## 2nd RFP : Common Technology / Solution Creating Research

November 2018 toOctober 2019

# Project title Development of multipoint high sensitive photon sensor for simultaneous ranging

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## **Project outline**

#### Objective

The technology for accurate recognition of the terrain surrounding any surface activity on the Moon and Mars is indispensable for automatic and autonomous controls, such as determining the self-location and travel paths with few obstacles. In addition, it is essential for ground-based self driven vehicles, such as automatic construction machines and drones, to have a grasp of the shape and position of the ground features (road, ground surface, obstacle). Therefore, our research aims to develop an exceptional three-dimensional imagesensor) that accurately recognizes the surrounding terrain and the shape of the human made objects. This sensor will have broad applications in several industries, including self driven vehicles, automatic construction machines, and drones.

The aim of this study is to develop the Flash LIDAR, which is an ultra-compact, lightweight, and ultrasensitive two-dimensional simultaneous distance measurement sensor. The distance measurement sensors are arranged in parallel as an array, and they can simultaneously measure the distance with a single-light pulse.

### Contents

The image sensor developed in this study can capture a three-dimensional distanceimage with a dedicated device in which pixels are integrated with an optical sensor and a circuit (ROIC: Read Out IC), that measures the time-of-flight (TOF) of light, are arranged in an array. A high-sensitivity avalanche photodiode (APD) that can detect individual photons, is arranged in an array in the optical sensor. Moreover, an ROIC made of integrated circuits is joined vertically below the APD. The number of pixels is 128 x 128, and the distance resolution in the line-of-sight direction is less than 10 cm.

Ranging systems using this sensor may be used in a wide range of applications from self driven vehicles on the ground to space probes. These systems have the following features:

- Ultra-high sensitivity that imposes very little burden on the required light quantity and optical system
- It can be applied to flying objects and traveling vehicles with a high degree of time synchronization.
- Simple structure, small size, and light weight

