METRICS FOR RESPONSE VELOCITY

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ABSTRACT

The rate at which a response to an incident proceeds should vary as the incident progresses. Certain factors contribute to the rate of escalation (and, eventually, demobilization) of response resources, personnel, and formation of a response organization. The rate at which a response organization grows, organizes, functions, and mobilizes resources can be described as an incident's "response velocity". Often, the time of the arrival of equipment to the incident scene is considered the sole measure of whether the response was quick. However, a single metric such as time to arrive on scene does not speak to the speed with which the incident command is established or the sustained velocity of the response. Examination of the spending patterns, staging area volume, established encounter rate of clean up equipment and other indicators can build a better assessment of the velocity of the response. A discussion of the concept, which adapts the "best response" idea and offers metrics for measuring velocity, is presented.

BUILDING DEFINITION

Velocity is a universal concept encountered and, sometimes, exploited daily. People depend on the velocity of transportation to get them where they need to go just as they trust in the velocity of electrons to carry energy or rely on the velocity of the wind to change the weather. Generally speaking, the velocity of anything is defined as the rate of change of the subject in question with respect to time. Incident response and, in particular, oil spill clean up, is often viewed as having a "velocity," that is, the speed at which the response moves. The velocity of a response changes over the lifetime of the response, and wise incident commanders make sure that they apply the necessary forces or incentives in order to make the response move with the proper velocity appropriate for the phase of the response they are in.

Many oil spill response organizations in fact make it a point to boast of response time and seek favorable reviews on response velocity. This common view of response velocity most often centers on the time it takes to put equipment on the scene to clean up oil. However, the overall velocity of response comprises more than starting a clock at the initial notification and stopping the clock once the first piece of equipment is on scene. The rate at which a response organization grows, organizes, functions, mobilizes and demobilizes resources better describes an incident's "response velocity."

A single metric such as time to arrive on scene does not speak to the speed with which the incident command is established or the sustained velocity of the response. In order to best understand the concept of velocity, the analogy of driving an automobile helps; to gain safe access to the highway one must accelerate the vehicle to achieve an adequate velocity for merging with traffic. On an oil spill response, the incident command is obligated to demonstrate an adequate speed of response initially. A common public perception harbors the notion that skimmers, booms, and beach clean up crews should be present within a few hours of notification of the spill. Responders generally seek to comply with that expectation but the two sets of expectations might not align completely. Getting the right equipment to the right place safely and operating it efficiently are more desirable goals. Kuchin and Hereth (1999) described, in the "best response" model, a means of hindsight assessment for response, and Weber and Hewitt (2001) acknowledged that lagging indicators were insufficient to project readiness posture. Real time or, even better, leading indicators are desirable to show progress and prompt decisions in altering response velocity while on a response.

In measuring velocity one seeks to identify and employ some sort of metric or indicator that could reliably report the response velocity throughout the life of the response; however, this telltale metric remains elusive for pollution response. To date, there is no single metric that can instantaneously indicate the rate of forward progress for the response. This is not to imply that there are not other means for assessing progress, though; a combination of factors can still reveal the relative movement of the response.

A critical point must be understood, however: nearly any metric can be "gamed." That is, one can devise a way to run the metric or make the metric "appear" to change in the favorable direction for whatever gain is sought. Pushing a process only for speed metrics sacrifices quality, and quality based metrics favor longer responses and sacrifice efficiency since time to completion is presumably lower in priority. The better metrics are more difficult to game and the best ones have elements of both quality and quantity. With many of the metrics discussed herein, the change of the variable is not directly measured with respect to time but the time to reach the milestone can be easily detected; in many cases, the metric is "one time use" and can only serve to tell the unified command (or "UC" will serve as the descriptor of the response leadership for the purposes of this paper). A metric that has only a binary value is sometimes known as a hygiene variable: "you have it or you don't". In the case of the one time use variables, attaining the checkpoint in sufficient time (which is subjective, thus far) can effectively be considered reaching proper velocity; these could very nearly be considered hygiene variables but, for the purposes of this paper, are treated simply as one time use metrics.

