

Letter to the Editor

Search assurance and human decision-making in SAR: Do current frameworks measure the right thing?

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<https://doi.org/10.61618/XUOM7451>

Search & Rescue (SAR) has evolved through advances in technology, coordination and doctrine, alongside more formal approaches to search planning and assurance. Within that progress, an ongoing discussion is how assurance practice should balance evidence of process completion and analytic outputs with the quality of the human judgements that generate, interpret and adapt them. This letter therefore invites sector-wide reflection on a question: to what extent do search assurance frameworks account for human decision-making under uncertainty, particularly cognitive load, bias and the maintenance of shared situational awareness across distributed teams?

One way to advance this discussion is to outline an author-proposed assurance concept that foregrounds human factors; for convenience it is labelled here human factor search assurance. It is offered as a discussion aid rather than as a definitive standard, a proprietary method, or a replacement for established doctrine. In brief, the concept treats the reasoning that links information to decisions (e.g., assumptions, uncertainties, confidence judgements, and thresholds for adaptation) as assurance-relevant artefacts alongside traditional measures of planning and execution, with particular attention to cognitive workload, bias and the development of shared situational awareness.

Over recent decades, search assurance in SAR has developed alongside planning doctrine and analytic methods, including more explicit documentation of intent, the use of coverage and probability-of-detection concepts, and structured debriefing to support learning and accountability. These developments have improved transparency in what was planned and what was done; a continuing question is how well assurance practices also represent the human judgements that connect evolving information to operational choices during time pressured incidents.

Cognitive vulnerability in SAR decision making

Here, “cognitive vulnerability” refers to predictable vulnerabilities in human performance under uncertainty, time pressure and high cognitive load, rather than individual negligence or lack of commitment. Operational learning literature, including reporting associated with the International Search and Rescue Incident Database (ISRID), indicates that while formal training is essential, cognitive factors can remain a challenge in improving non-find cases, i.e., cases where organised search activity does not locate the subject. Published case analyses and research have highlighted

situations in which cognitive factors contributed to missed opportunities. These accounts help illustrate why a human-factors lens may be relevant to assurance, alongside planning and coverage analytics.

Such examples are not confined to high-profile cases. Operational accounts also describe occasions where searches have focused on the wrong area, teams have been in the right place but searched ineffectively, or plans have been executed without access to basic information. These outcomes are not necessarily attributable to poor intent or lack of effort, but may reflect predictable cognitive challenges inherent in complex, time-pressured environments. The central premise is therefore straightforward but intentionally challenging: if assurance is intended to increase confidence in search decisions, it may need to make decision quality more visible, not just task completion.

SAR practice has benefited substantially from improving tools and processes, including more developed approaches to planning, resource deployment and coverage modelling. However, the field is arguably less consistent in making the quality of the judgements that underpin these activities explicit. In particular, this includes how information is interpreted, how uncertainty is handled, and how decisions are adapted as conditions change. This is not a critique of intent or professionalism, but an observation that decision quality is often assumed, rather than deliberately supported and assessed, within search assurance practice. Concepts such as situational awareness (Endsley, 1995), recognition-primed decision-making (Klein, 1993) and cognitive load are well established across aviation, healthcare, and military domains.

Similarly, research into high-reliability organisations highlights the importance of collective mindfulness, sensitivity to operations and disciplined reflection in maintaining performance under uncertainty (Weick and Sutcliffe, 2007). SAR shares many of these same characteristics, including dynamic conditions, incomplete information, distributed teams and high-consequence outcomes; however, the explicit integration of these principles into everyday search practice varies across organisations and contexts. This raises a key question: to what extent is search assurance currently a measure of process compliance rather than a reflection of decision quality? A recurring limitation in assurance practice is that what can be easily counted or audited (e.g., task completion, documented plans, coverage summaries, or adherence to agreed processes) is not always a reliable proxy for decision quality. In complex incidents, the most consequential cognitive demands often concentrate at specific SAR decision points.

These decision points include framing the initial working hypothesis and search objectives; delineating and prioritising search areas and segments; allocating resources and selecting tactics under time and capability constraints; evaluating ambiguous clues and deciding whether to widen, narrow, or re-orient the search; managing re-tasking and mid-mission plan changes as new information arrives; deciding on suspension, continuation, or escalation; and executing handovers between shifts or agencies without loss of context. At each of these points, cognitive workload, judgement bias and breakdowns in shared situational awareness can shape what is searched, how well it is searched and how quickly the plan adapts. The practical challenge, therefore, is not simply to “do the plan well”, but to ensure assurance frameworks can also make the reasoning behind these decisions—and the conditions under which they

should change—visible and reviewable, including attention to established judgement biases (Tversky and Kahneman, 1974) and team-level shared mental models (Mathieu et al., 2000). Against this background, the next section briefly sketches one illustrative example of how a human-factors-oriented assurance approach might be expressed in practice, without implying that any single framework is sufficient or universally applicable.

