

IGNSS 2018

# **NEW GENERATION OF PRECISE POINT POSITIONING: EXPLOITING SYNERGIES WITH SIS-BASED POSITIONING AUGMENTATION SERVICES**

February 9<sup>TH</sup> , 2018

**Session: Precise Point Positioning**

D. Calle, E. Carbonell, M. González, C. Mezzera, B. Torres, J. Barrios, G. Fernández

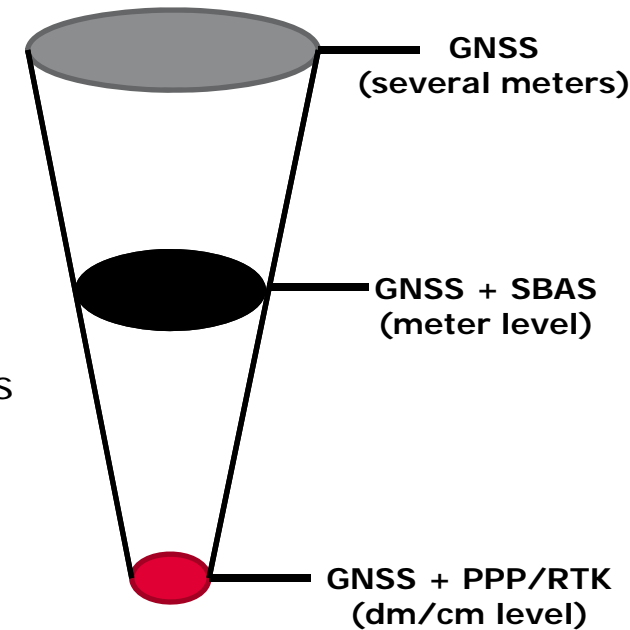
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# IGNSS 2018 HA GNSS POSITIONING

# HOW DOES HA AUGMENTATION WORKS?

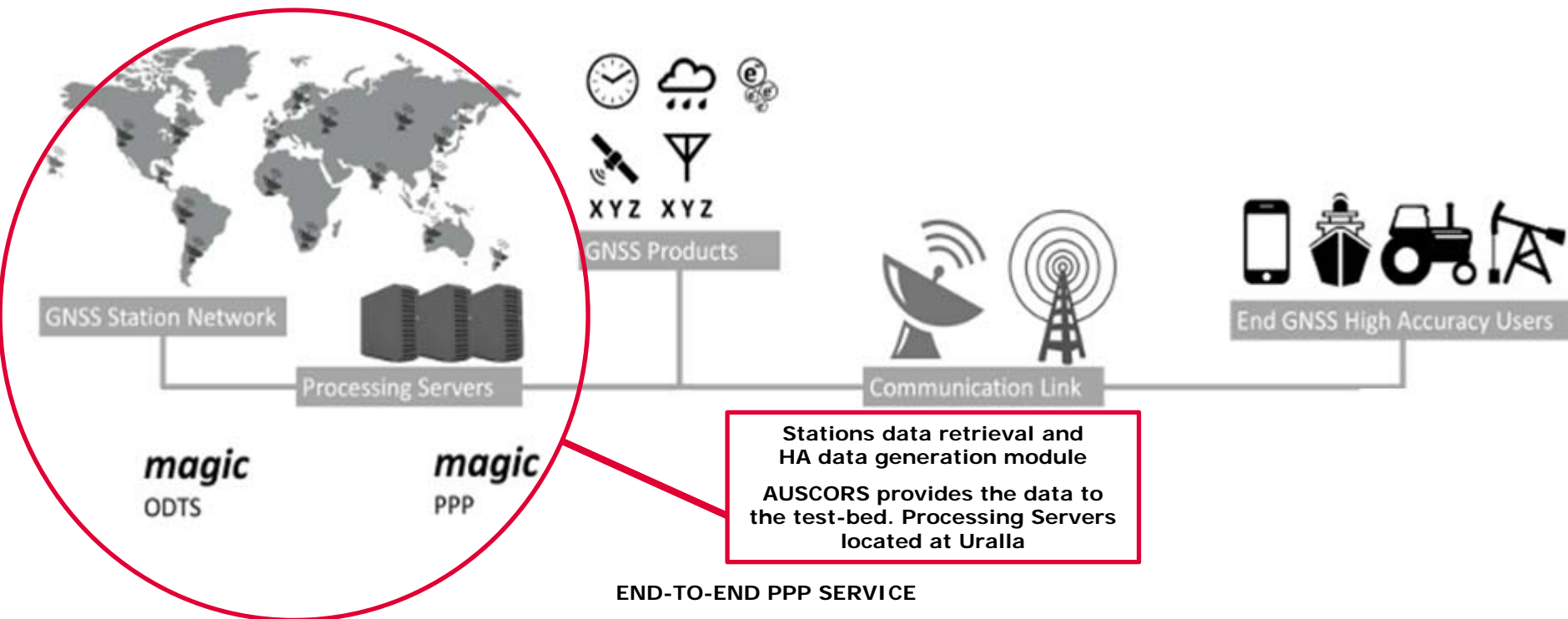
- Two working modes:
  - GNSS standalone
  - GNSS Augmented: Ancillary info is provided to the GNSS users through a third channel. SBAS , PPP, RTK
- GNSS+SBAS relies on code measurements and GEO augmentation.
- GNSS+PPP uses augmentation of satellite orbits and clocks plus phase measurements:
  - Price to pay, estimation of phase ambiguity
  - Convergence concept
- User performance driven by
  - User conditions (fading, high-multipath...)
  - Augmentation information availability/aging and positioning user algorithm.



