NZSAR Secretariat

New Zealand Search & Rescue Incident Management Systems

Analysis of current systems and recommendations for future interoperability

Prepared for:

Matthew Wheble
Senior Advisor - Kaitohutohu Matua
New Zealand Search and Rescue Secretariat | Rapu Whakarauora Aotearoa

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Prepared by:

Mark Constable
Maelstrom Consulting
maelstromconsulting.co.nz
mark@maelstromconsulting.co.nz

Table of Contents

Executive Summary

The two Search and Rescue (SAR) coordinating authorities, New Zealand Police and the Rescue Coordination Centre New Zealand (RCCNZ), have a fundamental responsibility to ensure there are Incident Management (IM) processes and systems in place to provide efficient and effective SAR Operations (SAROP), and to maintain the security and integrity of systems and data.

Currently, there are range of Incident Management System (IMS) methodologies being used across the SAR agencies in New Zealand, consisting of at least sixty-five platforms and supporting applications/technologies. Systems vary between, and within, agencies. No agency interviewed is using a single ICT system for *all* of their Incident Management Team (IMT) functions. Mapping tools, communication/notification systems, record management are typically handled separately, and are generally not integrated or connected in any way. The ability to operate SAR applications on the Police enterprise system and devices, and to have volunteer SAR workers use any such system, is seen as impossible due to dogmatic ICT security practices. This has resulted in the primary electronic systems for Police-led SAROPs being held by other agencies, and operated on non-Police devices. For Police in particular, this creates potentially significant data-security and record management risks with regards to the control and accessibility of records.

As a whole, the SAR sector lacks an effective means to gain and maintain a common operating picture internally and with partner organisations. The current myriad of manual systems, disjointed IT platforms and some “clunky” interfaces are likely creating latent process inefficiencies and risks. At best this may be causing many unnecessary administrative workhours; at worst this may lead to delayed and/or ineffective responses, or poor mitigation of health and safety risks to searchers.

Ideally the ownership of SAR IMS should sit with the coordinating authorities. Whilst there is an IMS for Category II (Cat II) SAROPs, owned by RCCNZ, there is no such centrally coordinated IMS for Category I (Cat I) SAR. For the systems that are in use, there is an overreliance on volunteer group funding and ownership. The de facto Police IMS is not owned by Police nor centrally managed, has mediocre uptake and usage across the country, and is generally not considered as user-friendly or fit-for purpose.

Historically, emergency management IT platforms have been imagined as single standalone systems, capable of doing everything required for emergency response. However, this is not a realistic proposition as it has the effect of restricting the use of specialist hardware and applications, and reduces the ability to integrate with emergent technologies. Therefore, the ideal is an IMS that provides the operations platform for tasking, logging and record keeping; with other systems integrated through configuration.

When considering a SAR IMS, it is important to note that there is not a “silver bullet” solution. The primary platform needs to be integrated with supporting applications, ICT hardware, user manuals, IT vendor and service support, change management, governance arrangements, security and data management practices, operational procedures, training (initial and ongoing), user support and communications. All of these elements need to be maintained in order for any system to be successful.

The risks and issues described in this report generally apply across both SAR categories and most agencies, however the largest risks lie with Cat I SAR management. In the long-term opportunities to implement a universal SAR IMS should be explored; however, the most pressing need is for a Police IMS for Cat I Land and Marine SAROPs.

Recommendations

1. Agree the need to consolidate Category I SAR Incident Management Systems (inclusive of land and marine searches) into a single platform for managing operations and information management and sharing.
2. Agree the appropriate agency and arrangements of IMS stewardship, with due consideration to agency responsibilities, and data retention and security requirements.
3. Determine a governance structure, including steering group, technical experts and subject matter experts, to ensure the successful IMS implementation and ongoing management.
4. Implement an ICT project with a dedicated project manager and project team to lead the IMS selection and implantation process.
5. Undertake a ROI process to appraise service delivery models, consistent with the requirement provided in this report and estimate costs.
6. Agree the funding model for IMS as a shared services, with consideration to whole-of-life costs such as ongoing licences, integration with third-party applications, updates, and service support.
7. Seek FED funding to support the procurement and implementation costs of the IMS.
8. Implement change management activities, such as initial and ongoing training and communications, to enable SAR agencies and operators to transition to the single IMS.

Considerations

These issues should be taken into consideration during the selection and implementation of an IMS.

- The high-level requirements within this report will need to be agreed by participating agencies. Further detailed and technical requirements will need to be developed by the project team, in consultation with subject matter experts.
- IMS implementation will need to include the development of appropriate interfaces with third party systems, including the Police CAD, RCCNZ IMS, and SARdonyx.
- IMS selection and implementation should consider opportunities for future integration of Category II SAR IMS, and CDEM IMS platforms.
- The lead agency and specific procurement processes will need to be agreed, with consideration of multiple agency participation.
- Any RFP process should include practical system demonstrations of proposed IMS, to ensure functionality can cover the breath of requirements.
- Existing ICT security provisions may need to be reviewed and updated to allow information sharing across and within participating agencies, and ensure that appropriate user provisioning controls are in place for volunteer workforces.

Introduction

Background

Police have identified a need for an interoperable SAR Incident Management operating processes and system to support SAR consistency and operational effectiveness throughout New Zealand. The *Rauora* SAR Exercise (SAREX) series has identified that the SAR sector lacks an effective means to gain and maintain a common operating picture internally and with partner organisations.

Currently SARTrack is the de facto IMS for Cat I SAROPs. It is financially supported by NZSAR (through LandSAR, and in agreement with Police) and a number of LandSAR groups. However, its use is limited to land SAROPs where capability and personnel to support this are available. SARTrack is not fully utilised throughout all parts of the country, or by all agencies and other systems are also used. Coastguard utilises a commercial application, RCCNZ and Surf Life Saving New Zealand (SLSNZ) use separate bespoke solutions. In many Police districts, SAROPs are undertaken using manual systems. *All* agencies use various additional third-party applications, tools, or web-based services.

Objective

Police and the NZSAR Secretariat wish to explore the possibility of bringing consistency and interoperability to IMT operating systems, processes, and technologies to support SAR IMTs and provide consistency of training. This report provides:

- analysis of the IMT systems and technologies currently in use across SAR and associated supporting agencies in New Zealand;
- high-level capabilities and requirements for an integrated and interoperable IMS, as defined by members of the SAR sector;
- an overview of the market of available IMT systems that may meet identified requirements; and
- recommendations to assist decisions regarding trials or funding for IMS or technology that meets the identified needs.

Methodology

The steps involved in conducting this analysis consisted of:

- Interviews were conducted across SAR and emergency management agencies, and SAR Coordinators from all Police districts (Appendix 2). Interviews focused on current IMT systems and processes, and the ideal requirements for future IMS.
- Descriptions of current-state systems and processes were summarised (Appendix 3, 4 and 5).
- Future-state requirements were synthesised into a set of high-level requirements, and have been prioritised for importance by the *Innovation in Technology Forum* (Appendix 6).
- Current states were analysed for trends, strengths and risks.
- A scan of the available IMS on the market was undertaken to gauge the potential of 'off-the-shelf' products to meet high-level requirements.

Constraints and Assumptions

- The New Zealand SAR sector contains a vast number of agencies and teams. Not all could be consulted during this analysis. Care has been taken to ensure that representatives from key organisations were interviewed.
- In developing the high-level requirements for a SAR IMS, emphasis was given to functional requirements of users with general consideration given to information security and privacy requirements. However, ICT security requirements of agencies will vary depending on the nature of their work; these will need to be considered in any further development of a common IMS.
- It has been assumed that the current SAR forms are functional, and that a version of these would continue to be used into the future as part of the IMS.
- Not all current systems were able to be viewed in action. Commentary regarding individual systems is anecdotal, based on user comments.
- The market scan of available IMS platforms was generally limited to information available online, though demonstrations were provided by users and some vendors. Vendor company details were not generally available. Some assumptions have been made regarding their capability and capacity to provide support based on information available and services offered, and commentary from experienced users.

Overview of SAROPs

SAR Categories

SAROPs are categorised in one of two ways:

- **Category I**: A SAROP coordinated at the local level; including land operations, subterranean operations, river, lake and inland waterway operations, and close-to-shore marine operations[1][2].
- **Category II:** A SAROP coordinated at the national level; including, operations associated with missing aircraft or aircraft in distress, and off-shore marine operations within the New Zealand Search and Rescue Region[3].

Coordinating Authorities

Each SAR category has a nominated coordinating authority:

- New Zealand Police (Cat I); or
- RCCNZ (Cat II).

A search operation may change categories, at which point the management of the search operation will be handed over.

Supporting Agencies

The coordinating authorities are supported by many organisations, made up of many smaller groups or units, across the country, and are staffed largely by unpaid volunteers. In addition, SAROPs may involve the coordination of spontaneous volunteers, non-SAR resources, and assets of opportunity.

SAR agencies provide the in-field response for both categories of search operation, and will also provide IMT support particularly for Police coordinated Cat I operations.

SAROP Process

Following the initial notice of a missing person/vessel (i.e. via a beacon activation, distress call, 111 call, etc), most SAROP will starts with a single person – a SAR Officer in the RCCNZ; or a Police officer on general duties, or at home. An initial assessment will be made to determine the urgency and type of response required.

When managing a SAROP, the coordinating agency will establish an IMT, at an Incident Command Post (ICP). For the RCCNZ, this is at their Operations Centre in Upper Hutt. For Police, the location and nature of an ICP will depend on several factors, including the location of the search, time of day, the anticipated duration, the resources available/deployed, and the scale of the operation. Initially, or for smaller SAR, the operation may be run by a single officer from home or in their vehicle; a full-scale SAROPs may be run from a fully equipped incident room at a police station, or a remote ICP tent or vehicle. For a major Category II SAR that

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[1] Category I SAROPs typically require the use of local personnel and resources and can be carried out efficiently and effectively at the local level.
[2] The nature of 'close-to-shore' will vary according to the availability of local resources and the need to task national assets. Typically such operations will be within NZ Territorial Waters (12 nautical miles).
[3] Category II SAROPs typically require the use of national or international resources and may involve coordination with other States.

exceeds the capacity of SAR duty team, a separate operations room will be established, with additional staff.

The initial SAR operator will perform all IMT functions, until additional resources are called on. All agencies generally adhere to New Zealand's Coordinated Incident Management System (CIMS)[4], albeit with adjustments to suit the specifics of the agency. Using CIMS means that agencies should be able to integrate other IMTs as required. Under the CIMS model, the staffing of functions will increase or decrease in size, depending on the scale of the operational requirements.

The IMT process will work through a cycle of intelligence gathering, action planning, operational tasking of field teams and assets, maintaining communications, and logistical support (See Appendix 7).

Intelligence

Information is gathered on all the factors that may inform the location of the search subject, and influence the methods of search, and safety of searchers. This includes, missing person descriptions, urgency assessments, topography, weather, locations of interest, last known position, etc. Modelling and assessments are undertaken to assess the possibilities of the subject being in certain locations.

Planning

Based on the intelligence picture, plans are developed regarding the actions for the assigned SAR Units (SRU). This will also include safety and communication plans, and forecasts of resource needs.

Operations

Operational tasks are recorded, and assigned (issued) to SRUs; the progress of the task is tracked, and upon completion of the task, the results will be added to the intelligence picture.

Tasks may be developed well ahead of being issued via the planning process, or they may be 'reflex taskings' issued immediately based on a change in the situation, or new critical information. Assigning tasks can happen two ways:

1) Direct tasking: specific instructions provided to SRUs under the immediate control of the IMT; or
2) Tasking for affect: instructions of intent are provided to an agency or on-scene coordinator, who will subsequently issue a direct task to the SRU under their control.

Tasks are currently provided to field teams via paper, emails, text, or radio messages.

Communications

Communications links are maintained between the IMT and SRUs, to track the progress of tasks, the status of searchers, and continue to develop intelligence based on field observations.

Logistics

The SAROP is supported through a range of activities such as administration and ICT support, purchasing consumables, organising catering and transport for search teams.

[4] Coordinated Incident Management System (CIMS) 3rd edition, 2020

SAR Incident Management Systems

There are range of IMS methodologies being used across the SAR agencies in New Zealand. The systems vary between, and within, agencies. Sixty-five platforms and supporting applications were identified through interviews for this analysis; this included at least 15 IMS-type applications, used for purposes and extents. No agencies is using one single ICT system for *all* of their IMT functions; Mapping tools (18 apps), communication/notification systems (16 apps), document management (7 apps), and others may all be used separately for specific purposes. Generally, these are not integrated or connected in any way.

A summary of each agency's IMS and other systems is included in Appendices 3, 4, and 5.

Category I

Land

For land-based SAROPs, there is a wide variety of IMS used across and within Police districts, and inconsistencies in how products or tools are applied. IMS range from paper-based through to fully digital. Manually, information is processed using a combination of tools such as paper forms, whiteboard or poster IAPs and status information, and occasionally T-card resource management. Generally any SAR information technology used is owned and operated by local SAR volunteer groups, though some Police districts have some ICT resources.

SARTrack (see below) is the de facto electronic IMS, however it's use is variable across the country and within districts. Some are using it to its full extent for the whole of IMT operation, others are using the tracking elements only. D4H is also being used for operation management in at least one area. Most districts are supplementing these systems with various mapping tools, with some using sophisticated Geospatial Information Systems (GIS).

Marine

For Marine SAROPs, where there is no Police marine unit, the local Coastguard system tend to become the operational system for Police.

Coastguard and SLSNZ each have their own systems for tasking their respective teams and assets during SAROPs, and for non-SAR activities. Coastguard and SLSNZ prefer Police to task them for affect, so that they can determine the best use of their assets in the given circumstance. Coastguard mostly use the D4H *Command Centre* module, though some units are still using paper-based mechanisms. SLSNZ have developed their own *Surf Patrol Application* as an IMS platform.

SARTrack

The SARTrack system was developed and is owned by an experienced ICT professional (also a SAR volunteer) in New Zealand, who continues to deliver the primary support and system maintenance. It is currently used by Police, LandSAR and Amateur Radio Emergency Communications (AREC). Currently SARTrack is somewhat financially supported by NZSAR (in agreement with Police) via LandSAR.

SARTrack is offered as a free product to any SAR agency across the world. Initially developed to provide live tracking of search assets in the field, it has developed somewhat organically over the last 15 years, through feedback and experiences of those using the system.

Governance

It was selected for broad use in New Zealand in ~2016, at which time a Memorandum of Understanding (MoU) was established between SARTrack Ltd, Police, NZSAR, and

LandSAR. When the MoU expired after 3 years, it was superseded by a Service Level Agreement (SLA) between LandSAR and SARTrack. Funding of $20k per annum in provided by NZSAR, paid to SARTrack via LandSAR. This payment is effectively a retainer for system maintenance; any additional developments need to be defined, communicated, scoped and financed separately. There were no requests for updates within the first three years under the MoU, and since then there has been only one occurrence of a deliberately specified and funded change[5].

The MoU and SLA both established tiered governance and relationship arrangements. However, whilst these seemed to have worked well initially, attention to them has slipped over the years. The lack of recent attention to structured governance arrangements, and financial investment has led to system changes driven largely by the vendor (albeit based on operator feedback), rather than agreed and deliberate client-driven changes. This issue extends to non-technical aspects such as instructional materials, operator manuals, training aids, and help-desk support; all of which fall outside the developer's skillset and/or purview. In some cases these issues could be sub-contracted, in others the responsibility may sit with LandSAR.

