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OPERATIONAL INTELLIGENCE FOR SUCCESSFUL CITY SPECIAL EVENTS

Providing Situational Awareness with a Geographic Approach

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EXECUTIVE SUMMARY:

Enhancing Awareness, Planning, and Communication

Public special events are the heart and soul of any community. While essential to the social fabric and economy, these events today require a level of operational intelligence that grows more complex by the day. As Chicago prepares for NASCAR's first-ever street course race, the excitement of the historic moment for the sport will draw strong interest the weekend before the Fourth of July 2023. The event will be preceded by months of planning. Geospatial technology will give event organizers, city leaders, and city staff greater precision in their decision-making—by mapping the requirements and providing real-time situational awareness to secure safe, smooth, efficient operations.

The Need and the Capabilities

The Big Idea

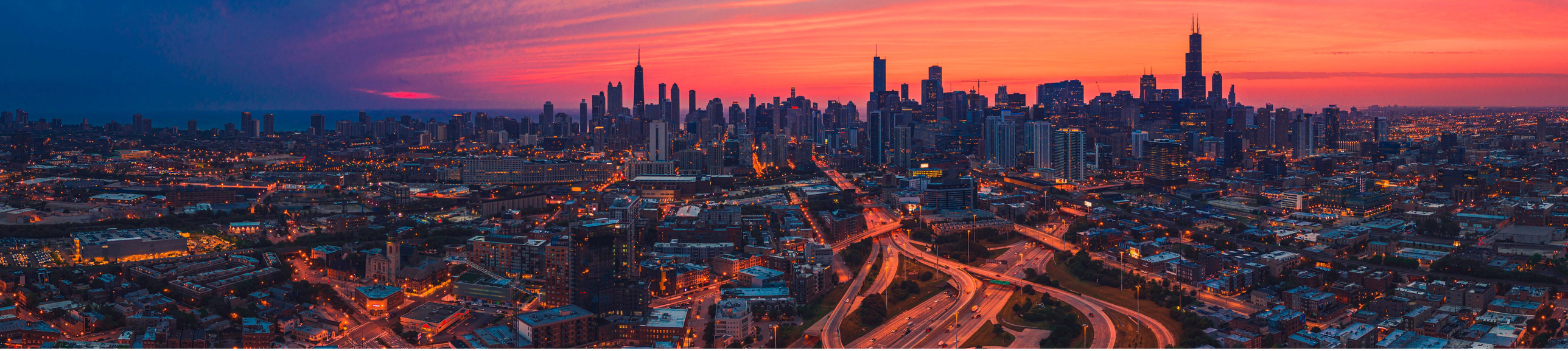
To ensure public safety, operational decision-makers need a solid safety operations plan and a system to provide situational awareness. Geographic information system (GIS) technology gives the web of local, regional, and federal managers who collaborate for event safety the means to plan together and communicate and coordinate actions in real time.

This geographic approach combines data collection, analysis, real-time mapping, and sharing to achieve operational intelligence. Around the world, complex organizations are applying GIS technology, apps, drones, artificial intelligence (AI), machine learning, and sensors from the Internet of Things (IoT) to populate a real-time view of assets and people on a shared high-tech map.

For instance, the decision for Chicago to host the first-ever NASCAR Cup Series street race along the shores of Lake Michigan and in downtown was actually preceded by employing a virtual course designed by iRacing. The near figure-eight, 2.14-mile, 12-turn layout includes the iconic landmarks of Grant Park and Buckingham Fountain.

The detailed digital twin that created the virtual course can easily be brought into GIS to add event-level details, such as spectator placement, concessions, and the security and services needed for operations.

With GIS technology, organizations gain an edge on complicated challenges because they can see trouble coming and manage decisively around it. For events, the same tools help deliver support more efficiently, with the added benefit of map-based situational awareness and transparency for all stakeholders. ▶



Here's the Why

In preparation, public safety leaders face distinctive logistic challenges that require intense behind-the-scenes planning of every imaginable facet—crowd control, traffic congestion, sanitary facilities, first aid, and more. The sheer size of events today mandates a large physical space to accommodate crowds of thousands. Risk factors and contingency plans range from the dramatic (terrorist threats) to the mundane (weather conditions).

These events, while an essential facet of the city's vibrant and diverse character, require much more than a standard level of permitting and planning. Public safety leaders plan and deploy staff for crowd safety; transportation officials plan bus and subway rerouting and anticipate road congestion; and the fire department and the department of health monitor permits for street vendors and prepare for the injuries and accidents that can come with any large gathering.

Although the basic structure underlying plans for each annual event already exists, each reuse presents its own challenges, many of which can't be discovered until the event is already underway. In this way, location-based technology has proved essential, providing real-time situational awareness for managing critical incidents and empowering involved staff and agencies to act in close coordination.

The work of managing special events starts with understanding and mapping the area of operation to define and protect vulnerable spaces. A modern geographic information system is the backbone for event operational intelligence because it supports collecting, integrating, and visualizing foundational data about the event's location. Event information can be mapped and monitored along with live data such as weather and traffic conditions, field reports, and health and safety incidents.

A geographic approach helps a city and event organizers see through this complexity to understand the ripple effects.

With a system that connects all stakeholders, officials on the ground can rely on shared maps and rapid communication to collaborate and make quick changes as events unfold.

Planners and public safety agencies can use GIS-enabled event management as a toolset to protect personnel, participants, and the public during a parade, festival, or protest. The tools can help develop health and safety plans, create event site maps, manage event assignments and incidents, monitor operations in real time, and create after-action reports for future planning. ▶

Here's the How

For operations officials, GIS also meets their needs for real-time management–to monitor current conditions; make better decisions about the allocation of resources, assets, and people; and respond to dynamic demands as events unfold.

Increasing volumes of sensor inputs, and data collected via mobile devices and drones, inform public safety operations today. A geographic information system provides data fusion, a place to aggregate and query this information at pace with changing conditions. It also provides a repository of details from the past that are used to make predictions so that public safety and event planning staff can be more proactive.

