

# [ARGO] Requirements of Operation System

*Yoon-Kyung Seo, Hyung-Chul Lim, In-Kwan Park, Hong-Seo Im, Jong-Uk Park*

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# Scope of Requirements

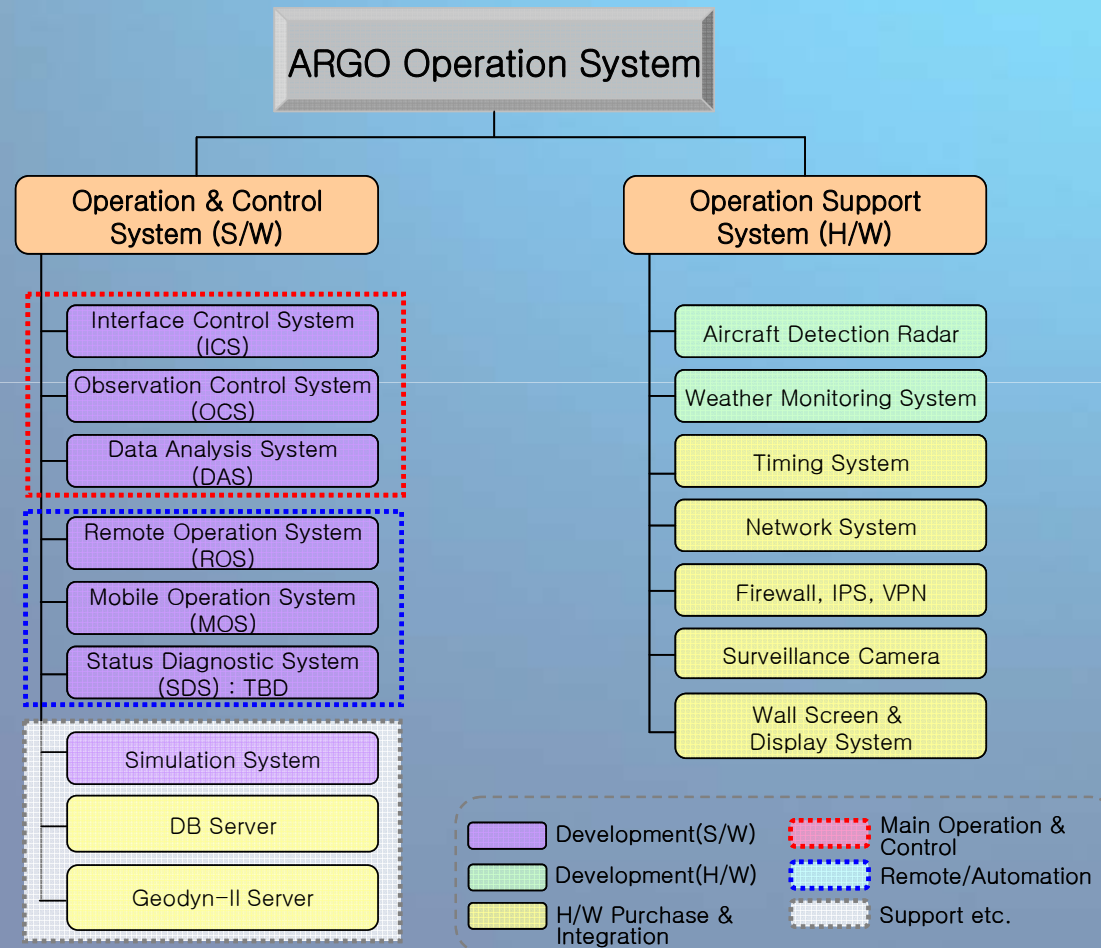


- **System Requirements Review(SRR) meeting : Sep.05.2008**
- **Related output document : System Requirements Specification**
  - : After having a SRR meeting, our working group submitted the output document to Project Manager, Mr. Hyung-Chul Lim. That output document was described as below:
    - Sub-system Definition
    - Functional Requirements Description
    - Performance Requirements Description
    - Interface Requirements Description
    - General Requirements Description for H/W (Equipments)

