Air Cargo Logistics and Supply Chain Research under the NSTB-funded Temasek Chair in Logistics

Written by A/Prof Huang Huei Chuen

The National Science and Technology Board (NSTB) has recently awarded the ISE Department and The Logistics Institute - Asia Pacific (TLI-AP) a research grant of $2.9 million to carry out research in Air Cargo Logistics and Supply Chain.

In recent years, there has been increasing pressure for shippers especially in the electronic industry to reduce their inventory investment. There have been significant efforts by shippers to move towards practicing zero inventories. New business models such as postponement strategies (delayed product differentiation), outsourcing manufacturing activities and order fulfillment (build to order) supported with integrated information technology are introduced as effective measures to remove any unnecessary inventories. Today, build-to-order is becoming more common rather than build for inventory or build for shipment to stores. For all these reasons, speedy delivery is more and more a necessary component of successful business practice and air transportation has become a common and integral part of the supply chain process.

The research project covers five areas, namely:
1. An Analysis of the Asia-Pacific Air Cargo Network and its Role in Various Modes of Supply Chain Management.
3. The Airlines and their Scheduling, Networks and Planning.

This study began by looking at the Asia-Pacific air cargo system both as a physical system and in the way it is utilized and managed as part of the supply chain network. The second and third areas of the study look at the two most important parts of the air cargo network: airports with their air freight terminals; and airlines with their routes, planes and crews. In the next area of the study, the operational aspects are addressed with emphasis on timely delivery of cargoes. The last area of the study returns to some of the management aspects of the supply chain system: long-term allocations, cargo booking systems, and revenue management in air cargo.

This paradigm shift of doing business brings in new sets of challenges across the entire supply chain system. In such a system, there is very little room for errors as there is little or no inventory to buffer against any unexpected event that can result in significant delays in the delivering process. This calls for proper capacity management across the entire value chain, and clearly an integrated, dynamic and transparent system would be a necessary requirement for success.

The Principal Investigator of the project is Professor Ellis Johnson (photo on the left) and the Program Manager is A/Prof Huang Huei Chuen. Professor Johnson was recently appointed Temasek Professor in Logistics, a position jointly hosted by the ISE Department and TLI-AP. He is Coca-Cola Chaired Professor in the School of Industrial and Systems Engineering at the Georgia Institute of Technology, USA, and has done groundbreaking work in the areas of crew scheduling, flight scheduling, airline operations and electronic distribution. A/Prof Huang is a faculty member of the ISE Department whose research area is in logistics. The research team includes several other faculty members of the ISE Department.
Organisational Excellence Through Six Sigma

Written by A/Prof Xie Min

Professor Goh Thong Ngee of the ISE Department recently delivered the keynote speech at the Singapore Quality Institute Symposium 2001 – Organisational Excellence through Six Sigma – held at Sheraton Towers, Singapore, on October 18, 2001. Six Sigma comprises a set of techniques for quality analysis and improvement, with a focus on the use of statistical techniques. Since its inception more than a decade ago, Six Sigma as a quality improvement initiative has been gaining increasing attention and acceptance in industry.

To provide more insight and initial critical thinking on the use of Six Sigma for Excellence which is the theme of this symposium, Prof Goh spoke about “The Eight Sigma Organisation” in which a realistic view is taken of the Six Sigma framework, with a discussion of the basis of Six Sigma and its long term potential. Prof Goh explained why, in the dynamic business environment of the 21st century, an organization seeking recognized and sustained levels of excellence should aim beyond the Six Sigma benchmark.

The ISE Department also showed its presence at this symposium. Among the more than 150 participants, 12 were ISE full-time Master and PhD students. It was a great opportunity for the students to hear about Six Sigma discussed by people from the manufacturing and service sectors.

Quality Engineering is a thrust area in the ISE Department’s research and educational programs. The Department’s Quality Engineering Group has about 20 research students. The MSc (Ind & Sys Eng) degree program offers a specialization in Quality and Reliability Engineering, while in the BEng (Ind & Sys) degree program, undergraduates may opt for a specialization in Quality Engineering and Management.

