Foreword to the Special Issue on High Performance Computing in Earth Observation and Remote Sensing

ADVANCES in sensor technology are revolutionizing the way Earth observation (EO) and other remotely sensed data are collected, managed and processed [1]. The latest-generation EO instruments onboard airborne and satellite platforms are currently producing a nearly-continual stream of high-dimensional data, and this explosion in the amount of collected information has rapidly introduced new processing challenges. In particular, many current and future applications of remote sensing in EO, space science, and soon in planetary exploration science, require the incorporation of high performance computing (HPC) practices to address applications with high societal impact such as, monitoring of natural disasters (e.g., earthquakes and floods) or tracking of man-induced hazards (e.g., oil spills and other types of chemical contamination [2]). Many of these applications require timely responses for swift decisions [3] which depend upon (near) real-time performance of algorithm analysis [4]. This is also the case for target detection applications [5], in which moving targets may be of interest, e.g., vehicles in a battlefield, drug trafficking in law enforcement, or chemical and biological agent detection in bio-terrorism.

New EO instruments (e.g., hyperspectral imagers [6]) are expected to substantially increase their spatial and spectral resolutions (imagers with hundreds of narrow spectral channels are currently available, and ultraspectral instruments with thousands of spectral bands are under development), thus producing a nearly continual stream of computationally intense image processing data sets. Technological advances are not only expected in optical instruments, but also in radar and other types of remote sensing systems. Specifically, synthetic aperture radar (SAR) is a very important instrument for EO. SAR image processing is particularly time consuming [7], and can greatly benefit from HPC techniques and practices to speed up processing of this type of data. Given the multiple types of remote sensing data currently available, computing resources will have to be used in complementary fashion to address problems such as efficient data sharing and distribution, compression, processing, transmission and storage [8]. Although the role of different types of HPC architectures depends heavily on the considered remote sensing application, cluster-based parallel computing seems particularly appropriate for efficient information extraction from very large data archives comprising data sets already transmitted to Earth, while the time-critical constraints introduced by many remote sensing applications call for on-board and often real-time processing developments, particularly focused on data processing and compression. This includes specialized hardware architectures such as field programmable gate arrays (FPGAs) and graphics processing units (GPUs) [1]. In all cases, these computing resources must also be available on-demand, possibly from a national grid or secure cloud resource that can support coupled, HPC codes with strict processing deadlines. Clearly such grand challenge systems could support a variety of application domains.

This special issue of the IEEE JOURNAL OF APPLIED EARTH OBSERVATIONS AND REMOTE SENSING (JSTARS) is intended to present the current state-of-the-art and the most recent developments in the task of incorporating HPC techniques and practices to EO and remote sensing problems. The special issue brings together recognized international experts from many different institutions to provide a remarkable sampling of the latest advances in the field. Out of a high number of submissions to the special issue, the following papers were selected after the review process.

1) The first paper of the special issue [9] provides a review of recent advances in HPC applied to remote sensing problems. In particular, the HPC-based paradigms included in the review comprise multiprocessor systems, large-scale and heterogeneous networks of computers, grid and cloud computing environments, and hardware systems such as FPGAs and GPUs. Combined, these parts deliver a snapshot of the state-of-the-art and most recent developments in those areas, and offer a thoughtful perspective of the potential and emerging challenges of applying HPC paradigms to remote sensing problems.
2) In [10], a review of recent advances in HPC applied to hyperspectral imaging problems is provided. Hyperspectral imaging constitutes a relevant example and case study of a remote sensing application in which the use of HPC technologies is becoming essential. A quantitative comparison across four different types of HPC architectures (clusters, heterogeneous networks, FPGAs and GPUs) is given in this context by analyzing performance results of different parallel implementations of the same hyperspectral unmixing chain, intended to provide sub-pixel analysis of hyperspectral images by means of the identification of spectrally pure constituents (*endmembers*) and their corresponding abundance fractions on a per-pixel basis.
3) In [11], several implementation optimizations are proposed to accelerate the well-known N-FINDR algorithm for automatic endmember extraction from remotely sensed hyperspectral data sets. The conducted experiments demonstrate that the proposed fast implementations can greatly reduce the computational complexity of the algorithm while preserving the same endmember extraction accuracy obtained by the original N-FINDR.
4) In [12], a parallel group and region-based parallel compression approach for hyperspectral imagery is developed. The proposed algorithm first divides the image into proper regions and then partitions the hyperspectral image into several groups according to their associated band correlation for each image region. Experimental results on clusters