# System Overview



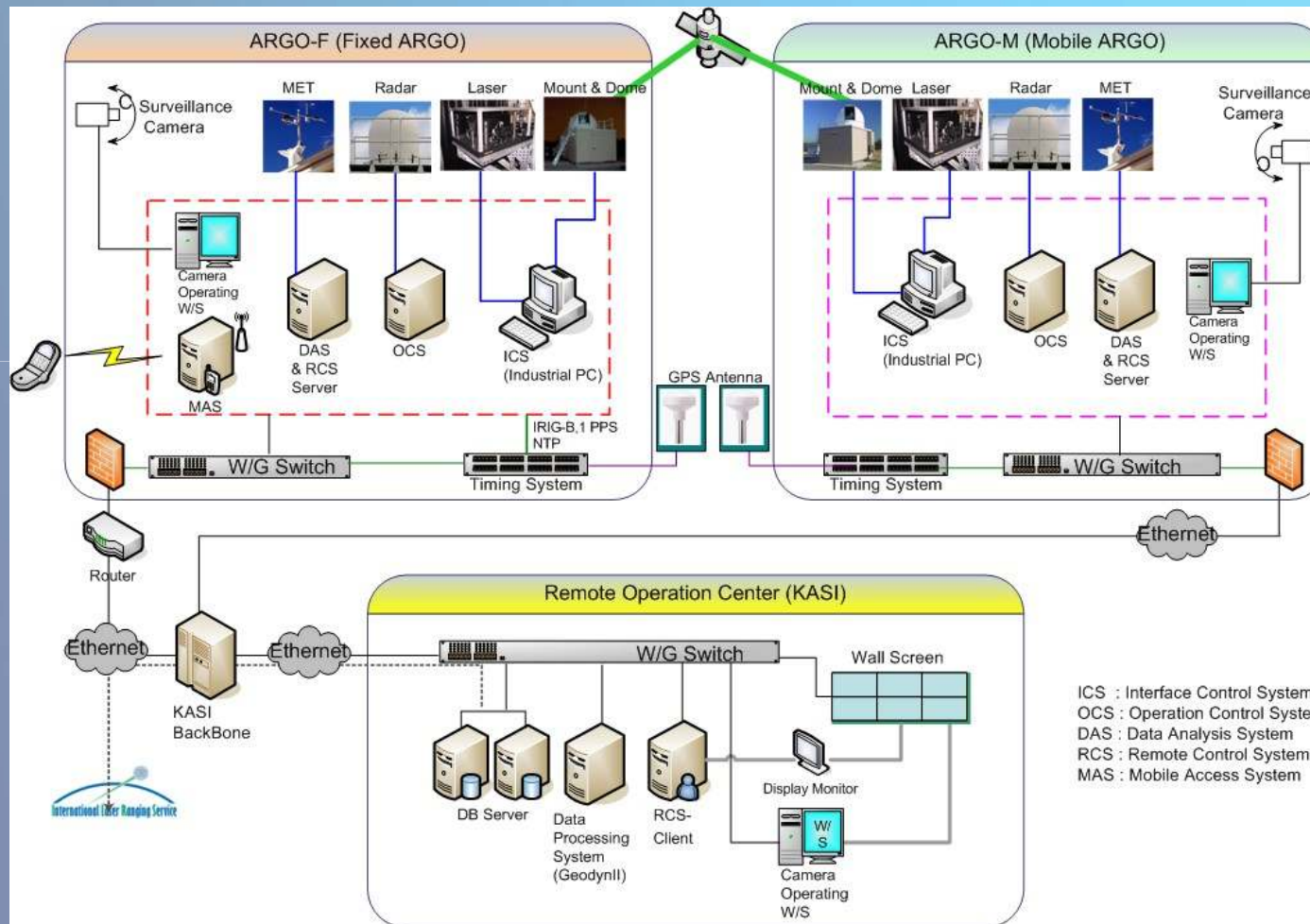
## Classification



# System Overview



## Block Diagram of Operation System



# Requirements – ICS



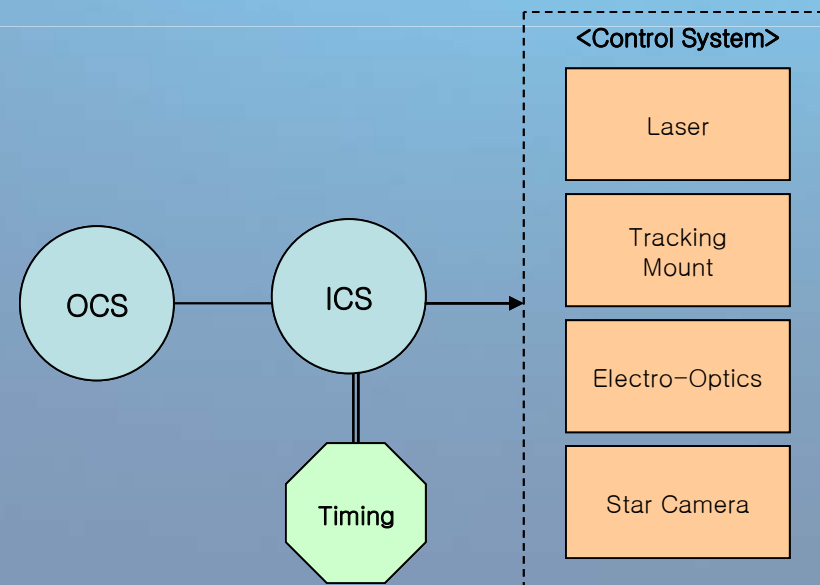
## ➤ General Requirements

- Interface Control System(ICS) has several interface cards of ISA or PCI type for delivering the commands or calculated values to related system (Laser, Tracking Mount, FPGA card and Star Camera)
- All delivering data on ICS shall be passed to and from OCS.
- The software runs under RTOS.

