SCEPTERAIR
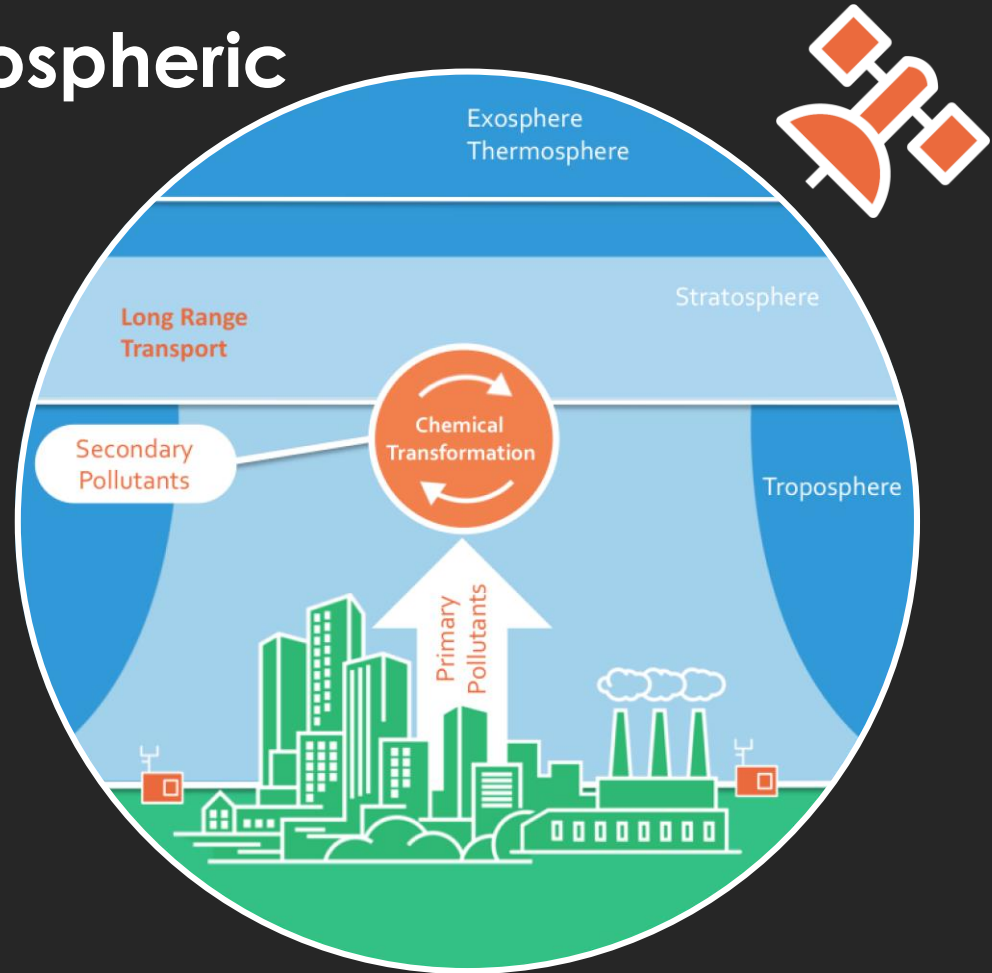
State-of-the-Art Atmospheric Monitoring via an Integrated Data Analytics Approach

