# SATELLITE DEVELOPMENT STATUS OF KOREA

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## OVERVIEW

Korea has entered the space age to manufacture satellites and to use them for space applications. For example, Korea has successfully launched a top class earth observation satellite named in KOMPSAT-2 in July 2006. Moreover, COMS, KOMPSAT-3 and KOMPSAT-5 are now under development and will be launched from 2009 in due order. In the Space Launch Vehicle field, KSLV is now under development in cooperation with Russia. With Space Center in Goheung which is almost completed, Korea will be able to launch satellites with its own launch vehicles in its own land. In this paper, Korean satellite development programs including space center and launcher are introduced.

## 1. INTRODUCTION

Since Korea launched the first satellite in 1992, Korea made remarkable success in satellite development. Until now, Korea developed and successfully launched 4 scientific satellites and 2 medium size commercial satellites. In addition, Korea also purchased 4 geo-stationary communication satellites from abroad and co-owns 1 DMB(Digital Multi-media Broadcasting) satellite with Japan. In less than 20 years Korea satellite history, Korea has been relatively lucky in satellite programs since Korea experienced only 1 complete failure. Moreover, the failure was due to a foreign launcher and fell on an 1 kg satellite which was developed by a university.

In satellite research & development in Korea, the most remarkable success is KOMPSAT-2 which was successfully launched in July 2006. The satellite delivers to us remote sensing images as fine as any leading-edge commercial earth observation satellites do. With these images, we can recognize up to small cars on the ground. At present time, lots of Korean user groups are anticipating for these images for their own research and industrial purposes such as geographic information, environmental surveillance, urban planning, etc. Most of all, these images are available in the world market through SPOT image company who is the worldwide distributor of geographic information products and services.

## 2. KOREAN NATIONAL SPACE PROGRAM

The Korean National Space Program was originally initiated in 1995 and revised in the years 2000 and 2005. As embedded in the National Space Program, Korea aimed to become one of the world's top ten countries in space technology by 2015. The total of 13 satellites were planned to be put into orbit by 2010; they include 7 multi-purpose satellites, 4 science satellites and 2 geo-stationary orbit satellites. In 2007, the National Space Program has been revised again to emphasize the technology development significantly.

In 2008, Korea is looking forward to one big success in Korea space development history. This event is expressed by one catch-phrase; "Korean satellite is launched by Korean launch vehicle at Korean space center." We can call this success as "Success of Troika" which means the success of launcher, satellite and space center in Korean territory at once. This success will make Korea a country which has full capabilities in space development. In the phrase, the Korean satellite is STSAT-2 (Science and Technology SATellite-2), illustrated in Fig. 1, and the Korean launch vehicle is KSLV (Korea Space Launch Vehicle). The Korean space center (Fig. 2) is almost ready to open and will play a central role in educating visitors about state-of-the art space science and technology and helping them to understand the importance of space development as well as the launch service itself.

## 3. KOREAN NATIONAL SATELLITE PROGRAMS

Under Korean National Space Program, Korea Aerospace Research Institute (KARI) had developed and launched KOMPSAT-1(Korean Multi-Purpose Satellite-1) in December 1999 (Fig. 3). The KOMPSAT-1 is a commercial satellite with the mass of 500kg to be operated at the sunsynchronous orbit and 98.13 degrees inclination at the altitude of 685km. The lifetime of KOMPSAT-1 was expected to be 3 years even though it still provides good imagery at present time. KOMPSAT-1 includes three instrumnet such as Electro-Optical Camera (EOC), Ocean Scanning Multispectral Imager (OSMI), and Space Physics Sensor (SPS) for the mission of cartography, worldwide ocean observation, and space environmnetal monitoring, repsectively.

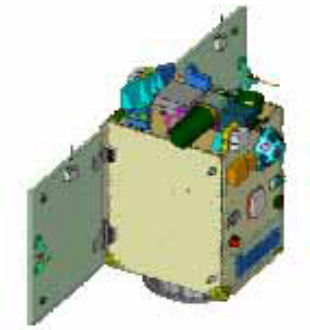


Fig. 1. STSAT-2 (Science and Technology SATellite-2)

Fig. 2. Korean space center in Goheung

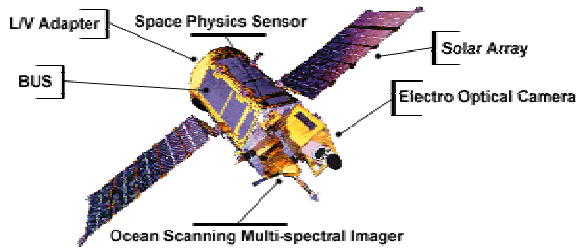



Fig. 3. KOMPSAT-1 (Arirang 1)

Since the sucessful launch of the KOMPSAT-1, KARI had developed KOMPSAT-2 (Koran Multi-purpose Satellite-2) which is a top quality earth observation satellite (Fig. 4). It provides high-resolution images, produced by the Multi-Spectral Camera (MSC), of the Korean peninsula for the production of maps and digital elevation models. Those images will be used for practical applications which include land utilization planning and diaster risk management. Figure 5 and 6 illustrate the images from KOMPSAT-2.