Usage

SARTrack appears to provide a comprehensive tactical management platform for SAR IMTs. Whilst doing the majority of what is required for a SAR, it was described by some users as being *overly* complicated and far exceeding the requirements of a "typical" SAROP. The almost universal sentiment regarding SARTrack was that the user interface was not particularly good; "Clunky" was used to describe the system in nearly every interview.

SARTrack does not offer broader emergency management aspects, nor provide strategic level 'dashboard' style views for those outside of the immediate IMT. Such things could be developed through additional services (such a website), with selected information being pushed for display. Similarly, SARTrack *could* push data to SARdonyx, Police's Computer Aided Dispatch (CAD), etc, if appropriately directed and funded. Though the operational logs can be printed after an event, the default formatting is not ideal for after action reports or coronial investigations.

A particular strength of SARTrack is its ability to work on and offline. A command post can establish a local network and work without internet connectivity. The SARTrack App (Android only) can be used remotely in the field, and then sync with the server once back in service areas.

Several levels of user access have been set up from *read-only* through to *supervisor*, including special access for Police commanders and RCCNZ. Additional user levels can be set if needed.

Use of the system is generally limited to land searches – but only where capability and personnel are available to support it. Some Police areas are using SARTrack to its full potential, and run whole SAROPs on the platform; whilst many districts use it in a limited capacity, primarily for live-tracking of SRUs. Several SAR coordinators stated that they would not consider using SARTrack for a response shorter than four, or up to twelve hours, as the difficulty of set up and maintenance was considered too great a burden.

[5] To develop capability to track InReach devices.

Training

Whilst a two-day initial training programme is offered (by LandSAR), most people interviewed expressed a concern that within twelve months, they had forgotten most of this training. Ongoing training and education on the system is limited. Those that use it most, tend to be running regular in-house training. It is important to note, that regardless of which IMS platform is used, ongoing training is essential to ensure that skills are maintained, and that users remaining engaged with the system.

System

It is understood that SARTrack uses data encryption, and that system redundancy is achieved through synchronised local and internet-based servers.

Issues were raised by users regarding unpredictable system updates and user interface changes. It appears that largest of these problems occur when both the client *and* the server versions are out of sync. This is largely a by-product of the client device having not been used for some time. More rigid update protocols have been introduced to address some of these concerns, such as major updates being pushed on a quarterly cycle, with supporting communications to LandSAR. However, simple or smaller changes may occur more frequently, and will not be communicated.

All of SARTrack's supporting tools are fundamentally free (e.g. OpenStreetMap). This reduces costs on the developer, however like all public domain systems, users are at the mercy of the system owners, which may contain latent risks and limited controls.

Support

Whilst the developer generally makes himself available as needed, there is no specific help desk functionality; it was indicated that this is the responsibility of LandSAR.

Having an IT platform that is locally owned and managed does provide some level of comfort in terms of general accessibility and familiarity with SAR practises and personnel. However, relying on a sole provider with limited capacity creates risks regarding the ability to maintain an upkeep systems, and provide ongoing and operational support when required.

Some considerations has been given by the developer to contingencies relating to an untimely death or serious misadventure. In such circumstances it is intended that LandSAR would take ownership of the SARTrack company, trademark and development PC. The SARTrack software source code would be released to the public domain[6].

Police Systems

Initial activation and dispatch regarding a SAROP is logged by the Police Emergency Communications Centre (ECC) in the CAD system. However, once an IMT is active, very few CAD entries will be made until the Incident Controller requests the event is closed. There is no automated or procedural periodic updates to CAD which leaves district and national commands with limited visibility of the event.

Some SAR coordinators will log reports into the Police *Investigative Management Tool*; however this is usually limited to SAROPs related to missing person investigations by CIB. The SAR coordinators will log their final SAR summary report into *National Intelligence Application* (NIA) under a provided file number, linked to the event number.

Most of the systems used for SAROPs, including SARTrack, are unable to be installed or used on the Police enterprise system; and most IMT users (as volunteers) are unable to access

[6] IMT_IT_Process_Support_V2-SARTrack Software (~2016)

Police systems due to security controls. As a result SAR systems and tools are accessed on stand-alone laptops. In some instances these are donated or e-waste computers, now held by Police SAR squads, in most instances the machines being used belong to LandSAR, or to individual volunteers.

Without a centralised directive for Police NHQ, the district SAR squads are somewhat at the mercy of district budgets, and the resourcing provided through volunteer groups and donations. Effectively the support agencies are providing the resources for SAR IMT.

Data security is crucial, as is the need to easily retrieve and search records. Current systems usage result in a lot of SAR information being secured in non-Police systems, or filed in archaic manual records.

Category II

As Cat II SAROPs are managed entirely through the RCCNZ, only a single-agency system is in use. The RCCNZ's IMS is a recently implemented bespoke application, designed following years of experience and lessons with the previous platform.

The IMS is generally used internally within the coordination centre. The RCCNZ runs 24 hours a day, 7 days a week. SAR Operators are using the IMS throughout their shifts for day-to-day operations, and to manage SAR incidents.

Tasks are logged within the IMS, but are issued through radio or telephone communications to agencies or appropriate assets.

A separate platform is used for mapping and tracking assets in the field, with GIS data files are periodically saved within the IMS log as a record.

There is little in the way of dynamic common operating picture for those external to the RCCNZ operations room, though the IMS does produce daily reports which are shared with key stakeholders.

See Appendix 3 for more details.

Assessment

Multiple Systems

The current myriad of manual systems, disjointed IT platforms and some "clunky" interfaces, across and within agencies, is likely causing latent process inefficiencies. At best this may be causing many unnecessary administrative workload, and at worst this may lead to delayed and/or ineffective responses.

IMS Ownership

Within and across Police districts, the choice of SAR IMS' is generally influenced by the preference of SAR Coordinator(s); funding and support within the district command; and the resourcing of the local LandSAR groups. There is an over-reliance on the funding and contribution from volunteer agencies, who largely own and manage IMS platforms for Cat I SAROPs[7].

Systems have been implemented in relative isolation, without broader and/or ongoing support. This has led to poor user uptake, and a subsequent lack of support for new solutions. Some systems have passionate users and supporters, and without a centralised mandate and funding model disparate, uncoordinated, and 'shadow' IT will continue to be used.

With varying systems across the country, there are inherent problems for scaling-up significant SAROP. Unfamiliarity with systems will slow down the operational tempo as out-of-area teams integrate into an operation. Similarly, SAR reviews require Police officers to familiarise themselves with the district's SAR methodologies *before* they can focus on their review at-hand. Manual processes and record keeping mean search reviews must be conducted in person.

Vendor Support

With ownership of systems not being centralised, and fragmented within agencies, there are particular risks regarding the reliance on vendor(s) that may lack capacity to support the needs of the sector. In not owning a system and/or licence, the management of the system is controlled only by the vendor. Having a centrally owned IMS, albeit in partnership with other SAR agencies, provides buying power which to drive stronger control and better customer/client relationships.

Care should be taken with small vendor operations where there may be inherent risks regarding the ability to provide operational support, and single points of failure. These risks should be vetted and managed during procurement and implementation projects.

[7] Noting that some are used for non-SAR activities for agencies such as Coastguard and SLSNZ.

Common Operating Picture and GIS

Multiple disconnected systems lead to an absence of a *common operating picture* beyond those sitting in the ICP. Logs, status information, and geospatial information is all contained within individual IMTs. Support agencies, district and national commands, investigative teams, and the Police Emergency Communication Centre have little visibility of the SAROP; any status updates have to be sought directly from the IMT.

Work is underway for the RCCNZ IMS to push information via API[8] to MNZ's MIRT and post-operational data to SARdonyx. Establishing a centralised Police IMS would allow for similar receipt and sharing of situational and post-operations information, and dramatically improve hand-over between the coordinating authorities.

Not all districts using tracking tools to actively monitor SRUs locations in the field. Others are using multiple tools to track teams, aircraft, and vessels. Whilst location tracking may not always be possible due to limited coverage and connectivity, best efforts should be made to monitor the safety of those in the field, and build stronger situational awareness for planning.

By its very nature, SAR is a geo-spatial activity. Whether GIS is processed on paper maps, or through specialist programmes, it is crucial for all aspects of SAROP management. Controllers, operations, planning and intelligence all need basic GIS skills and tools. Though most searches only require low-end GIS application, greater technical GIS capability can greatly enhance situational awareness, and be particularly powerful in intelligence and planning area, where multiple data layers can be interrogated for specific outcomes. High-end GIS applications require specialists trained in the use of such systems. Where such systems are currently being used, it is usually where there are SAR volunteers who happen to work with GIS in their day jobs. Police SAROPs appear to receive little in the way of GIS support, other than any skills and tools brought to bear by particular LandSAR groups. Though this was not raised as a major concern during interviews, there may be opportunities for Police GIS operators to better support in SAROPs through the development of modelling tools, sourcing data, and representing the interests of SAR within the governmental geospatial community and working groups[9].

Records Management and Data Security

Records management and data security is of particular concern. Currently records are being managed differently across the country with little-to-no consistency between agencies and within Police districts. Administrative time spent on reports, investigations and inquiries could be considerably shortened through standardised reporting systems and methodology.

With SAROP details being saved on various platforms and machines, owned by various agencies; privacy and data security is a particular risk. For Police, there is little in the way of controls. Each of the coordinating authorities should control their own IMS databases and archives.

There is a tension between the need for systems security and the largely non-police workforce who run SAROPs operations. Ironically, the security requirements that restrict volunteer access to the Police Enterprise System, are contributing to potential data security and records management risks by creating an environment, where it is easier and preferable to use of non-police systems, and/or manual systems.

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[8] Application Programming Interface

[9] Such as Land Information New Zealand and Geospatial Emergency Management Aotearoa

Appetite for Change

Across all interviews there seemed to be near universal agreement that there was a need for national consistency of both process and systems. Generally, there is consistency regarding the requirements for an integrated IMS; though there is likely to be disagreement as to exactly *which* system will be best.

Whilst the opportunity to have a combined SAR IMS platform should be considered, the most pressing need is for a Police IMS for Cat I SAR. The feeling expressed across those interviewed was that Police NHQ has to set and dictate the direction for a Cat I SAR IMS.

Training and User Competencies

The training burden on volunteers was continually emphasised throughout this analysis. Training hours for volunteers and Police is limited, and there are many specialist areas of training beyond the use of an IMS. Police have twelve training days per year; volunteers training regimes vary depending on their groups.

The lack of specialist systems knowledge, or skills atrophy of trained individuals, was often cited as one of the reasons that SARTrack was not used. The need for greater clarity regarding IMT processes and information flow was often highlighted. Improving understanding of these would help support the use of the CIMS structure, and will improve ICT systems use and manual processes.

Police SAR coordinators and IMT volunteer workers, are typically using their systems periodically during training and SAROPs, many of which may be less than half a day in duration. Most Police SAR coordinators are on-call, and have other duties as their primary day jobs. As such, systems must be relatively intuitive and allow for ease of usability following prolonged periods without training or exercises.

By comparison, operators for RCCNZ, Coastguard, and SLSNZ are all using their IT platforms Every day for SAR and other non-SAR activities. The frequency of use of these systems provides significant skills-maintenance and operational efficiencies, beyond any initial training in the systems that these operators may have.

Training on IMT processes procedures and systems should not be considered a luxury but a necessity, and must be included within the planning and budgeting for any future IMS. Regardless of any IMS implementations, it is crucial to recognise the importance of SAR operators understanding the process is which they are undertaking in the field and in the IMT. Any application needs to be seen as a tool to improve processes, however manual processes will still need to be practised to ensure that SAROPs can continue when technology is unavailable, regardless of the reason.

Summary of Risks

The key risks for the SAR sector relating to IMS are [10] [11] [12]:

Risk	Description	Likelihood	Consequence	Risk
1. Disparate operating models/IMS	• Unknown methodologies and/or incompatible systems limit the speed of scaling a response as new users gain familiarity. • Search reviews required education on system in use prior to substantive review of operation. • Remote support to SAROP in progress generally impossible.	Very Likely	Major	**High**
2. Inadequate monitoring of SAR personnel	• Inconsistent and/or lack of tracking of SRU locations • Limited situational awareness of risks and other influencing issues • Minimal fatigue monitoring • Potentially inadequate monitoring and control of health & safety issues for workforce	Possible	Major	**Medium**
3. Inefficiencies of operations	• Clunky technology delays data processing and slows down inexperienced users • Manual and paper-based systems do not enjoy the efficiencies of modern technology (e.g. ease of tasking, automated SITREP and clue mapping/logging) • Limited ability to automatically track asset hours.	Possible	Moderate	**Medium**
4. Over-restrictive security controls	• Inability for current systems to be hosted within Police Enterprise System • Applications not available on police devices. • Inability for volunteer workforce to use applications associated with Police Enterprise System	Very Likely	Moderate	**High**
5. Limited information sharing	• Operational information is not easily shareable outside of the IMT. • Police commands and ECC are largely blind to the details of the operation in progress. • A lack of interoperability may cause confusion & delays in responding.	Very Likely	Moderate	**High**

[10] Risks are considered broadly across SAR coordinating authorities and agencies. Whilst some controls are in place for some agencies, these are not universal.
[11] Note – The risks listed here are associated with SAR IMS, not with SAR activities.
[12] Note – Likelihood and consequence ratings are made using a generic relative risk matrix. Specific risk ratings will vary for individual agencies.

Risk	Description	Likelihood	Consequence	Risk
6. Inadequate data security	• Poor control on access of documents and data • Lack of assurance regarding accessibility of records • Potential for operational data leaks • Potential for privacy breaches – search subjects and searchers.	Likely	Major	**High**
7. Poor record management, data security and reporting	• IMT documentation recorded on different platforms. • Records filed in different formats - hard copy or digital. • Final reports not standardised. • Operational records not easily searchable after the fact. • Disparate records management and standards affect quality and timing of coronal reports and reviews	Very Likely	Moderate	**High**
8. Limited customer influence	• Products vendor-driven • Lack of controls to through contract • Limited control over systems architecture and design • Limited vendor accountability • Limited customer "buying power" to influence changes. • Lack of requirements and change control process leads to organic system development • Potential for unwanted/unnecessary system changes	Very Likely	Major	**High**
9. Limited vendor support	• Limited capacity for ongoing business support • Limited capacity for 24/7 operational help-desk support • Limited customer communications • Limited training support – technical / operational	Very Likely	Major	**High**

			Impact				
			Negligible	**Minor**	**Moderate**	**Major**	**Extreme**
1. Disparate operating models/IMS 2. Inadequate monitoring of SAR personnel 3. Inefficiencies of operations 4. Over-restrictive security controls 5. Limited information sharing 6. Inadequate data security 7. Poor record management, data security and reporting 8. Limited customer influence 9. Limited vendor support	**Likelihood**	**Very likely**	Medium	Medium	High 4 5 7	High 1 8 9	High
		Likely	Medium	Medium	Medium	High 6	High
		Possible	Low	Medium	Medium 3	Medium 2	High
		Unlikely	Low	Low	Medium	Medium	Medium
		Rare	Low	Low	Low	Medium	Medium

Future State

Adopting digital platforms for SAR IMS is essential to streamline responses, and improve agency interconnectivity. A future solution must meet the needs of SAR IMTs, create operational efficiencies, be useable for land or marine searches and be capable of passing between Cat I and Cat II SAROPs, and interfacing with future technological developments, and/or procedural changes.

A streamlined and integrated IMS platform will allow for smoother tasking, tracking of resources, and logging of information. Ideally, all teams and assets in the field will carry smart devices which can send/receive SAROP related information (briefings, taskings, waypoints, clue locations, etc). However due to the limitations of budgets, resources, and data coverage; contingency elements should be part of the system, such as the capability to print briefing papers and tasks; and for procedures to reflect workarounds, such as manually updating task details based on radio communications. The solution will need to work on- and offline, and will need to cater for remote workers - both in the field and at various operation centres.

