

Potential for application of QZSS to agriculture - Trial for agri-business development -

February 2018

Space Communications Policy Division
Global Strategy Bureau

Ministry of Internal Affairs & Communications

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Joint Meeting Outcomes

- ✓ The two leaders also welcomed cooperation on Japan's Quasi Zenith Satellite System and the formulation of several concrete projects in the area of innovative technology.
- ✓ The two leaders confirmed bilateral cooperation and collaboration in agriculture and the development of northern Australia.



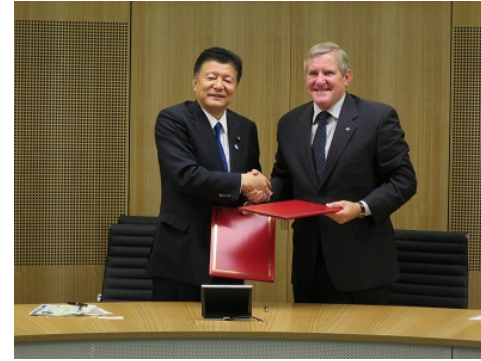
Visit of Former Minister of MIC to Australia

(April 29, 2014 @Sydney)

(1) Meeting with Minister for Industry

(Mr. Yoshitaka SHINDO – Mr. Ian MACFARLANE)

- ✓ Both ministers exchanged opinions on **utilizing Quasi-Zenith Satellite System(QZSS)** which also covers Australia and agreed to work out the details of the joint projects
- ✓ Both ministers **signed a joint statement** which includes that a workshop will be held in future in Australia.

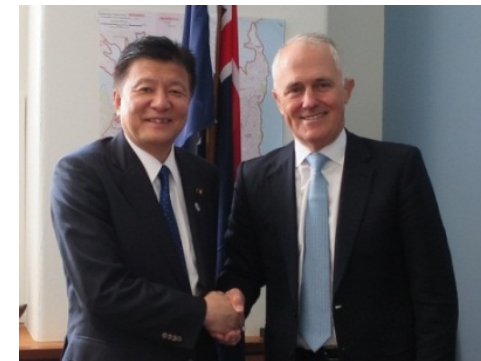


(Both ministers signed a joint statement)

(2) Meeting with Minister for Communications

(Mr. Yoshitaka SHINDO – Mr. Malcolm TURNBULL)

- ✓ Both ministers exchanged opinions on **how to strengthen bilateral cooperative relationships** by holding comprehensive policy dialogues between Japan and Australia **on the field of the ICT** in the future.



(Both ministers exchanged opinions)

Potential economic benefits by high precision positioning

(QZSS Workshop in Townsville (Queensland) in 2017)



- 17th February 2017, 10:00-15:30
- Hotel Grand Chancellor Townsville
- Around 60 participants from Government (Federal·QLD), Research Institute, Growers and Venders

Economic benefits of high resolution positioning in Australia:



Mr. Gary Johnston
(Geoscience Australia)



Mr. Gareth Jones
(DAF, QLD)



Dr. Phil Collier
(CRC-SI)



Construction

\$723m



Agriculture
cropping

\$466m



Road
Transport
(freight)

\$213m



Mining

\$1.1b

What do growers expect to the automation in agriculture ?

5

■ Enormous area of farms (in AUS)



■ Monitoring conditions of plants (by their own eyes)

- Checking Plants
 - Colors
 - Insects
 - Moisture
 - (- Soil)

etc.

* Need skills to analyze



■ Many necessary process for producing

- Time consuming for driving machines neatly.



