

# **2018 IEEE International Conference on Aerospace Electronics and Remote Sensing Technology (ICARES 2018)**

**Bali, Indonesia  
20-21 September 2018**



**IEEE Catalog Number: CFP1896Y-POD  
ISBN: 978-1-5386-6033-1**

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IEEE Catalog Number:	CFP1896Y-POD
ISBN (Print-On-Demand):	978-1-5386-6033-1
ISBN (Online):	978-1-5386-6032-4

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## Thursday, September 20 10:00 - 10:15

### Coffee Break & Photo Session

Room: Discovery Room

## Thursday, September 20 10:15 - 12:00

### Keynote Session

Room: Discovery Room

Chair: Arifin Nugroho (Institut Teknologi Telkom, Indonesia)

## Thursday, September 20 12:00 - 13:00

### Lunch Break

Room: Hotel Restaurant

## Thursday, September 20 13:00 - 15:30

### Technical Session I: Aerospace and Electronic Systems 1

Room: Squash A Room

Chair: Anggoro Widiawan (PT. Telekomunikasi Indonesia, Tbk., Indonesia)

#### 13:00 [\*An Analytical Model for Intermediate WDM Nodes\*](#) **1**

Krit Chaiwong (Phetchaburi Rajabhat University, Thailand); Kanyarat Sriwistiyakun (Sripatum University, Thailand)

The construction and configuration of nodes in WDM Networks requires an accurate analytical model that can rapidly forecast the performance of the system. To increase the performance of WDM system design, basic mathematical models have been investigated and presented. This article presents an analytical model that applies Little's Theorem to analyze the performance of an intermediate node in a WDM Network. The intermediate nodes were analyzed using the WDM-Wavelength and WDM-without Wavelength conversion and Share Per Link (SPL) and Share per Node (SPN) configurations. The model is a simple, fast and accurate alternative to the performance analyses of nodes in WDM Networks using both WDM-Wavelength and WDM-without Wavelength conversion system configurations, specifically when considering the blocking probability and the time delay. The results show that the simulation trends and the prediction are in good agreement.

#### 13:15 [\*Decoupled Imaging for Coherent FMCW- MIMO Radar with Compressive Sensing\*](#) **8**

Ferdinand Grimm (University of Technology Munich, Germany); Jawad Munir (Technische Universitaet Muenchen, Germany); Josef A. Nossek (TU Munich, Germany & Federal University of Ceara, Fortaleza, Brazil)

We investigate a framework for coherent multiple input multiple output (MIMO) radar imaging using frequency modulated continuous wave (FMCW). The structure of the FMCW signal decouples the joint estimation problem into range and azimuth imaging. Decoupling the problem reduces the computational complexity of the approach. The proposed method is generalized to near-field scenarios in case the point spread function of the output signal can be approximated by the product of the transmit and receiver antenna point spread functions. The range imaging problem is solved with the help of a fast-fourier-transform of the beat signal. In order to avoid forward-backward spacial smoothing techniques we rely on a compressive sensing-based direction of arrival estimation. The performance of the proposed approach is

tested and evaluated using simulations. Furthermore we investigate the computational complexity of the framework.

13:30 [RANS Predictions of Junction Flow with Localized Suction](#) **15**

Shakeel Ahmed, Abdullah Malik and Khalid Parvez (Institute of Space Technology, Islamabad, Pakistan) Horseshoe vortex is a prominent feature in junction flows which not only changes the local flow patterns but is also responsible for aerodynamic losses in the region. In the past many investigations using wind tunnels and CFD have been made to study the junction flow. These studies have shown that RANS prediction of the junction flow demonstrate an acceptable qualitative match with the experimental results. The present investigations extend the CFD investigations to RANS predictions of the junction flow with boundary layer control using localized suction. Localized suction is an active technique that has proved successful, in the past through wind tunnel measurements, in elimination of the junction horseshoe vortex. The present investigations used these experimental results to evaluate the RANS predictions from the current study. During the course of this study, six cases of junction flows with and without localized suction were numerically simulated and compared with the wind tunnel measurements. For no suction case, CFD and experiment have been found in total agreement where location and size of vortex core formation was observed to be similar. When suction was applied, CFD predicted its effect by showing reduction in size of the vortex core similar to the results observed during the wind tunnel experiment. RANS simulations have predicted fairly accurate results in almost all the cases in comparison with the experimental data.

13:45 [Extending Range and Minimizing Turn Radius for a Missile Rocket](#) **21**

Larasmoyo Nugroho (Rocket Technology Center & Indonesian Air and Space Agency, LAPAN, Indonesia)

This paper studied the control approach to extend flight range and height, and to direct a turn for a controlled rocket such as missile. The control system, in brief, used three-loop control architecture and PID gain methodology. This research emphasized on building control sequence in longitudinal mode as well as in the directional mode of rocket trajectory. Minimum turn radius and maximum range was used as parameter to check the quality of flight performance of the missile. It is found that minimum turn radius could be reached from a specifically narrow spectrum of static margin, and correlatively this spectrum would provide maximum range in longitudinal axis. Careful picking position of center gravity is a paramount instrument to produce successful missile design aerodynamically and in terms of controllability.

