SNAP Lab

UNSW THE UNIVERSITY OF NEW SOUTH WALES

High Accuracy Indoor Positioning: Multipath Mitigation via Locata's Beam-Forming Antenna Technology

Never Stand Still

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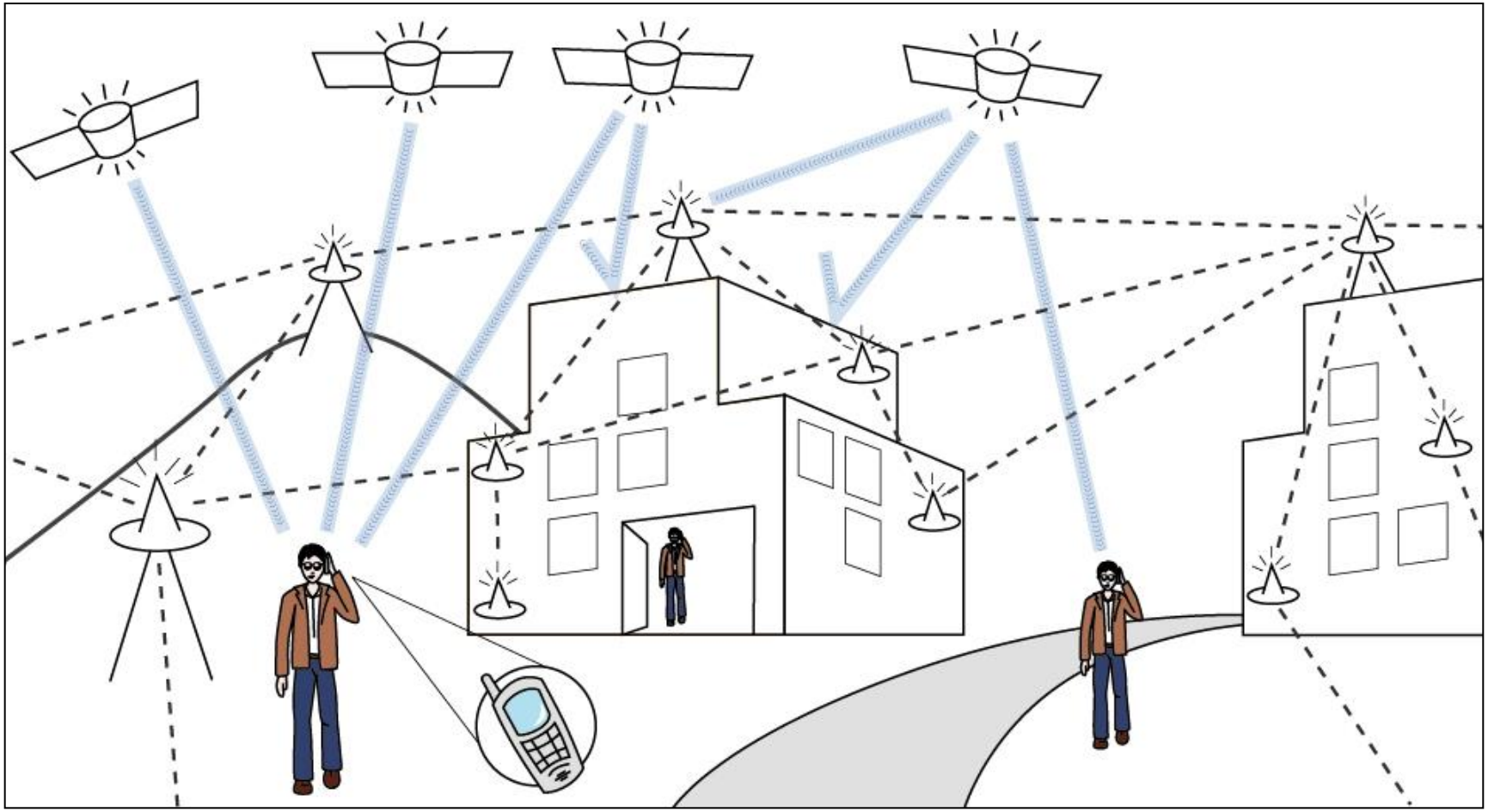
UNSW AUSTRALIA