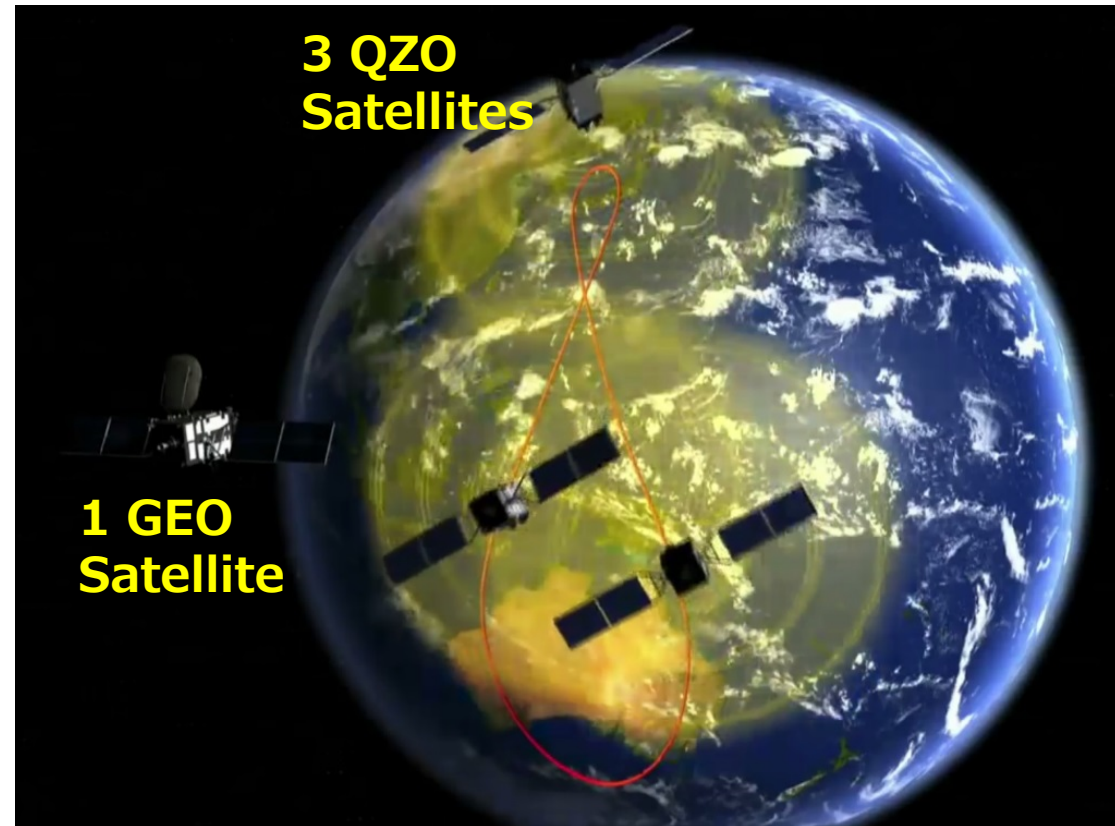
For improving productivity in farms, we need to

- Reduce
 - Labor costs (Monitoring, Driving, etc...)
 - Consumption of chemicals (Fertilizer, Insecticides, Herbicides ...)
- Make efficient schedule
 - Where, when and what to do in farms? (Taking action appropriately, timely at pinpoint position)

➔ By using drones (sensing from sky) & auto-controlled tractors can be realized above.
→ **Precise Poisoning** is crucial & indispensable.

■ **Functional Capability:**

- GNSS Complementary
- GNSS Augmentation
 - Sub-meter level accuracy
 - **Centi-meter level accuracy**
- Messaging Service



■ **Coverage:** Asia and Pacific region

■ **4 satellites constellation shall be established & the service will start in 2018.**

■ **7satellites constellation will be established in around FY 2023.**

Auto-mobility in agriculture using 3D high precision signal of QZSS

(The Concept of MIC's experiment in Australia)

- ✓ Automation with high accuracy 3D-positioning signal
- ✓ Observation data from Drones (UAVs)
- ✓ Much more productivity by integration with 3D digital maps



High Precision Signal From QZSS



Observing Crops by Drones(UAVs)



