From the Editors’ Desk

In the past eight quarters, we have seen phenomenal increases in traffic volumes for US railroads, requiring railroads to increase their capacities. Capacity expansion through capital investment is not only a very costly means of expansion, but also has large lead times. Major expansion plans need to go through thorough analysis, budgeting, scheduling, and implementation processes that could take a year or longer. In times of capacity constraints, asset utilization is the name of the game. Indeed, asset utilization has always been a big issue for railroads even before the onset of increased volumes, since it meant more cost effective use of resources. In today’s environment, there is a huge drive to squeeze more out of the existing assets. Every time a railroad has a locomotive dwell for 24 hours, it implies that one less locomotive being used for productive work. What are a railroad’s assets? There are two classes of assets: fixed - like track and yards, and rolling - such as railcars, locomotives, and in some sense crews. In addition to these hard assets, there is a virtual component of a railroad that impacts the utilization of these assets: the blocking plans and train schedules. In an ideal environment, with no disturbances to operations and where all railroads follow the schedules, blocking and scheduling and the associated resource cycling plan would be the sole cause of effective or ineffective use of assets.

What does all this mean for Operations Research (OR) professionals either working within the railroads or outside as consultants? Each of the assets discussed above needs tools at the strategic, tactical and operational level. Personally, we feel that OR folks should first tackle the strategic problems, as it gives them a chance to understand the problem better, and then use this understanding to develop real-time tactical tools at a later stage. However, with the need of railroads to increase their effective capacity through modeling tools, there are certain operational areas that can more easily be considered for modeling because they do not have that additional risk and complexity associated with other areas. In this article, we will describe some OR issues related to the rolling stock and crews, in the next issue we will touch upon the fixed assets:

Railcars: Most railroads have some form of optimization engine to help distribute their empty railcars to customers. These models have been very successful in the railroads and slowly railroads have been expanding the fleets that are being distributed in this manner. In the past few years, more and more railcars are owned by shippers instead by railroads and railroads are encouraging this trend. As a result, railroads have been trying to expand the use of optimization tools to distribute private fleets and unit trains as well. Because privately owned empty cars are returned to their origins immediately upon unloading, there has not been much scope for optimization. However, several shippers can consolidate their railcars and cooperate with each other in empty car distribution. There is an opportunity for OR modelers to study various types of cooperation schemes and potential benefits of this cooperation to shippers.

Crews: This is an opportunity area for all railroads as crews typically represent over 20% of a railroad’s costs. Railroads have some tactical tools available for crew assignment, but they are all rule-based, not optimization-based. When a crew reaches its away location, we need to make a tactical decision - whether to deadhead the crew back to the home location in a cab/train or send it to a hotel. A similar decision may be called for at a home location, and in some cases deadheading may lower overall crew costs. Railroads need a tool that can make these decisions intelligently considering the network-wide effects. Railroads also need crew models that can assist on planning and strategic levels. We need tools that given a historical train schedule can develop feasible crew schedules honoring numerous union (often crew district specific) and FRA rules and regulations, and determine the number of crews needed in each crew district. Using this tool, we can assess the impact of the number of crew districts and the territory each covers on crew costs. We need tools that can help us understand the impact of these rules on costs, which will equip the management better to negotiate with crew unions and improve overall system performance.

Locomotives: Locomotives are a big expense item for railroads. Each US Class I railroad spends over $1 billion in purchasing new locomotives and in maintaining and running its existing locomotives. Most railroads do not use any sophisticated OR models for assigning locomotives to trains, and there is need for strategic, planning, and real-time scheduling models. A planning tool for locomotives would generate a robust locomotive assignment for the scheduled trains including deadheading of power and light travel. A real-time tactical tool would make small adjustments to the assignment plan (called the power plan) to account for train delays, locomotive breakdowns, locomotive servicing requirements, and sharing of locomotives between scheduled and unscheduled trains. Finally, we need a strategic tool that can help management determine the need for locomotives for the next 1 to 5 years as a function of the projected traffic. Indeed, locomotive scheduling presents several challenges for modelers and algorithm designers, and is an immensely rich area for researchers.

