



Potential of Drones for Disaster Management

Disaster Risk Assessment, Monitoring, and Response

Hiroshi Inoue

National Research Institute for Earth Science and Disaster Resilience



Minami Sanriku, Miyagi, Japan 2011.4

Atele Demo Flight, April 25, 2018



An aerial photograph of a suburban area with houses, trees, and a large white building. A yellow rectangular boundary is drawn over the scene, tilted at an angle. Inside and around this boundary, there are red lines representing flight paths. These paths include a large loop on the right side and several smaller loops in the center. A blue line segment is also visible in the center. The text 'Yellow: Programmed waypoints' and '100 m ground altitude' is overlaid in yellow at the top. The text 'Red: Actual flight paths' and '3 km in 3 minutes + Take-off and Landing' is overlaid in red at the bottom.

Yellow: Programmed waypoints
100 m ground altitude

Red: Actual flight paths

3 km in 3 minutes + Take-off and Landing

Flight Path 3D

1 sec interval still photos with GoPro Hero 5



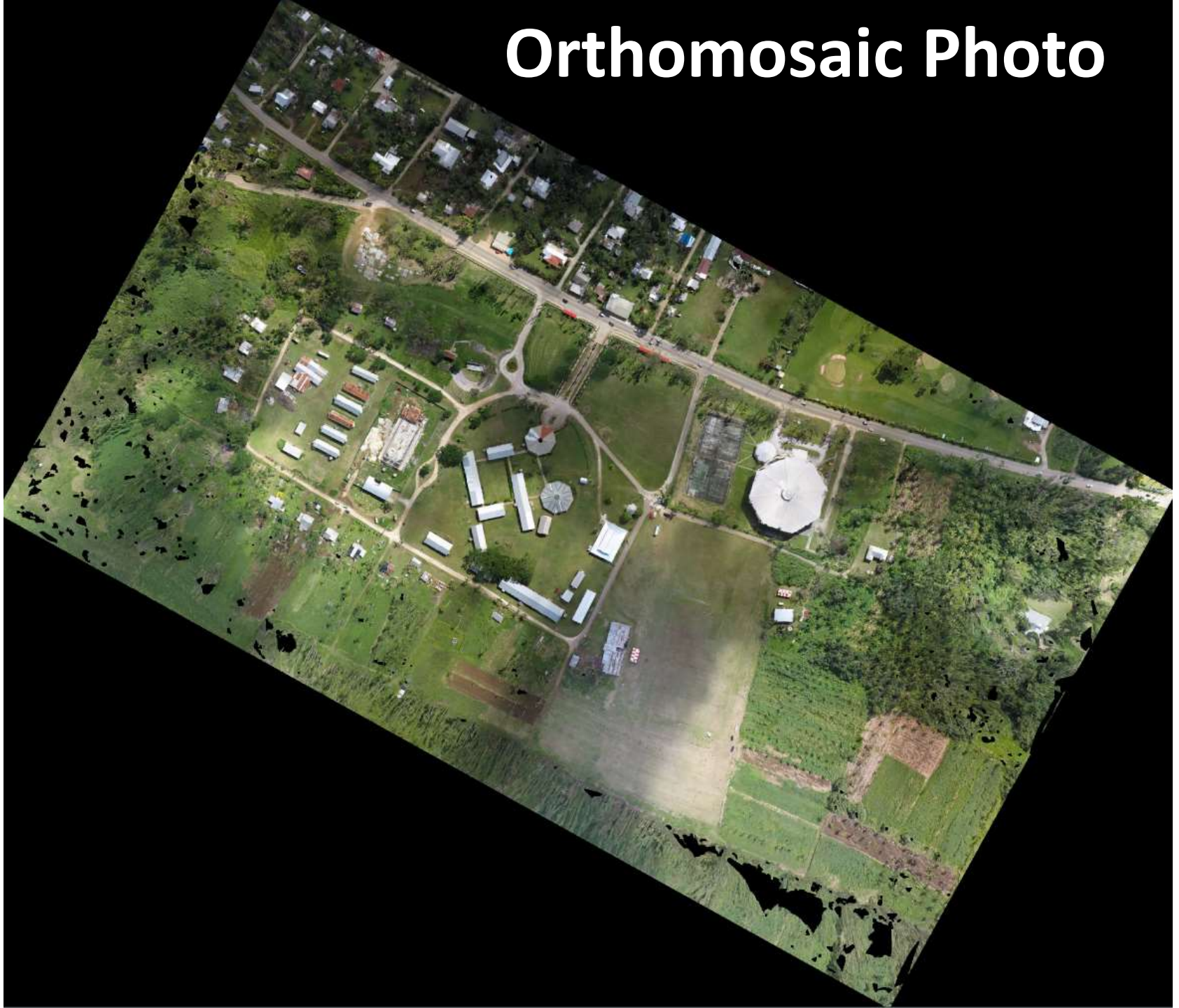
2000 Photos

Photos

3D Model (DSM) by PhotoScan™ 55 pictures



Orthomosaic Photo





Copter vs Plane



Size

40 cm

1.2 m

Weight

1.2 kg

1.2 kg

Cruise Speed

30 km/h

60 km/h

**Flight Time
Safe/Max**

15/30 min

60/120 min

**Flight Range
Safe/Max**

8/15 km

60/120 km

Earthquake/Tsunami/Flood Hazard/Risk Assessment



N3007274.JPG



N3007275.JPG



N3007276.JPG



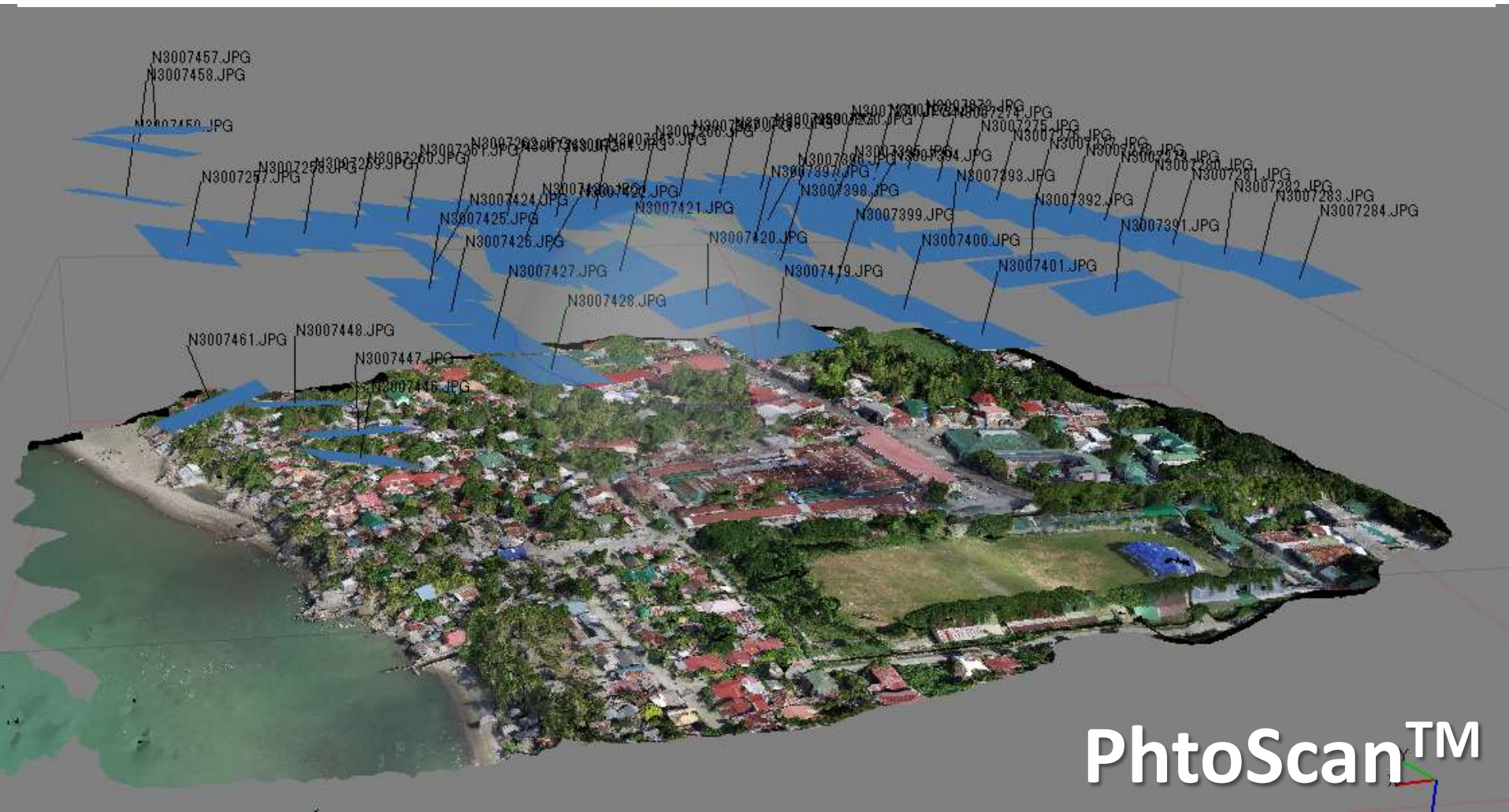
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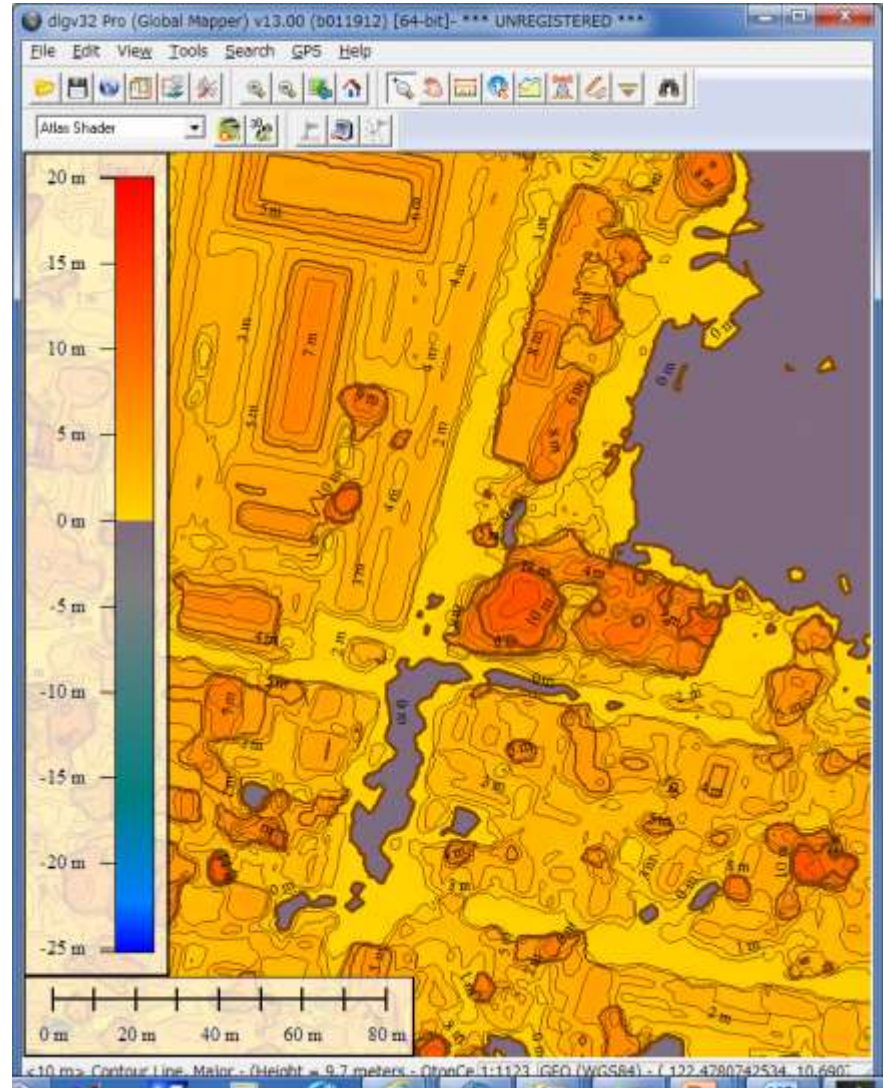