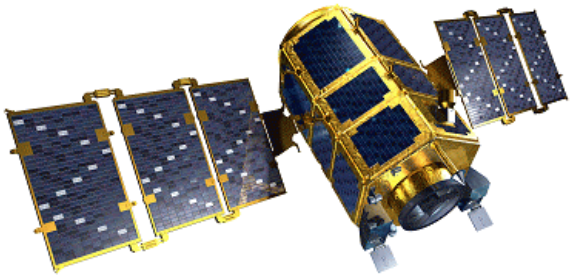


Fig. 4. KOMPSAT-2

ELOP was selected by KARI to co-develop Multi-Spectral Camera (MSC) of KOMPSAT-2. The launch vehicle was Rokot-KM which was manufactured by Krunichev of Russia and it was sucessfully launched at Plecetsk in Russia on the 28th of July in 2006.

Fig. 5. Mt. Baek-Du (from KOMPSAT-2)


Fig. 6. Land reclamation project (from KOMPSAT-2)

Following KOMPSAT-2, Korea is performing several satellite programs simultaneously, from low earth orbit satellites to a geo-stationary satellite. First of all, KOMPSAT-3 (Fig. 7) and KOMPSAT-5 (Fig. 8) are on the list. KOMPSAT-3 is a low earth orbit satellite whose payload is an electro-optical camera like KOMPSAT-2 with better agility than KOMPSAT-2. KOMPSAT-5 is the first low earth orbit satellite whose payload is SAR (Synthetic Aperture Radar) to increase the image acquisition frequency. Figure 9 shows the comparsion of KOMPSAT-1, KOMPSAT-2 and KOMPSAT-3 images. Figure 10 deomnstrates the evolution of KOMPSAT series. In addition to these satellites, one more KOMPSAT series satellite program is ready to start in 2009 and two more satellites of the KOMPSAT series are planned. It can be seen that KOMPSAT series represent continous improvement building up technologies from previous experience.

Korea is also on the way of geosynchronous orbit satellite development with a foreign partner ‘Astrium’ in France. This satellite is the first geosynchronous orbit satellite which is developed in Korea and has three different payloads for communication, oceanography and meteorology. Figure 11 shows the Communication, Oceanography, and Meteorology Satellite (COMS). The COMS has a dimension of 2.2 x 2.8 x 3.3m with the mass of 2,500kg to be operated at the geosynchronous orbit. The lifetime of COMS is expected to be 7 years. The

COMS includes three missions such as the meteorological observation, the ocean monitoring, and the dvelopment of next generation communication payload technology. We believe that the above-mentioned satellites will make our life qualities better than ever before.