An example of a human-factors-oriented assurance approach

One response to these issues is to treat certain elements of team cognition as assurance relevant artefacts, such as explicit assumptions, uncertainty statements, confidence judgements, alternative hypotheses, and agreed triggers for adaptation, captured in a way that is feasible during live incidents. In practice, these may be recorded briefly in existing briefing notes, decision logs, map annotations, or debrief prompts, so they can be reviewed alongside coverage and execution data. The framework referenced here is offered as one example of human-factors-oriented assurance for discussion; at a high level, it combines (i) brief training and shared language for common cognitive risks, (ii) structured prompts at key decision points, and (iii) mechanisms to record decision rationale.

To link prompts and documentation to operational rhythm, it may be useful to organise assurance supports around the search mission lifecycle: pre-search alignment (shared intent and thresholds), in-search cognition (maintaining situational awareness and adaptive replanning under load), and post-search assurance (review of decision rationale and learning). This framing provides a natural bridge from established assurance practices to a discussion of how human judgement might be represented within them.

Discussion: potential contribution and implications

The potential contribution of an approach of this kind can be considered in three areas. First, it may support calibrated confidence by encouraging transparent articulation of assumptions, uncertainty and decision thresholds, rather than relying on implicit judgement. In principle, making reasoning explicit can help teams coordinate under uncertainty and identify where additional information or challenge is needed.

Second, it provides one possible way to broaden what is meant by search assurance. If assurance is intended to be more than procedural verification, it may need to include at least some account of the reasoning that informed key operational choices, particularly when plans are adapted in response to new information. A process-compliant search can still be undermined by unexamined assumptions or cognitive bias; documenting decision rationale and uncertainty may therefore help make assurance claims more interpretable and support post-incident review.

Third, this approach could be put into practice with little extra effort if it is incorporated into current briefings, decision reviews, information displays, and debriefings, instead of relying on new technology or significant resources. Whether this can be achieved without adding undue burden is an empirical

question, but it is a relevant design requirement in resource-constrained SAR environments. The next section notes preliminary observations from an exercise context and highlights what would be needed to evaluate such supports more rigorously.

Preliminary observations from an exercise

A preliminary trial of elements associated with the illustrative concept described above was undertaken during a Search & Rescue exercise in May 2025, following familiarisation and iterative refinement with experienced search management practitioners. Feedback gathered during and after the exercise suggested that structured prompts may help some teams externalise assumptions, articulate uncertainties and reduce perceived cognitive pressure at key decision points. Participants also noted that prompts supported more consistent capture of decision rationale for subsequent review. These observations are indicative only and should not be interpreted as evidence of effectiveness beyond the trial context. Over the subsequent year, elements similar to those described above were reportedly used within one team's routine practice. Systematic evaluation (e.g., defined measures, comparison conditions, and multi-team replication) would be required to establish reliability, transferability and any effect on operational outcomes. A next step would be independent assessment of whether human-factors-oriented assurance prompts produce measurable differences in decision quality, shared situational awareness and the interpretability and defensibility of assurance claims under realistic operational constraints.

Acknowledging concerns

Formalising aspects of cognition may raise concerns that such frameworks could constrain professional judgement or introduce unnecessary structure. However, human factors research indicates that, when appropriately designed and used, structured supports can complement expertise by reducing unhelpful variability and improving shared understanding, while still allowing professional judgement to be exercised where it matters. The intention of the example described above is not to prescribe how individuals should think, but to illustrate how teams might make critical assumptions and decision rationale more explicit. SAR effectiveness is rarely the product of isolated expertise; it emerges from coordinated sense-making, shared awareness, and collective decision-making under pressure. Structured prompts, where appropriate, may support that coordination by encouraging constructive challenge and clearer articulation of uncertainty. The example outlined here is intended to support discussion about how human-factors concepts might be represented within search assurance and how such approaches could be evaluated under operational constraints. Further work could examine what information about decision rationale is feasible to capture during live incidents, how it can support shared situational awareness across distributed teams and what forms of review meaningfully improve learning without imposing undue burden. In that context, a constructive question for the sector is whether current search assurance frameworks sufficiently capture the human aspects of search management: how uncertainty is handled, how cognitive load and bias are managed, and how shared situational awareness is maintained and repaired as information changes. If gaps exist, what minimum set of practical decision-quality indicators would be useful, auditable, and acceptable across diverse

SAR contexts? Clarifying these indicators could support more consistent learning, review, and evaluation across organisations.

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