

Activity Report of EASTS IRG (International Research Group)

Date of Submission: 7 / 31 /2008

1. IRG code and Name of IRG

1) IRG code: IRG -08 - 2005

2) Name of IRG

Research on the control mechanism and simulation of safety conditions of perishable foods transportation and logistics

2. List of research members:

1) Xie Ruhe (Representative)

Professor, Ph.D., Research Center for Logistics and Transportation, Guangzhou University, P.R.China

2) Liu Guanghai

Ph.D., Research Center for Logistics and Transportation, Guangzhou University, P.R.China

3) Alan Foster

Research Fellow, Food Refrigeration and Process Engineering Research Centre (FRPERC), University of Bristol, UK.

4) Cheng-Min Feng

Institute of Traffic and Transportation, National Chiao Tung University, Taiwan

5) Lin Chaopeng

Lecturer, Shaoguan University, P.R.China

6) Zou Yifeng

Engineer, Research Center for Logistics and Transportation, Guangzhou University, P.R.China

3. Purpose and Mission of IRG:

The present goal is to study Food Logistics Technical Conditions.

Cold-chain is a system engineering to ensure the quality and reduce the loss of foods during production, storage, transportation, distribution and retailing of perishable goods under certain low temperature environment. It is a part of cool logistics and transport technology. Because of the complicated environment and long transport duration, the refrigerated transportation is the key to keep the quality in the whole cold chain.

The world population is growing. It has increased from 5.3 billion in 1990 to 6.4 billion in 2000. It is predicted to be 11.2 billion by the year of 2010. In order to meet the food demands, an efficient refrigerated transportation is necessary. According to the statistics, there are at least 1 million refrigerated trucks and 400,000 refrigerated containers in use in the world. The retail value of the products transported can be estimated more than 1200 billion US dollars.

In China, fresh and live produces and other perishable goods need refrigerated transportation urgently. According to interrelated statistics, there are more than 7000 refrigerated railway cars, 30,000 refrigerated trucks, 100,000 tonnes water refrigerated vessels and 10000 refrigerated containers in use.

However, the number is still deficient. Today, more than 120 million tonnes perishable goods need refrigerated transportation, but only half of them have been transported because of the restrict of condition and ability of refrigerated transport. More than 15% of foodstuff transported has decayed in the course of transport.

Low temperature is the key to keep the quality of perishable goods, but it is not the only necessary and sufficient condition. The excellent transport quality of perishable goods depends on the suitable control of temperature and humidity and the integrated use of multi-exercise. For example, Excessive low temperature would cause food frostbite and nutrition loss, on the other hand, excessive high temperature would result in rot. Excessive low humidity would cause serious weight-loss of food. On the other hand, excessive high humidity would result in mouldy. Moreover, temperature and humidity are only two main factors affecting quality of food transport.

This research aims to find the best control technology and method, which would keep the quality and reduce the weight-loss of perishable goods, and guarantee the edible safety of food, based on the character of perishable goods transportation.

In order to achieve the object, we will conduct a study to simulate the factors and find the principle of food. In the first, by means of refrigerated transportation experiment platform, we will test the best reference point under actual transport conditions by adjusting and controlling temperature, humidity, airflow and air composition, etc. In the second, we will set up heat and mass transfer models by computed simulation based on experiment data. The optimal control method would provide guidance for refrigerated transportation of perishable goods.

4. Past Achievements (2007.8~2008.7)

1) Paper, Report or Book: (Title, Authors, Year, Name of journal etc.)

Book:

- Xie Ruhe, Zhang Dezhi, Luo Rongwu, etc. Logistics system layout. China Logistics Publishing House. 2007.12
- Xie Ruhe, Huang Xiangrong. Simulation on the flow of logistics management. China Logistics Publishing House. 2008.3

Degree thesis:

- Liu Guanghai. Study on analysis of energy consumption and optimization of refrigerated transportation equipment [Doctor Thesis]. Tutor: Xie Ruhe. Changsha: Central South University. 2007.12
- Qiu Zhuqiang. Study on the optimization of logistics network and logistics safety for fresh agricultural products based on cold chain [Doctor Thesis]. Tutor: Xie Ruhe. Changsha: Central South University. 2007.12
- Huang Chengzhou. The simulation on refrigerated system of refrigerated container [Master Thesis]. Tutor: Xie Ruhe. Guangzhou: Guangzhou University. 2008.6

Paper:

- Xie Ruhe, Liu Guanghai. Heat balance model for refrigerated car and simulation and experimentation on the temperature field. The 22nd International Congress of Refrigeration. 2007.8, Beijing, China