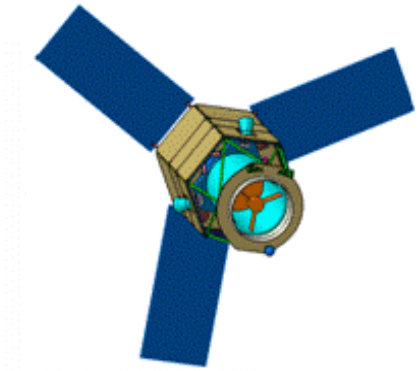


Fig. 7. KOMPSAT-3

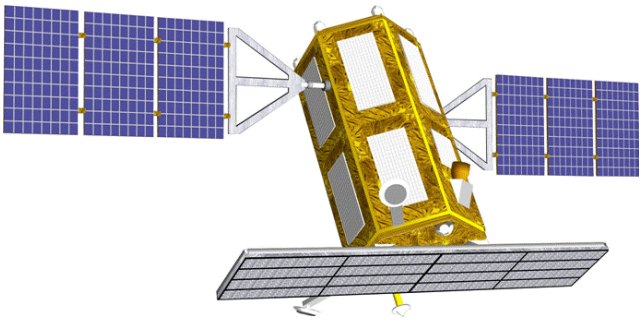


Fig. 8. KOMPSAT-5

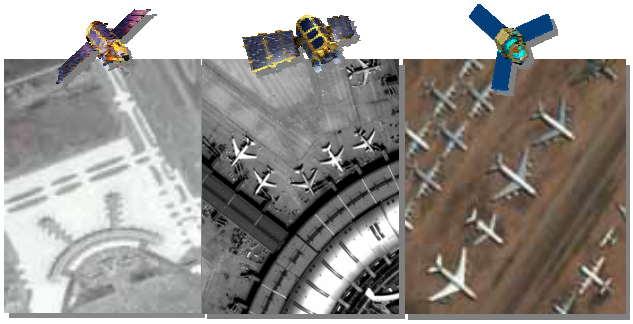
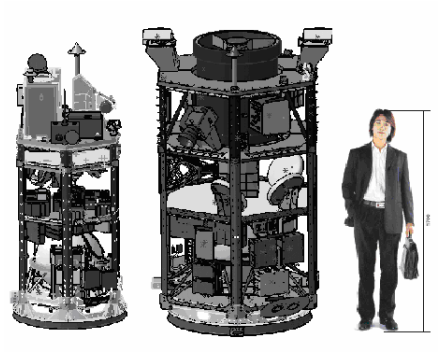
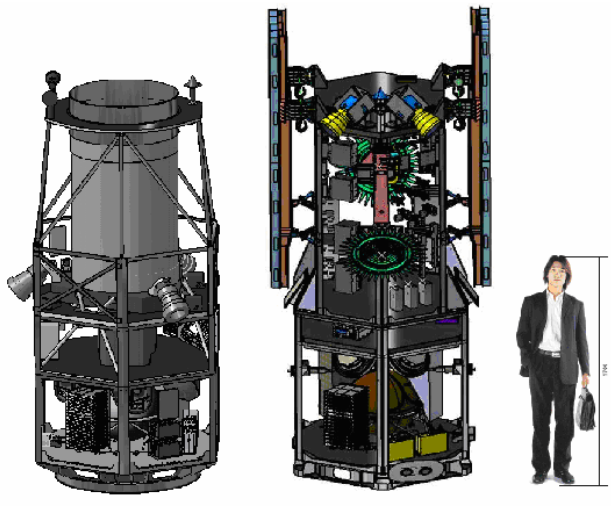


Fig. 9. Comparsion of K-1, K-2 and K-3 images

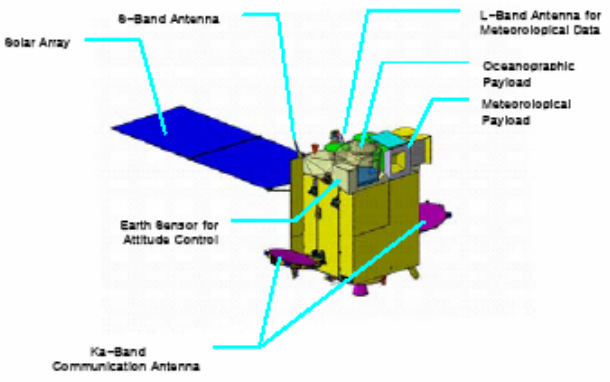


KOMPSAT-1 KOMPSAT-2



KOMPSAT-3 KOMPSAT-5

Fig. 10. Evolution of KOMPSAT



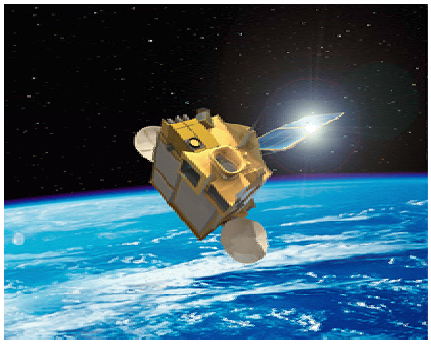



Fig. 11. Communication, Oceanography, and Meteorology Satellite (COMS)

## 4. KARI SITC

Korea Aerospace Research Institute (KARI) has run Satellite Integration and Test Center (SITC) to develop the satellites since 1996. The SITC started with 11,408 $m^2$ floor area to develop KOMPSAT-1. Later on, SITC building has expanded its size to 15,000 $m^2$ (Fig. 12) to develop KOMPSAT-2. Currently, the SITC is expanding its size again to accommodate the geo-stationary orbit satellite development. By the 1st of February in 2008, the SITC has an extra building of 7,490 $m^2$ floor area (Fig. 13).
Upon the completion, SITC has total 22,490 $m^2$ floor area.

The Figure 14 shows the evolution of KARI SITC. This kind of evolution concept in integration and test facility will be a good model for the countries who wants to start the satellite integration & test center with small satellite development program.

Fig. 12. KARI SITC after 1st expansion

Fig. 13. KARI SITC extra building for GEO satellite

Fig. 14. Evolution of KARI SITC

## 5. CONCLUSIONS

Korea has made quite good progress in satellite development in relatively short period time. We think the reason of this fast progress of satellite development in Korea may be attributed to the steady support from Korean government and the strong efforts of Korean engineers to develop the technologies in overall fields. We also think good lucks are the inevitable factors for this success. From 2009, Korea may launch a satellite almost every year. KARI SITC has been and will be the hub for this satellite development adjusting itself to accommodate these satellite development needs.

In 2008, Korea will become 9th country to posses the ability to launch a satellite in its own territory and then become a member of the Space Club. With this success, Korea wants to be a country which can share its technologies with other space family members, contribute world peace and enhance life quality of human being with space technologies.