Air Sensors International Conference
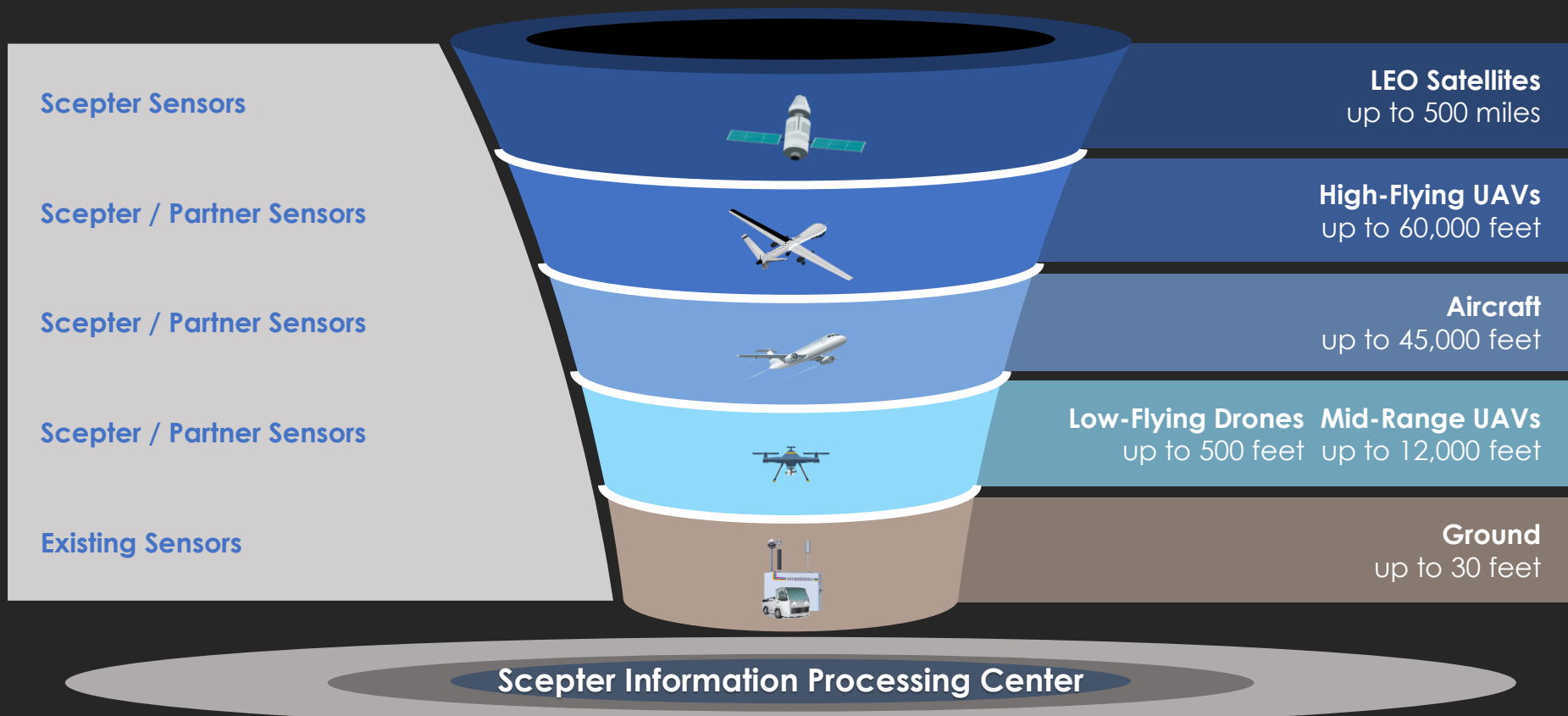
September 2018

Building a Global Atmospheric Monitoring System

❖ **Integrate and Visualize the Vertical Air Column**

❖ **Tackle the Next Big Data Frontier, Environmental Data**

Proprietary, but Leverage Free

Scepter Sensors — LEO Satellites up to 500 miles

Scepter / Partner Sensors — High-Flying UAVs up to 60,000 feet

Scepter / Partner Sensors — Aircraft up to 45,000 feet

Scepter / Partner Sensors — Low-Flying Drones up to 500 feet / Mid-Range UAVs up to 12,000 feet