A geographic approach empowered by modern GIS technology uses big data to understand movement and trends in the city, ranging from traffic patterns to extreme weather events to the tracking of disease outbreaks and public health issues. GIS provides a visual means to understand the full context of the city as well as the way the context affects–and is affected by–the movement of people and assets. ArcGIS® is enterprise technology as well as a suite of solutions used to address specific workflows and see what's happening across space and time. In many major cities, managers across diverse agencies and departments use GIS to make crucial resource management decisions. ▶

Using GIS technology can accomplish these interwoven objectives, with a portfolio of tightly integrated tools that can achieve several goals simultaneously:

- **Collect, Analyze, and Share Data–**Use purpose-built, location-based apps to collect data and optimize the efficiency of field activities. Then use GIS in the office to store, map, and analyze data points to see challenges in their totality. The data, map products, and analytical results can all be shared within the organization, across departments, and with partners, and pushed to and from the field.

- **Spatially Enable Operations–**GIS is rooted in operations, offering many inputs for real-time knowledge of what's going on. Operational awareness delivered by GIS lets managers see what is happening, track mobile employees, reduce mileage and fuel costs, save time and wear and tear on vehicles, and push routes and directions directly to the field to simplify communications and speed services, with tight integration between drones, apps, dashboards, and stories.

- **Achieve Real-Time Intelligence–**Cities are increasingly constructing digital twins, which combine a 3D model with IoT sensor data to see activity and the workings of the urban environment in real time. Situational awareness is key to understand a complex event. GIS ingests massive volumes of real-time data feeds and performs fast queries and analyses to help decision-makers understand movement and change. This real-time awareness allows users to see such things as bottlenecks in traffic as it changes, where to respond, and where there are service gaps.

- **Integrate Important Business Systems–**GIS provides a common meeting ground for other enterprise systems through a powerful factor—location. Through this primary attribute, contained in an estimated 80 percent of all records, relationships and patterns are established, and data from multiple systems can be seen, queried, and acted on. Esri has strong partnerships with providers of foundational enterprise technologies such as Microsoft, SAP, and Salesforce, adding the power of location intelligence.

- **See the Situation with Great Clarity–**Because GIS contains tools to understand people, places, objects, and processes, it provides unique context. This transparency helps create significantly higher levels of operational intelligence for the community. It's about being empowered through our devices, giving everyone faster and better answers, and getting to clarity and consensus quickly.

- **Bring Stakeholders Together for Shared Solutions–**By continuously collecting and storing data and providing the means to visualize it on maps, GIS allows decision-makers to note historical patterns and devise intervening solutions. Using machine learning and other AI tools, planners can forecast outcomes. Managers also use GIS to organize people to collect and analyze data around initiatives. GIS workflows underpin good decision-making by helping users analyze the data at hand, target the workforce to take action, and then monitor progress.

GIS manages this level of complexity while bringing visibility to problems and awareness of progress toward the operational and resiliency goals that define an innovative, action-oriented city for the 21st century. ■

PARADES:
ENSURING A SAFE, WELL-RUN PROCESSION

Celebrations, parades, protests, and other large-scale public events are living, breathing entities that often reflect the personality, vibrancy, and values of a city. Location intelligence from GIS helps public safety personnel ensure safety for event participants as well as residents who are just going about their daily routines, while enabling a safe space to let voices and cultural expressions be heard and celebrated.

Maps have long provided the means to design event spaces and plan the placement of personnel and event amenities. Today, drone technology and imagery have greatly improved the fidelity of reality capture, and 3D scenes create a digital twin of a physical space or parade route. With a representation drawn to scale of an event space or route, safety and security personnel quickly orient themselves when time is of the essence.

The ability to track moving assets in real time, including each float and emergency personnel crew, gives a diverse group of stakeholders a live view as an event unfolds. In operation centers, this information can be viewed on a dashboard that is fed by the movement and activity of field personnel who can see a similar view in apps on their mobile devices.

The amount and accuracy of information to orient decision-makers are of immense importance when the stakes are high, more so if an event is being televised. Being able to track resources lets overseers perceive where incidents may be developing, where gaps exist in response, and where units might need to move as a situation unfolds. ■

CASE STUDY

PASADENA FIRE DEPARTMENT

Real-Time Dashboard Keeps the Rose Parade on Track

Situation: More than 76 million people worldwide watched the annual Rose Parade—broadcast live from Pasadena, California—on New Year's Day 2019. Crowds along the city's Colorado Boulevard numbered around 700,000 people—all lining curbs, anticipating the elaborately decorated flower-covered floats.

Challenge: As hundreds of parade walkers, marching bands, and equestrians stood ready to start down the five-and-a-half-mile parade route, most didn't know that the parade could be called off due to weather. Wind was threatening the safety of the Rose Parade, and authorities were on high alert. Ten minutes before the start of that year's parade, the Pasadena Fire Department kept close watch on a live dashboard view of weather and CCTV camera feeds. ▶

Pasadena Fire Department (continued)

