

# KOREA AEROSPACE RESEARCH INSTITUTE







Aerospace development, which protects the nation and its people, is a growth engine of Korea. With cutting-edge aerospace technology, KARI will strive to open up a new future for Korea.



## President's Greetings

“KARI will play a leading role in taking a step forward in a rapidly changing world of aerospace technology by establishing sustainable system and improving global competitiveness”



The Korea Aerospace Research Institute (KARI) is a specialized organization for national aerospace development, which was established with the purpose of contributing to the national development. Despite its short history, KARI is becoming a world-class aerospace research institute through its tireless efforts of research and development.

In the field of aeronautics, KARI developed a tilt-rotor UAV and stratosphere solar-powered unmanned Electrical Aerial Vehicle-3 (EAV-3). Also, the Optionally Piloted Personal Air Vehicle (OPPAV) capable of vertical takeoff and landing using electric power, which is expected to be the core of next generation transportation, is in the process of development. In the area of satellite, KOMPSAT (Korea multi-purpose satellite, Arirang) series, which are earth observation satellites with high resolution and GEO-KOMPSAT (Cheollian) series to monitor the weather, ocean & environment, were developed and are being operated. In addition, in order to meet the public demand and industrialize the satellite sector, KARI successfully developed and launched CAS (Compact Advanced Satellite) using a standard platform. For space launch vehicle, KARI is developing KSLV-II (Korea Space Launch Vehicle, Nuri) equipped with 7-ton and 75-ton engines, and research on a staged combustion cycle engine to improve the performance of liquid engine, is being carried out. Moreover, as the first major step toward space exploration, the development of KPLO (Korea Pathfinder Lunar Orbiter) is in progress. KARI is also preparing for the era of 4th industrialization by developing various cutting-edge technologies including analytics platform converging AI and big data of drone and satellite imagery.

Built upon its experience and achievement, KARI will remain fully committed to securing future and innovative technologies. In order to achieve such initiatives, KARI will be focusing on developing environment-friendly and highly-efficient advanced aircraft and core technologies of manned and unmanned aerial vehicle. Furthermore, KARI will continue its endeavor in advancing future technology by developing state-of-the-art satellites, industrializing satellite technologies, establishing Korean Positioning System (KPS) to provide ultra-precision location information, securing indigenous satellite launch capability with its own space launch vehicle and obtaining space exploration technologies.

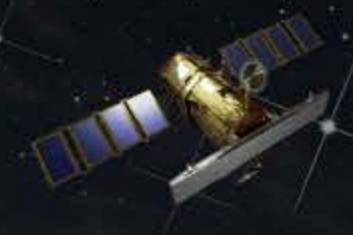
Aerospace technologies integrated with AI, robot, and future transportation systems, which are directly related with public safety and daily life of people, will be one of main pillars to enhance national competitiveness and serve as new growth engine in the era of industry 4.0. KARI will strive for the aerospace industry to be next growth momentum and exert every effort to contribute to ensuring public safety and improving the quality of life.

In this journey, KARI looks forward to your continued interest and support. Thank you.

President of the Korea Aerospace Research Institute **Sang-Ryool LEE**

## Mission

Contribution to solid development of the national economy and improving people's lives through new exploration, technology advancement, development and dissemination in the field of aerospace science and technology



## Major Functions



Research and development of aircraft, satellites, and space launch vehicle systems

Support for the establishment of national aerospace development policies and distribution of information on aerospace technology