Existing Sensors — Ground up to 30 feet

Scepter Information Processing Center

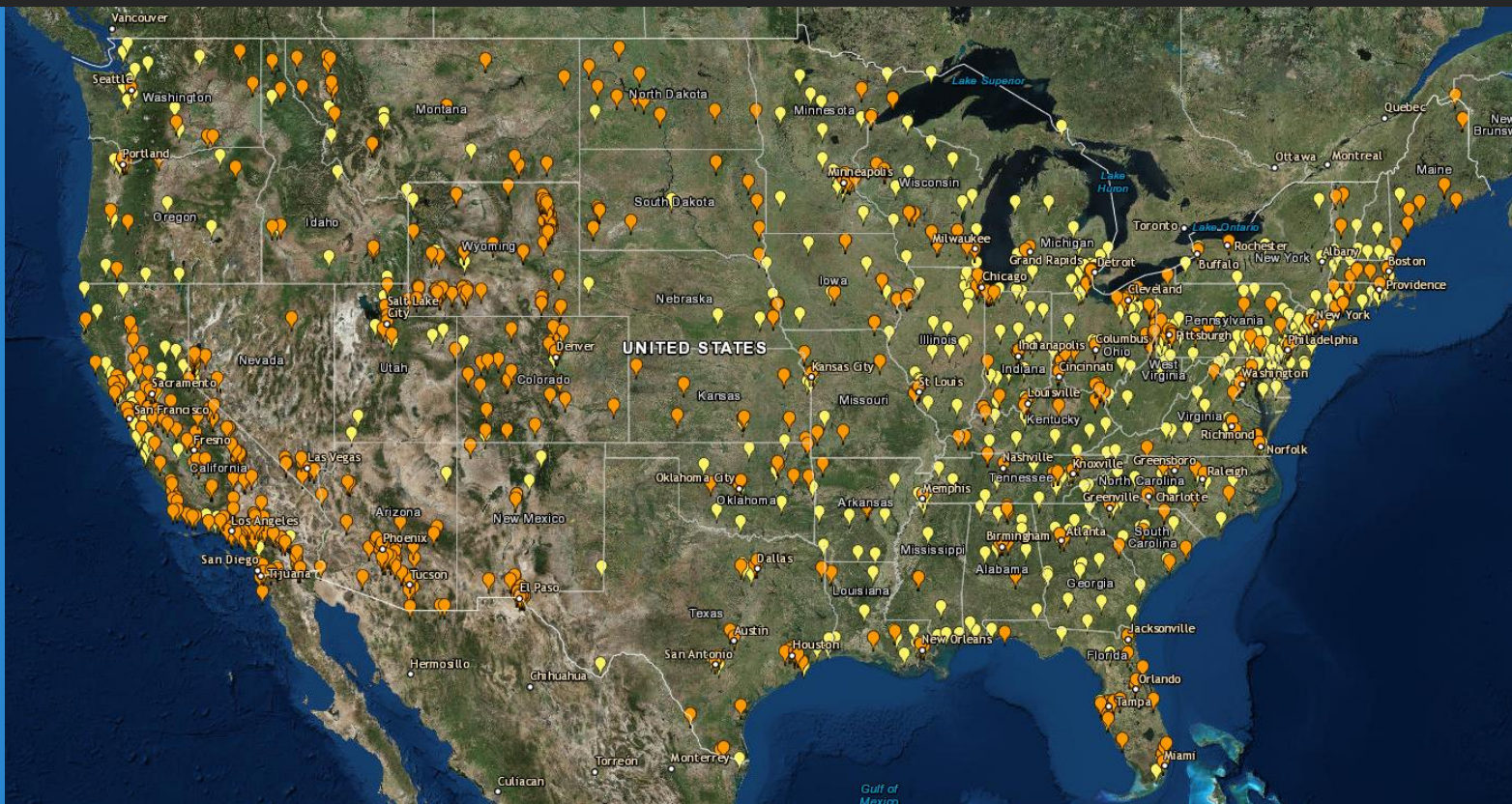# But Free Has Limitations; Spotty Coverage. . .

Active National Terrestrial Monitoring Stations

- PM 2.5 Monitoring Stations
- PM 10 Monitoring Stations

Transforming Atmospheric Data
Into Actionable Services – "Scepter Air"

Patent: "**Atmospheric Sensor Network and Analytical Information System Related Thereto**"

Sensors (Scepter and 3rd party)