In this article, we have listed some potential areas of research for operations researchers and RASIG members. We do see a tremendous opportunity available to us. Let us all work together to convert this opportunity into reality and in the process create success stories for both operations research and the railroad industry.

Ravi Ahuja and Pooja Dewan
Innovative Scheduling & BNSF Railway
Freight Rail Transportation: A Review of the 2004 Experience

[This article has been adapted from the Congressional Budget Office analysis, Freight Rail Transportation: A Review of the 2004 Experience, CBO Paper (May 2005). An electronic version of that paper is available at www.cbo.gov. - Editors]

Throughout 2004, fears were expressed that rail capacity might not be sufficient to meet a surge in demand for freight transportation that was fueled by an expanding economy, growth in international trade, and bumper grain harvests. Trade publications contained warnings of an impending “meltdown” of service, because demand seemed to be growing faster than capacity. The Department of Agriculture reported concerns about the availability of rail service in light of the agency’s forecast of record crops and strong export demand. The California ports of Los Angeles and Long Beach received special attention because of their key position in handling containers of goods produced in Asia for the back-to-school and holiday seasons. Some observers feared that those imports would overwhelm the ability of railroads to carry intermodal freight from the ports to the Midwest and East.

In June 2004, Roger Nober, chairman of the Surface Transportation Board (STB), the federal agency charged with regulating the railroads and ensuring adequate service, wrote to the heads of the seven major freight railroads asking how they intended to meet the unprecedented surge in demand. Nober expressed concern that the railroads’ performance in recent months had faltered, as measured by such indicators as the number of cars on-line, system train speed and yard dwell time, on-time performance, train- and engine-crew utilization, locomotive utilization, and infrastructure and capacity improvements. The railroads replied that they were indeed facing unprecedented demand but that they were taking action, such as adding more equipment and hiring greater numbers of new employees than previously planned. Some railroads also stated that they were planning to re-route traffic to avoid bottlenecks. In August 2004, the Association of American Railroads (AAR) convened a meeting of representatives from its member railroads, the STB, shippers, and other interested parties to discuss potential problems arising from the surge in demand. In addition, the Union Pacific Railroad held its own customer forum in San Francisco, and CSX Transportation held one in Atlanta.

What actually happened? Throughout 2004, the demand for rail transportation was strong, setting an annual record for traffic as measured in ton-miles and setting weekly records for intermodal service in 28 weeks, according to the AAR. Even so, the feared “meltdown” of service did not materialize. Actions taken by railroads to increase capacity or manage demand apparently were successful at avoiding massive systemic problems. Railroads dramatically accelerated their hiring and training, acquired new equipment, and modified their operations in order to increase capacity. They also raised rates on some commodities and services and asked shippers to moderate their demands.

In some cases, shippers changed their behavior to accommodate limitations in the availability of rail service. Some shippers combined into one shipment goods that might otherwise have been sent in several shipments. Some stockpiled materials in anticipation of delays, and some postponed making shipments at peak periods. Some sought alternative shipping methods, such as using less-congested rail routes, trucks or air freight.

Other factors helped moderate demand for rail transportation. For example, although 2004 marked the second year in a row of record grain harvest, grain prices were somewhat weaker than in 2003. That development may have reduced pressures to sell—and consequently transport—grain, which many farmers had felt the previous year. In addition, the ports of Los Angeles and Long Beach experienced problems getting enough workers to unload ships in a timely manner, creating a major bottleneck and thus moderating the flow of shipments to the railroads.

To summarize, the freight market functioned relatively well in the short run. The costs associated with an increase in demand were accommodated without serious damage to the economy. Yet certain factors that contributed to the surge in demand - increased international trade and intermodal shipping - are likely to continue to grow. That raises questions about whether there will be sufficient capacity in the future and how efficiently or inefficiently federal policy will influence the mix of capacity among rail, road, and water shipping. Such long-term considerations are the subject of continued interest by the Congressional Budget Office.

Beth Pinkston
Congressional Budget Office
bethp@cbo.gov

Nicknames for Railroad Jobs

"Baby Lifter" Brakeman, since he helped carry babies on the train for their mothers.

"Bakehead" Fireman, because his head was so close to the fire box while he was shoveling coal.