PhptoScanTM

Location and footprint of buildings from orthomosaic photo



Height of buildings from 3-D model



Volcano Crater Monitoring



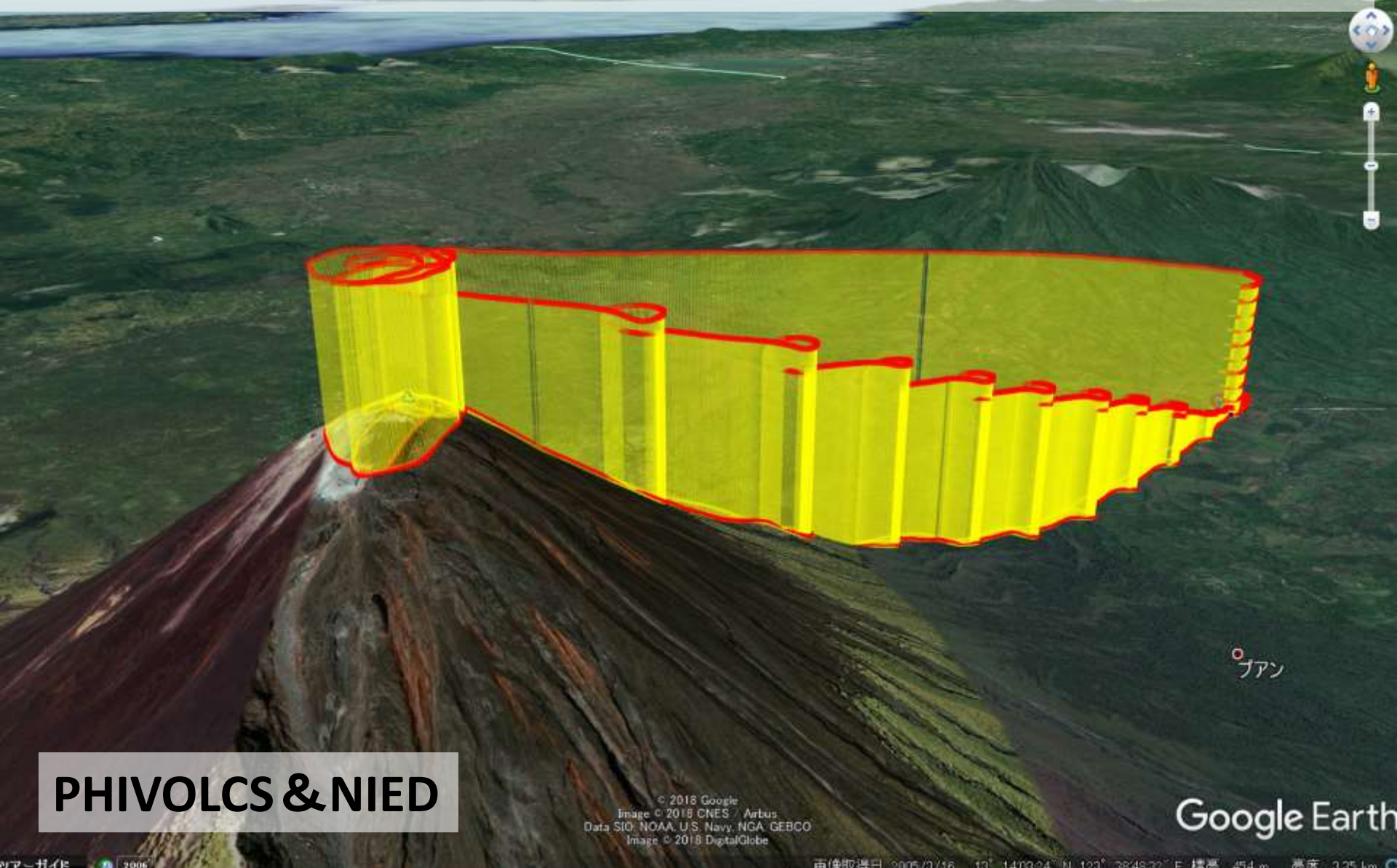
Central Crater of Mt. Aso, Kyushu, Japan