Data Aggregation

Fusion

Analytics & Machine Learning

Presentation

Build and Implement via an Ecosystem

❖ **Technical capabilities and key stakeholders**

Key Target Markets

Monitoring & Compliance Verticals

Legislated and Self Reporting Needs

Commercial & Government Verticals

Revenue Enhancement, Cost Reduction, Strategic Decision Makings Needs

Climate Vertical

Leadership, Trust and Cost-effective Implementation Needs

Space-Based Sensor Network
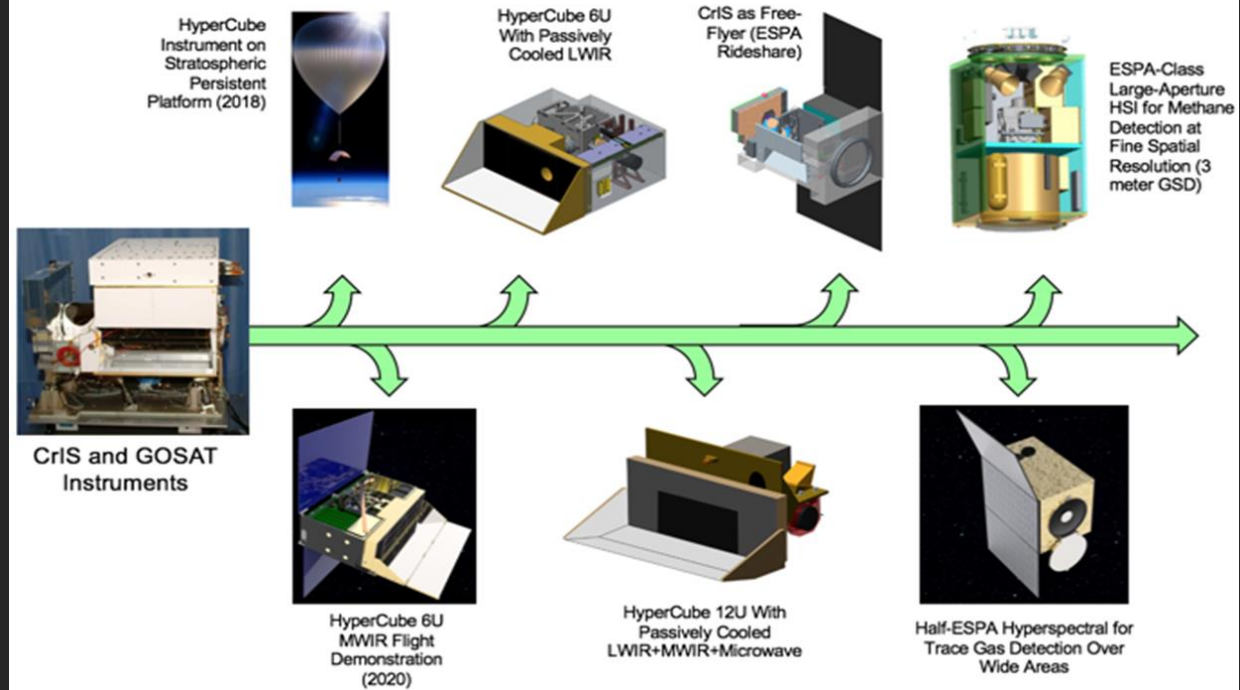## LEO Constellation Comprised of Up To 24 Satellites

❖ **Global coverage**

❖ **Real-time (< 1hr revisits)**

❖ **Suite of onboard sensors**

❖ **Vertical data profiles**

❖ **7-10 year design life**

❖ **SmallSat platform**

Sensor Partners:

❖ **Harris, Headwall Photonics, Maxar, DigitalGlobe, Surrey and others**

❖ **Hyperspectral, Infrared and others**

Harris is Miniaturizing our FTS Technology for a Family of Low-Cost Hyperspectral SmallSats

HARRIS

- HyperCube Instrument on Stratospheric Persistent Platform (2018)
- HyperCube 6U With Passively Cooled LWIR
- CrIS as Free-Flyer (ESPA Rideshare)
- ESPA-Class Large-Aperture HSI for Methane Detection at Fine Spatial Resolution (3 meter GSD)
- CrIS and GOSAT Instruments
- HyperCube 6U MWIR Flight Demonstration (2020)
- HyperCube 12U With Passively Cooled LWIR+MWIR+Microwave
- Half-ESPA Hyperspectral for Trace Gas Detection Over Wide Areas

Space-based Sensors Today:

Scepter / DigitalGlobe Aerosol Optical Depth[1]

