



## Emerging technologies for the Early location of Entrapped victims under Collapsed Structures & Advanced Wearables for risk assessment and First Responders Safety in SAR operations

### D6.5 Knowledge Capitalization: Design of an After-Action Reporting Mechanism

**Workpackage:** WP6 – S&R ICT Component Design & Development

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## Executive Summary

This document defines the conceptual view, inputs, outputs and requirements of the AAR Application within the S&R Project.

The AAR Application is aimed at knowledge capitalization and generating lessons learned after dealing with each incident to identify possible improvements and plan corrective actions for future management of similar incidents. Ultimately the AAR process and results can result in: a) recommended improvements of future interventions in similar incidents; b) recommended improvements of the S&R Platform; and/or c) support in analysis of prior incidents and interventions for training purposes; d) training

The AAR Application will usually build on other DSS type components in the project, especially the CONCORDE EMS, to acquire information describing the incidents and the action taken in response to them. In addition, the AAR Application will provide users with the ability to add in quantitative and qualitative information about incidents, analyzing the flow of actions, formulating recommendations for improvement, and planning corrective actions.

The overall content structure of the AAR will be the following:

- Incident overview
- Analysis
- Recommendations;
- Improvement plan;
- Conclusion

This document is a first version which formulated an initial high level conceptual view of the inputs, requirements, and architecture of the AAR Application. Further collective work will be carried out to advance the details of the AAR inputs, use cases and specifications and to actually develop the AAR Application.

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## List of Abbreviations

Abbreviation	Explanation
AAR	After Action Report(ing) or Review(ing)
DOA	Description of Action
DSS	Decision Support System
EC	The European Commission
EMS	Emergency Management System
S&R	Search and Rescue (Project)



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# 1 Introduction

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## 1.1 Document Objective and Scope

This deliverable is developed in the S&R Project, under Task 6.5 *Design of an aftermath knowledge capitalisation mechanism*. Its purpose is to develop the conceptual and specifications framework for an After-Action Reporting Web Application (AAR Application) which will be part of the broader S&R System. This document also discusses the expected potential data inputs received from the S&R Data Lake and Applications. It also presents the expected outputs and specification for the AAR Application.

It should be noted that, per DOA, this is an initial version of the conceptual vision and specifications of this deliverable. The final version **D6.11 Aftermath Knowledge Capitalisation Mechanism**, (which shall accompany the Application demonstrator) is due in month 32 of the project. We expect that this version is to incur changes and significant detailing as the project progresses.

## 1.2 Target Audience

This document has the dissemination status: Public. While it is aimed primarily at the Consortium Members and representatives of the financing authority, the European Commission (EC), it is also open to the general public, particularly to AAR interested members of the public.

## 1.3 Document Structure

The structure of the rest of the document is relatively simple. There is one main chapter following (Chapter 2: The After-Action Reporting Application: Conceptual approach, inputs, outputs and specifications). It discusses in separate sections:

- 2.1 The overall conceptual view and approach to the AAR;
- 2.2 It analyses the possible inputs to the AAR Application
- 2.3 Provides a high-level view of the AAR Application architecture, and
- 2.4 Describes the output of the AAR Application in terms of the structure of the AAR and the main requirements.

We conclude in Chapter 3: Conclusions.

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## 2 The After-Action Reporting Application: Conceptual approach, inputs, outputs and specifications

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### 2.1 Conceptual Approach

Under Task 6.5 we aim at designing (and ultimately building) a knowledge capitalization mechanism that would improve interventions under crisis management situations. More specifically, we are designing an After-Action Reporting (AAR) Application as part of the S&R Integrated Platform. This application would allow after action reflection, analysis and formulation of lessons learned to be used in the management of future incidents.

*After Action Reports are a form of retrospective analysis of a sequence of occurrences (as part of a broader event or incident) and actions taken in response to them, aimed at performance evaluation and improvement in managing such events.*

After action reporting began in the US military and is of rather recent date. The first AARs were implemented in the mid-1970s as part of various tactical training programs. Since then, the use of AAR has been refined, expanded and increasingly supported by specialized software. The AAR process is now widely institutionalized in the US Army, being recognized the single most important evolution in army training (Department of the Army, 1993; Morrison and Meliza, 1999).

AARs have gradually started being used outside the military by institutions around the world especially in civil protection and crisis/emergency management. In such context AARs are used to review both the uncontrolled series of events (the crisis/emergency) and the goal-oriented actions as part of crisis management (California Hospital Association, n.d.; Gearhart, 2014; Rasmussen University, 2021).