Diameter: 400m, Depth: 130m, Alert Level 1 , Nov.7, 2014

Volcano Monitoring



2400m relative elevation, launched from 8 km away



6500m cumulative elevation by climbing up-down test

River monitoring

GA 140m

Range 20km

Time 20min

Battery 50 %

Return point



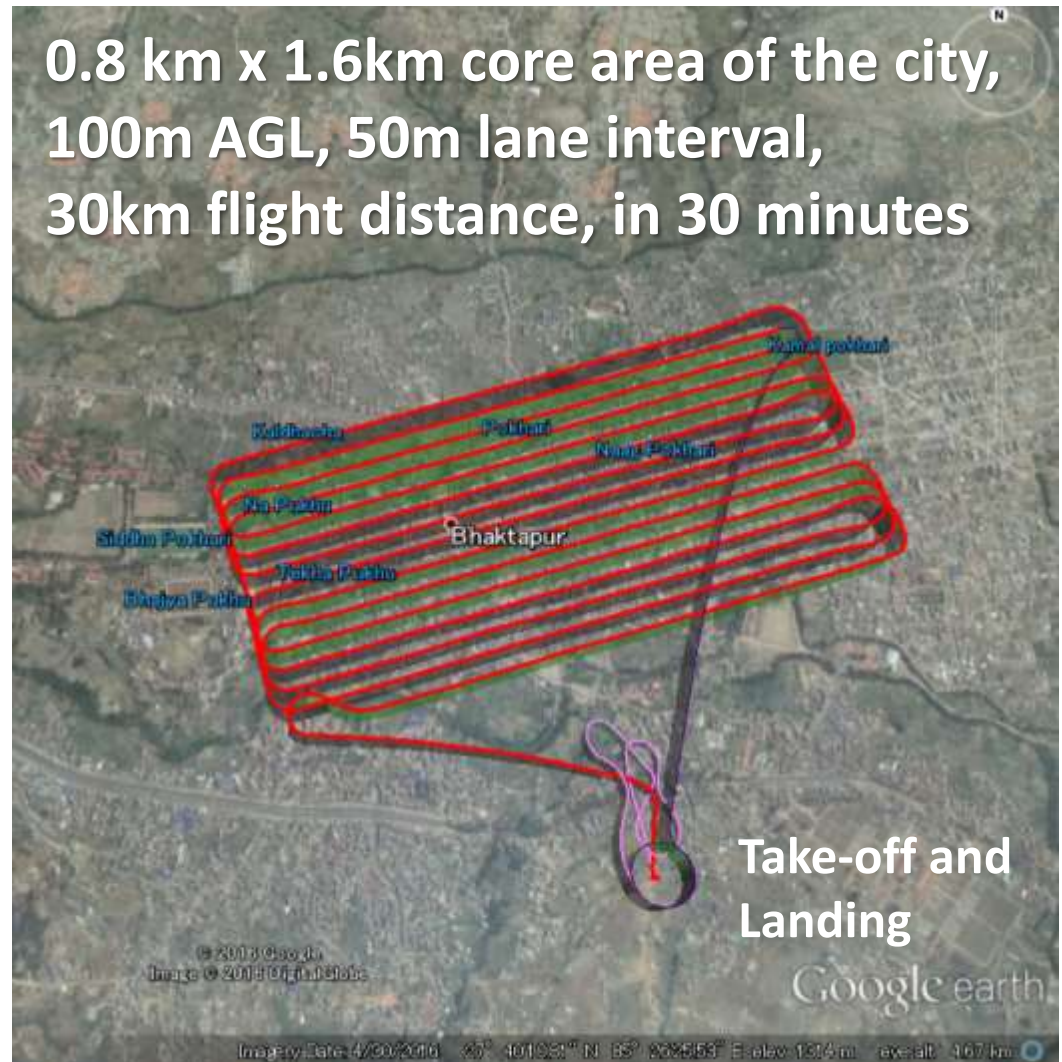
Take-off and
landing

917 m

GoProHero4 140mAGL
12Mpixel, UltralWide
7.5cm/pixel resolution



Damage Assessment using UAV for Gorkha Earthquake, 2015, Bhaktapur, Nepal



Bhaktapur



G0032270.JPG



G0032271.JPG



G0032272.JPG



G0032273.JPG



G0032274.JPG



G0032279.JPG



G0032277.JPG



G0032278.JPG



