Railroads play an important role in countries around the world. Railroads are efficient, safe, and environmentally friendly. Despite their many advantages, like any industry, railroads face many challenges – e.g., competition from other railroads, competition from other transportation modes, technological advances, increased customer expectations, increased shareholder expectations, governmental regulations, and a general drive for continual improvement.

The Railroad Application Section (RAS) of INFORMS brings industry experts, academic researchers, and OR/Analytics practitioners together to find creative solutions to meet the challenges facing the railroad industry. The RAS meetings at the INFORMS annual meeting play an important role in meeting RAS’s objectives. The RAS meetings will include:

- 13 sessions planned to shared findings and insights on a variety of topics
- the Problem-Solving Competition presentations of the three finalists (from the 37 submissions)
- the Student Paper Competition finalists’ presentations
- a roundtable discussion about railroad operations efficiency and recovery.

Thank you to all those who have helped with this year’s conference. We encourage all of you to consider taking an active role in RAS next year by running for office, chairing a session, presenting in a session, helping with the problem competition, or helping with the student paper competition, etc. RAS is only as good as we make it.

We want to congratulate Clark Cheng for being awarded the 2015 RAS Distinguished Member award for his continued contributions to RAS. The award will be presented at the RAS business meeting during the conference. We also want to draw attention to CSX and the University of Illinois at Champaign-Urbana for being finalists for this year’s Wagner Award. Congratulations!

Finally, we wish to express our sincere gratitude to our generous sponsors -- BNSF Railway, CSX Corporation, Norfolk Southern Corporation, Oliver Wyman, Optym, Tata Consultancy Services, and Tiger Analytics – whose contributions make many of the RAS functions possible. Thank you!

See you in Philadelphia!
RAS Sponsors

RAS is proud to serve its members via activities that help advance the application of operations research and analytics to railroad problems. Our events are organized by volunteers with a great sense of commitment and dedication, and we are very thankful for their time. These activities also involve a significant amount of money, so we rely on their financial support. This year we have raised $11,000 with the support of these sponsors, and we thank them for their continued time and generosity.

BNSF Railway is one of North America’s leading freight transportation companies, with a rail network of 32,500 route miles in 28 states and two Canadian provinces. BNSF is one of the top transporters of the products and materials that help feed, clothe, supply and power communities throughout America and the world. BNSF moves these goods more safely and efficiently, on significantly less fuel and with fewer emissions than the all-highway alternative.

CSX Corporation, together with its subsidiaries based in Jacksonville, Fla., is one of the nation’s leading transportation suppliers. The company’s rail and intermodal businesses provide rail-based transportation services including traditional rail service and the transport of intermodal containers and trailers. Overall, the CSX Transportation network encompasses about 21,000 route miles of track in 23 states, the District of Columbia and the Canadian provinces of Ontario and Quebec. The CSX transportation network serves some of the largest population centers in the nation. Nearly two-thirds of Americans live within CSX’s service territory.

Norfolk Southern Corporation is one of the nation’s premier transportation companies. Its Norfolk Southern Railway Company subsidiary operates approximately 20,000 route miles in 22 states and the District of Columbia, serves every major container port in the eastern United States, and provides efficient connections to other rail carriers. Norfolk Southern operates the most extensive intermodal network in the eastern United States and is a major transporter of coal, automotive, and industrial products.

Oliver Wyman, the fourth largest strategic consulting firm, is the premier consultancy for railways in operations planning and improvement, regulatory matters, process improvements and strategic guidance. In addition to consulting, their award winning MultiRail planning suite software is in use by many major railways in the United States, Canada, Mexico, Europe, Asia and Africa to provide business management for the entire operating plan process.

Optym is a leading provider of advanced planning, scheduling, real-time execution and business intelligence solutions for the global transportation and logistics industry. The company’s clients include railroads, mining companies, airlines, trucking companies and major retailers. Based in Gainesville, Florida, Optym develops its optimization, simulation and data analytics software using an innovative blend of operations research, computer science and vast industry knowledge. Optym was founded in 2000 and consists of over 160 highly skilled professionals with offices in four countries. Visit www.optym.com for more information.

