IMAGE INFORMATION MINING AT PLANET

The esa earth observation Φ-week • Nov 14, 2018

Giovanni Marchisio, Ph.D. | VP of Applied Analytics, San Francisco

Mailiao Refinery, Taiwan – May 31, 2016

MISSION 1

To image the whole world every day, making change **visible, accessible and actionable**.

HISTORY OF PLANET

Founded in 2010 by a team of ex-NASA scientists, Planet is driven by a mission to image the entire Earth every day, and make global change visible, accessible, and actionable.

2010
PLANET FOUNDED

Planet founded by NASA scientists, Robbie Schingler, Will Marshall, and Chris Boshuizen

2013
FIRST LIGHT

Planet launched Dove 2, an early build of the Dove into SSO orbit aboard a Soyuz rocket

2014
MISSION 1 ESTABLISHED

CEO Will Marshall announces Planet's mission to image the entire Earth's surface every day at TED

2015
LAUNCHES

67 total satellites across four launches
Planet acquires Blackbridge, and their RapidEye satellite constellation

Another 42 satellites are deployed across 5 more launches

2016
TERRA BELLA ACQUISITION

Planet acquires Terra Bella from Google, adding seven high-resolution SkySat satellites to the fleet

Launched 146 satellites, including the record-breaking launch of 88 Doves on a PSLV rocket, and six additional SkySat satellites

2017
MISSION 1 COMPLETE

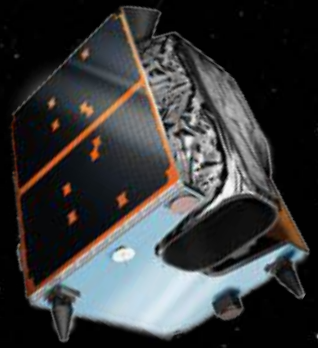
Planet is now able to image Earth's entire landmass on a daily basis

2018
QUERYABLE EARTH ANNOUNCED

Planet's vision to use machine learning to deliver a Queryable Earth is announced at TED