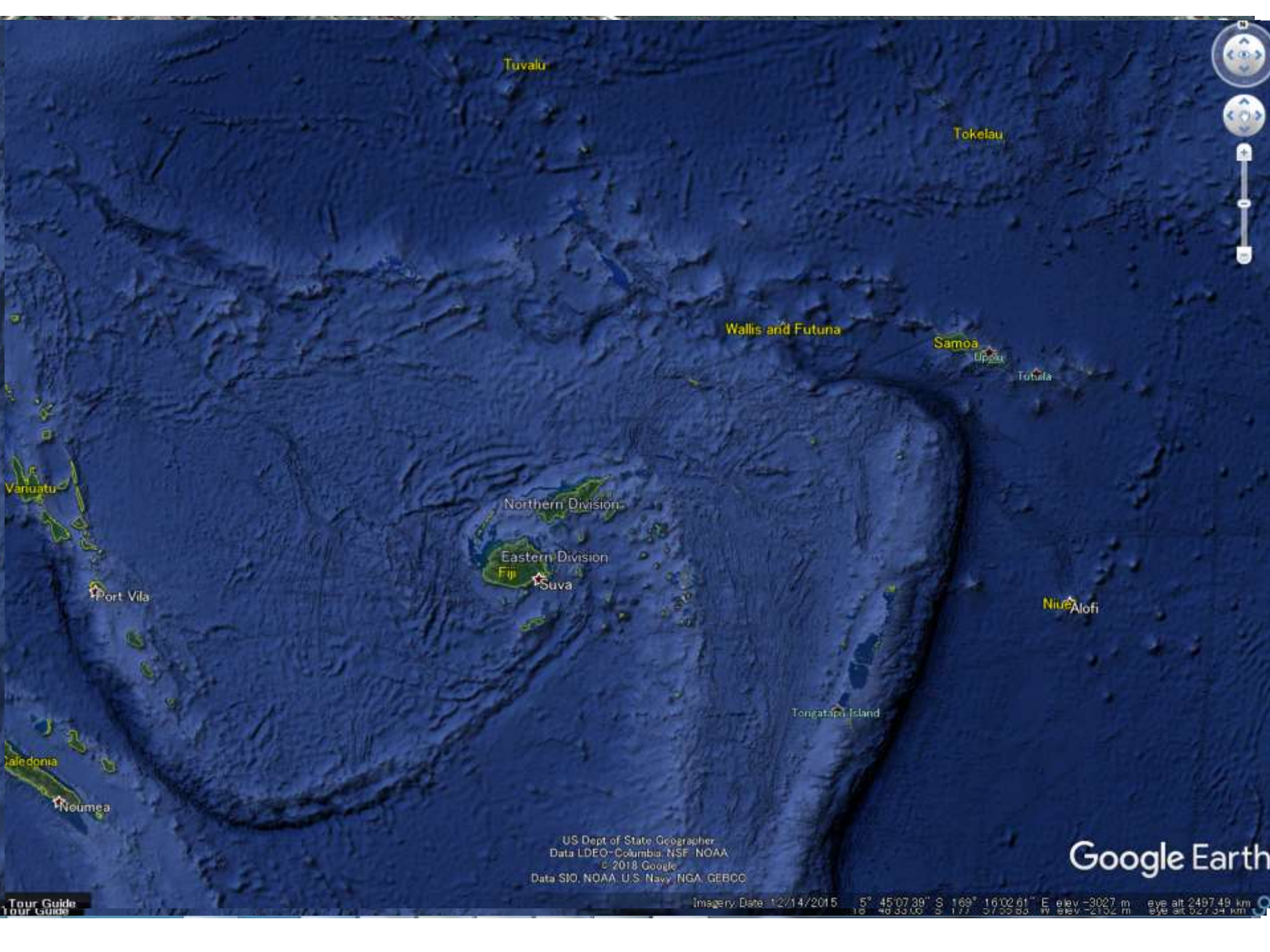
G0032281.JPG

G0032280.JPG

Langtang, Nepal, Oct.2015

Mapping avalanche debris and earthquake damage





Tuvalu

Tokelau

Wallis and Futuna

Samoa

Totila

Niue
Alofi

Tongatapu Island

Northern Division

Eastern Division

Fiji
Suva

Port Vila

Vanuatu

New Caledonia

Neumea

US Dept of State/Geographer
Data LDEO-Columbia/NSF-NOAA
© 2018 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google Earth

Tour Guide
Tour Guide

Imagery Date: 12/14/2015 5° 45'07.39" S 169° 16'02.61" E elev -3027 m eye alt 2497.49 km
16° 46'33.00" S 177° 57'55.83" W elev -2102 m eye alt 527.34 km

