A Brighter future always comes from the sky -Bento Gifts-

Ayano Komaki

One of the major problems we are facing is a rapidly aging society. Especially in Japan, the average life span is over 80 years, which is longer than any other country. On the other hand, the birth rate has been decreasing these years. The more elderly people do not have choice other than living alone. Most of them live in the countryside and have trouble going and getting their daily necessities. My grandmother is one of them. She already gave up driving a car for fear of causing any accident, so she has to walk all the way to the supermarket. Some solutions are suggested to tackle this problem. Some merchants drive to visit each house, but they cannot reach all those people. Some companies try to deliver items by drones, but that challenge is not practically used because of the low safety and poor cost performance. Since a drone is capable of carrying just one package, it is not actually an efficient way if the safety problem is improved. I think we can apply the technologies in Hayabusa to the delivery service. The basic idea is dropping and landing things very safely.

Hayabusa is a spacecraft designed to collect a sample of an asteroid and bring it back to the earth. The first one was launched in 2003 and it succeeded to grab a sample of ITOKAWA, which has a few hundred meters in radius and millions km away from the earth. The second one was launched in 2014 and again succeeded to collect a sample of RYUGU, whose size is 900m in radius. In the first program the exploration using a rover was intended to collect some sands from the surface. Sadly, the challenge failed. In the second chance it was programmed to take a sample inside the asteroid by digging the surface by throwing a copper lump and then to leave for another asteroid while sending the sample back to the earth. The obtained sample perfectly was landed

on the desert in Australia on 26 December last year, and many scientists are analyzing it in detail now. The speed and the timing of the lump was calculated. An exploration robot was also dropped down to RYUGU, which is the very first time for humanity. The detailed exploration with a rover was in fact planned in the first mission. However, the robot did not work. They managed to solve the problem in just a few years. We can see a great advance in science here. Using this safely landing technique, we can drop the necessities in security. A copper lump is 2 kg. This is roughly 4 times heavier than the average lunch box. Hayabusa also carries many other things like high-resolution cameras, lasers, communication devices and pebble collectors. A usual camera is necessary but high-quality camera is not necessary for the delivery. I will show some examples for more detailed application example. These cameras are a few kg. The system to collect pebbles inside an asteroid is called Small Carry-on Impactor, in short SCI. It is 18kg. The delivery robot can carry dozens of lunch boxes instead of these. I think we can apply the technics of drop to land safely on the ground should be used to deliver necessities to elderly people.

There are two merits. First, the flying object in my idea can bring many packages at the same time and does not need to land and kick off the ground each time. This new device would save a great amount of energy. Secondly, this system does not help only the elderly but also people isolated by disasters like earthquakes, typhoons or tornados. Since the industrial revolution in the 19^{th} century, people have been consuming too much energy that the environment cannot catch up. As a result, the abundance of CO_2 has been increasing and the temperature keeps rising. The climate in Japan changes badly because the higher sea temperature generates powerful typhoons near us. Every year heavy rain drains a road or a bridge which might be the only access

to the local houses. Many people lose their way to get to the necessities. In such a situation the delivery service would be really helpful. A camera attached to the delivery robot can also survey the situation around the disaster area. Getting to know the situation the disaster as soon as possible helps the rescue activities. The delivery robot helps people in need efficiently.

In this essay, I suggest my idea of applying the technics of Hayabusa to the delivering service. I hope that my idea would many people someday. I think a brighter future means that every one of us lives without any inconvenience. An application of scientific advances to the major social problems could save many people. I think this is the most direct way for science to contribute to making the better world. I hope that I could be a part of it.

<Reference>

S. Watanabe et al. 2019, "Hayabusa2 arrives at the carbonaceous asteroid 162173 Ryugu — a spinning-top-shaped rubble pile", Science, 19 March, 2019

和訳：「はやぶさ２」が到着した炭素質小惑星 162173 リュウグウ―コマ型ラブルパイル

論文：DOI: 10.1126/science.aav8032

K. Kitazato et al. 2019, "The surface composition of asteroid 162173 Ryugu from Hayabusa2 near-infrared spectroscopy", Science, 19 March, 2019

和訳：「はやぶさ２」の近赤外分光観測による小惑星リュウグウの表面組成

論文： DOI: 10.1126/science.aav7432

S. Sugita et al. 2019, "The geomorphology, color, and thermal properties of Ryugu:

Implications for parent-body processes", Science, 19 March, 2019

和訳：リュウグウの表面地形、多色画像、熱物性から探る母天体の進化

論文：DOI: 10.1126/science.aaw0422