Editorial: Lessons from Swiss Alps

I recently returned from a trip to Europe where I attended a railroad workshop ATMOS 2006 and gave a tutorial on next generation decision support systems in railroad planning and scheduling. I also had the unforgettable experience of riding on Swiss passenger railroad through Alpine mountain ranges. In this article, I will share my experiences of this visit with you. I will also share with you some photographs taken during the trip.

ATMOS 2006 – The Sixth Workshop on Algorithmic Methods and Models for Optimization of Railways took place at ETH in Zurich, Switzerland, on September 14, 2006. ATMOS took place in concert with ALGOS 2006 – one of the major algorithms conferences in Europe. ATMOS is like a European counterpart of RASIG and just as RASIG meetings take place in concert as a part of INFORMS, ATMOS workshops take place as a separate track of ALGOS workshops on one day. ATMOS 2006 was co-chaired by Dr. Riko Jacob (ETH, Switzerland) and Dr. Matthias Müller-Hannemann (TU Darmstadt, Germany). The main difference between ATMOS and RASIG sessions is that in ATOMS, potential speakers submit papers for presentations, which undergo a thorough refereeing process and only about half of the papers are accepted for presentation. The program consisted of a plenary lecture on railroad transit optimization by Dr. Ralf Borndörfer, an invited tutorial on next generation decision support systems for railroad scheduling by me, and eight other presentations by European researchers. Generally, the paper quality was high and presentations were interesting. In a focus issue of Transportation Science on Railroad Applications, guest edited by Riko, Matthias, and me, we are requesting selected authors to revise their papers and submit for publication. We have already invited RASIG members to contribute their papers to this focus issue.

I observed that there is considerable research on railroad applications taking place on two sides of the Atlantic Ocean (North America and Europe) but there is a lack of communication between them. I suggest greater cooperation between RASIG and ATMOS committees to promote applications of operations research in railroads. I recommended the following possibilities to the ATMOS management committee to promote this collaboration:

- Any important ATMOS announcement that are relevant to RASIG members (such as conference/workshop announcement, special journal issues, etc.), should be forwarded to the RASIG members through our mailing list. RASIG should reciprocate the same.
- Electronic versions of RASIG Newsletters should be emailed to all ATMOS members.
- INFORMS meeting and Student Paper Competition should be publicized through ATMOS mailing list. Efforts be made to attract European researchers to the INFORMS meeting.
- RASIG should allocate one INFORMS session for European participants.

The ATMOS committee was generally supportive of these suggestions. May I request the RASIG executive committee to consider these suggestions in its business meeting and, if approved, take steps to implement them? I am willing to volunteer to be the INFORMS contact point with ATMOS.

I would also like to make RASIG members aware that several European universities have formed a consortium and started research on large-scale robust and on-line optimization with focus on railroad applications. This consortium, called ARRIVAL (http://arrival.cti.gr/) consisting of over ten European universities and railroads, has received three-year multi-million Euros grant from European commission. Professor Christos Zaroliagis of the University of Patras, Greece (zaro@ceid.upatras.gr) is the coordinator of this project. I am a member of the External Advisory Board of the ARRIVAL project and will share with them the American perspective on their research projects. I attended the meeting of ARRIVAL in Zurich and observed that they are doing excellent research on several aspects of rail optimization. Following their lead, RASIG members may identify an important area of research within railroads, form a consortium of academic as well as industry institutions, and seek funding from federal agencies. FRA (Federal Railway Administration) will be a good bet for us. FRA has recently decided to increase its funding to new areas of capacity and efficiency in addition to safety and has opened new avenues of research for us who are developing models for improving railroad performance. >> Continued on Page 3
RASIG Chairman’s Message

Signs of Fall
As the signs of Fall start appearing everywhere, we as RASIG officers know that we need to start focusing on the next INFORMS Annual Meeting, to be held in Pittsburgh from November 5 to 8. We will have six sessions, plus the business meeting. Included in these sessions are the Student Paper Contest, a session on rail related work being performed at universities, a session on crew and equipment management, and a session on intermodal transportation. There is a series of round table sessions focused on capacity planning and management, and a session on computer-aided real-time dispatch planning. The detailed program of the RASIG sessions is given on Page 6 and 7 in this Newsletter. We look forward to seeing you in these sessions.