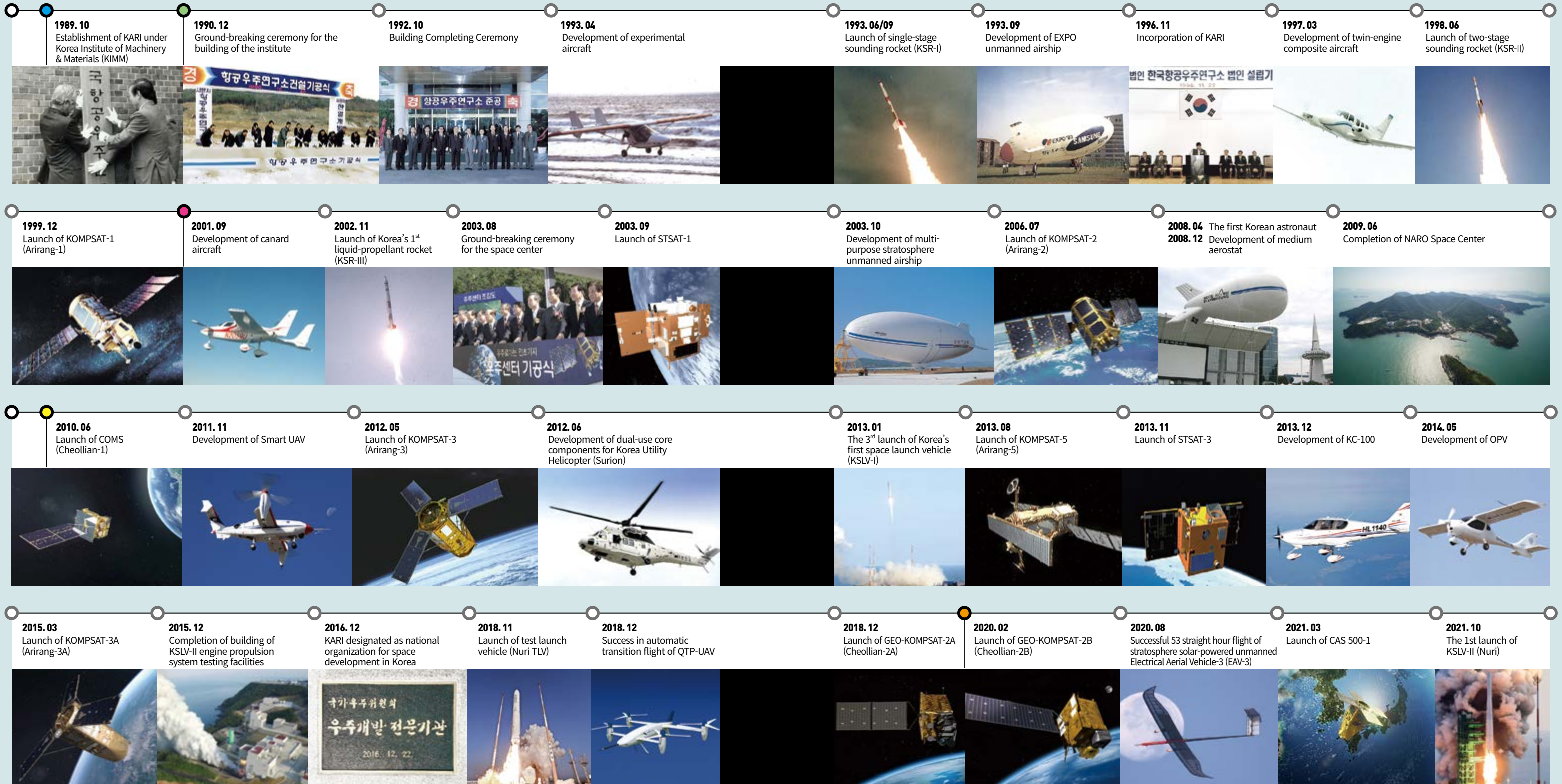
Joint utilization of testing and evaluation facilities, collaboration with industries, and industrialization of technology

R&D cooperation with the government, private sector, corporate bodies and other organizations / Nurturing professional manpower in key areas