Quick Access to Space
Two Parallel Paths

❖ **International Space Station (ISS) / CASIS**
  - Initial application accepted / business plan under accelerated review
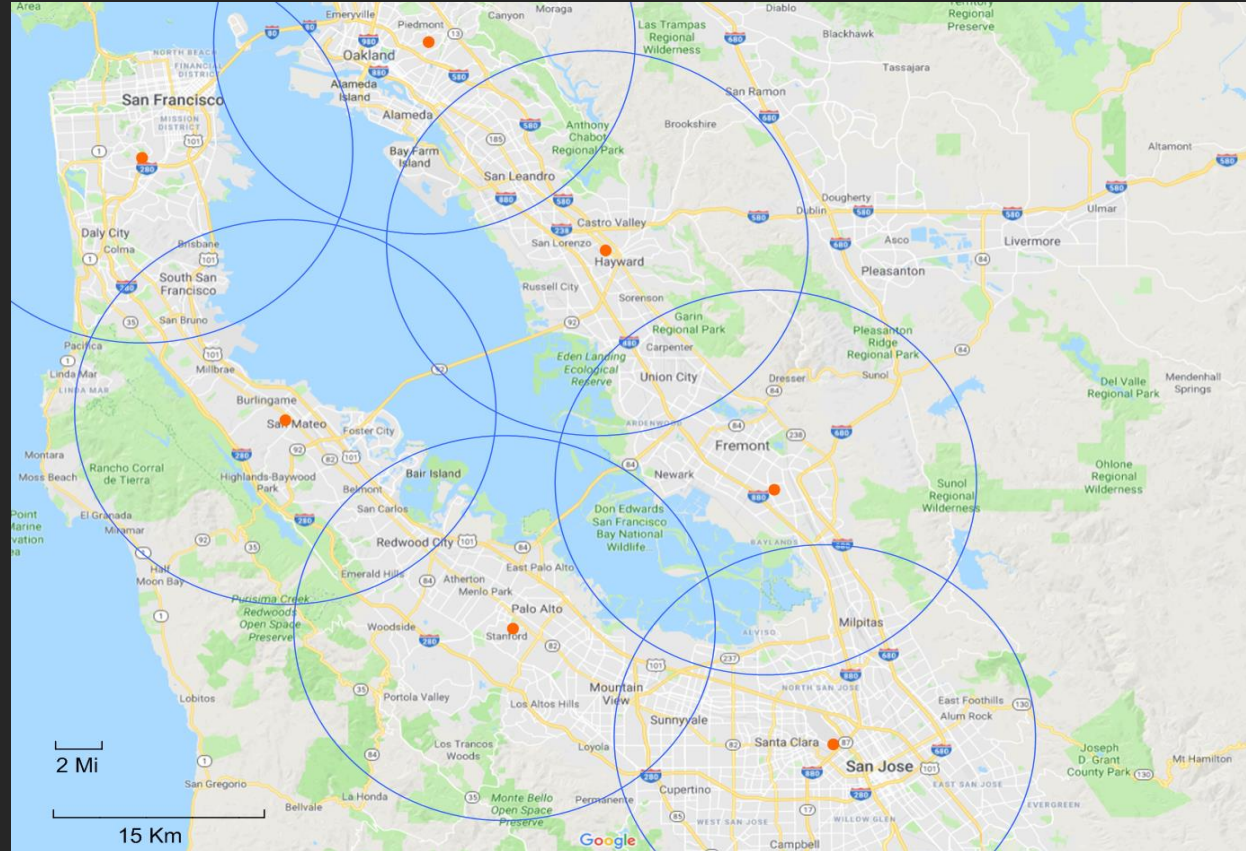 - ISS as Scepter sensor staging platform

❖ **DigitalGlobe**
  - Block 1.0 , two satellite constellation
  - Flexible bus
  - Falcon 9 2021 manifest
  - Customers

How We Can Help: Examples

❖ **AB 617, Phase 1: LiDAR**

- **Useful sampling range: 15 km**
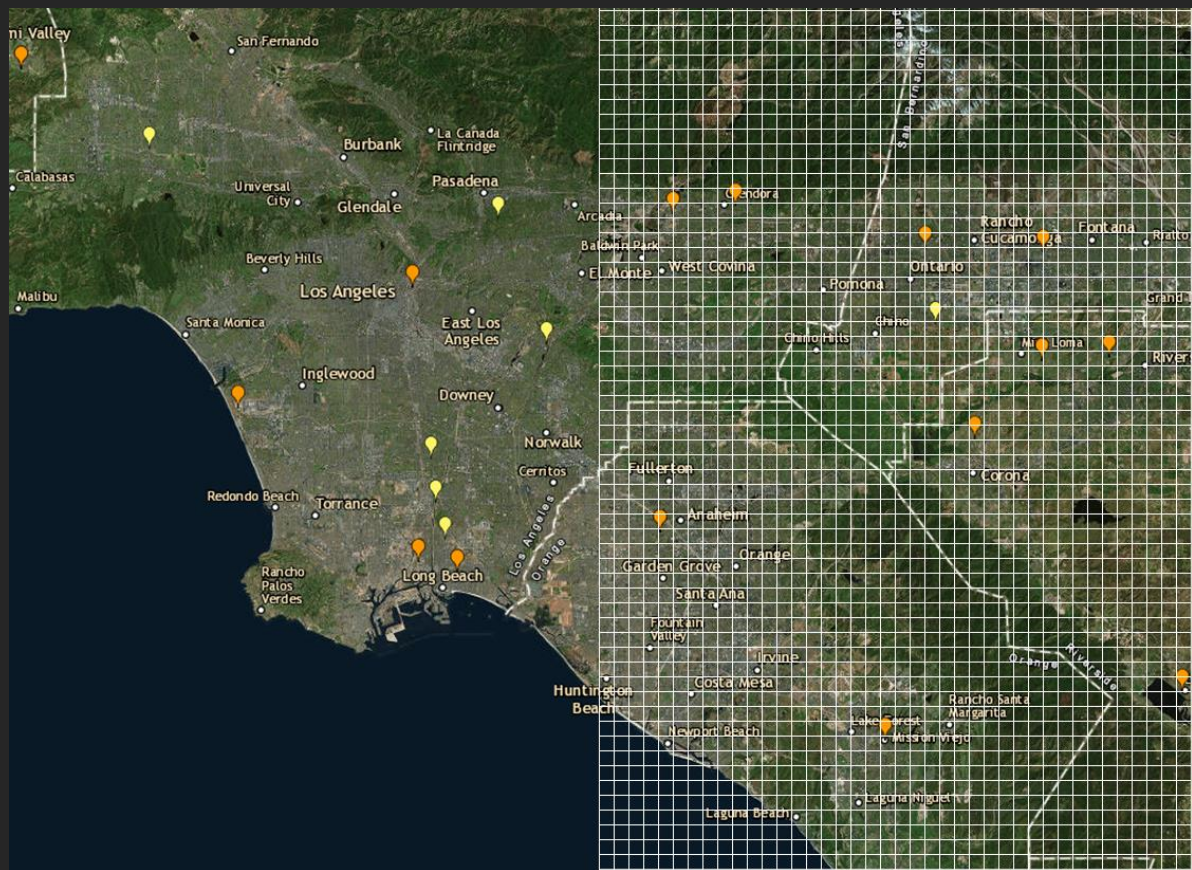
- **Useful sampling area: 700 km²**