RASIG Constitution Changes
Two other items of RASIG business are also under consideration, and will be put before the members for review and approval in the Pittsburgh business meeting. The first is a proposal to change the name of the organization. Our official name is the “Railroad Applications Special Interest Group.” However, within the INFORMS organization, we are considered a “section” and not a “special interest group.” As a result, we believe that it would be appropriate to change our group’s name, and will thus be proposing to become the “Railway Applications Section.”

The second is a proposal to change our constitution with respect to the election process. First, we would like to officially permit electronic voting by e-mail or other internet-based mechanisms (such as an election web site). While we have been using that process for the last couple of years, it has been pointed out that it is not an officially sanctioned method of voting by our constitution. Second, the constitution currently requires that we must have two candidates for every position. While this is a laudable goal, there are drawbacks. The most serious being that we often have difficulty finding people to stand for election, and finding two people for every position makes this process even more challenging. We are considering dropping the two candidates requirement for the positions of secretary and treasurer, and making the requirement for two candidates be strongly urged but not required for the position of Vice Chairperson. You will find the revised constitution on the RASIG’s website: www.RASIG.net, link Constitution. We hope that you will support us in approving these changes.

Optimization is in the Air
Maybe it is the Fall weather, or maybe it is just something that has been building up for a long time, but it seems to me that the level of interest in optimization at all of the major railroads has been building up for a long time, but it seems to me that the level of interest in optimization at all of the major railroads has never been higher. Furthermore this interest is not just focused on traditional areas such as equipment management, but is looking at a broad cross-section of issues such as operating plan design, capacity management, pricing, and tactical decision making.

While this interest in OR and optimization is very exciting, and should be encouraging to all of you who have spent many years laboring away at promoting more scientific decision making within the industry, I would also like to sound a note of caution. I believe that all of us have a professional responsibility to not over promise or over sell what can be achieved through optimization technology. Over the 25 plus years that I have spent designing and developing technology solutions for the railways, I have seen many people enter the field promising to solve world hunger through the use of optimization tools, only to leave the industry two or three years later. Often these departures are filled with acrimony on both sides, and much finger pointing, which in turn can poison the well with respect to innovative uses of technology for years to come in an already cautious industry.

I believe that freight railroads, as operated in North America, are probably one of the most complex transportation enterprises on earth. Capturing their operations in a computer model is almost impossible due to the combination of their networked nature, provision of multiple products (carload, intermodal, unit trains) on the same network, use of disparate signaling and control technology, diverse locomotive and equipment fleets, complex train make-up requirements, high degree of tactical decision making, and many other factors. When simple or “pure” optimization is applied to this complex environment, failure almost always results. The survivors learn that compromise is needed to succeed. Compromise is needed for many reasons, including the need to account for uncertainty in the data, the inability to capture all factors in the decision model, and other complexities and vagaries of the railroad industry.

New entrants to the industry rarely have a deep understanding of the inner workings of the railroads, and often are unwilling to compromise – resulting in the failures I cited above. However, we as industry insiders are just as much at fault. All too often our bosses or clients become enamored with the idea of push button solutions using optimization, and we blindly try to satisfy their desires. Off we go trying to solve world hunger by building the ultimate mouse trap. Instead, we should be saying “slow down!” Our focus should be on getting to the end game incrementally. While not as glamorous an approach, it is the much more likely to succeed. Compromise is needed for many reasons, including the need to account for uncertainty in the data, the inability to capture all factors in the decision model, and other complexities and vagaries of the railroad industry.

In closing, I believe that the opportunities to design and develop optimization and OR-based solutions have never been better. This should be great for RASIG, and great for our members – but as the sergeant always said at the end of the morning briefing on Hill Street Blues (just showing my age): “Be careful out there!”

Carl Van Dyke
Mercer Management Consulting
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"quick quote"

The human brain is like a railroad freight car - guaranteed to have a certain capacity but often running empty.