14:00 [Design of Low Frequency Meander Line Antenna with Efficient Size Reduction](#) **26**

Khalid Moustafa (Electronics Research Institute, Egypt); Mohamed Elsayed Elkattan (Nuclear Materials Authority, Egypt); Angie Eldamak (Faculty of Engineering, Ain Shams University, Egypt)

This paper presents a 140 MHz printed miniaturized monopole antenna suitable for several low frequency electromagnetic surveying systems. The design is based on Meander Line with overall foot print of 29.3 cm x 6.45 cm. It acquires 46% reduction in length compared to conventional monopole operating at same frequency and 13 MHz enhanced bandwidth. The proposed design also exhibits omnidirectional characteristics with radiation efficiency of 80.2% and directivity of 1.68 dBi. The proposed configuration has been fabricated and measured, where sub 200 MHz operation is confirmed from both simulation and measurements.

14:15

14:30 [Parameter Estimation on Low Observability Data](#) **31**

Javensius Sembiring and Joachim Siegel (Technische Universitaet Muenchen, Germany); Florian Holzapfel (Technische Universität München, Germany)

This paper presents an estimation technique tailored on low information content of quick-access recorder data to produce unrecorded parameters required in an incident analysis. This paper also discusses a processing technique to increase the information content of the data. Combination of the two techniques when implemented on quick access recorder data produces a good estimate both from physical meaning and statistical properties.

14:45 [Energy Management for Unstable Approach Detection](#) **38**

Javensius Sembiring (Technische Universitaet Muenchen, Germany); Changwu Liu (Tsinghua University, Germany); Phillip Koppitz (Technische Universitaet Muenchen, Germany); Florian Holzapfel (Technische Universität München, Germany)

This paper presents a generic approach for detecting unstable approaches through energy management. Airline's standard operating procedures used for detecting unstable approaches are different from one airline to the other so that occurrences in one airline cannot be used for benchmarking purpose on other airlines. An approach proposed in this paper is motivated by the fact that unstable approach is caused by the inability to manage aircraft's energy required for conducting a stable approach. Therefore, quantifying the minimum energy required by stable approach is a necessary condition for detecting the approach type. A workable algorithm is developed and implemented on 2,000 flights landing at the same airport. Results show that unstable approaches detected by energy management are also included in the procedure-based results. This finding indicates that energy management-based unstable approach provides a generic approach for detecting unstable approaches which can be used for benchmarking purpose. In addition to that, the method proposed in this paper also requires fewer parameters in the analysis compared to the standard operating procedures which include many parameters to be analyzed for the same purpose.

15:00 [\*Simulation Approach to Determine Position of the Fixed Installed Deployable Solar Panel\*](#) **159**

Harry Septanto (National Institute of Aeronautics and Space (LAPAN)); Oetomo Sudjana (Parahyangan Catholic Univesity (UNPAR))

Because the small satellite development popularity and its promising performance in orbit, trends of mission to be run by the satellite become more complex. Payloads that have to be brought by the small satellites to run its mission may require more power that may not be able to be provided by power system that its solar panel is a body mounted solar panel. Because of size and mass constraints, the small satellites may not be able to accommodate solar panel system with active motion mechanism with respect to the satellite body in order to point to the sun. A natural question to be answered is where the best installation position (placement) of the deployable solar panel with respect to the body satellite such that the power system can acquire maximal solar energy. This paper proposes simulation based method to determine placement (position) of the fixed installed deployable solar panel system such that maximal power can be provided. To validate this method, simulations is presented in this paper where concerns in two different orbits of satellites and eleven cases that accommodates. Based in the simulation results, options for the position of the fixed installed deployable solar panel is provided.

15:15 [\*The Design Progress of LAPAN-Chiba University SAR Micro-Satellite\*](#) **49**

Robertus Triharjanto, Poki Agung Budiantoro and Dwi Yanto (Indonesian National Institute for Aeronautics and Space, Indonesia); Josaphat Tetuko Sri Sumantyo (Chiba University, Japan)

The paper describes the progress in system and subsystem design of LAPAN-A5/ChibaSat, the 1st micro-satellite jointly developed by Satellite Technology Center, Indonesian National Institute for Aeronautics and Space (LAPAN), and Center for Environmental Remote Sensing, Chiba University. The satellite will carry synthetic aperture radar (SAR) payload for land cover, ice observation. Augmented with and automatic identification system (AIS) payload, the satellite will also carry maritime surveillance mission. As the Engineering Model of the SAR payload is completed in 2016, the design enters system/configuration phase. The focus of the design phase is to comply with launch constraint such as dimensional envelope and weight, as well as power budget and link budget, while ensuring that the fulfillment of mission objectives. The design method is trade-off study on simplified SAR micro-satellite design model. The design assumes to use bus subsystem heritage from previous LAPAN's satellites. The design result shows the SAR missions required could be served within micro-satellite dimensional and weight constraints.