SAROPs vary in geography, scale of response, urgency, and duration, IMS solutions need to be scalable to allow IMT to surge from one person to tens of people. A universal platform will make it easier to bring additional responders into an operation. The solution will need to be immediately accessible and simple to operate, to ensure that it is useful for short-duration SAROPs.A solution that allows for separate incidents to be linked as *parent/child* should allow agencies to retain direct control of their assets, while coordinating authorities' task them for affect (see Appendix 8 for example of tasking relationships). This will allow functional coordination of directly and indirectly controlled assets, and provide and auditable record.

Standardised reporting mechanisms will reduce administrative burden on SAR coordinators after operations, cutting hours required to produce SARdonyx reports, and providing ease of access to operational logs for coronial inquiries. Reviewers to access the operational records remotely, and will not need to learn a new methodology.

Emergent Technologies

Historically Emergency Management IT platforms have been imagined as single standalone systems, capable of doing everything required for emergency response. However, this is not a realistic proposition as typically business as usual systems (e.g. procurement, and travel bookings) are often required to support the response, and information sharing requires interaction with third party systems. This was reinforced by discussions with overseas SAR agencies, where IMS platforms are supported by multiple specialist applications (e.g. GIS, AIS systems). Anecdotally, one international rescue coordination centre regretted the choice of an all-in-one IMS, as they are now locked-in to certain over-complicated components, with limited interoperability with newer systems[13].

The ideal therefore, is that the IMS is the *master* platform for tasking, logging, and record keeping; and other systems are integrated as required - whether by web services, APIs, or configured integration. Similarly, changing, and emergent technologies (e.g. GIS, satellite

[13] Broad research into specific ICT used for international SAR was not undertaken. Though this may be of general interest, further investigation is of limited value, as appropriate IMS software for the New Zealand context will be discovered and determined through a formal procurement process.

communications, drones) can be tested and integrated more easily, if the system is not locked into specific and rigid tools.

Some configurations should be expected based on the need to integrate agency platforms and/or variations, and the development of customised APIs and web services for information sharing.

Requirements

High level requirements for a SAR IMS have been developed based on interviews with Subject Matter Experts (SME) and the CIMS doctrine. These requirements are broadly universal to SAR categories and search types (i.e. land, marine, etc), though some requirements will be of greater importance to some agencies than others.

The highest priority requirements are:

- Effective and efficient operational tasking
- Accurate event logging and integrated records
- Geospatial information, intelligence and planning
- Live tracking of people and assets in the field
- Sharing operational information within the IMT and with partner agencies
- Consistent end of operation reporting for investigators and/or coroner

Other key requirements are:

- Ability to manage multiple operations simultaneously
- Functionality linked to The CIMS model
- Integration of current SAR forms and procedures
- Effective and efficient intelligence and planning tools
- Ability to integrate with third party systems and data-feeds
- Administration, logistics, and financial tools and record keeping
- Searchable and auditable records of SAROP
- Efficiencies of training and education in systems and procedures
- Ease of access and usability for operators (intuitive interface)
- Vendor support for training and operations
- Secure and robust data storage and disaster recovery
- Web enabled accessibility on all devices
- Offline accessibility for remote areas

The complete list of capabilities and high-level requirements is included in Appendix 6.

Agency Requirements

SAR Agencies

At the time of writing, LandSAR are undertaking a review of the systems in use across their groups and are developing high-level requirements, with a view to assessing the market for future systems. In addition to the requirements listed in this report, any future IMS procurement should include consideration of the requirements developed by LandSAR, and any current requirements from other SAR agencies.

Civil Defence Emergency Management

Ideally any SAR IMS will be compatible with Civil Defence Emergency Management (CDEM) IMS. However, as there is no one system, or standard currently being applied across, or within

the CDEM Groups, and it is understood that NEMA intends to look at IMS options in the future; it is unlikely that a streamlining of systems interoperability will be possible in the near future. Nevertheless, in selecting an IMS, the SAR sector should give consideration to future alignment; and the requirements provided in this report should allow for integration and/or information sharing with future CDEM IMS platforms.

Barriers to Implementation

Potential barriers to successful implementation issues were identified during this analysis:

- **Funding:** prohibitive pricing of systems my reduce options. Combined procurement between SAR agencies could improve purchasing power. Agreement will be needed regarding the apportionment of costs across agencies and/or groups.
- **System suitability:** available applications may not suit all of the requirements as stated in this and other documents. Compromise will likely be required; including the use of separate specialist applications with appropriate integration tools.
- **Mandate**: a centralised directive for implementation is required. The system will need to be endorsed and mandated from the coordinating authority/ies.
- **Sector acceptance**: differences of opinion regarding the best systems may lead to poor uptake. This can be countered through the use of advisory and working groups, dedicated engagement campaign throughout the implementation of a new system, and the use of ongoing training.
- **ICT security -** Police ICT was continually referenced as a barrier to the implementation of an IMS. Police enterprise security requirements are not seen as compatible with those of external volunteer users; many support applications are restricted, and cannot be used on Police devices. Investing in an IMS that is provided as software as a service (SaaS) with companion smart device applications, and establishing effective security and credentialing requirements for users may help alleviate these issues.

Available IMS

A market scan was undertaken to assess if there are any suitable IMS with the potential meet the capabilities as listed in Appendix 6.

Publicly available information, demonstrations, and user reports we used to assess each system. An indicative rating has been given of the *potential* for each application to meet the stated capabilities (see Appendix 9). Further assessment via ROI or RFP processes will be required to determine each application and vendor's true capability to support the New Zealand SAR sector.

Several small, independent and largely free SAR applications are available. These are generally specialist applications focused on specific SAR elements (e.g. last person behaviour, pattern recognition, GPS tracking).

There are relatively few holistic SAR IMS, that broadly comply with the CIMS model. There are however several Emergency Operations Centre (EOC) systems which may be suitable for SAROPs in New Zealand. **Noggin**, **D4H**, **SARTrack** and **SAReye** were the strongest contenders[14]. Each of these platforms appear to have user friendly interfaces, and cover the range of incident management functions covered under CIMS. Noggin and D4H have the advantage of being well-established and supported systems, with some use in New Zealand

[14] **Note –** this is not an endorsement of these systems or vendors.

already. SARTrack and SAReye are specialist SAR application. SAReye has been broadly applied to in Iceland for SAR and emergency management.

Interviews with New Zealand and overseas SAR agencies suggest that single systems are overly restrictive, and it is unlikely that a single system will meet *all* of the requirements of SAR IMS. Interoperability with specialist GIS, GPS, tracking, communications, and notifications systems may still be required. Specialist software for GIS or notifications, was not directly assessed, as there are an abundance of these applications available. It is recommended that any application chosen is capable of interfacing with third party software and data-feeds, this will allow for future improvements of specialist systems and experimentation with new technologies.

Little information is available as to the business structure of the vendors, or the mechanisms of application support or hosting. Inferences can be drawn from the availability of certain apps, and the professionalism of their websites and information offerings.

Non-IMS Platforms

There has been some trend towards using Microsoft Teams and associated products for high-level IMS. These products have the advantage of being very familiar to users and require minimal training. Microsoft Teams channels are extremely customisable making them useful for creating CIMS functional areas. The configurable nature of Teams is advantageous; however, it does require a universal understanding, and a commitment to follow, unregulated processes and information flows. The use of MS Teams across the SAR sector would likely lead to considerable local customisation based on preferences of individual users, ultimately driving operations away from a centralised methodology. Whilst it is assumed that Microsoft 365 products will be used within in SAROPs for various aspects of communications and document creation, it is not recommended that MS Teams is used as the centralised IMS platform for SAR.

Conclusion

There are range of IMS methodologies, platforms and supporting applications/technologies being used across the SAR agencies in New Zealand. Systems vary between, and within, agencies. No agencies is using one single ICT system for *all* of their IMT functions. Mapping tools, communication/notification systems, record management may all be used separately for specific purposes. Mostly these are not integrated or connected.

The two SAR coordinating authorities have a fundamental responsibility to ensure there are IM processes and systems in place to provide efficient and effective SAROPs, and to maintain the security and integrity of systems and data. Ideally the ownership of SAR IMS Should sit with the coordinating authorities.

Whilst the IMS for Cat II SAROPs is owned by RCCNZ and is generally fit-for-purpose, there is no centrally coordinated IMS for Cat I SAR. For the systems that are in use, there is an overreliance on volunteer agency funding and ownership. The de facto Police IMS is not owned by Police nor centrally managed, has mediocre uptake and usage across the country, and is generally considered not user-friendly.

The coordinating authorities should set the direction for their respective SAR IMS, whether combined or separate platforms. Support agencies have responsibilities to ensure that they work with the requirements set by the coordinating authorities, ensuring that the systems they are using for non-SAR activities dovetail with designated SAR IMS applications.

Investing in a combined SAR sector IMS, or interconnected systems, will create opportunities to improve the efficiency of SAROPs, particularly with regard to activation (call outs), tasking allocation, sharing information with partner agencies; and maximising the potential of planning and intelligence activities through the capture and display and processing of all SAROP and supplemental information. The primary financial burden to support SAR IMS should not sit with volunteer groups, other than as may be reasonable for the maintenance and upkeep of their own aspects of the IMS. A partner licence agreement could be considered dependent on the nature of the solutions on offer.

The risks and issues described in this report generally apply across both SAR categories and most agencies, however the largest components of these lie with Cat I SAR management. Whilst the opportunity to have a combined system should be explored, the most pressing need is for a Police IMS for Cat I SAROPs. Addressing IMS tools, processes, and training in this space should be the short-term priority for the SAR Sector.

In the long-term a universal SAR IMS may be ideal. However, the current gap between Cat I and Cat II systems is possibly too large to bridge in the short-term. It is recommended that a technology uplift and maturity for Cat I SAROPs is developed before considering a universal SAR IMS.

Appendix 1: Abbreviations and Acronyms

Abbreviations	Definition
AMCART	Aoraki Mt Cook Alpine Rescue Team
API	Application Programming Interface
AREC	Amateur Radio Emergency Communications
BAU	Business-as-usual
CAD	Computer Aided Dispatch
CDEM	Civil Defence Emergency Management
CIMS	Coordinated Incident Management System
DOC	Department Of Conservation
ECC	(Police) Emergency Communication Centre
ECCs	(CDEM Group) Emergency Coordination Centres
EOC	Emergency Operation Centre
ESO	Emergency Service Organisations (Police, FENZ, ambulance services)
FENZ	Fire And Emergency New Zealand
GIS	Geospatial Information Systems
GPS	Global Positioning Satellite
IAP	Incident Action Plan
ICP	Incident Control Point
ICT	Information And Communication Technology
IMT	Incident Management Team
IT	See ICT
MDT	Mobile Data Terminal
MOT	Ministry Of Transport
MRC	Marine Recue Centre
NEMA	National Emergency Management Agency
NHQ	(Police) National Headquarters
NIA	(Police) National Intelligence Application
PIMT	(Police) Investigative Management Tool
PNHQ	Police National Headquarters
RCCNZ	Rescue Coordination Centre New Zealand
RFP	Request For Proposal
ROI	Registration of Interest
RSS	Really Simple Syndication
SaaS	Software As a Service
SAR	Search And Rescue
SAREX	Search And Rescue Exercise
SAROP	Search And Rescue Operation
SITREP	Situation Report
SLSNZ	Surf Life Saving New Zealand
SME	Subject Matter Expert
SOP	Standard Operating Procedure
SRU	Search And Rescue Unit
TRT	Transport Response Team

Appendix 2: Interviews

New Zealand Police

- Craig Rendel
- Scott Iszard
- Craig Burrows
- Garry Larsen
- Sara Arrow
- Sean Keeley
- Andrew Knox
- Craig Pickering
- Peter Payne
- Barry Shepherd
- Dave Comber
- Andrew Wong Too
- Conrad Smith
- Andrew (Andy) Brooke
- Antony Callon
- Mike Jackson
- Rob Stokes
- John Fookes
- Brian Benn
- Matt Sheat
- Mike Higgie

Rescue Coordination Centre New Zealand

- Neville Blackmore

Ministry of Transport

- Lucas Vetter

Royal New Zealand Coastguard

- Rob McCaw
- Ray Burge

Department of Conservation (Aoraki Mt Cook Alpine Rescue Team)

- George Loomes

Land Search and Rescue New Zealand

- Matt Ellingham
- Johnny Franklin

Surf Life Saving New Zealand

- Allan Mundy

New Zealand Amateur Radio Emergency Communications

- Don Robinson,

Fire and Emergency New Zealand

- Ian Duncan
- Craig Bedford
- Angel McSaveney
- Hami Taite
- Ben Fairweather
- Gavin Traver

Other

- Bart Kindt, SARTrack
- Paul Gatty, Transit & Public Safety Command Victorian Police
- Guðbrandur Örn Arnarson, Slysavarnafélagið Landsbjörg / ICE-SAR (SAReye)

Appendix 3: Agency Incident Management Systems

This appendix provides a summary of the IMS and supporting systems in use by each agency interviewed for this report. Whilst care has been taken to represent the primary systems in use for SAROPs, it is likely that there are additional supporting products also in use which were not mentioned during the interview process. Any opinions expressed within the summaries reflect descriptions of the systems by those interviewed.

Police

Systems Snapshot

- National Intelligence Application (NIA)
- Investigation Management Tool (IMT)
- Computer Aided Dispatch (CAD)
- iNet Viewer (CAD web browser access)
- Mobile Responder (CAD mobile device)
- Whispir
- Manual (Paper-based, whiteboards, T-Cards)
- SARTrack*
- D4H Incident Management module*
- SARtopo*
- Memory maps
- *Google Maps
- Google Earth*
- Arc GIS*
- TracPlus*
- MapToaster*
- NZ Topo Maps*
- Dropbox*
- WebEx*
- Google Docs/Drive*

* Denotes systems not licenced directly by agency.

Overview

There is a wide variety of IMS used across and within Police districts, and inconsistencies as to how products or tools are applied. IMS range from paper-based through to fully digital. The choice of system is generally influenced by the preference of the SAR Coordinator(s); the funding and support within the district command; and the resourcing of the local LandSAR groups.

Paper-based / Manual IMS

Where manual systems are being used, the exact methodology varies. Information is processed using a combination of tools such as paper forms, whiteboard or poster IAPs and status information, and occasionally T-card resource management. These analogue methods are sometimes supported by document filing/sharing tools such as **Google Drive**, **Dropbox**, and **Webex**. Manual systems seem to have the advantage of being simple and easy to set up and use in any location, and require minimal training efforts. When deploying for urgent or short-duration searches, the speed of implementing manual process is seen as preferable to "hassle" of setting up ICT systems.

SARTrack

The predominant electronic system used is **SARTrack**, however only a couple of areas are using the system close to its full extent/capabilities and as a complete IMS.

SARTrack has considerable capability to track tasks, maintain operational and communication logs, connect records to maps, and live track teams via GPS devices. Most of the areas using SARTrack do so predominantly for live-tracking of SAR teams and as a communications log, to complement otherwise manual processes. SARTrack has the advantage of being available

when offline. It has an Android mobile app (not iOS) for use in the field, which will sync data back to the server when connectivity is restored.

Some districts use SARTrack only when a search duration is anticipated to extend beyond four, or even twenty-four hours. The system as viewed as being too resource intensive and slow to set up; for rapid SAROPs, a manual IMS is considered to be easier.