- Unknown
The change that prompted this effort was an update of the name, Railroad Applications Special Interest Group, to reflect that we are a Section within INFORMS. The INFORMS subdivision hierarchy includes Societies and Sections. Societies are larger than Sections and can have multiple Special Interest Groups. The Transportation Science and Logistics Society, for example, has Freight, Urban, Facility Logistics, ITS, and Air Special Interest Groups. To better reflect our standing within INFORMS, we propose a name change to Railway Applications Section. The other significant change is to allow the Secretary and the Treasurer to serve a maximum of two consecutive terms, instead of one, if they are re-elected. The Chair and Vice Chair can still serve only one consecutive term.

The procedure to amend the Constitution calls for the proposed amendments to be disseminated to the membership prior to the annual business meeting, discussed at the annual business meeting, and followed by a formal mail vote after the business meeting. The next business meeting will be at the annual conference in Pittsburgh on November 5, 2006 at 6 PM. The items that have changed are summarized below.

- Change the name from Railroad Application Special Interest Group to Railway Applications Section;
- Change references from the "membership meeting" to the "business meeting";
- The Secretary and the Treasurer may serve a maximum of two consecutive terms, if they are re-elected;
- The Vice Chair is responsible for conducting the elections;
- The timing of the elections was shortened, to better reflect actual practice;
- On the ballot, only one nominee is necessary for the office of Secretary and one nominee for the office of Treasurer; and,
- Electronic approval via secure e-mail or website login of amendments to the Constitution will be permitted, instead of requiring a sealed envelop bearing the voter’s name

If anyone would like a copy of the current Constitution for comparison purposes, please contact me. A copy of the revised constitution is also available at RASIG’s website: www.RASIG.net, link: Constitution. This link will give you a MS Word document where you can easily see the changes made. We are looking forward to your feedback about the changes.

David Hunt
Cambridge Systematics
dhunt@camsys.com
New Challenges Down Under: Perspective from Australian Railroads

Australia is one of the most urbanised countries in the world and its five largest cities all have metropolitan passenger rail networks. The networks are essentially owned by each state government, who (in most cases) also operate the services. Demand is strong and there is evidence of over-crowding during morning peak periods in Sydney, Melbourne and Brisbane. New lines are currently under construction in Sydney and Perth with planning underway for new lines in Brisbane.

Brisbane is a particularly interesting case. The city is located in Southeast Queensland, the fastest growing urban region in Australia. Approximately, 1,000 people per week migrate to Brisbane and the surrounding Gold Coast and Sunshine Coast areas, mostly from states further south. This is partly due to the movement of retirees but primarily because housing prices in Sydney and Melbourne have driven the property market beyond the reach of many young families. The Brisbane metropolitan network is essentially a through running, radial system. Services operate from the outer suburbs, through the inner-city and then continue in the same general direction to the outer suburbs on the other side of the city. The Gold Coast line is one of the newest lines with services commencing only 10 years ago. In recent years, morning services on this line are so overloaded that some passengers are forced to stand for the one-hour journey to the inner-city.

The problem has not gone unnoticed by transport planners. Funding has already been approved to allow Queensland Rail, the government owned operator, to purchase additional rolling stock and to further double track on the Gold Coast line. However, the planned extension of the line is expected to create additional demand pressure on services. Similar demand growth on other lines is pushing the capacity of the network rapidly towards its limit. As part of addressing the issue of capacity across the whole network, we are nearing completion of an extensive capacity study that has identified required upgrades until 2026. These capacity improvements extend well beyond the AUS$5.5 billion that has already been identified by the Queensland Government for network and station upgrades and new rolling stock. Spending money on railway infrastructure has substantial political benefits. Recently, the state opposition highlighted the Gold Coast case in a campaign that generated a dramatic swing against the government candidate in a local by-election. Fittingly, our study has captured the interest of politicians, with the Minister for Transport and Main Roads requesting his own personal briefing from members of the study team.

Such an environment is ripe for the application of OR/MS techniques to ensure that future demand can be accommodated. In the US rail freight market, Operations Research has successfully delivered substantial savings to private railroad owners and operators. In Australia, however, the challenge is to use similar techniques to give passenger services the biggest bang for the taxpayer buck. This requires analysis techniques to be applied to strategic decisions in addition to the tactical or operational problems that have proven fertile grounds for OR in US railroads. We hope that operations research tools will be developed to solve these decision problems.