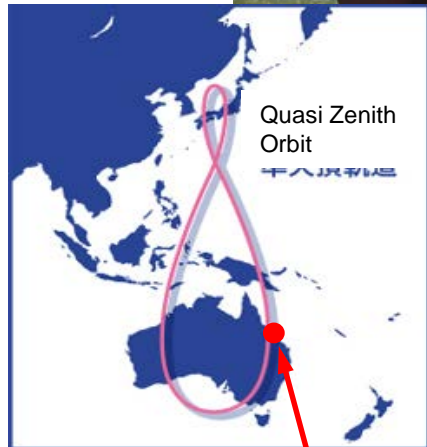
Tillage



Spray

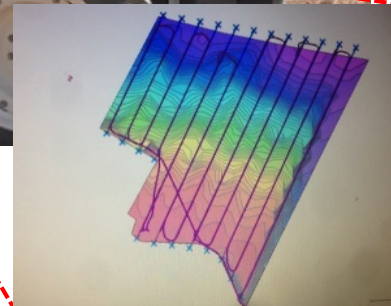
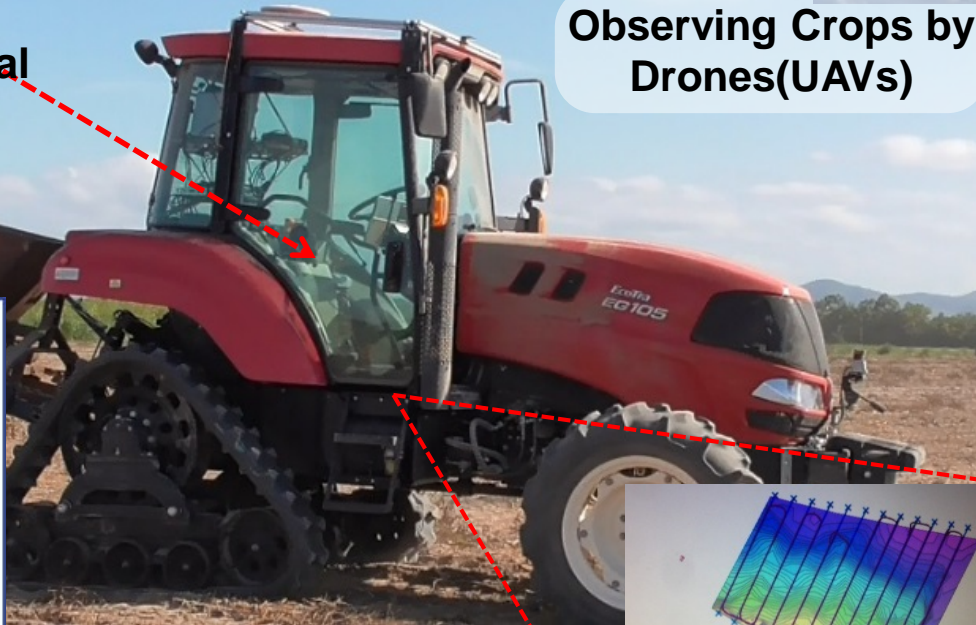


Fertilize



Quasi Zenith Orbit

Mackay in Queensland (Place of experiment in 2017)



3 dimensional electric map

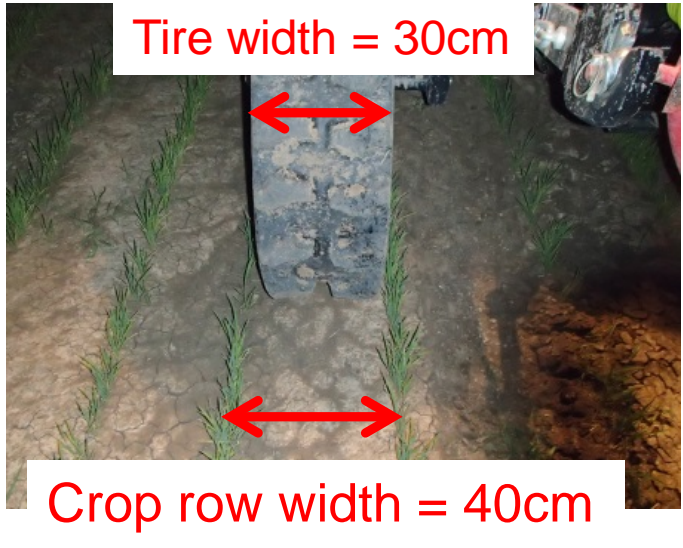
Automation depending on data of growth, altitude, weather...

27 November 2014

RRA Rice Field in Jerilderie



- ✓ Validated autonomous tractor controlled within 5cm accuracy
- ✓ Demonstrated unmanned weeding, fertilization, tillage, and spraying in night-time

