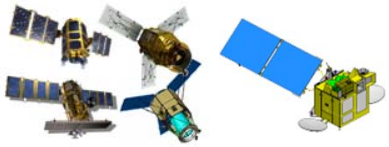
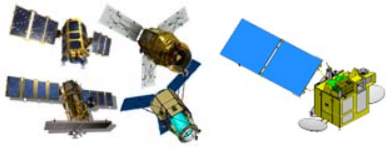


KARI
Space Debris Mitigation Activities

Dr. Hae-Dong Kim

29 Sep. 2018

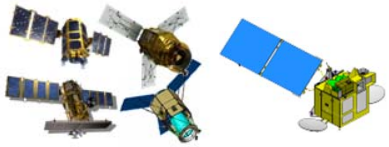
IAA SDC, Bremen, Germany



IADC Activities

- KARI has joined as a 13th IADC Member in 2014
- Dr. Hae-Dong Kim is a Head of KARI Delegation since 2017
- KARI Delegation members join the Steering group, WG1 and WG4

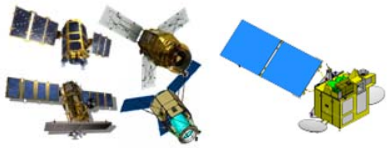
- Development of the KARI Space Debris Mitigation Guideline (On-going)
- Some of IADC guideline have applied to the development of KARI satellites and Space Launch System on a trial basis



KARI Statistics (box score) of 2018

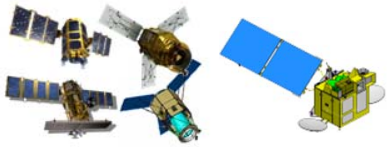
- **# of satellites in orbit (current number) : 6**
  - KOMPSAT-1 (LEO-664km, Not Operational)
  - KOMPSAT-2 (LEO-685km, Retired in 2017)
  - KOMPSAT-3 (LEO-685km)
  - KOMPSAT-5 (LEO-550km)
  - KOMPSAT-3A (LEO-528km)
  - COMS (GEO)
- **KOMPSAT-6, 7 and Next generation small satellites are developing**

- **Korean Space Launch Vehicle – 1 (KSLV-1) was launched in 2013**
- **KSLV-2 will be launched in 2021 (TBD)**
  - Orbit : SSO, up to 800km
  - Considering the IADC space debris mitigation guideline



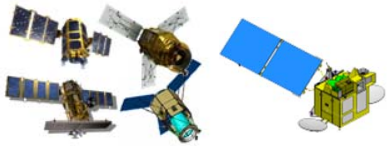
Satellite Conjunction Monitoring Activity

- **Tool : KARISMA (KARI Space Debris Collision Risk Management System)**
  - 24/7 Operational (Automated) SINCE August 2014
    - **Developed : 2011 ~ 2013**
  - Major Functions
    - **Conjunction Assessment (Coarse using TLE, Fine using CDM)**
    - **Optimized Collision Avoidance Maneuver Planning**
    - **Precise Orbit Determination & Prediction**
  - Data Sources
    - **JSPOC TLE (download twice a day)**
    - **JSPOC CDM (download every 2 hours)**
    - **Precise Ephemeris (In-house ephemeris of KARI satellite)**
    - **Radar Tracking Data (External Sources-FHR[Germany], if necessary)**



