Written testimony of Shimon Elkabetz
U.S. House of Representatives Science, Space & Technology
Subcommittee on Environment
Hearing "Silent Killer: The Rising Problem of Extreme Heat in the U.S."
Wednesday, July 21, 2021

Good morning.

Chairwoman Sherrill, Ranking Member Bice, and Members of the Committee, thank you for inviting me to testify before you today. It is an honor to be here among Congressional leadership that has identified extreme heat in the U.S. as the critical issue it is.

My name is Shimon Elkabetz. I was born and raised in Israel and served in the Israeli Air Force for over 11 years flying Apache helicopters. I have seen first hand how weather forecasts without context can negatively impact operations in an elite military unit, and in fact I faced multiple near-death experiences related to the weather. We founded Tomorrow.io as a Boston-based weather intelligence and climate security company to bridge that gap between forecast and decision making, working with customers including federal agencies, utilities, airlines, on-demand services and professional sports teams.

Extreme heat, made worse by climate change, is a real challenge that is impacting more people, in more parts of the world, more frequently than ever before. Several key reports including the National Academies weather attribution report affirm that one of the clearest signals in contemporary weather is in extreme heat events. Furthermore, studies such as the National Climate Assessment continue to confirm that extreme heat will disproportionately impact the elderly, certain racial groups, children, and the poor. Businesses are feeling the impacts too. Extreme heat and humidity could decrease labor productivity by 10-27% by 2050 in certain regions of the globe. Rail operators have to divert trains to avoid buckled tracks. Electric utilities have to meet increased demand to keep the lights and air conditioning on. Farmers have to take actions to minimize crop damage and protect outdoor workers. Sports teams have to adjust practice plans to protect athletes. Airlines, shipping, rail operators, and numerous other industries are significantly impacted by the heat.

Improved weather forecasts and new tools to support decision-making are critical to minimizing the impacts of such events on people, infrastructure and the economy.

At Tomorrow.io, we see three key components to improving forecasts and response to extreme heat as well as wildfires, drought, hurricanes, winter storms and many other hazards:

First, I encourage the committee's continued support of critical weather forecasting infrastructure--the observations, models, and computing that underpin all weather forecasts. Today's global weather forecasting infrastructure, which has been developed over many decades through a successful collaboration of the public, private and academic sectors, is one of the great technology success stories of our time. The bi-partisan support of this committee in many ways is directly responsible for that success. Yet, there is much work that remains to be done, given that extreme weather still costs countries, businesses, and individuals trillions of dollars annually, and these costs are only rising.

Second, I encourage the committee to continue to support programs like NOAA's Commercial Weather Data Pilot, which has been successful thanks to the leadership of Ranking Member Lucas and the Members of this Committee, but also to broaden the scope to take advantage of expanding commercial capabilities. In our case, Tomorrow.io will be launching a first-of-its kind global constellation of small satellites equipped with precipitation radar. NOAA has indicated that one of its greatest challenges is the need to improve precipitation forecasts across timescales from weather to climate. Research has shown the type of data Tomorrow.io's constellation will collect should significantly improve operational weather forecasts, especially for hurricanes and particularly forecasts of hurricane intensity.

Programs like the NOAA Commercial Weather Data Pilot, the Air Force Weather Service's Commercial Weather Data Pilot, and NASA's Commercial Smallsat Data Acquisition Program are distinct and each successfully demonstrates how the government can save taxpayer dollars by taking advantage of private-sector innovation. Companies like Tomorrow.io are able to raise capital and provide value to the commercial market faster than government appropriations cycles. Furthermore, while there may have been concerns about the stability of commercial providers in the early days of these pilot programs, companies like Tomorrow.io are not dependent on government contracts, having firmly established their own commercial markets and thus inspiring confidence in the long-term reliability of their data.

To truly leverage the speed and agility of the private sector, the government should seek to further augment its owned and operated systems by more formally incorporating commercial data into programs of record, much as other mission-critical capabilities (such as satellite imagery and space launch) were once the exclusive domain of government but have now benefited from greater participation of the private sector. Rather than competing from behind, the government should conduct broad searches through those pilot programs for innovative solutions. Ultimately, there should be business incentives for companies to sell their data and services to augment existing and future government capabilities.

Third, I encourage the committee to continue to explore new ways that the government can tap into private-sector innovation. This includes more open-ended solicitations that aren't as focused on specific data or sensors, but rather allow industry to innovate the path to solving grand forecast challenges. This also includes enabling government agencies to use private-sector technologies to increase their resilience to extreme weather and climate.