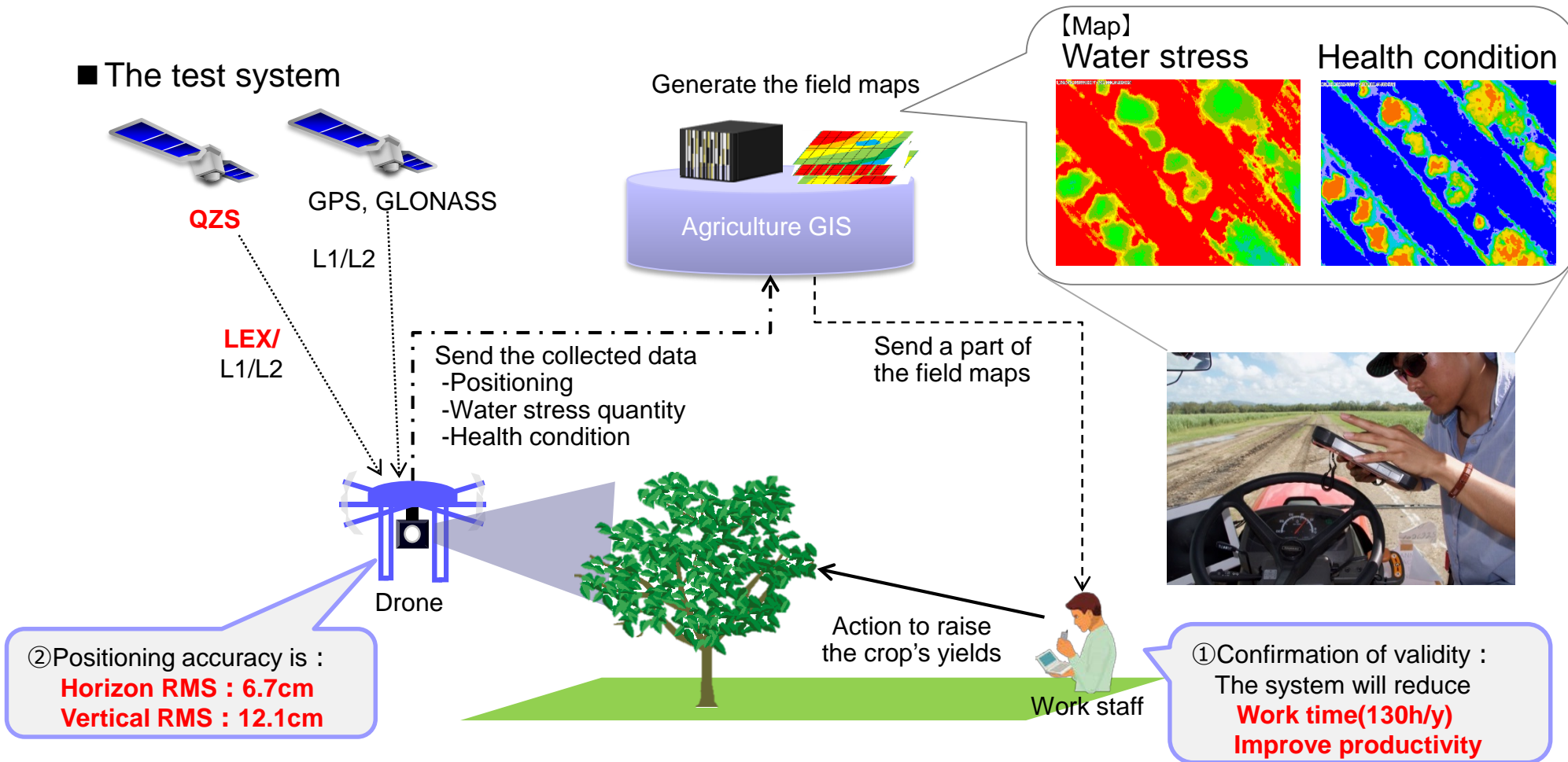


Tillage in night time
(January 2015)



Tracks of the autonomous tractor
--> Confirmed reliability of high precision positioning by QZSS