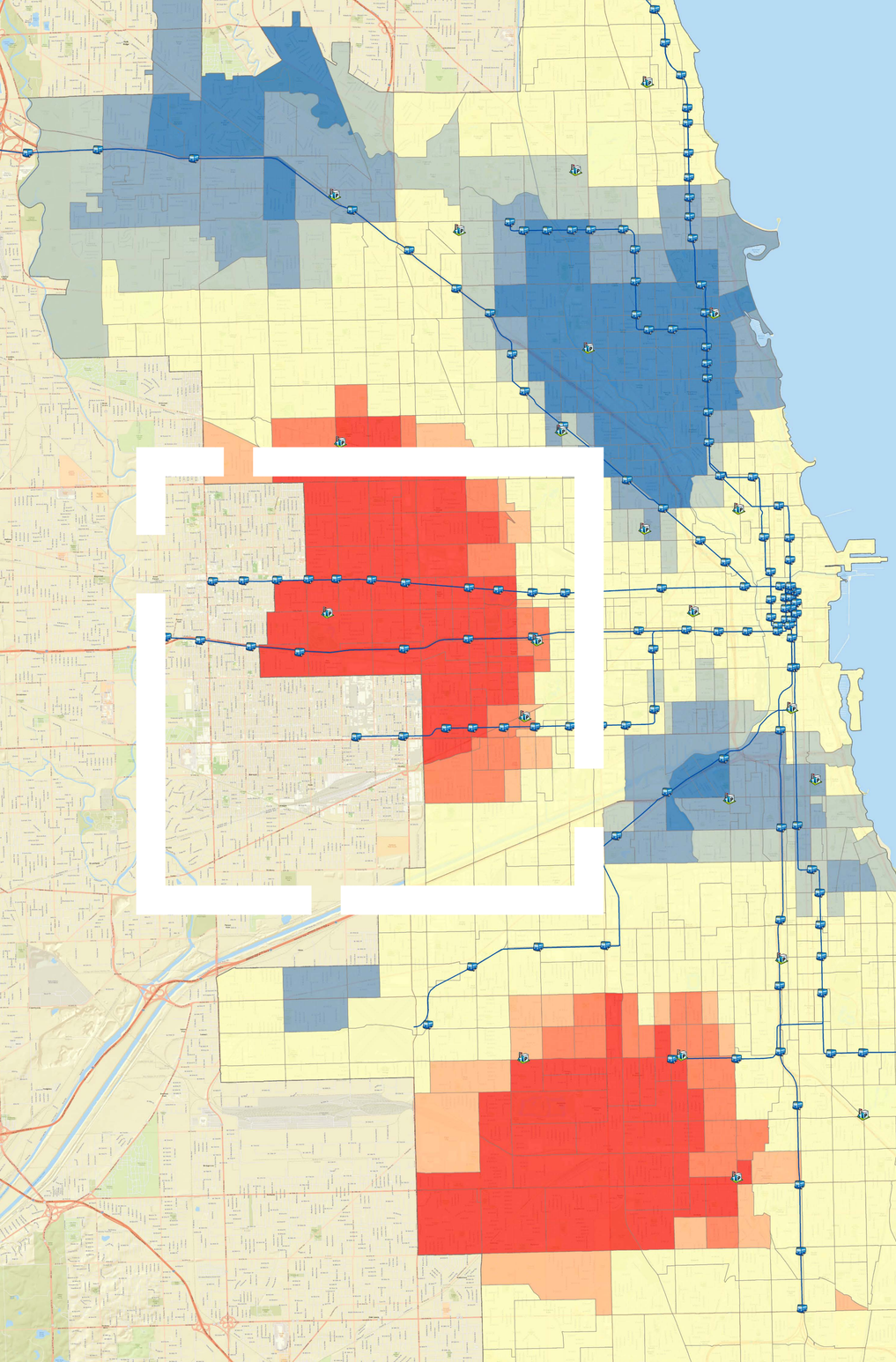
Solution: On-site representatives from the National Oceanic and Atmospheric Administration (NOAA) helped with weather forecasting. This expertise, along with real-time awareness of personnel and assets from the live dashboard, empowered authorities to decide that the parade could go on.

Months prior to the parade, Pasadena Fire Department officials looked at plans for the floats, routes the floats would take, where crowds would be directed, how people would be seated, and more. Strongly focused on safety, fire department staff decided they needed to integrate real-time situational awareness at the event. More information would give them more options.

Using a real-time GIS, public safety officers can see data from sensors on parade floats, handheld devices given to personnel, and social media feeds. Real-time visualization of these feeds on a shared map means the progress of floats can be tracked along the route, potential dangers are easier to identify, and hazardous weather becomes visible with up-to-the-moment understanding.

Result: Now, decision-makers can easily access dashboards on phones or tablets and see current activity within the city. Having access to real-time information has helped support the right people at the right time. This real-time GIS builds on the city's use of GIS across multiple departments for day-to-day public works and public safety operations as well as long-term planning. The Pasadena Fire Department maintains the same speed of response across the city regardless of the activity at any of the large-scale events. ■

> "The ability to monitor the wind along with other data points was very helpful and made the difference in our decision-making."
>
> – Bertral Washington, Pasadena Fire Chief



NATIONAL CHAMPIONSHIP:

COORDINATING CROSS-JURISDICTION COLLABORATION

Using GIS, different organizations involved in an event add their data and insights to build a holistic picture of the critical elements and the challenges. The map shows the complete context of the event from different perspectives.

As the mission shifts from preparation to reaction during the live event, maps relay real-time readings. The map quickly becomes the universal language for a coordinated response. Shared maps keep everyone focused on the immediate tasks at hand and show how many people working together coordinate their actions to achieve remarkable outcomes.

Responders around the world have shown us how maps enhance understanding and speed collaborative action, both vital powers when addressing today's urgent challenges.

Shared maps have a way of simplifying complex matters, and they provide a way to coordinate decisions while ensuring that diverse perspectives are considered. The shared map isn't your map or my map, it's our map. It provides a common ground for a group of stakeholders to work from and a way to prioritize key decisions and actions.

Many GIS mapping innovations initiated at a special event have the tendency to become standard practice for a city when coordinating any major function.

For example, a city constantly issues permits for local fairs, races, and other special events. Now, each event is mapped in GIS with the event type, date, time of day, number of attendees, and other details. This information can quickly be shared across departments, such as with public works where right-of-way permits trigger shutting down a road lane, roadway, or sidewalk. ■

CASE STUDY

CITY OF ATLANTA | Bringing Together a Team to Secure the Super Bowl

Situation: With an anticipated full stadium of more than 70,000 Super Bowl fans and a global television audience of more than 100 million people, Atlanta city officials knew they had to be prepared to make events safe and successful.

Serious operational preparations started six months ahead of time. The game, scheduled for February 3, 2019, at Mercedes-Benz Stadium, was just one of many Super Bowl events the city needed to be ready for, with pregame festivities, entertainment, and concerts drawing large crowds over a 10-day span.

Challenge: Early on, Atlanta's director of emergency preparedness realized there was a need to bring data together to make preparations for the complex event. He knew that the city needed to prepare to deal with traffic plans, permitting of events, and all of the myriad other details of event management. ▶

City of Atlanta (continued)