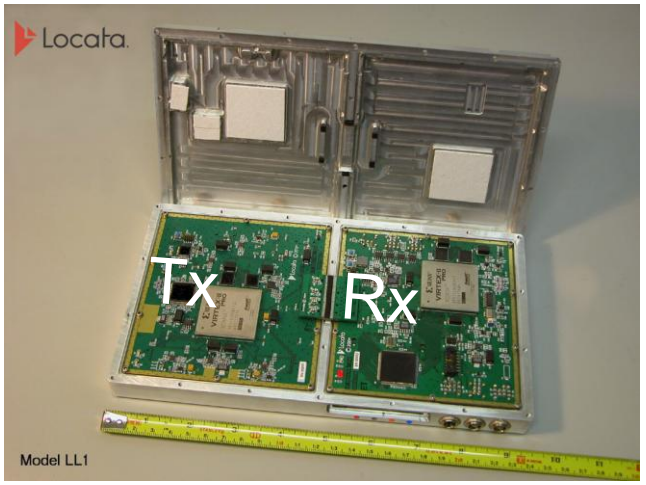
Locata Positioning Concept

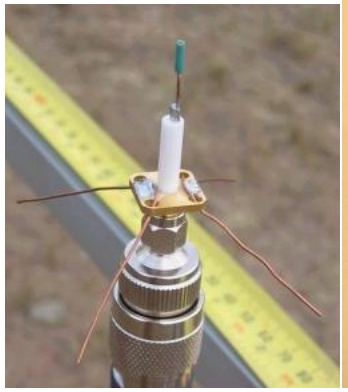


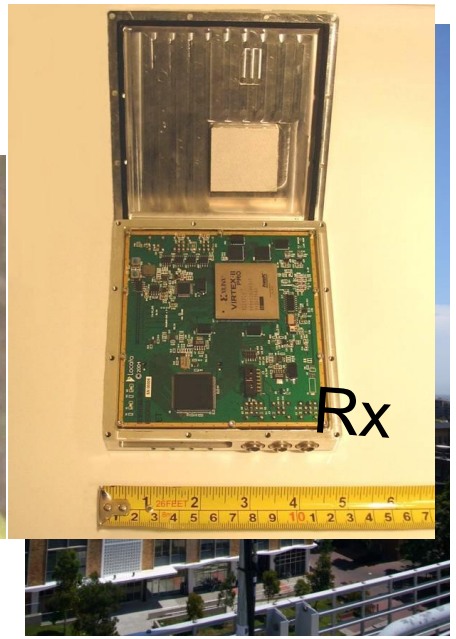
LocataLites form a time-synchronised positioning network – *supporting either GNSS+Locata or Locata-only Precise Positioning (cm-level accuracy)*