## Technical Session II: Geoscience & Remote Sensing 1

Room: Squash B Room

Chair: Agustan Agustan (Agency for the Assessment and Application of Technology (BPPT) & PTPSW-BPPT, Indonesia)

13:00 [\*Recurrent Neural Networks based on LSTM for Predicting Geomagnetic Field\*](#) **56**

Tong Liu, Tailin Wu, Meiling Wang and Meng-Yin Fu (Beijing Institute of Technology, P.R. China); Jiapeng Kang (Bit, P.R. China); Haoyuan Zhang (Beijing Institute of Technology, P.R. China)

The predicting accuracy of geomagnetic field is a major factor influencing magnetic anomaly detection, geomagnetic navigation and geomagnetism. The limitations of current methods consist of complex model,

a large number of parameters, method of solving parameters with high complexity and low forecast accuracy during geomagnetic disturbed days. In this paper we explore a deep learning method for forecasting geomagnetic field that adopts structure of recurrent neural networks (RNN) based on long-short term memory (LSTM). This method of LSTM RNN includes analyzing the characteristics of geomagnetic field and training the data set of geomagnetic data with simple and robust mathematical model. Compared with current methods, the high-precision prediction of geomagnetic field based on LSTM RNN is achieved during both geomagnetic quiet and disturbed days. Furthermore, it could be found that the average error and maximum error of LSTM RNN are far smaller than those of the other methods.

13:15 [\*FMCW Radar Post Processing Method for Small Displacement Detection\*](#) **61**

Aloysius Adya Pramudita, Erfansyah Ali, Fiky Suratman and Dharu Arseno (Telkom University, Indonesia)

A large bandwidth is needed for conventional FMCW radar for detecting a small displacement in millimeter scale. Phase data processing usually implement to avoid the large bandwidth problems that needed. Many implementations of phase detection in FMCW, generally utilize the IQ demodulation that placed at radio frequency (RF) circuit that it makes a significant change in RF circuit part. The advance post processing method of FMCW radar for small displacement detection was proposed in this paper. In the proposed method, IQ demodulation is performed at computation domain to minimize the RF hardware change and the beat frequency detection using Fast Fourier Transform (FFT) still elaborate in the proposed post processing to detect the initial position of the target. Theoretical and simulation analysis has performed to investigate the ability of the proposed method and the results show that the proposed method capable to detect a small displacement in millimeter scale without increasing the FMCW bandwidth and modification in RF hardware.

13:30 [\*An Application of SMART Method in vendor selection of Satellite Systems Case study of Indonesia Remote Sensing Satellite Systems \(InaRSSat\)\*](#) **66**

Muhamad Sadly (BMKG, Indonesia); Oni Bibin Bintoro (Agency for Assessment and Application of Technology (BPPT), Indonesia); Agustan Agustan (Agency for the Assessment and Application of Technology (BPPT) & PTSPW-BPPT, Indonesia); Dewayany Sutrisno (BIG, Indonesia); Fauziah Alhasanah and Swasetyo Yulianto (Agency for Assessment and Application of Technology (BPPT), Indonesia)

Indonesia is an Archipelagic State (maritime continent) with a strategic position and high potential in natural resources. Satellite technology is expected to provide answers in managing spatial-based natural resources. This paper presents a Simple Multi Attribute Rating Technique (SMART) approach for structuring and appraising activities of a large and complex solution to a problem. To illustrate the approach, a case study dealing with the assessment task of selecting affordable satellite provider from the vendor list is examined throughout the paper. The process is embedded in a decision support system (DSS) which is making use of the SMART method to determine vendor rankings and an efficient frontier. SMART method is used in this group decision making process because it allows complex problems to be divided into sets of simpler analysis and therefore able to directly influence the understanding of stakeholders on the process used in finding solutions. This group decision making process involves many stakeholders. Vendor selection of a satellite system is an important issue as the satellite system is a long-term investment for the government and the success of satellite application services is directly influenced by the result of the vendor selection. Furthermore, the vendor selection of a satellite system is a complex multi-stakeholder, multi-criteria decision-making issue. The group decision-making process can be improved by a systematic and logical approach to assess priorities based on the inputs of several stakeholders from related government sectors. The SMART method can be very useful in involving several decision-makers with different conflicting objectives to arrive at a consensus. The use of the proposed model indicates that it can be applied to improve group decision making in selecting a vendor that fulfills stakeholder specifications. It is found that the decision process is systematic and that using the proposed SMART model can reduce the time required to select a vendor. A procedure for selecting the number of providers shall be made in a process which presents as an efficient frontier analysis. Finally, results of criteria and cost benefit analysis design scenarios of satellite industry in the approach are discussed and conclusions are made.