## ➤ Functional Requirements

- Mount Control
- Star Camera Control
- Laser Control
- Timing Synchronization
- Collection of System Status Check Value from Related System

## ➤ Interface Requirements



# Requirements – OCS



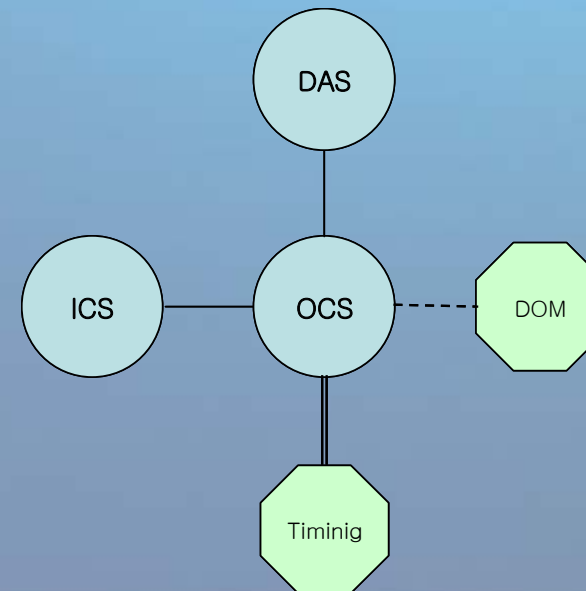
## ➤ General Requirements

- Operation Control System(OCS) is the main system which reflects operator's decision and makes the real-time prediction and scheduling.
- OCS shall be performed star & ground calibration and commands to Dom in emergency.
- The software runs under non-RTOS. But, because OCS is supplied the time code signal from timing system, it shall be synchronized to other system(ICS) and maintain the exact time.
- For ARGO system, because electro-optics part will perform the measurement of the Laser round trip time and many computation logics required the tracking in real-time, we think that OCS shall not be needed for processing burden

## ➤ Functional Requirements

- Real-time Satellite Schedule changing
- Range Prediction
- Mount Angle Computation
- Star Calibration
- Ground Calibration
- Dome Control
- Timing Synchronization
- Data Recording
- Supplying the Observation Data for Display in real-time

## ➤ Interface Requirements



# Requirements – DAS



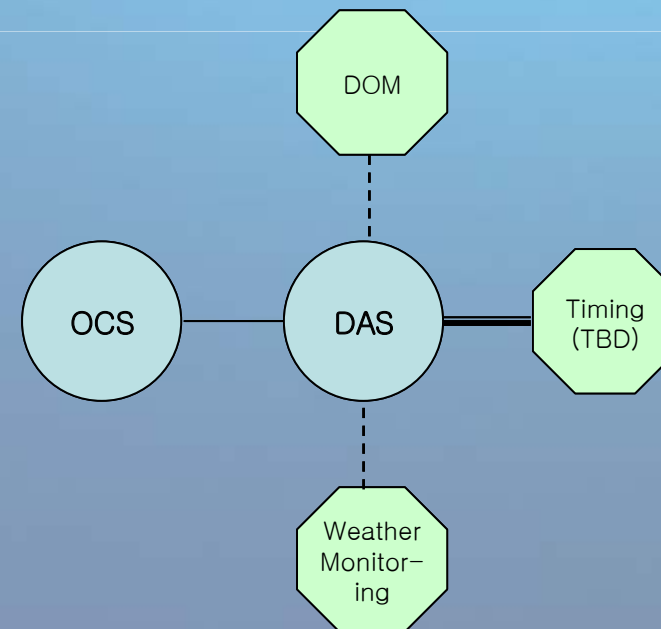
## ➤ General Requirements

- Data Analysis System(DAS) shall generate “Full-rate” data and the final data product(“Normal Points”) after making an observation one pass and send Normal Points data to ILRS periodically.
- DAS shall be collected the meteorological data from Weather Monitoring System and system status data.
- DAS shall undertake a role of “Server” for remote access from ROC or anywhere available for internet.