Locata Components

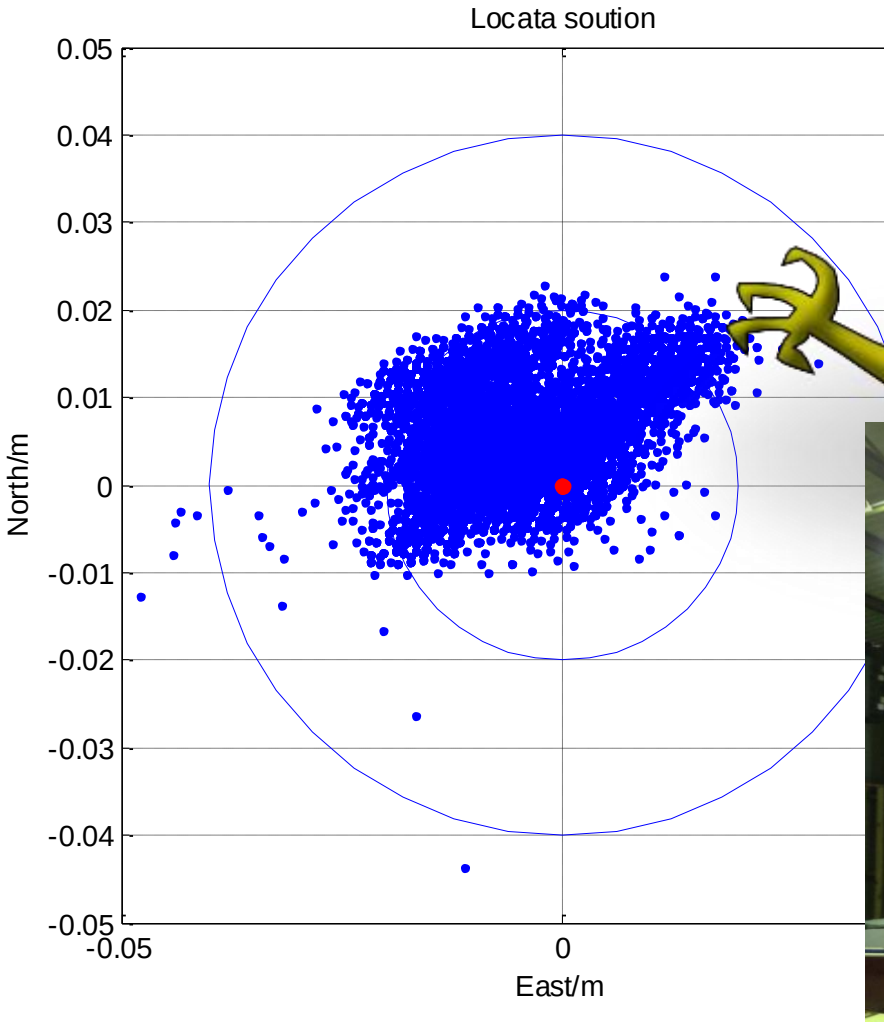
- Signal Structure
  - Licence-free ISM frequency band (2.4GHz)
  - Dual-frequency carrier signals
  - CDMA PRN codes
  - Precise TDMA pulsing
  - >1 Watt output power - *range of over 10's km*
- *LocataLite*
  - Time-synchronised transceiver network
  - Dual Tx antennas
  - Uses low-cost clock, shared by receiver section
  - Network time is "relative" to master LL
- *Locata Receiver*
  - CPH or PR single point-positioning
  - CPH requires ambiguity resolution
  - Real-time positioning at 10Hz