# History / Achievements

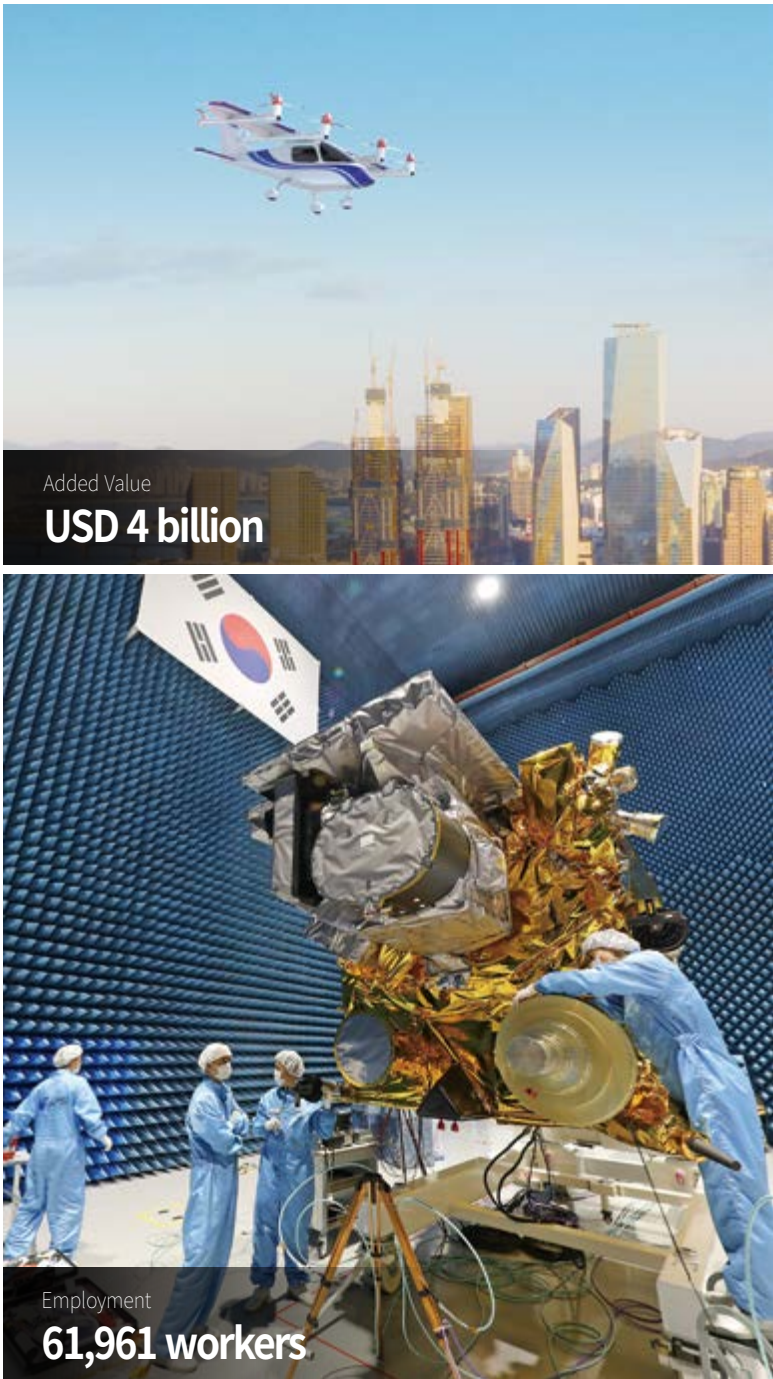




# Aerospace R&D, contributing to national economic development

By establishing and vitalizing the aerospace industry ecosystem, Korea's GDP increased by nearly 16.7 billion USD.

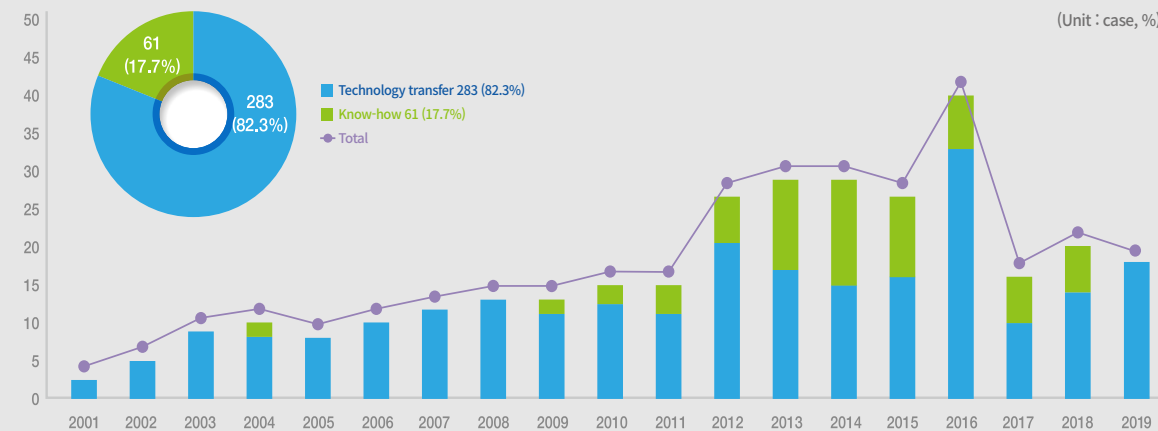
Over the past three decades, about 6.5 billion USD have been invested into aerospace R&D, which had the effect of generating approximately 7.5 billion USD in production, an added value of 4 billion USD and supporting around 62,000 jobs. It is estimated that the aerospace sector has contributed a total of 16.7 billion USD to Korea's GDP.



