IMPROVING SITUATIONAL AWARENESS USING A COMPREHENSIVE SURVEILLANCE STRATEGY

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ABSTRACT

Having accurate, timely, and relevant situational awareness information is vital during an oil spill response to ensure informed operational and strategic decision making as well as effective coordination of field operations. Recent technological advancements have greatly enhanced situational awareness data collection capabilities such that numerous real-, or near real-time, data streams and inputs into the Incident Management Team are now possible. Although these advancements are generally beneficial, they can easily result in data overload and the subsequent burial or masking of critical information. This issue is compounded by the absence of standardized mechanisms or processes to assess and manage the data. Another area of concern is while surveillance is a key component of situational awareness, it is often comprised of random acts of surveillance rather than an objective driven, fit-for-purpose strategy.

To address these issues, IPIECA, in coordination with the American Petroleum Institute (API), held stakeholder workshops in the United States and United Kingdom on situational awareness needs as well as the development of a comprehensive surveillance strategy. The results are being incorporated into an Oil Spill Surveillance Strategy technical support document currently under development by IPIECA.

This paper will primarily focus on the key components of situational awareness as well as considerations for developing a comprehensive surveillance strategy. Additionally, it will discuss key findings of the workshops, exercise blind spots, data flow and timing, who should own the data collection process and other related topics.

INTRODUCTION

Obtaining accurate, timely and relevant situational awareness information during the response to an oil spill is critical in the Incident Management Team (IMT) making informed operational and strategic decisions which, in turn, often determines the effectiveness of the response. Much of the situational awareness information is derived from surveillance activities utilizing aircraft, vessels, remote sensing platforms, field observations and others. Continuing advancements in technology, particularly regarding aerial surveillance and remote sensing, have greatly improved data collection capabilities. These capabilities can provide numerous real-time or near real-time data streams and other inputs to the IMT thus enhancing situational awareness and, subsequently, effective decision making and field coordination. The basic components of situational awareness and associated data collection and utilization are depicted in Figure 1.

Even though advances in surveillance capabilities often result in improved situational awareness, several issues need to be addressed to fully optimize these advances including:

- Situational awareness information is often obtained through random acts of surveillance rather than an objective driven, fit-for-purpose strategy
- Numerous surveillance data streams and inputs can result in data overload or the masking of critical information