To that end, Tomorrow.io has developed a unique software platform that takes weather data and provides actionable decisions to our customers. (See Appendix for screenshots of Tomorrow.io's Weather Intelligence Platform.) Figure 1 in the appendix provides insight into the numerous industries that are currently benefiting from Tomorrow.io's platform.

The following are a few examples of how the Tomorrow.io Weather Intelligence Platform can be used to monitor and mitigate the impact of extreme heat on business operations:

Utilities: Heatwaves can have a huge impact on energy production, strain electric grids, cause power prices to spike, and threaten outdoor maintenance workers. Extreme heat can decrease equipment efficiency, reduce power output, increase operational costs, and lower the capacity of underground conductors. Tomorrow.io's Weather Intelligence Platform can monitor when and where heat will exceed specific thresholds across an electric grid and provide alerts to implement operations protocols to keep employees safe and outages to a minimum.

Shipping: The trucking industry moved more than 11 billion tons of freight in 2019 and generated $792 billion in revenue according to the American Trucking Associations, which means that even a 24-hour delay can have serious consequences, especially for critical supplies such as medicine and food. Extreme heat can compromise the performance of tires and lead to engine failure at fast speeds. Perishable cargo is vulnerable to heat, requiring refrigerated trucks or rerouting to avoid the heat. Not to mention the potentially harmful impacts of heat to the driver. Tomorrow.io's Weather Intelligence Platform can monitor when and where heat will exceed specific levels that will damage the trucks, their cargo or drivers, and generate alerts to implement heat protocols such as reduced speeds or alternate routes.

Figure 2 in the appendix is a snapshot of what a trucking company might see while using the Tomorrow.io platform when delivering goods between New Jersey and Oklahoma. The Poly-line feature allows the company to see what conditions the truck, driver and cargo will experience during the transit. A company can select a basic dashboard as shown in Figure 1 or develop their own based on their specific weather criteria and unique risk factors. In this case the platform outputs an instruction to increase container refrigeration due to external heat conditions. This can lead to less strain on the driver, cost-effective route planning, and longer-lasting goods.

Rail: Rail is a key component of intermodal transportation, and any delay can cause goods to miss their connecting train or ship, ultimately delaying delivery times and reducing customer satisfaction. When temperatures rise, railway tracks expand, warp and buckle. Extreme heat also puts stress on ballasts, rail anchors and ties. Tomorrow.io's Weather Intelligence Platform can monitor when and where heat will reach thresholds for warping equipment, and generate alerts that tell operators when they may need to slow trains to put less stress on tracks and avoid derailment.

Defense: Furthermore, heat illnesses can degrade U.S. military effectiveness by causing considerable morbidity, particularly during training of recruits and of soldiers and Marines in combat arms specialties. According to a report by the Department of Defense's Armed Forces Health Surveillance Branch published in April 2019, annual rates of incident heat stroke diagnoses increased steadily between 2014 and 2018. During the same period, the annual incidence rate of heat exhaustion diagnoses peaked in 2018 when there were 578 incident diagnoses of heat stroke and 2,214 incident diagnoses of heat exhaustion among active component service members. During 2014–2018, a total of 325 heat illnesses were documented among service members in Iraq and Afghanistan and 28 were diagnosed as heat stroke. Tomorrow.io's Weather Intelligence Platform can monitor for forecast temperatures and humidity

exceeding extreme thresholds at locations across the world and generate alerts to alter or delay training to reduce risk of heat stroke among our warfighters.

Finally, Figure 3 in the appendix is a city wide view of Dallas, TX. In this example, the Tomorrow.io Weather Intelligence Platform recommends the city of Dallas can take precautionary measures, specific to each city district, to ensure worker safety during an extreme temperature event. This can be used by local government managers to protect city employees required to work outside, by a construction foreman to better plan for the installation of materials vulnerable to heat, and by a sports league or team to alter practice plans and reduce heat stress on athletes.

This is only a small example of Tomorrow.io's current capabilities, which scale to numerous weather phenomena and industries, and will become even more powerful as our satellite constellation comes online.

In conclusion, I want to thank the committee for your commitment to addressing such an important issue. Thank you again.