## ➤ Functional Requirements

- System Status Data gathering and delivering to OCS
- Meteorological Data gathering and delivering to OCS
- CPF downloading from ILRS
- Satellite Schedule File generation
- Full-rate & Normal Point data generation
- Data uploading to Remote Operation Center and ILRS periodically
- Dome control in Emergency(Redundancy)

## ➤ Interface Requirements





# Requirement – RAS



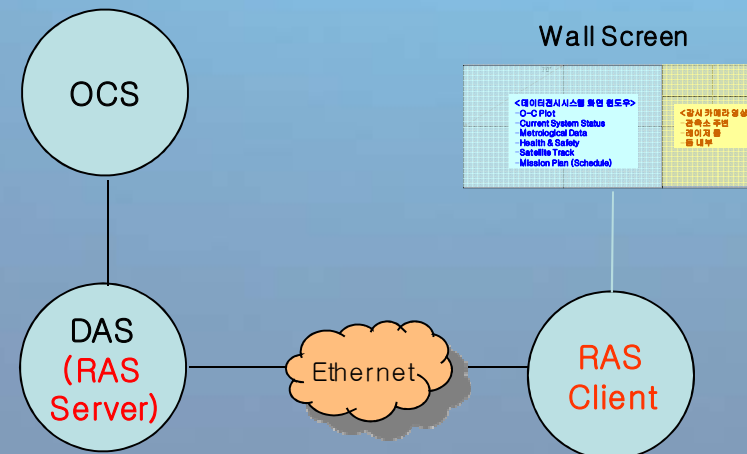
## ➤ General Requirements

- Remote Access System(RAS) shall be able to monitor or maneuver the observation process in real-time.
- RAS has a Server-Client structure.
- The received observation data through RAS client shall be displayed on Wall Screen in ROC(Remote Operation Center in KASI).

## ➤ Functional Requirements

- Real-time Communication
- User Authorization/Authentication for Remote Access
- Site permission for System Handling

## ➤ Interface Requirements



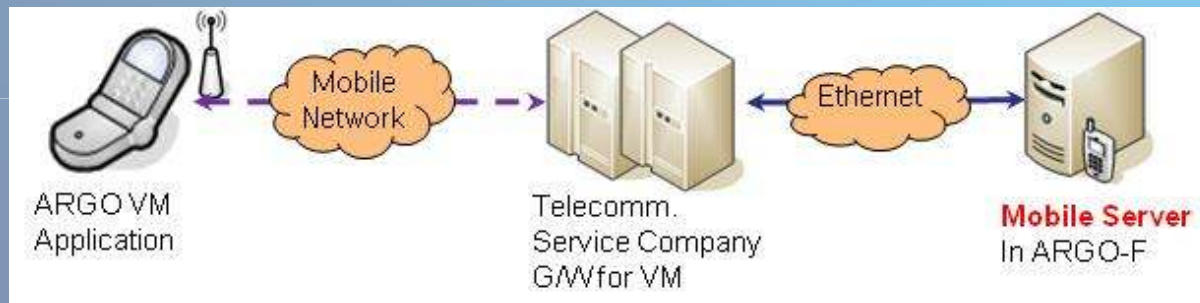
# Requirements – MAS



## ➤ General Requirements

- Mobile Access System(MAS) shall be able to control “ARGO-F” remotely by using mobile-phone.
- MAS shall be made up “Server” in ARGO-F and “mobile-phone” for user and needed for coordination form Telecommunication Service Company in order to use the mobile network.

## ➤ Interface Requirements



# Requirements – MAS



## ➤ Functional Requirements of Mobile Server

- Sending “SMS” to mobile-phone belongs to authorized user in emergency situation
- User Authorization/Authentication according to user’s phone number and password
- Providing the inquiry service for user information, notice message and list of system failure from DB
- Providing the monitoring the status of system and the service in progress
- Providing the service for accessing to system on-site remotely and identifying the result of processing
- Logging the communication failure and access information

## ➤ Functional Requirements of User’s Mobile-phone

- WIPI VM service realization through the mobile communication service company
- User Authorization/Authentication by connecting with the mobile server
- Inquiring about user information, notice message and list of system failure
- Monitoring the status of system and the service in progress
- Accessing to system on-site remotely and identifying the result of processing
- Inquiring about the list of system failure notice

# Requirements – Radar



## ➤ Purpose of Use

- For ARGO, because we use the Nd:YAG Laser, not eye-safe, so it is necessary to equip the RF radar and other method for detecting the aircraft to prevent an accident. (Beam does harm to the pilot's eyes. )
- Radar shall be able to prevent an accident by detecting the aircraft in advance.

## ➤ Objects Requirements

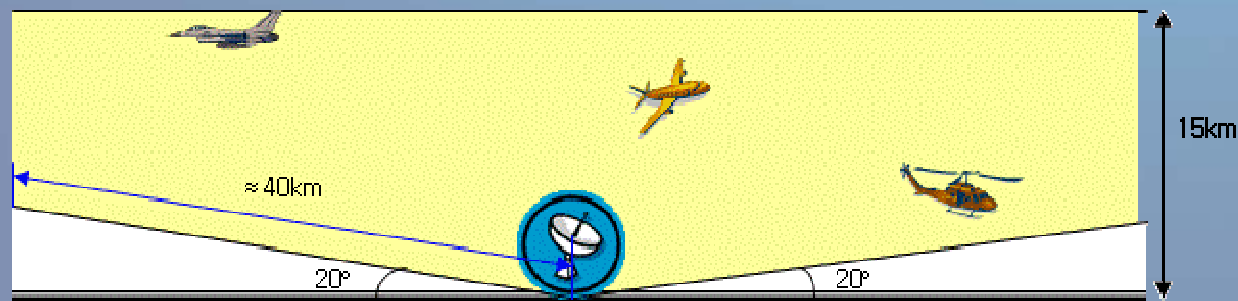
- Military & Civilian aircraft (including Helicopter) and a Hang-glider.