Tata Consultancy Services is an IT services, consulting and business solutions organization that delivers real results to global businesses, ensuring a level of certainty that no other firm can match. TCS offers a consulting-led integrated portfolio of IT and IT-enabled services delivered through its unique Global Network Delivery Model™ (GNDM™), recognized as the benchmark of excellence in software development. TCS's mission is to help customers achieve their business objectives by providing innovative, best-in-class consulting, IT solutions and services and to make it a joy for all stakeholders to work with us. TCS is part of the Tata group, one of India’s largest industrial conglomerates and most respected brands. TCS has over 319,000 of the world’s best-trained IT consultants in 46 countries. See www.tcs.com for more information.

Tiger Analytics is a boutique advanced analytics firm that provides services to businesses to help them make data driven business decisions. They combine their quantitative modeling expertise with deep understanding of business needs and state-of-the-art technologies to solve complex problems.
RAS is able to serve our profession through the contributions of volunteers. Although help from everyone is appreciated, some volunteers’ contributions have a far reaching impact. Their work has given RAS a new direction and continues to inspire others to follow their footsteps. The RAS Distinguished Member Award was set up to recognize such individuals. The award committee consists of the current officers, past award winners and past RAS Chairs/Presidents. Dr. Clark Cheng was selected as the recipient of the RAS Distinguished Member Award for 2015. Dr. Cheng is the senior director of the Operations Research (OR) group at Norfolk Southern (NS). He has been a strong promoter of the OR applications in railroad industry, actively reaching out to academic and industries to raise interests in railroad research and applications, and providing valuable service to RAS and other railway-relevant organizations.

For the last decade, NS OR has developed and implemented more than a dozen of decision support systems for network planning, service design, locomotive fleet planning, locomotive real-time shop routing, railcar fleet planning, traffic demand forecasting, rail yard management, crew planning, line capacity, blocking plan optimization, train schedule optimization, empty railcar distribution, local service planning, intermodal equipment supply/demand forecasting, and next generation car scheduling. Under Dr. Cheng’s leadership, OR has built a good reputation and track record of delivering the right tools to assist NS with improving operations efficiency and reducing costs. A suite of closely integrated planning tools, ranging from traffic forecast to train plan to asset planning of locomotives, railcars, crews, line and yard capacity, have become an indispensable part of NS management’s decision making process.

Dr. Cheng also reached out to academics for joint research and development, working with researchers from Princeton University, University of Florida, and Northwestern University. Over the decade, NS OR has hired and trained more than one hundred OR graduate students in its co-op/internship program. Based on the feedback from those students, the co-op/internship experience at NS taught them real-world experience and well prepared them for their future careers.

Dr. Cheng has been an active INFORMS/RAS member since mid-90s, organized numerous RAS sessions, and made dozens of presentations at the INFORMS annual meetings. He has served as RAS chair (2007-2008), vice chair, secretary and treasurer in the past. On behalf of RAS, Dr. Cheng has organized the OR track in the Joint Rail Conference annual meetings since 2012. In addition to the RAS activities, Dr. Cheng is a member of the Standing Committee on Railroad Operating Technologies of the Transportation Research Board (TRB). He is a member of the External Advisor Board of the Institute for Sustainable Transportation and Logistics, University at Buffalo, the State University of New York.

2015 Distinguished Member Award: Dr. Clark Cheng
Updates from RAS Officers

Sandra D. Eksioglu (seksiog@clemson.edu) RAS Chair 2015
Kevin Crook (kevin.crook@bnsf.com) RAS Vice Chair 2015
Xuesong Zhou (xzhou77@asu.edu) RAS Vice Chair 2015
Mingzhou Jin (jin@utk.edu) RAS Secretary 2015
Alper Uygur (alper.uygur@bnsf.com) RAS Treasurer 2015
Xiaopeng Li (xiaopengli@usf.edu) RAS PR Officer 2015

RAS Membership

2015 was just another year RAS kept its membership count strong and stable. Compared to 2014, we dropped from 117 to 114; however, student members increased from 21 to 22. We strongly encourage students (for a nominal fee of $5 for INFORMS members and $10 for non-INFORMS members), academicians and business practitioners (for $15 for INFORMS members and $25 for non-INFORMS members) to become RAS members to enjoy and benefit from many perks of being a member. These include the invitation to the RAS reception at the annual meeting, opportunity to meet with industry leaders and like-minded professionals, and receiving notifications for the job/internship openings among others.

RAS Problem Repository

The RAS Problem Repository was created in 2011 to facilitate a platform on which:

1. Real-life railroad application problems are presented along with dataset(s) and solutions publicly available for anyone to research, develop and test solution approaches.