13:45 [\*Statistical-based Stripe Noise Correction on LAPAN Microsatellite Imagery\*](#) **72**



Kamirul Kamirul and Patria Rachman Hakim (Indonesian National Institute of Aeronautics and Space, Indonesia); Sartika Salaswati (National Institute of Aeronautics and Space, Indonesia)  
LAPAN-A2 and LAPAN-A3 are the second and third generation microsatellites developed by Satellite Technology Center, Indonesian National Institute of Aeronautics and Space. To support earth observation and maritime surveillance, these satellites were equipped with matrix camera payload capable of producing digital images formed in Bayer pattern. Due to usage time of the camera, the quality of captured images is degraded leading to the appearance of vertical and horizontal stripe noise on captured images. The purpose of this study is to implement a statistical-based stripe noise correction involving median and mean filter in order to overcome relying stripe noise on images captured by LAPAN-A2 and LAPAN-A3 microsatellites. The performance of proposed method was evaluated quantitatively by calculating peak signal to noise ratio and structural similarity of corrected image.

14:00

14:15 [\*Deep Belief Networks for Feature Fusion in Hyperspectral Image Classification\*](#) **78**

Mohammad Ghassemi, Hassan Ghassemian and Maryam Imani (Tarbiat Modares University, Iran)  
Hyperspectral data classification is a great challenging method for remote sensing. In recent years, the researchers have had a great attention to the feature fusion of hyperspectral data. In this paper, we propose a new feature fusion method based on deep learning for hyperspectral data classification which employs deep belief networks (DBNs) to fuse spectral and spatial features. In the light of the above-mentioned descriptions, one can extract the discriminant and hierarchical features of remote sensing data, which are useful for further processing and classification based on support vector machine (SVM). First, we verify the eligibility of spectral, spatial and spectral-spatial features. Then, we propose a deep architecture, which stacks the spectral-spatial features, fuses and classifies fused features with DBN, and SVM to get high classification accuracy. First, we extract some spatial features by principal component analysis (PCA) and extended morphology (EMP), then stack them with spectral features and fuse the extracted features by the proposed method. The experimental results demonstrate that DBN is able to yield an unsupervised learning method. This proposed deep learning idea opens a new window for future remote sensing data fusion.

14:30 [\*Detection and Enumeration of Trees using Cartosat2 High Resolution Satellite Imagery\*](#) **84**

Suvarna Vani Koneru (VR Siddhartha Engineering College, India); Arul Raj M (National Remote Sensing Centre, India); Padmaja M, Praveen Kumar Kollu, Jitendra A, Ravi Raja A and Lokesh B (VR Siddhartha Engineering College, India)

Remote sensing plays a vital role in monitoring the earth resources. Remote sensing uses High-Resolution Satellites to capture and observe the various conditions of the earth like the Land cover and Land use which provides the information regarding how much of land is covered by forest, wetland, waterbody and how much of land is used by people for rural development, urbanization and agricultural in Digital Images. Digital Image Processing is useful in decrypt satellite data which helps to know change detection and land cover classification. In this research, satellite data are used to investigate trees and identifying trees on both coarse and fine scale. Tree crown is a major parameter for finalizing the tree location. It is a very difficult task to identify tree crown from high-resolution satellite imagery. Digital Image Processing consists of various techniques like image enhancement, segmentation, feature extraction and classifying the extracted features. In this research, CartoSat-2 images are used for Tree Crown Delineation. The Principle objective of Digital Image Processing is to process an image and get to know information available in satellite image without any degradation in the original image. Image enhancement or image processing helps to improve the structural appearance of an image without loss of data in the satellite image. Image segmentation is used to analyze the image in an understandable form, where it divides an image into multiple parts in the form of pixels. Basically, it is used to detect and classify the shapes or object boundaries and other relevant data in the digital images. Contrast Limited Adaptive Histogram Equalization(CLAHE)is one of the effective simple techniques for enhancing image quality. Active Contour Model with masking is best suit for image Segmentation and feature Detection and Tree Crown Delineation.

14:45 [\*Autonomous Image Georeferencing Based on Database Image Matching\*](#) **90**

Patria Rachman Hakim, Ade Putri Septi Jayani, Annisa Sarah and Wahyudi Hasbi (National Institute of Aeronautics and Space, Indonesia)

As an experimental remote sensing microsatellite, LAPAN-A3/IPB satellite has been continuously producing daily multispectral images for monitoring Indonesian archipelago. The autonomous image preprocessing software has been developed to process raw image into systematically corrected image, except for high level image georeferencing process which is still conducted manually. This research aims to develop an autonomous image georeferencing for LAPAN-A3/IPB multispectral images so that entire image preprocessing can be executed autonomously. The algorithm is based on template image matching approach, by using numerous of previously processed images. The developed algorithm has been well validated and successfully georeferences LAPAN-A3/IPB multispectral images with a good accuracy. The time needed for the algorithm to process single image can be considered very fast, therefore the algorithm can be integrated into already established image preprocessing software. With this fully autonomous image preprocessing, each raw image captured could be processed inside one hour since its acquisition, allowing fast and consistent image distribution to the end user.