It can be said that the most of KARI's R&D budget has been reinvested into the aerospace industry, contributing to the creation of aerospace ecosystem and its industrialization. Also, developed aerospace technologies are continuously being transferred to the private sector, which enables the industry to grow in the market. Through close cooperation with more than 470 organizations, KARI is pursuing technological advancement and industrialization of national aerospace.

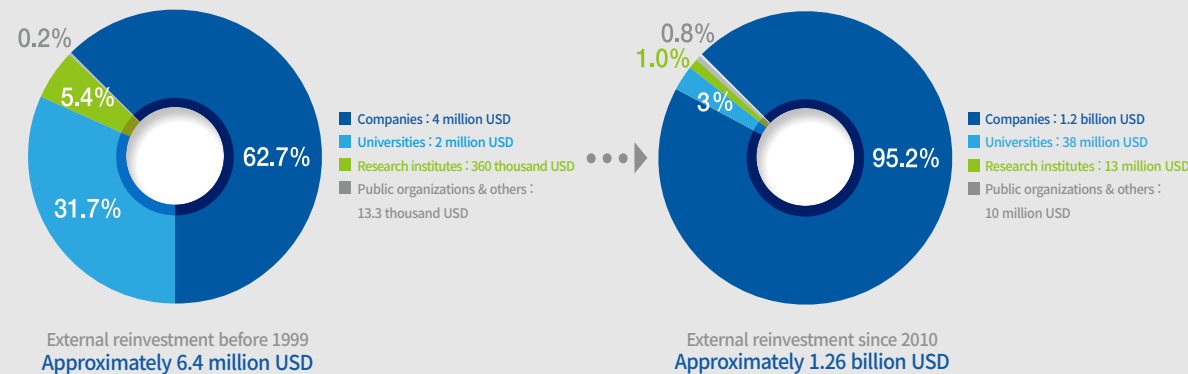
## Outcome of Technology Transfer

- Since 2001, a total of 344 cases (annual average: 18.1) of technology transfer has been made. Among the figure, Know-how transfer accounts for 17%.
- It is found that annual sales of the private sector grew by approximately 345 thousand USD in average attributable to the technology transfer and the influence index of technology transfer stands at 20.3% (Result of survey conducted on the technology transferred companies)



## Vitalization of Industrial Ecosystem

- KARI's R&D budget is being reinvested into the aerospace industry, contributing to the vitalization of aerospace industry ecosystem.





## Aerospace technology, making our lives more convenient and safer

### UAVs for disaster response

### Satellites monitoring weather and climate

Our life has become much safer and easier with the advancement of aerospace technology. UAVs monitoring disaster and emergency ensure community's safety and save people's lives, and satellites monitoring weather and climate help us predict and prepare for the air pollutant such as fine dust. In addition, precise positioning system such as GPS used in navigation is

an indispensable technology in our daily lives. Likewise, aerospace technology is essential to improve the quality of people's lives and make our world a safer place for all.

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- Establishment of geographical information system



- Monitoring ocean pollution and ecosystem



- Urban planning
- Monitoring forest and crops



- Natural disaster management
- Emergency rescue



- Monitoring atmospheric environment



- Acquiring satellite information for the safety of people



## Aerospace industry as future growth engine

### Knowledge-based industry with high added value

#### Contributing to national economic development and job creation

Over the past years, auto, semiconductor, steel, and shipbuilding industries have been key pillars of economic development in Korea. However, it is time for us to come up with new growth momentum to lead Korea into the future. Aerospace industry is a knowledge-based industry with high added value, which can provide higher quality jobs compared to conventional manufacturing industry and create more jobs than ICT industry.

In 2020, it is estimated that global aerospace industry including manufacturing and space application services is worth about 847 billion USD, surpassing the volume of semiconductor industry approximately 433 billion USD. By 2030, the industry is expected to reach around 1.5 trillion USD. Moreover, with the advent of new service sector such as UAM and spread of space application service, it is anticipated that the industry will grow enormously beyond our expectation. Aerospace industry, a next growth momentum of Korea, will greatly contribute to the economic development, job creation and the improvement of people's lives in Korea.