In the S&R Project the AAR Application will support the overall After-Action Reporting and Review which will follow the management of crises supported by the S&R Platform. The Application will have to be flexible enough to accommodate the AAR processes of the various end-user institutions involved.

The AAR will be at the end of the emergency management cycle and at the end of the S&R data flow. Therefore, this Application will build on the data collected and aggregated under the S&R Platform and relevant Components.

## 2.2 Data Inputs

This AAR Application will selectively make use of heterogeneous data received by the Data Fusion and Mediation System and stored in the S&R Data Lake. The S&R Mediation System receives data from a variety of sensor sources:

- Wearable devices;
- Chemical sensors;
- Robot systems;
- Drones;
- Multi-spectrum camera;
- Tough phone;
- Smart glasses;
- Smart helmet;

(These sources are described in more detail in D4.1, Chapter 2.2.4).

However, for these data to be relevant for an AAR, they need to be associated to the events/incidents/actions of interest. In other words, the AAR will not work with the full flow of data arriving from sensors but will work with data which has linked with specific events. This association between data and events is assumed to take place in DSS type components, especially CONCORDE EMS. The other DSS components used in the project such as SOT DSS and Physio DSS may also provide relevant data, but their scope is less congruent with AAR since they focus on narrower and more specialized issues.

In addition, other data generated by the CONCORDE EMS are critical for the AAR. As described in D4.1, information generated in the CONCORDE EMS is divided in 3 categories:

1. **Interactions:** communication exchanges between actors in the workplace, caller and higher command. The main interactions are:
  - a. *Receive information:* means that information is sent to an actor without a prior request on his/her part. The information can be of any kind. Notifications and alerts on any actor's device are also in this group.
  - b. *Request information:* means that the actor wants to obtain information of any kind that is already available and take steps to obtain it.
  - c. *Provide information:* means that the actor has information and make this information available to other actors.
2. **New information creation** the main functionalities are:
  - a. *Gathering of new information:* means that the actor gathers information usually from the moment of approaching the incident scene onwards.
  - b. *Decisions= Total information processing resulting in the criterion of new information:* refer to decisions made based on processing information which is gathered.
3. **Information Documentation** refers to documenting any written or recorded information gathered during the incident management for handover and post-action evaluation.

Therefore, the AAR will need to work closely with and act as a logical extension of the CONCORDE EMS. After Action Reports will be built based on "Action Reports" (i.e. incident reports) generated in CONCORDE, after the incidents have been closed.

### **2.2.1 Data Inputs from CONCORDE EMS**

This section presents the data inputs generated from the CONCORDE EMS modules.

#### *2.2.1.1 Incident Management*

- Id
- Hazardtype\_set (e.g people trapped, explosions, fallen trees)
- Created
- lastModified
- incidentTimeOfAnnouncement
- incidentStatusCode
- priorityDispatchCode (e.g immediate)
- Name (e.g Earthquake in Poggioreale)
- Description (e.g 6.0 Richter earthquake , epicenter: Northern Italy)
- additionalInformation (e.g 6.0 richter earthquake in Poggioreale. School collapsed)
- hazardBackground (e.g Earthquake caused school and buildings to collapse. Children and teachers are trapped under rubble. Trees have fallen on cars causing explosions and fire)
- numberOfAdultPatients (e.g 250)
- numberOfChildren (e.g 200)
- numberOfFatalities (e.g 1)
- areaType (e.g URBAN)
- Lng (e.g 13.0349738)
- Lat (e.g 37.7631772)
- Location (e.g Poggioreale)
- callerContactDetails (e.g 000012345678)
- isActive (e.g true)

### 2.2.1.2 Organization Management

- organizationId
- organizationType (e.g EMS\_STATION)
- createdDate (e.g 2021-11-12)
- lastModifiedDate (e.g 2021-11-12T12:25:25.736861Z)
- Name (e.g Civil Protection EMS”,
- telephoneNumber
- Lat (e.g 38.47)
- Lng (e.g 23.60)
- Location (e.g Poggioreale)
- fleetSize (e.g 50)
- fleetTypeAVehicles (e.g 20)
- fleetTypeB Vehicles (e.g 30)
- totalNumberOfParamedics (e.g 25)
- Expertise (e.g ADVANCED\_LIFE\_SUPPORT)

### 2.2.1.3 Users Management

- id
- details:
  - Id (e.g 7)
  - Position (e.g MEDIUM)
  - specialExpertise (e.g BASIC\_LIFE\_SUPPORT)
  - organizationId
  - organizationType (e.g EMS\_STATION)
  - Role (e.g EMS)
  - EMSposition (e.g RESCUER)
  - Enabled (e.g true)
  - Username (e.g ems2)
  - First\_name
  - last\_name
  - Date\_joined (e.g 2021-11-16T09:55:53.209900Z)
  - createdBy (e.g concorde\_admin)
  - Email (e.g ems2@mail.com)
  - phoneNumber

