RoGO Fire white paper

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Contents

Abstract

Wild fires are growing in size, impact and cost on our society. They are occurring more often and taking more human lives, burning more land, incinerating more homes, generating more greenhouse gasses from burning trees, and costing more tax dollars to fight.

Because of the cumulative monetary cost, the cost in human lives and the environmental destruction wild fires cause, we need to address fighting wild fires with a new all-encompassing holistic approach. To date, the wild land firefighting market remains archaic in their use of technology to help fight wild fires better…they still use paper maps, compasses and two-way radios to coordinate the efforts of up to many hundreds or -thousands- of firefighters to extinguish destructive, dynamic blazes. These methods are inefficient for extinguishing wildfires quickly, saving lives and saving firefighting response expenditures.

This paper describes the system & technology behind RoGO Fire's unique wild land firefighting solution, called the RoGO communication system.

While this white paper describes the RoGO application to wild land firefighting, be cognizant that this system will save lives and monetary response expenditures in any All-Hazards response scenario. These All-Hazards scenarios include emergency response to any areas that do not have cellular communications, such as those affected by hurricane, tornado, flood or remote search & rescue. There is also a sizeable governmental market in Border Patrol, FEMA and military applications, and a sizeable consumer need for our solution in markets like forestry, pre-event insurance risk assessment, remote utility applications, oil pumpjack methane gas emissions monitoring, adventure travel and more.

Problem Statement

On today's large wild land fires, there is a lack of current and consistent communication technology to support the firefighting personnel across the varying topography and distances that firefighters operate in. This results in communications inaccuracies, no communication at all and limited timely updates. This is primarily due to pass-through of audibly-relayed information between parties (think the telephone game), no VHF or cellular service in remote areas, and the large distances or geographical obstacles between parties in a remote emergency scene that inhibits radio signal transmissions.

There is currently no way to organize the tactical effort of many wild land firefighters to extinguish a wild fire with a high level of efficiency and effectiveness. There is no current way to acquire current Situational Awareness data in remote areas like up-to-the-minute wind speed, wind direction, the position of other nearby fire crews or firefighting resources like engines, tenders, dozers, water resources or the location of high-value structures. Crews cannot currently effectively communicate with other crews or with Incident Command in an emergency. And there is no way for Incident Command to efficiently communicate emergency or tactical

information to specific deployed firefighting teams…information that can save lives like weather updates or the position of the fire currently, the direction the fire is moving in or projected to move to. Having timely, accurate weather updates is critical. Fast moving wind-driven wildfire events have wreaked havoc, destruction and death across many wildfire scenes and resulted in a large loss of life whether firefighter or civilian. Examples of where extreme weather, poor communications and a lack of situational awareness has cost many lives are: 2013's Yarnell Hill Fire in AZ, 1994's Storm King Mountain/South Canyon Fire in CO, and 2025's Palisades wildfire in CA, whose economic losses for this one fire alone are estimated between $52 & $57 Billion dollars as of this writing (with the fire still burning out of control to date).

Instead, we need to find a better way to fight wildfires: We need to fight them with intelligence. To solve this growing problem, this paper outlines the technology solution that RoGO Fire has developed to solve these issues. RoGO has developed a patented integrated satellite communications system incorporating GPS-enabled & SATCOM-enabled portable devices called DropBlocks. DropBlocks track the GPS positions of human and non-human firefighting assets, transmits weather & wind speed/direction information from remote areas, and enables firefighters to communicate with the incident commanders and emergency response operations in real time. Our devices also share up to the minute vital scene information, like the status & location of firefighters, weather changes, point-to-point tactical communications, resource GPS position, maps, photos and changes in assignment. The result is a Common Operational Picture (COP) across hundreds or thousands of firefighters that provides a single source of truth when it comes to assessment and tactical coordination in a wildfire.

In the future, RoGO will transmit local wind/weather sensor information over satellite, mesh or cellular in a least-cost-routing fashion and apply AI/ML to this information to conglomerate wind speed/direction, local slope & topography, and even moisture content in local fuel types. Considering all of these variables enables RoGO, along with our AI/ML software partners to accurately predict - in real-time - where the fire is headed, when it will arrive at a particular location and what firefighters are in possible danger.