# IGNSS 2018 END-TO-END SYSTEM

END-TO-END SYSTEM

# *magicGNSS'* REAL TIME INFRASTRUCTURE



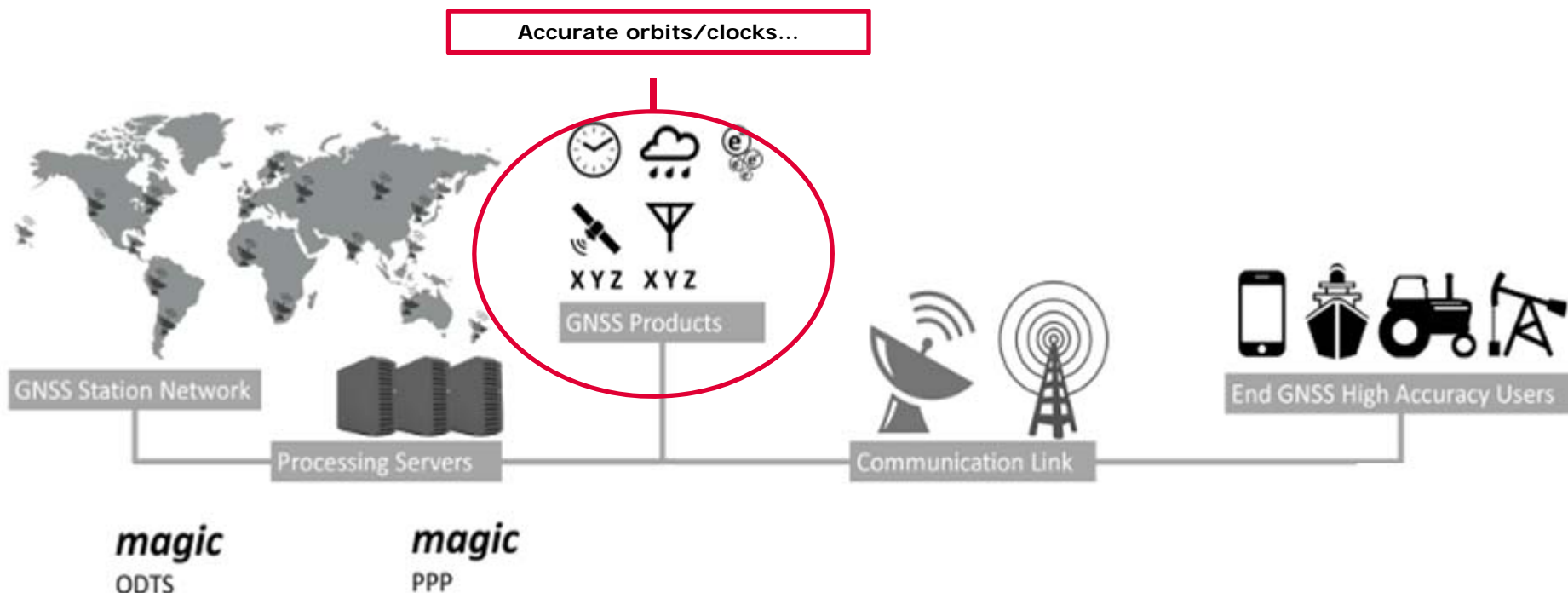
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# *magicGNSS'* REAL TIME INFRASTRUCTURE



END-TO-END PPP SERVICE

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# *magicGNSS'* REAL TIME INFRASTRUCTURE



END-TO-END PPP SERVICE

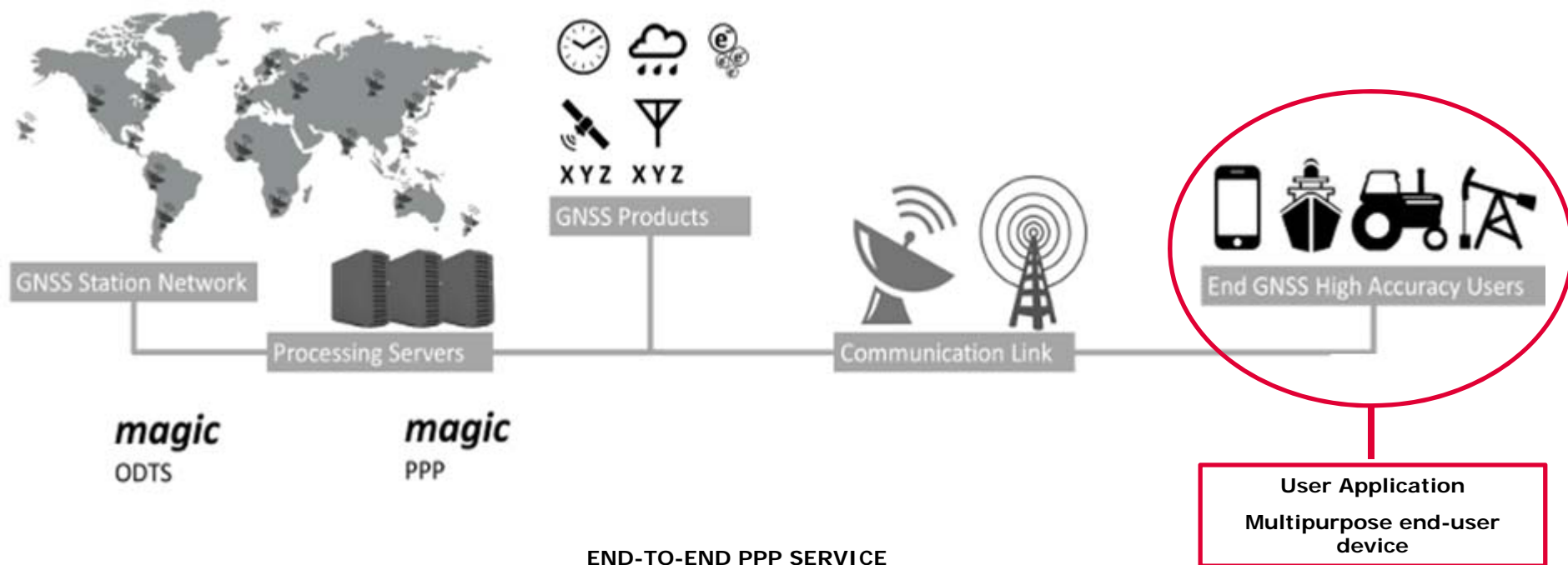
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# *magicGNSS'* REAL TIME INFRASTRUCTURE



