

# ROUNDTABLE PROFILE

BY STEFAN E. KARISCH AND MIKE POUND

**Editor's note:** This is another in a series of articles profiling members of the INFORMS Roundtable.

## Jeppesen soars with O.R.

Operations research drives operating efficiencies and product enhancements for world's leading provider of navigational information.

Jeppesen was founded in 1934 by airmail pilot and aviation pioneer Elrey B. Jeppesen as an outgrowth of his work to compile information about his mail route and the landscape over which he was flying. At the time, there was little information about terrain, obstacles or potential landing sites available. As a result, many of his fellow airmail pilots were injured and killed in unfortunate accidents. "Jepp," as he was known among his fellow aviators, spent his off time climbing mountains, scaling smokestacks and towers and otherwise gathering information about their heights and locations. He also spent time surveying farmers' fields, recording drainage patterns, recording locations of fences and buildings and even recording phone numbers. He then compiled them in a 10-cent notebook he used as a reference.

As word of Jepp's notebook spread, other pilots began asking for copies of it, and thus the company that bears his name was born. Jeppesen grew to be the world's leading provider of navigational and operational information and today helps people all over the globe reach their destinations safely and efficiently. Jeppesen provides mission-critical information solutions to 85 percent of the world's airlines and more than one million individual pilots. It also has a burgeoning marine business, which provides similar navigational and operations planning and management information to hundreds of thousands of recreational boaters and the operators of more than 18,000 commercial vessels.

Jeppesen depends on operations research (O.R.) to deliver industry-leading information solutions to customers around the world who depend on them around the clock. Through a suite of solutions that synthesize and integrate information from a vast number of sources, Jeppesen helps its customers solve increasingly complex business problems related to navigation, operations and logistics through the application of intelligent information. And while operational efficiency is important, safety can never be compromised, so it is actively pursued and built into everything Jeppesen does.

In recent years, Jeppesen has been cited numerous times for O.R. excellence. In 2000, Jeppesen won the Franz Edelman Award for its



Jeppesen uses O.R. to forecast inventory levels of perishable aeronautical charts.

work on optimizing production processes; in 2006 it was a finalist for the Daniel H. Wagner Prize. More recently, Jeppesen was awarded the 2010 INFORMS Prize for the outstanding, widespread use of O.R. throughout the company.

### O.R. in Jeppesen Operations

JEPPESSEN DEVELOPS, maintains and distributes route manuals containing navigational and other information for more than 600 airlines and nearly one million pilots around the world. Because of the nature of aeronautical information, these manuals are continually revised. In 1997, Jeppesen saw its service deteriorate, as growth in aeronautical information and its rate of change accelerated. Jeppesen responded to the situation by establishing a small O.R. group to analyze production processes and develop improvements to them. The group developed a suite of decision support tools intended to increase efficiency and reduce cost. By late 1999, the percentage of customer orders being shipped late dropped to zero from a high of nearly 35 percent. Since then, O.R. has been used to reduce inventory carrying costs by balancing the continual revision of aeronautical information (thus making printed charts highly perishable) against the need to have on hand a sufficient inventory of current charts to meet highly unpredictable customer demand.

# All About the Roundtable

O.R. also is essential to Jeppesen's ability to launch new products and services. It was used to support the introduction of Marine Pilotage Charts, which are similar to aeronautical charts, to the commercial marine market, where such a product was completely unknown. O.R. helped model and assess cost structure, project print quantities, quantify risk and define a pricing model. O.R. minimized uncertainty surrounding the launch of the product and increased product management's confidence in their pricing and profitability decisions.

O.R. is also used to develop and refine business and operational models that facilitate transformation of Jeppesen's core business. Whereas flight manuals have traditionally been issued to individual pilots, who were then responsible for amending them, some airlines are beginning to outsource this time consuming and tedious task by having Jeppesen do it. Under this model, Jeppesen employees of amend manuals by filing revised charts, replacing worn or torn pages, then quality checking each manual. Amended and current manuals are then delivered directly to the flight decks of customer aircraft, where they are exchanged for the manuals in use. The process is then repeated. As this service grows to include more customers, with larger and increasingly complex operations, the O.R. group is charged with ensuring that production schedules and distribution networks keep pace with it. As part of this effort, several large-scale optimization models have been developed including models for production scheduling, inventory management and delivery scheduling.

Other areas where the O.R. group supports corporate decision-making include resource utilization, inventory optimization, capital investments, market strategy, product development and pricing, and real estate strategy.

## Operations Research in Customer Offerings

**CREW COSTS** – pilots and cabin attendants – represent the second largest variable expense in the operation of an airline. More than 30 major airlines use Jeppesen crew scheduling solutions to schedule in excess of 200,000 crew members each month. Factors considered in scheduling crews include duty time regulations, labor and contractual requirements, fatigue and risk management models and other variables. It is conservatively estimated that these airlines save hundreds of millions of dollars annually through the use of Jeppesen tools. Most customers receive Jeppesen crew scheduling software through a subscription agreement, whereby they receive all-new versions as upgrades are made, ensuring they benefit continually from industry-leading optimization tools. Under this arrangement, customers actively participate as development partners, helping to ensure that developmental efforts deliver maximum value to the customer.

Crew costs represent a similar portion of overall expenses in passenger rail operations, and Jeppesen crew scheduling tools are used in similar fashion by several of the largest rail operators in Europe and Australia.