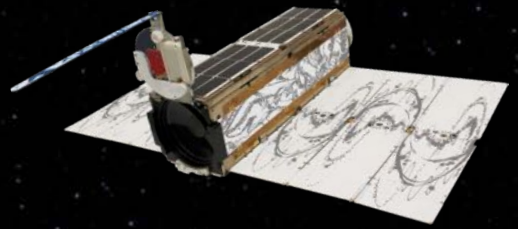
Launch of Planet Analytics

PLANET'S INDUSTRY-LEADING CONSTELLATION



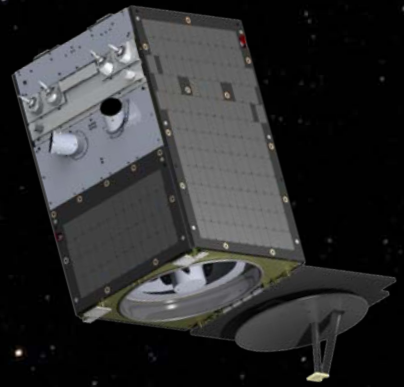
5 RapidEye Satellites

Capacity = 6M km^2/day
GDS = 6.5 m



130+ Dove Satellites PlanetScope

Capacity = 346M km^2/day
GDS = 3.9 m

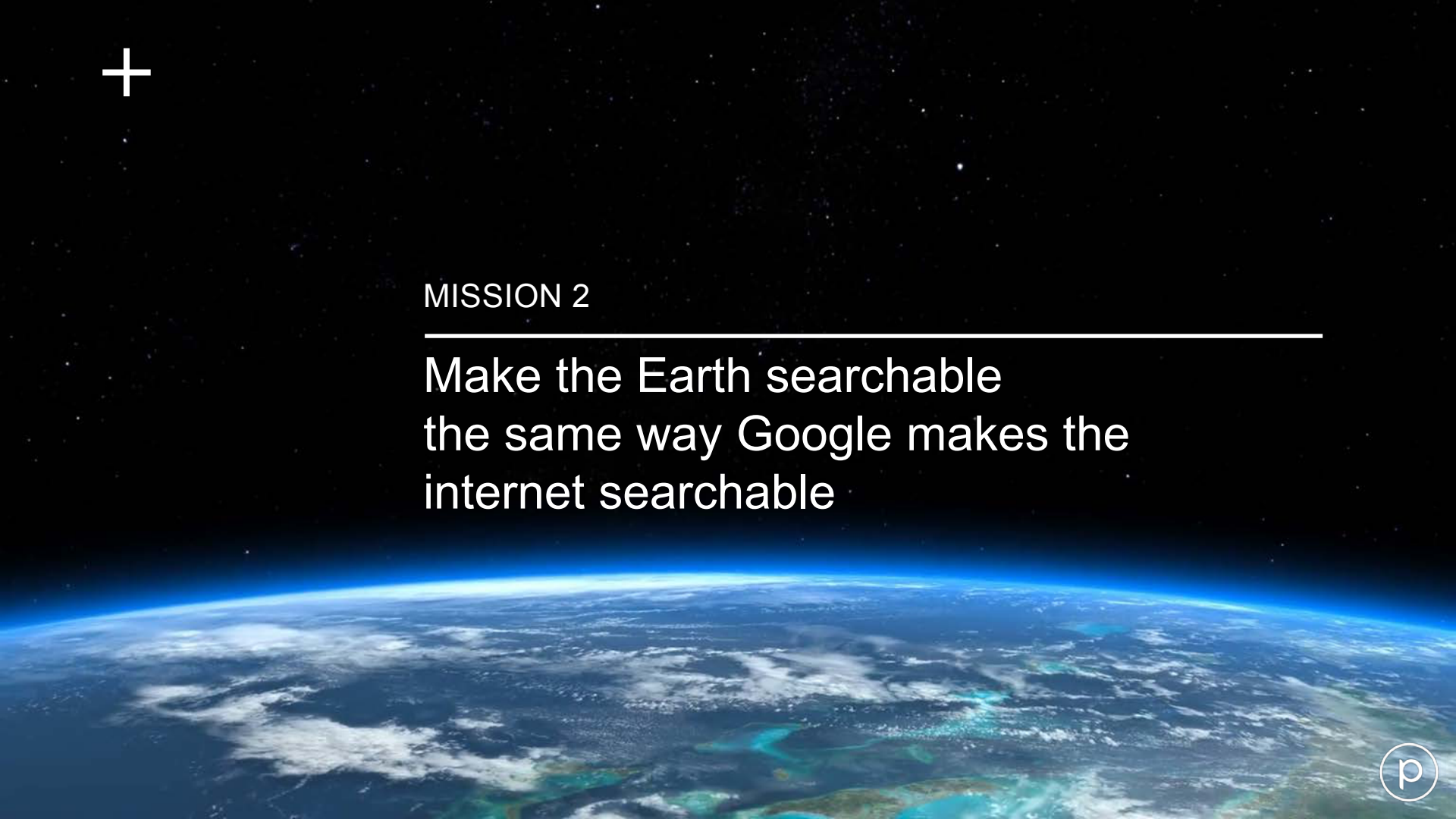


13 SkySat Satellites

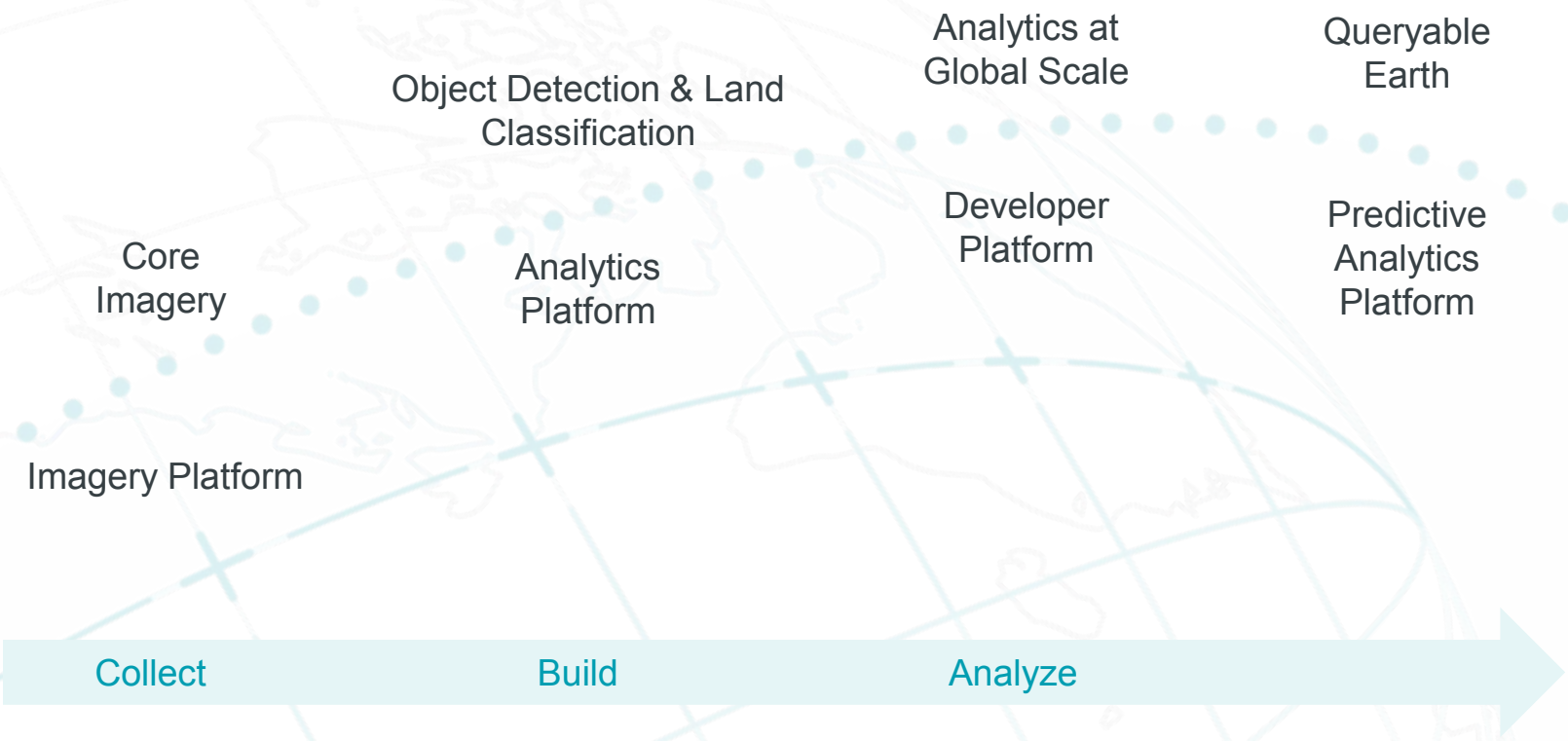
Capacity = ~160K km^2/day
GDS = 0.7 m

PLANET BY THE NUMBERS

Total images per day	1.5 million 29MP images
Area covered	350 million km^2 per day
Data	6+ TB per day downlinked
Burning through the clouds	95% cloud free imagery of Earth's landmass each week
Image stack	On average over 800 images per location on Earth


MISSION 2
Make the Earth searchable
the same way Google makes the
internet searchable