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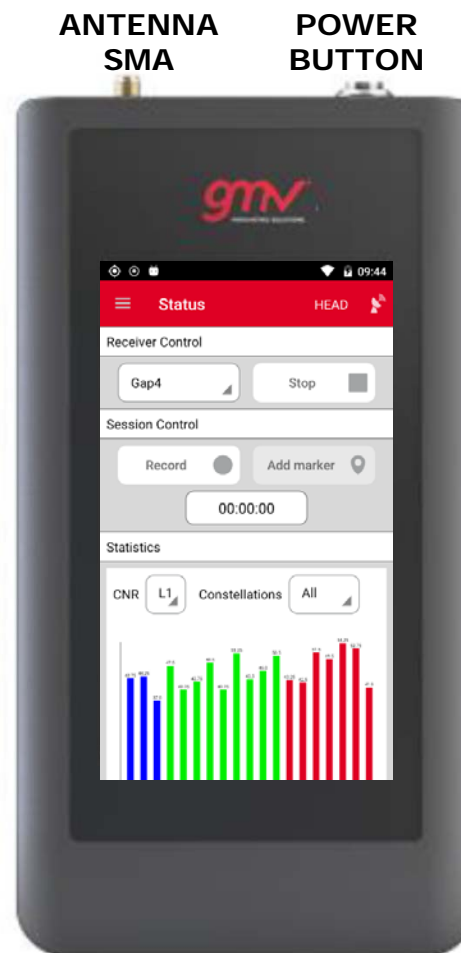
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# USER TERMINAL

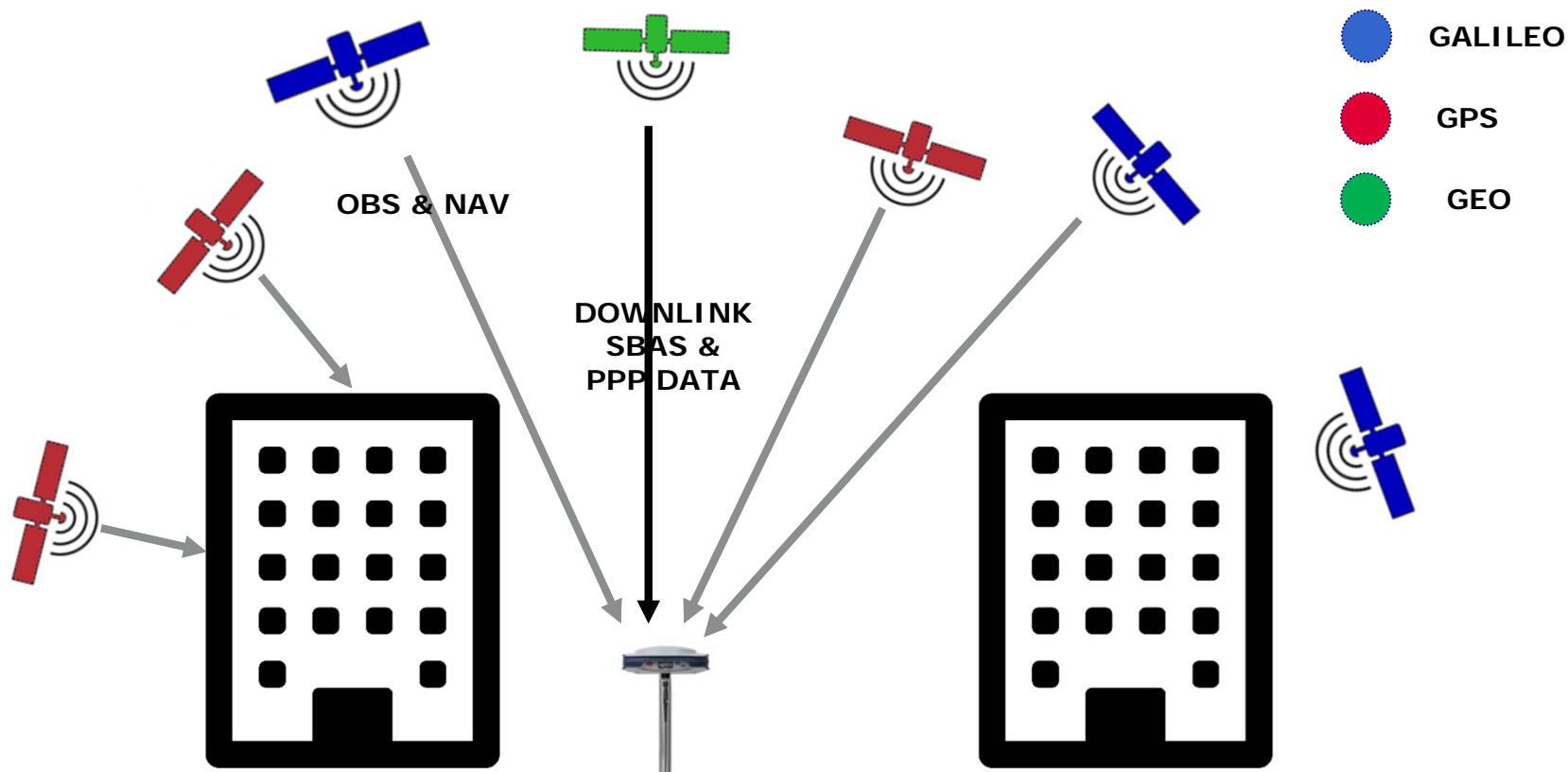
Two generations of user terminals have been developed