"Old Head" Someone who does his job well.

"Bull" Railroad detective.

"Piglet" A locomotive engineer trainee.

"Skipper" The conductor

"Spotter" A company employee charged with spying on other employees, especially in the old days when a conductor would collect cash fares from passengers and sometimes did not turn in all the receipts to the company.

"Door Slammer" What freight trainmen called passengers.

"Foamers" Name given by train crews for people who gathered along the railroad tracks to watch trains.
Decision Support in the Rail Industry: Let’s Reminisce.

Recently, I was working on a short presentation for some railroad executives to describe the discipline of operations research (OR) and the efficacy of decision support tools to the rail business. In the course of developing my story board, I thought it would be useful to show that the railroad industry has a long history of research, development, and application of operations research and management science techniques. The many initiatives that we RASIG members are working on now will only be successful because others have blazed a trail in our industry. The tools we are building are often replacing first, and sometimes second generation applications that have served their purpose well, but are now out-of-date because of advances in hardware and software technology.

These railroad OR pioneers not only laid a technical foundation for us to build upon, but also worked very hard to promote a culture in our industry that is now more willing to accept and consider OR tools as a critical element in the railway management process. Whether it was a simple algebraic screening model, a small-scale simulation model, a rudimentary network flow model, or a very detailed simulation of track-train dynamics, the first generation models encouraged users and managers to apply structured thinking to railroad problems and to install analytically-based business processes. These tools enabled us to objectively study and understand the very complex cause and effect relationships that exist in all railway systems and subsystems: the interplay between railcar mechanical systems and the track structure, the stochastic processes within terminals and on corridors, and the network-wide dynamic relationship between resources, costs, and service quality. Finally, our predecessors and mentors fostered an environment for railway decision support that cut across institutional barriers and company organizations. Many of these tools were developed as collaborative efforts between academicians, practitioners, consultants, and governments. Industry committees, user group communities, and international forums were created to facilitate discussion, support benchmarking, pool resources, and ensure the right balance between theory and application.

I have used many different railway OR models throughout my career. I studied other models in school and learned about additional models as I did research writing papers. Indeed, like most railroad expertise, my knowledge and understanding of some of these older models is purely based on what I learned while huddled over a pub-table watching the veterans scribble on soggy napkins. “Remember when so-and-so did something at some now bankrupt railroad that saved millions of dollars at some now-closed yard . . . ?”

So, here it is, my first attempt to catalog the history of OR decision support tools in the rail industry in the figure above. Thanks to Carl Martland and Andreas Aeppli for reviewing, correcting, and augmenting this chart when I originally prepared it. While I initially intended this exhibit to simply give a flavor for our past to some executives, I knew I was onto something fun when we spent several hours on the phone and several L-O-N-G emails reminiscing. Upon seeing the exhibit for the first time, Ingrid Schultze commented it looked like her resume! How true is that for others? Of course there is stuff missing.

1970s
- USRA: screening models, line, yard, fleet
- FRA: FCUP focus on terminals, TPC, and SPM
- ALK: PTNM
- RR’s: Car Scheduling (TOPS), C-Model, TRIMS
- MIT Rail Group: SPM, ABM
- NECIP: line capacity modeling (PMM)

1980s
- ALK: TSS
- AAR: TEM, TMCost, TRACS, NuCars, HAL
- Dispatching: USS, Berkeley, Wharton
- Car Distribution: Cornell, Wharton, MIT

1990s
- Multi-Modal: MultiRail
- RR’s Focus: Databases, Mid-tier, Mergers, Y2K
- Dispatching: GE-Harris, Digicon, RAILs
- AEI data integration

2000s
- Large-scale and real-time optimization now possible
- Multi-commodity becomes multi-dimensional
- Optimal solutions require simultaneous service scheduling and resource assignment
- GPS, PTC

Apologies to Bengt Muten for not listing the CRM, a tool that I have used and found very useful. It just slipped my mind. I think it would be fun for RASIG to take on the task of archiving and documenting a comprehensive list of tools. So rather than trying to correct the chart here-and-now, I throw it out to you RASIG members. Bring your comments, suggestions, additions and corrections to San Francisco or e-mail me. I will collect and consolidate the input and publish a more comprehensive inventory of Railroad OR decision support tools in the future.