## Aeronautics

### Leading the future aviation industry with core next-generation technologies Disaster and emergency UAVs to save people's lives for public safety

KARI successfully developed the Smart UAV, a tilt-rotor UAV(TR-100) capable of vertical takeoff and landing as well as high speed flight, and solar-powered unmanned Electrical Aerial Vehicle-3 (EAV-3) which flies in the stratosphere for long endurance. In addition, disaster and public safety UAV has been developed to keep people safe and save lives from disaster and emergency. Based on such technologies, KARI is currently working on the development of public / industrial UAVs converged with AI and IoT technology, as well as core next-generation technologies to lead the future UAV market. KARI is also moving forward with developing the Optionally Piloted Personal Air Vehicle (OPPAV), which can bring about innovation in air transportation, and the low-altitude Unmanned aerial system Traffic Management (UTM) to ensure safe and effective flight of UAV.



**Stratosphere solar-powered unmanned Electrical Aerial Vehicle-3 (EAV-3)**

Wingspan : 20 m  
Total Weight : 53 kg  
Payload : less than 1 kg  
Service ceiling : more than 18 km



**Quad Tilt Prop-UAV (QTP-UAV)**

Length : 2 m  
Max. speed : 160 km/h  
Total Weight : 48 kg  
Payload : 3 kg  
Endurance : 30 minutes (battery), 2 hours (hybrid)



**Electric vertical take-off and landing (eVTOL) Optionally piloted personal aerial vehicle (OPPAV)**

Length : 6.15 m  
Cruise speed : more than 200 km/h  
Max. take-off weight : 650 kg  
Range : more than 50 km



**Smart UAV (TR-100)**

Length : 5 m  
Max. speed : 500 km/h  
Max. take-off weight : 1,000 kg  
Endurance : 5 hours



**Surion (Development of key modules for dual civil-military purposes)**

Passengers : 13 including pilot  
Main rotor diameter: 15.8 m  
Max. take-off weight : 8,709 kg  
Max. cruise speed : 261 km/h



**Indoor small-sized disaster and public safety UAV (MC-1)**

Weight : 6.91 kg  
Size (hub to tub) : 589 mm  
Operating hours : 20.4 minutes



**Outdoor medium-sized disaster and public safety UAV (MC-3)**

Weight : 28.61 kg  
Size (hub to tub) : 1,680 mm  
Operating hours : 26.3 minutes



**Outdoor small-sized disaster and public safety UAV (MC-2)**

Weight : 14.19 kg  
Size (hub to tub) : 910 mm  
Operating hours : 21.6 minutes



**Tilt-rotor UAV (TR-60)**

Length : 3 m  
Max. speed : 250 km/h  
Max. take-off weight : 210 kg  
Endurance : 5 hours



## Satellites

### World-class technology for ultra-precision earth observation satellite and medium and large-sized GEO satellite

KARI has been developing and operating world-class KOMPSAT series satellites (LEO earth observation satellites), CAS (Compact Advanced Satellite) and GEO-KOMPSAT series satellites which are capable of monitoring weather, ocean and environment. KOMPSAT series with various payloads including electro-optical camera, IR camera, and radar, are being operated for earth observation, and the development of earth observation satellites with advanced high-resolution is on the way. As for the follow-on of COMS which laid the groundwork for independent capability of meteorological observation, GEO-KOMPSAT-2A facilitating faster and more accurate weather forecast and GEO-KOMPSAT-2B monitoring atmospheric pollution and ocean around Korean peninsula, were developed and are in operation. Moreover, in order to vitalize the satellite industry of Korea, KARI has transferred its technologies to the private sectors and jointly developed CAS. In addition, based upon KARI's accumulated technologies in satellites, public multi-purpose communication satellites to prepare for and respond to a natural disaster and ultra-precision navigation satellites are planned to be developed.







## Satellite Operation and Applications

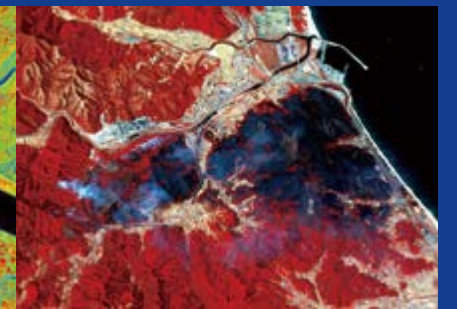
High-tech satellite operation with world-class IT technologies  
Creating added value through active satellite application by private sector

KARI is in charge of the whole cycle of satellite operation from mission planning to receiving, processing and distribution of satellite images for national satellite asset KOMPSAT (Arirang) and GEO-KOMPSAT (Cheollian) series, and promote R&D for satellite data analysis and applications. In the era of Industry 4.0, satellite images work as significantly important Big Data in both public and private sectors, which makes it crucial to develop a platform for integrated and systematic management and utilization of government satellite data.

