traced, as they have entered into the GOCI aperture. As they pass through each GOCI optical part, the ray path and intensity are adjusted according to the measured characteristics for reflection, transmission, refractive index and surface scattering. The ray-traced imaging and radiative transfer performance indicators confirm that the computer generated GOCI optical system with measured characteristics can be used for in-orbit operation simulation following the designed measurement sequence. The computational technique and its implications as a operation support tool are discussed.

### [III-2-4] Current progress in development of full 3D earth model for integrated ray tracing simulation of planetary disk averaged spectra

Dongok Ryu[1] , Kiljae Jung[1], Eun-song Oh[1], Ki-Beom Ahn[1], Soomin Jeong[1], Yukyeong Jeong[1], Jinhee Yu[1], Jae-Min Lee[1], Eric(JS) Hong[2], and Sug-Whan Kim[1]

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Detection of spectral bio-signatures from extra terrestrial planets has received an increasing attention from the astronomy and space science communities in recent years. In an attempt to better-understand disk averaged spectra of the only know terrestrial planet i.e. Earth, we are constructing a scale-able 3D earth model with surface reflectance and scattering properties. The USGS coastal line data were used to form coastal line segments and they were then stitched to generate continuous coastal lines to represent major continents and large islands. As the first stage of model verification, wavelength dependent ocean and land reflectance data and scattering characteristics were defined over the land and sea surfaces respectively. We then performed ray tracing based imaging and radiometric transfer simulations using a hypothetical optical payload receiving the reflected and scattered sun lights from the earth. The model concept, computational details, the simulation results are discussed as well as the future development plan.

## ■ Session IV-2 : Satellites 1
## Wednesday, 22 October [17:40-18:40]

### [IV-2-1] Star Visibility Analysis for a Low Earth Orbit Satellite

Jo Ryeong Yim, Seon-Ho Lee, and Ki-Lyuk Yong

*Department of Satellite Control System, Korea Aerospace Research Institute*

Recently, star sensors have been successfully used as main attitude sensors for attitude control in many satellites. This research presents the star visibility analysis for star trackers and the goal of this analysis is to make sure that the star tracker implementation is suitable to the mission profile and scenario and satisfies the requirement of attitude orbit control system. As a main optical attitude sensor imaging stars, accomodations of a star tracker should be optimized in order to improve the probability of the usage by avoiding the blinding (the unavailability) by the Sun and the Earth. For the analysis, a statistical approach and a time simulation approach are used. The statistical approach is based on the generation of numerous cases, to derive relevant statistics about Earth and Sun proximity probabilites for different lines of sight. The time simulation approach is performed for one orbit to check the statistical result and to refine the statistical result and accomodations of star trackers. In order to perform simulations first of all, an orbit and specific mission profiles of a satellite are set, next the earth proximity probability and the sun proximity probability are calculated by considering the attitude maneuvers and the geometry of the orbit, and then finally the unavailability positions are estimated. As a result, the optimized accomodations of two star trackers are suggested for the low earth orbit satellite.

### [IV-2-2] Contamination Control of Optical Observation Satellite

Chang-Ho Lee, Choon-Woo Lee, Young-Jun Cho, and Do-Soon Whang

*Korea Aerospace Research Institute*

Contamination has the potential for degrading the performance of the optical payload beyond the limits defined by mission requirements, therefore it must be considered a risk to system performance and must be mitigated. To mitigate contamination problem, contamination budget is allocated according to the contamination requirements which is derived from contamination effect analysis. Once the contamination budget is allocated, prediction for on-ground and in-orbit contaminants amounts and cleanliness control is performed. In this article, typical contamination control for observation satellite is described.