2. Researchers may showcase their results, engage in questions, answers and discussions, and measure the performance of different solution approaches.

You can find the problem description and data files on our website: http://informs.org/Community/RAS/Problem-Repository.

We have added the initial version of “Track Geometry Analytics” to the repository. We encourage researchers to submit different problems to add to the repository. Please contact RAS officers to upload your problem.

LinkedIn and Email List

RAS has a LinkedIn group (visit http://www.linkedin.com/groups?gid=2399643) or simply search the Rail Applications Section of INFORMS). LinkedIn provides us a forum in which people can post and discuss topics. It is also used as part of communication during our RAS competitions. The number of members in our group increased significantly from 181 in 2012 to 602 in 2015. If you are not already a member, please join the group to connect with the other members from academia, railroads and consulting.

We also have a mailing list of all past and present RAS members. You can post job opportunities or reach out to other members for a specific question or discussion item.

Got News to Share?

Published a paper? Published a book? Hiring for full timers or interns? If you have news that you would like to share with RAS members, please let us know. We can help spread the word.

Look forward to seeing you in Philadelphia!
### Annual INFORMS Meeting Sessions

Cluster Chair: Jeremiah Dirnberger, CSX, jeremiah_dirnberger@csx.com

This year we have a couple of new session types added to the mix: a tutorial on railroad data mining and a session focused on contributed presentations from the academic community. This brings our total number of sessions to 13 over four days. I would like to thank our session chairs for taking the time to plan and organize the sessions (details are below). We look forward to much sharing and learning about the work we are all doing to advance the science of railroading. See you all in the City of Brotherly Love!

RAS Sessions are in Track 70 and will be held in Room 202A at the Convention Center

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#### Sunday, November 1

<table>
<thead>
<tr>
<th>Time</th>
<th>Session Description</th>
<th>Chair</th>
<th>Details</th>
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| 08:00 – 09:30 | **SA70:** Railway Applications Section (RAS) Student Paper Award | April Kuo, BNSF Railway | First Place: “A novel two-stage approach to robust periodic timetabling” Nikola Bešinović, Delft University of Technology, The Netherlands (Co-Author: Rob M.P. Goverde)  
Second Place: “Solving the depot problem” Joris C. Wagenarr, Erasmus University, The Netherlands (Co-Authors: Jørgen T. Haahr & Richard M. Lusby, Danish Technical University)  
Third Place: “Real-time high speed train rescheduling in case of a partial segment blockage” Shuguang Zhan, Southwest Jiaotong University, China (Co-Author: Leo G. Kroon, Erasmus University) |
| 11:00 – 12:30 | **SB70:** RAS Problem Solving Competition 2015 | Francesco Corman, Delft University of Technology | Team 1: IRA Group-Negin Alemazkoor, Conrad Ruppert, Hadi Meidani; University of Illinois at Urbana-Champaign, USA  
Team 2: TCS Explorers-Sadir Kumar Sinha, Sumit Raut, Harshad Kadilkar; Tata Consultancy Services, India  
Team 3: Uniandes Team of Stochastic Optimization (UTSO)-Iván Cárdenas Gallo, Carlos Sarmiento Cardona, Gilberto Morales Zamora; Universidad de los Andes, Colombia |
| 13:30 – 15:00 | **SC70:** Roundtable Part I: Railroad Operations Efficiency and Recovery | Erick Wikum, Tata Consultancy Services | Speaker 1: Clark Cheng, Norfolk Southern  
Speaker 2: Jeffrey Guelker, BNSF Railway  
Speaker 3: Bob Gutman, CSX |
| 16:30 – 18:00 | **SD70:** Roundtable Part II: Railroad Operations Efficiency and Recovery | Erick Wikum, Tata Consultancy Services | Speaker 1: Lonny Hurwitz, Southwest Airlines  
Speaker 2: Siddhartha Sengupta, Tata Consultancy Services  
Speaker 3: Tao Tang, Beijing Jiaotong University |
### Monday, November 2

#### MA70: Rail Safety and Risk Analysis
**Chair:** Xiang Liu, Rutgers University

- Using Text Mining and Data Visualization to Analyze Railroad Grade Crossing Accidents (Trefor Williams, Rutgers University)
- Comparative Train Accident Analysis for Class I U.S. Freight Railroads (Zhao Wang, University of Illinois Urbana-Champaign)
- Fault Tree Analysis of Train Accidents on Shared-use Rail Corridor (Chen-Yu Lin, University of Illinois Urbana-Champaign)
- Risk-based Rail Inspection and Repair (Xiang Liu, Rutgers University)