- First version composed by several elements: Linux tablets, SBAS Rx, COTS Rx...
- New generation: Integrated user terminal. All-in-one concept, the antenna is the only external element
  - Android-based
  - Includes SBAS user terminal and PPP applications
  - GPS+GAL+SBAS
  - Compatible with GEO, SISNET, PPP proprietary
  - Wifi/3G and Bluetooth connectivity



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# PROCESSING INFRASTRUCTURE IN AUS-NZ



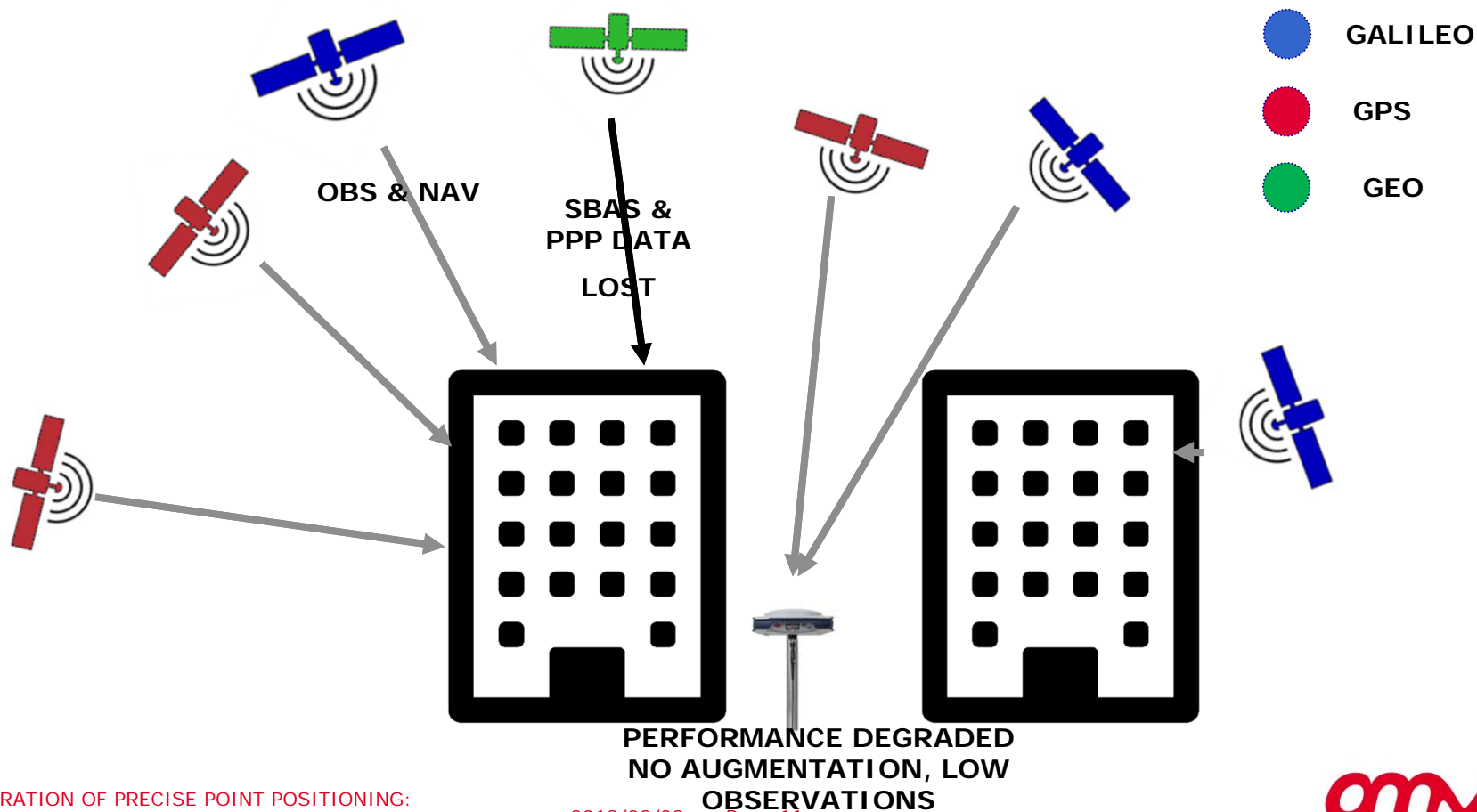
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# PROCESSING INFRASTRUCTURE IN AUS-NZ