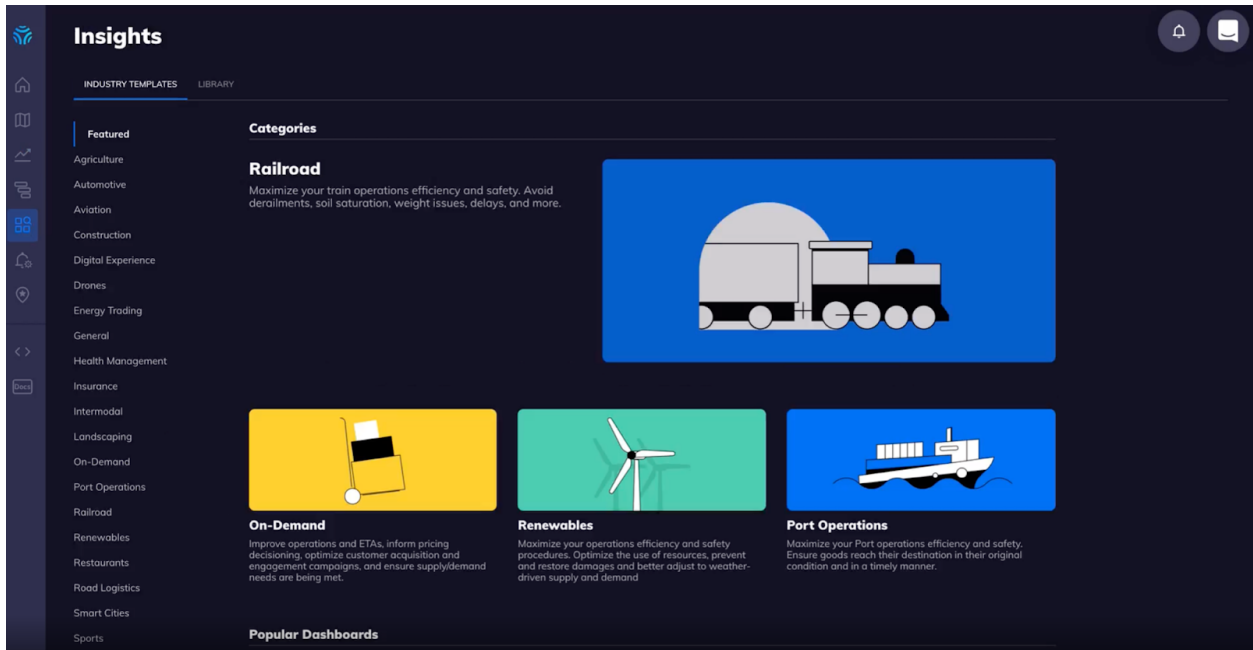**Appendix: Screenshots of Tomorrow.io Weather Intelligence Platform**

Figure 1. Tomorrow.io helps customers across numerous industries translate their use cases into actionable business insights and best-practices.
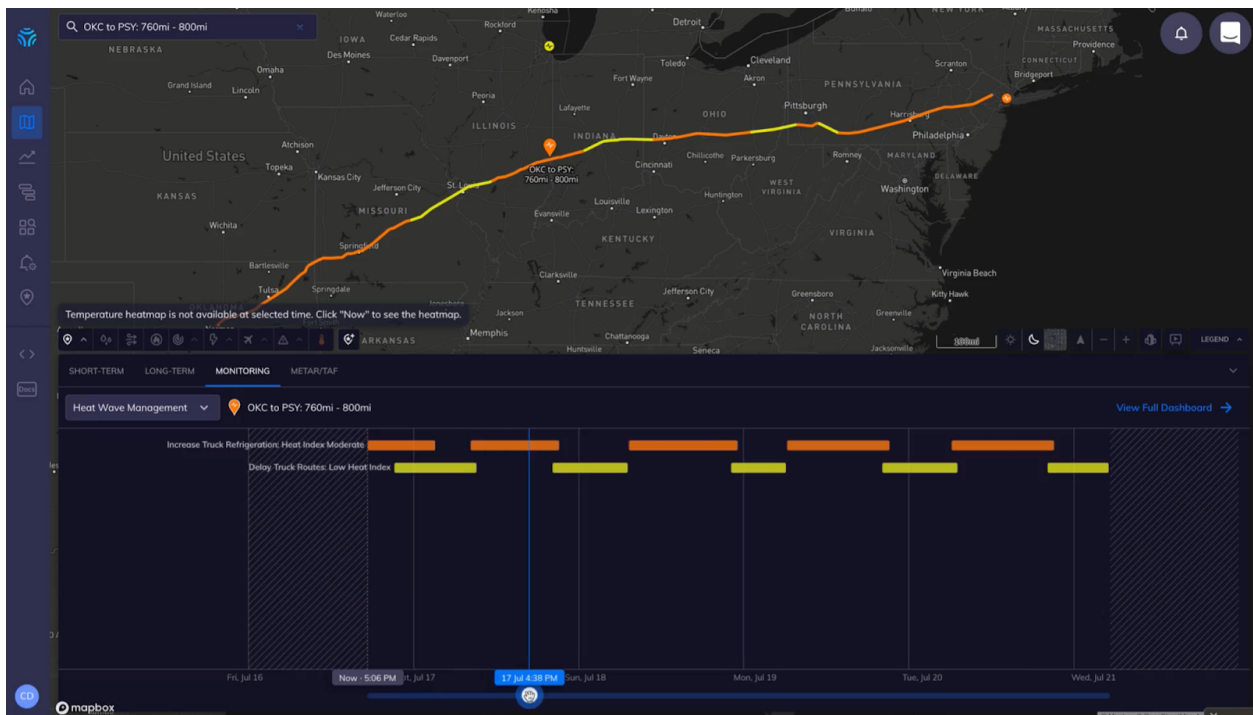

