

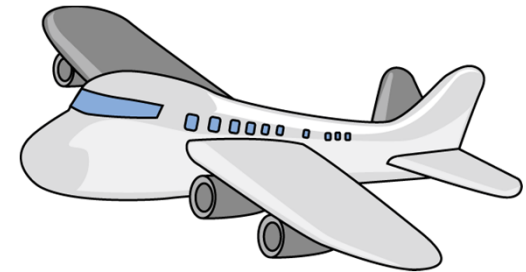
Study of Precision Agriculture using Unmanned Aerial Vehicles for Japan

Japan Aerospace exploration Agency

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Unmanned Aerial Vehicles

- The UAV is an acronym for Unmanned Aerial Vehicle, which is an aircraft with no pilot on board.
- Fixed wing aircraft
- Rotary wing aircraft
- Airship
- Balloon



Power source of UAV

Engine and Fuel

- High power weight ratio
- Easy restart by refueling
- Long flight



Electric motor and battery

- Easy control
- Clean and silent power source
- Easy operation

The motor for models became powerful by the evolution of the battery and the magnet.

Fixed wing aircraft for long time flight



Wingspan : 2100mm
Length: 1150mm
Payload: Max 2kg

Maximum flight time: 4 hours

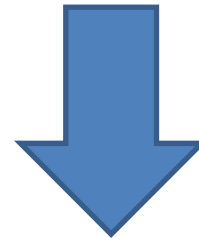


UAV used for agriculture

What does **UAV** do from the sky for agriculture?



Pesticide spraying RC helicopter



- Information gathering
- Transportation
- Agricultural work



Information on rice fields from the sky

Effective use for precision agriculture

Precision agriculture using UAV



Pesticide spraying at pinpoint

Information gathering by fixed wing

insect affection



manurial deficiency

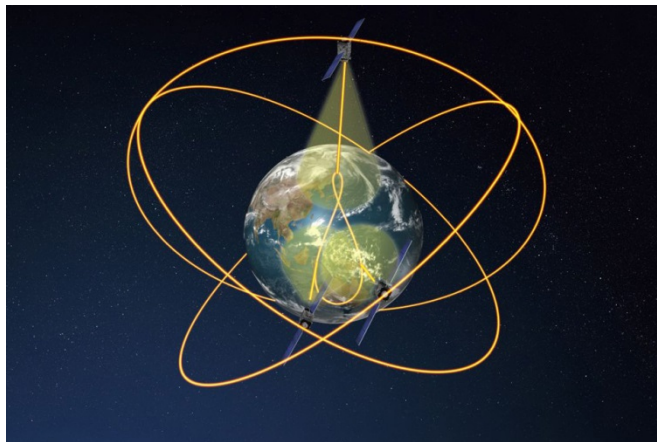
Change to a good area
with additional fertilizer

good area

Good areas sell higher price
when harvested separately

**Precision agriculture can
make profitable efficiently**

Quasi-Zenith Satellite System



Quasi-Zenith Satellite System

QZSS is a Japanese satellite positioning system composed mainly of satellites in quasi-zenith orbits (QZO). It is generally said that single-frequency satellite positioning, such as GPS, involves errors of around 10 meters. QZSS is expected that this service will be used for surveying and on-board vehicle equipment as well as mobile devices. With centimeter level augmentation, positioning can be accomplished with an error of several centimeters by utilizing surveying technologies.

QZSS is essential for precision agriculture using UAV

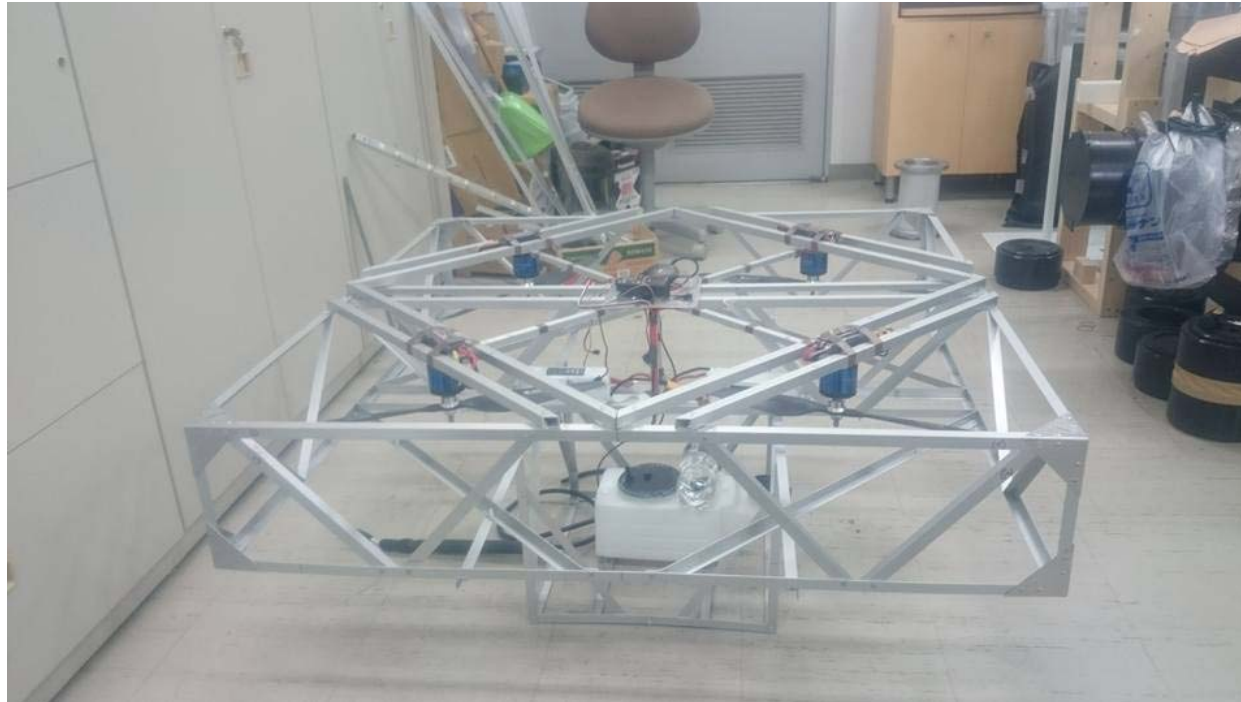
QZSS can be used not only in Japan, but also in Asia and Australia