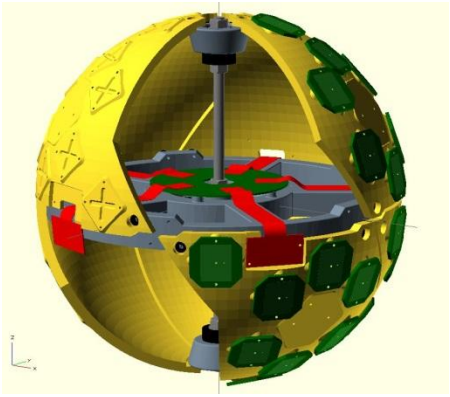


Indoor Positioning Results... Sept 2012



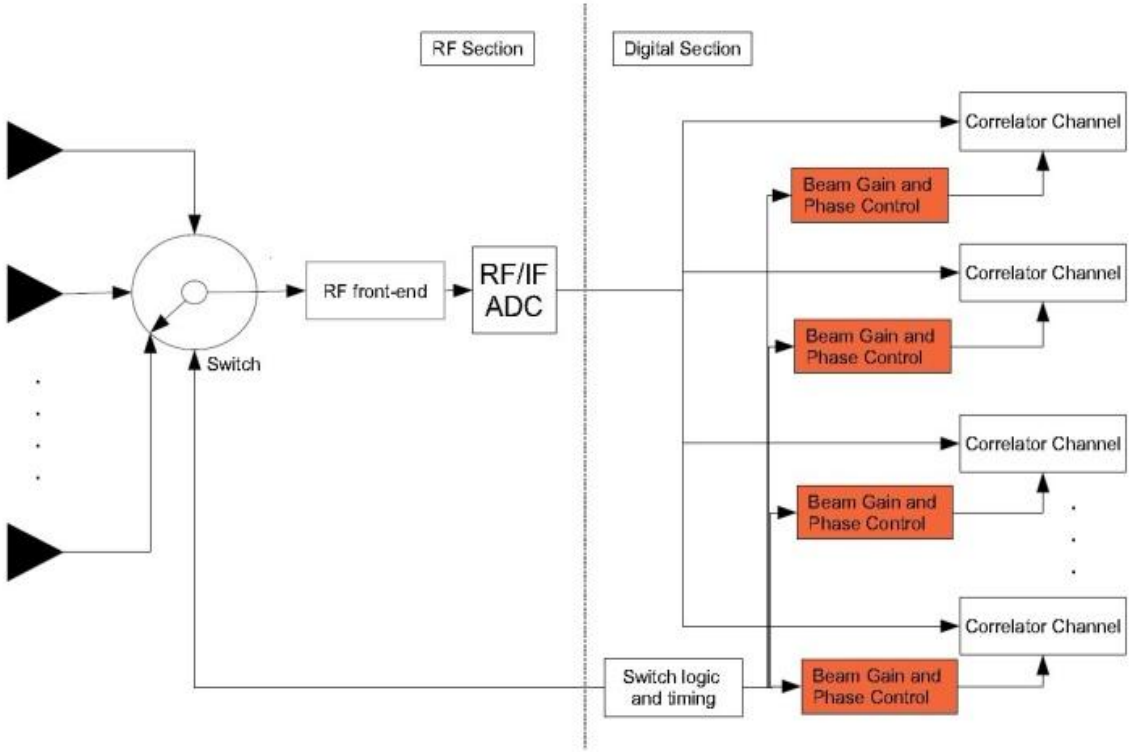
VRay™ Antenna

- Utilises an array of antenna elements... *but is not a conventional phased array anetnna*
- Takes advantage of *Locata's* proprietary signal structure and time synchronisation... *SW-controlled "correlator beam-forming" technique*
- Dynamically tracks *only* direct line-of-sight ranging signals... *and knows where the signal transmitters are located, hence "locks-out" spurious or multipath signals*

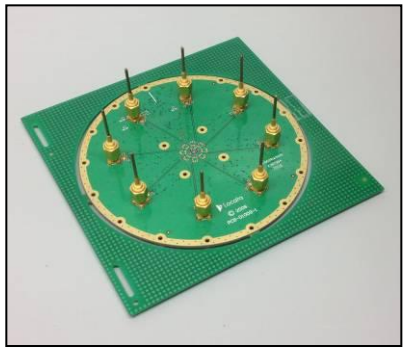


Correlator Beam-Forming (CBF)

- Only one RF front-end, but multiple antenna elements
- CBF creates beams by sequentially switching through each element of an antenna array and forming the beam with phase and gain corrections in the receiver's individual channel correlators
- VRay antenna is capable of pointing multiple beams simultaneously in different directions



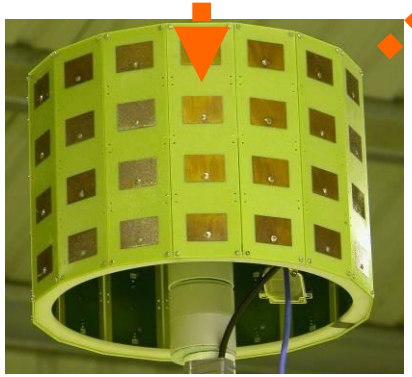
VRay Antenna Development



2007: first proto, 8-element
1-dimensional – 12 cm diam.

2011: 3rd proto, 80-element
3-dimensional – 35 cm diam.

2014: production version, 80-element
3-dimensional – 35 cm diam.
This antenna is called an Orb 80



2009: 2nd proto, 64-element
2-dimensional – 30 cm diam.