It will also inform tactical coordination like where to draw fire lines, and how wide to draw fire lines to account for burning embers being carried by the wind to prevent new spot fires being started behind the fire line…by using available firefighting resources near to where the fireline needs to be created. This enables better efficiency and effectiveness in stopping the fire in its tracks and preventing further fire spread. Our solution is further described *infra*.

Background

The development of the RoGO solution came about after the Yarnell Hill tragedy in 2013. The Yarnell Hill fire, ignited by lightening on June 28th, 2013, overran and killed 19 Granite Mountain Hotshot firefighters two days later on June 30th, 2013. With a background in electrical engineering, Rod Goossen (who founded RoGO Fire) was discussing this deadly incident with his brother Derek Goossen. Derek is a 27-year wildland firefighter and Captain and Battalion Chief for the Red, White & Blue Fire Dept. in Breckenridge, CO.

When Rod asked Derek how a tragedy like this could occur, Derek responded with "we are still using paper maps, compasses and 2-way radios". Rod, knowing technology, and Derek, knowing firefighting needs, created a solution to address communications and situational awareness issues so that a tragedy like Yarnell would never happen again. Rod then teamed with other industry experts, a strong hardware and software engineering team and industry advisors to develop this satellite-based communication and information solution for all Wildland Firefighters, remote All-Hazards responders, and for anyone or any group that works or plays in remote areas void of cellular coverage.

In 2016, NIST estimated the annualized cost of wildfire to be as much as $62.8 billion, and annualized losses as high as $285.0 billion dollars, and the total economic burden of wild fires as high as $347.8 billion dollars (NIST, 2017). We can save large fractions of these overall amounts by bringing this system to fruition in order to coordinate the tactical effort of many human and non-human resources on an All-Hazards response effort. The situational awareness (SA) component of this system alone will save lives and save money, but the RoGO solution will do much more than that.

Solution

The RoGO system will significantly cut down on the incident check-in and check-out process, significantly reduce response time and time to get to the assigned post upon arriving at the incident, it will save much time on clerical work like acquiring time cards of individuals from remote areas or sending Incident Action Plans (IAPs) out to remote, spiked-out firefighters. It will also save on unnecessary redundant operations due to uncoordinated communications, get emergency assistance to injured firefighters/first responders faster through instant communications and accurate victim location, and many, many more money-saving and time-saving benefits…all through the application of technology. It will get information, like current and forecasted wind speed, wind direction, precipitation and humidity information, and the predicted direction and speed of the moving flame front sent out to the remotely-located firefighters who need this information.

The RoGO solution is a two-part system: Part one will be SATCOM-enabled lightweight, portable DropBlocks, which will be carried by Hand Crews. These devices, which only weigh a few ounces, will provide the vital data communications link for Incident Management applications on a Hand Crew users' smartphone. DropBlocks can also send data from remotely-located wind speed/wind direction sensors (like a Kestrel 5500) to inform firefighters of erratic and dangerous weather anomalies and fire behaviors.

DropBlocks will also mark & track the position of all other firefighting resources: DropBlocks can mark & track the real-time position of bulldozers, water tenders, fire engines, or can mark high-value structures, med-e-vac rescue pick-up spots, or one of about 40 different things. All DropBlock positions will be shown on all hand crews' smartphone applications, and on all other Wildland Firefighting crews' leader's tablets or laptops, discussed below. Knowing

the real-time location of surrounding resources will enable firefighters to employ those capabilities when needed.