I would encourage others to take on the task of submitting some RASIG newsletter articles describing these tools in more detail. For each tool, who wrote it? When? What organization sponsored it? What was the solution technique? What was the platform, architecture, and computer languages employed? How widely used was the model? What groups used it and on what problems? What were the predecessors, competitors, and successors to the model?

Today is tomorrow’s history. Happy modeling!

Larry Shughart
Innovative Scheduling
larry@InnovativeScheduling.com
Developing a Railroad’s Zero-Based Operating Plan

MultiModal Applied Systems continues developing zero-based operating plans for the railroads of North America. Since completing our incredibly successful Thoroughbred Operating Plan for Norfolk Southern, we have done projects for CSX, BNSF, and UP. We continue to add some new techniques and have incorporated some of the optimization technology developed by Innovative Scheduling into these projects. Since the techniques used are often of greater interest to the OR community, we will review what we have learned in detail here. However, as the techniques used have improved and arguably produced better underlying plans, none of these projects has been as successful as the NS TOP project in improving the operations of these other railroads. Ultimately, we have found that the best OR practices are futile without addressing the soft organizational issues required in implementing organizational change. This is a new area and a new challenge for us, as well as all of you in the RASIG group in applying better OR practices to the railroad industry.

We create a completely new operating plan in four steps as follows:

**Blocking Plan Development**

Since the NS project, the most significant change we have made is collaborating with Innovative Scheduling to create the initial blocking plan using their blocking plan optimizer. This process saved a lot of time on these projects with varying degrees of success. The best results occurred for BNSF, producing more reasonable results than in previous efforts in large part because we rolled up the traffic flows to the serving yard level. This greatly reduced the tendency of the optimizer to build very small blocks directly from origin to destination as if they were moving in small unit trains by-passing all yards and using the most direct routes.

We also noticed the blocking plan optimizer had a tendency to directionize nearby yards of the same functional type. This is a very reasonable way to rationalize yard capacity, but does not always work in practice. In several cases, however, the yard layout is set up with capabilities to handle a specific number of blocks in one direction and a specific number in the other direction. In future projects, we would split these types of yards into separate nodes.

Given an impedance structure where hump (or system) yards were given the lowest impedances, regional yards a medium impedance, and local/serving yards the highest impedance, we did as expected shift classification work from smaller yards to the larger production facilities. This strategy has two implications:

1. It suggests that railroads must intensely focus on these large production facilities to ensure that they run smoothly at low costs and with a minimum of delay to cars. In practice, many North American production hump facilities are not operated well and this type of network structure drives traffic to a facility that, while able to hold a large inventory of cars ultimately, delays the trip plan for the car considerably.

2. This network structure works well with the large train sizes seen in North America. By sweeping cars as quickly as possible to a large production classification facility, the number of blocks on a train is kept to minimum and the average block size is made as large as possible, thus keeping the train plan as simple as possible and easy to execute.

The final observation from the blocking plan is that, as one would expect, large interior yard facilities located where traffic flows intersected are the most critical yards on the system and must often be impeded somewhat more than other system production yards to keep volumes within practical operational limits. On the BNSF network, Kansas City was the most important yard on the system. By increasing the impedance on this yard relative to the other system level yards, we added additional handleings and circuity to move switching to other less centrally located facilities.

Once we had a final blocking solution from Innovative Scheduling, we cleaned up some of the details for run-through blocking and other specific issues. Then we ran MultiRail’s circuitry and by-pass analysis to double check and tweak the solution slightly. As the train plan is developed, these tools became more important to adjust the blocking plan for operational issues that arose in developing the train plan.

**Train Plan Development**

A convenient way to automate the development of the train plan has still not been developed. Two alternative processes are available:

1. A quick calculation based on average daily car flows and a target train size suggests a target number of daily trains starts. Using Microsoft Access, we look at the largest blocks and create a train for each of the largest blocks up to the target number of trains, and assign those blocks to the newly created trains. Disadvantages to this approach are:
   a. More than half of all blocks must still be manually assigned to the created trains.
   b. Many of the created trains run overlapping routes on the major mainlines and secondary routes end up with no trains to move smaller size blocks.
   c. The created trains by definition only provide a single outlet for each of the largest blocks. By manually consolidating overlapping trains, multiple outlets can be provided for many of these larger blocks.

