

Report

The Korean High Altitude Airship Program

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Keywords

Airship, High altitude airship, Stratospheric platform, Intelligence, Surveillance, Reconnaissance, Communications, Telecommunications, Wireless communications.

Summary and Assessment

The government of South Korea has identified the high altitude airship as a critical future technology and has kicked off a ten-year program to develop an unmanned airship that will operate at an altitude of approximately 20 km and perform missions that must currently be handled by satellites or aircraft. For example:

- Intelligence
- Surveillance
- Reconnaissance
- Communications
- Broadcasting

High altitude airship technologies naturally fall into two categories, airship systems and mission payload systems. The Korea Aerospace Research Institute (KARI), a government laboratory located in Taejon, has been placed in charge of airship systems R&D and systems integration.

Assessment

The potential military and commercial usefulness of high altitude airships is clear and worldwide interest is growing. Japan's program (see previous ONR IFO reports) has been under way since 1998. Korea's effort was more recently begun, but is making progress. KARI's researchers and upper management seem open to the idea of working collaboratively with overseas organizations and this is worth exploring. As KARI's president puts it, 'Currently, the aerospace industry in Korea is in transition from basic industry with limited technological scope to an advanced industry that is fully self-sufficient in aerospace mission development. Furthermore, the industry is expanding to include international partners.'

Establishing an effective R&D relationship at this time may be a good strategy.

Introduction to the Korea Aerospace Research Institute



The Korea Aerospace Research Institute (KARI) is a government laboratory that dates back to 1981, when the Aviation Laboratory was established at the Korea Institute of Machinery and Metals (KIMM). In 1989, this lab was merged with a space-oriented research institute to form KARI, still under KIMM. In 1996, KARI became an independent activity.

As of 2001, KARI employed 347 people and its budget was approx. \$67 million. It occupies a modern lab/office complex in the Daeduck Science Town area of Taejon. Its scope of operations is reflected in its organizational structure, which includes six technical divisions:

- Aircraft Division
- Satellite Division

- Space Technology R&D Division
- Propulsion System R&D Division
- Satellite Operation and Application Center
- Quality and Certification Center

There are six departments within the Aircraft Division – one of them is the Airship Research Department whose current missions are:

- Development of system concepts and new technologies for next generation airships
- Systems integration and testing & evaluation of manned and unmanned airships
- Airship platform development and system assembly
- Development of ground facilities and support equipment

Korea's stratospheric airship program

The Korean Ministry of Commerce, Industry and Energy has established a ten-year R&D program to develop a stratospheric airship. The missions that this airship is intended to serve are the same as in the various other national programs currently under way in Japan, China, and elsewhere. These missions include:

- Intelligence
- Surveillance
- Reconnaissance
- Communications
- Broadcasting

High altitude airships are intended to perform certain missions currently handled by satellites or aircraft. High altitude airships would be an attractive platform when there is a need for:

- Continuous coverage over long periods of time – months or potentially years
- Ability to move from one station to another
- Comparatively low cost

The basic design requirements that the KARI program is pursuing are similar what is being worked in other programs (see previous ONR IFO reports), i.e. an unmanned airship to operate at an altitude of 20 km over long periods of time, using solar panels (daytime) and a regenerative fuel cell system (at night) to supply power for mission systems and propulsion.

The Korean stratospheric airship program is organized into three phases:

PHASE I: 2001-2003

Objective: Fundamental technologies, low altitude airship experience.
Research: Basic technologies, simulation and analysis, ground testing, etc.
Airship system: Low altitude airship, 50m length, turbo-generator.

PHASE II: 2004-2007

Objective: Long endurance, stratospheric airship development
Research: Prototype development, stratospheric validation, durability, environmental data.
Airship system: Stratospheric altitude airship, 150m length, powered by solar cells (day) and regenerative fuel cells (night), payload will be surveillance and communications gear.

PHASE III: 2008-2010

Objective: Full commercial realization

Research: Full-scale system development, mission payload integration

In this program, KARI is responsible for airship systems and systems integration. The Electronics and Telecommunications Research Institute (ETRI), also in Taejon, will be developing payload systems and ground communications systems. The longest lead times and highest risk are on the vehicle side of the program.

Critical technologies identified by KARI

The critical technologies that KARI is working include:

- Airship systems
- Configuration design, aerodynamic analysis
- Autopilot and station keeping algorithm
- Structural development
- Ground tracking and control system
- Ground facilities
- Regenerative fuel cells
- Thermal treatment (analysis)
- Materials
- Launch and recovery

KARI identified the first three areas (airship systems, configuration design and aerodynamics, and the autopilot and station keeping algorithm) as areas in which they have made strong progress. KARI is not so experienced in the last four areas (fuel cells, thermal treatment, materials, and launch & recovery) and will work with outside organizations (companies, universities) to develop those.

Previous ONR IFO reports on airships

Koenig, Philip C., *Communications, Surveillance, and Cargo: Some Current Directions and Programs in Airship Design and Development*. Tokyo: ONR IFO Asia, August 21, 2001.

Koenig, Philip C., *Third Stratospheric Platform Systems Workshop (Tokyo, 1-2 Oct. 2001)*. Tokyo: ONR IFO Asia, October 4, 2001.

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