A map of Tongatapu island, Tonga, showing a flight path. The path is marked with white dots and lines, indicating a route that covers the island's perimeter and internal distances. Key locations labeled include Kaniokupatu, Kalofoai, Nukunuku, Tongatapu, Liahona, Pea, Hoi, Mua, Nakalo, and Kalonga. Distances between points are marked, such as 60.00 km, 70.00 km, 80.00 km, 90.00 km, 100.00 km, 110.00 km, 120.00 km, 130.00 km, 140.00 km, 150.00 km, 160.00 km, 170.00 km, 180.00 km, 190.00 km, 200.00 km, 210.00 km, 220.00 km, 230.00 km, 240.00 km, 250.00 km, 260.00 km, 270.00 km, 280.00 km, 290.00 km, 300.00 km, 310.00 km, 320.00 km, 330.00 km, 340.00 km, 350.00 km, 360.00 km, 370.00 km, 380.00 km, 390.00 km, 400.00 km, 410.00 km, 420.00 km, 430.00 km, 440.00 km, 450.00 km, 460.00 km, 470.00 km, 480.00 km, 490.00 km, 500.00 km, 510.00 km, 520.00 km, 530.00 km, 540.00 km, 550.00 km, 560.00 km, 570.00 km, 580.00 km, 590.00 km, 600.00 km, 610.00 km, 620.00 km, 630.00 km, 640.00 km, 650.00 km, 660.00 km, 670.00 km, 680.00 km, 690.00 km, 700.00 km, 710.00 km, 720.00 km, 730.00 km, 740.00 km, 750.00 km, 760.00 km, 770.00 km, 780.00 km, 790.00 km, 800.00 km, 810.00 km, 820.00 km, 830.00 km, 840.00 km, 850.00 km, 860.00 km, 870.00 km, 880.00 km, 890.00 km, 900.00 km, 910.00 km, 920.00 km, 930.00 km, 940.00 km, 950.00 km, 960.00 km, 970.00 km, 980.00 km, 990.00 km, 1000.00 km, 1010.00 km, 1020.00 km, 1030.00 km, 1040.00 km, 1050.00 km, 1060.00 km, 1070.00 km, 1080.00 km, 1090.00 km, 1100.00 km, 1110.00 km, 1120.00 km, 1130.00 km, 1140.00 km, 1150.00 km, 1160.00 km, 1170.00 km, 1180.00 km, 1190.00 km, 1200.00 km, 1210.00 km, 1220.00 km, 1230.00 km, 1240.00 km, 1250.00 km, 1260.00 km, 1270.00 km, 1280.00 km, 1290.00 km, 1300.00 km, 1310.00 km, 1320.00 km, 1330.00 km, 1340.00 km, 1350.00 km, 1360.00 km, 1370.00 km, 1380.00 km, 1390.00 km, 1400.00 km, 1410.00 km, 1420.00 km, 1430.00 km, 1440.00 km, 1450.00 km, 1460.00 km, 1470.00 km, 1480.00 km, 1490.00 km, 1500.00 km, 1510.00 km, 1520.00 km, 1530.00 km, 1540.00 km, 1550.00 km, 1560.00 km, 1570.00 km, 1580.00 km, 1590.00 km, 1600.00 km, 1610.00 km, 1620.00 km, 1630.00 km, 1640.00 km, 1650.00 km, 1660.00 km, 1670.00 km, 1680.00 km, 1690.00 km, 1700.00 km, 1710.00 km, 1720.00 km, 1730.00 km, 1740.00 km, 1750.00 km, 1760.00 km, 1770.00 km, 1780.00 km, 1790.00 km, 1800.00 km, 1810.00 km, 1820.00 km, 1830.00 km, 1840.00 km, 1850.00 km, 1860.00 km, 1870.00 km, 1880.00 km, 1890.00 km, 1900.00 km, 1910.00 km, 1920.00 km, 1930.00 km, 1940.00 km, 1950.00 km, 1960.00 km, 1970.00 km, 1980.00 km, 1990.00 