## ➤ Output Requirements

- Position (including height) and Speed of Aircraft
- The period of output transmitting shall be able to be controlled by an operator.

## ➤ Coverage Range Requirements

- Let us suppose that the maximum altitude which the aircraft can cruise is 15km. RF radar shall be able to cover the detecting area above 20 deg and the length of ~40km.



\* The maximum cruising altitude is assumed 15km.

# Requirements – Radar

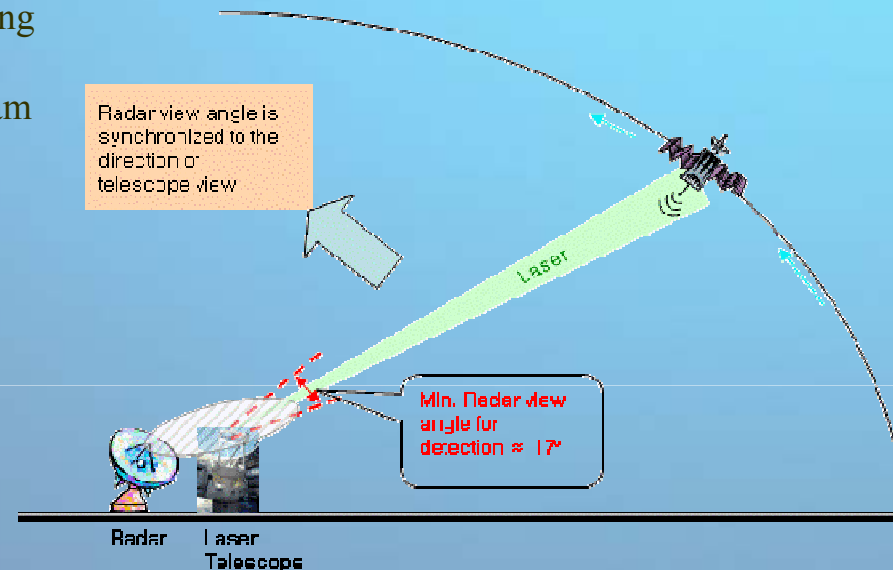


## Control Requirements

- Radar shall be able to receive the pointing computation value from OCS and synchronize two directions, the laser beam and radar pointing.
- Radar shall not be pointed below the horizontal level.
- Radar shall be able to recognize the Start/Stop signal from OCS.

## Installation Requirements

- Before a radar was installed, it shall be needed for RF analysis to prevent a damage about Electro-Optics detector and other electronic equipments.
- Radar shall be installed on place which is not harmful to telescope and mount system.



# Requirements–Weather Monitoring System

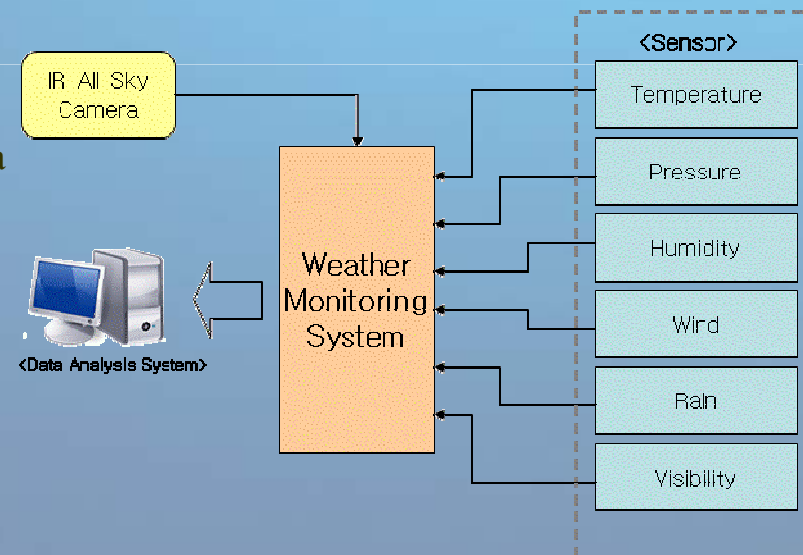


## ➤ Purpose of Use

- For Autonomous system, we are going to install the several kinds of sensors for acquiring the meteorological data.
  - Pressure, Temperature and Humidity data is used to correct range measurements of refraction.
  - Precipitation, Fog and Wind data is needed for system health and safety(ex. Dome Closing).
  - Visibility and All sky cloud sensors are needed for a fully autonomous system.
- (I'll pass the requirements about each sensor without detail description)

## ➤ Operational Requirements

- The output from each sensor shall be processed and displayed to an operator at a time by using the Integrated Solution.
- The operator shall control the sampling interval of data collected from several meteorological sensors.

