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The Third FEMA/NASA Near-Earth Object Impact Tabletop Exercise

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ABSTRACT

In 2016, we conducted a tabletop exercise for the Federal Emergency Management Agency (FEMA) and NASA, the third in a series of exercises bringing NEO and impact specialists together with emergency managers to discuss effective responses to a simulated disaster involving the impact of an asteroid in the continental United States. We devised a realistic scenario, with discovery of a hypothetical asteroid on Oct. 1, 2016 and a potential impact on Sep. 20, 2020, less than four years later. Information on the likelihood of impact, size of the notional object, range of possible physical consequences, and worst-case casualty estimates and infrastructure damage was presented in a series of three mock “injects”. The first inject outlined initial details of the scenario just 25 days after discovery of the asteorid, when the probability of impact was about 2 percent, and the size of the simulated object was known only roughly. The risk corridor of the potential impact (the locus of possible impact locations in 2020) extended across North America, from Los Angeles to New York. Further observations were needed, not only to narrow down the possibility and location of impact, but also to assess the object’s size to constrain what the possible impact effects could be. With a relatively short orbital period of 295 days, the asteroid would spend much of its time inside the Earth’s orbit, making it generally difficult to observe. The worst-case at this stage of the scenario was a 450-megaton explosion over a large US city, but the likelihood of such an event was very small.

The second inject advanced the scenario timeline by 13 months. The threatening asteroid had been observed extensively over that time, and orbit experts had concluded that an impact in 2020 was certain. The likely area of impact had been narrowed down to an 800-km-long region centered at Los Angeles; the estimated size of the object was still uncertain, ranging from100 to 250 meters. Ground-based observations were suspended because the asteroid had moved too far from the Earth; it would not be observable again for two years. A space mission to characterize the asteroid was under development, with launch planned for March 2019, but time was too short to mount a deflection mission. Since the impact footprint straddled a coastline, a dangerous tsunami or air blast affecting large populated areas were both possibilities.

The third inject advanced the scenario another two years: impact was now only six months away. The characterization mission had successfully encountered the asteroid a month earlier and obtained not only a good estimate of its size (about 120 meters), but also a much better fix on its trajectory. Six months earlier, the asteroid had emerged from behind the Sun, allowing ground-based observations to resume. The impact point could now be predicted accurately, and the footprint had been narrowed down to the northern Los Angeles area. The worst-case estimate for the airburst energy had decreased to 55 megatons, still large enough to completely destroy everything within a 15-km radius of Pasadena. Light damage (broken windows, etc.) could occur as far away as 30 km. We will report on the details of the exercise, as well as highlights of the group discussions and subsequent feedback.