The principal criticism of SARTrack, including from its proponents, is that it has a cumbersome user interface and is difficult to navigate. It has been discarded in many areas as users feel that it is too hard to learn and retain skills on the platform. The training overhead is considered too much, particularly in terms of volunteer time. Conversely, the strongest users of the system have maintained training efforts for both Police and volunteers, and appear to reap the benefits in terms of making full use of the system.

D4H

At least one area as adopted the use of a **D4H *Incident Management*** module, as its principal system. This is a relatively new implementation, but is spoken of with great enthusiasm from the users. The platform is seen as being very intuitive for users, and able to be set up quickly and easily with forms and basic workflows. Though the platform has to be set up from scratch, forms can be shared with other system owners. The *Incident Management* module also interfaces with the LandSAR group's D4H ***Personnel & Training*** and ***Equipment Maintenance*** modules, allowing allocation of pre-loaded resources to an incident. The mapping module within D4H does not contain New Zealand geodetic information (NZTM), leading to the continued use of **SARTopo** as the primary mapping tool.

Marine SAROPs

For marine based category-1 SAR, Police may set up at local Coastguard operations rooms, and by default will rely on the Coastguard's IMS as the primary log.

GIS

GIS use varies considerably across the districts. In addition to SARTrack's maps, districts are using **SARTopo**, **Memory Maps**, **Google Maps**, **Google Earth**, and/or **ArcGIS**. The purpose and extent of use varies depends principally on the skill set of operators and what applications the local LandSAR group has acquired. More sophisticated systems and usage seem to align with high-skilled volunteers who work with geospatial technologies in their day jobs. In some areas, IMTs are using paper-based maps with transparent overlays to draw on various planning and intelligence information. There appears to be little in the way of centralised operational GIS support from PNHQ.

Contacts and Activation Systems

Police own and operate the Whispir system for use in mass-text notifications. It is generally considered to be a secure platform for contact information. Some districts are using Whispir to good effect, maintaining contact details and calling out their SAR operators. However, in other districts, there is more reliance on systems used by LandSAR groups, which are seen as easier to access, use or maintain. These other systems are also accessible to volunteers working within an IMT, where Whispir is available only via Police computers/users.

Emergency Communications Centre

Police use the **Computer Aided Dispatch (CAD)** system to create events to any calls received by the Emergency Communications Centre (ECC). When an event is created, it will generate an event number. All communications passing through the ECC related to the event

will be recorded as a chronological log. Event records include geographic coordinates, and are linked to CAD maps. CAD maps are not integrated with other GIS.

For calls that are immediately obvious as SAR events, dispatchers will contact the appropriate SAR Coordinator; otherwise the event may be dispatched to local general duties officers, until such time as the sergeant in the field determines the need for SAR, at which point a handover will be given.

Once a SAR IMT is established, most records are maintained in the SAR file or applications; there is usually little in the way of CAD event log updates. SAR Coordinators occasionally enter updates directly into CAD via the mobile app (**Mobile Responder**) or browser version **(iNet Viewer**).

CAD event files are closed when the SAR coordinator advises the ECC to do so. Once the event is closed, the system generates a file for the National Intelligence Application (NIA) along with a file number, linked to the event number. Officers will file their incident reports using the NIA file number.

CAD events are sometimes closed before the SAROP has been concluded or suspended, which means there is no available information on the SAROP event for those not directly involved, without having to make calls directly to the SAR Coordinator. It was noted that periodic updates to the CAD event would improve the visibility and understanding of the operation for the district and national commands. Currently this requires an officer to update the CAD on the mobile platforms, or call into the ECC. The ECC is trialling an options for receiving email updates for non-urgent event updates, which may provide a short-term solution; however automatic updates from a future SAR IMS to the CAD would be ideal.

Police and Fire And Emergency New Zealand (FENZ) share the CAD platform, so information is easy to share and handover as required. The Inter-CAD system creates an interface to the ambulance CAD; however the interface is not ideal. Initial scoping investigations are underway to assess the feasibility of replacing the CAD system of all Emergency Service Organisations (ESO), to improve connectivity and consistency between ESOs, improve access to other government and non-government organisations that support emergency service activities, and improve access for the public to emergency services.

ICT

Most of the ICT hardware and software being brought to bear for category-1 SAROPs is owned and supplied by local volunteer groups. The funding to supply and maintain these systems is largely provided by the volunteer groups; in some locations funding has been supplemented via the Police district command. In other areas ICT hardware has been donated, or recycled e-waste, sometimes including old operating systems.

Solutions (such as SARTrack) cannot be stored on or accessed via Police enterprise systems. Due to security restrictions, volunteers are unable to use Police computers. With volunteers making the bulk of a SAR IMT workforce, Police ICT is not used as it is generally seen as a barrier. SAR coordinators have similar limitations with their Police issued cell-phones as many of the preferred apps are prohibited from use. One or two police computers may be used in an IMT, but only for accessing **NIA**, and **IMT**.

Records

The records of searches is also somewhat variable. Typically all areas end up with a printed file from a SAROP. For some this is maintained or printed on a daily basis throughout the operation. Others print records at the end, or as needed for coronal inquests. Some scan

printed documents and upload the final file into the Police IMT. Archived electronic records of previous searches are largely being marinated in systems outside of the direct control of Police.

LandSAR

Systems Snapshot	
• D4H • SARTrack • T-Cards • Dynamics database • SARTopo • SearchLight	• eTXT • Whispir • Volunteer Rescue • WhatsApp • Signal • Scanners

Overview

In addition to SAR field teams, LandSAR provide IMT capability and resources to support Police, with some districts relying very heavily on volunteers within their IMTs. LandSAR volunteer groups are using a variety of different systems to manage their IMT operations. **SARTrack** is the semi-default search management tool, with approximately 60% of LandSAR groups using it. Several groups are using D4H *to manage resources and training records; s*ome are also using **D4H** for incident management; other groups are using largely paper-based systems.

SARTrack is described as doing a lot of what is needed. It has capability for managing tasks, team, equipment, mapping search areas and paths, analysing lost person behaviours, GPS tracking tools, and communications integration. It was also described as somewhat lacking for the user experience, not having a particularly intuitive interface. Certain functionality is 'buried' within menus. A primary complaint is that the system often updates just as it is being started up to manage an SAR, causing a period of down time and frustration in the initial stages of a SAROP. This can be exacerbated by an update resulting in a changed the user interface. System changes appear to not be managed by a strict control process, with upcoming changes not being well communicated, or pre-trained.

SARTrack Training

LandSAR run two levels of training on SARTrack: the first as operators coving the basics and task management; the second covers details of system set up and support. The training requirements are considered high, and there is minimal ongoing system use or training, leading to rapid "skill fade" in users.

GIS

In addition to the mapping component of **SARTrack**, **SARTopo** is being used for area and location plotting. **SearchLight** is occasionally used to provide AI pattern recognition.

Contacts and Activation Systems

LandSAR manage a **Dynamics 365** database of members, with the content including contact details and competencies. The individual groups are responsible for managing the actual member data. Different systems are being used across the country in the activation of LandSAR teams. **Whispir** used by Police and some LandSAR Groups, allows the sender to collate the responses; as does **Volunteer Rescue**. **eTXT** is used by some Police districts to activate teams, which only allows for a push of messages. Various app-based communications tools and chat-clients such as **WhatsApp** or **Signal** are used for general activation coordination between and amongst Police and SAR teams.

ICT

The technology hardware employed ranges widely from local Police resources, through to volunteers using their own personal laptops. A range of systems are being used for on-site team and assembly are management: sign-in sheets, **T-cards**, and barcode scanners.

Department of Conservation

Systems Snapshot	
• Microsoft 365 • MS File Explorer • OneDrive • Volunteer Rescue	• Google Earth • Flight Radar • InReach • GaiA GPS (on iPads)

Overview

The DOC Aoraki Mt Cook Alpine Rescue Team (AMCART) operate their IMT on behalf of the Police, from the Emergency Services Room in Mt Cook Village. The principle platform for the IMS is **Microsoft 365**. The team have a pre-defined file structure and suite of template forms, which are copied and renamed for incidents. Most of the documents used are **Excel** worksheets, which are adapted versions of the standard SAR forms. Microsoft 365 has largely been used due to the ease of access and the familiarity with the products that IMT staff bring with them from business-as-usual activities.

At the end of the operation, all the documents are bundled into a zip-file and emailed to Police.

Contacts and Activation Systems

For call outs, the ARC uses **Volunteer Rescue**, which allows for sending notifications and tracking responses.

GIS

Google Earth is used for creating search patterns and marking clue locations. It is preferred for ease of use by operators. It also has the benefit of regularly updated satellite imagery, and the ability to reference altitude in addition to coordinates. **Flight Radar** is the primary tool for tracking the air ambulance and other air assets.

Garmin ***InReach*** is used for tracking SAR team locations. Text messages from phones linked to InReach provide SITREPS and location coordinates.

The AMCART also use iPads with **GaiA** GPS, which syncs across laptops. This allows teams to mark a location which can be sent to helicopter pilots, who are using **iPads** in-flight.

ICT

The ICP is set up using 5 workstations with double screens, with whiteboards and TV screen displays.

Training

Training for DOC staff on the IMS takes approximately 1 hour per week for between 8-12 weeks each year.

Amateur Radio Emergency Communications

Systems Snapshot	
• SARTrack • Analogue radio network	• Enable Fleet

When supporting SAROPs, AREC provide radio operators for the Police IMT, and additional ICT capability and support. In the early stages of a SAROP, AREC will prepare the communications plan based on the local topography, anticipated radio coverage gaps, and search areas. AREC use **SARTrack** for logging communication traffic to/from the IMT. All radio and telephone communications from the IMT will be logged. On occasion, an AREC member will be the primary logger of all SARTrack data on behalf of the Incident Controller.

AREC will advise teams which frequencies to use and will deploy **mobile repeater stations** where needed/available. AREC has its own **digital radio network** and **analogue radio network** (licenced amateur network) which is used to provide radio coverage across a search area. AREC's radio network is augmented with the use of other agency repeaters.

When working with out-of-area SAR teams, AREC will user a cloud-based **Enable Fleet** system to update radios to work in the local area. SAR Team radios will ping locations every 15 minutes, and every time a radio conversation is first initiated. Location data is received by AREC's base radios, which are linked to SARTrack, which can map the team locations.

SARTrack was described as being good at recording information, with the capability to sort and filter logs by fields. However it was noted that it is not particularly good at extracting the data for displays. SARTrack does provide a virtual playback of SAROP.

SARTrack was noted as processing information quickly, as it does not rely on SQL databases, and can run on various operating systems. The system runs from an online server, but can operate remotely when there is no internet coverage. An Android app version is also available.

SARTrack was described as doing the majority of what is required for a SAR IMT. The system was described as having developed organically; it may lack from not having a full and detailed set of user requirements.

Ongoing training and education of how to SARTrack is limited. AREC noted that whilst SARTrack support and training was not their role, it may be something they *could* do. AREC also noted the need for greater process clarity for SAR IMT information flows that would better support the CIMS structure. SARTrack training has recently been extended from one to two days, which appears to be improving understanding and results. It was suggested that each SAR IMT could use a "admin unit" to help set up and trouble shoot the technical issues during the operation.

Being owned and managed by local developer, familiar with LandSAR has the advantage of providing personal support localised innovations. However, being a sole provider does provide the system with a single point of failure.

Surf Life Saving

Systems Snapshot

- Surf Patrol Application
- Mobile Data Terminal (MDT)*
- GPS tracked radios
- Dropbox
- WhatsApp

* Denotes systems not licenced directly by agency.

Overview

SLSNZ have a custom-built ***Surf Patrol Application*** which captures information for business-as-usual patrolling ("between the flags"), operational risk assessments, event safety, and SAR incidents. The Surf Patrol App shows the resources on-duty/available at each location, and how many people are on patrolled beaches. By using a system for both patrolling and SAR, there is a feeling that it is easier for members to use and be trained in.

When SLSNZ receive reports from the public, and suspect that there is a missing person, they will immediately notify the Police. In the event of a SAR incident accruing on or near a patrolled beach, the patrol captain will assume the role of SLSNZ SAR Coordinator, and manage the scene until Police establish an IMT.

The Marine Rescue Centre (MRC) communication room contains a St John's **Mobile Data Terminal** (MDT) as a notification platform, it notifies of any water incidents (as a heads-up only). SLSNZ can respond if needed, or if they have patrols close to any life-threatening notifications. For reflex tasking, SLSNZ will notify Police if they are responding.

The SLSNZ SAR coordinator will initiate immediate tactical activities, and will report back to the Surfcom at the MRC in Auckland. Some of the SAR forms are filled in 'on the beach', however the Surfcom staff will manage the majority of the documentation, including: logging key actions/decisions and noting SAR team information. The Surfcom documents and tracks the assets and fuel used for invoicing Police after the incident. Drowning Reports will are also initiated by the Surfcom. At the conclusion of the incident, SLSNZ documentation will be buddled into a **Dropbox** and sent to the relevant Police Incident Controller.

Once new SLSNZ members are entered into the system they can use the app on their phones. The system runs with three levels of authentication: users (view/enter information), approvers (patrol captains) and administrators. The app can be used when there is no signal, with data uploading once connection is restored.

There is an online learning platform with a training module for patrol captains on using the app. It is described as being very user friendly.

The Surf Patrol Application was developed by a SLSNZ member; however the app is fully owned by SLSNZ. It is built on a Google platform, which allows for relative ease of improvements and changes, and can work with other applications, and can easily push/pull information through APIs. The app is hosted in a data centre, with an offsite DR location.

Contacts and Activation Systems

Following notification from emergency services communications centres, Surfcom will send mobile text messages to appropriate SAR squad members. On-scene assets are notified by SLSNZ SAR coordinator using **WhatsApp**.

GIS

Surfcom digital radios are being rolled out across the country. Digital radios are GPS tracked. Location data comes in automatically but is not currently mapped in GIS. An **ArcGIS** server is being built, which will likely interface into the Surf Patrol Application.

Coastguard

Systems Snapshot

- D4H
- Trip Manager
- Wave – VHF radios
- Addcom – phone system
- Active alerts (Active911)
- TracPlus
- AIS
- Mobile Data Terminal (MDT)*

* Denotes systems not licenced directly by agency.

Overview

There is not currently a common IMS across all of the Coastguard units, though CIMS is used in all locations. The Marine Recue Centre in Auckland is staffed 24/7, with supplemental volunteer staff on working over the weekends. This centre keeps a watch over all Coastguard channels, and Surf Life Saving channels outside of the summer months. The Coastguard unit in Tauranga provides a backup location for continuity. The national watch does not monitor channels in some areas during the day, where there is a volunteer watch officer on duty.

For business-as-usual activities the Coastguard use a platform for trip reporting (Trip **Manager**), which will log callsign, location, destination, souls on board, estimated time of arrival/return. Trip manager is a web-based application that Coastguard built themselves. Currently eight of thirteen Coastguard watches are using it.

The Coastguard Operation Centre will run Coastguard incidents for events occurring north of Waikato. For other locations, most units stand up their own IMT once activated by the watch officer. Wherever the operation is being managed, the responding Coastguard unit will connect with local Police Search Coordinator as soon as possible. For operations with the Greater Auckland area, the Police controller will often manage the incident from the Operations Room of the MRC.

For incident management, Coastguard are using the cloud-based **D4H**. Coastguard will start an *incident* as soon as it is determined they can be of assistance. All incidents are managed using D4H, though most are providing assistance, with about 20% being SAROPs. Multiple and concurrent incidents can be managed within D4H. Some units are only just starting to use *Control Room*. Others are still using the NZSAR Marine Incident Forms.