How We Can Help: Examples

❖ **AB 617: Space-based fill in the gaps and more**

Active National Terrestrial Monitoring Stations

🟡 PM 2.5 Monitoring Stations

🟠 PM 10 Monitoring Stations

Los Angeles Area versus Satellite View

How We Can Help: Examples

❖ **Health Effects Alert Services**

Today

Air Quality Index Levels of Health Concern	Numerical Value
Good	0 to 50
Moderate	51 to 100
Unhealthy for Sensitive Groups	101 to 150
Unhealthy	151 to 200
Very Unhealthy	201 to 300
Hazardous	301 to 500

With Scepter

Symptom	Exposure	Pollutant	Effect	Actionable
Myocardial infarction (MI	25 $\mu g/m^3$ PM$_{2.5}$ 2 hours	<PM2.5 ambient air	28%-41% increase per exposure *1996	√
In Utero development	Accumulative 9 months	Diesel exhaust VOC PM$_{2.5}$ -PM$_{10}$		√
Renal function cardiovascular	Accumulative	> PM$_{2.5}$ ambient air VOC		√
Systemic Lupus	1-7 days Accumulative	> PM$_{2.5}$, BC, and NOx, 03		√
Asthma	15 min Accumulative	Urban PM$_{10}$ PM100 NO2 CO VOC O$_3$		√
Atherosclerosis		>PM$_{2.5}$ ambient air		√
Cardiopulmonary disease	14 days Accumulative	>PM$_{2.5}$ ambient air	21 % Acute decompensated heart failure (ADHF)	√
Respiratory disease	1-3 days Accumulative	Urban PM$_{2.5}$ PM$_{10}$ NO$_x$		√

Overview: Samantha R.

VITALS
Weight: 175 lbs — +5
BMI: 27
Height: 5'8"
Blood Pressure: 120/80 — +10
Heart Rate: 86bpm
Temperature: 98.3F° — -3

MEDICATIONS
Insulin Glargine: 100ml
Propranolol: 40mg
Advil: 200mg

PAIN
Right Knee: 7-8
pain when walking up and down stairs
Abdomen: 3-4
mild pain in lower stomach area

KAISER PERMANENTE.

Source: App example from Redshift Digital,

Emerged from Stealth Mode

SPACENEWS

5th edition
LATSAT
May 15-16, 2018 / Mexico City

Scepter Inc. unveils plan for global atmospheric monitoring constellation

by Debra Werner — March 23, 2018

Philip Father, Scepter chief executive, and former DigitalGlobe executive Rafay Khan, discuss plans for a global constellation of atmospheric-monitoring satellites at Space Systems Loral, a Maxar Technologies company. Credit: SSL.

PALO ALTO, California — Scepter Inc., a Silicon Valley startup, unveiled plans March 22 to launch a constellation of satellites to provide global atmospheric monitoring services for government and commercial customers.