Figure 1 depicts velocity as a function of time over the lifetime of the response; while only a notion, it shows that the organization accelerates initially, attains a "cruising" velocity and then eventually decelerates. If a single metric existed for monitoring velocity, it would show that velocity is not constant during the total response.

Maintaining velocity of the response requires another set of metrics. Many would agree that attaining the "project" phase, that transition from the initial, chaotic formation of the command structure to the more efficient, sometimes harmonious, working period where the workers understand their purpose and function in the organization, signals a milestone in the life of the response. The difficulty in defining "project" phase is that the attainment is a relative feature on the timeline of the response and different portions of the response might enter into project phase sooner than

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others. Nonetheless, it signals that the organization is capable of self learning and the expectations of velocity are different.

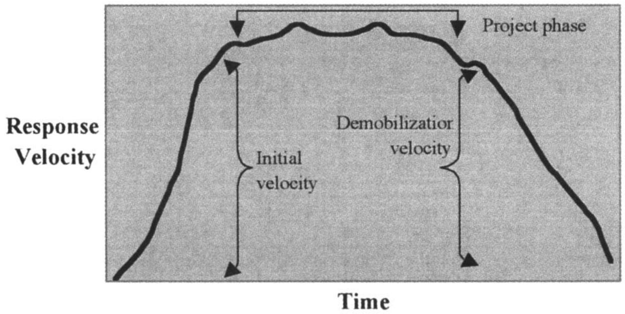

FIGURE 1. NOTIONAL RESPONSE VELOCITY OVER THE COURSE OF A SPILL.

To call upon the vehicle analogy again, the response might be said to be on "cruise control": most of the resources necessary are on hand, the main thrust of the response is devoted to cleaning the spill, and the UC has the opportunity to devote attention to myriad other issues that blend into a response.

ACCELERATION OR INITIAL VELOCITY

The time for equipment to arrive on scene remains a handy measurement of initial response velocity while the organization is still accelerating. Subject to many unpredictable factors such as weather, personnel availability, road and sea conditions, and equipment reliability to name a few, the physical arrival of equipment on scene normally cues the public and other stakeholders that the incident has priority and attention. The questions of whether it's the right equipment, the right location, or the right personnel are left unanswered. A small skiff operated by two personnel with a bale of sorbent pads qualifies for "on-scene response" but does little for addressing the thousands of gallons of #6 oil floating in the harbor. Key elements concerning the type, encounter rate, and storage capacity of the equipment and the capability of the personnel to operate it are central to answering whether the incident has achieved proper initial velocity.

Another metric for gauging initial response velocity is to measure the time it takes for the incident (more appropriately, unified) command to order the first resource using the incident command system. Why is this telling? Standing up the incident command post consists of more than collocating the various response organizations under one roof. Even then, a typical command post experiences a transition period where the new inhabitants undergo a chaos period where one witnesses extreme effort for limited returns. By the time the Incident Command System (ICS) organization can order its first resource as a command, it has stood up a good portion of the Logistics Section, Planning Section, and the Operations Section. Larger organizations should theoretically expect to have longer ramp times to attain their first order. The Operations Section may report achievement in establishing the first task force or strike team in heralding its ability to stand up within the UC.

Similarly, noting the time to issue the first joint press release denotes the functioning of a Joint Information Center. Keeping in mind that "jointness" might still include a geographic separation, the issuance of a message from the UC signals initial capability of the command to use the ICS to deliver on key success factors.

PROJECT PHASE

The number of "mile markers" available to the UC during project phase can dwindle somewhat since the overall pace of movement is steady. Should the lifetime of the response be sufficient to measure these items, one could custom devise metrics for the unique nature of the response. For instance, if in a fast water environment, one could potentially measure the ability to stay ahead of the spill in establishing geographic response plans downstream from the known affected areas. Or, depending on the kind and types of equipment, measuring actual daily collection with respect to encounter rate for individual pieces of equipment shows the efficiency of the equipment.