15:00 [\*Satellite Attitude Determination Based on Pushbroom Image Band Coregistration\*](#) **96**

Patria Rachman Hakim and A. Hadi Syafrudin (National Institute of Aeronautics and Space, Indonesia); Satriya Utama (National Institute Aeronautics and Space, Indonesia); Wahyudi Hasbi (National Institute of Aeronautics and Space, Indonesia)

LAPAN-A3/IPB multispectral images have been systematically corrected for both geometric and radiometric distortions by using pre-flight imager calibration data as well as in-orbit satellite metadata such as satellite position and attitude. However in several cases, star tracker sensor as the main attitude sensor, could not provide satellite attitude data as needed, which causes a significant performance degradation of the resulting image correction. This research aims to provide satellite attitude data needed for image correction based on multispectral image captured. The research characterizes the relationship between band coregistration distortion occurs on the image to satellite attitude while imaging. Measurements and data fitting which have been conducted show that satellite attitude while imaging has strong relationship to band coregistration distortion caused. However, the accuracy of satellite attitude calculated from band coregistration distortion has moderate accuracy, for about 3 degree for each satellite axis. Although the accuracy produced can be considered low for other applications, it is good enough to provide attitude data needed for image correction purpose.

**Thursday, September 20 15:30 - 15:45**

**Coffee Break**

Rooms: Squash A Room, Squash B Room

**Thursday, September 20 15:45 - 17:00**

**Technical Session III: Geoscience & Remote Sensing 2**

Room: Squash B Room

Chair: Harry Septanto (National Institute of Aeronautics and Space (LAPAN), Indonesia)

15:45 [\*Comparison of Supervised Algorithms on DIWATA-I Microsatellite Space Bourne Multispectral Imagery\*](#) **103**

Fritz Rhaem Olivar, Kristian Monay, Mark Edwin Tupas, Benjamin Jonah Magallon and Romer Kristi Aranas (University of the Philippines-Diliman, Philippines)

The Phl-Microsat program in the Philippines was initiated for capacity building and with the end goal of having a source of remotely-sensed data for local planning, disaster risk mitigation, and resource management for the country. To increase its benefits, an established process to effectively utilize these images such as image classification is needed. This study aims to determine the most appropriate supervised algorithm for image classification among a set of classifiers that will yield the best results for DIWATA-I Spaceborne Multispectral Images (SMI). SMI is an optical payload, with 80m resolution, and a multiwavelength selection at 10nm width at 1nm steps. Three study sites within the Philippines were selected to test the classifiers - Camarines Sur, Ilocos Norte, and Oriental Mindoro. Spectral reflectance



values were then derived from atmospheric calibrations of the images. These images were then classified using six supervised classifiers and were post-processed using Majority Analysis. Accuracy is assessed by comparing the overall accuracy, kappa coefficient, producer's accuracy and user's accuracy extracted from the confusion matrix. From the results, Support Vector Machine and Maximum Likelihood classifiers produced the most desirable and most consistent results.

16:00 [\*Participatory Scenario Planning for Indonesian Space Industry in 2025\*](#) **110**

Agustan Agustan (Agency for the Assessment and Application of Technology (BPPT) & PTPSW-BPPT, Indonesia); Dewayany Sutrisno (BIG, Indonesia); Muhamad Sadly (BMKG, Indonesia); Oni Bibin Bintoro, Swasetyo Yulianto and Fauziah Alhasanah (Agency for Assessment and Application of Technology (BPPT), Indonesia)

As the world's largest archipelagic country with terrestrial and marine terrain, Indonesia needs a mastered space technology to be used to support national development in all areas including political, economic, defense and security. Satellite observer industry or remote sensing satellite industry is one solution to the answer. But the satellite industry is not yet developed in Indonesia. Therefore, the paper intends to examine the development of satellite observation industry in Indonesia by using "scenario planning" approach. The method used is descriptive qualitative analysis with Stakeholder scenario planning approach. The results show that the development of the national satellite industry targeted for implementation in 2025 requires strong political support with adequate human and economic support, among others, can be achieved by the adoption of satellite programs in national development priorities and forming a cross-sectoral consortium of stakeholders interest to build Indonesian Remote Sensing Satellite (InaRSSat) at this time.