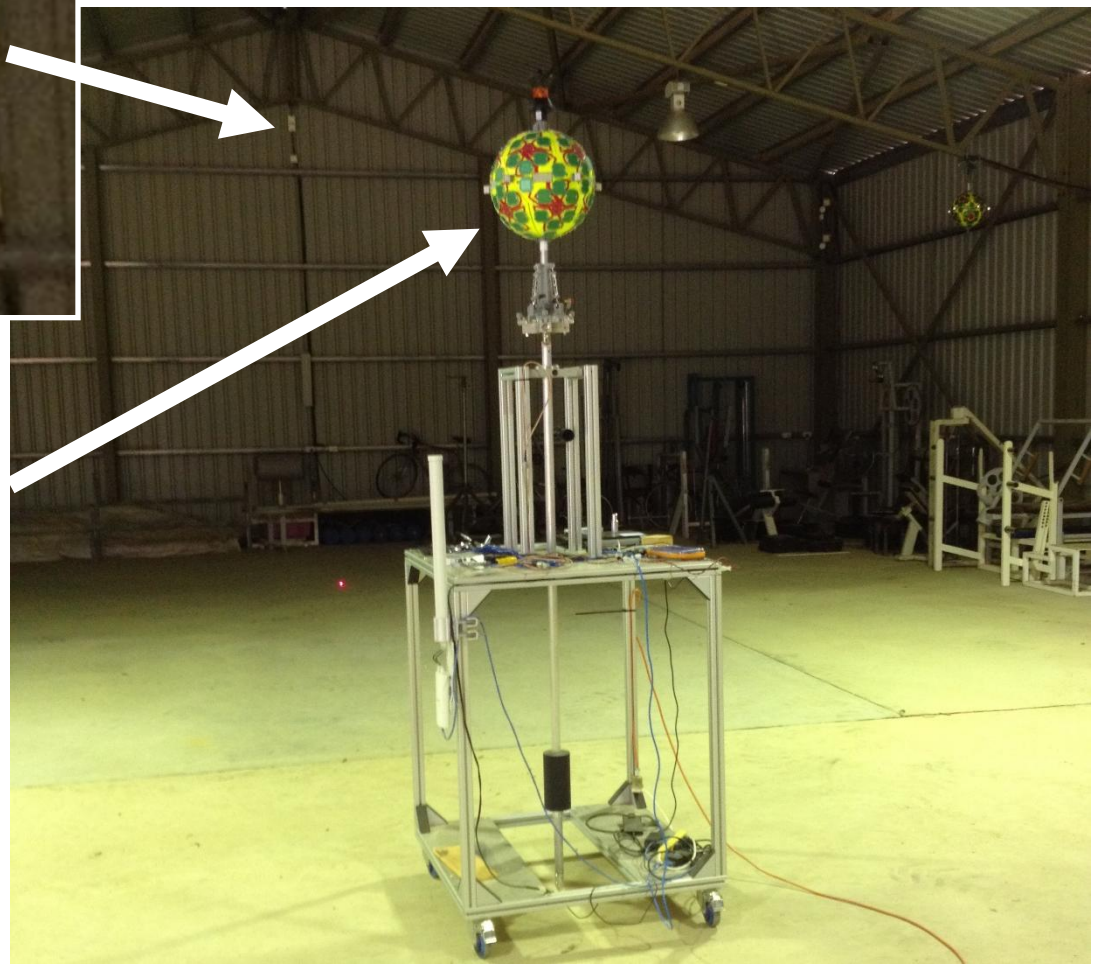
2014: production Orb 80 illustrated on a ground-penetrating radar system, used to find and map underground assets (pipes, cables, water mains, etc) for city surveying.