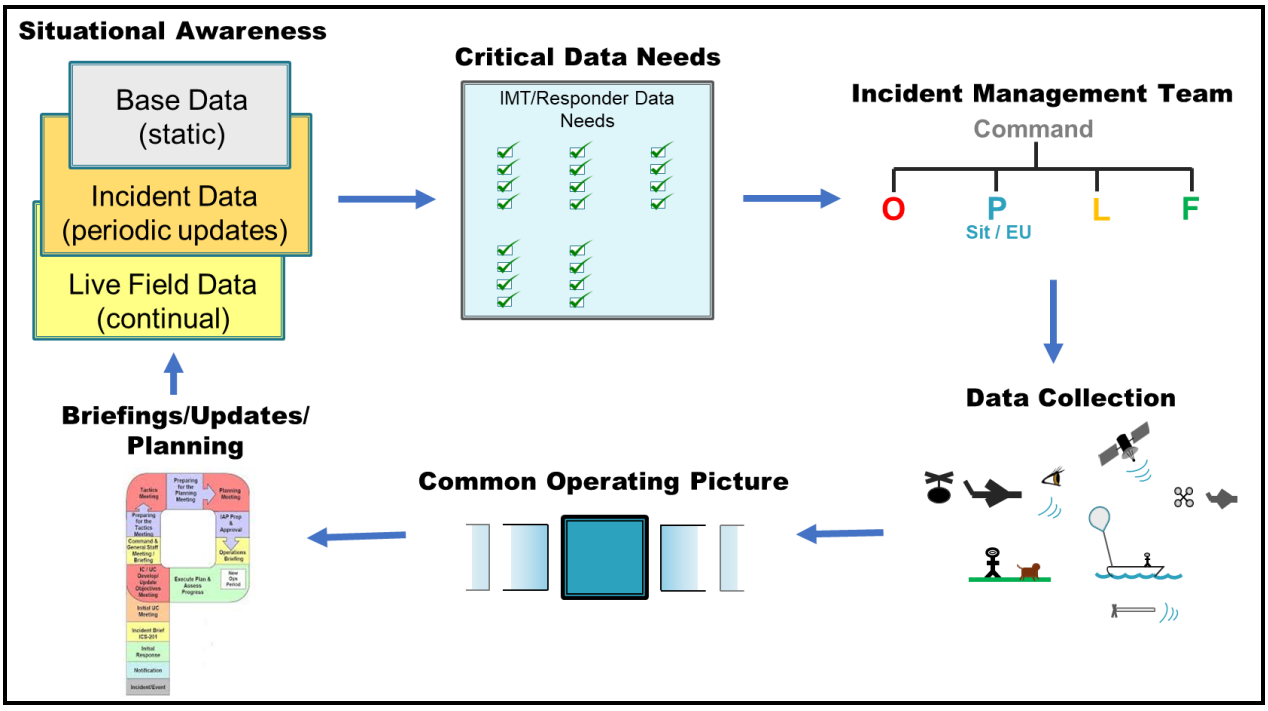

Figure 1. Situational Awareness and Data Components

- Lack of consensus on which surveillance/situational awareness data is considered critical or most useful for decision making
- Minimal connectivity between those driving data collection and the end users including a mutual understanding of when data is needed
- No standardized process for managing and distributing surveillance data or even who, within the IMT, owns the process
- Lack of a comprehensive or holistic surveillance strategy can result in reduced response effectiveness and efficiency as well as credibility

Additionally, the design of most oil spill response exercises creates a surveillance blind spot that obviates the need to develop a comprehensive surveillance strategy as well as an effective data management process.

To address these issues, IPIECA, in coordination with the American Petroleum Institute (API), initiated the development of an Oil Spill Surveillance Strategy technical support document scheduled for completion later in 2021. A key component of the development process involved stakeholder workshops on situational awareness needs and the development of a comprehensive surveillance strategy that were held in the United States and United Kingdom.

The purpose of this paper is to raise awareness of the need for comprehensive surveillance strategies during exercises and actual oil spills to enhance situational awareness and better inform operational and strategic decisions. By identifying the primary surveillance strategy considerations, discussing the workshop outcomes and including recommendations for addressing the more pertinent issues, the hope is for companies to begin including the development of a surveillance strategy and plan as a focus area in upcoming exercises. This will ensure a greater level of preparedness should an oil spill occur.

RANDOM ACTS OF SURVEILLANCE

In most oil spill response exercises and at least in the initial stages of many actual spill incidents, there is no cohesive surveillance strategy. Consequently, data is primarily collected through random acts of surveillance. Typically, the IMT Environmental Unit, Operations or Logistics Sections or even Command will request overflights or other data collection activities at various times with no consideration of the need for coordination or collaboration. Similarly, there is little, or no thought given to the overarching objectives or priorities of the surveillance activities. Rarely are specifics of the end users, timing needs, data formats, data management/distribution process, etc. determined and communicated to those collecting the data resulting in less than optimal situational awareness and decision making.

The IMT's Air Operations Branch often has limited aircraft availability and numerous daily missions wherein random aerial surveillance requests are at risk of being denied or delayed. This can lead to problems such as Incident Action Plans (IAPs) being developed based on old information thus requiring major revisions when current data becomes available. Similarly, the IMT Public Information Officer function relies heavily on up to date incident information for their frequent press releases and social media communications to keep the public adequately informed, minimize speculation and maintain credibility. This can be severely compromised if surveillance activities and associated situation status updates are delayed.