#### MB70: Joint RAS/TSL/AAS: Real-Time Decision Support Practice
**Chair:** Ravindra Ahuja, OPTYM

- Simulation-guided Optimization Algorithms for Real-time Train Scheduling (Pedram Sahba, OPTYM)
- Real-time Airline Schedule Recovery (Dejun Hang, Jeppesen)

#### MC70: International Rail Freight
**Chair:** Steven Harrod, Technical University of Denmark

- Growth Potential for Rail Freight in Short Distance Markets (Steven Harrod, Technical University of Denmark)
- Freight Operations from a North American Perspective (Marc Meketon, Oliver Wyman)
- An Integrated Model for Locomotive Routing and Fueling Facility Locating (Gongyuan Lu, Southwest Jiaotong University)

#### MD70: Railway Analytics
**Chair:** Qing He, SUNY-Buffalo

- Multi-task Learning for Joint Prediction of Failure Time and Failure Types of Train Wheels (Weixin Wang, University at Buffalo)
- Diagnostic Method to Measure the Impact of Railway Traffic Heterogeneity from Field Operations Data (Mei-Cheng Shih, University of Illinois Urbana-Champaign)
- Evaluating Track Maintenance Aggregation in Extended Work Windows on Freight Railroad Lines (Alexander Lovett, University of Illinois Urbana-Champaign)

### Tuesday, November 3

#### TA70: Advanced Analytics in Tactical Decision Making
**Chair:** Krishna Jha, OPTYM

- Forecast Locomotive Surplus and Deficit to Balance the Terminals and Shops (Kamalesh Somani, CSX)
- Failure Prediction and Sensor Spacing Optimization Along Track Corridors (Yanfeng Outang, University of Illinois Urbana-Champaign)
- Development and Application of Line-of-road Emulator Tool in CSX (Yu Wang, CSX)
- Optimization Algorithms for Hump Yard Decision Support System (Alexey Sorokin, OPTYM)
**TB70: Yard and Terminal Simulation**
Chair: Roger Baugher, TrAnalytics, LLC

- Exploiting Data to Create Yard and Terminal Replay Capabilities (Roger Baugher, TrAnalytics, LLC)
- Simulation Model for a Large Railroad Flat Switching Yard (Clark Cheng, Norfolk Southern)
- Conflict Avoidance in Yards and Terminals (Brigitte Jaumard, Concordia University)
- Applying Dynamic Simulation to Validate and Improve New Transloading Terminal Operations (Martin Franklin, MOSIMTEC LLC)

**TC70: Predictive Analytics in Railways: Practice**
Chair: Dharma Acharya, Kosu Services, LLC

- State of Railway Analytics (Dharma Acharya, Kosu Services, LLC)
- Big Data Analytics for Optimized Track Maintenance and Renewal Management (Luca Ebreo, MERMEC Inc.)
- Using Data Visualization to Assess Performance Risk (Eric Pachman, CSX)
- Deploying Predictive Analytics Solutions in the Rail Industry and Seeing a Return on the Investment (Robert Morris, Predikto, Inc.)

**TD70: Tutorial: Railroad Predictive Analytics**
Chair: Aihong Wen, CSX

- Railroad Data Mining Tutorial
  (Aihong Wen, CSX, and Jerry Kam, CSX)

**Wednesday, November 4**

**WA70: Recent Academic Research in Railway Applications**
Chair: Jeremiah Dirnberger, CSX

- Integrated Systems Management Framework to Analyze the Critical Role of PTC in Rail Safety (Yalda Khashe, University of Southern California)
- Managing Rail Transportation for Hazardous Materials (Ginger Ke, Memorial University of Newfoundland)
- Potential Areas Affected by a Liquid Hazardous Material Release (Jose Manuel Martin Ramos, University of Illinois Urbana-Champaign)
- A General Solution for Rail Yard Simulation with Conflicting Routes (Yuan Wang, Southwest Jiaotong University)
The 2015 Problem