In an effort to make effective use of drone and satellite images, KARI is studying AI applications to detect ground objects such as cars, ships, airplanes, roads and building from the images.



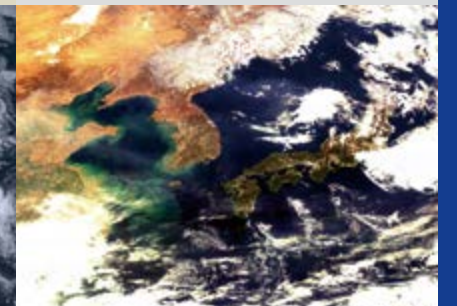
Seoul, KOMPSAT-3A IR



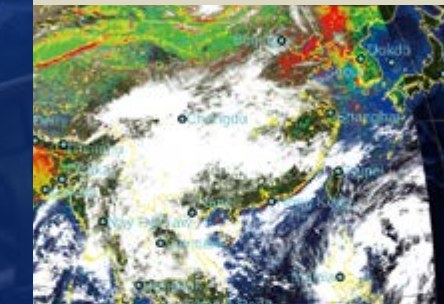
Gangwon-do forest fire, KOMPSAT-3



Typhoon Maysak, GEO-KOMPSAT 2A



Oceanic payload image, GEO-KOMPSAT 2B



Environmental payload image, GEO-KOMPSAT 2B



Drone image analysis using AI

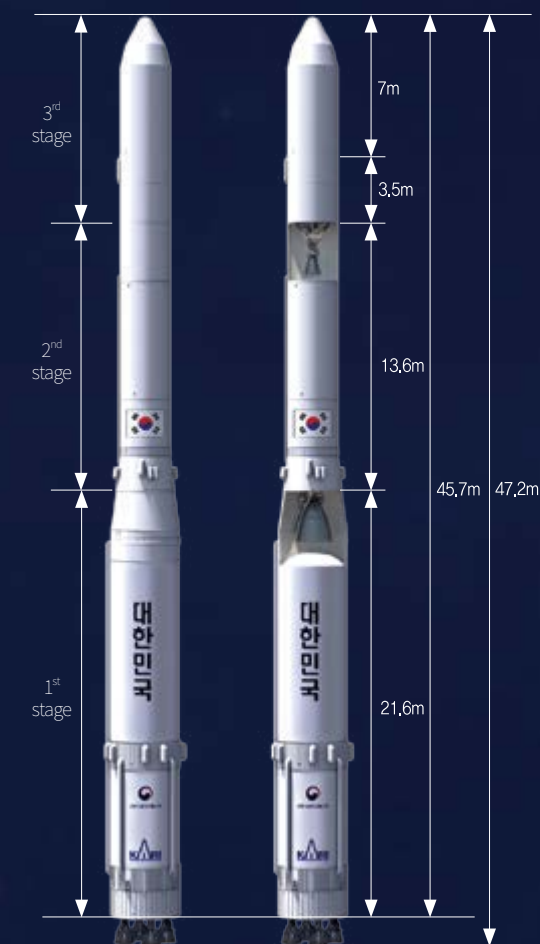




## Space Launch Vehicle

**KSLV-II (Nuri) the symbol of independent space carrier rocket technology of Korea**  
**Future launcher R&D to lead launch vehicle development capabilities**

Space launch vehicle is an essential means of space transportation for satellite launch and space exploration. KARI is developing three-stage launch vehicle KSLV-II (Nuri) that can launch a 1.5-ton utility satellite into the low earth orbit of 600~800km above the earth using its own technology and experience gained from KSLV-I (Naro). After successfully verifying the performance of 75-ton engine through the test launch vehicle in 2018, the institute advanced to the maiden flight of Nuri in October 2021. KARI will continue to improve the performance of Nuri to develop low-cost high-performance launch vehicle, and is also developing future launch vehicle technologies.