VRay Development - Phase 1

NOTE!
Simple patch antennas for Locata transmitters

VRay = RECEIVE ANTENNA

NOTE !
Complex VRay antennas for Locata receivers



VRay Development – Phase 2

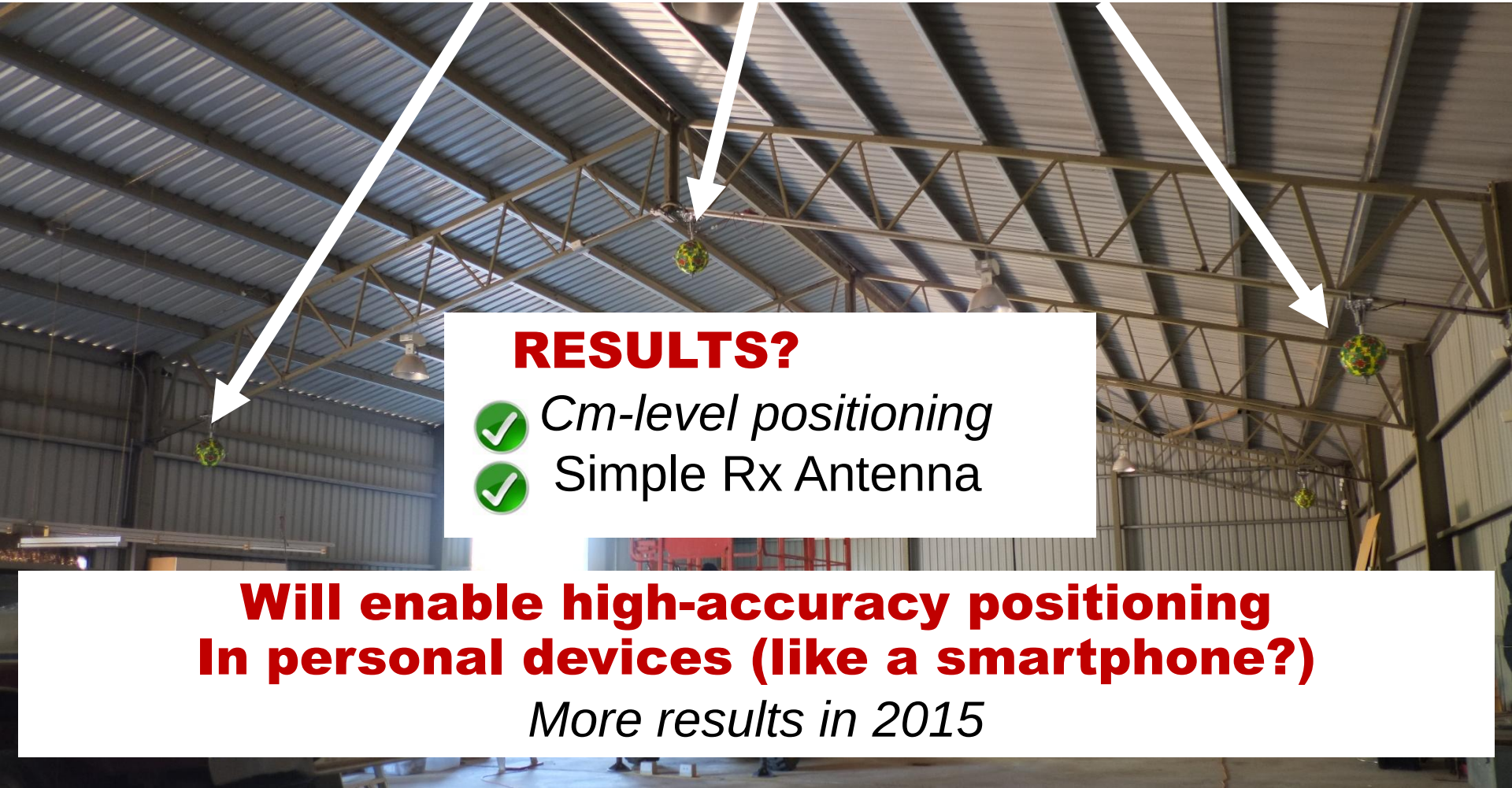
VRay = TRANSMIT ANTENNA!

The original VRay method can be
INVERTED
to be a complex transmit antenna
with a SIMPLE RECEIVE antenna

Remote correlator beam-forming...
Same multipath mitigation benefits

VRay Development – Phase 2

VRay = TRANSMIT ANTENNA!