INFORMS has two types of members: individual and institutional. The latter (usually a company) joins the INFORMS Roundtable and appoints as its representative the person in overall charge of O.R.

The Roundtable has been very active since its founding in 1982, with three meetings each year and much communication in between. It, its member institutions and its member representatives take a strong interest in how INFORMS serves the needs of practitioners, and have undertaken many initiatives and provided many services toward this end. These involve, for example, public awareness of O.R., both of the annual INFORMS conferences, continuing professional education, one of the prizes and various committees.

In addition, the Roundtable has an advisory responsibility to INFORMS. One bylaw states that it "... shall regularly share with INFORMS leadership its views, its suggested initiatives and its implementation plans on the important problems and opportunities facing operations research and the management sciences as a profession and on the ways in which INFORMS can deal proactively with those problems and opportunities ..." By tradition, it meets with the newly elected INFORMS president-elect each spring to discuss practice-related topics of interest to him or her, and with the entire INFORMS Board each fall to discuss topics of mutual concern.

The Roundtable membership comprises about 50 organizations. Further information is available at <http://roundtable.informs.org>.

This series of articles aims to share with the INFORMS membership at large some information and insights into how O.R. is carried on in practice today.



Jeppesen amends pilot manuals for a growing number of U.S. airlines.

Jeppesen has for more than 30 years helped customers in all segments of aviation – from individual pilots to the largest airline operations in the world – optimize flight operations to achieve maximum efficiency. Optimal performance is influenced by many factors and must take into account aircraft performance characteristics, weather, desired routing, air traffic control and associated constraints, and other relevant regulatory considerations.

While route optimization is not unique to Jeppesen, as most computer flight planning systems are capable of this, Jeppesen is leading the effort to push the boundaries of flight planning to achieve even higher levels of efficiency.

Many airlines still use fixed "company routes" most of the time. Jeppesen recently used O.R. to study and determine the benefits of dynamic route optimization at an airline flying medium-haul routes with a fleet of approximately 60 single-aisle jet airplanes flying fixed

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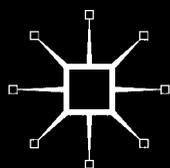


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## ROUNDTABLE PROFILE



company routes. Using historical wind and ATC data, the study determined that dynamic route optimization, taking into account the most current forecast winds, with numerical constraints modeling ATC requirements, yielded a savings of approximately one million U.S. gallons of fuel annually which, in turn, would reduce annual CO2 emissions by nearly 20 million pounds.

While computerized flight planning, and some degree of optimization, is nearly ubiquitous in aircraft operations, similar tools are the exception, not the rule, in maritime operations. Using O.R. principles, Jeppesen has developed its Vessel and Voyage Optimization Solution (VVOS) which has the ability to similarly optimize oceanic voyages for given ship types, port pairs, loading conditions and transit dates, taking into account long-range wind and sea condition forecasts along with vessel operating characteristics and limitations. Jeppesen develops comprehensive vessel-specific performance and motion response models, making optimized route plans accurate and realistic. Data from actual VVOS users confirms consistent and repeatable reductions in fuel consumption and greenhouse gas emissions of 3 percent to 8 percent versus route plans generated using conventional weather routing techniques with dramatically fewer outliers (incidents of routing decision errors resulting in excessive fuel consumption). One long-time VVOS user, in addition to reporting fuel savings of 6 percent over the study period, achieved the following measurable improvements:

- hours delayed due to heavy weather decreased 80 percent;
- structural damage claims due to heavy weather encounters decreased by 73 percent, while the cost of such claims declined by 29 percent; and
- cargo damage claims caused by heavy weather encounters decreased 87 percent.

As in the aviation and rail portions of its business, Jeppesen will continue to leverage O.R. to bring improvements to maritime safety and efficiency and protection of the global environment.

### Sustained Value Creation

JEPPESEN DEPLOYS more than 75 professionals with O.R. backgrounds throughout its organization to ensure that analytics are used to improve decision-making, build better products and offer better services. As a result, O.R. is practiced in close proximity to and in partnership with internal and external customers alike. A corporate O.R. department has overall responsibility for O.R. and optimization programs. As a result, O.R. is managed as a core competency of the company. O.R. professionals are connected through a community of practice, headed by the corporate O.R. department. In addition to regular and ongoing communication among O.R. professionals, the community meets formally twice a year to refine the value proposition O.R. brings to Jeppesen and to engage company leaders in a dialogue about O.R. and its benefit to the company, customers and industry.

Through analytics and O.R., Jeppesen successfully turned around its struggling chart production and distribution processes in the late 1990s. Out of that experience, O.R. is today a staple of the company's operations and provides it with a distinct competitive advantage. It is an essential part of Jeppesen's business strategy and central to the development of end-to-end value solutions that allow clients to operate more efficiently and provide better services to their customers. World-class original research in O.R., and the ability to apply results to solve business problems while building long-term relationships with customers, sharpens Jeppesen's competitive edge. Enterprise-wide application of O.R. has contributed hundreds of millions of dollars worth of improved decision-making to Jeppesen and, potentially, billions of dollars worth to its customers. O.R. will be an even more significant factor in the future as Jeppesen continues to pioneer new ways of transforming transportation through the application of intelligent information solutions. **IORMS**

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