16:15 [\*Key Issues of the National Initiative for Indonesia Remote Sensing Satellite: Three rounds Delphi Study\*](#) **116**

Oni Bibin Bintoro (Agency for Assessment and Application of Technology (BPPT), Indonesia); Agustan Agustan (Agency for the Assessment and Application of Technology (BPPT) & PTPSW-BPPT, Indonesia); Dewayany Sutrisno (BIG, Indonesia); Muhamad Sadly (BMKG, Indonesia)

Indonesia as a maritime continent with abundant natural resources requires a monitoring system of space or satellite remote sensing (RS) to obtain information quickly with broad coverage. Consequently, Indonesia needs to master the ability of earth observation and natural resource exploration satellite based on remote sensing technology. Indonesia currently has mastered the micro class technology satellite system and also has an earth station infrastructure system that receives satellite data. The country considered the need to develop operational satellites nationwide to support the country's self-reliance in the field of remote sensing satellite technology, and national technology development. Considering that the satellite industry is a complex system, it is necessary to apply an engineering analysis system that includes supply chain, business processes, and human resources (HR). This paper discusses the application of the Delphi method in prioritization of alternative key issues related to the Indonesia Remote Sensing Satellite Systems (InaRSSat) initiative. Delphi method is a method for structuring a group communication process so that the group can communicate effectively, allowing a group of individuals, as a whole, to deal with complex problems. This technique is one method of forecasting or estimating, which in this case is aimed at developing a consensus estimate of the future by asking an expert opinion on satellites and remote sensing applications in Indonesia. This study used an online method by utilizing website and WhatsApp application and executed in 3 (three) rounds. Results of the study are that key issues related to business process have more issues and ranked higher in the top 10 in comparison with key issues related to Supply Chain and Human Resources. Within the top ten issues, Business Process contain the following 5 issues: Creating Roadmap, Funding Satellite Project, Alligning National Vision, Increasing synergy of Industry, and improving synergy of RS Satellite development. Meanwhile, supply chain-related issues within the top ten issues are: Building RS Satellite, providing integrated Satellite System, Selecting Satellite technology. Human Resources-related issues are: building HR and improving the quality of education.

16:30 [\*Comparison of DEM generated from Cartosat-1 Stereo Pair with SRTM DEM: A case study of Betul \(M.P\), India\*](#) **121**

Suneetha Manne (India & VRSEC, India); Jha C s and Rajashekar Gopalakrishnan (NRSC ISRO, India); Suraj Reddy RS (National Remote Sensing Center, India); Neti Narasimha Sastry (V R Siddhartha College, India); Ramya M N S M n s (VR Siddhartha Engineering College, India)

Digital Elevation Model represents elevation in two dimensional varying raster. It provides significant analysis of the terrain characteristics and planning. Availability of high-resolution satellites helps extraction of DEM at different global scales from the stereo imagery. Cartosat-1 is an along track sensor which acquire stereo data acquired continuously with fore and aft cameras. Stereo data including Rational Polynomial Coefficients (RPCs) is used to generate DEM based on standard Rational Polynomial Model. This paper evaluates the DEM generated from Ames Stereo Pipeline (ASP) for Carosat-1 stereo pair with Shuttle Radar Topography Mission (SRTM) DEM. The accuracy of the DEM extracted from ASP is tested with the standard SRTM DEM available worldwide. The performance analysis shows that correlation of AMES DEM with SRTM shown 0.97 and RMSE of order 13.64m. The AMES DEM has shown high correlation and low RMSE values with the standard SRTM DEM.

16:45 [\*Water Trophic Status Mapping of Tecto-Volcanic Maninjau Lake during Algae Bloom using Landsat 8 OLI Satellite Imagery\*](#) **127**

Anggia Rivani (Universitas Gadjah Mada)

Maninjau Lake is a tecto-volcanic lake that benefit its surrounding in various aspect. The objectives of this study were 1) Mapping out the concentration of chlorophyll-a, total phosphor and transparency of Maninjau Lake through analysis of Landsat-8 OLI image and field survey, 2) Identifying and mapping trophic status of Maninjau Lake using Carlson method through Landsat-8 OLI and survey. The parameters used to determine the Carlson TSI are chlorophyll-a, total phosphorus, and Secchi Disk Transparency (SDT). The Carlson TSI parameter are modeled from Landsat 8 OLI image. The modeling was derived from field survey and laboratory data is re-coded with the image pixel of Landsat 8 OLI using stepwise regression method. The result of this stepwise regression will show the highest determination coefficient ( $R^2$ ) which is considered to be aviable variable to be modeled The variables that fulfill the prerequisite of stepwise regression is band 4 that strongly correlated with SDT data ( $R^2=0.82$ ). Band 5 and 6 band ratios are also strongly correlated with a-chlorophyll data ( $R^2 = 0.64$ ). Band ratios of 3.4 and 5 are strongly correlated with total phosphorus data ( $R^2 = 0.46$ ). The TSI Carlson mapping results show that Maninjau Lake is in a light eutrophic to hypereutrophic position with the greatest distribution being heavy eutrophic. Modeling that has been mapped requires validation test. The estimated error standard (SE) SDT was 0.2 m with a maximum content of 74,06%, SE total phosphorus maintained 0.14 mg/ l with a maximum content of 76.69%, and SE chlorophyll-a 0.02 mg/ l with. Landsat-8 OLI is capable to estimate the conditions of each trophic status parameter

