



## WG on Engineering as Collaborative Negotiation (WG-ECN)

Meeting held on 2004-08-27, 14:00 – 18:00, in Krakov, Poland.

### MINUTES

**PRESENT:** Stephen C-Y. LU (Chair); Robert WILHELM (Vice Chair) ; A.Y.C. NEE; Ann KJELLBERG; Deba DUTTA; Guenther SCHUH; Gunnar SOHLENIUS; Hans-Peter WIENDAHL; Hoda ELMARAGHY; Jozsef VANCZA; Mitchell TSENG; Nam P. SUH; Paul MAROPOULOS; Pedro CUNHA; Peihua GU; Robert WILHELM; Serge TICHKIEWITCH; Stephen C-Y. LU; Torsten KJELLBERG; Waguih ELMARAGHY; Pierre BOURDET; Juan M. MINGUEZ; M.A. MANNON; Gunther SELIGER; Jan-Gunnar PERSSON; Luc MATHIEU

### GUESTS:

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#### 1. Opening, welcome, approval of the agenda

- a. Professor Lu made opening remarks and recounted the history and plans for the ECN WG.
  - i. The ECN WG was formally established in January 2003 for a duration of 3 years
    1. This is our 3rd formal meeting
  - ii. This is the beginning of our 2nd phase effort



1. Year 1 – Defining and learning ECN concepts
2. Year 2 – Working to improve ECN knowledge
3. Year 3 – Organizing and disseminating ECN results
- iii. More information/results are posted on the ECN website (see <http://mspde.usc.edu/ecn>)
- b. A new journal is being established
  - i. Publisher: Inderscience Publishers
  - ii. Proposed publication date: 2005/10
  - iii. Frequency: Quarterly
  - iv. Format(s): Printed text and Online
    1. (Print) ISSN 1745-0039
    2. (Online) ISSN 1745-0047
  - v. An international Editorial Board is being organized
- c. Special meetings at CIRP Design Seminars
  - i. 2005 in Shanghai, China
  - ii. See: [www.cirp2005sh.sjtu.edu.cn](http://www.cirp2005sh.sjtu.edu.cn)
  - iii. 2006 in Calgary, Canada
- d. ECN books to be published
  - i. Single author and group authors
- e. On target for 2007 Dn/O joint keynote paper
- f. We need to contribute CIRP Newsletter
- g. Joint ECN research projects (TBD)

## **2. Progress on action items from last meeting**

- a. Report from the 2004 CIRP Design Seminar
- b. Key Concepts
- c. Test cases and bench marks
- d. Collaborative research efforts

R. Wilhelm reviewed items – progress on identifying key concepts with significant material added to the ECN website. So far, no progress on test cases and bench marks. Will discuss collaborative research efforts later in today's agenda.

## **3. Liaison Reports**

- a. Prof. Waguih H. ElMaraghy – American Liaison

Reviewed further literature review on ECN, relationship to product complexity, human focus, and systems engineering. Proposed some steps for future work. (PPT included)

- b. Prof. Paul Maropoulos – Europe Liaison

Discussed opportunity for Research collaboration via VRL-KciP (European Network of Excellence). The CIRP Seminar in Digital Enterprise Technology (DET'04) in Seattle 13-16 Sept. 2004 will include a roundtable discussion session regarding ECN. Next DET meeting will be in 2006 in Portugal. Professor Maropoulos suggested that ECN WG work at coordinating with this meeting. Suggest that Wilhelm and Lu serve on international programme committee for DET2006. Suggests that proof of concept funding from EU, North America and the Pacific Rim would strongly motivate a successful research project for the ECN WG



ACTION ITEM: Request Prof. Maropoulos to report on output from DET2004 Seminar of CIRP

- c. Prof. Fumihiko Kimura – Asia Liaison - To be presented later.

#### **4. Technical Presentations**

- a. Prof. Gunnar SOHLENIUS presented a paper on “SYSTEMIC NATURE OF ENGINEERING AS A BASE FOR COLLABORATIVE NEGOTIATIONS TO OBTAIN ECONOMIC GROWTH AND INCREASED WELFARE” (PPT and DOC)

Discussed motivation for innovation processes and then defined and analyzed a system structure for innovation processes, proposed two additional design axioms for productivity, discussed relationship between ECN and important mechanisms for improving human welfare.

DISCUSSION ITEM: G. Hazelrigg suggests that the axioms as stated are reflexive and really state preference systems, and that since there are four, they are either redundant or inconsistent

DISCUSSION ITEM: W. H. ElMaraghy comments that besides design, ECN must also address productivity, manufacturing, etc - it is appropriate that the WG scope include all engineering activity.

- b. Prof. Mitchell TSENG on “Mass Customization as Multi-attribute Negotiation” (PPT)

Discussed drawbacks of fixed offers, enablers for push systems, mass customization requires push enablers on customer side and supply chain side, different attributes for provider and customer, conflict on multiple dimensions, dynamic pricing – such as price line is single attribute – outcome is either win or lose, multi-attribute - potential win for both buyer and seller, product family architecture (PFA) used to represent solution space, when solution can be arrived at – opportunity of new product variant.