Professor Goh Thong Ngee elected Fellow of the American Society for Quality

Extracted by A/Prof Tan Kay Chuan

On 9 November 2001, the American Society for Quality (ASQ) elected Professor Goh Thong Ngee of the Department as a Fellow of the Society, citing his "continuous outstanding contributions to the quality profession". ASQ President Thomas Mosgaller stated: "The grade of Fellow is an earned distinction. Your achievement of this grade is a token of respect from your colleagues that has been accepted by the highest officers of our organization".

Professor Goh’s academic and professional attainments in quality engineering need no introduction. Internationally known for his contributions to this specialized field, he is a frequent invited speaker at professional conferences and corporate meetings, and has served as advisory board member, external examiner or reviewer for various universities and research agencies abroad. He is currently on the editorial boards of several leading research journals.

Professor Goh’s recognition is just the latest event that helps put the ISE Department on the world map of academic and professional excellence. The Department in particular has been known for its activities in Quality Engineering (QE). Its QE Group has been working with research collaborators from the US, Europe, Asia and Australia. Indeed the spectrum of education and research opportunities offered by the Department has been unique in this part of the world.
The Empty Repositioning Problem in the Containerized Shipping Industry

Written by Dr Lee Loo Hay, A/Prof Tang Loon Ching and Mr Lam Shao Wei

The transportation of materials has always been an essential part of any viable economic activity. The rapid process of globalization partly due to the advent of Information and Communications Technology has exacerbated the need for the development of highly efficient and cost-effective means of transportation technology. The objective of this research, which is being conducted in the ISE Department, is to develop effective operational strategies for the management of the relocations of empty equipments, in particular, for the containerized sea cargo industry.

This process of globalization has also brought about a rapid growth in containerized trade due to the efficiencies and cost-effectiveness that such a mode of transportation provides. In 1999, 54 percent of the world’s general cargo trade were containerized cargo [1]. There is significant potential for growth in the containerized cargo industry especially with the rapid economic developments presently taking place in giant economies such as China and the Indian sub-continent, bringing with it substantial potential for further container penetration.

The most prevalent form of global trade imbalance is the trade flows between Asia and the Americas. Figure 1 [2] shows the trade imbalance between NE Asia and N America in TEUs. Apart from the significant inter-regional imbalances between the three major economic zones of Asia, the Americas and Europe, imbalances exists in the intra-regional trade flows as well. Such trade imbalances are projected to increase as shown in Figure 1.

The cost of moving empty containers was estimated to be US$25 billion per annum in 1999 and was forecasted based on current trends to exceed US$50 billion by 2010 [3]. In addition to this repositioning costs are the costs of providing further land storage and wharf facilities to accommodate empty containers.

Presently, these costs have been simply passed on to existing customers either visibly in the form of Equipment Imbalance Surcharges (EIS) or as implied sea-freight costs. This form of practice would have resulted in the loss of price competitiveness. This would adversely affect the carriers’ market share due to the relatively non-differentiated nature of this industry. In addition, deregulation brought about by the Ocean Shipping Reform Act of 1998 have further motivated the need for the development of more efficient forms of empty container management. This necessity is further magnified by the problems of low margins and utilization rates prevalent in this industry.

This research focuses on developing a model for the Dynamic Container Allocation problem specific to the container shipping industry. A dynamic stochastic program was developed to capture the dynamic characteristics of this problem with consideration to the stochastic nature of the following components:
(1) Demand.
(2) Supply.
(3) Ship Capacity.

A numerical value iteration method proposed by Bertsekas [4] was modified to cater for the special Markovian Decision Process of this problem. Convergence properties of different modifications of this method were also studied to obtain the appropriate algorithm that satisfies the assumption related to this value iteration method.

References
The departmental gathering held on 27 October 2001 turned out to be a great success with more than 100 participants, consisting of students, staff and their family members attending. However, with much regret, not all are captured in the group photograph.

Nonetheless, most enjoyed themselves by catching up with one another or playing games that have been carefully planned by our students. Most importantly, the purpose of the gathering was achieved, i.e., to welcome our new staff and students, enhance the sense of belonging and increase the flow of communication between members of the ISE Department.

Prof George Nemhauser (photo, right), the External Examiner for the MSc (Ind & Sys Eng) program, visited the Department during the period 6th –10th August 2001. He met with all the ISE faculty and reviewed the curriculum, and also met with current students and graduates of the coursework and research programs.