2. The process ultimately used on the project was to download all the existing train schedules and block-to-train assignments. Disadvantages to this approach were:
   a. Only blocks matching existing blocks get assigned to trains; all newly created blocks remain unassigned.
   b. The train plan is not structured to take best advantage of the newly created blocks, creating unnecessary block swaps by trying to fit the blocks to an existing train plan. The benefits in reduced handling and dwell time of the new long-haul blocks created are partly offset when the new blocks are block swapped between trains.

(contd.)
We also focused on measuring enroute work events on trains. Enroute work events add to mainline congestion, but in some cases reducing enroute events leads to increased block-swapping, and/or the elimination of blocks which increases handlings. The MultiRail by-pass opportunities capabilities were used to determine what additional blocks might be added to replace blocks which were taken down during the construction of the train plan.

In our recent zero-based planning projects, we have had a difficult time in getting clients to buy into the principle of reducing yard dwell time and increasing yard throughput, by creating a train plan which offers multiple daily outlets for larger blocks. We also find North American railroads to be still driven by minimizing train starts and maximizing train size. This is partly due to increasingly tight mainline capacity, but also due to thinking that costs are driven by train starts. In reality, costs are driven more by equipment utilization which means train balance and daily operating frequencies are far more important because they keep cars and locomotives cycling faster, in spite of degradation in average train sizes and a modest increase in train starts.

Simulation and Analysis of the New Train Plan

The last piece of the study is to simulate the plan over a seven-day period and review train sizes and yard volumes by day-of-the-week. This is critical, as one of the major problems with many operating plans that focus on large train sizes, is the tactical intervention required by field operations and/or the network control center when peak day train sizes exceed operational thresholds. This problem creates yard congestion and gets power and crews out of their normal planned cycles. Once the plan has been reviewed by day-of-the-week, the key statistics: car-handlings, gross ton-miles, crew starts, and car-days, are compared to the base case to document improvement in the new plan.

Review and Implementation

The last step is field review and acceptance and implementation. This is where we find many projects sputter or outright fail. MultiModal sponsored a conference in Europe last week, and Jeff Adams of Canadian Pacific, provided some great insights into the reasons for the failure to successfully implement these projects. We will be spending a lot more time in the future on understanding these issues and determining how we can better influence the change process at our client organizations to ensure a more favorable outcome on these projects. The most important thing we have learned since the NS TOP project is that the best OR techniques can produce the best operating plans, but they are useless unless they actually get implemented. Clearly, improving the OR techniques produce better results, but the most common reasons for lack of success in implementation are soft organizational issues, more than failures in the OR techniques and technology used in the project. All of us in the OR field must keep this in mind when trying to increase the application of OR techniques and technology in the railroad industry.

Jason Kuehn
MultiModal Applied Systems
jason@multimodalinc.com

### World's Six Longest Railroad Tunnels

<table>
<thead>
<tr>
<th>Tunnel</th>
<th>Year Opened</th>
<th>Miles</th>
<th>Operating Railway</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seikan</td>
<td>1985</td>
<td>33.5</td>
<td>Japanese Railway</td>
<td>Japan</td>
</tr>
<tr>
<td>English Channel Tunnel</td>
<td>1994</td>
<td>31.04</td>
<td>Eurotunnel</td>
<td>United Kingdom-France</td>
</tr>
<tr>
<td>Dal-Shimizu</td>
<td>1979</td>
<td>14</td>
<td>Japanese Railway</td>
<td>Japan</td>
</tr>
<tr>
<td>Simplon No. 1 and 2</td>
<td>1906, 1922</td>
<td>12</td>
<td>Swiss Federal and Italian State</td>
<td>Switzerland-Italy</td>
</tr>
<tr>
<td>Kanmon</td>
<td>1975</td>
<td>12</td>
<td>Japanese Railway</td>
<td>Japan</td>
</tr>
<tr>
<td>Apennine</td>
<td>1934</td>
<td>11</td>
<td>Italian State</td>
<td>Italy</td>
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RASIG Sessions at INFORMS Annual Meeting, San Francisco 2005

RASIG has organized several interesting sessions at the forthcoming INFORMS National Meeting in San Francisco, from November 13-16, 2005 (http://www.informs.org/Conf/NO2005/). The titles and the authors of these talks are provided below. We hope that RASIG members will attend and benefit from these sessions. Abstracts of these papers are available at the conference website.