Participants were asked to predict when measured defects on railway tracks will exceed regulations, and require immediate maintenance. Track geometry defects are critical for keeping trains moving safely. Understanding when a defect will need to be fixed can help with preventive maintenance planning and reduce the probability of track failures. Track geometry vehicles periodically measure tracks – e.g., track gauge, alignment, curvature, and cross level – to help identify geometric defects. Track defects are classified into two severity levels – red tags and yellow tags. Red tag defects violate safety standards and must be treated as soon as possible after they are detected. Yellow tag defects instead satisfy safety standards, but do not meet the particular railroad’s own standards. The key question is when those yellow tags will turn red. Proactively identifying yellow tags that are turning into red tag defects, before they actually become red tag defects, allows railroads to more efficiently maintain the rail and remain in compliance of safety standards. Participants are given historical measurements for three types of defects: surface, cross level, and dip, with the goal to predict future (measured) defects at given places and times. The total cash award for this year’s competition is $3,750: First Place: $2000; Second Place: $1,000; Third Place: $750.

Additional details on the competition have been published on the web site: http://www.informs.org/Community/RAS/Problem-Solving-Competition

The Response

We would like to thank all of the participating teams for their hard work. We had a total of 37 teams registered (with members from China, Colombia, France, India, Iran, Italy, Taiwan, Tunisia, the United States) ten of which submitted reports. Special thanks go to the all RAS board and April Kuo (BNSF) for proposing the competition problem. Three finalist teams will make their presentations at the INFORMS Annual Meeting during the RAS Problem Solving Competition Session on Sunday, November 1, Session ID = SB70, Room 202A at the Convention Center. Their team reports will be made available on our website (www.informs.org/Community/RAS/) soon after. We invite you to come and support these bright minds.

Finalists (in alphabetic order)

IRA Group, Negin Alemazkoor, Conrad Ruppert, Hadi Meidani; University of Illinois at Urbana-Champaign, US
TCS Explorers: Sadir Kumar Sinha, Sumit Raut, Harshad Kadilkar; Tata Consultancy Services, India
Uniandes Team of Stochastic Optimization- UTSO Iván Cárdenas Gallo, Carlos Sarmiento Cardona, Gilberto Morales Zamora; Universidad de los Andes, Bogotá, Colombia

Honorable Mention

Given the high quality and innovativeness of work, we are also recognizing the following team with a honorable mention:

Tunisian Team/VNP: Souhir Elleuc, Bassem Jarboui, Nenad Mladenovic; Sfax university, Tunisia and Valenciennes, France

Recognition

We thank the sponsors and the following organizing committee members for their efforts:
  Francesco Corman (Chairman, Delft University of Technology, the Netherlands)
  Aihong Weng (CSX Transportation)
  Behnam Behdani (BNSF Railway)
  Chip Kraft (Transportation Economics & Management Systems Inc.)
  Edward Lin (Norfolk Southern)
  Kamalesh Somani (CSX Transportation)
  Krishna Jha (OPTYM)
  Krystel Castillo (University of Texas at San Antonio)
  Linkan Bian (Mississippi State University)
  Mengqi Hu (Mississippi State University)
  Tyler Dick (RailTEC, University of Illinois at Urbana-Champaign)
Special thanks go to Jeremiah Dirnberger (CSX) and Sandra Eksisoglu for their general help.
2015 RAS Student Paper Awards

Chair: April Kuo, BNSF Railway, April.Kuo@BNSF.com

Rail Applications Section (RAS), a section of the Institute for Operations Research and Management Science (INFORMS), sponsored a student research paper contest on analytics and decision making in railway applications, with a total cash award of $1,750:

First Place: $1,000, Second Place: $500, Third Place: $250.

To qualify, the paper must have been written by a student or students enrolled in an academic institution during the 2014-2015 academic year. The paper must advance the application or theory of OR/MS for improvement of freight or passenger railway transportation, and it must represent original research that has not been published elsewhere by the time it is submitted. More details on the eligibility criteria, the application procedure and deadlines are available at RAS’s website: https://www.informs.org/Community/RAS/Student-Paper-Award.

Eight students from around the world with a wide variety of topics registered for the competition. The quality of the submitted papers was in general very outstanding. Authors of the First, Second and Third Place award winning papers will present their papers at the Student Paper Award Session of the INFORMS Annual Meeting in Philadelphia, PA. We encourage all RAS members to attend this session and motivate our young researchers to continue to make great strides in building new models for railroad planning, scheduling and analytical problems. We provide below the abstracts of these papers. Extended abstracts of the awarded papers are available on the RAS website.

I had the honor of leading an elite paper reviewing committee made up of eleven members from different academic and industry backgrounds. In order to avoid any conflict of interest, members of the committee with any type or affinity with any of the authors or co-authors did not review the corresponding paper(s). The First Place paper will be considered for publication in Networks. The paper needs to go through the journal’s normal refereeing procedure; however, the paper will receive an expedited referring and publication .