Octocopter for spraying pesticides



Size: 1300mm Square
Payload: over 50kg

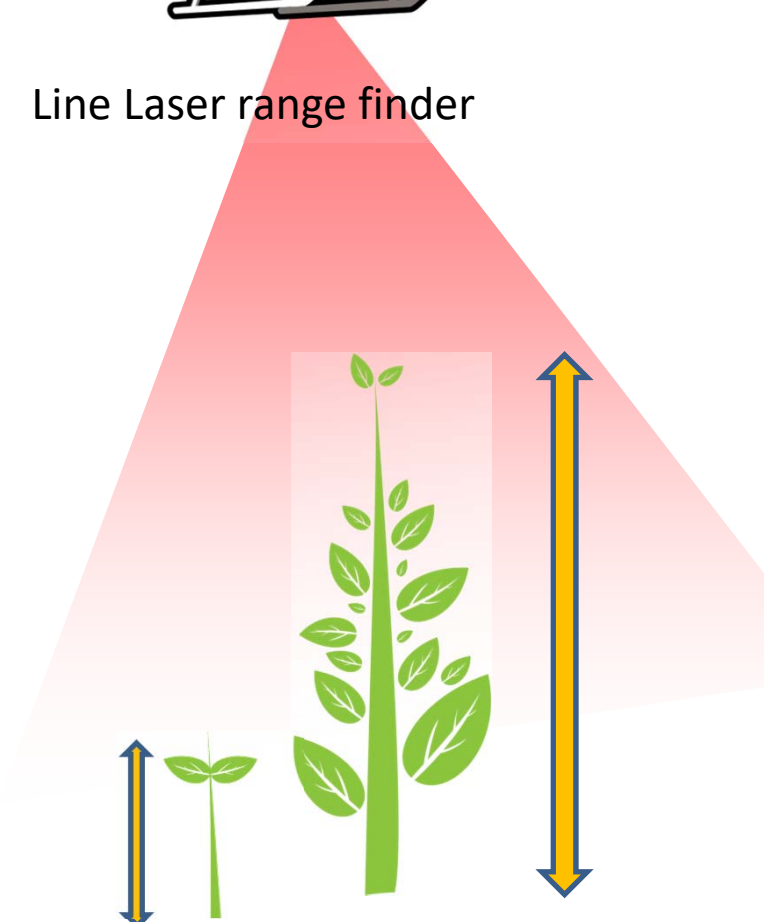
Low cost multi-copter for agriculture



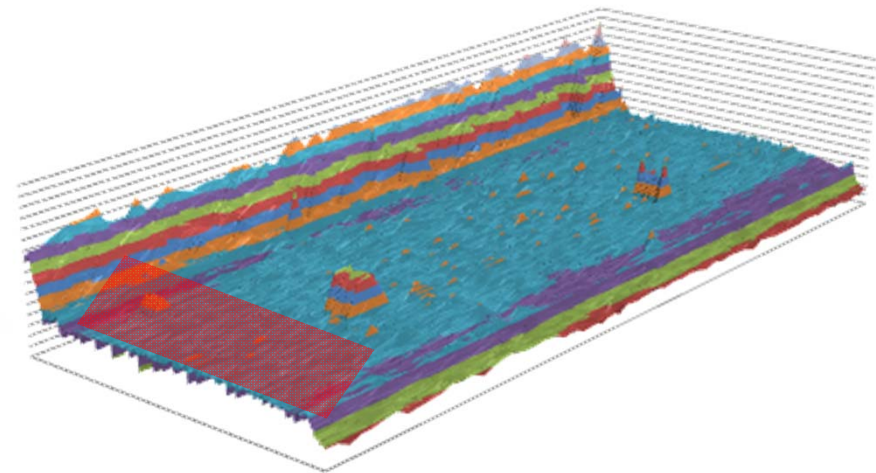


Plant growth research

Line Laser range finder



Measure the ground height of plants



Plant's ground height 3D graph

Growth survey by autopilot using GPS



Airship

- hovering
- payload (30kg)
- crash safety
- silent

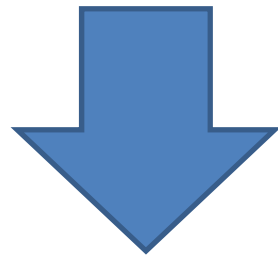
- airspeed
- Wind & rain
- size



Use UAV for disasters

Natural disasters

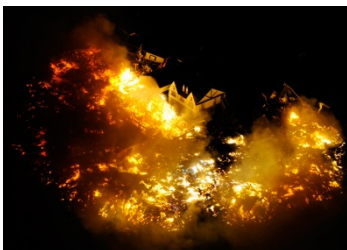
- Earthquake
- tsunami
- landslide
- distress



Isolation of mountainous rural areas

Information gathering

Logistics of foods and medicine



Need automatic autopilot by GPS

sea rescue by multicopter



Summary

- Precision agriculture brings a different form from large scale agriculture
- UAV matches Japanese type precision agriculture
- Precise positioning with QZSS is essential for precision agriculture
- UAV for precision agriculture can be used for disaster countermeasures