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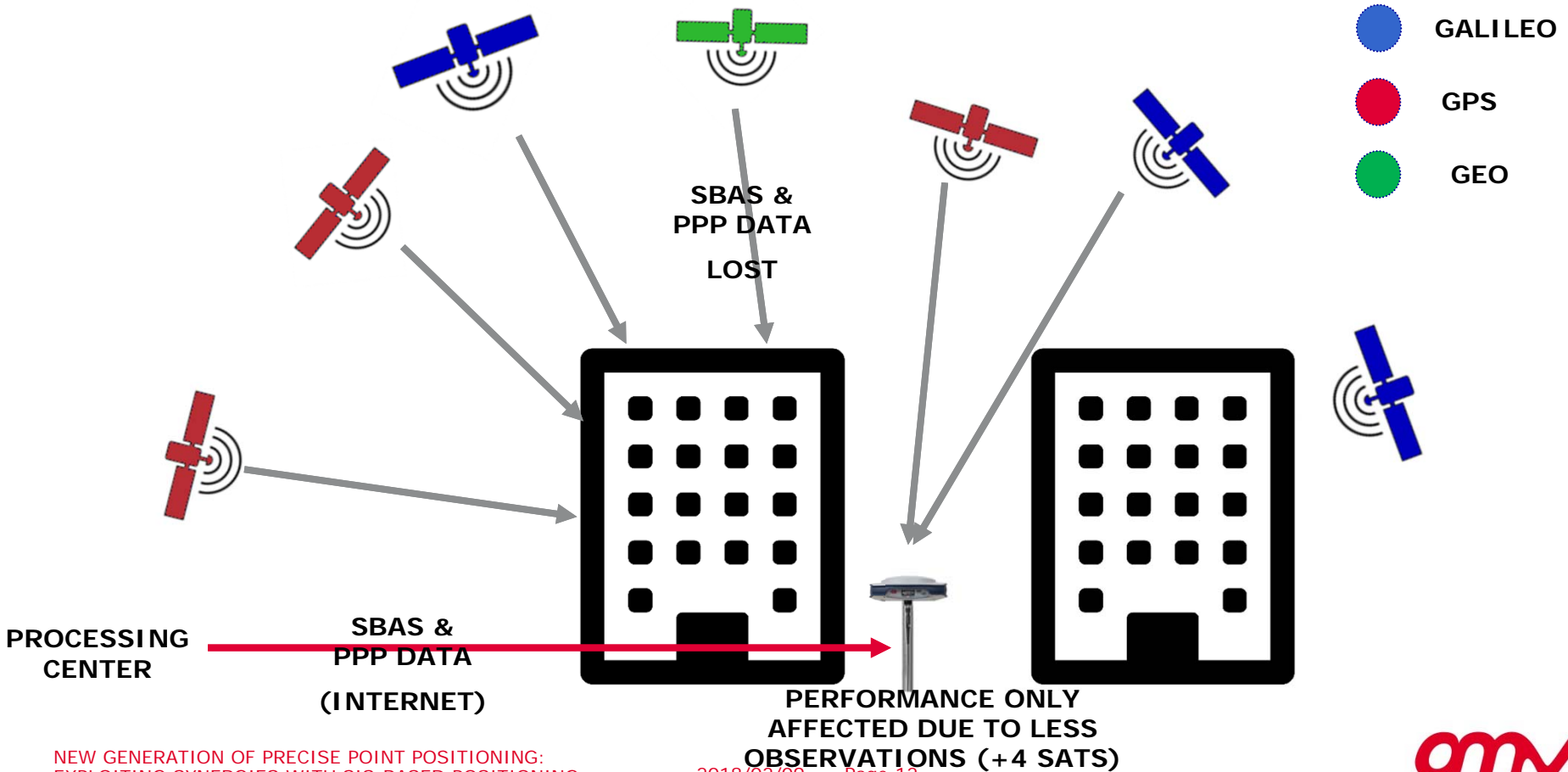
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# PROCESSING INFRASTRUCTURE IN AUS-NZ



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# IGNSS 2018 TEST CAMPAIGN



# TESTING SCENARIOS

## ■ In Madrid:

- Test#1 - Logo Scenario:
  - Open sky, kinematic. Walking user dynamics
  - Three receivers: PPP internet augmentation, PPP-SBAS SISNET augmentation and PVT not augmented
- Test#2 - Automotive Scenario:
  - Different conditions: Open sky, bridges, soft and hard-urban.
  - Two receivers: PPP internet augmentation, PPP-SBAS SISNET augmentation

## ■ In Australia:

- Test#3 – Boat Trip Scenario:
  - Different dynamics
  - Changing conditions, partially open-sky and partially harsh.