Digital Object Identifier 10.1109/JSTARS.2011.2163551

demonstrate the efficiency and parallel performance of the proposed data compression approach.

5) In [13], a new parallel simulated annealing approach for band selection from remotely sensed hyperspectral images is presented. Band selection is a common technique for dimensionality reduction. The proposed approach groups highly correlated hyperspectral bands into a smaller subset of modules regardless of the original order in terms of wavelengths. Two parallel implementations for clusters and multicore systems are presented, showing significant improvements from the viewpoint of computational performance.
6) In [14], a new computationally efficient technique for band selection is presented. It performs progressive band dimensionality expansion and reduction in hyperspectral data using a band prioritization approach which prioritizes the hyperspectral bands according to their priority scores calculated by a specific criterion. By virtue of its progressive nature, the proposed approach can be efficiently implemented in HPC systems while avoiding excessive computing time.
7) In [15], a new system is developed for efficient distribution and sharing of remote sensing data, based on the integration of web coverage and sensor observation services. Experiments on data retrieval have been conducted using hyperspectral imagery data collected by NASA's Earth Observing-1 (EO-1) Hyperion instrument, demonstrating that the proposed system is able to perform efficient data retrieval and distribution as compared to other similar developments.
8) In [16], a fast and effective algorithm for detecting ridge- or ribbon-like linear features from remote sensing imagery is presented. High-resolution aerial images were used to test the algorithm's ability to extract roads. The experimental results indicate that the proposed algorithm improves the processing of road details while the processing time significantly decreases with regards to other linear feature extraction algorithms.
9) In [17], a computationally efficient approach to segment SAR satellite images is presented and discussed. It adopts a multilayer level set approach which is able to segment an entire given SAR image into several sub-regions such that the segmented regions are homogeneous. By implementing the algorithm in terms of finite difference, this method offers an efficient and stable approach to SAR image segmentation.
10) In [18], a framework enabling an easier implementation of GPU codes for some parts of a global remote sensing image processing pipeline is presented and discussed. The framework is available as open source software. Several examples of implementation with increasing complexity are described and show significant improvements in different analysis scenarios, illustrating how GPU processing capabilities can assist in fast processing of remotely sensed data sets using GPU cards from NVidia, one of the most important GPU vendors.
11) In [19], GPU implementations of algorithms for improved transmission of remote sensing data to ground receiving stations are developed. Specifically, the paper focuses on accelerating low-density parity-check codes, which are used for designing efficient and flexible data communication links. The GPU implementations on NVidia cards are shown to significantly improve the performance of an available technique of asynchronous data transfer for decoding.
12) In [20], GPU implementations of band selection algorithms for remotely sensed hyperspectral data are provided. Band selection is adopted in this work not only to alleviate the computational burden, but also to achieve real-time processing of data with vast volume. The proposed algorithms are shown to provide performances comparable to those obtained by implementations on cluster-based parallel systems, illustrating the advantages of GPUs with regards to more expensive and difficult to maintain HPC systems.
13) In [21], the advantages of GPU technology in remote sensing applications are demonstrated by accelerating a hyperspectral imaging algorithm for analyzing submerged marine habitats. The obtained results demonstrate that data-parallel GPU computing can provide substantially faster processing times, as well as an avenue to achieve real-time desktop processing, for this complex algorithm.
14) In [22], a GPU-based implementation of the predictive partitioned vector quantization compression scheme, known for its effectiveness in lossless compression of ultraspectral sounder data, is presented. These ultraspectral sounders feature spectral resolution of over a thousand of infrared channels in each spatial location, hence the large volume of data observed on a daily basis needs some form of compression to reduce its size for data transfer and archive. Experimental results on NVidia cards show significant acceleration factors.
15) In [23], a GPU implementation of the discrete wavelet transform (DWT)-based set partitioning in hierarchical trees (SPIHT) algorithm is proposed. This technique is widely used in many image compression systems. The developed system obtains significant speedup when compared to its single-threaded CPU counterpart, being able to decompress satellite images at a speed of 90 frames per second.
16) In [24], a GPU-based radiative transfer model for the infrared atmospheric sounding interferometer (IASI) instrument is developed. This system was launched onboard the first European meteorological polar-orbiting satellites. The parallel model exhibited linear scaling with the number of available GPUs when implemented in several multi-GPU platforms from NVidia, and is proved to be suitable for the assimilation of IASI observations into an operational numerical weather forecast model.
17) In [25], an FPGA-based implementation of radiative transfer modelling of high resolution infrared (or microwave) spectra is provided for the processing of atmospheric remote sensing data. The design and implementation of an FPGA coprocessor for this purpose is presented, along with several performance tests. The obtained performance results can be used to estimate the performance of larger and/or faster hardware resources.