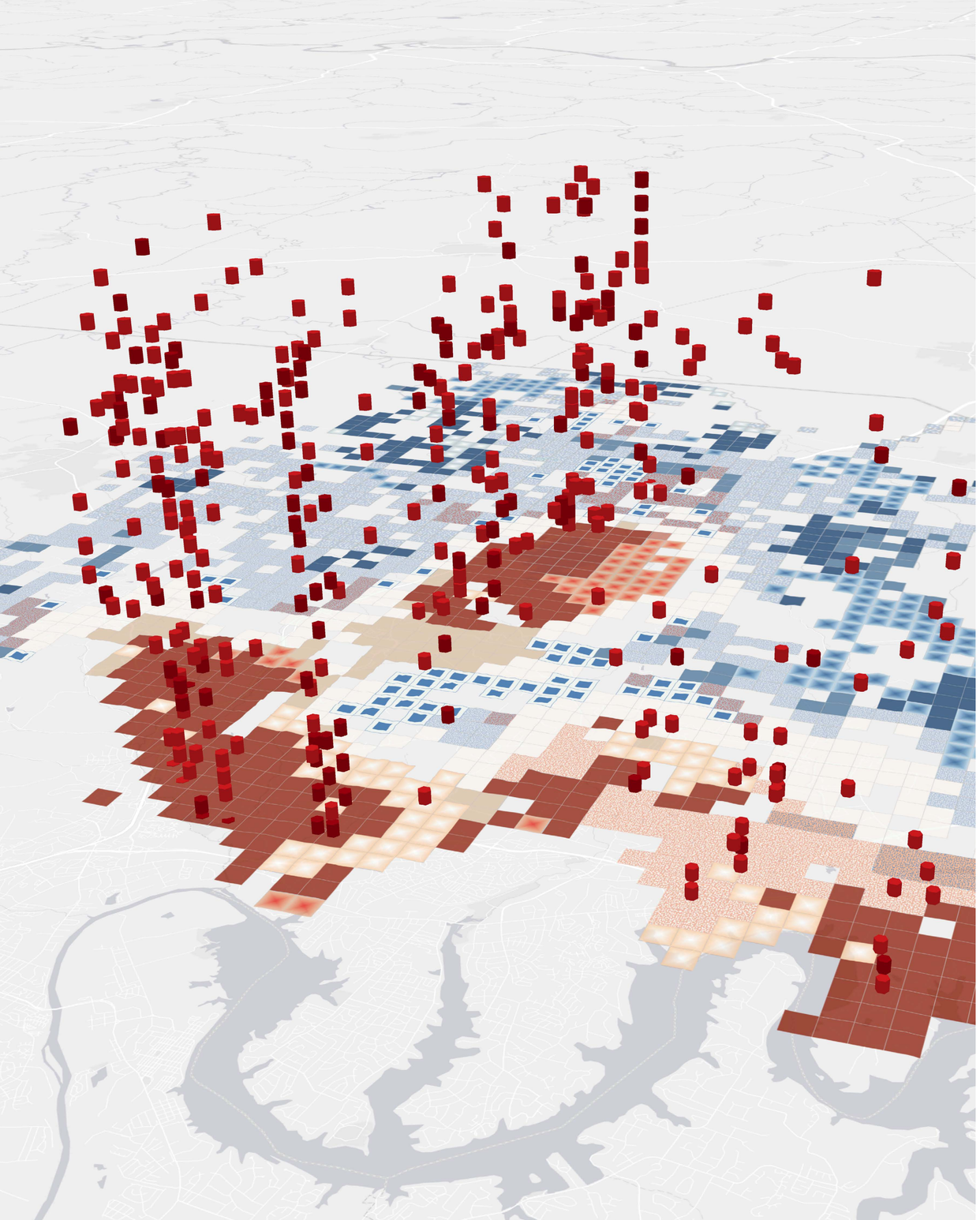
Solution: A broad range of organizations that work with GIS on a daily basis came together to help the city. They collaborated and shared data using ArcGIS Online—a software as a service offering from Esri. Participants included staff from multiple departments of the City of Atlanta, Fulton County, Cobb County, the Georgia Emergency Management Agency (GEMA), the Georgia Bureau of Investigation, the Federal Bureau of Investigation, the Federal Emergency Management Agency, and the Department of Homeland Security. The collaborators totaled 77 members, who shared 189 data layers of content.

The central repository for data meant that each participant didn't need to worry about finding or creating the data needed on game day. Instead, the participants had the layout of the new Mercedes-Benz Stadium at their fingertips, including floor plans, exits, and evacuation routes.

Result: Atlanta's GIS team staffed the Joint Operations Center around the clock for a 10-day period. The most intense days were the Thursday, Friday, and Saturday prior to the big game, and then Super Bowl Sunday. Fulton County staffed the Emergency Operations Center, which is where all the emergency medical service personnel were being routed from. The rest of the broader GIS team had a variety of assignments and kept busy answering any location-related questions.

Dashboards displayed the locations of strike teams for various operations centers. During the course of the event, there were 5.5 million requests for the live data layer alone. That equates to roughly 381 requests per second over the course of the four-hour event, proving that "Who is where?" is a foundational question for event management. ■

> "The event spurred us to get folks together to agree and adopt innovation. It would have taken another year or two to adopt a shared understanding if we didn't have the Super Bowl."
>
> – Jeffrey Johnson, GIS Manager at the City of Atlanta



ROAD RACE:

TRACKING RUNNERS FOR A TIGHT RACE

At an emergency operation center, officials are thinking about a quick response as much as they're thinking about the recovery and aftermath of each incident.

If an incident involves the need for evacuation, in GIS a data layer can quickly be accessed to show the location and capacity of each evacuation route. If an incident requires a strong local response, a data layer of staging areas could be added and shared with nearby personnel, who would then concentrate the needed equipment closer to the incident.

Having a record of what happened where and when proves useful after the event to examine any incidents and plan for future improvement. It's also a crucial piece if an incident reaches the level where briefings to executive leadership and elected officials become necessary. Emergency operations centers are used to compile details for after-action reports. GIS records information in a way that can be scrolled and clicked to uncover details and to help people understand the response as an incident evolved. ■

CASE STUDY

CITY OF CHICAGO

Real-Time Awareness of Runners for the Chicago Marathon

Situation: Runners love the Chicago Marathon for its mix of raucous urban canyons filled with cheering fans and its quiet and colorful leafy side streets. Chicagoans are always into an event, with a lot of fun-loving people turning out to encourage the runners and keep them smiling through the pain. The course also runs flat and fast, which brings many new runners who are reaching for their personal record. It's one of six World Marathon Majors competitions, and world records have been broken there four times.

For the 40th Chicago Marathon, the race was capped at 45,000 runners, and according to the race website, 44,508 finished the race, with 1.7 million spectators. The elite runners added to the spectacle, with $500,000 in prize money on the line.