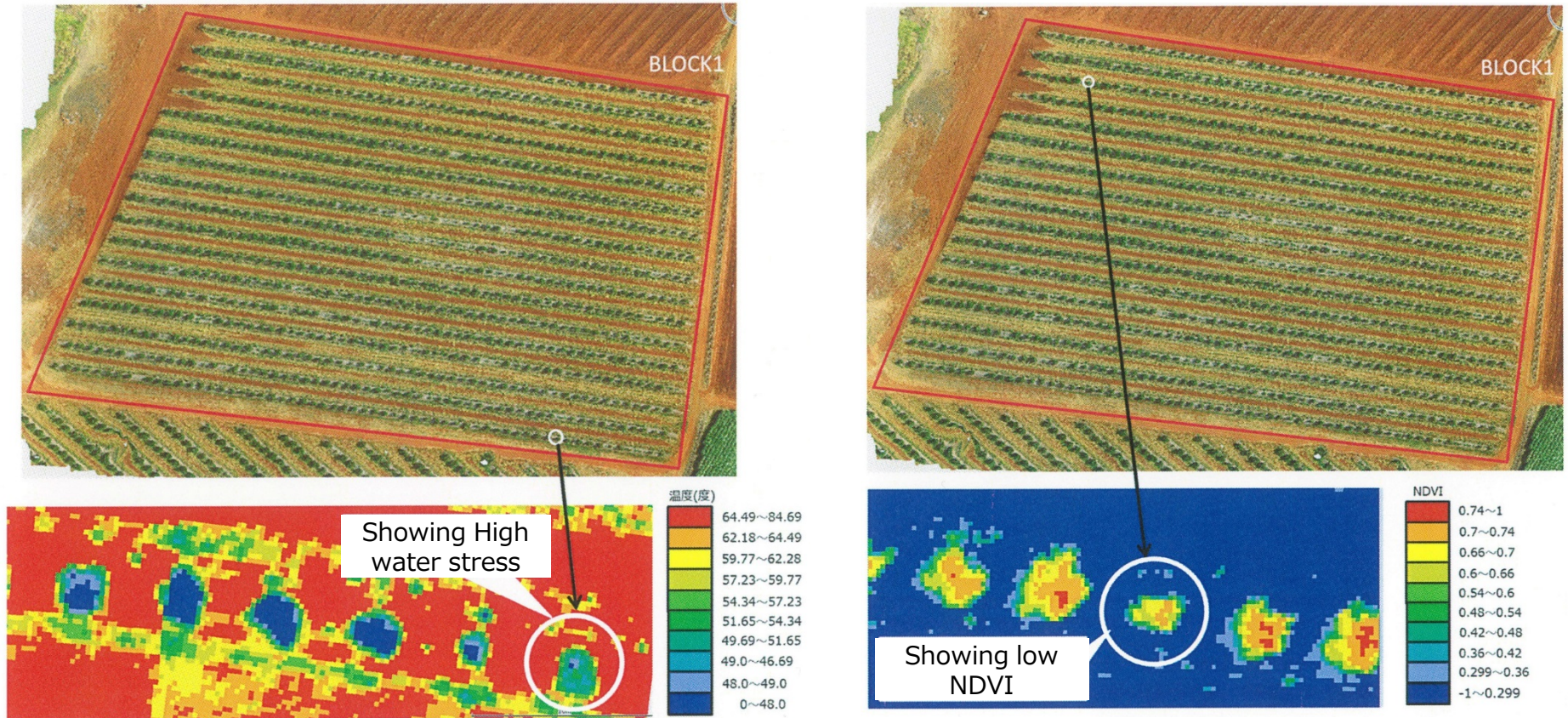
- ❑ Purpose : Confirm validity of map system by using **a drone with LEX signal**. Evaluate the positioning accuracy of the drone.
- ❑ Test site : Bundaberg, QLD, Australia (Avocado field)
- ❑ Test date : February, 2017



Result of Experiment (2017)

Flew drone over 19ha avocado farm, collected water stress and health condition data of leaves by using infrared camera and multi-spectral camera to evaluate usability of sensing system using QZSS technology.