Summarizing, the wide range of HPC-based techniques and applications covered by the articles in this special issue exemplifies a subject area that has drawn together an eclectic collection of participants, but increasingly this is the nature of many endeavors at the cutting edge of science and technology. In this regard, one of the main purposes of this special issue is to reflect the increasing sophistication of a field that is rapidly maturing at the intersection of many different disciplines, including remote sensing, computer engineering, signal and image processing, optics, electronics, and aerospace engineering, among many others.

Last but not least, the Guest Editors would like to particularly thank the Editor-in-Chief, Prof. Jocelyn Chanussot, and the founding Editor-in-Chief, Prof. Ellsworth LeDrew, of JSTARS for their constant support and encouragement to this special issue. Special thanks also go to the former Deputy Editor-in-Chief, Prof. Kun-Shan Chen, who has been instrumental in this special issue from the very early stages of development. They all deserve enormous thanks for all their time and effort. The Guest Editors would also like to take this opportunity to gratefully thank all the contributors and reviewers who participated in the evaluation of manuscripts for the special issue. Without their outstanding contributions, the special issue could not have been completed.

ANTONIO PLAZA, *Guest Editor*
Hyperspectral Computing Laboratory, Department of Technology of Computers and Communications
Escuela Politécnica, University of Extremadura
Cáceres, 10003 Spain

QIAN DU, *Guest Editor*
Department of Electrical and Computer Engineering
Mississippi State University
Mississippi State, MS 39762 USA

YANG-LANG CHANG, *Guest Editor*
Department of Electrical Engineering
National Taipei University of Technology
Taipei, 10608 Taiwan

ROGER L. KING, *Guest Editor*
Center for Advanced Vehicular Systems
Mississippi State University
Mississippi State, MS 39762 USA