A novel two-stage approach to robust periodic timetabling

by Nikola Bešinović, Delft University of Technology

Coauthor: Rob M.P. Goverde

Abstract: In dense railway networks, infrastructure capacity is a great limitation and the planning tasks become more complex and time consuming. We propose a new two-stage model for solving a robust periodic timetabling problem that aims at finding a timetable that uses minimally the existing capacity and maximizes the robustness. The experimental results report high quality timetables and give an insight in appropriate objective functions. Finally, the computational times are promising for practical uses.

Solving the depot problem

by Joris C. Wagenarr, Erasmus University

Coauthors: Jorgen T. Haahr and Richard M. Lusby

Abstract: This paper considers the depot planning problem for railway train units, an important problem for railway planners. During daily operations, train units often enter and exit shunting yards as train capacities are adjusted to better match forecasted passenger demand. Upon arrival at a depot, a unit must be assigned to one of the available depot tracks. Furthermore, since units of the same type are considered to be interchangeable, a matching that maps physical units to arrival and departure services is often required. The Depot Problem therefore involves matching units to arriving and departing train services as well as assigning them to appropriate depot tracks in a cost free manner. We present a comparison benchmark of multiple solution approaches for this problem. In particular, we consider a Mixed Integer Linear Program, a Constraint Programming formulation, a Column Generation approach, and a randomized greedy heuristic. The benchmark contains multiple real-life instances provided by the Danish State Rails (DSB) and Netherlands Railways (NS). The results show that a selected number of the

Real-time high speed train rescheduling in case of a partial segment blockage

by Shuguang Zhan, Southwest Jiaotong University

Coauthor: Leo Kroon

Abstract: This paper considers the problem of real-time train rescheduling on a double-track high speed railway line in a disrupted situation, where one track of a segment is temporarily unavailable for a relatively long period of time. Due to the disruption, trains on the disrupted line are unable to run as planned. We have to decide the sequence of trains passing through the unblocked line in the blocked segment, the arrival and departure time of each train at each station, and the trains that have to be canceled due to the reduced capacity. Three train rescheduling strategies are explicitly compared. Three Mixed Integer Programming models are formulated to minimize the total weighted train deviation and the number of canceled trains. The uncertain duration of the disruption is handled by updating the information. A rolling horizon approach is utilized to solve our problem. Finally, the model is tested on the
A recent collaboration between the Operations Research group at CSX and the University of Illinois at Urbana-Champaign has been selected as a finalist for the 2015 Daniel H. Wagner Prize for Excellence in Operations Research Practice. The work is entitled “Integrated Planning of Multi-type Locomotive Service Facilities under Location, Routing and Inventory Considerations,” and will be presented at the 2015 INFORMS conference on Monday, November 2, 2015.

Thousands of locomotives run on the United States railroad network each day to move trains from their origins to their destinations. These locomotives require various types of mechanical work. This work may be unscheduled (repairs), periodic (routine service), or on-demand (fueling). Each type of work is conducted at various types of geographically fixed facilities such as shops, service centers, fueling stations, or movable vehicles called locomotive trucks. Each of these facilities is characterized by its specific capability and capacity. Note that not all facilities have the ability to do all types of work.

At CSX, the Mechanical Department supports mechanical work. Right sizing the mechanical locomotive infrastructure is critical to improving asset availability and utilization while reducing transportation and mechanical costs.

Mathematically, the planning of mechanical facilities integrates three fundamental problems related to service systems design: 1) the multi-type capacitated facility location problem for most fixed facilities, 2) the capacitated routing problem for movable facilities, and 3) the inventory problem for fueling. The overall objective is to minimize the total system cost (including facility investment cost, locomotive transportation cost, truck operating cost, and fuel cost), while satisfying multiple sets of constraints that address location, routing, and inventory considerations.

In addition, numerous business rules and practical requirements, which are critical for real-world railroad operations, must be incorporated as additional constraints. For example, a locomotive can reach a facility while it provides power for the trains (especially for routine service). In this case the transportation cost to move this locomotive to facility should be zero. We call it a free-move. Ignoring free-moves will change the total transportation cost and model decisions significantly.