THE PATH TO QUERYABLE EARTH



PLANET ANALYTICS

Spatial information feeds at scale based on **Deep Learning**

OBJECT DETECTION FEEDS

Find objects of interest in daily imagery

Maritime Vessels

Aircraft

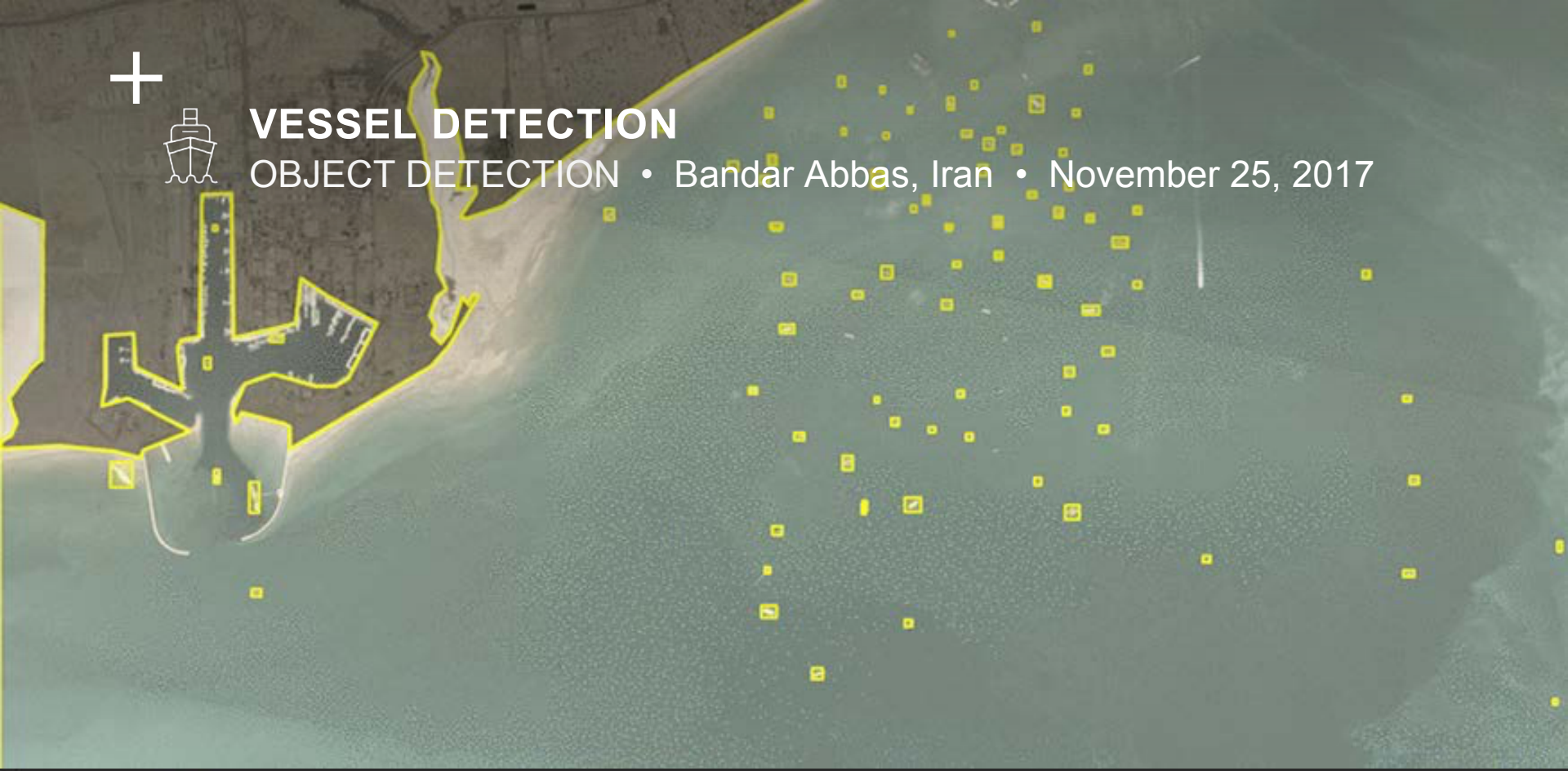
LAND CLASSIFICATION FEEDS

Automatically extract geographic features

Road Networks

Building Footprints

Deforestation


VESSEL DETECTION
OBJECT DETECTION • Bandar Abbas, Iran • November 25, 2017
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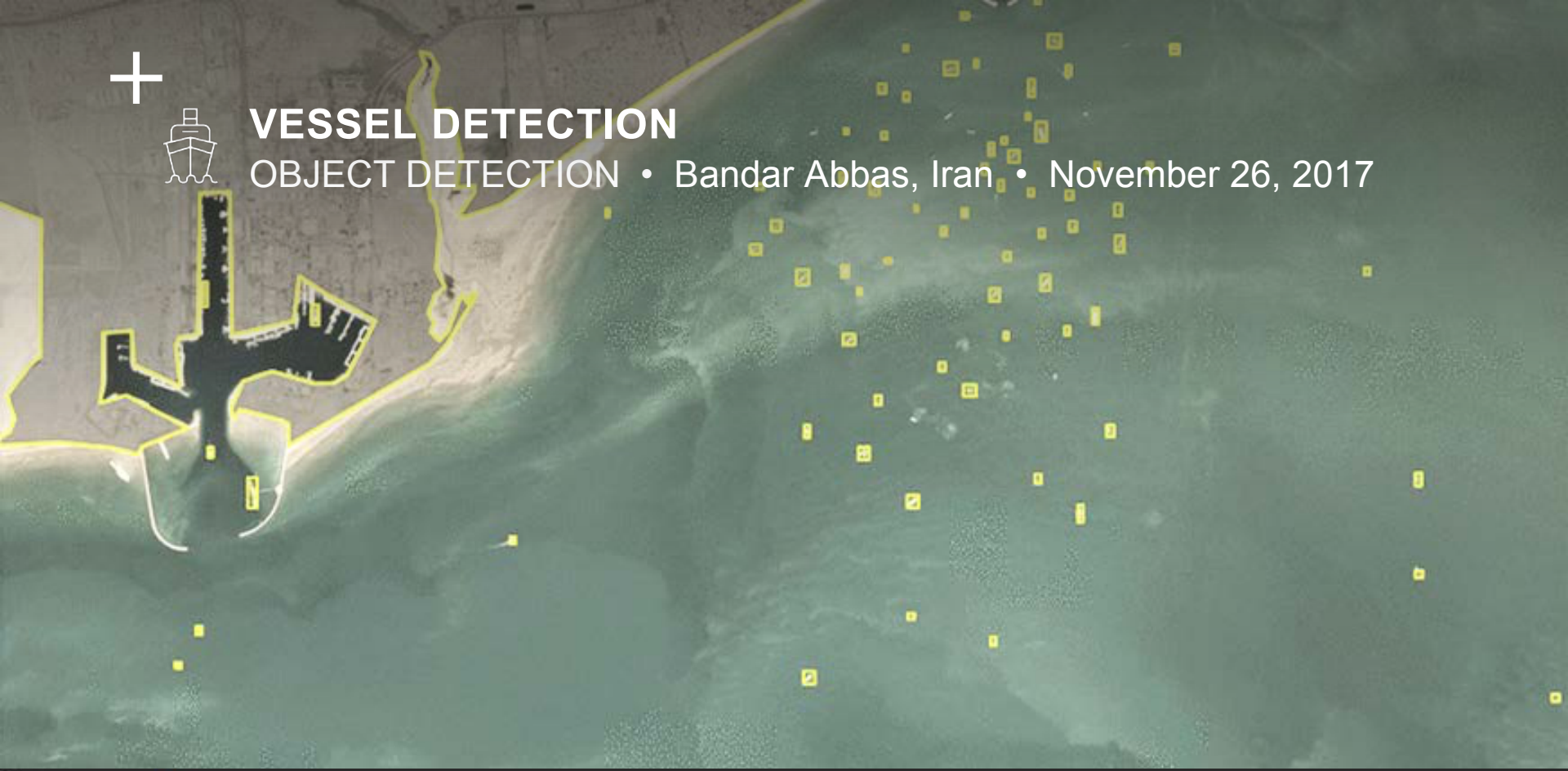
VESSEL DETECTION

OBJECT DETECTION • Bandar Abbas, Iran • November 26, 2017




VESSEL DETECTION
OBJECT DETECTION • Bandar Abbas, Iran • December 10, 2017
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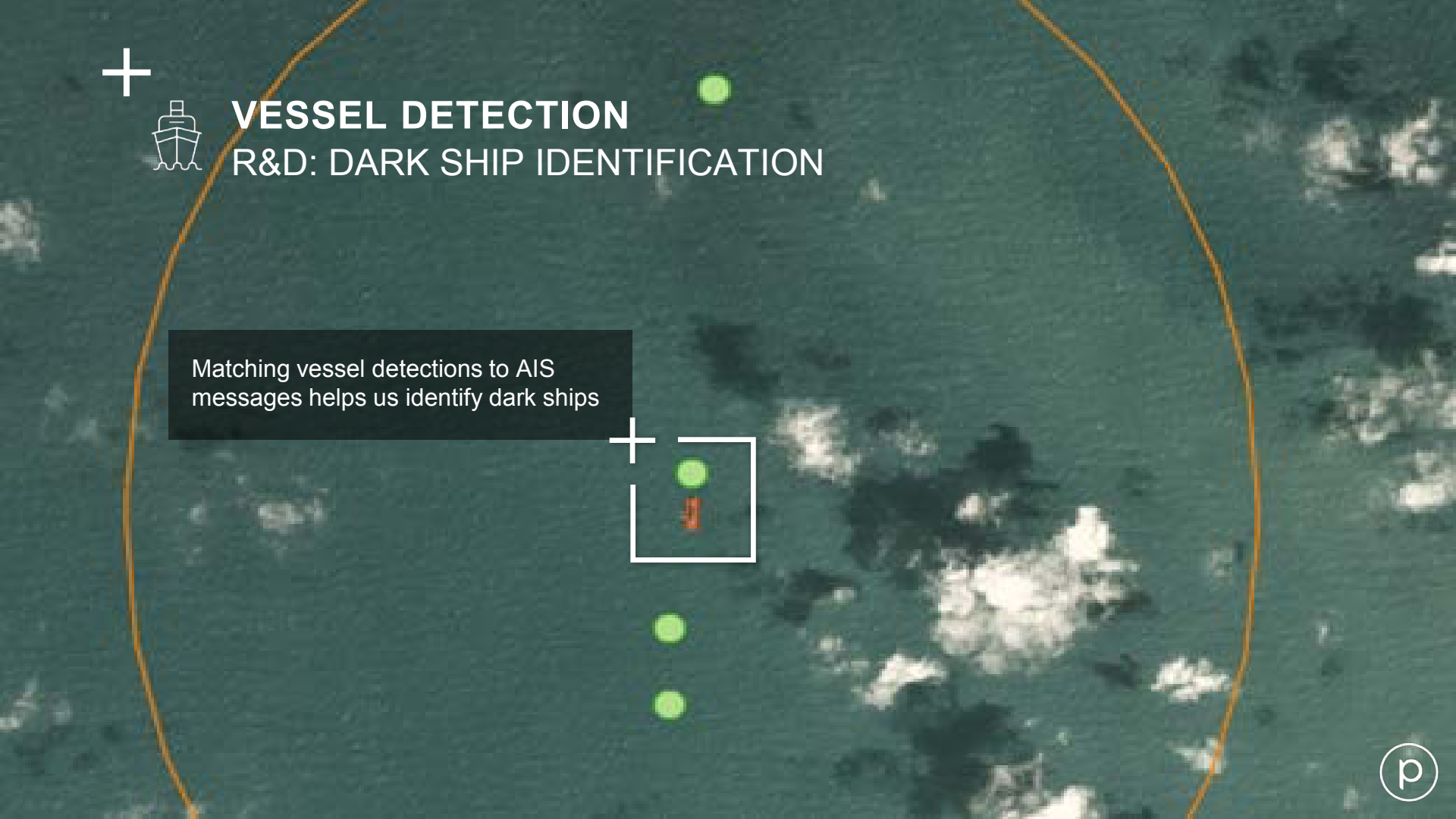
VESSEL DETECTION