REFERENCES

[1] A. Plaza and C.-I Chang, *High Performance Computing in Remote Sensing*. Boca Raton, FL: CRC Press, 2007.
[2] A. Plaza and C.-I Chang, "Special issue on high performance computing for hyperspectral imaging," *Int. J. High Performance Computing Applications*, vol. 22, no. 4, pp. 363–365, 2008.
[3] D. Brunner, G. Lemoine, F.-X. Thoorens, and L. Bruzzone, "Distributed geospatial data processing functionality to support collaborative and rapid emergency response," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 2, no. 1, pp. 33–46, Mar. 2009.
[4] A. Plaza, "Special issue on architectures and techniques for real-time processing of remotely sensed images," *J. Real-Time Image Processing*, vol. 4, no. 3, pp. 191–193, 2009.
[5] T. K. Cossio, K. C. Slatton, W. E. Carter, K. Y. Shrestha, and D. Harding, "Predicting small target detection performance of low-SNR airborne LiDAR," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 3, no. 4, pp. 672–688, Dec. 2010.
[6] A. Plaza, J. Plaza, A. Paz, and S. Sanchez, "Parallel hyperspectral image and signal processing," *IEEE Signal Processing Mag.*, vol. 28, no. 3, pp. 119–126, May 2011.
[7] M. Stasolla and P. Gamba, "Spatial indexes for the extraction of formal and informal human settlements from high-resolution SAR images," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 1, no. 2, pp. 98–106, Jun. 2008.
[8] S. S. Durbha, R. L. King, S. K. Amanchi, S. Bheemireddy, and N. H. Younan, "Standards-based middleware and tools for coastal sensor web applications," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 3, no. 4, pp. 451–466, Dec. 2010.
[9] C. A. Lee, S. D. Gasster, A. Plaza, C.-I Chang, and B. Huang, "Recent developments in high performance computing for remote sensing: A review," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 508–527, Sep. 2011.
[10] A. Plaza, Q. Du, Y.-L. Chang, and R. L. King, "High performance computing for hyperspectral remote sensing," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 528–544, Sep. 2011.
[11] W. Xiong, C.-I Chang, C.-C. Wu, K. Kalpakis, and H. M. Chen, "Fast algorithms to implement N-FINDR for hyperspectral endmember extraction," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 545–564, Sep. 2011.
[12] L. Chang, Y.-L. Chang, Z. S. Tang, and B. Huang, "Group and region based parallel compression method using signal subspace projection and band clustering for hyperspectral imagery," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 565–578, Sep. 2011.
[13] Y.-L. Chang, K.-S. Chen, B. Huang, W.-Y. Chang, J. A. Benediktsson, and L. Chang, "A parallel simulated annealing approach to band selection for high-dimensional remote sensing images," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 579–590, Sep. 2011.
[14] C.-I Chang, S. Wang, K.-H. Liu, M.-L. Chang, and C. Lin, "Progressive band dimensionality expansion and reduction via band prioritization for hyperspectral imagery," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 591–614, Sep. 2011.
[15] N. Chen, Z. Chen, L. Di, and J. Gong, "An efficient method for near-real-time on-demand retrieval of remote sensing observations," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 615–625, Sep. 2011.
[16] Y. Shao, B. Guo, X. Hu, and L. Di, "Application of a fast linear feature detector to road extraction from remotely sensed imagery," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 626–631, Sep. 2011.
[17] Y. Huang and Y.-C. Huang, "Segmenting SAR satellite images with the multilayer level set approach," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 632–642, Sep. 2011.
[18] E. Christophe, J. Michel, and J. Inglada, "Remote sensing processing: From multicore to GPU," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 643–652, Sep. 2011.
[19] C.-C. Chang, Y.-L. Chang, M.-Y. Huang, and B. Huang, "Accelerating regular LDPC code decoders on GPUs," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 653–659, Sep. 2011.
[20] H. Yang, Q. Du, and G. Chen, "Unsupervised hyperspectral band selection using graphics processing units," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 660–668, Sep. 2011.
[21] J. A. Goodman, D. Kaeli, and D. Schaa, "Accelerating an imaging spectroscopy algorithm for submerged marine environments using graphics processing units," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 669–676, Sep. 2011.
[22] S.-C. Wei and B. Huang, "GPU acceleration of predictive partitioned vector quantization for ultraspectral sounder data compression," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 677–682, Sep. 2011.
[23] C. Song, Y. Li, and B. Huang, "A GPU-accelerated wavelet decompression system with SPIHT and Reed-Solomon decoding for satellite images," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 683–690, Sep. 2011.
[24] J. Mielikainen, B. Huang, and A. Huang, "GPU-accelerated multi-profile radiative transfer model for the infrared atmospheric sounding interferometer," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 691–700, Sep. 2011.
[25] D. Kohlert and F. Schreier, "Line-by-line computation of atmospheric infrared spectra with field programmable gate arrays," *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens. (JSTARS)*, vol. 4, no. 3, pp. 701–709, Sep. 2011.