Part two of the RoGO system is a high-bandwidth SATCOM connection: In Wildland Firefighting, besides hand crews, who are always on foot, there are also Task Force leaders. Task Force leaders usually operate out of a vehicle, where power and weight are not so much a consideration as they are for hand crews operating on foot. For these leaders positioned in vehicles, RoGO provides high-bandwidth 700 kbps full IP data connectivity. This connectivity allows these leaders to have full versions running of any incident management (IM) platform. Examples of IM platforms are: ATAK, Rhodium Incident Management from IRT, Intterra Incident Management, and Tablet Command. All of these platforms can leverage a SAAS component through our 700kbps SATCOM data connection to provide up-to-date data on wind, weather, location of nearby resources,

It will also provide instant communications from Incident Command and to/from other nearby firefighting groups. These platforms create a Common Operational Picture (COP). This COP will empower leaders to make informed decisions, based on what fire or weather events are occurring in near-real-time. Lastly, we will overlay the GPS position of each DropBlock on the incident management platform of choice. Now, every leader can see where everyone is at in near real-time, have current weather information to inform tactical decisions on, and be able to communicate with any one crew, or a geo-fenced group of crews, in seconds via RoGO's point-to-point text messaging function available on the RoGO platform, including from crew-to-crew across our satellite-enabled DropBlock devices. This COP will enable a better tactical coordination across the firefight, as well as increase safety for all firefighters.

An example of needing to identify surrounding resources in real-time to employ them effectively would be: firefighters have been instructed to create a fire line, but the fire is being pushed toward their location quickly by changing wind conditions like a cold front, aka an outflow boundary. Looking on their smartphone app and seeing the location of a bulldozer just around the bend (that they couldn't otherwise know about), they can summon that bulldozer's help to finish drawing the fire line shortly before the fire arrives. This effort, enhanced by the bulldozer stops the fire by starving it of fuel, saving further time, effort and environmental resources had the fire not been stopped with help of the bulldozer at the beckon of the handcrew.

DropBlocks can be used to mark the locations of high-value structures to protect, water resources, food & supply drops from aircraft, the location of an injured firefighter for immediate medevac pick-up and more. Additionally, DropBlocks will have the functionality of vector positioning. Vector positioning will allow a firefighter on the ground to place the DropBlock pointing along a certain vector…this vector can then be transmitted up to a slurry-bomber aircraft. Slurry bombers, flying through heavy smoke often miss their intended slurry drop point target. With the marking of a specific position *and* vector along which to drop the slurry, slurry bombers flying through heavy smoke and low-visibility conditions will no longer miss their target drop point. Accurate, targeted slurry drops will provide maximum effectiveness for each slurry drop. This feature will also increase firefighter safety by providing an "All-Clear" message to the slurry pilot to confirm all hand crews are out of the way of the drop zone, and that it is safe

to drop the slurry or water. This will save further time and money spent fighting the fire, and increase firefighter safety.

Conclusion

Wildfires are a large, growing problem in the United States and worldwide. Wildfires consume more acreage, more lives, and more taxpayer money to fight them year over year. We need a better way to fight wild fires: we need to fight them with intelligence. Using RoGO technology to deliver information and communications -in near real time- provides situational awareness, pertinent data and information directly to firefighters of all ranks and will allow firefighters to fight the fire more efficiently and effectively. The free flow of communications and situational awareness information to firefighters will also save firefighter and civilian lives. It will save time fighting the fire, preventing extraordinary environmental impacts and CO_2 emissions, and save significant taxpayer money spent fighting wildfires.

After the explanation above, it would take only a little imagination to envision how this system can be applied to any other All-Hazards response scene, making their responses more efficient and productive. After a hurricane rolls through a city, there are few -if any- cellular towers left. Tornadoes, and high flood waters also destroy cellular and ground-based communications. This leaves first responders at a disadvantage to help citizens in peril, and to help themselves survive in extreme conditions, which are often met during the extra-ordinary events that occur during an All-Hazards emergency.

In all these instances, the timely transmissions of communication and information is key. Communication, coordination, information and collaboration are essential aspects to responding to natural disasters effectively and saving lives and money *and* unnecessary environmental damage. When cellular and ground-based communications methods are down, or simply not available, there is only one place to go: upward with SATCOM communications. Let's use our available technology to fight wildfires with intelligence, and let's also use this fabulous tool to fight any all-hazards event more efficiently and effectively…let's fight all of these disaster events…with intelligence.

Reference

National Institute of Standards and Technology. (2017). *The Costs and Losses of Wildfires.* Retrieved from https://www.nist.gov/publications/costs-and-losses-wildfires