EXERCISE BLIND SPOTS

Most oil spill response exercise designs include a Simulation Cell (Sim Cell) or "Truth" function that simulates an evolving incident and adds a degree of realism by providing situation status updates to the IMT members upon request. While the Sim Cell is an essential component of all exercises, it does tend to create a blind spot with respect to surveillance by precluding the need to plan, coordinate and conduct the related activities.

The standard exercise practice is for the Environmental Unit, Operations or other position/function to contact the Sim Cell and request an overflight or other surveillance activity to collect selected types of data. The Sim Cell acknowledges the request and after waiting 30 to 60 minutes to simulate conducting the surveillance activity, they provide the data to the requestor. In some cases, aerial surveillance requests must be submitted to the Air Operations Branch first and the simulated mission scheduled and completed before the Sim Cell will provide the data to the requestor. Regardless, the practice excludes the need to develop a comprehensive surveillance strategy that would be required during an actual spill response. Consequently, IMTs may struggle

in a real incident to develop a surveillance program that will provide the data necessary for good situational awareness, informed decision making and effective field coordination.

STAKEHOLDER WORKSHOPS

The initial workshop was held in Washington, DC in October 2017 and involved several representatives each from the oil industry, federal regulatory agencies, oil spill removal organizations (OSROs) and consultants. This was intended as an exploratory effort to better define situational awareness and determine the need for a surveillance strategy. Other topics such as critical information needs, data management and others were also discussed.

Subsequent workshops involving primarily oil industry and OSRO representatives were held in London and Houston in the fall of 2018. Spill response scenarios were used to give context to the issues and focus on the components of a surveillance strategy and the data management process. The primary outcome was the development of a draft surveillance strategy consisting of eight components as shown below in Figure 2.

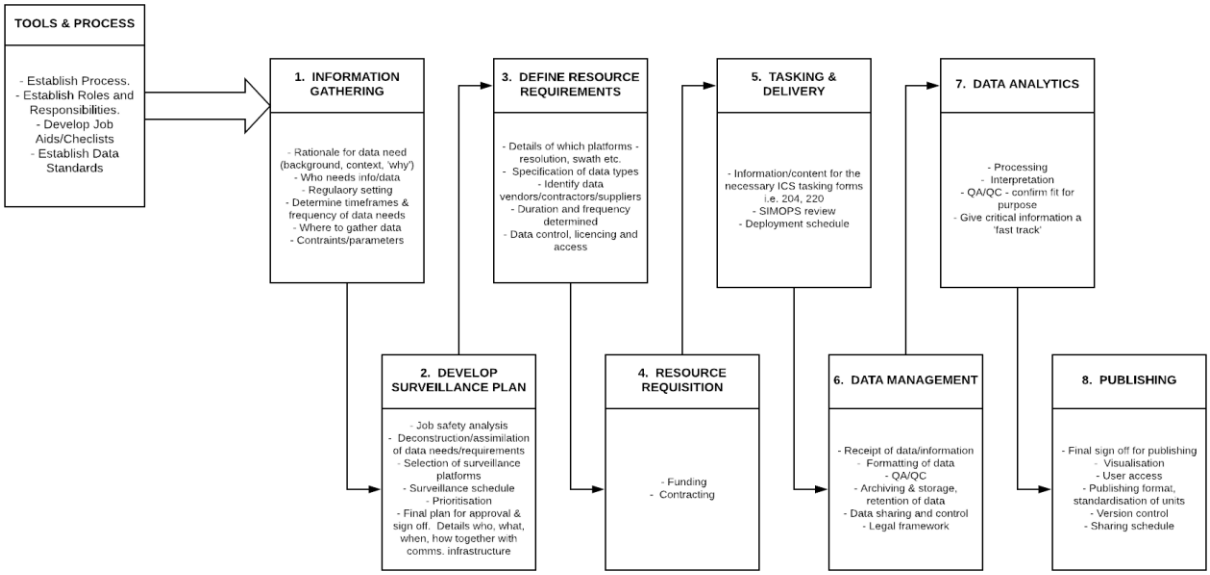

Figure 2. Draft Surveillance Strategy Components

SURVEILLANCE STRATEGY DEVELOPMENT

There are several factors that must be taken into consideration when developing a comprehensive surveillance strategy. These typically include:

- What are the overarching objectives?
- What are the critical data needs?
- Who are the end users of each type of data and when do they need it?
- What is the most efficient/effective means of collecting each type of data?
- What level of QA/QC is required for each data type?
- What IMT functions are responsible for collecting, managing and distributing the data?

These considerations, and others, should be addressed when developing a surveillance strategy and an associated plan. The plan should describe the objectives that will drive the surveillance strategy and include details on how it will be implemented. Additional discussion on each of the above considerations is provided below to aid in the development of a surveillance strategy during an incident or exercise.

Surveillance Objectives

The IMT Planning Section Chief should work with other key functions such as the Environmental Unit, Operations and Logistics to establish the overarching objectives of the daily surveillance program. Examples may include:

- Support Operations in tracking the location(s) and movements of the floating oil
- Support the Environmental Unit in assessing resources at risk
- Support Logistics in validating the location and status of key resources

These objectives will serve to focus the surveillance activities on those related to the objectives and deprioritize other activities that are less critical or time sensitive. This will also assist the IMT Air Operations Branch Director in prioritizing aerial surveillance missions.

Critical Data Needs

There are numerous types of surveillance data that can contribute to good situational awareness and effective decision making but determining which data are most critical can be problematic. Surveillance data deemed critical for one IMT function such as the Environmental Unit, is often different than that for Operations, Command, Logistics or other functions. Data requirements may also differ depending on the response options under consideration.

Determining which of those data are most time sensitive is also necessary for prioritizing and scheduling data collection as part of the surveillance strategy and plan. Establishing the surveillance program objectives will greatly assist in prioritizing data collection activities.

There was considerable discussion on what data qualifies as critical during the Washington DC workshop in 2017 and to a lesser extent in the subsequent workshops. The primary outcomes of those discussions were:

- Critical data needs will differ depending on the incident specifics as well as the IMT function/position and which external stakeholders are involved
- It is impractical to develop a short list of specific critical data needs for a "typical" oil spill incident as every spill is different
- Consensus was reached on the general types of critical data needed for most spills which, in prioritized order, are:
    1. Incident Information – oil type, quantity, location, controlled/uncontrolled

2. Slick Information – current and predicted locations/dimensions and impact areas (models, remote sensing and visual observations)
3. Environmental Conditions - wind and current speed and direction, wave height, weather, temperatures, etc. (required for trajectory models and response option feasibility determinations)
4. Resources at Risk – ecological, socio-economic, cultural

Not all types of critical data identified above are surveillance related but most are. Depending on the scenario, other types of surveillance related critical data needs could include, but are certainly not limited to:

- Slick locations, dimensions (including thicknesses and quantities) and degree of weathering over time
- Hydrocarbon vapor concentrations
- Surface or subsea dispersant effectiveness
- In-situ burning smoke plume dispersion
- Wildlife locations and densities

In addition to determining critical data needs for operational planning and decision making, data collection for legal purposes (e.g., regulatory compliance, natural resource damage assessment, compensation claims, etc.) may also need to be considered but would generally receive a lower priority. Once the list of required data needs is established, the capacity of the IMT to collect and manage that data must be evaluated. This, in turn, could reduce or expand the types of data that will be collected.

During an oil-on-water exercise conducted by Oil Spill Response Ltd. (OSRL) in 2017, several Unmanned Aerial Vehicles or Systems (UAVs and UASs) and Autonomous Underwater Vehicles (AUVs) were deployed to test their ability to provide surveillance data to the IMT. Although the IMT was well staffed, they experienced difficulties keeping up with and managing the amount of data coming into the Incident Command Post. Therefore, IMTs should avoid collecting data just because it would be nice to have but instead focus on the critical data needs and what will be most useful for operational planning and decision making.