km, 2000.00 km, 2010.00 km, 2020.00 km, 2030.00 km, 2040.00 km, 2050.00 km, 2060.00 km, 2070.00 km, 2080.00 km, 2090.00 km, 2100.00 km, 2110.00 km, 2120.00 km, 2130.00 km, 2140.00 km, 2150.00 km, 2160.00 km, 2170.00 km, 2180.00 km, 2190.00 km, 2200.00 km, 2210.00 km, 2220.00 km, 2230.00 km, 2240.00 km, 2250.00 km, 2260.00 km, 2270.00 km, 2280.00 km, 2290.00 km, 2300.00 km, 2310.00 km, 2320.00 km, 2330.00 km, 2340.00 km, 2350.00 km, 2360.00 km, 2370.00 km, 2380.00 km, 2390.00 km, 2400.00 km, 2410.00 km, 2420.00 km, 2430.00 km, 2440.00 km, 2450.00 km, 2460.00 km, 2470.00 km, 2480.00 km, 2490.00 km, 2500.00 km, 2510.00 km, 2520.00 km, 2530.00 km, 2540.00 km, 2550.00 km, 2560.00 km, 2570.00 km, 2580.00 km, 2590.00 km, 2600.00 km, 2610.00 km, 2620.00 km, 2630.00 km, 2640.00 km, 2650.00 km, 2660.00 km, 2670.00 km, 2680.00 km, 2690.00 km, 2700.00 km, 2710.00 km, 2720.00 km, 2730.00 km, 2740.00 km, 2750.00 km, 2760.00 km, 2770.00 km, 2780.00 km, 2790.00 km, 2800.00 km, 2810.00 km, 2820.00 km, 2830.00 km, 2840.00 km, 2850.00 km, 2860.00 km, 2870.00 km, 2880.00 km, 2890.00 km, 2900.00 km, 2910.00 km, 2920.00 km, 2930.00 km, 2940.00 km, 2950.00 km, 2960.00 km, 2970.00 km, 2980.00 km, 2990.00 km, 3000.00 km, 3010.00 km, 3020.00 km, 3030.00 km, 3040.00 km, 3050.00 km, 3060.00 km, 3070.00 km, 3080.00 km, 3090.00 km, 3100.00 km, 3110.00 km, 3120.00 km, 3130.00 km, 3140.00 km, 3150.00 km, 3160.00 km, 3170.00 km, 3180.00 km, 3190.00 km, 3200.00 km, 3210.00 km, 3220.00 km, 3230.00 km, 3240.00 km, 3250.00 km, 3260.00 km, 3270.00 km, 3280.00 km, 3290.00 km, 3300.00 km, 3310.00 km, 3320.00 km, 3330.00 km, 3340.00 km, 3350.00 km, 3360.00 km, 3370.00 km, 3380.00 km, 3390.00 km, 3400.00 km, 3410.00 km, 3420.00 km, 3430.00 km, 3440.00 km, 3450.00 km, 3460.00 km, 3470.00 km, 3480.00 km, 3490.00 km, 3500.00 km, 3510.00 km, 3520.00 km, 3530.00 km, 3540.00 km, 3550.00 km, 3560.00 km, 3570.00 km, 3580.00 km, 3590.00 km, 3600.00 km, 3610.00 km, 3620.00 km, 3630.00 km, 3640.00 km, 3650.00 km, 3660.00 km, 3670.00 km, 3680.00 km, 3690.00 km, 3700.00 km, 3710.00 km, 3720.00 km, 3730.00 km, 3740.00 km, 3750.00 km, 3760.00 km, 3770.00 km, 3780.00 km, 3790.00 km, 3800.00 km, 3810.00 km, 3820.00 km, 3830.00 km, 3840.00 km, 3850.00 km, 3860.00 km, 3870.00 km, 3880.00 km, 3890.00 km, 3900.00 km, 3910.00 km, 3920.00 km, 3930.00 km, 3940.00 km, 3950.00 km, 3960.00 km, 3970.00 km, 3980.00 km, 3990.00 km, 4000.00 km, 4010.00 km, 4020.00 km, 4030.00 km, 4040.00 km, 4050.00 km, 4060.00 km, 4070.00 km, 4080.00 km, 4090.00 km, 4100.00 km, 4110.00 km, 4120.00 km, 4130.0