TEST CAMPAIGN

# TEST#1 – LOGO SCENARIO



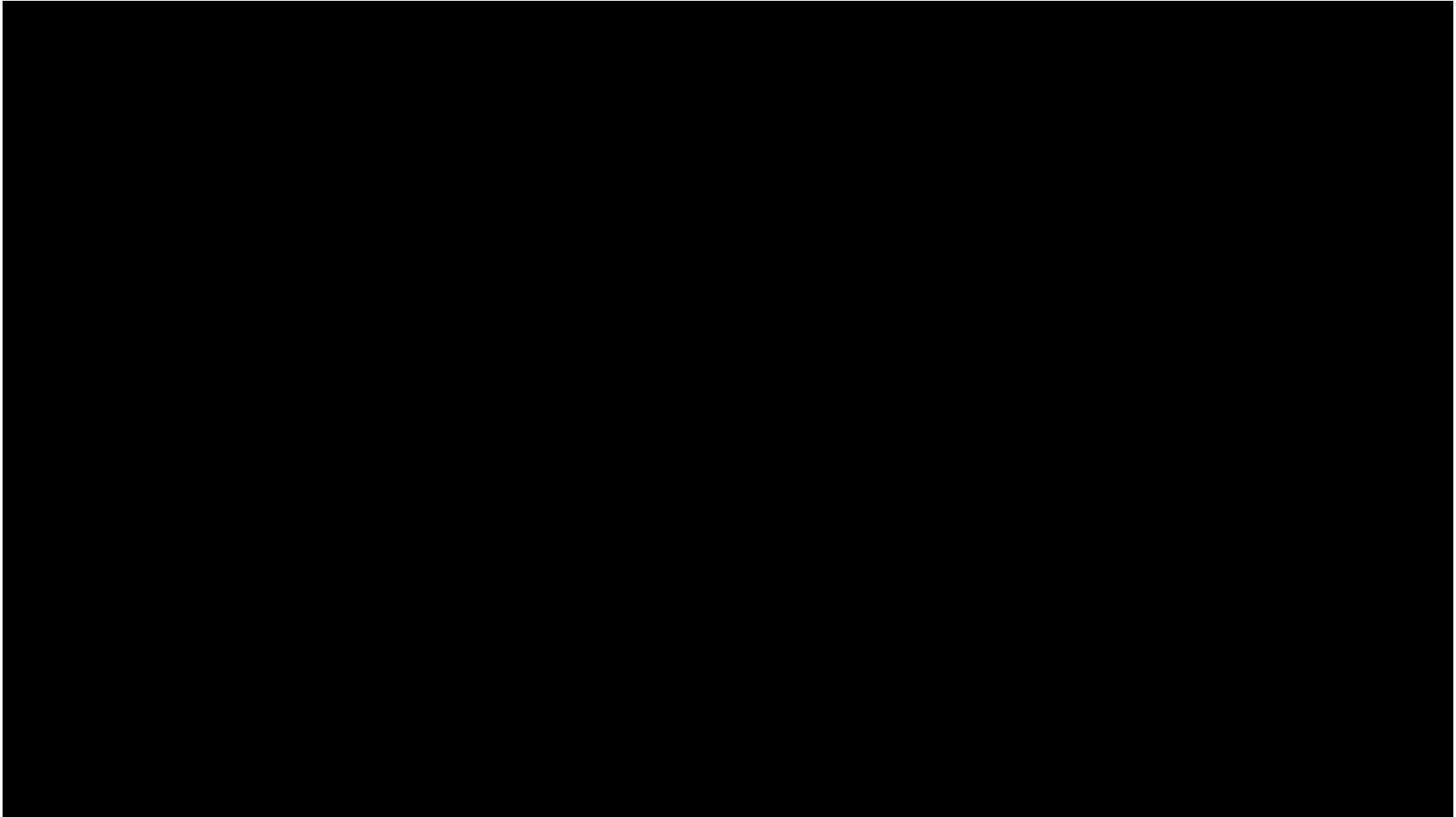
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TEST CAMPAIGN

# TEST#1 – LOGO SCENARIO



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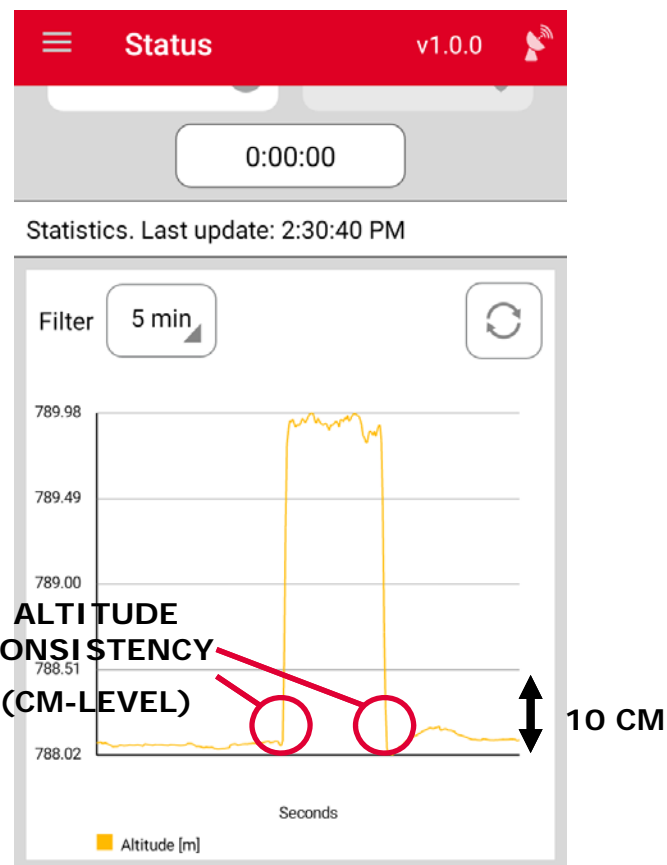