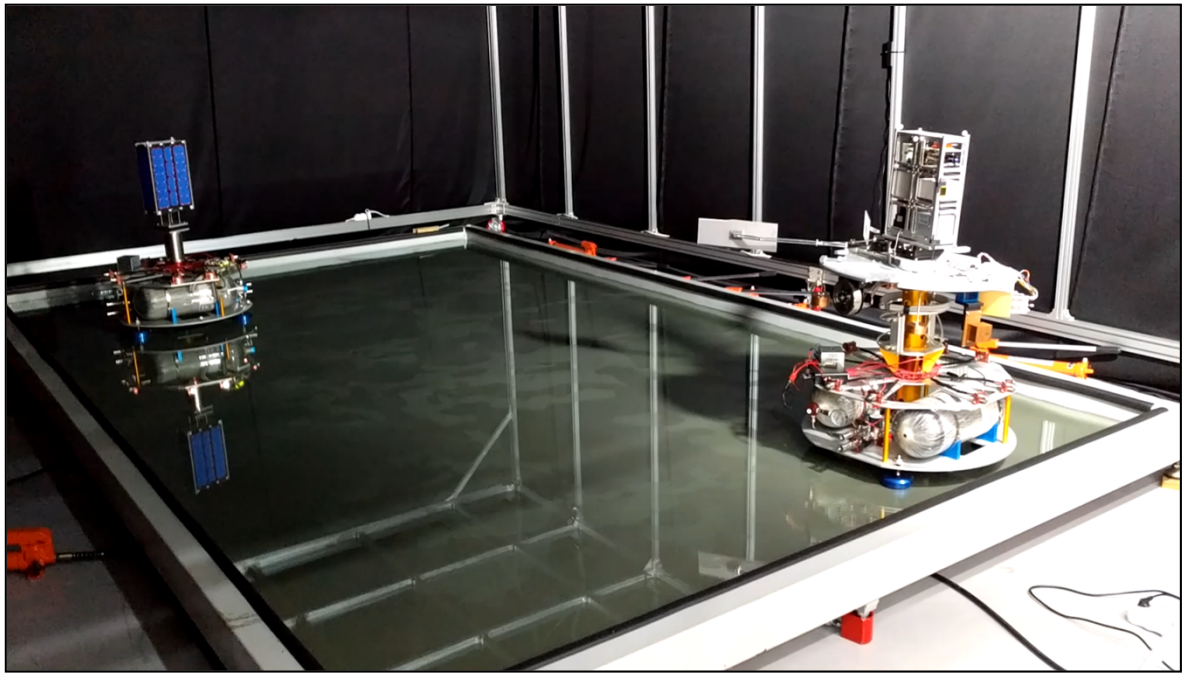
KARI R&D for Remediation

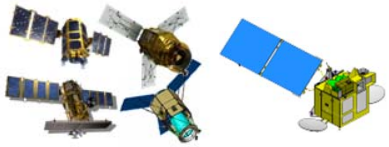
- **Background**
  - Started to discuss Space Debris Hazard Mitigation since 2012 nationally
  - Prepared a comprehensive plan for Space Debris Hazard in Oct. 2013
    - **Long-term plan for '14~'23**
    - **Development of Radar system and Optical system for space surveillance and collision avoidance**
    - **Development of Phased array radar for observing re-entry objects**
    - **Development of Space debris removal systems**
    - **Implement of National Space Debris Hazard Management System**



KARI R&D for Remediation

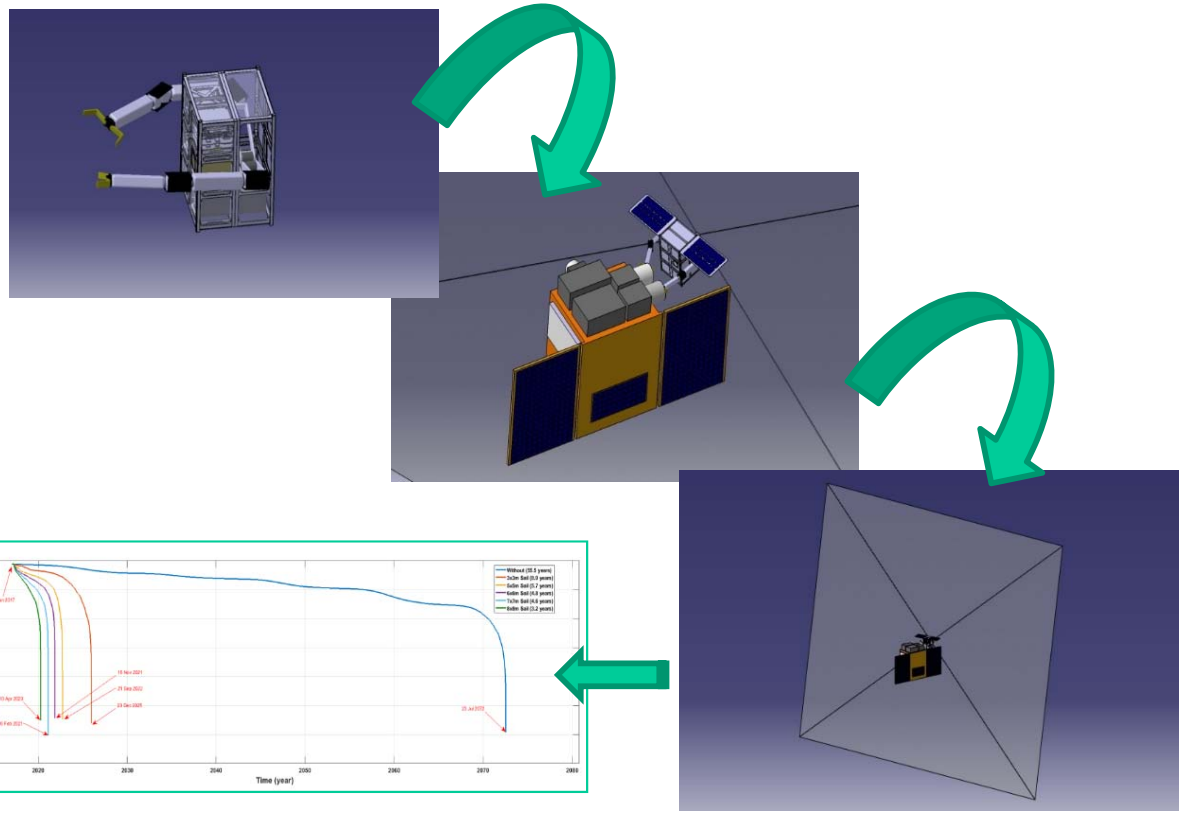
- **Conducting as National Agenda Project since 2014**
  - Project period : 2014~2016
- **Purpose**
  - Develop 5 D.O.F Ground based test-bed for Capture system
  - Vision-based Navigation Algorithm which is running on Smart Phone Processor
  - Target for Nano satellites (less than 10 kg)



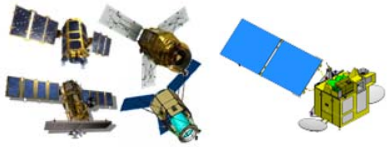


KARI R&D for Remediation

- **Plan for development of Space Active Debris Removal System**
  - Project Period : 2020~ ? (TBD)
  - Study for several removal technologies at a low cost
  - **Seek for International co-operation partner**
  - Finally, attempt to remove own debris, i.e., KOMPSAT-1 (retired 2008)



Operation : 1999 ~ 2008
In orbit at an altitude of 664 km




KSR-I
Thank You!