Uri Schlafrig
Systemwide
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Railroad Labor Facts

- In 1864, organization of railway labor began with the unionization of locomotive engineers.
- America’s railroads have the lowest injury rates in transportation.
- In 2004, the number of employees in USA freight railroads was 176,899.
- In 2004, Class 1 union employees earned an average compensation of $88,862 (Salary: $64,138 and Benefits: $24,624).
- Rail workers rank 11th out of 57 industries in compensation - ahead of auto workers and employees in other heavily unionized industries.
- In 2006, railroads will pay nearly $2 billion to provide health care benefits to their employees, up from approximately $870 million in 1999.
- Railroads in 2006 will pay an average of $12,134 per employee for family medical, dental and vision coverage.
RASIG Student Paper Awards

RASIG and Railway Age sponsor a student research paper contest on Management Science in Railroad Applications. This contest offers the following awards:

- Cash Awards: $500 First Place, $250 Second Place
- Honorable Mention recognition for other top papers

Authors of First Place, Second Place, and Honorable Mention papers are asked to present the papers at the INFORMS Annual Meeting in the Fall. RASIG covers the conference registration fees for all authors who are asked to present their papers. Railway Age publishes summaries of the First Place and Second Place entries.

To qualify, the paper must be written by a student or students enrolled in an academic institution during the 2005-2006 academic year. The paper must relate to application of Management Science for the improvement or utilization of railroad transportation, and must represent original research (not literature reviews) that has not been published elsewhere. More details of the eligibility criteria, the application procedure, and deadlines for submission are available at RASIG’s website: www.rasig.net.

In this year’s competition, we received eight student papers and selected three of them for awards. We expect that these papers will be presented in Student Paper Contest session at the INFORMS 2006 Meeting in Pittsburgh. We give below the abstracts of these papers. We encourage all RASIG members to attend this session and motivate our young researchers to continue to make great strides in building new models for railroad planning and scheduling problems.

**First Prize:**

- **Spatial Scheduling and Resource Selection Problem: Modeling, Algorithm, and Application in the Production Gang Scheduling for Railway Maintenance Operations.** Gang Li, The University of Texas at Austin, Austin, TX; Gang.li@mail.utexas.edu

  **Abstract:** Given a set of geographically-dispersed jobs with time windows and inter-job coordination requirements, we address the problem of assigning and routing resources to jobs and sequencing the jobs to minimize the total cost for deploying and repositioning resources. We formulate this combined routing-scheduling problem as a large-scale integer program, develop valid inequalities to strengthen the model, and report its successful application in the production gang scheduling problem for a major railway company in North America. The model has been helping the company to save millions of dollars each year and significantly improve the quality of the company’s maintenance operations.

**Second Prize:**

- **Modeling Reordering and Local Rerouting Strategies to Solve Train Conflicts during Rail Operations.** Andrea D’Ariano, Civil Engineering and Geosciences Transport and Planning Department, Delft University of Technology, Stevinweg Delft, The Netherlands; a.dariano@tudelft.nl

  **Abstract:** A decision support system is presented to manage real-time timetable perturbations and blocked tracks. A mathematical model is adopted to solve train conflicts through reordering and local rerouting (dynamic use of platform tracks and alternative corridors). Rolling stock and passenger connections are also formulated. An iterative reordering and rerouting algorithm is developed to increase the punctuality. Experiments on a Dutch railway network show that the algorithm improves the solutions provided by practical dispatching rules.