- Michael Gorman, University of Dayton

### Sunday (November 13)

**Rail Applications Academic Session**  
Chair: Christopher Barkan, Univ. of Illinois at Urbana-Champaign  

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 – 9:30 AM</td>
<td>A Risk-Cost Approach to Rail-Truck Intermodal Transportation of Mixed Freight</td>
<td>Manish Verma, Memorial University, and Vedat Verter, McGill University</td>
</tr>
<tr>
<td></td>
<td>Genetic Algorithm to Minimize Earliness and Tardiness of Outbound Trains in a Rail Yard</td>
<td>Rob Randall and Mary Beth Kurz, Clemson University</td>
</tr>
<tr>
<td></td>
<td>Optimization of the Loading Patterns of Intermodal Freight Trains</td>
<td>Yung-Cheng Lai, Christopher Barkan, and Hayri Onal, University of Illinois at Urbana-Champaign</td>
</tr>
<tr>
<td></td>
<td>A Decision Support System for Train Scheduling Problem</td>
<td>Krishna Jha, Arvind Kumar, and Ravindra Ahuja, Innovative Scheduling; Pooja Dewan, BNSF Railway</td>
</tr>
</tbody>
</table>

**RASIG Student Paper Competition**  
Chair: Pooja Dewan, BNSF Railway  

- **First Prize Winner:** Decreasing the Passenger Waiting times for IC Networks of Belgian Railways  
  Pieter Vansteenwegen, Catholic University of Leuven, Belgium  
- **Second Prize Winner:** N-tracked Railway Traffic Rescheduling during Disturbances  
  Johanna Tornquist, Blekinge Institute of Technology, Sweden  
- **Honorable Mention:** Revenue Management of Auto train at Amtrack  
  Soheil Sibdari, University of Massachusetts, Dartmouth  

**RASIG Roundtable: Part I**  
Chair: Michael Gorman, University of Dayton  

Our roundtable discussion will address issues with the current capacity crunch in the North American rail industry. Railroad traffic grew at a pace that exceeded the general growth in the economy in 2004, and this pace of growth is expected to continue in 2005. Some projections have this growth boom continuing through as late as 2007. As a result of this growth, some railroads are reporting significant capacity issues, while others seem to be absorbing growth rates as high as 10% without significant problems. We hope to identify and contrast specific examples of success in dealing with tight capacity at the railroads. These examples could include traditional models such as line capacity tools, and equipment management tools, as well as contrasting various management techniques and philosophies in place in the railroads.

**Panel members and their topics:**  
- Reilly McCarren, “Yield and Capacity Management”  
- Lawrence Ratcliffe, CSX Transportation, “Capacity Planning at CSX”

**Drinks and Snacks sponsored by RASIG**

**RASIG Roundtable: Part II**  
Chair: Michael Gorman, University of Dayton

**RASIG Business Meeting**

**Dinner sponsored by RASIG, Multimodal Applied Systems and Innovative Scheduling**  
(Location to be announced at the INFORMS Conference)
### Monday (November 14)