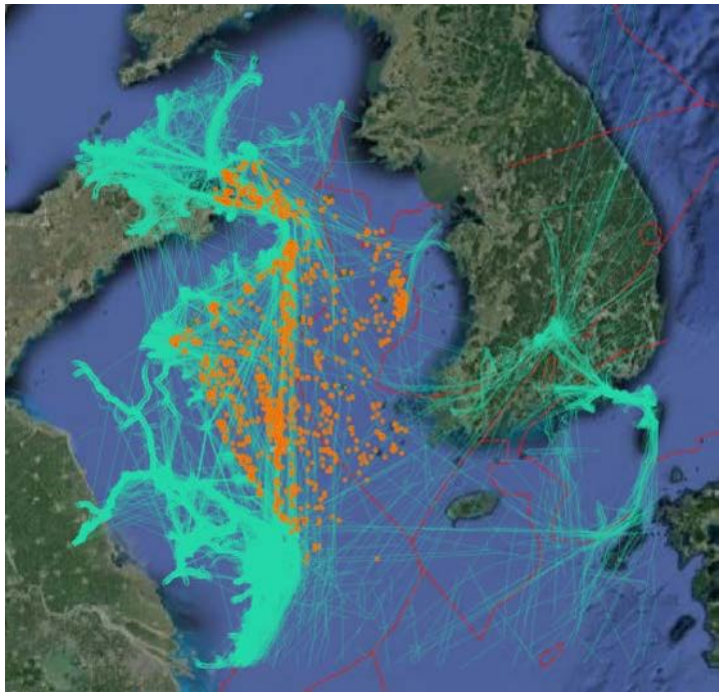
R&D: DARK SHIP IDENTIFICATION

Matching vessel detections to AIS messages helps us identify dark ships



VESSEL DETECTION AND AIS MATCHING

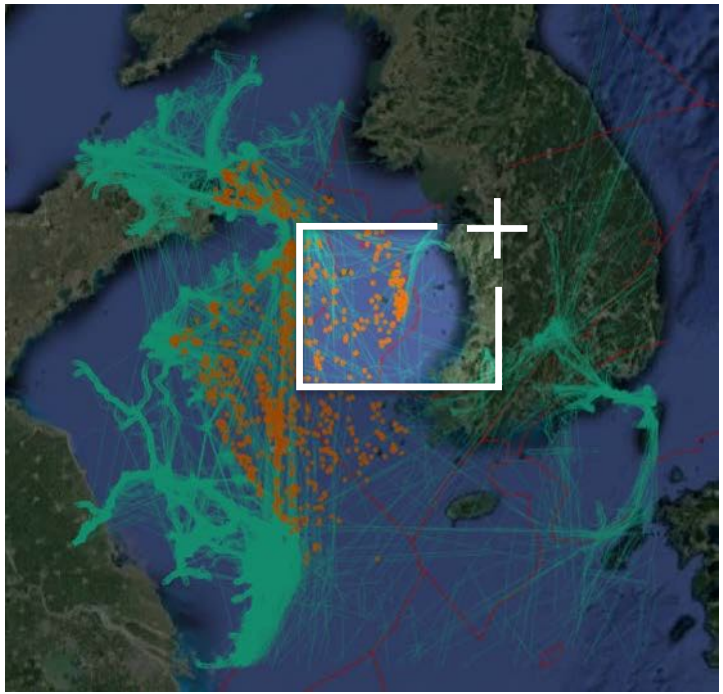
R&D: PATTERN DISCOVERY FROM OUR ARCHIVES