Figure 2. In this case, Tomorrow.io's Weather Intelligence Platform recommends a trucking company delay, or avoid outright, portions of this route to prevent food from spoiling due to excessive heat.
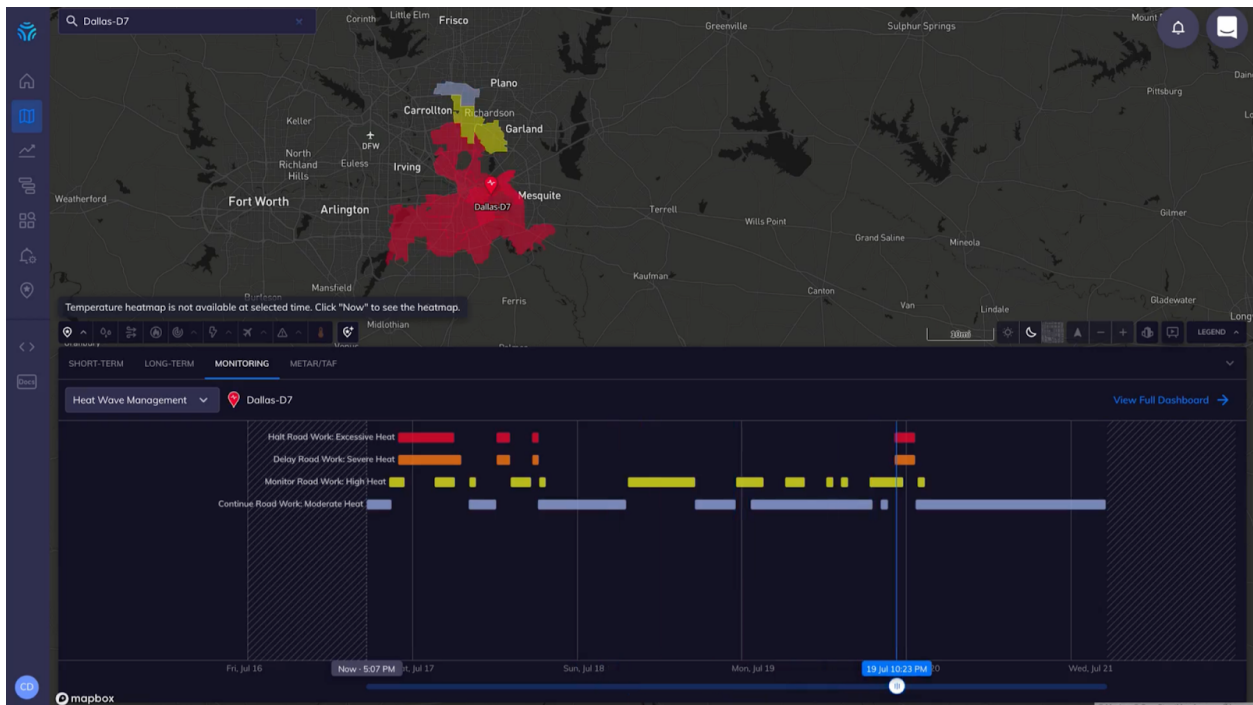
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