Costs are somewhat traditional figures to use to assess the speed of the response. In the project phase their utility in no less important. By examining daily expenditures and the forecast for continued clean up, the UC has at least one data point for velocity. Finance Section should be able to further clarify costs to spot trends in usage of any particular varieties of resources.

DECELERATION OR DEMOBILIZATION VELOCITY

Once the response effort begins to show signs of completion, it is incumbent upon the UC to dismantle the organization and ramp down. Sometimes, the UC expresses a reluctance to wave goodbye to the project phase and move into the final phase of the organization's lifecycle. The departure of people and equipment, driven by mounting costs, is then often precipitous and can overwhelm the capacity of the decontamination and demobilization units.

This is not to say that signing off beaches or waterways as "clean" is completely ignored. In fact, the first sign off of a stretch of shoreline as "clean" can act as a metric for velocity as well. However, other signs can indicate the deceleration of the UC. One such sign is the tapering rate of funds expenditure (or burn rate). Another is the growth of inventory in the staging areas. Both of these tie to funding. Interestingly enough, daily cost figures, unlike nearly any other metric, report a consistent type of figure and can be measured with respect to time. As the Cost Unit in Finance achieves the pace of the overall organization, their efficiency in reporting daily cost figures (and even predicting the velocity of spending) increases. Hence, dailies are a reliable and understandable tool for indicating a portion of the velocity. Expenditure rate, strangely enough, remains the one figure that can be easily sampled during the response and consists of easily understood units. Its value in gauging velocity is non-trivial. Given the close attention paid to money, it is also quite resistant to gaming. As seen in Figure 2., the steepness of the ascent is a measure of the velocity of the response at any one point, i.e., the slope shows how fast the UC was expending money.

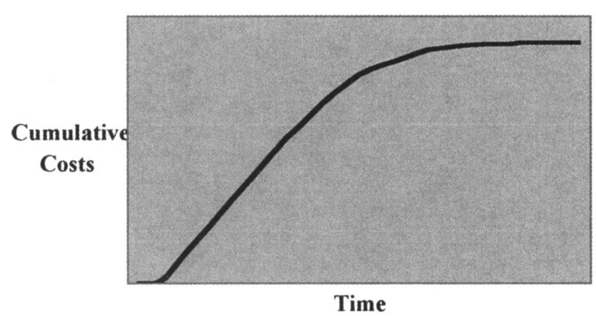

FIGURE 2. TYPICAL COST ACCUMULATION OVER THE LIFECYCLE OF A SPILL.

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Transitioning from project phase to demobilization phase should be difficult to detect using any probe. A precipitous transition can signal that resources were unnecessarily retained beyond their usefulness to the detriment of the overall bill and to the readiness for some other response. Resources should be shaved nearly continuously in order to maintain the leanness of the organization. One may watch for building inventories in staging areas to determine if demobilization is overdue. Ramping down from a response is oftentimes like braking in a fast moving vehicle: by anticipating the upcoming decrease in velocity, the organization can safely and consciously slow the overall pace of the operations to match the decrease in demand for cleanup resources.

THE WAY FORWARD

Using spend rates from actual responses, examining patterns of spending and looking for empirical transition points with an eye towards assessing goals for different levels of responses holds promise for establishing near real time velocity measurement. Data acquisition while on a spill is difficult because of the many forces that are converging on the UC simultaneously. Nonetheless, further identification of project phase mile markers that require no additional internal collection or disruption are sought in order to afford responders with reference points for progress.

BIOGRAPHY

CDR Mark Dix is Chief of Operations at MSO Puget Sound in Seattle, WA. He holds two Masters degrees from the College of William and Mary.

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