We used a heuristic approach based on decomposition to solve the integrated planning model. We first designed customized network transformation and consolidation so as to reduce network size and associated complexity without changing the problem. Then the integrated design problem was decomposed into multiple components, which are solved iteratively. In order to address the huge number of candidate locations in a full-scale railroad network, an adaptive scaling method was also designed to reduce the problem size and improve solution speed.

The model may be used to present the best possible solution regardless of current system state. However, such optimized solutions may be far from existing infrastructure. The model has been most heavily leveraged to generate new solutions based on fixed existing infrastructure with specific changes. Thousands of what-if scenarios were run over the past few years. These scenarios have helped (i) improve network efficiencies by consolidating work and resources into fewer facilities, (ii) identify the best locations for new facilities, and (iii) forecast facility usages and productivities for projected future traffic.

The computational results from these case studies show that the proposed model can provide solutions superior to the current practice (which is manual in nature). Use of this model helped improve efficiencies, reduce nonproductive locomotive time, and reduce overhead costs. To date, this research project has resulted in tens of millions of dollars in savings at CSX.

The Daniel H. Wagner Prize strives to promote works of the highest quality applied to solve practical problems. The Wagner Prize emphasizes strong mathematical applications supported by well-written documentation, strong analytical contributions, and verified substantial contribution to the discipline in practice. The collaborators at CSX also received the 2013 Chairman’s Award of Excellence (arguably the most prestigious award given to CSX em-
CSX OR Team Organizational Changes

The CSX Operations Research (OR) team had organizational changes in the first quarter this year. After more than 20 years of distinguished services to CSX and the Railroad community, Dr. Dharma Acharya retired from his role as the AVP of Operations Research. Bob Gutman, previously the AVP of Network Planning under Service Design in CSX, accepted the role of OR leader upon Dharma’s retirement. In addition, the OR team expanded in size by merging with the existing Network Modeling group. This larger group has the new official title of Operations Research, Modeling and Analytics (ORMA).

Dharma holds a PhD in Transportation Systems from MIT, and joined CSX in 1994 after a 4 year stint at AAR. With his contributions and leadership, the CSX OR team grew into a well renowned team with solid technical expertise in Optimization, Simulation, Data Mining and Statistical Analytics. The team helped drive millions of dollars savings annually from the multiple decision support tools and systems they developed. Dharma presented many papers, and served in various official positions in the INFORMS RAS organization, including treasurer, session chairs, cluster chairs, Vice Chair and Chair. He was there as a stable visionary at the time when RAS was founded as a Railroad Special Interest Group, and later blossomed into a section in INFORMS. Dharma has earned a multitude of accolades through his career, including the INFORMS Franz Edelman Finalist in 2009. Along with all his colleagues, including the RAS members, we wish him well on his new adventures!

The new leader of the ORMA team at CSX, Bob Gutman, is a seasoned CSX veteran. Bob holds a BS in Applied Economics and Management from Cornell University, and an MBA from Loyola College. Bob joined CSX in 1984 and in his thirty one years with CSX Transportation, he has held a wide range of leadership positions in Finance, Sales & Marketing, Process Improvement and Service Design. He has been a keen advocate of leveraging analytics to generate business value to CSX, and he brings a unique perspective of how ORMA can closely align itself with business, IT and other partners. Bob is also a strong supporter of the RAS community. Under Bob’s leadership, CSX will continue to engage in INFORMS and RAS activities, and build on existing collaborations with other railroads, universities and vendors.

Currently, ORMA has 20 members distributed in 4 sub-teams. The newly expanded Modeling and Analytics sub-team brings a valuable skill set to augment the traditional Operations Research skills, as well as a wealth of connections to the field and other operational departments. The integrated team serves analytics needs for a variety of spectrums across CSX organizations, with focus spread among short-term, mid-term and long-term corporate goals, strategies and priorities. As a proud sponsor to RAS, the CSX ORMA group is looking forward to a long and fruitful association with RAS.
Incoming RAS Officers:

Chair: Xuesong Zhou, Arizona State University
Vice Chair: April Kuo, BNSF
Secretary: Shantih Spanton, CSX
Treasurer: Gunnar Feldmann, Norfolk Southern
PR Officer: Tyler Dick, University of Illinois at Urbana-Champaign

Newsletter Staff:

Xiaopeng Li (Co-Editor)
University of South Florida

Xuesong Zhou (Co-Editor)
Arizona State University

Janice Kaplan (Co-Editor)
Optym

Saumya Ahuja (Designer)
Optym

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