**Height:** 47.2m  
**Mass:** 200t including propellant  
**Diameter:** 3.5m  
**Payload mass:** 1,500kg  
**Orbit:** Low Earth orbit 600~800km  
**Specification:** three-stage rocket with four 75t engines clustered in the first stage



Launch of test launch vehicle



1<sup>st</sup> stage hot firing test



The 1st launch of KSLV-II (Nuri)



## Naro Space Center

### Outpost of Korean space development Gateway to space

Naro Space Center was established in 2009, making Korea the world's 13th country to have its own space center.

The Center, dedicated to satellite launches and launch vehicle engine testing, includes high-tech facilities in the area of 5 million m<sup>2</sup> ; from launch pad system to satellite testing building, launch vehicle assembly building, solid motor building, and control tower.

It also has cutting edge range infrastructure such as tracking radar, telemetry system, launch control system, optical equipment and meteorological observatory in order to track and control launch vehicle, and operates Palau Tracking Station to ensure safety of the launch through stable data reception.

Naro Space Center also features Space Science Hall where visitors can learn and experience space science through various exhibitions and 4D theater on space development.



## Aviation Center

### Korea's first professional aviation facility Yearly 10,000 users from 30 organizations

Aviation center, located in Goheung-gun, Jeollanam-do Province, the southern end of Korea, is the first aviation-specialized facility in Korea focused on aircraft system integration, ground and flight testing, and performance test for advanced high-tech aircrafts and national R&D aircrafts.

The center features medium-sized and small-sized test buildings; 700m-long 24m-wide runway; a whirl tower for balancing test of main rotor and tail rotor; landing system drop test facility, etc..

Based on National Aviation Test Center project, Aviation Center plans to enhance its facilities with 1,200m-long 45m-wide runway to enable instrument flight as well as apron and hangar by 2021. In the second phase, it will construct facilities and equipment for flight testing and navigation safety to become a national-level flight testing and research facility for the research and development of aircraft in Korea.







## SBAS and Satellite Navigation

**Satellite navigation system, the key to the 4th industrial revolution and national competitiveness**

**Highly accurate GPS system, Korean Positioning System (KPS)**

Satellite navigation system is a system that uses satellites to provide position, navigation, and timing information, and it is widely used in our daily lives from navigation system for cars and ships to emergency relief and disaster prediction.

Highly accurate, reliable and secure satellite navigation system is integral in establishing national competitiveness and preparing for 4th industrial revolution, and already countries like the United States, Russia, Europe, China, Japan, and India are operating their own satellite navigation system that can offer centimeter-level navigation services.

KARI is currently developing Korea Augmentation Satellite System (KASS) to improve the GPS accuracy and plans to provide accurate location data for aircraft navigation from 2023. Furthermore, we aim to launch Korean Positioning System (KPS) that can provide centimeter-level precise positioning information.





## Space Exploration

### Lunar exploration to push the boundaries of space Future of space technology, space exploration

KARI is in the pursuit of space exploration based on advanced space technologies it has acquired for years, starting from lunar exploration. We aim to launch Korea's first lunar orbiter Korea Pathfinder Lunar Orbiter (KPLO) by 2022 and put lunar lander on the surface of the Moon through Korean launch vehicle KSLV-II (Nuri) by 2030. Our future vision also includes asteroid exploration.

Lunar exploration will contribute not only to the advancement of national space technologies, but also to the improvement of national prestige.