There are currently inconsistencies of approach across the country as to in how Coastguard boat crews get details of their taskings, from phone calls after initial notification, to radio calls once on the water.

Coastguard's radio runs through Kordia's **Wave** system, which records all radio traffic. Rapid-recall function allows for the playback of calls from the previous 30 minutes. The Addcom system records all phone calls into the MRC. Records are deleted after 90 days unless there is cause to retain them. Coastguard use the St John's **MDT** in the same way as SLSNZ.

Contacts and Activation Systems

For staff activation, Coastguard use pagers, however these are slowly being replaced with the phone app, ***Active Alert*** (aka **Active911**), which provides options for responses to the alert, including mapping functionality to show arrival times.

GIS

The mapping component of D4H is rudimentary; it will pin a location from logged coordinates, however there is not additional overlay or intelligence capability. Instead, Coastguard use **Google Earth**. TracPlus is used to track the location of all Coastguard vessels, with plans to

use push this data via API to maps in the future. This system only allows for visibility of Coastguard assets. It does not track other official SAR assets in the field such as Navy vessels, Airforce planes, drones, or other assisting vessels.

Reporting

D4H generates a PDF report at the conclusion of an incident, for submission to the Police. D4H can accept any API or similar feed and integrate this into its reporting or displays.

Rescue Coordination Centre NZ

Systems Snapshot	
• IMS platform (bespoke) • Google Earth Pro • Wave • MAPIT (plugin)	• TracPlus • Automatic Identification Systems (AIS) • Flight Explorer • MS Teams

Overview

RCCNZ use a bespoke platform for their incident management, referred to as the "**IMS**". The IMS is a relatively recent implementation and has been designed following principals and lessons learnt from several years of using an adapted *Lotus Notes* system. In addition to managing category-2 or supporting category-1 SAROPs, the system is designed and used for day-to-day operations, such as communicating coastal and navigational area warnings.

For daily operations, the system provides a landing page from which the operators can see various notifications, temporary procedures, navigation warning, and the operations log. The system contains master copies of RCCNZ procedures and plans, with uncontrolled back-ups stored separately in Maritime's document management system.

Incidents Logs

When an incident is started, the system creates a unique 'page' with an auto-generated refence number[15],where all the information relating to the incident is viewed. The IMS is capable of running several incidents simultaneously.

The principal component of the system is the *log*, which allows for operators to make a record of everything that occurs, or is communicated, relating the incident. All log entries are categorised, with data entry fields changing to suit the particular category chosen. Categories of log entries are used to provide specific on-screen windows which can be filtered and sorted as needed. The log contains a range of highlighting styles to indicate various issues to operators (e.g. an entry by the Incident Controller).

Log entries include the creation of tasks. When an asset is assigned to a task, a link is created between the asset and the task, prevent double-tasking. Time on-task for the asset is tracked for future audit and reconciliation. Incident related invoices are sent to Maritime NZ's accounts payable team; when these are sent to the RCCNZ for approval, a copy of each invoice is attached to the specific log entry for the relevant incident.

SAR IMT forms and other documents sent or received are currently loaded as attachments into log entries. GIS data layers (GPX files) are also filed as attachments at various times throughout an incident, providing a visual record of a point in time.

GIS

RCCNZ uses **Google Earth Pro** as its primary GIS tool for planning and plotting purposes. This platform was chosen due to the ease of operator training and use. The tool is seen as being intuitive, with operators generally being familiar with the **Google Maps** interface. Google Earth tools allow for importing and creation of GIS layers and objects, such as those from **MapIt**. Assets from the SAR Resource Database can be displayed on Google Earth. For asset

[15] Reference numbers have different prefixes depending on whether the SAROP is Category-1 or -2.

tracking, the RCCNZ uses **TracPlus**, **AIS**, and **Flight Explorer**. TracPlus flight paths can also be displayed in Google Earth.

Contacts and Communications

The IMS contains and extensive contacts database. Each incident also allows for incident specific contacts to be listed and highlighted. RCCNZ have two people assigned to maintain this database. During events, operators can flag changes required to the contact list if they find incorrect information.

All radio and phone calls into and out of the RCCNZ are recorded using **Wave**. This system allows for immediate audio playback if required, and is saved for future reference. Usually the substance of messages is written into the log, however audio files can be attached to log entries when required.

Supporting Category-1 SAR

When providing support to Police run SAROPs, the RCCNZ create an incident within their IMS which is marked as category-1. Within a category-1 incident, processing information largely continues as per category-2 incidents; however, the system configuration prevents the creation of 'tasks' within the log. Category-1 incident files have a unique prefixed reference that allows for easy identification as a support incident. The incident summary information provides a field for the Police *Event Number*. In the event of a SAR being handed over (in either direction) and the category changing, the RCCNZ can change the category in the incident record, and all the previous log entries are ported over into the 'new' incident record and a new prefix incident number is generated accordingly.

Reporting

The system auto-generates a daily summary report of all incidents initiated over the last 24 hours. RCCNZ duty staff augmented this report by adding any ongoing incident data from previous days, and the report is emailed to a restricted list of interested parties. It is planned for upcoming interactions to create draft Incident SITREPS through extracting incident data from the system.

End-of-incident reports can be generated by the system, providing a chronological view of all log entries. Reports are generated as word documents, for formatting corrections and then saved as pdf files for sharing as required.

SARdonyx reports are also generated at the end of an incident; this information is currently able to be pushed via an API directly to SARdonyx[16].

System Information

The IMS is a web-based platform allowing for remote access; it is hosted on a Maritime NZ server which allows for local access in case of internet connection outages. The system allows for the push/pull of data through APIs. **MS Teams** has been used when working remotely, but this has been used more to create a 'virtual office' rather than processing information: SAR operators have maintained an open Teams meeting, allowing discussions whilst attending to operations or incidents using the IMS.

The RCCNZ was pleased with the choice to have several separate products that could share information, rather than a single "all-in-one" system, as this has the benefit of allowing for easier changes of whole elements, or customisation of individual components. It was noted

[16] At the time of writing, the current version of SARdonyx was unable to receive data through APIs.

that visiting overseas RCCNZ representatives “wished” that they had taken this approach, over their all-in-one system, which was found to be restrictive.

Training

Two weeks after the IMS was introduced into the RCCNZ, operators were using the system with relative ease, noting that the IMS does retain many elements of the previous system. For new operators, the IMS is an ongoing component of the 11-week training and onboarding course. By the end of this course, users are described as being fully proficient. The day-to-day use of the system for regular operational activities means that use of the system is continually reenforced.

Large or Extended CAT II SAROP

Individual SAR operators run ‘typical’ SAROPs in the IMS themselves. Larger or ongoing events require shift handovers, and support form additional RCCNZ staff as required. For exceptionally large or extended SAROPs (e.g. such as the search for MH370), a separate operation would be required which would be managed in breakout spaces away from the main RCCNZ Ops Room, with supplementary CIMS-trained staff being sought from MNZ. The RCCNZ IMS would remain the primary system.

In the event that a SAROP involved a broader maritime incident, such as an oil spill or salvage operation where Maritime Incident Response Team (MIRT) was be involved, the intent of RCCNZ is that their IMS will be able to push relevant information to the MIRT’s system[17].

[17] At the time of the analysis it was noted that work was needed by the developer of MIRT’s system to receive this data.

Maritime NZ

Systems Snapshot	
• WebEOC	• MS Teams

Maritime NZ use **WebEOC** for its MIRT for response to oil spills and maritime incidents. It is provides the system for Regional Council's use responding to local events.

WebEOC is used across the CIMS functions, with various dashboards across the functional areas. All the tools are designed by MNZ, then any background functionality is built by the software developers on request. In addition to dashboards and document libraries, the contact database is maintained including full training and qualification records. MNZ have two staff supporting WebEOC functionality and administration, and to provide training and support to users across the country.

WebEOC does not have a messaging function. Currently MNZ are considering using **MS Teams**, as a supplemental tool, for its use in messaging. The use of Microsoft product is considered favourably based on user familiarity.

MNZ have created tools and procedures which allow externals to as access certain tools within WebEOC when needed. For example, during large operations MNZ's travel provided can log in to access a deployment list, allow for bulk bookings without going through the business-as-usual travel bookings for individuals.

The mapping function of WebEOC was described as having basic functionality, primarily displaying static pre-entered information – such as sensitive sites and marine chart layers.

WebEOC has the capability of sharing and receiving data from third parties. Juvare (WebEOC developer) is working on having RCCNZ IMS push information into WebEOC for when MNZ is operating in support of larger SAROPs.

Fire and Emergency NZ

Systems Snapshot	
• MS Teams • MS Outlook • Microsoft 365 • MS Planner • Computer Aided Dispatch (CAD) • Arena • Availability Messaging System (AMS) • e-IAP	• FireMapper • Drones • ArcGIS • Survey123 • QuickCapture • Field Maps • Prometheus • Satellite communications

Coordination Centres

FENZ use several ICT systems to support different aspects of their IMTs. For the National and Regional Coordination Centres (N/RCC), FENZ have recently started using **MS Teams** as the primary IMT platform. '*Channels'* are created for each new incidents being managed. Standard CIMS forms are created using **Microsoft 365** documents, and saved in **MS SharePoint** filing structures, via the Teams channel. MS Teams was described as working well, but not perfect, as FENZ continue to align its coordination centre functionality with CIMS. The flexibility of Teams allows for ad-hoc changes during responses, which informs further incident templates.

MS Outlook is the primary communications tool for the NCC. There are a number of NCC email addresses established for use in operations, which allows for function-based emails, rather than from individuals. This provides facility for personnel changes; however it does require users to ensure they are setting "send as" from the appropriate NCC function, rather than their individual username.

MS Planner is used for the recording and tracking of tasks within MS Teams. This does not push the tasks to external recipients of the task (i.e. those without access to the MS Teams site/channel).

The particular advantage of using MS products is the alignment with BAU usage to capitalise of user familiarity. Training on MS Teams for coordination centres is currently a half-day process, with users assessed during exercises or live events.

With recent remote working established, the coordination centre personnel can use these systems from any location with internet connectivity. There are limitations for non-FENZ personnel, as partner agencies cannot be granted access to view incident channels.

For NCC logistics, most procurement is handled using FENZ business-as-usual systems such as p-cards, travel provider portals, and pre-existing supplier arrangements. MS Teams is used by logistics to track their own tasks and keep parallel records, for later consolidation with FENZ Finance team. MS Teams does not integrate with FENZ's **Computer Aided Dispatch (CAD)** system, and there is no facility within MS Teams to view resources available for deployment. Any immediate deployment of recourse is handled centrally by the Communications Centre.

Communication Centre

Any assets or assistance required by an IMT is requested via the Communications Centre. All radio and phone calls through the Communication Centre (Comcen) and recorded and time-stamped. CAD system provides live information to the Comcen (such as vehicles at incidents and those responding). CAD provides the database of FENZ resources for deployment by the Communications Centre. Air assets are accessed via the **Arena** portal. There is a very particular requirement for assets for be entered into the system.

For coordination centre records, details are saved as PDF documents for filing with the incident records in MS SharePoint.

Contacts and Activation Systems

FENZ use their own **Availability Messaging System** (AMS) to activate volunteer firefighters. It lets them see what and where an incident is, and confirm their attendance. It provides real-time information regarding the ETA of responders to the station, and includes skills and qualification details of responders to ensure that the right people are responding.

Local Incident Management

For urban fires, on-scene IMT uses **e-IAP**. This system allows onsite controller to collate key intelligence and create a plan for their incident/sector. This system was described as good for *an* incident; however it lacks the facility to coordinate between multiple IMTs and scale to join multiple instances into a single incident.

The **FireMapper** application is used at the incident sites to map details of the fireground. Using pre-set symbology and drawn information, this system allows those close to the field to track the local data by creating a "mud map" of changes to the incident ground on a tablet. Temporary logins are accessed via an incident QR code which gets posted at the IMT. FireMapper syncs and shared with other users to give a live view of the field. The FENZ GIS team provide background support by refining and cleaning up the map data as needed.

For some rural fires IMTs are using manual systems, such as **T-cards** to tracks tasks and resource deployments.

GIS

For geospatial information management, FENZ use **ArcGIS** and other ESRI products. In addition to specific incident related data, ArcGIS can consume, display and interrogate data from third-party sources via RSS[18] or API feeds, (e.g. road closure information from Waka Kotahi or weather information from MetService). Sharing of GIS data can be easily shared from one IMT to another via the creation of webservices that be consumed by other GIS users and displayed as layers when needed, and chose the refresh rate.

ESRI **Survey123** is used by USAR teams for rapid building and damage assessments. This tool allows geo-tagging of information, including photos and pre-determined questionnaires/forms. The data is uploaded into the ArcGIS for mapping and further analytics. Survey123 forms allow collection fields to be turned on/off based on the needs of the event. ESRI **QuickCapture** has similar functionality, but uses a simplified methodology for collection. It is described as a "big button application", allowing user in the field to simply select a category, take a photo and submit. This system was praised for its simplicity of collecting basic information. Both Survey123 and QuickCapture are relatively easy to adjust depending on the needs of data collection for the event; Both allow for the creation of dashboards to display information sets in addition to GIS displays.

ESRI **Field Maps** was described as providing the best of Survey123 and Explorer. It is not fully deployed for use by FENZ, but is being used in some localities. Operators are experimenting with various aspects of its functionality, and FENZ are exploring processes for how ideas/uses are captured, assessed, and rolled-out to other users.

[18] Really Simple Syndication

Prometheus is used by specialists to model potential fire behaviours. The output data being available for use with GIS products to assist with intelligence and planning activities.

The NCC has a large map display which uses data feed from the Comcen's Intel Hub. This allows for a view of all current incidents, calls, and resources, and provides summary information for any icon selected. Live CAD information is also available on tablets in IMT command vehicles.

Specialist Equipment

FENZ have several command vehicles which are kitted out to provide mobile IMT sites. Each vehicle is equipped with office equipment, computers, display screens, radio base-stations, and satellite connectivity. Deployable **BGAN**, **K_u band**, **inReach** satellite communications allow for voice and data connectivity in situations where cellular and radio coverage are insufficient. Whilst useful, these were noted as being expensive and limited by satellite coverage/visibility.

FENZ's mobility project is in the process of putting a tablet device on each appliance, which will push intelligence views to field, providing visibility of all the Communications Centre information (such as active calls, maps, hydrants, at-risk buildings).

USAR teams have drones that can be deployed, with visual and thermal capabilities. These can record footage and/or provide a live feed, depending on the resolution of the image.

National Emergency Management Agency

Systems Snapshot	
• MS Teams (Emi)	• ArcGIS

NEMA are using a version of **MS Teams** as their IMS platform. It is intended as a collaborative workspace for the NCMC and all CDEM Groups. The platform is set to allow for guest access, which enables wider agency participation and data sharing.

'*Channels*' are set up as workspaces for each functional area, with the *General* channel acting as the event log. Tasks are tracked, but not pushed via the system. Some automated templates and workflows have been set up to allow for CDEM Groups SITREPs and requests for assistance.

CDEM Group ECCs, EOCs, and ICPs are able to access the system and replicate the tools and templates as created by NEMA. However, for the most part it is not being used across the CDEM sector, as CDEM Groups are using other software products or manual processes.

ArcGIS is being used, in an extremely limited capacity.

Ministry of Transport – Transport Response Team

Systems Snapshot	
• MS Teams • MS Outlook • MS Planner	• Microsoft 365 products • Document management system

The Transport Response Team (TRT) uses **MS Teams** for its IMT responses, and the MOT document management system (**TARDIS**) for storing final copies of documents and archiving. This is a relatively recent change, along with a more deliberate use of the CIMS methodology, away from manual processes.