### 2.2.1.4 Patient Management

- Id (e.g 1)
- createdBy (e.g concorde\_admin)
- creationTime (e.g 2021-11-29T09:55:19.577820Z)
- lastModified (e.g 2021-11-29T09:55:19.577843Z)
- Location (e.g Poggioreale)
- Fr (e.g for real?)
- Referred (e.g 020-05-22T02:00:00Z)
- Accepted (e.g 2020-05-22T02:00:00Z)
- Vehicle (e.g vehicleA)
- transportDepart (e.g 2020-05-22T02:00:00Z)
- Time (e.g 2020-05-22T02:00:00Z)
- injuryDescription (e.g he is dead)
- refDG (e.g ref):

```
"incident": 1,
"triage1": {
  "id": 1,
  "triage_score": 14,
  "o2": "120.00",
  "temp": true,
  "breathing": "NORMAL",
  "eyeOpening": "SPONTANEOUS",
  "motorResponse": "OBEY_COMMANDS",
  "verbalResponse": "CONFUSE",
  "patient": "1"
},
"triage2": {
  "id": 1,
  "triage_score": 14,
  "o2": "120.00",
  "temp": true,
  "breathing": "NORMAL",
  "eyeOpening": "SPONTANEOUS",
  "motorResponse": "OBEY_COMMANDS",
  "verbalResponse": "CONFUSE",
  "hr": "100 bpm",
  "skin": true,
  "pain": 5,
```

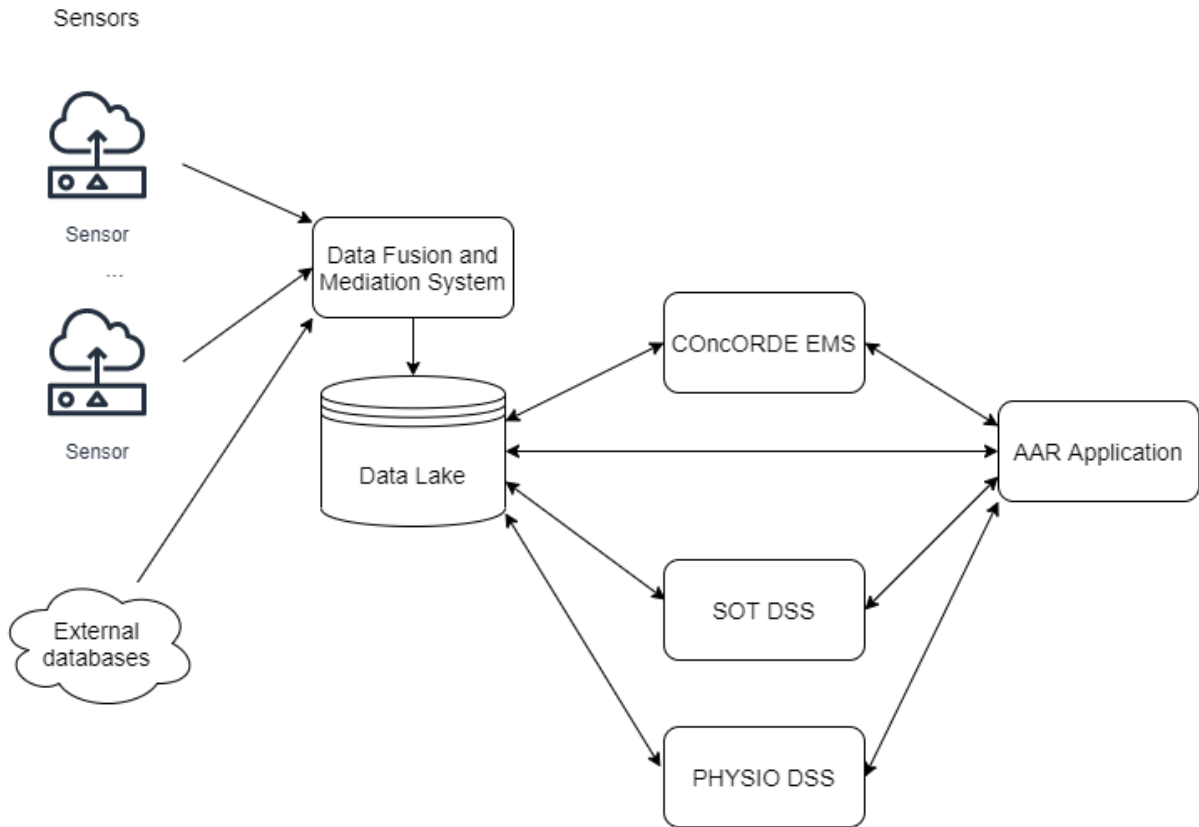
```
"rr": "6-9",  
"bp": "50-75",  
"rightPupil": 4,  
"leftPupil": 5,  
"airway": true,  
"capillary": false,  
"patient": "1"  
}
```