<table>
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<tr>
<th>Time</th>
<th>Session</th>
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| **8:00 – 9:30 AM** | **Railway Optimized Equipment Distribution: Success or Failure?**  
Chair: Carl Van Dyke, MultiModal Applied Systems |
|               | **Experience in Using a Dynamic Empty Car Distribution System at CSX**  
David Sellers, CSX Transportation |
|               | **Freight Car Distribution at Canadian Pacific Railway**  
Clarke Carson, Canadian Pacific Railroad |
|               | **Using Optimization Tools for the Management of Empty Railcars and Locomotive Distribution at NS**  
Clark Cheng, Hardik Shah, and Ajith Wijertne, Norfolk Southern Corporation |
|               | **Empty Railcar Distribution at BNSF**  
Kevin Crook, BNSF Railway |
| **10:00 – 11:30 AM** | **Yield Management in Railroads**  
Chair: Michael Gorman, University of Dayton |
|               | **Estimating Predictability in Customer Arrival Patterns**  
Michael Gorman, University of Dayton |
|               | **Revenue Management in the Rail Industry**  
Warren Lieberman, Veritec Solutions |
|               | **Yield Management at Wisconsin Central**  
Reilly McCarren, Arkansas & Missouri Railway |
|               | **Maximizing Revenue in Amtrak’s Northeast Corridor in the Presence of Capacity and Fare Constraints**  
Masroor Hasan, Daniel Brand, and Ammon Matsuda, Charles River Associates |
| **4:30 – 6:30 PM** | **TSL/RASIG: Emerging Trends in Rail Optimization**  
Chair: David Hunt, Cambridge Systematics |
|               | **New Frontiers in Railroad Optimization**  
Ravindra Ahuja, Innovative Scheduling and University of Florida |
|               | **Robust Optimization of Investments in Freight Network Capacity**  
Yao Sun, Linda Nozick, and Mark Turnquist, Cornell University |
|               | **Fleet Ownership and Intermodal Supply Chain Efficiency**  
Michael Gorman, University of Dayton |
|               | **The Little Stretch from Airline Tail Assignment to Rail Fleet Routing**  
Sami Gabteni, Carmen Systems |

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**Railroad Tutorial at INFORMS**

Ravindra K. Ahuja will be offering a 90-minute tutorial at INFORMS 2005 entitled, "Transforming Railroads through Cutting-Edge Operations Research," on Sunday (November 13) from 10:00-11:30 AM. This tutorial will give an overview of important railroad planning and scheduling problems including blocking, train scheduling, yard locations, locomotive scheduling, and crew scheduling, and will describe the recent state-of-the-art operations research algorithms developed to solve these problems.
Innovative Scheduling, Inc. develops and licenses large-scale computer models and software to help transportation industry managers analyze and solve complex network problems. We specialize in developing very efficient, responsive, interactive, and user-friendly software solutions to complex decision problems resulting in substantial benefits for our clients. Our team of experts is also available for consulting engagements. We also provide consulting in systems design, economic analysis, forecasting, re-engineering, and capital investments.

Our forthcoming products include:

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

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

RASIG OFFICERS:
Ravindra K. Ahuja (Chair)
University of Florida & Innovative Scheduling
ravi@InnovativeScheduling.com
Michael F. Gorman (Treasurer)
University of Dayton
Michael.Gorman@udayton.edu
Carl Van Dyke (Vice-Chair)
MultiModal Applied Systems
carl@multimodalinc.com
Krishna C. Jha (Secretary)
Innovative Scheduling
krishna@InnovativeScheduling.com

NEWSLETTER STAFF:
Ravindra K. Ahuja (Editor)
Pooja Dewan (Editor)
Krishna C. Jha (Editorial Assistant)
Saumya Ahuja (Layout Designer)

BNSF contributes to RASIG

To promote and encourage RASIG activities, BNSF Railway helped sponsor the Railroad Workshop held at Dallas in December 2004. RASIG committee greatly acknowledges BNSF’s contribution and thanks for its generosity.

RASIG Dinner at INFORMS

We would like to invite all RASIG members for a dinner on Sunday (November 13). We will walk to a nearby local restaurant immediately after the RASIG Business Meeting which ends at 7:15 PM. Please show your commitment to RASIG by joining us at the dinner. This dinner will be sponsored by RASIG, Multimodal Applied Systems, and Innovative Scheduling.

Railroad OR Library

RASIG, in collaboration with Innovative Scheduling, has developed an on-line library of papers related to Operations Research in railroads. This library contains references and abstracts of hundreds of papers in railroad OR published in the past fifty years. The library allows 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.InnovativeScheduling.com.

Link: Publications > Railroad OR Library. Visitors can also add their papers to this electronic library.