60km x 15 flights

300m ground altitude,
300m interval

Ha'apai
70km
x2 flights

The map shows a flight route around the island of Ha'apai. The route is marked with white dots and lines, with distances labeled in kilometers. The route starts at the top, goes clockwise, and ends at the bottom. Key locations marked include Muliā and Kōnia. Distances along the route include 10.00 km, 20.00 km, 40.00 km, 80.00 km, 100.00 km, 120.00 km, and 150.00 km.

Vava'u
50km
x2 flights

The map displays a network of flight routes connecting various islands in the Vava'u archipelago. The routes are marked with white lines and dots representing airports. Key islands labeled include 'Vava'u' (the main island), 'Tutuila', and 'Nukunono'. The network is designed to ensure that any two islands are reachable within a maximum of two flights, with each flight leg being no longer than 50km. The map uses a blue color scheme for the water and green for the land.

Rarotonga 30km x1 flight



Tarawa 70km x2 flights



Phonpei 70km x 1 flight



Dropping small items

Challenges

Inter island missions

Big countries



Engine plane

Terra EG-4000

500 – 1,000 km range

4 m wing span, 10 kg dry weight



Hunga

70 km from Tonga



Challenges

**Durability against wind and rain
because disasters can occur anytime**



Fast plane

Rainproof plane



✖ More simple system is needed

DIY is not for everyone

**Local drone builders
are necessary**



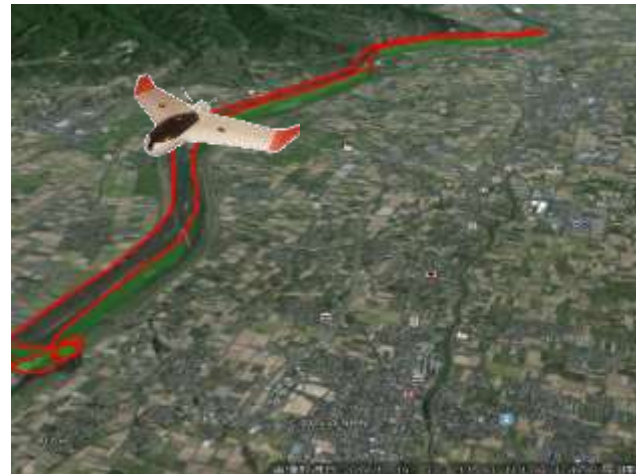
Software is also complicated



Power-on and throw



Fly, return, land fully
automatically





Thank you