**Honorable Mention:**

- **Developing Fueling and Servicing Friendly Locomotive Plans.** Balachandran Vaidyanathan, Industrial & Systems Engineering, University of Florida, Gainesville, FL; vbala@ufl.edu

  **Abstract:** We study the problem of generating fuel and service feasible routing of locomotives starting from a base fleet assignment plan which satisfies several operational and contractual constraints. Fueling feasibility requires that every locomotive visits a service location at least once for every 1,800 miles of travel. A locomotive fleet assignment plan which does not take the fueling and servicing requirements into consideration cannot be implemented and has limited value. Solving this problem is therefore of great value to US Railroads.
## RASIG Sessions at 2006 INFORMS Annual Meeting, Pittsburgh

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<th>Time</th>
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| 8:00 – 9:30 AM | **RASIG Student Paper Session**  
Chair: Pooja Dewan, BNSF Railway  
- Spatial Scheduling and Resource Selection Problem: Modeling, Algorithm, and Application in the Production Gang Scheduling for Railway Maintenance (Gang Li)  
- Modeling Reordering and Local Rerouting Strategies to Solve Train Conflicts during Rail Operations (Andrea D’Ariano)  
- Developing Fueling and Servicing Friendly Locomotive Plans (Balachandran Vaidyanathan) |
| 10:00 – 11:30 AM | **Railway Decision Support Models**  
Chair: David Hunt, Cambridge Systematics  
- A Web-Based Decision Support System for Railroad Service Design (Ravindra Ahuja)  
- A Decision Support System for Hump Yard Management (Larry Shughart, Ravindra Ahuja, Nikhil Dang, Arvind Kumar, Saurabh Mehta)  
- Algorithm for the Train Platforming Problem (TPP) (Laura Galli, Alberto Caprara, Michele Monaci, Paolo Toth)  
- Solving a Real-World Train Unit Assignment Problem (Valentina Cicchiani, Alberto Caprara, Paolo Toth) |
| 1:30 – 3:00 PM | **RASIG Roundtable: Part I**  
Chair: Carl Van Dyke, Mercer Management Consulting  
- Impact of Capacity Constraints on Operating Plan Design (Alan Blumenfeld)  
- Use of Operations Research Models to Plan Capacity at Norfolk Southern (Wayne Mason)  
- The Rail Network Capacity Crunch: Public and Private Goals (David Hunt, Raphael Kedar)  
- Dynamic Planning and Implementation: Managing Emergency Rail Outages (Trent Sommers) |
| 3:00 – 3:15 PM | **Refreshments (Courtesy of RASIG)** |
| 3:15 – 4:15 PM | **Informal Session: What Makes OR Interesting to Railroads?**  
Chair: Dharma Acharya, CSX Transportation  
The goal of this session is to have an informal discussion of what OR topics are of interest to the railroad industry, and what it takes to get such ideas funded.  
- Alan Blumenfeld, CSX Transportation  
- Jeff Adams, Canadian Pacific  
- Other Panelists and Session Attendees |
| 4:15 – 6:00 PM | **Roundtable II - Tactical and Operational Capacity Management**  
Chair: Dharma Acharya, CSX Transportation  
- Revolutionary Functionality via Evolutionary Development (Ron Lindsay)  
- Factors Affecting Railroad Yard Performance (Carl Martland)  
- Lean Production Applications at CPR Freight Classification Yards (Jeff Adams)  
- Improving Railroad Classification Terminal Performance Using Concepts of “Lean Railroading” (Jeremiah Dimberger, Christopher Barkan) |
| 6:00 – 7:00 PM | **Refreshments, Railroad Applications Annual Meeting, & Election of Officers** |
| 7:30 PM – 9:30 PM | **Railroad Applications Annual Dinner (Sponsored by Innovative Scheduling, Mercer Management Consulting and Jeppesen Rail, Logistics & Terminals): Grand Concourse Restaurant at Station Square (412-261-1717).**  
Speaker: Henry Posner III, Chairman, Railroad Development Corporation |
### Monday (November 6)

#### Experiences and Opportunities in Rail Fleet and Crew Management
Chair: Sami Gabteni, Jeppesen Rail, Logistics & Terminals

- Decision Support System for Crew Planning at CSX Transportation (Kamalesh Somani, Dharma Acharya)
- New Opportunities Based on Recent Experiences in Rail Crew Management (Michael Forbes)
- Next Generation Approach for Rolling Stock Scheduling Optimization (Sami Gabteni)

#### Issues in Real Time Train Dispatching Systems
Chair: Roger Baugher, BNSF Railway

- Brief Summary of Real Time Meet-Pass Planning Implementations (Roger Baugher)
- Optimized Tactical Traffic Planning: What is Required for Success? (Frank Boyle)
- A System for Improving Network Capacity (Melih Arpaci, Iris Jungherr)