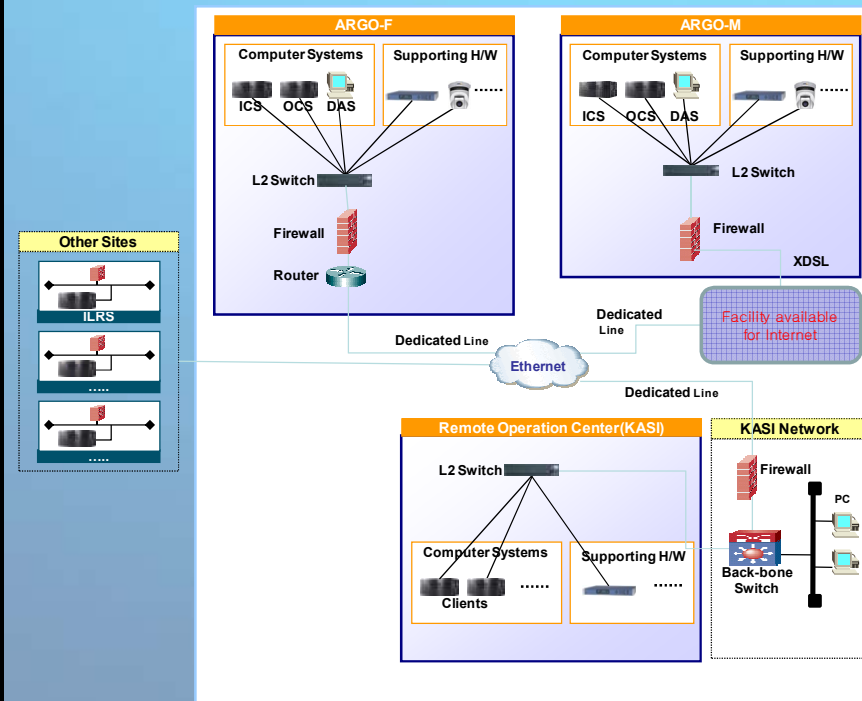


# Requirements – Network



## Environmental Pre-Requirements

<p><b>ARGO-M</b></p>	<ol style="list-style-type: none"> <li>shall be able to link from the closest facility equipped with internet conditions.</li> <li>shall be received minimum 3 static IP from facility nearby available for internet .</li> </ol>
<p><b>ARGO-F</b></p>	<ol style="list-style-type: none"> <li>shall be built up the network itself.</li> <li>shall consider the dedicated line for receiving ATC data</li> <li>shall be considered the minimum construction cost for connecting the dedicated line when ARGO-F site is selected.</li> </ol>
<p><b>ROC (Remote Operate Center)</b></p>	<ol style="list-style-type: none"> <li>shall be located in KASI and keep the rule of KASI network.</li> <li>shall consider the firewall itself, if necessary.</li> </ol>



# Requirements – Timing System



## ➤ Purpose of Use

- Timing system(or Time and Frequency System) is needed for synchronizing the system time to reference time(GPS).
- Timing system is composed of several equipment, GPS Antenna, Receiver, Oscillator, NTP server & client and interface card for receiving the distributed time signal in computer system.

## ➤ General Requirements

<b>GPS Antenna &amp; Receiver</b>	<ul style="list-style-type: none"><li>- GPS Antenna shall be equipped with over-voltage protector.</li><li>- GPS Antenna Operating Temp. : <math>-50^{\circ}\text{C} \sim +80^{\circ}\text{C}</math></li><li>- Better than RG-59/U connecting cable</li><li>- 12 channel GPS receiver</li><li>- Acquisition time: Cold Start &lt; 20 min.</li><li>- 1PPS Output Accuracy : UTC(USNO): <math>\pm 30\text{ nS RMS } 100\text{ ns peak}</math></li><li>- Freq. Output Accuracy : <math>1 \times 10^{-12}@ 1\text{ day}</math></li></ul>
<b>Oscillator</b>	<ul style="list-style-type: none"><li>- Maintain the accuracy over 5 days without GPS signal</li></ul>
<b>Output &amp; Distribution</b>	<ul style="list-style-type: none"><li>- UTC(IRIG-B)</li><li>- 1PPS</li><li>- Selectable Frequencies (1, 5, 10MHz)</li></ul>
<b>NTP</b>	<ul style="list-style-type: none"><li>- Client time Accuracy <math>\leq 10\text{ms}</math></li></ul>
<b>Interface Card</b>	<ul style="list-style-type: none"><li>- Support to RTOS system</li></ul>