MS Teams has been used for work management such as daily schedules, rosters, forms, and using live meetings when working remotely.

Tasks and actions have largely been tracked on a spreadsheet, accessible in **MS Teams/SharePoint**; it is intended to move towards using **MS Planner**, though this is not yet set up for use.

The *Intelligence* function of the TRT is largely focused on producing SITREPS, compiling most of its data from email traffic into the TRT shared mailbox. Status boards and action trackers will largely be displayed on projectors or whiteboards.

MOT are currently investigating how they might be able to have other agency liaison officers join the TRT Teams Site to share intelligence, however this is currently problematic due to security restrictions.

There is relatively minimal time on training TRT systems, though most IT products will be familiar to MoT staff involved.

Appendix 4: Summary of Systems by Agency

Note – it is assumed all agencies are using Microsoft 365; References in the table below are included where agencies specifically cited the use of these products.

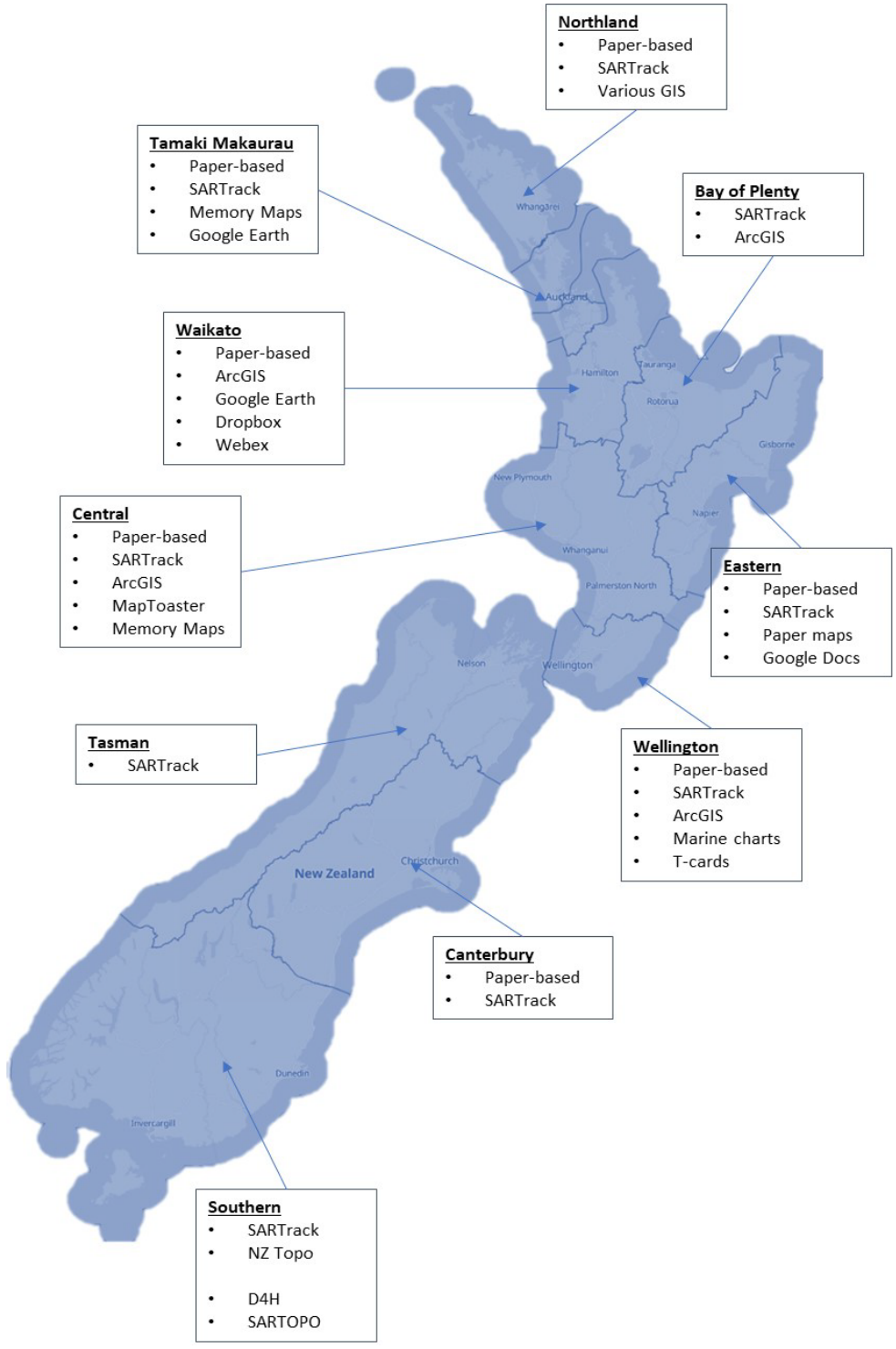
Agency	Systems Used	
Police	National Intelligence Application (NIA) Investigation Management Tool (IMT) Computer Aided Dispatch (CAD) iNet Viewer (CAD web browser access) Mobile Responder (CAD mobile device) Whispir Manual (Paper-based, whiteboards, T-Cards) SARTrack D4H Incident Management SARtopo	Memory-map Google Maps Google Earth Pro ArcGIS TracPlus MapToaster NZ Topo Map Dropbox WebEx Google Docs/Drive
LandSAR	D4H SARTrack T-Cards Dynamics 365 SARtopo SearchLight	eTXT Whispir Volunteer Rescue WhatsApp Signal Scanners
AMCART (DOC)	Microsoft 365 MS File Explorer OneDrive Volunteer Rescue	Google Earth Pro Flight Radar InReach GaiA GPS (on iPads)
AREC	SARTrack Analogue radio network	Mobile repeater stations Enable Fleet
Surf Life Saving	Surf Patrol Application Mobile Data Terminal (MDT)	GPS tracked radios Dropbox WhatsApp
Coastguard	D4H Wave – VHF radios Addcom – phone system Automatic Identification Systems (AIS)	Active alerts (Active911) TracPlus Mobile Data Terminal (MDT)
RCCNZ	Incident Management System (Custom) Google Earth Pro Wave mapitGIS (plugin)	TracPlus Automatic Identification Systems (AIS) Flight Explorer MS Teams
Maritime	WebEOC	MS Teams
FENZ	MS Teams MS Outlook Microsoft 365 MS Planner Computer Aided Dispatch (CAD) Arena Availability Messaging System (AMS) e-IAP	FireMapper Drones ArcGIS Survey123 QuickCapture Field Maps Prometheus Satellite communications
NEMA	Emi (MS Teams)	ArcGIS
MoT TRT	MS Teams MS Outlook MS Planner	Microsoft 365 Document management system (TARDIS)

Appendix 5: IMS Usage Across Police Districts

Primary IMS currently used by districts, including GIS tools.

Notes:

- Most systems used are licenced by LandSAR and are not used on Police enterprise computers.
- This diagram does not indicated the consistency or limits of system usage.
- Systems usage may vary within districts.



Appendix 6: High Level Requirements – SAR IMS

Capabilities

In order to be effective, a SAR Incident Management System (IMS) needs to be adaptable and scalable to meet any size of SAROP. An IMS needs to be able to undertake the following:

Capability Reference	Capability	Summary Description
Cap-1	Incident Management	• Ability to create, manage and close a new SAR incident.
Cap-2	Incident log	• Ability to maintain a recorded timeline relevant operational information such as key events, decisions, and communications throughout an incident. • Ability to attach documents and files as created or received during the operation • Ability to view as a list by status, category, priority, and flags. • Ability to create approval workflows for specified entries or forms.
Cap-3	Task Management	• Ability to record, update, allocate and track the progress of tactical tasks • Ability to record, allocate and track the progress of admin or logistical support tasks • Ability to push assigned tasks to chosen teams/asset.
Cap-4	SAR Forms	• Ability to prepare and store standard SAR forms
Cap-5	Reporting and records management	• Ability to produce a standardised incident reports for end of day and end of incident, including automatic generation of SARdonyx data. • Ability to print all forms, tasks, reports in a readable format for use offline.
Cap-6	Displays and dashboards	• Dynamic data displays of incident data. • Dynamic data displays of live incidents across the country.
Cap-7	Mapping and geospatial	• Ability to process and display and share all incident related geospatial information. • Ability to create mapping information for the purposes of planning and communications. • Ability to receive and display geospatial information from third parties. • Includes live dynamic data and static information.
Cap-8	Notifications and communications	• Ability to draft, send, receive notifications, record/transcribe and log messages and communication, including time-stamps.
Cap-9	Resource and assets	• Ability to create, update and track resource and assets before and during incidents. • Ability to manage the provision and resupply of resources for search operation • Ability to plan and manage transport of SAR teams and resources
Cap-10	Training and exercises	• Ability to run simulated SAR incidents for training and exercises, using all the functionality of the solution.
Cap-11	User interface	• Ability to provide an uncomplicated user-friendly experience in a timely manner, appropriate to the speed of response.
Cap-12	Technology and systems	• Ability for deployed technology to work with various applications, systems, hardware and communication networks and brands. • Ability to manage users and configure menu options, and other fields as appropriate.

Requirements per Capability

High level requirements have been grouped by category. The priority of requirements has been determined by Innovation in Technology Forum. Priorities shown represent the majority view of responses received[19]. The priority column shows values of:

- **M** – Must have. This requirement is necessary for a functional SAR IMS.
- **S** – Should have. Important requirement, but not strictly necessary. Inclusion within the solution will enhance the SAR IMS.
- **C** -Could have. A "nice to have" and desirable element. Not having this requirement will not negatively impact the SAR IMS.
- **W** – Will not have. This requirement is not a priority for the SAR IMS.

CAP-1: Incident Management

Ref #	Future Requirement Description	Priority
IM-1	Any authorised user will be able to create and set up a SAR '*incident*', without specialist administrator intervention	MUST
IM-2	Every new incident will be created with a new unique reference number	MUST
IM-3	Every SAR incident will have a field to note the unique Police Event Number or RCCNZ reference number	SHOULD
IM-4	Every SAR incident will note whether the incident is a *Category One* or *Category Two*.	COULD
IM-5	Each SAR incident will contain a description field	MUST
IM-6	The status of SAR Incident can be set to: • Investigating • Active • Suspended • Completed • Stood-down	SHOULD
IM-7	Changing the status of the incident will require the Incident Controller's approval.	SHOULD
IM-8	Once a SAR incident status is approved as 'completed', the Incident cannot be reactivated.	WILL NOT
IM-9	A user can assign roles, create new roles, change roles	MUST
IM-10	An IMT organisation chart will be generated according to CIMS roles, displaying the assigned to users	SHOULD
IM-11	An incident can be designated as a "sub-incident" and linked to a "parent incident" to accommodate incident scaling (e.g. for sector commands), or agencies tasking their own assets (i.e. when supporting the coordinating agency).	COULD
IM-12	An incident can be merged with parent when multiple incidents have been started separately to each other (in the case of offline devices)	COULD
IM-13	Multiple incidents can run simultaneously in any number of localities	MUST
IM-14	Incidents can be categorised to meet security and privacy restrictions as may be appropriate for the operation.	SHOULD

CAP-2: Incident Log

Ref #	Future Requirement Description	Priority
LOG-1	Users will be able to create, update, and edit event log entries.	MUST
LOG-2	Log entries allow file attachments	MUST

[19] Responses were received from Police, RCCNZ, FENZ, LandSAR, and AREC.

Ref #	Future Requirement Description	Priority
LOG-3	When a SAR form has been completed manually or handwritten, it can be scanned or uploaded an attached to an appropriate back-dated log entry	MUST
LOG-4	Log entries can be back dated to allow for the capture of information entered out of sequence.	MUST
LOG-5	List of log entries provides flags/colour coding to indicate actions, decisions, issues, and/or users.	SHOULD
LOG-6	Log entries and forms can be assigned to IMT functions	SHOULD
LOG-7	Every **event log** entry is to include: • Log ID number • Category (Actions, decisions, issues, risks, SAR form type, task, message, information, clue, occurrence) • Priority • Status • Subject • Description • Ability for attachments • Ability to Geo-reference • Timestamp (logged time) – system suggested, editable by user. • Timestamp (creation, edits) – system generated, not editable • IMT 'level' or location • Author • Editors • Track changes • Reference number • Assignment (Asset, resource, team, role, person) • Resolution comments	MUST
LOG-8	**Communication** records in the event log will include: • Ref Number • Date and Time • Subject • Message details • Channel (Radio frequency/channel, email, SMS, phone call, other, etc.) • Sent by	MUST
LOG-9	Log entries can be categorised to meet security and/or privacy restrictions as may be appropriate for the operation or organisation.	SHOULD
LOG-10	Event log entries can be linked to other log entries for reference	SHOULD
LOG-11	No event log entry can be deleted by a user. Log entries may be corrected or struck from the active log; however the original record should remain.	MUST
LOG-12	Relevant event records form Police Comcen are automatically recorded as log entries	COULD
LOG-13	Workflows provide rules for Incident Controller approval of: IAP, SITREPS, communications plans, or individually flagged tasks.	COULD

CAP-3: Task Management

Ref #	Future Requirement Description	Priority
TASK-1	Users can create new tasks, or edit existing tasks	MUST
TASK-2	Users can assign one or more resources/assets to a task	MUST
TASK-3	Users will be able to view tasks to see which assets are, or have previously been, assigned to that task.	MUST

Ref #	Future Requirement Description	Priority
TASK-4	Users can read, edit, or correct tasks.	MUST

TASK-5	**Tasks** records will include fields for:
	• Ref number
	• Date and time
	• Subject
	• Task description
	• Completion time
	• Assigned resources/assets
	• Task type
	• Locations:
	  ○ Search path
	  ○ Search area
	  ○ Single location
	• Status:
	  ○ Created
	  ○ Assigned
	  ○ In progress
	  ○ Completed
	  ○ Cancelled
	  ○ Reopened
	• Comments
	• File attachments
		MUST

TASK-6	Task details are automatically pushed to assigned resource/asset – via mobile application, email, or text message	SHOULD
TASK-7	Any new or received tasks will show an on-screen notification to be accepted by the recipient.	SHOULD
TASK-8	Task records will have the ability to have files attached	SHOULD
TASK-9	Task records will have the ability to be linked with other log records	SHOULD
TASK-10	Tasks can be assigned by the lead agency to controlled assets or teams	SHOULD
TASK-11	Tasks can be assigned by the lead agency to participating agencies (for further sub-tasking)	COULD
TASK-12	When a task is assigned from the lead agency an audio and visual notification is received on the device of the assignees.	COULD
TASK-13	Task lists can be filtered and sorted by attributes such as date/time, status, assignee, location	SHOULD
TASK-14	Tasks can be duplicated to allow for rapid creation of new tasks.	SHOULD

CAP-4: SAR Forms

Ref #	Future Requirement Description	Priority
FORMS-1	The solution will integrate current and future SAR forms as individual digital documents, or as incident log entries with the same requirements as listed in CAP-2.	SHOULD
FORMS-2	All forms have the same basic requirements as those detailed within the Incident Log requirements.	SHOULD
FORMS-3	The solution will allow operators to create, edit and save specific forms: 1. Initial missing person report 2. Missing persons summary 3. Information collection plan 4. Search urgency assessment - land 5. Search urgency assessment - marine 6. Scenario recording 7. Marine vector worksheet	SHOULD