#### Emerging Trends in Intermodal Transportation
Chair: Krishna Jha, Innovative Scheduling

- New Approaches to Solve the Load Planning Problem (Krishna Jha, Ravindra Ahuja, Ashish Nemani)
- Optimizing the Aerodynamic: Efficiency of Intermodal Freight Trains (Yung-Cheng Lai, Christopher Barkan, Hayri Onai, Yanfeng Ouyang)
- Capacity Challenges = OR Opportunities (Erick Wikum)

#### Academic Contributions to Railroad Operations Research
Chair: Christopher Barkan, University of Urbana-Champaign

- Optimizing Ballast Sourcing and Delivery Operations (Xiajun Pan, Anant Balakrishnan, Brian Roth)
- Optimal Production Gang Scheduling for Railway Maintenance Operations (Anant Balakrishnan, Brian Roth)
- Location of Railroad Wayside Defect Detection Installations (Yanfeng Ouyang, Christopher Barkan, Yung-Cheng Lai)
- Tank Car Safety Design vs. Infrastructure Improvements in Reducing Hazardous Materials Transportation Risks (Mohd. Rapik Saat, Christopher Barkan)

### Railroad Applications (Other Sessions of Possible Interest)

#### Revenue Management in Railroads (Revenue Management Cluster)
Chair: Luce Brotcorne, University of Valenciennes

- Commercial Cartography of Trains and Yield Management (Mariane Riss)
- A New Generation of Revenue Optimization Tools for the Railway Industry (Jean-Philippe Côté)
- Revenue Management of Auto Train at Amtrak (Soheil Sidbari)
- Integrated Operations Planning and Revenue Management for Rail Freight (Gilles Savard)

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**Railroad OR Library**

RASIG, in collaboration with Innovative Scheduling, has developed an on-line database of papers related to Operations Research in railroads. This database contains references and abstracts of hundreds of papers in railroad OR published in the past fifty years. It will allow users to search for papers using key words or find papers on specific railroad decision problems. We hope that this database will assist in the literature survey and thus promote the use of operations research techniques in railroads. This database is available at the website: [www.RASIG.net](http://www.RASIG.net). Link: [OR Library](http://www.RASIG.net). It also enables visitors adding their papers to the electronic library.
Innovative Scheduling is developing software products to solve large-scale planning and scheduling problems arising in railroads. The company is developing optimization engines using cutting-edge operations research techniques and packaging them in interactive, web-based decision support systems using latest information technology tools. Our products include:

- Innovative Railroad Blocking Optimizer
- Innovative Train Scheduling Optimizer
- Innovative Locomotive Optimizer
- Innovative Hump Yard Manager
- Innovative Network Flow Analyzer

Our team of experts is also available for consulting engagements. We also provide consulting in service design, economic analysis, forecasting, re-engineering, and capital investments. To learn more about us, our software products, and consulting services, please visit our website: www.InnovativeScheduling.com or contact:

Ravindra K. Ahuja, President & CEO
ravi@InnovativeScheduling.com
Phone: (352) 870-8401

We would like to invite all RASIG members for a dinner on Sunday (November 5) at the INFORMS Meeting. Please show your commitment to RASIG by joining us at the dinner. This dinner will be free for RASIG Members and is sponsored by: Innovative Scheduling, Jeppesen Rail, Logistics, & Terminals, and Mercer Management Consulting. The dinner will take place at 7:30 PM in the Grand Concourse Restaurant and will include a lecture by Henry Posner III, Chairman, Railroad Development Corporation. Grand Concourse has an interesting history and has been converted into a restaurant from an old railway station. To learn more, visit: www.stationsquare.com/grandconcourse/. Telephone: (412) 261-1717.

We invite you to visit RASIG’s new website. You can find the following material at the website:

1. A list of all RASIG members
2. Copies of all recent RASIG Newsletters
3. INFORMS presentations after the conference is over
4. Link to a railroad papers database
5. Instructions and deadlines for Student Paper Competition
6. Winners of Student Paper Awards