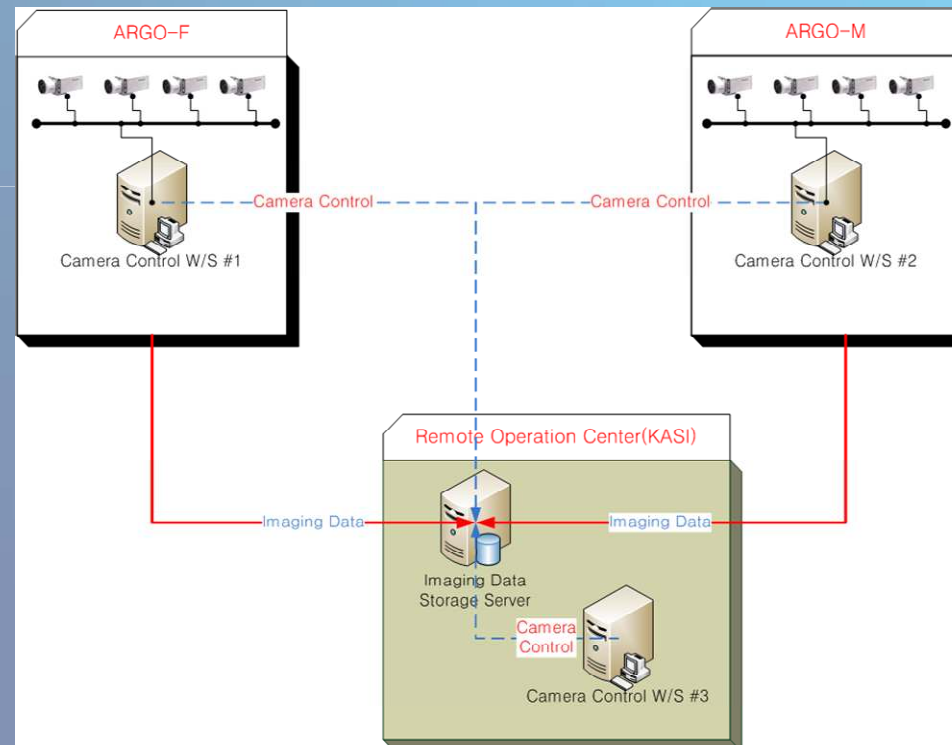


# Requirements – Surveillance Camera



## ➤ Purpose of Use

- To secure the safety of ARGO-M & -F facility
- To prevent the hazard in an operation
- We are going to install 4~5 web camera in ARGO-F and ARGO-M separately.
- And also these web cameras can be controlled from RCS remotely by operator.