George Nemhauser is the A. Russell Chandler Chaired Professor in the School of Industrial and Systems Engineering at the George Institute of Technology.

The ISE Departmental Consultative Committee (DCC) met on 30th November 2001. The meeting went through the recent developments of the Department’s changing curricula and BEng program. Members of the ISE Department DCC include (sitting L-R): Dr Leong Thin Yin, Prof Ang Beng Wah (ISE Dept Head), Mr Koh Soo Keong, Ms Seow Boon Quay, Mr Bill Foo, Mr Peter Leong.

Prof William Schowalter (Dean Emeritus, College of Engineering, University of Illinois at Urbana – Champaign) is Senior Advisor to the President of NUS. He visited the Department on 17th November 2001 to get an overview of the academic activities of the Department. Prof Schowalter (centre sitting) is here to advise on curriculum matters.
ISE STAFF

Congratulations to Dr Chew Ek Peng and Dr Tan Kay Chuan on their promotion to Associate Professor.

Congratulations to A/Prof Yaacob Ibrahim on his appointment as the Minister of State – Ministry of Community Development and Sports.

ALUMNI

Congratulations to Mr Khaw Boon Wan, MSc (Industrial Engineering) Class of 1982, on his appointment as Senior Minister of State – Ministry of Transport and Ministry for Information, Communication and the Arts.

NEW PhD/MEng STUDENTS

A warm welcome to the following Research Scholars and students who joined us in July, Semester 1, 2001/2002 (institution graduated from given in brackets):

Mr Chen Gang (Sichuan University)
Mr Gao Fei (Southeast University)
Mr Katiyar Mohit (Punjab Technical University)
Ms Kuan Sze Nee (NUS)
Mr Liu Guoquan (Tsinghua University)
Ms Puvaneswari Manikam (Univ of Tech Malaysia)
Ms Tan Yen Ping (NUS)
Ms Vijayalakshmi Raghavan (Anna University)
Mr Vivek Garg (University of Delhi)
Mr Wang Wei (Xi’an University of Technology)
Ms Zeng Ling (Beijing University of Chemical Tech)
Mr Zhang Caiwen (Utah State University)
Ms Zhou Runrun (Tongi University)

RECENT PhD/MEng GRADUATES (July – December, 2001)

PhD Degree

Ms Tang Xinyan
Thesis Title: The Economic Design of Control Charts for High Quality Processes

Ms An Yuhang
Thesis Title: Research on the Relationship between Innovativeness of the Company and Skill Requirements for Electronics Manufacturing Workers

Mr Choo Kin Wee
Thesis Title: Modeling and Heuristic Solution of Multi-Period Multi-Commodity Transportation Problem

Ms Kong Hong
Thesis Title: A Study of the Reliability of Maintained Systems

Mr Liu Li
Thesis Title: Some Issues Related to Energy Efficiency, Aggregation and Decomposition

Ms Mira Tjahjapranata
Thesis Title: The Impacts of Firm Size, Concentration and Financial Leverage on the Effectiveness of R & D Investment in Generating Firm’s Growth Opportunities

Mr Xu Zhenyu
Thesis Title: R & D Investment and Systematic Risk: A Theoretical and Empirical Study

RECIPIENTS OF STUDENT AWARDS/PRIZES: YR 2000/01

Winner | Prize(s)
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Mr Lee Kok Hoh | NSTB Gold Medal Op Res Soc of Singapore Prize
Ms Yap Wanjun | Stan Chart Bank Book Prize IIES Book Prize
Mr Loo Chiang Yau | Soc of Proj Mgrs Book Prize
Ms Goh Mui Luang | Auto Assoc of Singapore Prize
Mr Pek Beng Kiat | SAS Institute Pte Ltd Prize
Mr Lee Kok Hoh | Singapore Quality Institute Prize
Mr Tony Halim | VICOM Prize

Note: The Department gratefully acknowledges the donors of the above prizes.

Prize winners at Commencement 2001 held on 18th Sept 2001 at the University Cultural Centre, NUS.
Dear Students and Alumni,

To make us more effective and efficient in updating you with our departmental information and functions, kindly provide us with your latest personal particulars.

Thank you for your cooperation.

Name: __________________________________________________________

Address: __________________________________________________________

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