Challenge: The 2017 event took place just seven days after a mass shooting in Las Vegas. In addition, the bombing at the 2013 Boston Marathon is always in the back of every marathoner's mind. As the first World Marathon Majors race since 2013, Chicago had already substantially augmented its security plan and continued to make adjustments to it from year to year. Given this backdrop, community safety and security concerns for the 40th marathon were heightened. ▶

City of Chicago (continued)

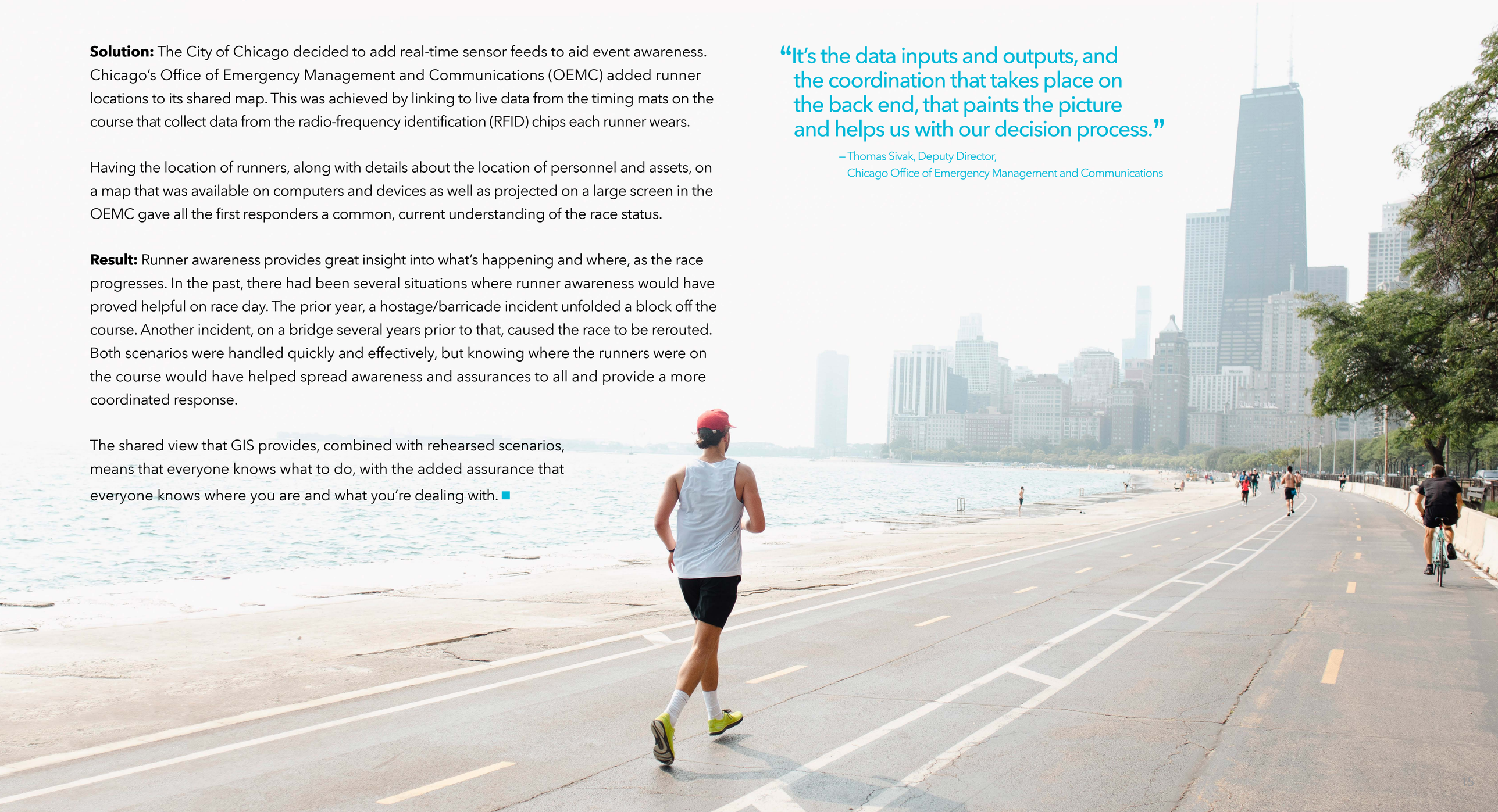
Solution: The City of Chicago decided to add real-time sensor feeds to aid event awareness. Chicago's Office of Emergency Management and Communications (OEMC) added runner locations to its shared map. This was achieved by linking to live data from the timing mats on the course that collect data from the radio-frequency identification (RFID) chips each runner wears.