**Thursday, September 20 15:45 - 17:30**

**Technical Session IV: Aerospace and Electronic Systems 2**

Room: Squash A Room

Chair: Robertus Triharjanto (Indonesian National Institute for Aeronautics and Space, Indonesia)

15:45 [\*Power Analysis of Optimal Earth Observation Micro-Satellite Design Under Different Control Parameter\*](#) **134**

Muhammad Sulaiman Nur Ubay (National Institute for Aeronautics & Space (LAPAN), Indonesia); Abdul Halim (Universitas Indonesia, Indonesia)

The main task of an earth observation satellite is to deliver accurate and valid earth surface information to the ground station. In order to perform this task, the satellite is equipped with an attitude control system. The control system establishes closed-loop with attitude sensors, especially in the imaging operation. However, the limitation of satellite power supply capacity causes the restriction of attitude control operation, which in turn, limits the satellite imaging capacity. The aim of this paper is to analyze the power performance of optimal satellite design by observing the effects of a Proportional Integral Differential (PID) parameter changes to satellite power consumption. In this paper, firstly optimal satellite parameters are chosen. The parameter choice is based on a quadratic objective function that representing power consumption. In the sequence, the PID attitude control system is designed for the satellite. Through simulation, the effects of various PID parameters have been studied.

16:00 [\*A Case Study in User Capacity Planning for Low Earth Orbit Communication Satellite\*](#) **140**

Maulana Arifin (Satellite Technology Center & Indonesia National Institute of Aeronautics and Space, Indonesia); Nova Khamsah (National Institute of Aeronautics and Space, Indonesia)

Nowadays, Indonesia as archipelago country is focusing on strengthening their competitive advantage in boosting the capability and development of satellite technology especially in providing communication link for rural area in Indonesia. Currently, low earth orbit satellites constellation is the best choice to complement terrestrial networks, and one of the most important process of the communication satellite design is user capacity planning. In the proposed design, user capacity planning became a determining factor whether the satellite is feasible to be implemented. With benchmarking to TELESAT Low Earth Orbit (LEO), this paper aims to calculate and analyze user capacity in proposed low earth orbit communication satellite design using throughput calculation. The result of this communication satellite planning can provide services up to 74,746 user uplinks and 9,753 user downlinks. This paper also explores power variations of the power transmission which able to confirms the feasibility of the proposed design, where the user capacity in the lowest power scenario is 25,299 user uplinks and 6,705 user downlinks.

16:15 [\*Implementation Of CAN Bus Communication To UART In LAPAN-A4 Satellite\*](#) **146**

Rommy Hartono (Indonesian National Institute of Aeronautics and Space, Indonesia); A Hadi Syafrudin (Indonesian National Institute of Aeronautics and Space, Indonesia); Wahyudi Hasbi (National Institute of Aeronautics & Space (LAPAN), Indonesia); Rakhmad Yatim (Indonesian National Institute of Aeronautics and Space, Indonesia)

The Controller Area Network (CAN) is a vehicle bus standard which allows various electronic components such as microcontrollers, sensors, actuators to communicate with each other without a host computer, with speed up to 1Mb/s. It is a message-based protocol designed specifically for automotive, but it is also used in areas such as aerospace, maritime, and industrial automation. The new satellite generation of LAPAN, LAPAN-A4, will carry payload Medium Resolution Multispectral Imager/SLIM4 and the interface of this payload utilizes CAN bus communication. This paper is aimed at the design and implementation of CAN using microchip MCP and microcontroller for being able to communicate with SLIM4 over CAN Bus. For hardware design, the CAN controller used in this research is MCP 2515 and the CAN transceiver is MCP 2551 which uses the SPI interface to widen CAN Bus interface. From the result of the design and implementation, we got bit rate 388.042 Kbit/s by using internal oscillator 14.7456 Mhz without baud rate prescaler (BRP), the total bit time is 19 Time Quantum (TQ) which consists of 1 TQ for synchronization segment, 7 TQ for propagation segment, then 8 TQ for phase segment1 and 3 TQ for phase segment2, respons time acknowledgement average is approx 403-405 ms, and the final configurations we choose for the baud register MCP 2515 are CNF1=0x00, CNF2=0xBE, and CNF3=0x02.

