SGx Talk, “Mālama Lani: Protecting the Space Environment”

[Slide 1] I come from a small island in the middle of the Pacific called Maui. Because of the vast distances from our islands to other land masses, there is a special connection between Hawaiians and the land. So much so, that you often hear “Mālama ʼāina,” which means to nurture or care for the land.

[Slide 2] And while our islands are far from other land, we are actually much closer to space. Native Hawaiians spent a lot of time going up Haleakalā on Maui and Mauna Kea on Big Island to study the heavens. [Slide 3] I can’t help but think they would want to “Mālama Lani,” or care for the heavens, too.

So, do we have a problem protecting the space environment? [Slide 4] We must…after all, we’ve seen it in movies…like “Gravity” and “Wall-E,” right? [Slide 5]

While these portrayals don’t reflect reality, it should make you wonder what’s going on up there and how serious the problem might be. This vision from “Wall-E” shows hundreds of intact satellites docilely floating in space.

[Slide 6] The reality is that there are tens of thousands of objects now in Earth orbit—active and dead satellites and their debris. They range from the size of a softball—the smallest things the US government can currently track—up to the size of a school bus. And that number continues to grow.

[Blank Slide 7] And it’s all moving fast—really fast. While the movie “Gravity” appears to show things moving pretty quickly, the reality is that they are moving so fast that you couldn’t possibly see them—any more than you could see a bullet fired past you.

Muzzle velocity for a high-performance rifle is about 1 km/s—or about three times the speed of sound. But objects in low-Earth orbit, or LEO, are traveling 7.5 km/s—or about Mach 22! And the damage this debris can cause goes up as the velocity squared.

Let’s put that in perspective. If I had a good arm—and don’t worry because I don’t—and I threw a bullet at you, I might be able to reach 45 m/s or 100 mph. That might sting and even leave a mark, but you’re going to be okay…except you’ll probably be pretty annoyed at me. But if any of us were hit by the same bullet from a high-powered rifle, we all know it’s going to leave more than a mark, because it’s traveling 22 times as fast and has almost 500 times as much energy. Increase that by another factor of 50 for objects in LEO and you start to realize the threat whizzing by our satellites. And our global economy and security depends upon these satellites.

[Slide 8] Oh, and did I mention that the US government can only track things down to the size of a softball? [Slide 9] At over 23,000 objects, that still seems like a lot of stuff, but NASA estimates over half a million objects the size of a marble or larger. All these

hyper-bullets in space have the potential to cause even more debris or take out key systems in critical satellites—creating the next large piece of debris.

So, what can you do about all of this? Or should I say, what can WE do about this, since we will all need to work together to have an impact?

First, nobody wants space debris, so this should be easy, right? Well, some countries insist on intentionally doing things to further jeopardize the space environment in the name of national security—as evidenced by the Chinese ASAT test [Auto Slides 10-26] that alone generated more than three thousand pieces of debris. We need to insist that intentionally causing debris in orbit be made a violation of international law.

Next, we have to stop leaving our unneeded stuff in orbit. [Slide 27] Cosmos 2251, launched in June 1993, died two years later—and then floated around for another 14 years before smacking into Iridium 33 and generating another two thousand pieces of debris. Current international agreements are to remove things from orbit before 25 years—does that make sense? If your car broke down on the highway, do you think you should have 25 years to have it removed? We need to be much more proactive and some companies, like OneWeb, are already leading the way.

[Slide 28] How about moving critical stuff out of the way? Easier said than done, but we're trying to do that every day. Of course to do that, you first need to know where everything is. Unfortunately, everybody wants to use their own coordinate systems—and many don't want to share their best data. Imagine how well that would work finding a place to eat tonight using your smartphone.

[Slide 29] In fact, it reminds me of when I used to cycle in Colorado. One day I ran across a dead skunk along one of my regular cycling routes. At 7,000 feet elevation, let's say it can be a challenge to hold your breath for long, so I contacted animal control. I could provide them GPS coordinates, but they wanted a mile marker. They eventually found the skunk and removed it—probably by just rolling down their window and smelling for it—but you can't smell in space! Operators and governments need to be transparent and share the best data available to help avoid the next collision.

[Slide 30] How about we send up the trash collectors? [Slide 31] Again, easier said than done, and there are many challenges here. But we need to find a way to do this—and to pay for it—since the problem won't go away by itself. Some stuff will decay from below 600 km altitude, but the rest is up there essentially forever if we don't do something.

[Blank Slide 32] And when things go wrong, operators need to share their lessons learned with the rest of the community. We need to work together to understand the true magnitude of this problem and the potential impacts. If we don't, we may end up applying solutions to the wrong problem. In fact, we should have independent accident investigation boards, just like we do for other modes of transportation.

And finally, we all need to be informed! Tell your friends! Advocate for Mālama Lani whenever you have the opportunity. [Slide 33] Mahalo!