# TEST#1 – LOGO SCENARIO

## ■ In Madrid:

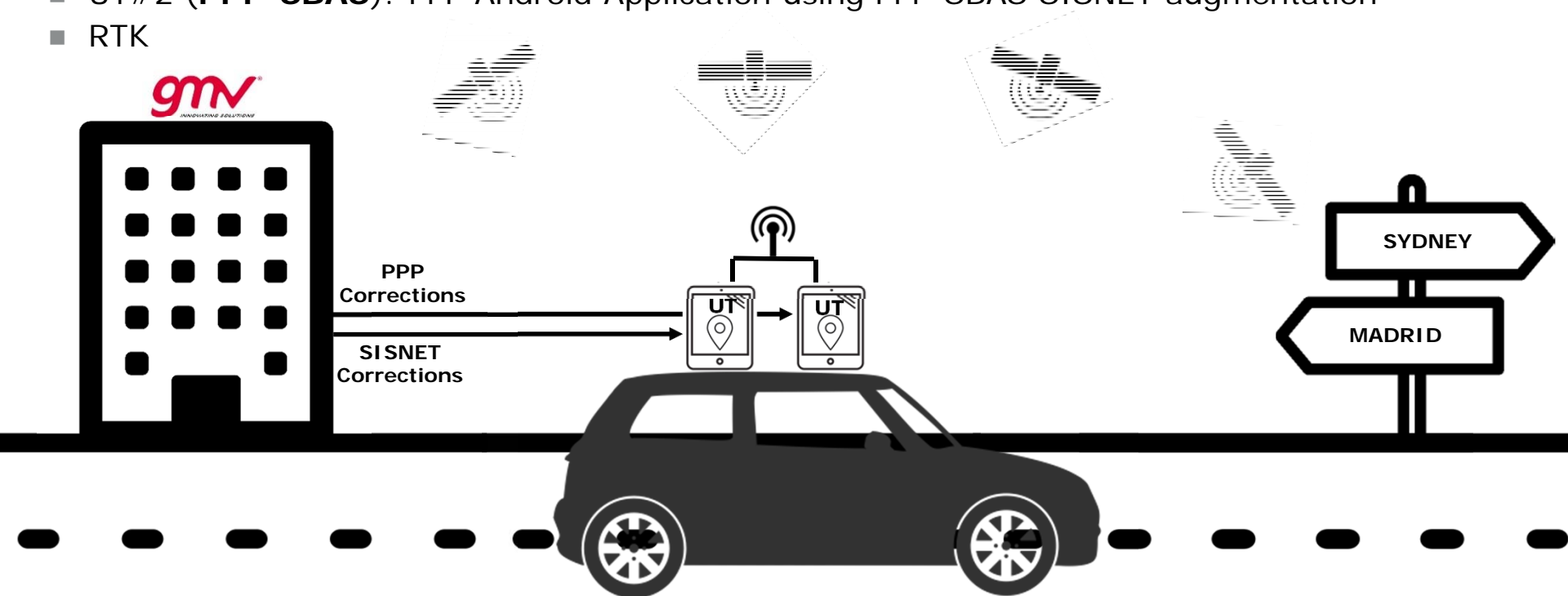
### – Test#1 - Logo Scenario:

- High-consistency between PPP and SBAS-PPP (below 10cms)
- Dynamics are well characterized
- SF-GNSS shows a bias + errors evolution during the test.



# TEST#2 – AUTOMOTIVE SCENARIO

- UT#1 (**PPP**): PPP Android Application using PPP internet augmentation
- UT#2 (**PPP-SBAS**): PPP Android Application using PPP-SBAS SISNET augmentation
- RTK



TEST CAMPAIGN

# TEST#2 – AUTOMOTIVE SCENARIO



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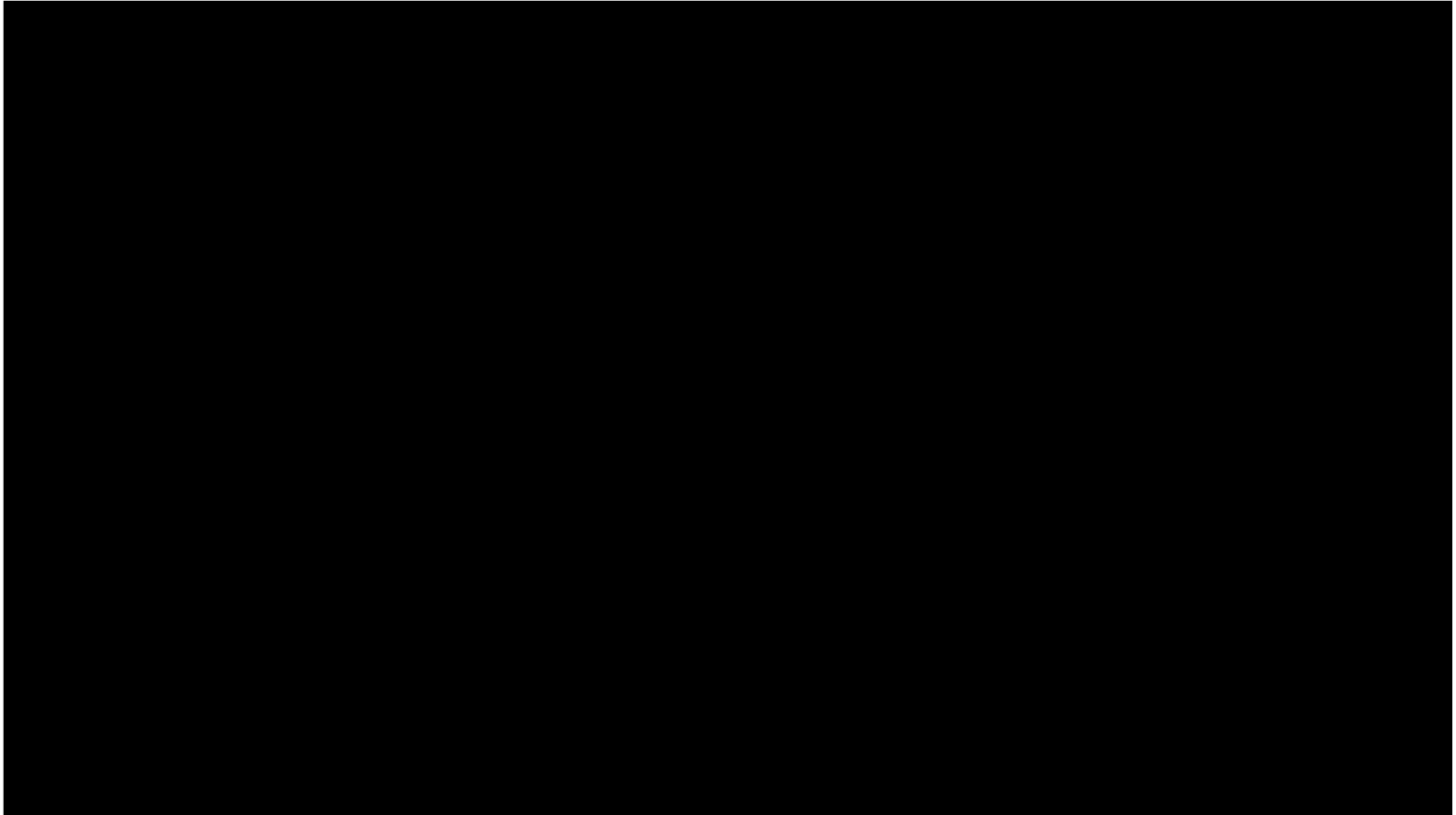