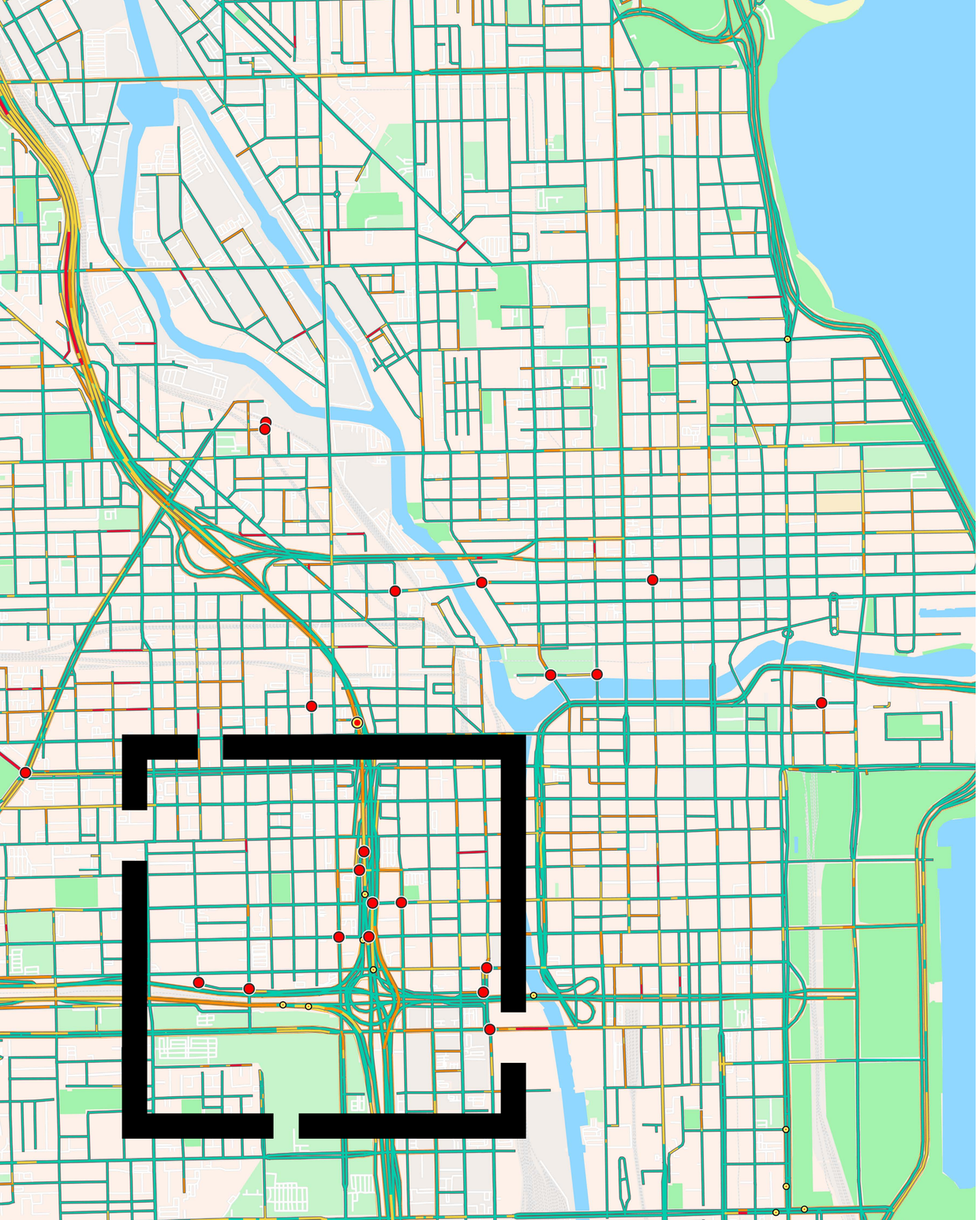
Having the location of runners, along with details about the location of personnel and assets, on a map that was available on computers and devices as well as projected on a large screen in the OEMC gave all the first responders a common, current understanding of the race status.

Result: Runner awareness provides great insight into what's happening and where, as the race progresses. In the past, there had been several situations where runner awareness would have proved helpful on race day. The prior year, a hostage/barricade incident unfolded a block off the course. Another incident, on a bridge several years prior to that, caused the race to be rerouted. Both scenarios were handled quickly and effectively, but knowing where the runners were on the course would have helped spread awareness and assurances to all and provide a more coordinated response.

The shared view that GIS provides, combined with rehearsed scenarios, means that everyone knows what to do, with the added assurance that everyone knows where you are and what you're dealing with. ■

> "It's the data inputs and outputs, and the coordination that takes place on the back end, that paints the picture and helps us with our decision process."
>
> – Thomas Sivak, Deputy Director,
> Chicago Office of Emergency Management and Communications





CELEBRATION:

APPLYING REAL-TIME TRAFFIC MANAGEMENT

The crowds leaving or entering a special event can quickly overwhelm roadways and cause bottlenecks that create havoc in everyday operations of the city, its employers, and emergency responders. Cutting-edge systems built on location technology, traffic camera networks, and AI are making a difference.

The goal is to move people on foot in and out of a venue in the safest, most expeditious manner. That can happen routinely if there is good collaboration between police department personnel and department of transportation officials to create a shared situational awareness and control center approach that leverages advanced technologies, including AI and GIS.

A control center that features shared views of live camera feeds monitoring the pathways and surroundings can be replicated anywhere, even on mobile devices. Those feeds can also track activity at critical intersections, including traffic-prone spots where pedestrians and cars come together. With so much to monitor and limited resources to manage it all, quick insight and fast action are critical to keeping fans, residents, and mobile workers safe and happy.

One of the biggest concerns of any special event is traffic. Critical to the success of any event is the ability to ensure that people get to and from the venue safely and quickly. This is where the control center and the AI-GIS collaboration come into play. The system incorporates live feeds and a shared dashboard, providing the same information every time to keep responders informed and ahead of any potential crowd or traffic issue. ■

CASE STUDY

Cobb County

Putting the Wraps on a Stellar Season

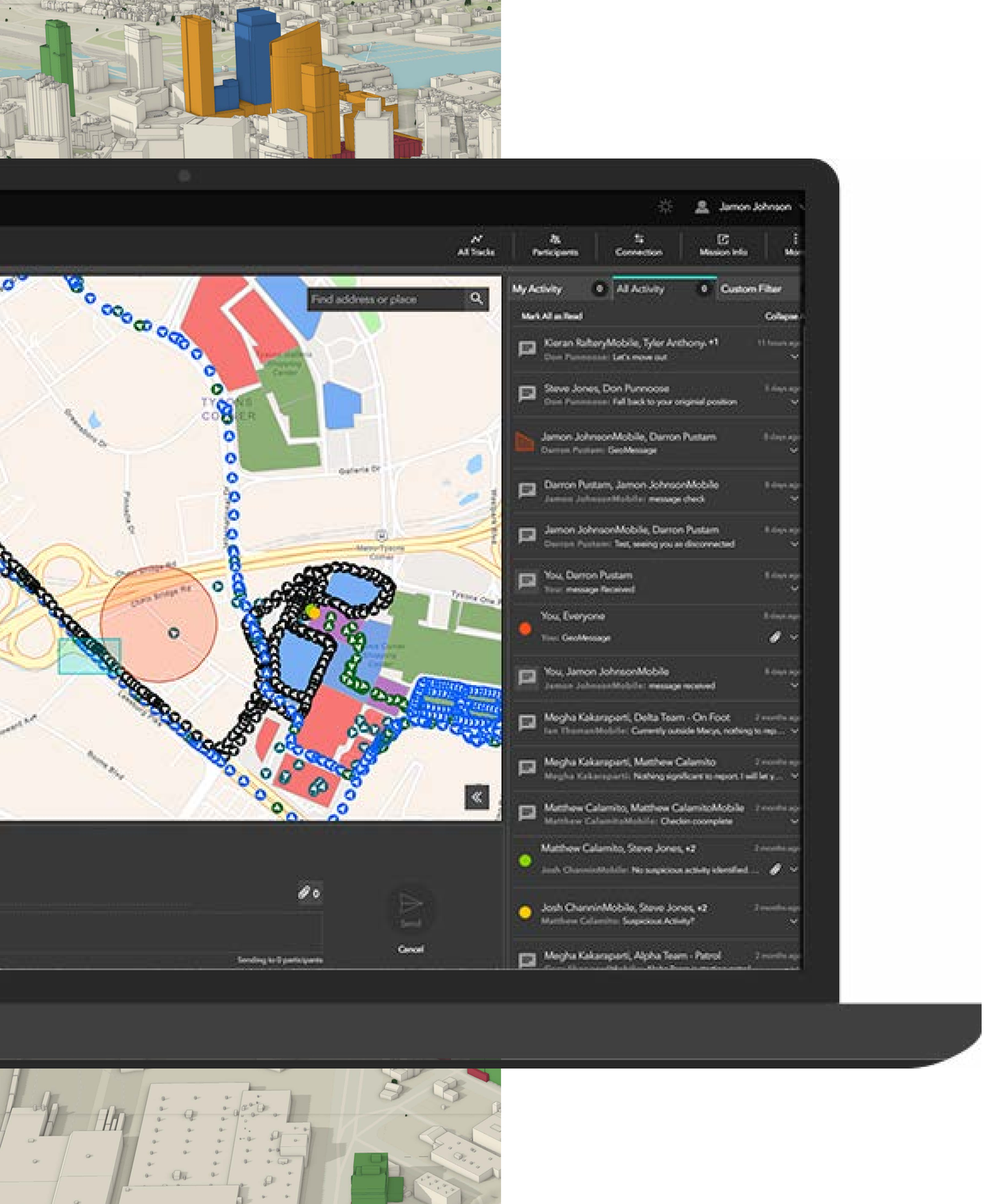
Situation: In 2021, the Atlanta Braves defeated the Houston Astros in the World Series, clinching the title on the road in game six. Back in Georgia, officials in Cobb County knew that if the Braves won, the county would need to organize a huge public victory party and parade to help fans celebrate safely.

