and a continuous monitoring approach with hybrid online reporting may have been poorly considered from the outset. Regardless, ISO9001: 2015 requirements were not being met, including to address my concerns.

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United Kingdom	AAIB	(2018) 83.0%	**(2009) 69.6%**	(2009) 69.6%	**(2022) 82.4%**
United States	NTSB	(2007) 81.3%		**(2007) 76.4%**	(2007) 76.4%

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Table 2, Column 6 shows that some (bolded purple) ICAO changes had been made by 28 December 2024 (and the same yesterday). Other than my draft paper provided to ICAO, there is no explanation for why the Netherlands online result now shows the 68.6% ICAO provided to the AIGP chair in April 2023 which ignores the explanation ICAO provided to its Member State for the 6.9% being correct. ICAO AIP USOAP datasets for the Netherlands still show 6.94% in one and 72.73% in another for the same last Mission audit year of 2008. There is no explanation for the UK result moving to 82.4% for a last Mission audit year of 2022 when the AAIB confirmed that AIG was out-of-scope in that year. AIP USOAP datasets for the UK still show 69.57% in one and 82.95% in another for a **2009** last Mission audit year.

Recommendations to ICAO

- Evidence/analysis provided to ICAO should be sufficient to prompt serious systemic action, not *ad hoc* changes
- Unlikely data issues restricted to ITSA 8 of 12 members (187 ICAO Member States of 193 are audited) & global average AIG EI variability also remains problematic
- Recommend ICAO, in line with ISO9001: 2015, thoroughly review & commission appropriately qualified independent systemic audit & research to evaluate and explain the USOAP CMA online database issues found, determine how best to avoid future errors & omissions, and transparently take remedial action

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I consider that this research and analysis should provide sufficient evidence to prompt a thorough ICAO review followed by required remedial action. It seems unlikely that research involving 12 ITSA AIAs would incorporate the only 8 of 187 USOAP-audited ICAO Member States that experienced problematic data issues; and the global average AIG EI variability also remains problematic. To avoid a total USOAP CMA 'wipeout', I have recommended that in line with ISO9001:2015, ICAO commission systemic research and an independent evaluation audit and prioritise transparent remedial action.

Next steps

- Respond to journal reviewer comments re manuscript on USOAP data issues (and any further ICAO comment)
- Finalise a manuscript covering 12 participants' written & interview data with analysis & themes
- Assist ISASI HOF subcommittee's 2025 work program & a joint paper I am drafting/coordinating for ISASI 2025
- Write PhD dissertation integrating the published papers

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My next steps PhD are to: respond to journal reviewer comments in relation to the manuscript on USOAP CMA data issues and to any further ICAO comments; finalise a manuscript summarising my research covering the 12 ITSA AIA participants' written and interview data with analysis and themes; further assist the ISASI government Human and Organisational Factors investigators' subcommittee 2025 (& 2026) work program and finalising of the joint paper I drafted for ISASI 2025 in Denver; and of course, write a PhD dissertation that integrates the (hopefully) published five or six papers.

Thanks to

ECU PhD supervisors, Associate Professors Drs Marcus Cattani & Leesa Costello;
ITSA AIA participants, contacts & interviewees.

Thank you for your attention!

Very happy to take your questions now or later
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I am grateful to my PhD supervisors at Edith Cowan University, Associate Professors Marcus Cattani and Leesa Costello, for their support and thank the ITSA AIA participants and those delegated to provide information to assist me, including through interviews.
Thank you for your attention and I look forward to addressing some of your questions now or later via email if time does not permit.