16:30 [\*Study on Impact of Outdated Two-Line Element Sets in Tracking of LAPAN-A2 and LAPAN-A3 Satellites\*](#) **153**

Muazam Nugroho and Nova Khamsah (National Institute of Aeronautics and Space, Indonesia)

On satellite tracking, information about orbital elements of the satellite which is contained in North American Aerospace Defense Command Two-Line Element (NORAD TLE) is needed. This paper shows a study of how updating Two-Line Element effecting the position prediction of LAPAN-A2 and LAPAN-A3 satellites. The positions of the satellites observed are determined by their latitude, longitude, and altitude. The results of orbit simulation, and position error calculation demonstrate that in the case of 1-day and 1-week Two-Line Element, compared to the updated Two-Line Element, shows insignificant errors of the satellites position. Nonetheless, for more than 1-week outdated Two-Line Element yields a very high error in predicting the position of the satellites and could affect the satellite tracking results. Furthermore, the mission simulation of LAPAN-A2 satellites illustrates the difference result of the imaging mission of the satellite with roll angle  $4.21^\circ$  between the updated and the outdated Two-Line Element scenario, which makes it convincing that updating Two-Line Element in satellite tracking tools is very important in satellite tracking.

16:45 [\*LAPAN-A4 Concept and Design for Earth Observation and Maritime Monitoring Missions\*](#) **44**

Muhammad Saifudin, Abdul Karim and Mujtahid Mujtahid (LAPAN, Indonesia)

Lapan-A4 is Indonesian fourth's microsatellite after successfully launch of LAPAN-A3/LAPAN-IPB on June 2016 which is currently in 2 years operational. Continuing the previous mission, all activities such design, assembly, integration, and test are fully carried out in Indonesia. The main mission of LAPAN-A4 is an earth observation using multispectral imager and support global maritime traffic monitoring using space-based Automatic Identification System (AIS) receiver. The other missions are scientific research using space-based magnetometer and experimental thermal infrared sensor. The multispectral imager

consists of four bands (R, G, B, and NIR) medium resolution and high resolution. The space-based AIS receiver is more advance compare with the AIS receiver that has been flown in LAPAN-A2/LAPAN-ORARI and LAPAN-A3/LAPAN-IPB. These two missions will complement previous missions of LAPAN-A2/LAPAN-ORARI and LAPAN-A3/LAPAN-IPB. Supporting these missions, several aspects of design has been defined, considered, and analyzed include the payload system, bus and electronics system, and structure. LAPAN-A4 plans to launch in the 1st quarter of 2020

17:00 [\*A Green Propulsion System Requirement for LAPAN-A4\*](#) **163**

Satriya Utama (National Institute Aeronautics and Space, Indonesia); Muhammad Saifudin (LAPAN, Indonesia); Mohammad Mukhayadi (National Institute of Aeronautics and Space, Indonesia)

This paper provides the requirement of green propulsion that will be used on LAPAN-A4 satellite for station keeping. LAPAN-A4 is designed for earth observation mission using high resolution multispectral imager. To maintain the quality of imaging, station keeping is needed especially to keep the orbit sun-synchronous. LAPAN-A4 will be equipped with the propulsion system that use a green propellant. One of the green propellant is High Performance Green Propulsion (HPGP). HPGP propellant has specific impulse 235 second and LAPAN-4 will apply the nominal thrust of 1 N. LAPAN-A3 orbit data is applied to calculate the local time drift. For 5 years operation 2.4 kg propellant needed for inclination maneuver every 3 months or less.

17:15 [\*Diwata-1 Target Pointing Error Assessment using orbit and space environment prediction model\*](#) **169**

Benjamin Jonah Magallon (University of the Philippines-Diliman, Philippines); Francisco Miguel Felicio, Ariston Gonzalez and John Leur Labrador (PHL-Microsat Program, Philippines); Mark Edwin Tupas (University of the Philippines-Diliman, Philippines)

Diwata-1 is the Philippines' first Earth observation microsatellite launched to space through the International Space Station. It has an altitude of 400 km and a velocity of 7 km/s. As an observation satellite, it is required to have high target pointing accuracy. However, being a low Earth orbit microsatellite, it experiences stronger external disturbances compared to larger and higher altitude satellites. Such disturbances are from the sun, and the Earth's albedo and magnetic field. How these disturbances impact the pointing accuracy of the satellite must be determined to improve the setting of satellite missions, where such disturbances would be minimal. In addition, the satellite's orbit decays quickly due to these disturbances, which means accurate satellite prediction is also critical in setting correct parameters for its targeting operations. In this paper, a comparison of different satellite prediction models to the Diwata-1 telemetry in varying TLE ages were done to determine which model fits best to the satellite's orbit and what corrections are needed to minimize the difference between the actual satellite position from the predicted version, and in effect improve the satellite's pointing accuracy. In addition, cases comparing the target area set during the creation, and the upload of the satellite command with the actual location captured by the satellite, were linked to disturbances from the sun and the earth to determine if these disturbances affect the target pointing of the satellite.

**Thursday, September 20 19:00 - 21:00**

- Gala Dinner

**Friday, September 21 8:00 - 16:00**

- Bali One Day Tour