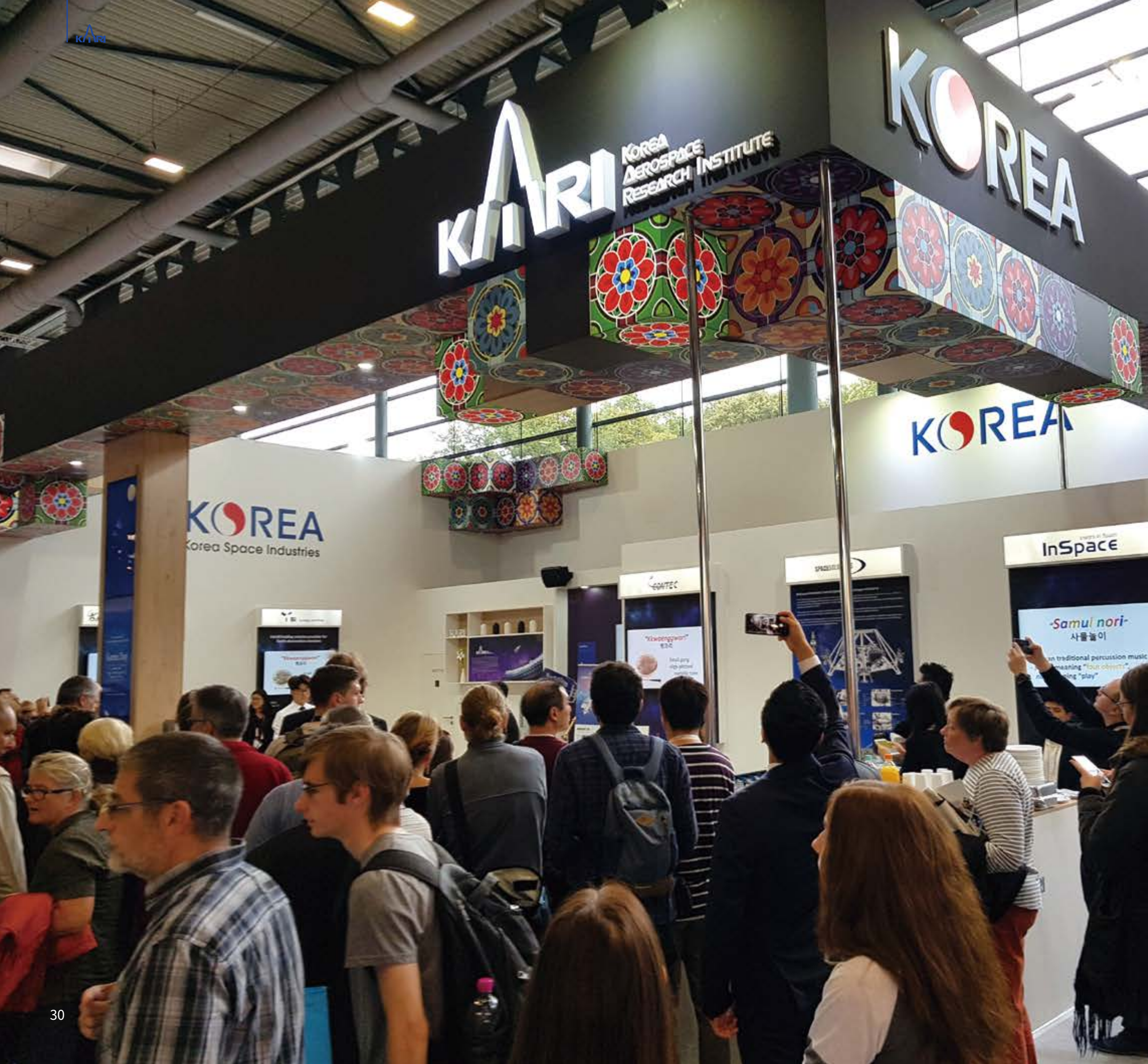
Korea Pathfinder Lunar Orbiter (KPLO)



Lunar Lander







## International Cooperation

### Active participation in international space community Building on global partnership for sustainable future

KARI strives to strengthen the international cooperation in the space arena by expanding its participation in international bodies and dialogue in order to keep abreast of global trends in space development.

Also, as part of efforts to contribute to the international space community, KARI has been offering a two-week educational program KARI International Space Training (KARIST) for space experts in particular from emerging countries since 2010. The main goal of this course is to provide various opportunities for the young professionals to develop their space capacities and to serve as a space diplomat to promote international cooperation among participants and with Korea.

KARI will continue to strengthen the global partnership with other countries and international organizations by actively addressing global issues, engaging in international projects such as space exploration and so on, all of which are key parts of our policy to facilitate space diplomacy to strengthen Korea's status in the international community.



KARI International Space Training

The 3<sup>rd</sup> Korea-France Space Forum



The 35<sup>th</sup> Space Symposium

Korea-US Bilateral Meeting



## Outreach Programs

### Science programs for youth and teachers

### Global exchange and cooperation programs for college and university students

KARI offers various science educational programs for children, teenagers, university students, and educators. Our programs include field trip to research facilities, science camp, aerospace competition, middle school free-semester program, online career mentoring, and teacher training program.

We also service numerous educational contents through online channels such as YouTube(TV KARI).

For college and university students, we support active participation to international internship program and global exchange and cooperation programs hosted by International Space Education Board (ISEB) based on the agreement between NASA and KARI.