- Xie Ruhe, Liu Guanghai. Design and test on the simulating test-bed of refrigerated transportation condition. The 22nd International Congress of Refrigeration. 2007.8, Beijing, China
- A.M. Foster, J.A. Evans. Advanced techniques to understand and improve open-fronted vertical refrigerated display cabinets. The 22nd International Congress of Refrigeration. 2007.8, Beijing, China
- A.M. Foster, M.J. Swain, S.J. James. Two and three dimensional CFD models of the effectiveness of an air curtain used to restrict cold room infiltration. The 22nd International Congress of Refrigeration. 2007.8, Beijing, China
- Xie Ruhe, Qiu Zhuqiang. A New Heuristics for VRP with Simultaneous Delivery and Pick-up. Proceedings of the International Conference on Transportation Engineering. 2007.8, Chengdu, China
- Liu Guanghai, Xie Ruhe, Qu Ruigui. Study on outdoor high temperature parameter by Pearson- χ^2 distribution model. The Journal of Chongqing Architecture University. 2007.8: 107-110
- Liu Guanghai, Xie Ruhe. Heat condition and energy consumption model and experimentation on refrigerator car. Journal of Refrigeration. 2008, 29(3): 47-53
- Lin Chaopeng, Xie Ruhe, Xu Xiaochun, Zhang Xianghua. The analysis on consumers' attention and information channel of safety risk in pork accommodated chain, based on the consumer survey in Shaoguan. Guangdong Agricultural Sciences. 2008,(3):100-102
- Chen Baoxing, Xie Ruhe, Zhu Yuancheng. Towards the framework and construction of food logistics security and safety for the 2010 Guangzhou Asian Games. Journal of Guangzhou University [Social Science Edition]. 2008,7(1):40-43
- Zhao Bo, Xie Ruhe. Application framework of GIS based simulation technology in food logistics safety management. Agriculture Network Information. 2007, (5):16-19
- Zhang Yanping, Xie Ruhe, Pan Siying. On Strengthening the Legislation Construction of Food Transportation Safety Management. China Market. 2007, (11):106-107
- Xie Ruhe, Liu Guanghai. The development of refrigerated transportation equipment. The National Conference of Refrigerated Transportation. 2007.12. 44-47. Shanghai, China
- Xie Ruhe, Liu Guanghai. The study on food standard of cold chain. The National Conference of Refrigerated Transportation. 2007.12. 40-43. Shanghai, China
- Xie Ruhe, Liu Guanghai. Investigation on energy consumption of railway refrigerated transportation. The National Conference of Refrigerated Transportation. 2007.12. 22-26. Shanghai, China
- Xie Ruhe, Liu Guanghai. Integrated experiment on quality and energy consumption of banana in refrigerated transportation. The National Conference of Refrigerated Transportation. 2007.12. 15-21. Shanghai, China

2) Seminar, Symposium or Special Session: (Title, Date, Venue & abstract)

- The 22nd International Congress of Refrigeration, 2007.8, Beijing, China
Study on the simulating test-bed of refrigerated transportation condition and technique of refrigerated transportation
- The EASTS conference, 2007.9, Dalian, China
Introduction the production of IGR-08-2005

- The 6th National Conference of Logistics, 2007.11, Shenzhen, China
Study on the transported condition of perishable goods and food safety
- The 19th National Conference of Refrigeration, 2008.11, Hangzhou, China
Study on the technique of cold chain
- The National Conference of Refrigerated Transportation, 2007.12, Shanghai, China
Study on the transported condition of perishable goods
- The National Conference of Cold Chain Criterion, 2008.1, Guangzhou, China
Study on the cold chain criterion about refrigerated transportation equipment and condition
- The Symposium on New Technique of Cold Chain and Food Safety, 2008.4, Shanghai, China
Study on the new technique of cold chain and food safety
- The Member Conference of Refrigeration Academy, 2008.5, Beijing, China
Introduction the production of Research Center for Logistics and Transportation in Guangzhou University and IGR-08-2005

3) Group meeting: (Date, Venue & abstract)

- 2007.8, Guangzhou, China
Research members: Xie Ruhe, Alan Foster, Liu Guanghai, Lin Chaopeng, Huang Chengzhou
Study on the simulating test-bed of refrigerated transportation condition
- 2007.8, Beijing, China
Research members: Xie Ruhe, Alan Foster, Liu Guanghai, Huang Chengzhou, Lin Chaopeng
Study on the refrigerated transportation of perishable goods all over the world
- 2008.5, Guangzhou, China
Research members: Xie Ruhe, Liu Guanghai, Zou Yifeng, Lin Chaopeng, Huang Chengzhou
Study on the energy consumption and food safety on refrigerated transportation

4) Result of Application to other research funds: (Name & result)

- ICRA for incubating research, EASTS 2007~2009
Research on the control mechanism and simulation of safety conditions of perishable foods transportation and logistics
- Standardization Administration of the People's Republic of China, National Criterion, No.20071409-T-469
Technical requirements for temperature-controlled transportation of perishable food
- Standardization Administration of the People's Republic of China, National Criterion, No.20076476-T-322
Railway refrigerated car-specification and testing
- Guangzhou University, Incubating research
The study on technique of refrigerated transportation and new insulated material
- The paper "Heat balance models for refrigerator car and simulation on the temperature field" got the third grade excellent paper in China Refrigerated Academy in 2007.

5) Promotional activities of your IRG: (Home page, Newsletter, Mailing list etc.)

Our work is shown in www.gd56.org

The E-mail address: ruhe_xie@yahoo.com

Will you continue your IRG activity in next term (after August 2008) ? [YES]

→ If “YES”, please answer the following questions.

5. Future research plan including time frame with the following items:

- Planned seminar, symposium etc. (Date & Venue)

- 1) The 8th EASTS conference, 2009, Surabaya, Indonesia
- 2) The 7th National Conference of Logistics, 2008.11, Guilin, China
- 3) The National Conference of Cold Chain, 2008.10, Shanghai, China
- 4) The National Conference of Cold Chain Criterion, 2008.10, China
- 5) The 4th Symposium on Continual Development of Guangzhou, Hong Kong and Macao, 2008.9,

Guangzhou, Hong Kong and Macao, China

- Possibility of Special Session at the next EASTS conference in 2009

A series of papers and reports should be published in the EASTS conference in 2009

- Special considerations to young researchers

Refrigerated transportation is a domain involving multi-subject and adopting various techniques, including logistics, transportation engineering, economic and management, mechanism manufacture, the technology of refrigeration, the technology of food processing, etc. Our research is comprehensive. It takes the leader in this research field.

On the other hand, 2~3 doctors and 2~3 masters will be brought up by the project.