Challenge: As soon as game six concluded, Cobb County had no time to waste. Officials had less than 36 hours to plan a party with an estimated 350,000 guests, none of whom could be turned away. The celebration would include a parade through downtown Atlanta, culminating at the Braves' home field, Truist Park. Almost three decades had passed since the Braves' previous World Series victory, and that was at a different ballpark. That meant Cobb County had no prior plans from which to draw to deal with safety, crowd control, and general logistics.

Solution: During regular season baseball games at Truist Park, Cobb County police had worked with GIS experts to use mapping for crowd control, security, and traffic management. These activities provided a blueprint of sorts for the World Series victory parade. In the hours leading up to the parade, the GIS team worked with the Braves organization, along with state and county officials, to delineate and approve the route. The map—and real-time awareness of progress and officer positioning—helped Cobb County design a route that put the public near players while keeping everyone safe. ▶

Cobb County (continued)

Result: The real test of the system was how it behaved during the parade. GIS maps displayed the location of every officer along the route, giving commanders the power to identify not only where officers currently were but also where they were needed and could be sent to respond to an emergency. As the parade proceeded, the maps also allowed workers to hasten each road's return to normal by removing the barricades as soon as the parade passed them. Using ArcGIS® Mission, commanders could track the location of officers, redeploying them as needed. This was especially helpful with undercover officers, who could blend in with the crowds and access all the details they needed on their phones without giving themselves away by talking on a radio. ■



Products from Esri

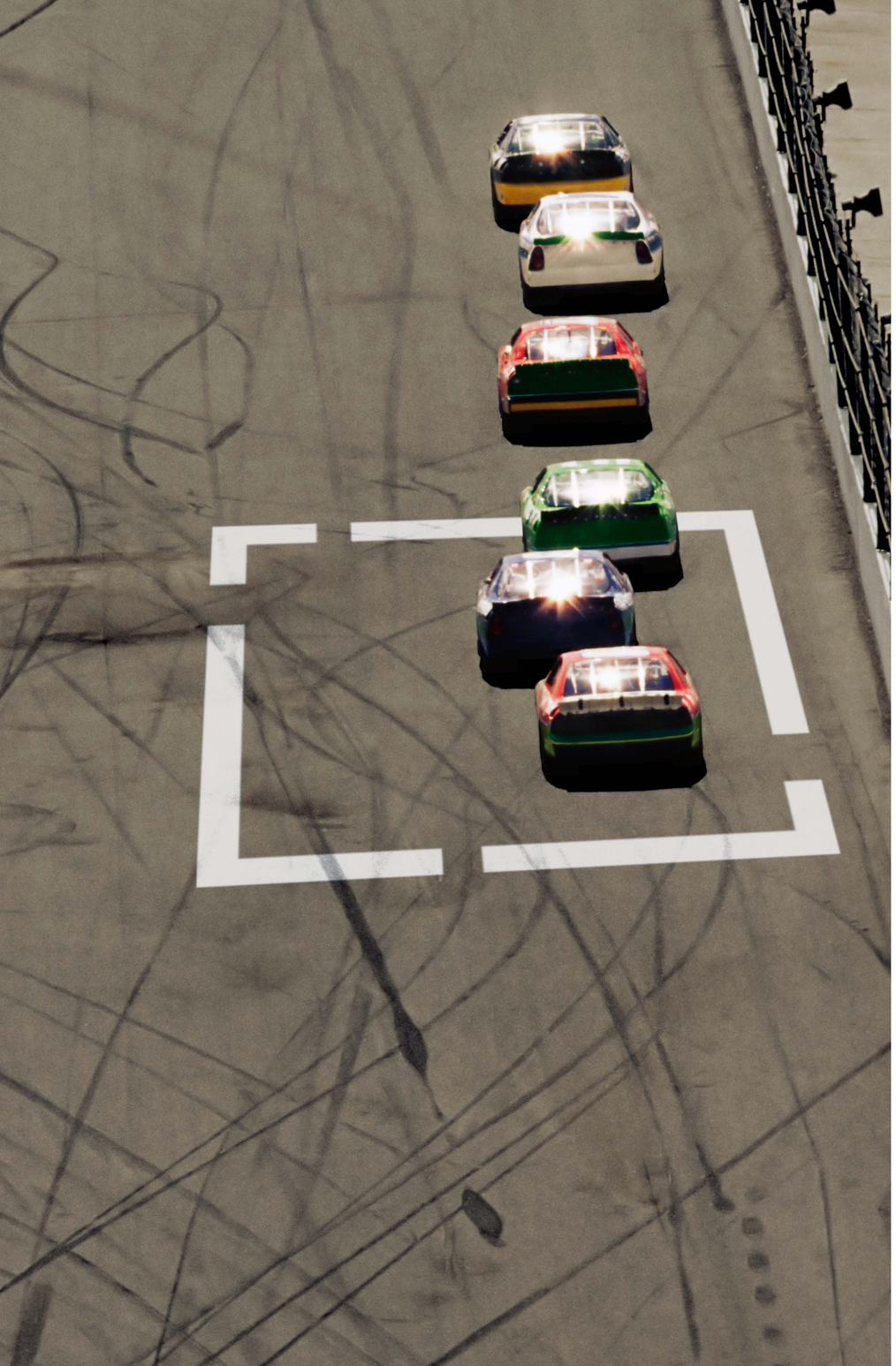
Three ArcGIS products add important real-time perspectives that enhance an organization's situational awareness:

ArcGIS VelocitySM is a cloud-native software as a service for ArcGIS Online that allows organizations to ingest data from IoT platforms, message brokers, and third-party APIs. It helps users process, visualize, and analyze real-time data feeds; store them as big data; and perform fast queries and analysis. This capability adds an awareness that brings clarity to essential operational decisions, allows for remote monitoring of important assets, and provides key inputs to achieve predictive maintenance and process optimization.

ArcGIS Field Maps integrates the ability to capture data with easily configured forms; combine position and locations on a map to find assets and route to the work site; capture the tracks of field staff, monitor where they are, and analyze where they have been; and improve transparency between the field and office by seeing tasks alongside the location of the workforce.

ArcGIS HubSM community engagement software as a service provides an easy way to organize people, data, and tools to tackle challenges. Cities, states, and even the White House have applied this framework of tools to take on operational challenges. The suite of products provides a means to share open data, create unlimited outreach efforts, and organize action around initiatives.

Each of these products speeds an organization's ability to gather data at high volumes to provide context. ■



CONCLUSION

Geospatial technology continues to evolve, with streaming real-time location data providing a current view of reality that greatly accelerates understanding, as well as the ability to look at historical patterns and detect trends. GIS enables a common view and a way to share data and input from anyone. A growing suite of spatial analytics tools allows organizations and agencies to dive deeply into every incident to answer the *where*, the *why*, and the *now-what* questions quickly.

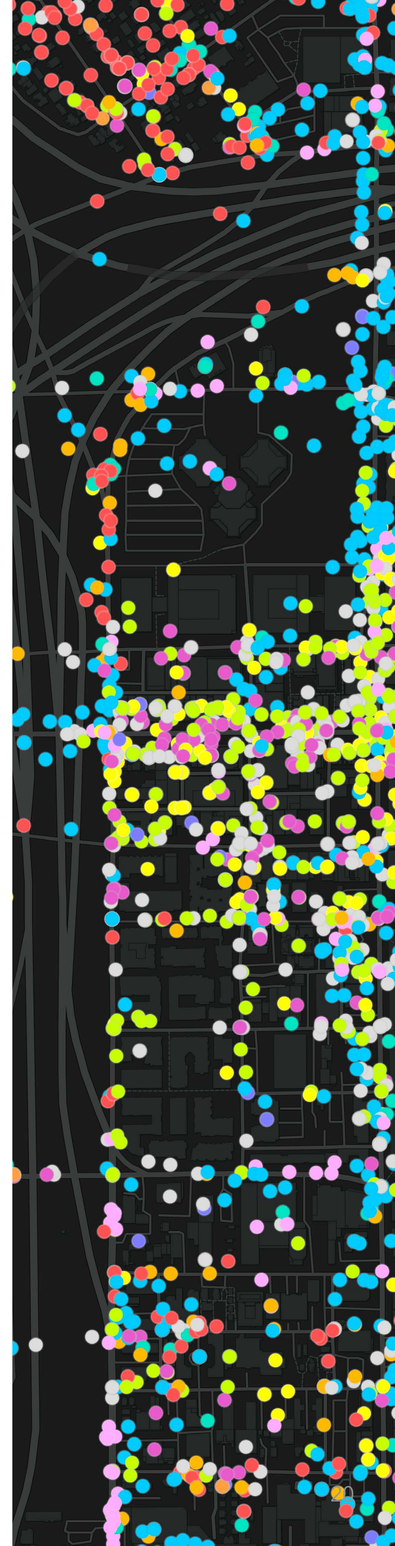
By applying a geographic approach in operations, the data gets better; the root causes and places to invest in become readily apparent; and the analysis, communication, and collaboration necessary for success grow clearer.

A new fusion of technologies—cloud computing, mobile applications, Internet of Things sensors, and artificial intelligence—can fine-tune understanding and foster swift and meaningful action across any city.

As Chicago prepares for the first-ever urban NASCAR race, event preparations are top of mind. After testing multiple designs for raceability in the virtual world, iRacing made a recommendation for the final NASCAR layout based on tried and tested scenarios. In a similar fashion, a digital twin of the city and an event space provides the means to test scenarios and sharpen results.

Factors that surround this and other citywide events require interdisciplinary experts to work together to expedite solutions, but they can't do that easily with the systems that are in place. Speeding collective action—across all levels of government and with the public—requires new levels of data sharing. Collaboration on solutions requires technology that fosters data transparency and tools for collective analysis, planning, and actions.

In many cities, a geographic approach and the technology that empowers it are helping leaders tackle and understand emerging challenges that come with complex events. ■



Learn More

Esri, the global market leader in geographic information system (GIS) software, location intelligence, and mapping, helps customers unlock the full potential of data to improve operational and business results. Founded in 1969 in Redlands, California, USA, Esri software is deployed in more than 350,000 organizations globally and in over 200,000 institutions in the Americas, Asia and the Pacific, Europe, Africa, and the Middle East, including Fortune 500 companies, government agencies, nonprofits, and universities. Esri has regional offices, international distributors, and partners providing local support in over 100 countries on six continents. With its pioneering commitment to geospatial information technology, Esri engineers the most innovative solutions for digital transformation, the Internet of Things (IoT), and advanced analytics.

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