IMT Functions Responsible for Data Collection

Under the standard IMS/ICS roles and responsibilities, there is no single IMT position or function that is assigned responsibility for collecting surveillance related data. This issue was discussed at length during the above-mentioned workshops wherein a general consensus was reached as described below.

Within the Planning Section and for small to moderate incidents, a Surveillance Specialist function should be established under the Situation Unit Leader and assigned responsibility for developing a surveillance strategy and plan. For larger incidents, a separate Surveillance Unit should be established within the Planning Section to more effectively manage the activities. In either case, the Surveillance function will need to obtain input from other functions regarding their individual surveillance related data needs and timing as well as which functions (Operations, Environmental, Safety, Logistics, etc.) are best suited for collecting each data type. Examples include the following:

- Incident Information – The Operations Section including field personnel are generally well placed to collect this type of information

- Slick Information, Environmental Conditions, Resources at Risk– The Environmental Unit is often responsible for compiling environmental data, slick tracking and trajectory analyses and identifying resources at risk

The majority of surveillance activities undertaken during a spill response involve aerial surveillance using manned and unmanned aircraft. Consequently, the recommendation is to have the Surveillance Specialist compile all aerial surveillance related data collection requests including recommended equipment and platforms for each and provide a prioritized list to the Air Operations Branch Director for implementation. This would enable the Branch Director to determine the most appropriate aerial platforms for each data collection activity based on suitability and availability. It would also facilitate combining multiple data collection activities for individual missions where applicable.

Requests for other types of surveillance related data collection activities such as visual observations or sampling from on-water vessels, underwater monitoring from remotely operated vehicles (ROVs) or AUVs or satellite remote sensing should also be compiled and coordinated by the Surveillance Specialist to maximize efficiency and avoid duplication.

End Users and Timing

Once the list of surveillance data needs has been established, it is important to determine who the actual end users are as they may not always be the same as the persons or positions requesting the data. This will better ensure the end user obtains the data in a timely manner. Optimal timing of data delivery to the end user must also be determined to assist data collection scheduling and ensure the data is available when needed. One example is overflights to verify slick locations should be completed and the results submitted to the Situation Unit

Leader and Operations Section Chief in advance of key Planning Cycle meetings where it is important to include in the Situation Status Briefing portion of the meetings. Another example could be providing aerial videos or images of selected response activities to the Public Information Officer prior to a scheduled media briefing, town hall or a local television station's evening news deadline. In any case, the end user of the requested surveillance data and the desired timing should be conveyed to the Surveillance Specialist when compiling the list of data needs as described in the previous section.

Means of Data Collection

The most effective or efficient means of collecting specific types of surveillance data is generally known or determined by the requestor/end user who will often specify the optimal data collection platform or device. If not, the requestor should seek the advice of technical specialists prior to submitting the data collection request to the Surveillance Specialist as it is typically beyond their scope to determine the best means of data collection. In the case of aerial surveillance data, the Air Operations Branch Director should be involved in the determining the most appropriate aircraft or UAVs/UASs as they will often be based on availability or feasibility.

Due to rapid advances in data collection technologies, there are often numerous formats in which data can be collected and transmitted. Consequently, the end user should specify the format in which they would prefer to receive the requested data which, in turn, will need to be conveyed to those collecting the data. In many situations, the surveillance data will be uploaded to the Common Operating Picture (COP) platform in which case the format(s) in which the data is transmitted will be dictated by those which are compatible with the COP.