# TEST#2 – AUTOMOTIVE SCENARIO



TEST CAMPAIGN

# TEST#2 – AUTOMOTIVE SCENARIO



# TEST#2 – AUTOMOTIVE SCENARIO

## ■ In Madrid:

- Test#2 – Automotive Scenario:
  - Automotive user-dynamics well characterized during the whole test
  - Good recover after all signals are lost thanks to Gap-bridging algorithm. Almost seamless solution.
  - Robustness in urban canyons and tree canopy same or better than RTKLib





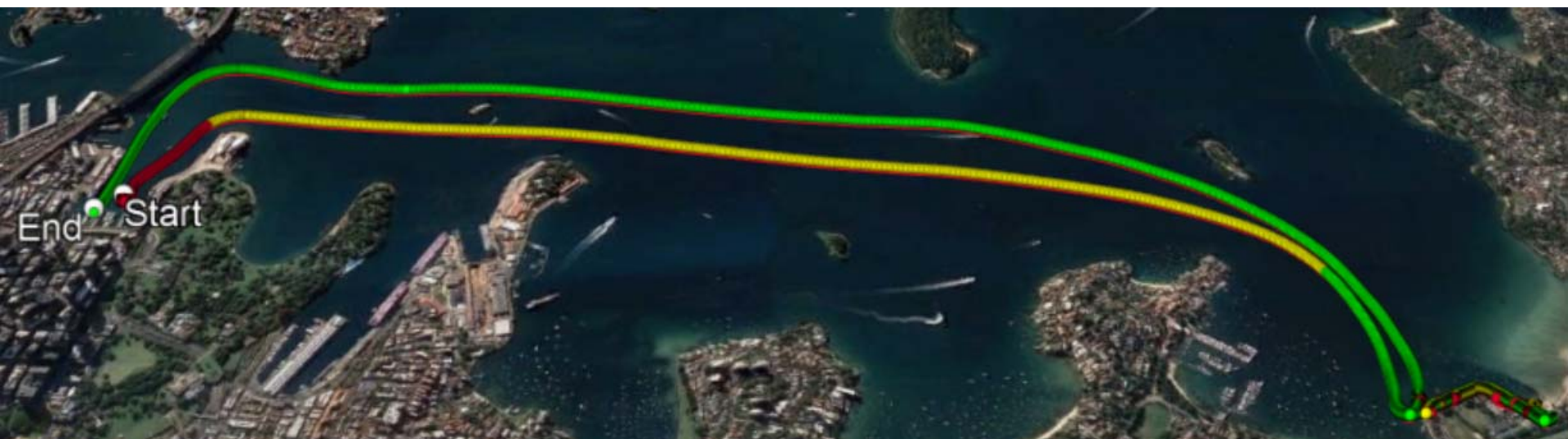
# TEST #3 – BOAT TRIP SCENARIO



- Kinematic scenario:
  - Taking a ferry in Circular Quay
  - Convergence during the travel
  - Walk in Rose Bay
  - Return to Circular Quay
  
- User conditions
  - Different dynamics
  - Partial Open sky during the boat travel
  - Harsh conditions due to roofs in the boat terminals, trees and buildings

TEST CAMPAIGN

# TEST #3 – BOAT TRIP SCENARIO



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TEST CAMPAIGN

# TEST #3 – BOAT TRIP SCENARIO



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# IGNSS 2018 CONCLUSIONS

# CONCLUSIONS

- End-to-end service has been deployed in AUS-NZ region:
  - Supports PPP through SBAS GEO
  - Provides SISNET and internet-direct PPP augmentation
- New user terminal has been developed. It will facilitate the user activities and will be very beneficial for on-going and future experimentation activities.
- The User-terminal has been tested obtaining promising performances and robustness in different user conditions
- GEO and land-based communication links can be complementary. GEO is perfect for Open-sky conditions, land based options behave better in urban zones.

CONCLUSIONS  
**ACKs**



Australian Government  
Geoscience Australia



**THANKS TO ALL THE PROJECT STAKEHOLDERS**

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