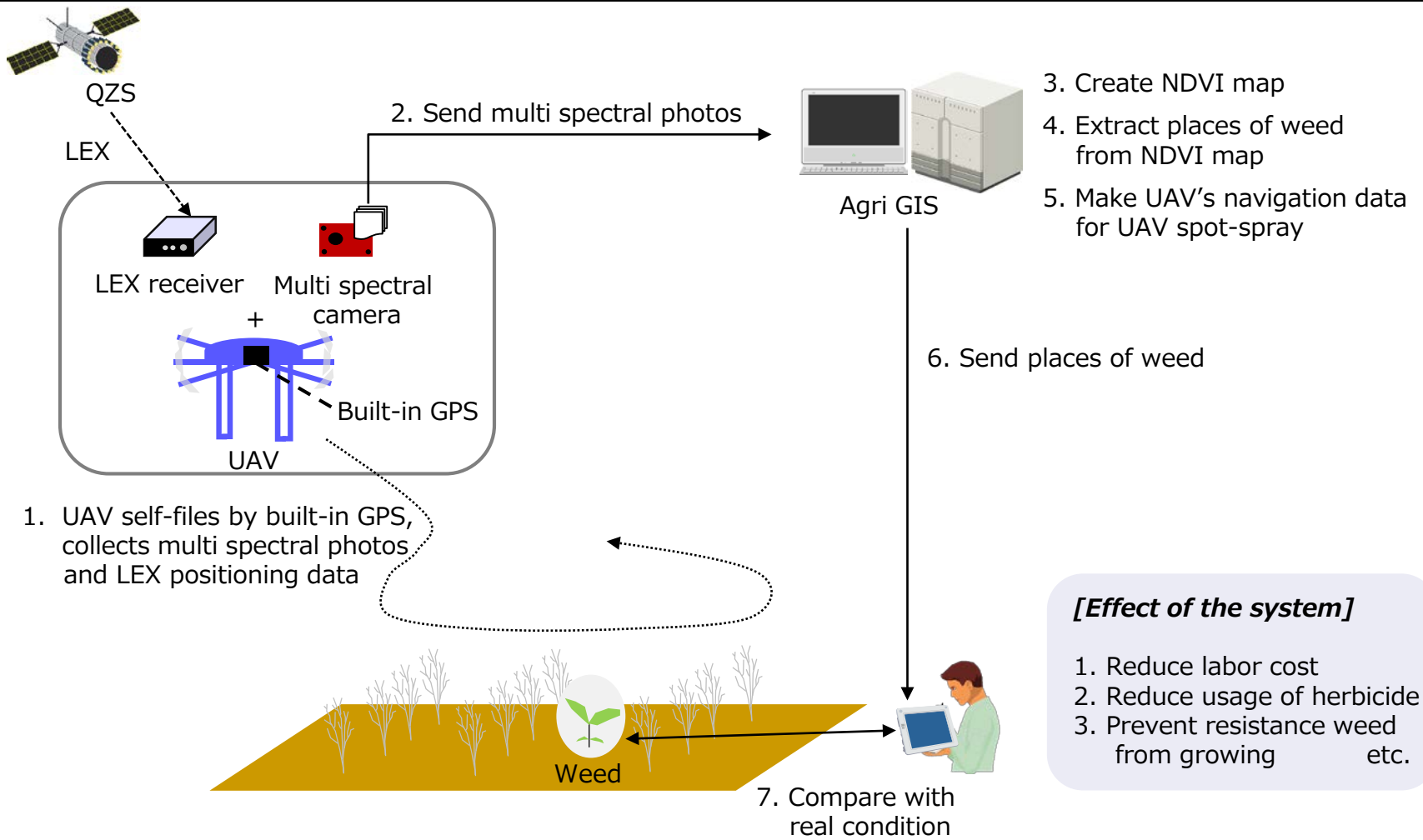
One of 19ha Avocado farms



Water stress

NDVI: Normalized Difference Vegetation Index

- **Purpose :** To develop and verify a auto spot-spray system of herbicide by LEX positioning and Agri GIS.
To verify reduction of labor cost by using this system.
- **Venue, Date:** Carnarvon (WA), Mid-February 2018

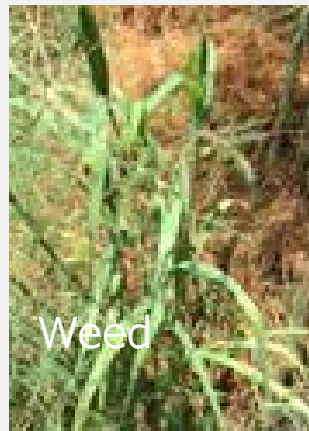


- Crop : Banana(0.4ha) or Asparagus(0.02ha)
- Farmer's name : Byron Sutcliffe

<Banana>



<Asparagus>



▼ Carnarvon

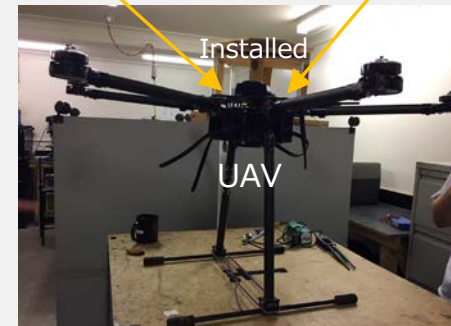
(110 South River Road,
Carnarvon, WA)



LEX positioning receiver



Multi spectral camera



- AUS and JPN are definitely good partners for each other in the field of agriculture.
 - The concept of “**Global Food Value Chain**” has been shared with JPN (MAFF) and AUS (DAWR).
- For improving productivity in farms, “automation” would be effectively work
 - **Precise positioning** must be a key component for automation.
- For investigating technical feasibility, some experiments were conducted by MIC
 - **High precision signal of QZSS** would be available **in AUS**
- For installing actual automated systems in Australian farms, much more benefit/cost analysis would be necessary through future experiments and surveys.
 - Under the cooperation among MAFF, MIC and AUS gov’t agencies.
Welcoming contribution and investment from private-sectors in this field !



Since QZSS could provide capability for the automation in agri-business, for exploring and making paradigm shift for the future sophisticated way of agriculture in AUS,

Think together & work together among public-private sectors in both AUS and Japan !

Thank you for your kind attention !