# Requirements – Surveillance Camera



## ➤ General Requirements

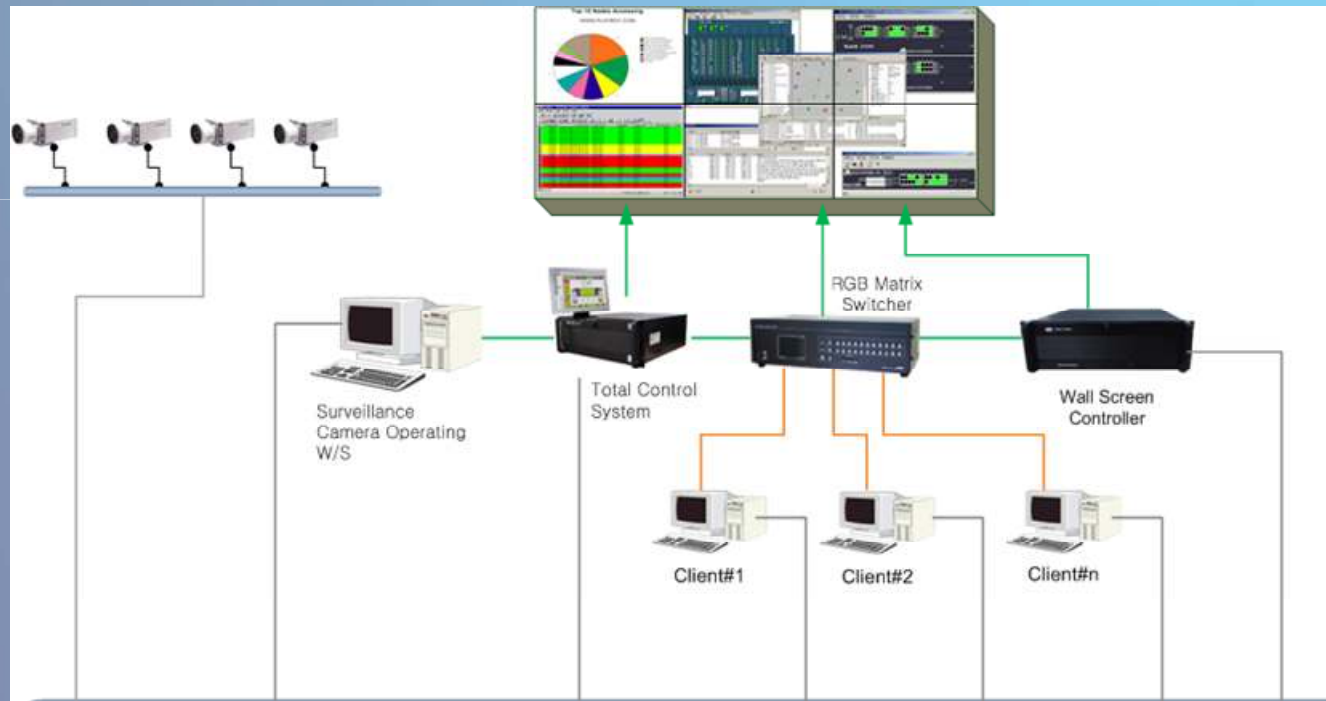
<b>Functional Requirements</b>	<ul style="list-style-type: none"><li>- Available in night time</li><li>- Automatic Zooming &amp; Focusing Control</li><li>- Pan : <math>\pm 170^\circ</math> , Max Speed <math>100^\circ</math> /sec</li><li>- Tilt : <math>-30^\circ \sim 90^\circ</math> , Max Speed <math>90^\circ</math> /sec</li><li>- Controlled remotely from Remote Operation Center(KASI)</li></ul>
<b>Installation and Housing Requirements</b>	<ul style="list-style-type: none"><li>- Operating Temperature : <math>-20^\circ\text{C} \sim 50^\circ\text{C}</math></li><li>- Including the Fan &amp; Heater &amp; Waterproof</li><li>- Exposed wire shall be covered with Shielding Tube.</li></ul>
<b>Operating W/S &amp; S/W Requirements</b>	<ul style="list-style-type: none"><li>- The imaging data shall be transmitted by wire/wireless network (Wireless is optional)</li><li>- S/W shall monitor &amp; store the minimum 4 cameras simultaneously.</li><li>- The imaging data of 4 Cameras shall not be exceed 1TB in a week.</li><li>- The stored image data shall be able to replay using MPEG-4 media player.</li><li>- S/W shall capture the image according to preset time interval</li><li>- S/W shall provide Auto-Scheduling function which is changeable by surveillance object, purpose and method.</li></ul>

# Requirements – Wall Screen & Display System



## ➤ Purpose of Use

- Displaying the status of the observation which is processing in ARGO-F & ARGO-M in real-time on Wall Screen
- Displaying the image acquired from surveillance camera on Wall Screen.



# Requirements – Wall Screen & Display System



## ➤ General Requirements

<b>Wall Screen</b>	<ul style="list-style-type: none"><li>- Resolution per 1 cell : more than <math>1,400 \times 1,050</math></li><li>- Luminance Accuracy : more than 95%</li><li>- Screen Gap : within 1 mm</li></ul>
<b>Wall Controller</b>	<ul style="list-style-type: none"><li>- Maximize, Minimize and PIP control</li><li>- Hybrid duplex composition with RGB Matrix Switcher</li><li>- Quadrant Viewer</li></ul>
<b>RGB Matrix Switcher</b>	<ul style="list-style-type: none"><li>- shall be control the video input/output signal by LAN or RS-232</li></ul>
<b>PC Interface</b>	<ul style="list-style-type: none"><li>- shall be able to branch off the video signal to RGB Matrix Switcher without a loss.</li></ul>
<b>Integrated Control System</b>	<ul style="list-style-type: none"><li>- Supplying the Touch Panel for operator's console</li><li>- shall be able to change the display layout easily</li></ul>
<b>Audio System</b>	<ul style="list-style-type: none"><li>- Audio mixer shall use a digital technology to produce the stereo output.</li><li>- Wireless microphone and receiver shall not be jammed up.</li><li>- Speaker shall consider the sound output according to the area of OCS and be suitable for interior.</li></ul>

# Future Work



- **System Design Review(SDR) for ARGO-M**
  - According to development schedule of ARGO program, “**System Design Review**” meeting for ARGO-**M** will be held on **the end of this year**.
  
- **S/W part,**
  - More precise review for system composition, main algorithm needed for automatic tracking
  - For analyzing the established requirements, we will draw “Usecase Diagram” and then feed back to requirements again.
  
- **H/W part,**
  - More precise review of specification for selecting the equipment adequately.
  - For reflecting the interface requirements, we need the survey of the interface between systems.



Thank you !!!