One day (March 9th, 2018) of PlanetScope and AIS within the Yellow Sea AOI

VESSEL DETECTION AND DARK SHIPS

R&D: PATTERN DISCOVERY FROM OUR ARCHIVES



Cluster of dark ships just outside of the South Korean EEZ

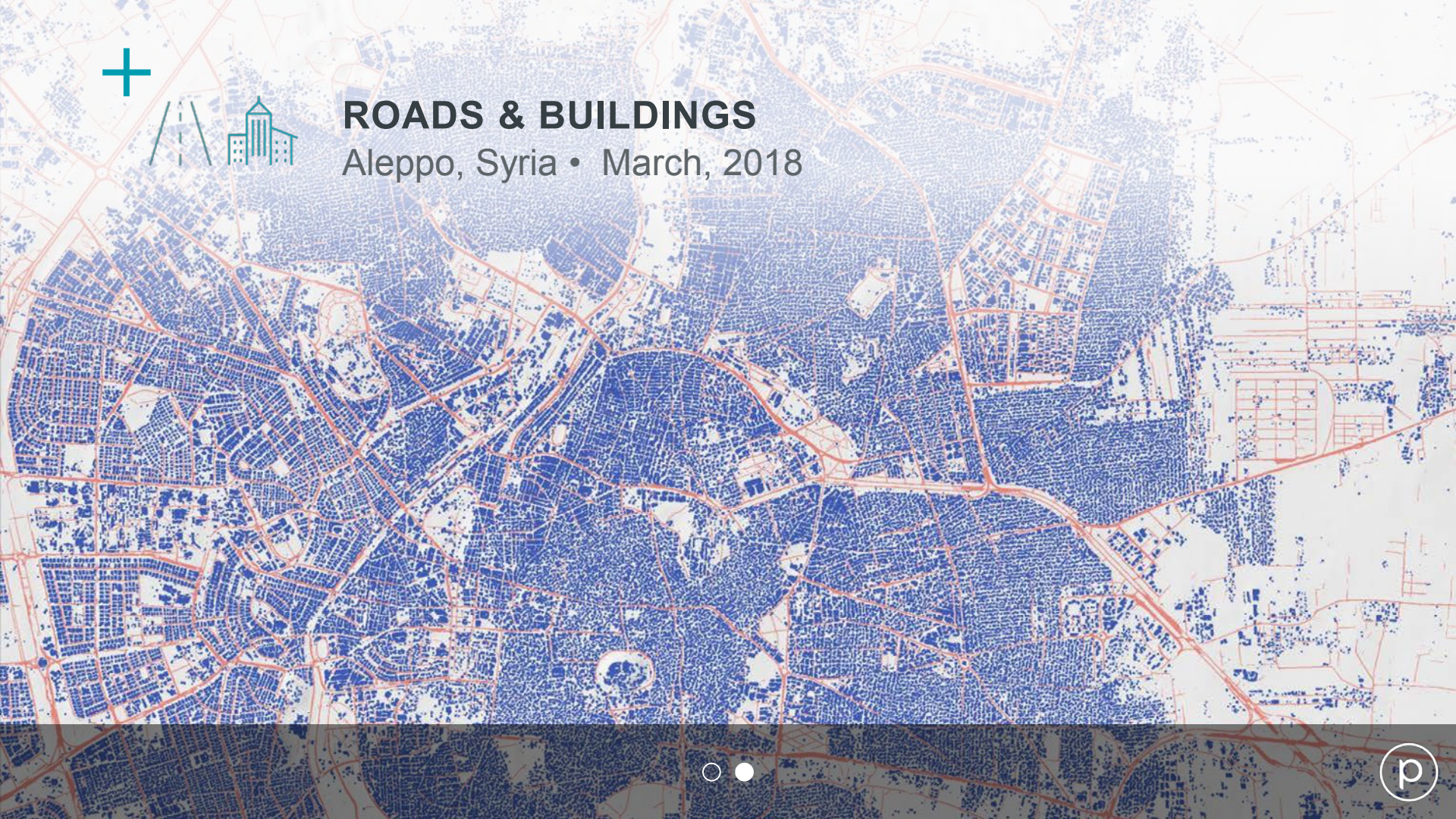
One day (March 9th, 2018) of PlanetScope and AIS within the Yellow Sea AOI

VESSEL DETECTION

R&D: TIP AND CUE • Bemun, Pulau Workai, Indonesia • February 8, 2017

Using PlanetScope data to tip SkySat, we catch this cluster of fishing vessels on February 8 near Bemun, Pulau Workai, Indonesia