### 2.2.1.5 SOT DSS

- **SOT Service 1: Allocation of available EMS units to Incident**  
Send 5 EMS unit(s) from EMS station: Poggioreale to Incident 1  
Send 15 EMS unit(s) from EMS station: Civil Protection to Incident 1
- **SOT Service 2: Allocation of patients to first receivers**  
Send patient01 via EMS Retriever02 to Hospital Paolo Borsellino  
Send patient02 via EMS Retriever17 to Hospital Paolo Borsellino
- **SOT Service 3: Allocation of tasks to available Actor on the field**  
Send EMS Rescuer01 to incident01 in location [38.9842273, 21.9997331]  
Send EMS Rescuer02 to incident01 in location [38.9842273, 21.9997331]  
Send EMS Runner02 to patient01 in location [38.9953683, 21.9877132]  
Send EMS Runner01 to patient02 in location [38.9842273, 21.9997331]  
Send EMS Retriever02 to patient01 in location [38.9953683, 21.9877132]  
Send EMS Retriever17 to patient02 in location [38.9842273, 21.9997331]
- **SOT Service 4: Casualty estimation**  
Incident\_id: 01,  
Casualty estimation: "There is a 4% chance for 1-10 human casualties"  
"There is a 24% chance for 10-100 human casualties"

## 2.3 AAR High Level Architecture

Figure 1 below displays the high-level architecture of the AAR Application. It shows that there are several dataflows/inputs that go into the AAR Application. The main ones according to the current understanding will be the one coming from the CONCORDE EMS and directly from the Data Lake. The next two dataflows allow for direct communication between the DSS components SOT DSS and PHYSIO DSS and the AAR Application. We are less certain at this moment about the later two. The matter will be solved as we work on the details.



**Figure 1: AAR High Level Architecture**



## 2.4 After Action Report Application: Output and Requirements

The AAR Application will be a Web Application what will support end users in creating AARs following various incidents. This application will build on the data and outputs of the COncCORDE EMS and possibly other data from the Data Lake. The AAR should support users with:

- Generating part of the report (especially the incident description) automatically based on COncCORDE incident report.
- Allowing to insert additional elements (charts, tables, etc.) based on data from the Data Lake<sup>1</sup>;
- Providing the possibility to edit or add supplemental text information:
  - either in an ad-hoc manner as completions or edits to the existing descriptions,
  - or as part of the predefined fields determined by the AAR structure.

### 2.4.1 AAR Overall Structure of Content

- Incident overview
  - What were the events constituting the incident.
  - What were the actions taken in response
- Analysis
  - What were the some relevant observations;
  - What happened as expected and what was unexpected;
  - What were the strengths and areas of opportunity;
  - What were the weaknesses observed;
- Recommendations;
  - Explain what are the areas and items that need to be improved;
- Improvement plan;
  - Detail the improvements/corrective actions: include training requirements, resources needed, who should take the corrective actions, and the timeline of corrective actions.
- Conclusion
  - Summarize the main sections of the AAR.

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<sup>1</sup> This avenue is somewhat uncertain at this moment as accessing data from the Data Lake will need to be preconditioned by having such data linked (tagged) to the incident.

## 2.4.2 Main Requirements

**Table 1: AAR Main Requirements**

Code	Title	Description
AAR01	View AAR	The system shall display the after-action report in view only mode in a single web page.
AAR02	Edit AAR	The system shall allow the user to edit the editable parts of the AAR by means of editable rich text boxes. The user should be allowed to save partially completed work on the AAR. The user should be able to Submit the AAR once finalized.
AAR03	View incidents list	<p>The system shall display the incidents list containing at least the following information about incidents:</p> <ul style="list-style-type: none"><li>- incident name;</li><li>- incident beginning date/time;</li><li>- incident closing date/time;</li><li>- AAR status (non existent, begun, finalized);</li></ul> <p>For each incident the user has the possibility to open, edit, or export the AAR.</p>
AAR04	Export AAR	The system shall provide the capability to export AARs in PDF format.

### 3 Conclusions

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