Data Management, Quality Assurance/Quality Control and Distribution

A key component of the surveillance strategy is determining who will manage the data including performing the necessary level of quality assurance/quality control (QA/QC) for each data type or stream and distributing it to the appropriate end users. The general consensus from the workshops is the Situation Unit within the IMT should be responsible for receiving and managing the majority of the surveillance data. This will create a central repository for the data and facilitate uploading to the COP since that is also the responsibility of the Situation Unit. In some cases, however, surveillance data may go directly to the end user if it is for a specific purpose. Examples could include the Environmental Unit requesting an overflight to validate the results of oil spill trajectory models or Wildlife Branch personnel conducting an overflight or drone survey to assess at risk bird populations and densities.

Data QA/QC and distribution can be somewhat contentious due to differing needs of the end users, including external stakeholders, that may be involved. Since the technology is often available to provide real time data feeds, it has become the default expectation of many end users which can be problematic if no QA/QC is performed. Erroneous data is very difficult to correct once it is in the public domain. The consensus from the workshops is that most surveillance related data should undergo some level of QA/QC prior to distribution and incorporation into the COP which could be different for each data type.

Key data management, QA/QC and distribution process, protocols, etc. should at least be summarized in the surveillance strategy and plan to ensure transparency and efficiency. In some cases, they may also be incorporated into data sharing agreements with external stakeholders, if applicable, or an incident wide data management plan.

SURVEILLANCE STRATEGY PLAN

Once a surveillance strategy has been developed, it will need to be documented in a surveillance plan and distributed to the IMT. This will ensure awareness of the planned data collection activities and the process by which the data will be managed and distributed to the end users as well as who is responsible for implementing each aspect of the plan.

Details on the surveillance plan content, organization and format will be included in the forthcoming IPIECA Surveillance Strategy technical support document but in the interim, the recommendation for plan content and organization include:

- Purpose and Scope – Summarizes the plan's purpose and what is covered and what is specifically excluded.
- Data Request Process – Describes the process by which data requests will be solicited or submitted to, and compiled by, the Surveillance Specialist or Unit or other designated function/position.
- Daily Data Requests and Collection Activities – Includes a list of the data requests including the preferred formats, end users and deadlines as well as the associated collection activities, schedule and assigned responsibility for each activity. The ICS 220 Air Operations Summary form can be referenced for aerial reconnaissance activities as applicable.
- Data Management and Distribution – Identifies who is responsible for data management and describes the process by which the requested data will be transmitted to the IMT, how and where it will be stored, the level of QA/QC that

will be performed on each data type and how it will be distributed to the end users or uploaded to the COP.

The surveillance strategy plans should be reviewed daily although only the section on data requests and collection activities will generally require updating.

SUMMARY AND CONCLUSIONS

The importance of a comprehensive surveillance strategy in underpinning a robust and accurate situational awareness and informing good operational and strategic decisions cannot be over stated. It is clear from the above discussion that a comprehensive strategy includes developing several components and processes and involving multiple functions within an IMT suggesting it may not be a simple and straightforward task to complete. Furthermore, since surveillance activities often start early each day, the strategy and associated written plan will generally have to be prepared the previous day and updated daily.

As noted in the sections on Random Acts of Surveillance and Exercise Blind Spots, the current design and practices of most oil spill response exercises are not conducive to increasing awareness of the need for, or practicing the development of, a surveillance strategy and plan. Based on the outcomes and recommendations of the surveillance strategy workshops conducted by IPIECA and API, much of the responsibility within an IMT for the development and implementation of a surveillance strategy, including data management, falls to the Surveillance Specialist within the Situation Unit. Due to the limited incorporation of surveillance strategy development and implementation in most exercises, the Situation Unit may be under prepared and under staffed to manage a comprehensive surveillance program. Even if a separate Surveillance

Unit is established for larger incidents, the management of surveillance data would still be the responsibility of the Situation Unit.

A recommended path forward is to include the development and implementation of a surveillance strategy and plan as a focal point in future oil spill response exercises. This would also encompass increasing the staffing of the Situation Unit in the IMT including individuals that are well versed in data processing and management.