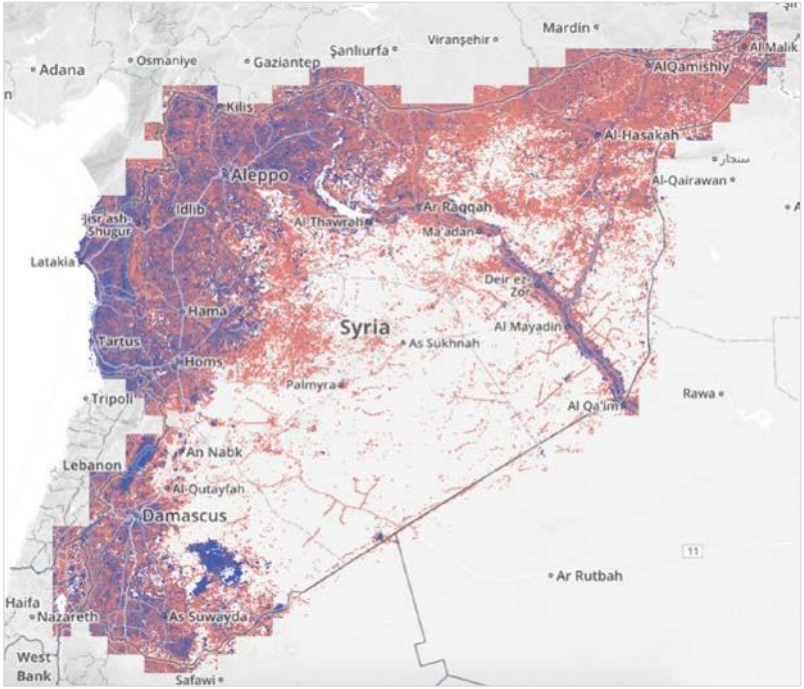

ROADS & BUILDINGS
Aleppo, Syria • March, 2018 • PlanetScope mosaic


ROADS & BUILDINGS
Aleppo, Syria • March, 2018

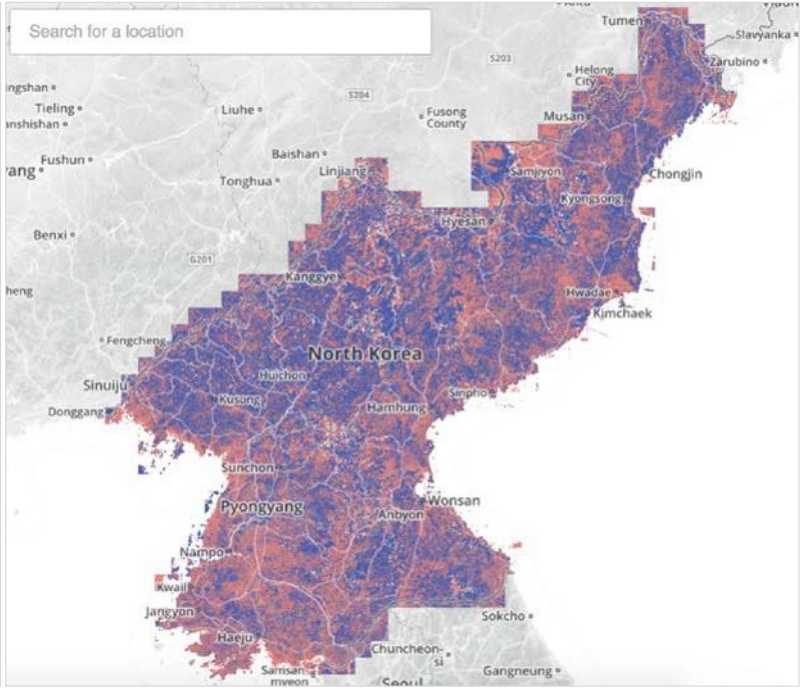
EXTRACTED ROAD NETWORK

Aleppo, Syria • March, 2018

ROADS & BUILDINGS
BROAD AREA ANALYTICS



Syria
March 2018



North Korea
March 2018

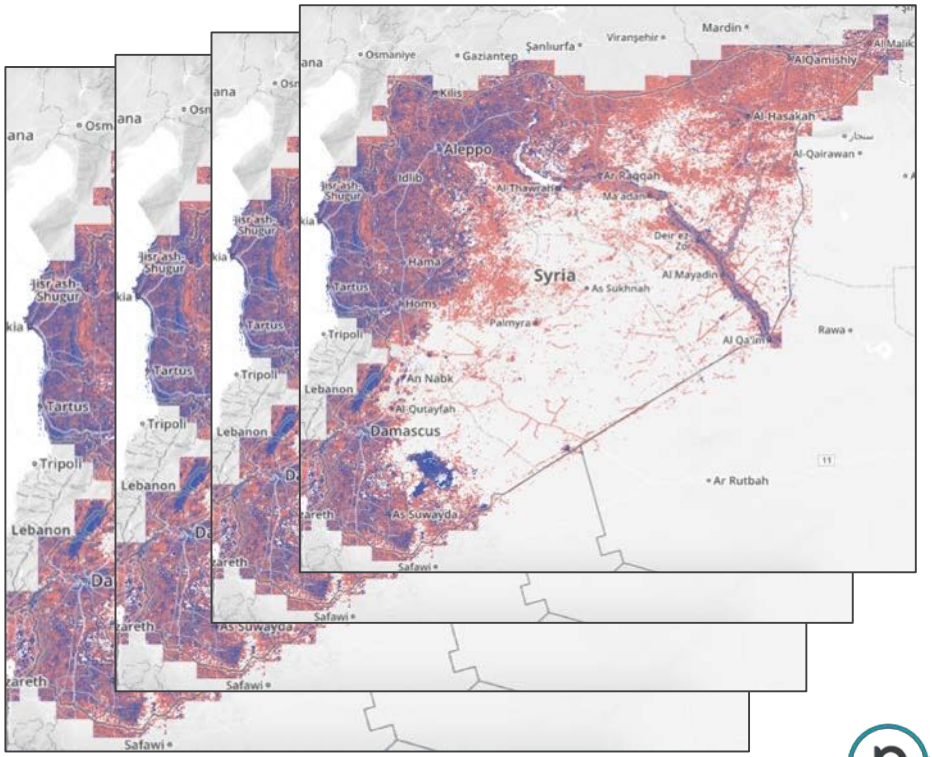
ROADS & BUILDINGS

CHANGE DETECTION AT SCALE

Leveraging Planet's daily cadence

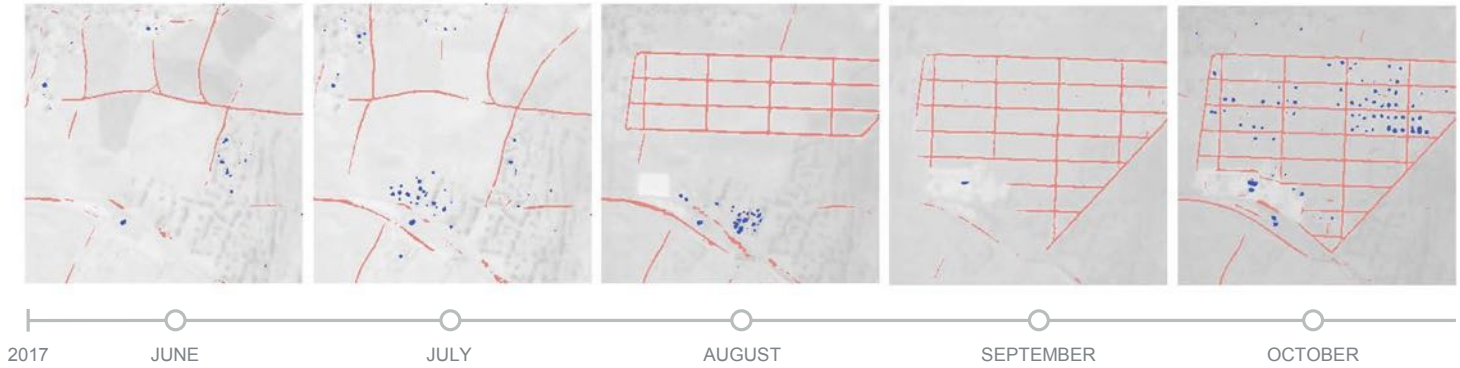
- Multiple observations allows for identification of *persistent change*
  - Reduction of false positives and noise
- More accurate change detection enables
  - Reduced man-hours searching for change
  - Efficient tasking of limited, costly resources
  - Fulfillment of more requirements and de risking

Impact: Enabling prioritization of resources based on real need rather than perceived/guessed need