Antonio Plaza (M'05–SM'07) received the M.S. and Ph.D. degrees in computer engineering from the University of Extremadura, Caceres, Spain.

He was a Visiting Researcher with the Remote Sensing Signal and Image Processing Laboratory, University of Maryland Baltimore County, Baltimore, with the Applied Information Sciences Branch, Goddard Space Flight Center, Greenbelt, MD, and with the AVIRIS Data Facility, Jet Propulsion Laboratory, Pasadena, CA. He is currently an Associate Professor with the Department of Technology of Computers and Communications, University of Extremadura, Caceres, Spain, where he is the Head of the Hyperspectral Computing Laboratory (HyperComp). He was the Coordinator of the Hyperspectral Imaging Network (Hyper-I-Net), a European project designed to build an interdisciplinary research community focused on hyperspectral imaging activities. He has been a Proposal Reviewer with the European Commission, the European Space Agency, and the Spanish Government. He is the author or coauthor of more than 280 publications on remotely sensed hyperspectral imaging, including more than 50 Journal Citation Report papers, book chapters, and conference proceeding papers. His research interests include remotely sensed hyperspectral imaging, pattern recognition, signal and image processing, and efficient implementation of large-scale scientific problems on parallel and distributed computer architectures.

Dr. Plaza has coedited a book on high-performance computing in remote sensing and guest edited four special issues on remotely sensed hyperspectral imaging for different journals, including the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING (for which he serves as Associate Editor on hyperspectral image analysis and signal processing since 2007), the IEEE JOURNAL OF SELECTED TOPICS IN APPLIED EARTH OBSERVATIONS AND REMOTE SENSING, the *International Journal of High Performance Computing Applications*, and the *Journal of Real-Time Image Processing*. He has served as a reviewer for more than 240 manuscripts submitted to more than 40 different journals, including more than 120 manuscripts reviewed for the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING. He has served as a Chair for the IEEE Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensing in 2011. He has also been serving as a Chair for the SPIE Conference on Satellite Data Compression, Communications, and Processing since 2009, and for the SPIE Europe Conference on High Performance Computing in Remote Sensing since 2011. He is a recipient of the recognition of Best Reviewers of the *IEEE Geoscience and Remote Sensing Letters* in 2009 and a recipient of the recognition of Best Reviewers of the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING in 2010. He is currently serving as Director of Education activities for the IEEE Geoscience and Remote Sensing Society. He is a Senior Member of IEEE.

Qian Du (S'98–M'00–SM'05) is currently an Associate Professor in the Department of Electrical and Computer Engineering at Mississippi State University. She has authored or coauthored more than 160 scientific publications including journal papers, book chapters, and peer-reviewed conference proceedings. Her research field is digital image processing and its application to remote sensing problems with an expertise on hyperspectral image exploitation. The research she has conducted covers almost all the topics in remote sensing image processing and analysis, such as target detection, anomaly detection, change detection, supervised and unsupervised classification, linear and nonlinear unmixing, endmember extraction, real-time processing, parallel processing, band selection, data compression, registration and mosaicking, sharpening, visualization, etc. Her research interests also include image super-resolution and neural networks.

Dr. Du is a Senior Member of IEEE. She has been active in the IEEE Geoscience and Remote Sensing Society (GRSS). She has been serving as a technical reviewer for many remote sensing and image processing journals, and received the 2010 best reviewer award from *IEEE Geoscience and Remote Sensing Letters* (GRSL). She currently serves as the Co-chair for Data Fusion Technical Committee of IEEE GRSS. She serves as the Guest Editor for the special issue on Spectral Unmixing of Remotely Sensed Data for IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING (TGRS), and the Guest Editors for the special issue on High Performance Computing in Earth Observation and Remote Sensing and the special issue on Exploitation of Optical Multiangular Data for IEEE JOURNAL OF SELECTED TOPICS IN APPLIED EARTH OBSERVATIONS AND REMOTE SENSING (JSTARS). She is the General Chair for the IEEE GRSS 4th Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensing (WHISPERS).