Ref #	Future Requirement Description	Priority
	8. Marine SAC worksheet 9. Marine timeline 10. Situation report (SITREP) 11. Team Assignment (briefing) 12. Incident action plan 13. Communication plan 14. Medical plan 15. Found items 16. Suburban search log 17. Register of sightings 18. Casualty assessment form 19. Land SAR team debrief 20. Marine SAR team debrief 21. Handover briefing	
FORMS-4	The **Initial Missing Person Report** will include: • Date and time • Informant • Full name • Address • Contact numbers • Relationship to missing person • Reason for reporting missing person • Missing person o Full name o Preferred name o Home address o Phone numbers o Occupation o Medical and mental condition o Doctors name and contact details o Physical fitness o Age o Race o Gender o Build o Height o Hair colour o General description, clothing worn, equipment carried o Smoker (Y/N) o Footwear information o Photo attachment • Circumstances o Location missing from o Point last seen o Date/time last seen o Last known point o Activity (what doing) o Last seen by whom o Vehicle description o Registration number o Previous search subject (Y/N) ▪ Previous circumstances/location found o Reliability	MUST

Ref #	Future Requirement Description	Priority
	○ Experience and knowledge of area ○ Actions taken by informants or others	
FORMS-4	The **Missing person summary** will include: • Date and time • Missing person description: ○ Name ○ Nickname/aka ○ Age ○ Gender ○ Height ○ Weight ○ Hair colour/style ○ Build ○ Headwear ○ Jacket/top ○ Pants ○ Footwear ○ Distinctive features ○ Equipment carried ○ Photo attachment • Vehicle/Vessel Details ○ Type ○ Registration ○ Description ○ Location • Place last seen ○ Place last seen date and time • Last known point ○ Last night point date and time • Intentions • Medical issues / state of mind • Lost person behaviour • Concerns held for person	MUST
FORMS-5	The **Information Collection Plan** will include: • information required • source • assigned to • date and time assigned • notes • status	MUST
FORMS-6	The **Search Urgency Assessment - LAND** will include: • Date and time • Assessment ○ Number of missing persons (1-3) ○ Age of missing persons (1-4) ○ Medical conditions (1-4) ○ Fitness (1-3) ○ Experience (1-4) ○ Reliability (1-4) ○ Clothing (1-3) ○ Equipment (1-4) ○ Weather (1-4) ○ Terrain hazards (1-4)	MUST

Ref #	Future Requirement Description	Priority
	○ Length of time missing (1-4) • Score / urgency rating (calculated from above) ○ Requires emergency response (11 – 18) ○ Measured response (19-27) ○ Evaluate and investigate (28-41)	
FORMS-7	The **Search Urgency Assessment - MARINE** will include: • Date and time • Assessment ○ Method/Type of alert (1-3) ○ Weather (1-3) ○ Medical issues (1-3) ○ Vessel/Equipment suitability/condition (1-3) ○ Time of Day (1-3) ○ Location (1-4) • Score / urgency rating (calculated from above) ○ Distress, requires emergency response (≤7) ○ Alert, measured response (8-15) ○ Uncertainty, evaluate and investigate ≥16)	SHOULD
FORMS-8	The **scenario recording** will include: • Date and time • Starting point • Activity or purpose • Direction of travel • Route • Destination • Map attachment • Evidence or factors to develop this scenario • Likelihood of scenario (%) • Comments	MUST
FORMS-9	The **Marine Vector Worksheet** will include: • Date and time • Subject • last know/probable position ○ date and time • target description • leeway target type • Current details ○ Times (to/from) ○ Direction ○ Speed ○ time interval ○ vector to plot (degrees / NM) • Wind ○ Times (to/from) ○ Direction ○ Speed ○ Leeway direction ○ Leeway rate per hour ○ time interval ○ vector to plot (degrees / NM) ○ TDV to plot from LKP: degrees/NM	SHOULD
FORMS-10	The **Marine SAC Worksheet** will include:	SHOULD

Ref #	Future Requirement Description	Priority

	• Date and time
	• Target description
	• meteorological visibility (km)
	• wind speed (Knts)
	• sea height (m)
	• Eye Height
	  ○ 2.4m
	  ○ 4.2m
	  ○ 500'
	  ○ 1000'
	• Uncorrected sweep width (wu)
	• weather correction factor (Fw)
	• sweep width (W) (Wu x Fw)
	• fatigue factor (Ff)
	• corrected sweep width (WxFf)
	• practical track spacing (S)
	• search area (Sq NM)
	• search hours (T) required (T = Area / V x S)
	• available search hours (Area = T x V x S)
	• modified area at practical track spacing and available search hours (S = Area / T x V)
	• Whole area at practical track spacing and available search hours	

FORMS-11	The **Marine Timeline** will include: • Date and time • Target • Clues • Search unit • General	SHOULD
FORMS-12	The **SITREP** will include: • Date and time • Location • Map/chart reference • Situation • Actions taken • factors impacting on planning • Contingency and long-term planning	MUST
FORMS-13	**Team Assignment (briefing)** records will include: • Task ID • Time and date • Team name • Team type • Team leader / Officer name • Team member / crew names • Vehicle/vessel reference • Map reference/attachment • Tasking assignment • Decision points • Hazard and risk controls • Previous or current search tasks in the area • Communication channels and frequencies • Additional information	MUST

Ref #	Future Requirement Description	Priority
FORMS-14	The **Incident Action Plan** will include: • Date and time • Phase/Operational period • Situation • Mission/Goal • Date/time missing • Missing person details • Next of kin name • Last known position • Survivability rating • Objectives for operational period ○ Strategies for execution • Weather • Safety/hazards • Critical elements / to do • Communications plan • Rescue plan • Command structure	MUST

FORMS-15	The **Communications Plan** will include:
	• Date and time
	• Operational Period
	• Key contacts (list)
	  ○ Landline
	  ○ Cell phone
	  ○ Email / other
	• VHF communications
	  ○ Functional grouping
	  ▪ Channel name
	  ▪ Channel ID
	  ▪ Channel number
	• HF communications
	  ○ Channel name
	  ○ Schedule time
	• Comments
		MUST

FORMS-16	The **medical plan** will include:
	• Date and time
	• Medical unit details
	  ○ Name
	  ○ Location
	  ○ Phone or radio channel
	  ○ Paramedics available
	• Transportation details
	  ○ Service
	  ○ Location
	  ○ Phone or radio channel
	  ○ Paramedics available
	• Medical facility details
	  ○ Facility name
	  ○ Address
	  ○ Phone
	  ○ Travel times (road, air)
	  ○ Heli pad (Y/N)
		MUST

Ref #	Future Requirement Description	Priority
	• Special emergency procedures	
FORMS-17	The **found item** will include: • Id number • Relevance of clue (%) • Description of item • Location found • Time found • Who found • Status: left in situ / removed • Relationship to other items • Protection • If removed, where held • Additional comments • Photo attachments	MUST
FORMS-18	The **Suburban Search Log** will include: • Time • Address • Name • Section searched • Comments, clues, hazards, • Follow up • Search team comments • IMT comments	MUST
FORMS-19	The **register of sightings** will include: • Date and time • Source • Location • How identified • Corroborated • Comment • Source reliability • Information validity	MUST

FORMS-20	The **Casualty Assessment Form** will include:
	• Date and time
	• First Aider Names
	• Casualty details
	  ○ Name
	  ○ Date of birth
	  ○ Age
	  ○ Gender
	  ○ Address
	  ○ Phone numbers
	  ○ Email address
	  ○ Doctor's name
	  ▪ Contact number
	  ○ Next of kin
	  ▪ Contact number
	• First checks
	  ○ Complaints
	  ○ Events leading to problem/onset
	• Assessment
		MUST

Ref #	Future Requirement Description	Priority
	○ Past medical history ○ Medications ○ Allergies ○ Last ate / drank time ○ Examination result • Pain ○ Provoked or improved by ○ Quality ○ Region/radiation ○ Severity ○ Timing ○ Blood loss (Y/N) ○ Passed urine since incident (Y/N) ○ Vomited (Y/N) • Vital signs ○ Time taken ○ Pulse ○ Respiration ○ Skin ○ Patient response ○ Pupils ○ Pain level ○ Temperature • Baselines for injured limb ○ Time taken ○ Colour ○ Warmth ○ Sensation ○ Pulse • Treatment record ○ Time taken ○ Event/ treatment • General comments	
FORMS-21	The **Land SAR team debrief** will include: • Date and time • Team name • Task number • Search effort • Techniques • Detectability • Clues • Team effectiveness • Issues identified • Search effort evaluation ○ Subsegment ○ Likelihood ○ Comments ○ Debriefer comments	MUST
FORMS-22	The **Marine SAR team debrief** will include: • Date and time • Team name • Task number	MUST

Ref #	Future Requirement Description	Priority
	• Search method • Probabilities of Detection for search areas • Factors affecting detectability • Gaps in coverage • Decision Points • Areas of interest for further investigation • Clues found/not found • Other issues or hazards • Suggestions for further search efforts	
FORMS-23	The **Handover Briefing** will include: • Date and time • Operational Period • Situation • Key issues • Outstanding tasks	MUST

CAP-5: Reporting and Records Management

Ref #	Future Requirement Description	Priority
REC-1	Solution will have the ability to upload documents of various formats (MS office files, PDFs, media files, datafiles, etc)	MUST
REC-2	Solution allows for a database of all files uploaded for an incident.	MUST
REC-3	Solution allows for a library of documents and web links	SHOULD
REC-4	All records will note the date and time of entry, and the user who made the entry.	MUST
REC-5	All fields and metadata from an incident should be searchable during and after the response.	MUST
REC-6	Incident records will be fully searchable (including advanced and fuzzy searches)	MUST
REC-7	Incident records will allow playback of events within log and maps	SHOULD
REC-8	All event logs and other solution entries are configurable and exportable via APIs, RSS, or webservices for sharing with third parties.	MUST
REC-9	Once a SAR incident status is approved as complete, the Solution will auto generate an end-of-incident report for the Incident Controller's approval, sharing and archiving.	COULD
REC-10	Incident reports will provide a chronological record of all logged information from the incident.	MUST
REC-11	Incident report will include 'cover' summary information including: status, lead agency, reference numbers, SAR category, police district, police area, marine area, operational hours, costs.	SHOULD
REC-12	Daily incident reports will be created when required by the IMT	SHOULD
REC-13	Daily reports will provide (for the specified period): • Chronological timeline of events (sortable/filterable by categories) • Include visual supporting materials (e.g. maps and GIS data at points in time) • Include attachments or references to supporting files (e.g. videos, maps, photos) • Details of resources currently assigned to the incident and expenses incurred.	SHOULD
REC-14	End of Incident Reports will created at the completion of an incident.	MUST
REC-15	End of Incident Reports will provide (for the period of the incident):	SHOULD

Ref #	Future Requirement Description	Priority
	• Chronological timeline of events (sortable/filterable by categories) • Include visual supporting materials (e.g. maps and GIS data at points in time) • Include attachments or references to supporting files (e.g. videos, maps, photos)	
REC-16	Reports will be downloadable for sharing outside of Solution viewer	SHOULD
REC-17	All reports will be formatted for readability and printability, and available on either: • MS Word • PDF • MS excel	SHOULD
REC-18	Individual Incident Log entries, Tasks and SAR Forms can be printed for use offline.	MUST
REC-19	Once a SAR incident status is approved as complete, the Solution will automatically generate a SAR incident data, for the Incident Controller's approval, and upload to SARdonyx	SHOULD
REC-20	Data for upload to SARdonyx includes: • Core/Raw Incident data • Asset details • Resource Details • Search Techniques used • Subject Aircraft Details • Subject Vessel Details • Subject Person Details **Note** – Refer to *NZSAR Data Standard*[20] for complete SARdonyx data requirements.	MUST

CAP-6: Displays and Dashboards

Ref #	Future Requirement Description	Priority
DASH-1	The solution will provide dashboard and map displays at the incident and national level.	SHOULD
DASH-2	Incident displays will create a common operating picture for the IMT and all users directly engaged in the respective SAR operation.	MUST

DASH-3	**Incident** displays will include:
	• Map(s) of operational area
	• Active tasks
	• Active resources/assets
	• Event log by status
	• Search area details:
	  ○ Area (km²)
	  ○ % searched/remaining
	  ○ % probability of detection
	• Duration
	• Operator deployment hours
	• Costs
		SHOULD

DASH-4	**National level** display will include: • Active incidents	SHOULD

[20] NZSAR Data Standard, Version 4-3, 29 September 2020

Ref #	Future Requirement Description	Priority
	• Status of incidents • Urgency of incidents • Scale of incidents (by area or resources) • Resource requirements/shortfalls	
DASH-5	National level display will function as a portal with the ability to enter/view incidents in progress for approved users.	SHOULD

CAP-7: Mapping and Geospatial

Ref #	Future Requirement Description	Priority
MAP-1	Map allows user to define the area of operation for the incident	MUST
MAP-2	Map allows user to define specific search areas and sectors	MUST
MAP-3	Map allows user to plan and define specific search paths	MUST
MAP-4	Map provides live tracking of resources in the field	MUST
MAP-5	Map provides live feeds of available (unassigned) resources	SHOULD
MAP-6	Map provides a view of any issues and incidents within the defined area of operation (other SAROPs or responses from external feeds)	SHOULD
MAP-7	Map pings the location of radio transmissions from search teams	SHOULD
MAP-8	Clues/evidence found in the field are tagged on the map, including photos, drawings, and supporting information.	MUST
MAP-9	Map allows for probabilistic drift models	MUST
MAP-10	Map allows for probabilistic behaviour modelling of subject(s)	SHOULD
MAP-11	Map allows for various cadastral, topographic, satellite imagery, and marine chart base layers	SHOULD
MAP-12	Map provides details of local access points, amenities, tracks, vegetation.	SHOULD
MAP-13	Map allows for the consumption and display of additional static and dynamic layers from third party sources, such as: • Weather • Sea state • Tides • Local hazards • Traffic and road closures • Land Information (LINZ) data library webservices	SHOULD
MAP-14	Map can be queried to provide: • Location coordinates • Distance • Travel times • Altitudes	MUST
MAP-15	Map allows for the controlled publication and sharing of static and dynamic layers to third parties	SHOULD
MAP-16	Map tools and general functionality must be available when solution is not connected to the internet.	MUST
MAP-17	Map displays any geo-referenced tasks or log entries	SHOULD
MAP-18	Map allows for cross referencing between various layers (e.g. all tasks within a sector)	SHOULD
MAP-19	Map displays the percentage for “completeness” for search paths/areas	COULD
MAP-20	Map displays completed search tracks of all trackable SAR assets/resources	MUST
MAP-21	Users can create polygons, lines, and points on the map with supporting fields for data capture.	MUST
MAP-22	Map periodically saves data as gpx file to the incident log to provide a visual record throughout the incident.	SHOULD

CAP-8: Notifications and communications

Ref #	Future Requirement Description	Priority
COMMS-1	The solution will contain a detailed contact list for all relevant parties.	MUST
COMMS-2	Contact details can be added for particular incidents	MUST
COMMS-3	The **contact records** will include: • Individual's name • Agency • Rank or position • Phone number • Email address • Alternative number and email • Qualifications, specialties, experience levels • Next of Kin • LandSAR reference number	MUST
COMMS-4	The Solution will allow for the creation of notification templates	COULD
COMMS-5	Solution messaging can be used to send IAPs, Sitreps, tasks, or other incident related communications as required,	SHOULD
COMMS-6	Users can send notifications to selected people on the contact list	SHOULD
COMMS-7	Recipients can respond to notifications	COULD
COMMS-8	When activating an IMT, the initiating user can notify selected individuals or groups by SMS (text), email, or Solution app notifications	SHOULD
COMMS-9	The Solution will track responses to notification texts	SHOULD
COMMS-10	A user will be able to view the responses provided to notifications by each recipient	SHOULD
COMMS-11	Call out responses from SAR personnel or teams, show availability and travel times	COULD
COMMS-12	A notification will be displayed when receiving a task or alerts from the lead agency	SHOULD
COMMS-13	Each SAR incident will retain a record of each communication and notification sent and received	MUST
COMMS-14	When a notification has been sent, its details are automatically logged within the event log.	MUST
COMMS-15	Radio transmissions and phone calls are recorded and saved as log entries, including time-stamps	MUST
COMMS-16	Radio transmissions and phone calls are saved in the log as sound files or auto-transcribed text	COULD