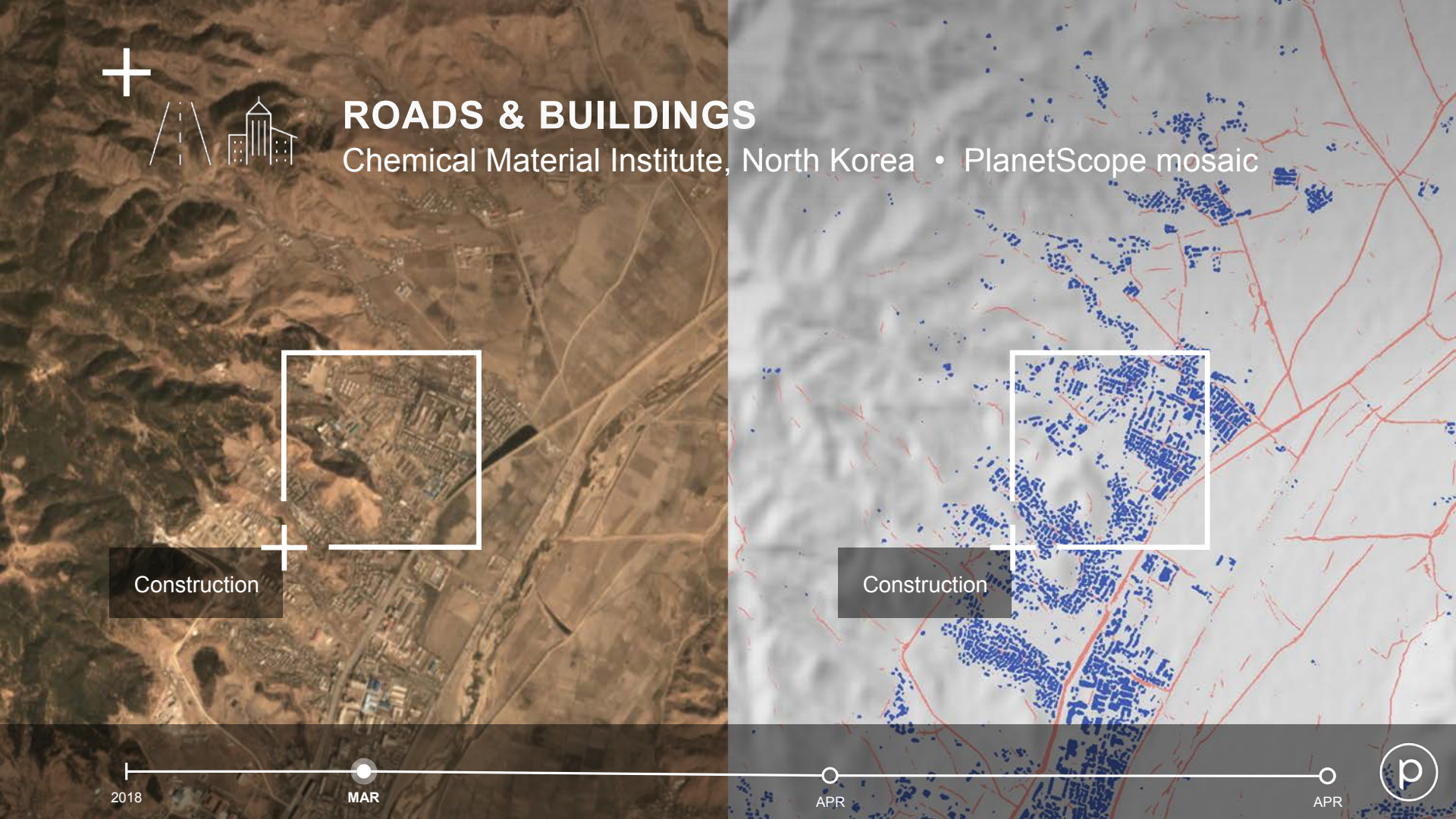
ROADS & BUILDINGS

IDP CAMP GROWTH IN SYRIA



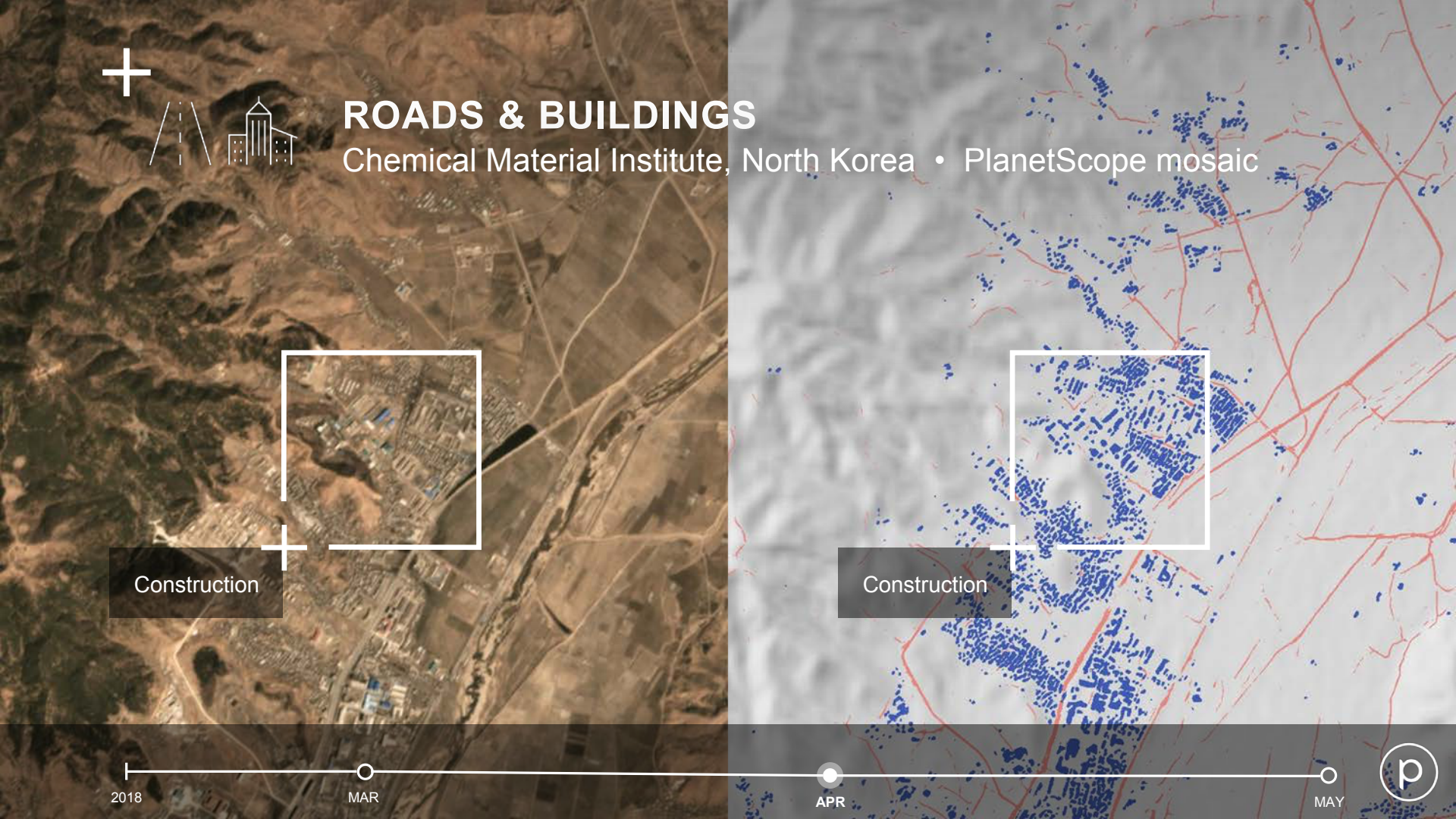
ROADS & BUILDINGS

Chemical Material Institute, North Korea • PlanetScope mosaic



ROADS & BUILDINGS

Chemical Material Institute, North Korea • PlanetScope mosaic



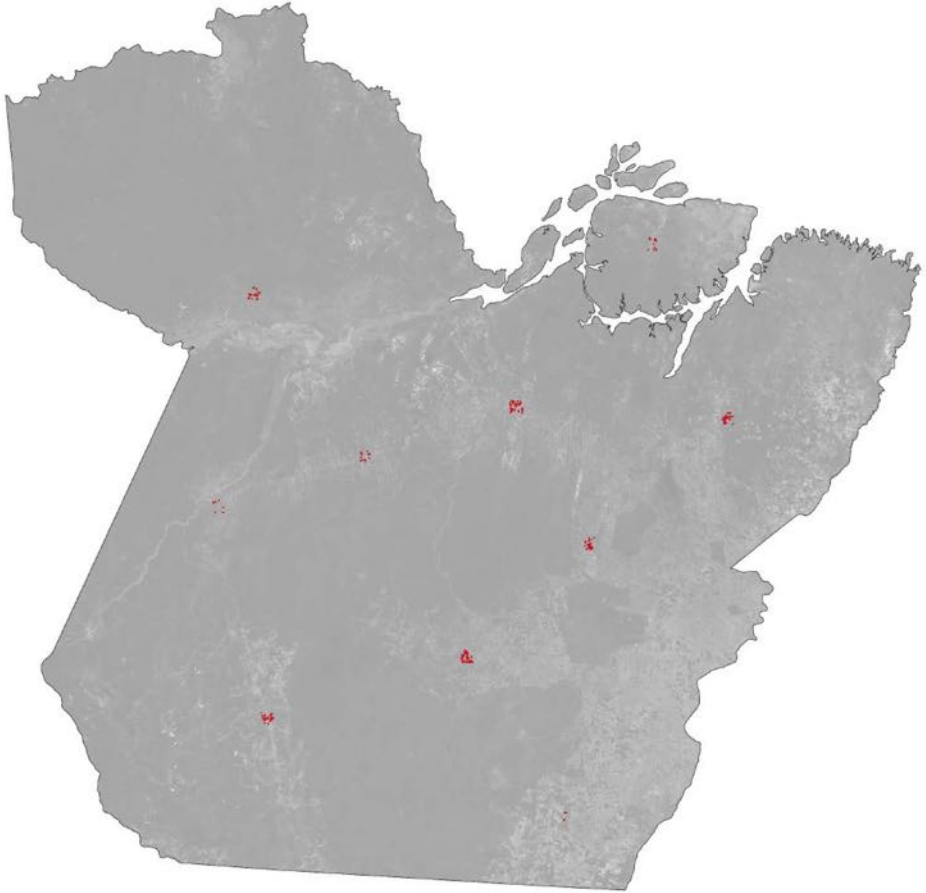
ROADS & BUILDINGS

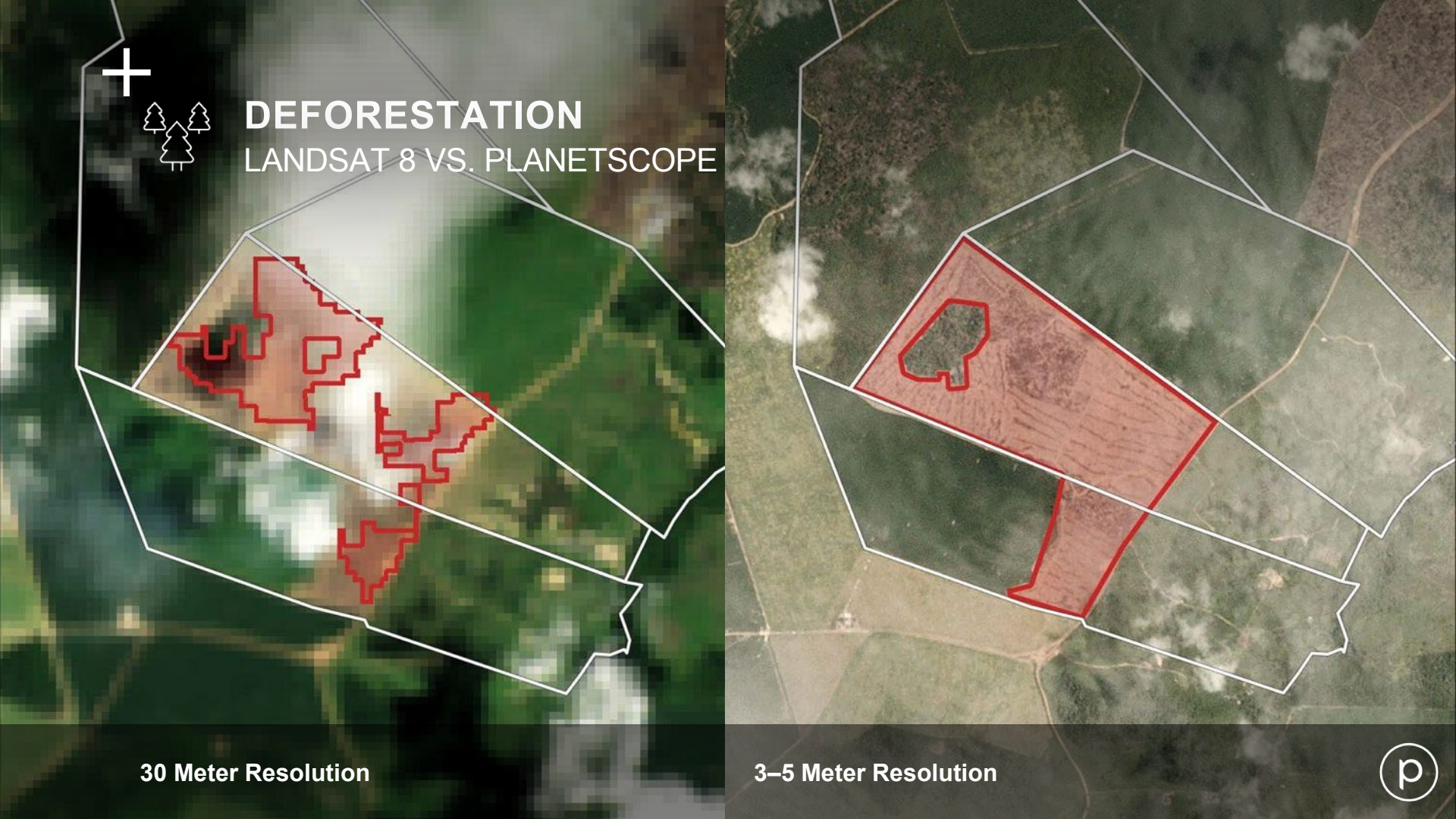
Chemical Material Institute, North Korea • PlanetScope mosaic

DEFORESTATION
DETECTIONS IN BRAZIL

Wide-scale coverage

- Starting with the Brazilian state of Pará, Planet analyzed several high priority AOIs, each approximately 38,200 hectares in area between September and October 2017.
- During that time we detected 354 areas over 1 hectare that had been deforested, totaling 1057 hectares.



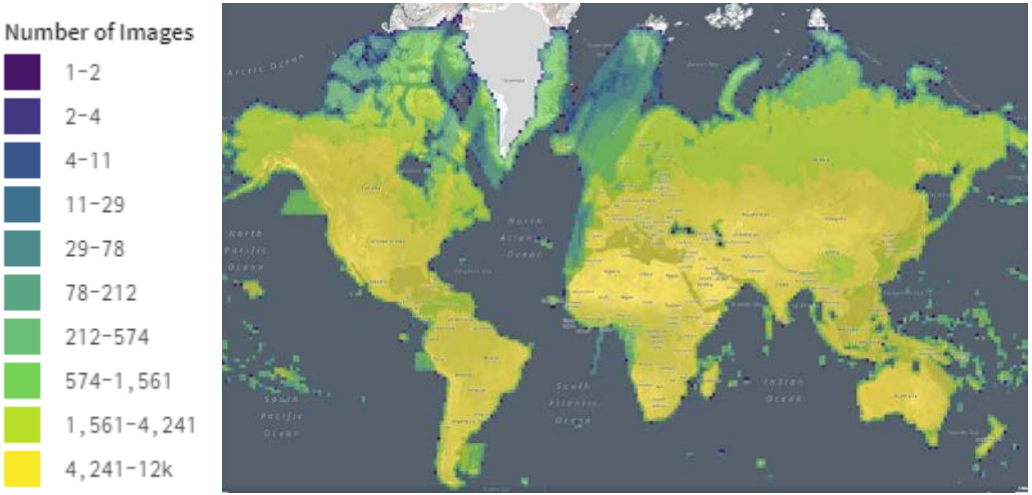

DEFORESTATION
LANDSAT 8 VS. PLANETSCOPE
30 Meter Resolution
3–5 Meter Resolution

ARCHIVE ADVANTAGE

6+ petabytes of training data

With an archive of 800+ images available for any given location, Planet generates an unparalleled amount data on which to train and refine its algorithms and establish historical baselines for change detection.

- PlanetScope and RapidEye archive since 2009
- SkySat archive since 2014



SPATIO TEMPORAL CHANGE DETECTION

PALU, INDONESIA

ANALYTIC READY DATA (ARD) FOR INTEROPERABILITY

LANDSAT-8
Sentinel-2
MODIS
Sentinel-3
VIIRS
AVHRR

Hyperion
EnMAP
SkySat
WorldView
TerraSAR-X
Sentinel-1

SuperDoves

calibration
interpolation
superresolution
georeferencing
tasking

harmonized stacks that are more than the sum of the parts

CONCLUSION

- With Mission 1, Planet has led the Small Sat revolution.
  With Mission 2 is now embracing the Deep Learning revolution.
- Analytics can yield high quality information from PlanetScope imagery.
- We are building a global, daily, temporally dense baseline of high resolution imagery that may eventually enable reliable global daily change alerts.
- The near future will see analytic interoperability (ARD) with Sentinel & Landsat.

THANK YOU!

QUESTIONS?

Reach out to giovanni@planet.com

Kure Atoll, Hawaii, USA – May 12, 2016

APPENDIX

London Array Wind Farm, United Kingdom – April 17, 2016