### [IV-2-3] Satellite FEM Validation test for High Frequency Jitter Analysis

Shi-Hwan Oh and Ki-Lyuk Yong

*Department of Satellite Control System, Korea Aerospace Research Institute*

The aim of the test is to provide an experimental basis to

validate the prediction of the FEM for high frequency jitter analysis due to reaction wheel. The principle is to measure structural transfer functions between the input disturbances at RWA base plate and the accelerations near the end tips of payload, in a configuration close to the operational model. The spacecraft shall have to be suspended, in order to be representative of on-orbit boundary conditions. The results of the test shall be compared to the output of the FEM analysis, and if needed, local upgrades of the FEM and/or margin policy shall be defined in order to guarantee a good test/FEM consistency. Test results were compared with the transfer functions of the FEM, which is globally tuned based on the results of vibration test and consequently have lower damping coefficients values than 1% in the frequency range of 60~200Hz. The damping coefficients estimated from the figures of FRF test results are different from the theoretical FEM, but the magnitude trend of FRF of the test results is somewhat similar with the analytical, it is expected that the overall jitter effect of final estimation is nearly same with the preliminary analysis result in which the damping coefficients were assumed to be 1% for all modes in FEM.

### [IV-2-4] Simple and Flexible Temperature Control System for Space Environment Test

Sang-Hoon Lee, Hyokjin Cho, Hee-Jun Seo, Guee-Won Moon, and Seok-Weon Choi

*Space Environment Test Department, KARI*

The temperature control system which is using liquid and gaseous nitrogen has been known as the most economical system to simulate space temperature condition due to relatively not expansive price of the liquid nitrogen (less than 0.2 USD per liter). And, among these systems, the closed loop system which circulates compressed nitrogen gas come from sprayed liquid nitrogen by blower and makes a target temperature with heat from an electrical heater and flow rate of liquid nitrogen is prevail all over the world. But, this complete closed loop system requires expansive equipments such as blower, heater, and liquid nitrogen injector, and special maintenance on the system. Therefore, KARI is developing efficient and simple open loop system which utilizes liquid and gaseous nitrogen with eliminating a special blower and other expansive units. In this study, this open loop system with more efficiency and flexibility will be designed and introduced.

## ■ Session V-1 : Astronomy & Cosmology 2
## Thursday, 23 October [10:00-11:15]

### [V-1-1] A Photometric Study of the W UMa-type Contact Binary GX Aurigae

Jang-Ho Park[1,2,3], Chun-Hwey Kim[1,2], and Jae Woo Lee[3]

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The CCD photometric observations of the W UMa type contact binary GX Aur were performed for 33 nights from 2004 to 2008 using a 2K CCD camera and Johnson BVRI filter system attached to the 61cm reflector at Sobaeksan Optical Astronomy Observatory (SOAO). From our observations, the first BVRI light curves of GX Aur were completed and eight new times of minima (primary: 4, secondary: 4) were obtained. All the times of minima including our timings were collected and analyzed to see the dynamical behavior of GX Aur system. Intensive analysis of our BVRI lightcurves with the recent Wilson-Devinney binary model shows that GX Aur is an over-contact binary whose component stars have equal mass and time-variable spots.

### [V-1-2] Period study of 1RXS J062518.2+733433 from the X-ray and optical data

A-Mi Yun[1,2], Youggi Kim[1], and Chul-Sung Choi[2]

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[2]*Korea Astronomy and Space Science Institute.*

1RXS J062518.2+733433. The X-ray data was obtained in April 6, 2006 with the XMM-Newton and the optical data with CCD R filter at the 1m telescope of the Lemonsan observatory in 2005-2006 for 11 nights. This source is classified as a magnetic cataclysmic variable with a spin period of 1187.3 s in the optical region. We determine the spin period to be 1187.26 ± 0.11 s using the X-ray data, which is well consistent with the optical studies. However, we find that the pulse profile of the data (0.2-10 keV) folded at the period is different from the quasi-sinusoidal optical profile and is dependent on the selected X-ray energy bands. The results of period searching with times of extrema will be also presented.

### [V-1-3] Neutron Capture Elements in Meltal-poor Giants

Ye Rim Lee[1], Jae Woo Lee[2], Jeong Deok Lee[2] and Ji Na Lee[1]

[1]*Sejong University,* [2]*ARCSEC*