CAP-9: Resources and Assets

Ref #	Future Requirement Description	Priority
RES-1	The solution will allow for the creation and maintenance of a universal database an SAR assets.	COULD
RES-2	SAR resources can be created and maintained within the solution	SHOULD
RES-3	New SAR Resources can be created for use in the in the SAR Incident	SHOULD
RES-4	New SAR resources added during an incident can be added to the Solution resource database	SHOULD
RES-5	**Resources records** will display: • Name / Title • Description • Registration • Call-signs • Owner • Contact details	SHOULD

Ref #	Future Requirement Description	Priority
	• Base location • Active location (tracked) • Capacity • Skills/qualifications/experience • Capabilities • Capacities • Specialist equipment • Status • Limitations • Set deployment costs	
RES-6	SAR Resources can allocated to an Incident	MUST
RES-7	Resource records can be viewed to see which tasks they are, or have been, assigned to for the active incident.	MUST
RES-8	Resource records can be viewed to see all log entries associated with that asset	MUST
RES-9	SAR resources are signed in/out of the incident	MUST
RES-10	SAR resources have arrival/departure times at assembly/staging areas recorded	MUST
RES-11	Resources allocated to an incident will have their current location and search tracks recorded when in the field	SHOULD
RES-12	Asset owners can assign their resources as available, including the duration of availability.	COULD
RES-13	Asset owners can assign can offer their resources for particular SAR incidents	COULD
RES-14	IMT staff can notify solution users of any resource or service requirements	SHOULD
RES-15	Solution will provide a mechanism to track deployed hours of SAR operators and assets	MUST
RES-16	Solution will provide a mechanism to track incident expenditure	COULD

CAP-10: Training and Exercises

Ref #	Future Requirement Description	Priority
TRAIN-1	The solution will allow for the creation and use of training and exercise incidents	MUST
TRAIN-2	Training Incidents will have unique identifies that distinguish it from live incidents.	MUST
TRAIN-3	Training Incidents will operate and function for individual users in the same way as live SAR Incidents.	MUST
TRAIN-4	The solution will allow for training 'injects' and/or exercise information to be pre-created.	SHOULD
TRAIN-5	The creation or allocation of resources to a Training Incident, will not register that resource as being unavailable for the use in live incidents or within other Training Incident instances.	MUST
TRAIN-6	Alerts, messages, notifications and other communications will be disabled for Training Incidents, or feature texts that clearly identify the message as belonging to a Training Incident.	MUST
TRAIN-7	All reports and Sardonyx data will by clearly identified as training incidents	MUST

CAP-11: User Interface

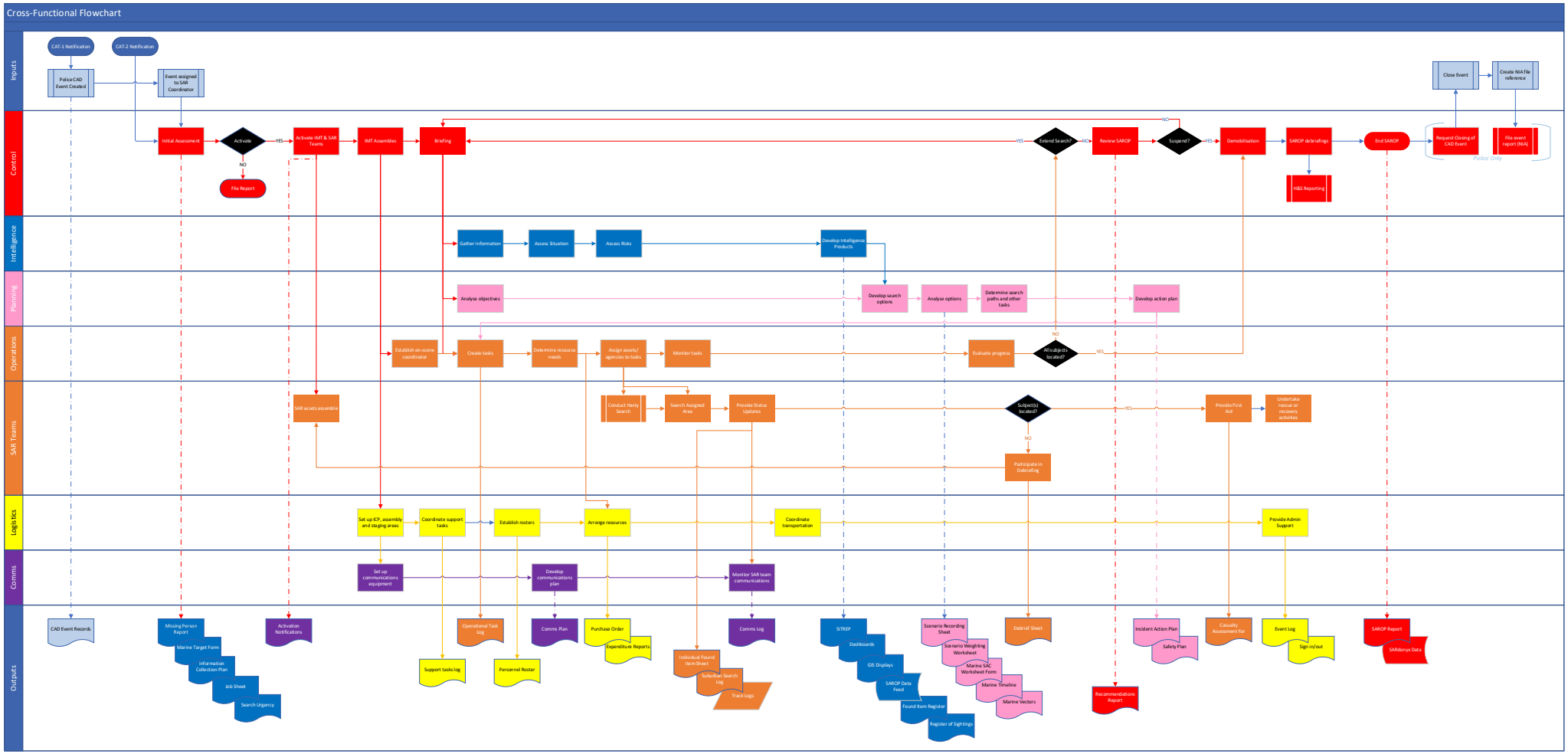
Ref #	Future Requirement Description	Priority
UI-1	Solution must be configurable to allow changes resulting from procedures or standards	MUST
UI-2	Solution will have an intuitive and user-friendly interface	MUST
UI-3	Solution navigation will follow simple paths and require minimal effort	MUST
UI-4	User interface should be configurable to allow individuals to personalise their view and layout of the incident information, without interfering with other user's experiences, or incident data	SHOULD
UI-5	Users can configure dashboard views to display various incident data.	SHOULD
UI-6	Solution will allow for customisation of drop-down menus and picker-lists by appropriately credentialled administrator.	COULD
UI-7	Solution allows users to view multiple windows simultaneously	MUST
UI-8	Solution allows for the creation of workflows to approve selected forms and tasks.	SHOULD
UI-9	Solution has minimal start up times	SHOULD
UI-10	Multiple users can access and edit forms simultaneously.	MUST

CAP-12: Technology and Systems

Ref #	Future Requirement Description	Priority
TECH-1	The solution must be accessible on the following types of devices: • Desktop PCs • Laptops • Tablets • Smartphones	MUST
TECH-2	Systems and hardware needs to be compatible with: • SmartScreen • Printers • Projectors • Bluetooth • USB A, B, C • SD and micro-SD cards • Digital radios • Digital phone systems	MUST
TECH-3	All devices will require network, Wi-Fi, and internet connectivity capability.	SHOULD
TECH-4	System will be capable for sending data over radio	SHOULD
TECH-5	System will be capable for sending data over satellite connection	SHOULD
TECH-6	The solution will be accessible via different Browsers (Edge, Chrome, Safari, Firefox)	SHOULD
TECH-7	Solution is cloud-hosted	COULD
TECH-8	The solution and systems must have the ability to work when there is no connection to the internet, with data being synchronised across servers and devices when connectivity is re-established.	MUST
TECH-9	Solution will synchronise with server and other devices when (re)connected to a network or internet	MUST
TECH-10	All forms will be printable in a user-friendly formats.	MUST
TECH-11	Solution will interface seamlessly with common MS office products	SHOULD
TECH-12	Solution allows consumption and display of available APIs, RSS, and webservice data feeds	MUST
TECH-13	System and solution maintenance will be scheduled and notified	MUST

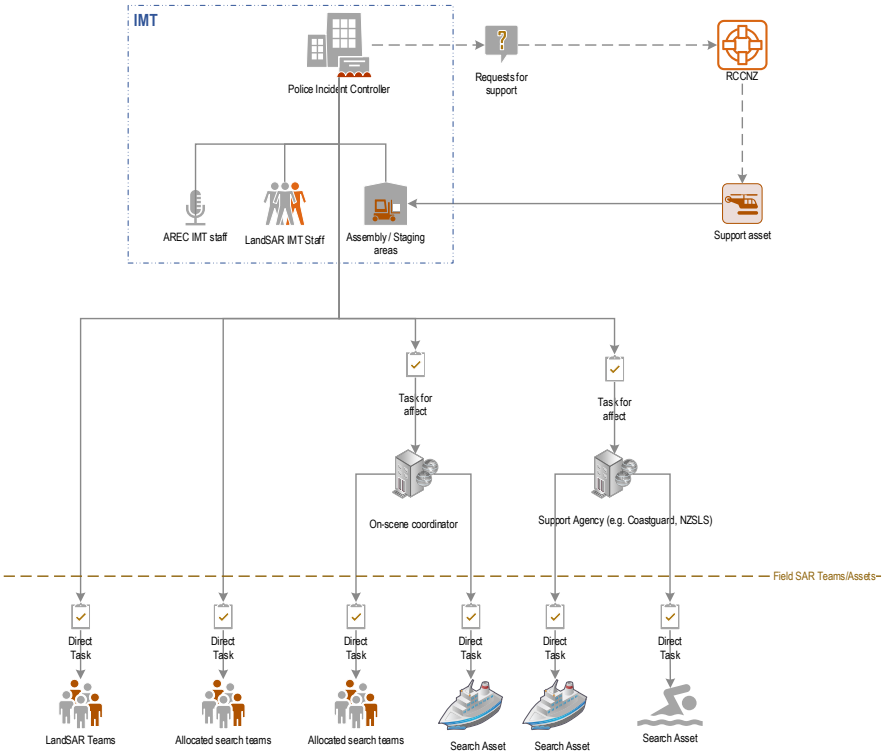
Ref #	Future Requirement Description	Priority
TECH-14	Solution change controls will be in place to ensure that updates are known for ahead of time, and that the solution remains available.	MUST
TECH-15	Software update status must not be a barrier to start-up or access	MUST
TECH-16	Solution must be a secure platform, protected by real-time security and data encryption.	MUST
TECH-17	Access to the solution will be controlled through user credentialing	MUST
TECH-18	New users can be added by credentialled users.	MUST
TECH-19	Solution will have multiple access levels to control access to certain actions, workflows, and information	MUST

Appendix 7: SAROP CIMS Process Map

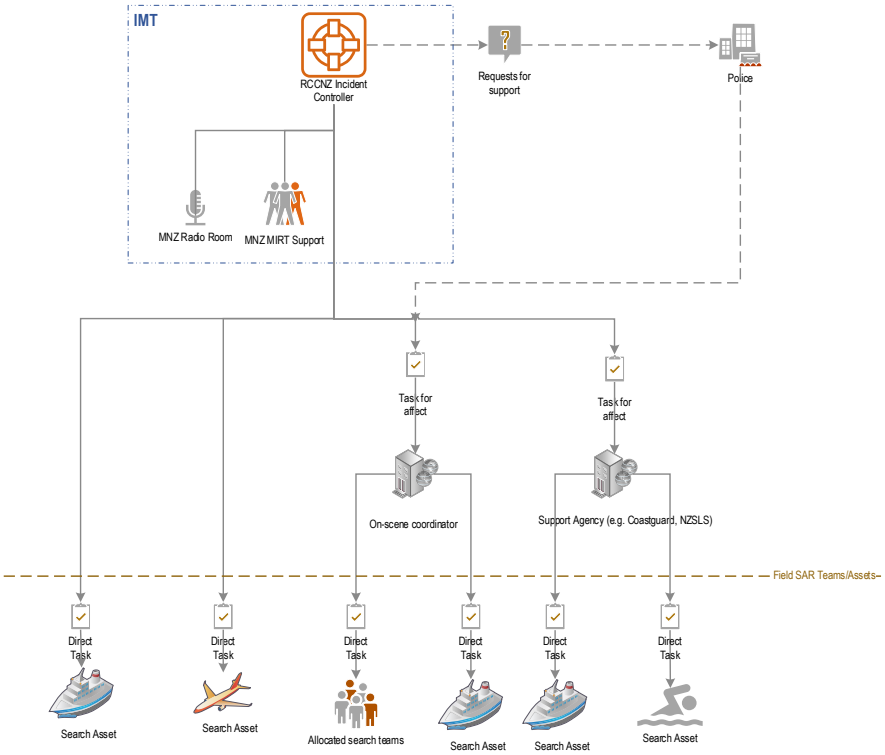


Appendix 8: SAROP IMT/Asset Relationships

Category I Example



Category II Example



Appendix 9: Market Scan

		Cap-1	Cap-2	Cap-3	Cap-4	Cap-5	Cap-6	Cap-7	Cap-8	Cap-9	Cap-10	Cap-11	Cap-12
Applications	Average Indicative Rating for Applications[21]	Incident Management	Incident log	Task Management	SAR Forms	Reporting and records management	Displays and dashboards	Mapping and geospatial	Notifications and communications	Resource and assets	Training and exercises	User interface	Technology and systems
Noggin	**4.3**	5	4	5	4	4	4	5	4	5	3	4	4
SAReye	**4.0**	5	5	5	3	4	3	4	5	4	3	4	3
SARTrack	**4.0**	4	5	5	5	4	3	4	4	5	3	3	3
D4H	**3.9**	4	4	4	4	4	4	3	4	5	3	4	4
WebEOC	**3.5**	4	4	4	4	3	4	3	2	3	3	3	5
Adashi C&C	**3.0**	3	4	3	3	3	3	3	2	3	3	3	3
e-IAP	**2.9**	3	3	3	1	2	4	4	2	3	2	4	4
Microsoft 365 / Teams / Planner	**2.6**	3	3	3	2	2	2	1	2	2	1	5	5
	Average Indicative Rating per Capability	**3.9**	**4.0**	**4.0**	**3.3**	**3.3**	**3.4**	**3.4**	**3.1**	**3.8**	**2.6**	**3.8**	**3.9**

[21] **Note:** This table is provided for general information regarding the availability of SAR IMS applications. Scores are indicative only, and are limited based on readily available information. Indicative scores should not be considered as a true reflection of any systems or company's capability or capacity. This table should not be considered as an endorsement of any product or company.