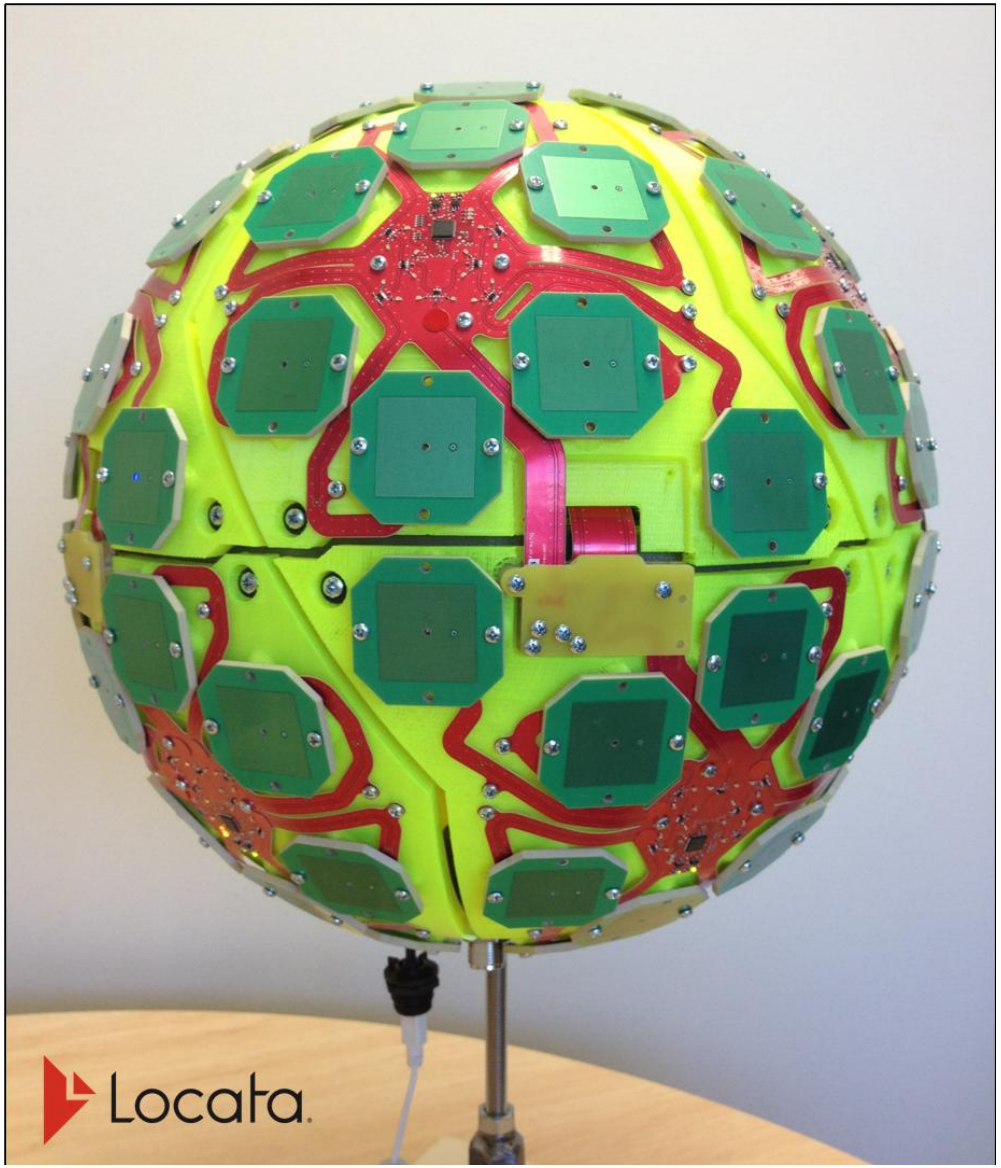
RESULTS?

- *Cm-level positioning*
- Simple Rx Antenna

Will enable high-accuracy positioning
In personal devices (like a smartphone?)

More results in 2015

New Antenna Technology for Precise Indoor Positioning



Vray Orb Antenna

MULTIPATH SOLUTION FOR LARGE MACHINES

- ✓ Warehousing
- ✓ Supply-chain & logistics
- ✓ Ports
- ✓ Machine automation
- ✓ Indoor positioning for industrial environments

***Inverse variant is coming*... which will make more user applications viable** (can also be adapted for GNSS rxs)