Yang-Lang Chang (M'05–SM'07) received the B.S. degree in electrical engineering from Chung Yuan Christian University, Taiwan, in 1987, the M.S. degree in computer engineering from Syracuse University, Syracuse, NY, in 1993, and the Ph.D. degree in computer science and information engineering from the National Central University, Taiwan, in 2003.

He started his career with NDC IBM Taiwan as a Hardware Design Engineer before joining ALCATEL as a Software Development Engineer, and presently is an Associate Professor in the Department of Electrical Engineering, National Taipei University of Technology. His research interests are in remote sensing, high performance computing, and hyperspectral image analysis.

Dr. Chang is a Senior Member of IEEE, a member of SPIE, the Phi Tau Phi Scholastic Honor Society, the Chinese Society of Photogrammetry and Remote Sensing, and the Chinese Society of Image Processing and Pattern Recognition. He has been a Conference Program Committee member and Session Chair for several international conferences. He is a member of the Editorial Advisory Board of the *Open Remote Sensing Journal*. He serves as Guest Editor for the special issue on High Performance Computing in Earth Observation and Remote Sensing in the IEEE JOURNAL OF SELECTED TOPICS IN APPLIED EARTH OBSERVATIONS AND REMOTE SENSING (JSTARS). Currently, he also serves as a General Secretary of the Taipei Chapter of the IEEE Geoscience and Remote Sensing Society. He is the recipient of the Best Reviewer Award of the IEEE JSTARS in 2010.

Roger L. King (S'70–M'76–SM'92) received the B.S. degree from West Virginia University, Morgantown, WV, in 1973 and the M.S. degree from the University of Pittsburgh, Pittsburgh, PA, in 1978 in electrical engineering. He received the Ph.D. in engineering from the University of Wales, Cardiff, in 1988.

He began his career with Westinghouse Electric Corporation, but soon moved to the U.S. Bureau of Mines Pittsburgh Mining and Safety Research Center. Upon receiving his Ph.D. in 1988 he accepted a position in the Department of Electrical and Computer Engineering at Mississippi State University where he holds the position of Giles Distinguished Professor. At Mississippi State University, he serves as the Director of the Center for Advanced Vehicular Studies in the Bagley College of Engineering which is a member institute of the High Performance Computing Collaboratory (HPC^2). The HPC^2 provides an advanced computing infrastructure in support of research and education activities. This infrastructure includes HPC systems, a fully immersive 3-D scientific visualization system, high performance storage systems, a large capacity archival system, high-bandwidth networking systems, and an extensive number of traditional desktop workstations. The primary computational systems consist of a 34-teraflop 3072-core Intel Westmere cluster with 6 terabytes of RAM and quad data-rate InfiniBand interconnect, a 10-teraflop 2048-core AMD Opteron cluster with 4 terabytes of RAM, a 384-core Intel Xeon cluster with an InfiniBand interconnect, and a 512-processor SGI ORIGIN 3900 shared memory server. Data storage capabilities include a 500 terabyte high performance RAID-enabled disk system, a 9 petabyte near-line storage/archival system, and a multi-terabyte high performance parallel file system.

Dr. King has received numerous awards for his research including the Department of Interior's Meritorious Service Medal. Over the last 30 years, he has served in a variety of leadership roles with the IEEE Industry Applications Society, Power and Energy Society, and Geosciences and Remote Sensing. He has served for four years as the Chair of the IEEE GRSS Data Archiving and Distribution Technical Committee and served as a member of the IEEE GRSS AdCom. He also served as the Co-Technical Chair for IGARSS 2009 in Cape Town, South Africa. He is a member of the European Image Information Mining Coordination Group (IIMCG) and Senior Member of IEEE.