DISCUSSION ITEM: Prof. N. Su commented on assumption made in negotiation, design axioms 1 and 2 do not completely address complexity of design, in systems he finds 4 types of complexity. There is sometimes an inherent assumption in discussions of ECN that if you negotiate you will get a better result – theories on complexity suggest that this is not always true. Also observes that stability is fundamental. Goal of negotiation should be to both remain stable and also improve the solution by reducing complexity.

DISCUSSION ITEM: S. Lu recounted common ideas of negotiation and noted how they relate to convergence, complexity, stability, periodicity, and re-set.

DISCUSSION ITEM: G. Sohlenius comments that competence is key driver behind negotiation.



DISCUSSION ITEM: W. ElMaraghy comments that modularity is not always required for mass customization. Defining product requirements is a negotiation process.

- c. Prof. Guenther SCHUH presented a paper on “Different Negotiation Levels for New Product Development”

Discussed topics including ECN paradigm provides new insights into success and failure of new product development, Every single type of deviation in quality can be traced back to a deficit on a negotiation level, product development process can be understood as 4 step negotiation process, example – over-constrained assembly, example – product variant planning.

DISCUSSION ITEM: J. Aurich, Kaiserslautern – question who would be allowed to be a negotiator in the process you describe?

DISCUSSION ITEM: S. Lu a lot of time negotiation is difficult because we don't know who the stake holder is

DISCUSSION ITEM: G. Sohlenius – seems stakeholders are different for different products – perhaps we should classify into different categories.

DISCUSSION ITEM: M. Abramovic– how can you apply this to transaction in the automobile supply chain?

ACTION ITEM: Request G. Schuh to add a bit more detail so we can this as a case study on the ECN website

- d. Prof. Yan JIN presented a paper on “Toward Productive Engineering Negotiation”, (PPT)

Discussed Background on collaborative design and current practice, Framework for argumentation-based negotiation, Research issues include “what to argue about” and “how to argue effectively”, presented a model of engineering negotiation, discussed further challenges

DISCUSSION ITEM: W. ElMaraghy comments that we need to clarify difference between problems that can be solved traditionally, problems that can be solved traditionally or via ECN, and only ECN problems. i.e. Schuh's example could be solved via robust design methods.

DISCUSSION ITEM: W. ElMaraghy asks - are the negotiation issues known ahead of time? (No) So it's possible that issues can change during negotiation? E.g. if issues are fixed, the problem could be solved via multiple objective optimization.

DISCUSSION ITEM: G. Sohlenius – comments that decisions about product and customers need are only a subset of the entire process.



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DISCUSSION ITEM: T. Kjellberg comments that by using arguments you are able to gather information about product requirements

ACTION ITEM: Request that Y. Jin adds more detail and creates a book chapter from this material

- e. Prof. H.P. Wiendahl presented a paper on “Team Syntegrity (PDF)

Synteintegration – coming from synergy and integration. Developed by Prof. Malik at management zentrum st gallen.

Discussed topics including approach uses biological approaches to solve problems, icosahedron as model for communication and creative strategy, includes workers, critics, and observers, 32 people work on 12 topics, each person’s strengths are optimally leveraged, information and cross-linking happen automatically, high redundancy drives intense but systematic information consolidation

DISCUSSION ITEM: S. Lu comments - the presentation started with a nice and relevant quote: “we must reach the critical mass to overcome the resistance to change” – it appears that ECN has now reached the critical mass.

DISCUSSION ITEM: M. Tseng asks - Explain how the twelve topics are selected.

DISCUSSION ITEM: G. Hazelrigg asks - Have you thought about proving the stability of this process. i.e. very small changes in the process may significantly change decision results

DISCUSSION ITEM: W. ElMaraghy asks - One measure of the utility of the process is how much the system changed after using the process – how much change did you observe?

DISCUSSION ITEM: P. Gu asks – Can different levels that can be pursued – i.e. can you do this with 4 or 20 or other numbers of people?

DISCUSSION ITEM: H.H. Wiendahl asks - So the basic idea is to believe the ideas of the experts, ie if there is no knowledge the result will be interesting but not relevant?

- f. Professor Stephen LU presented a paper on “An ECN Foundation: Negotiation Analysis, the science and art of collaborative decision making” (PPT)

Presented roadmap of the ECN foundation that classifies according to decision type and knowledge type, recounted developments in decision theory have followed from descriptive->prescriptive-> normative – ECN should follow these development steps, discussed differences between behavioral decision theory, decision analysis, game theory, and negotiation analysis, discussed negotiators dilemma, Listed relevant questions for ECN research

DISCUSSION ITEM: G. Hazelrigg comments – you modify the list of ECN research questions to include “prove stability and convergence”



DISCUSSION ITEM: W. ElMaraghy asks - In mechanical systems when stability can't be achieved, you may add elements to change the model e.g. dampers. Can you do this with negotiation?

DISCUSSION ITEM: J. Aurich, Kaiserlautern comments - on stability – in practice we don't have stability with current engineering processes – any ECN results will improve on the current practice.

## **5. Open Discussion**

S. Lu suggests that we need more activity, and that we can achieve this by discussing more on the ECN website.

H.P. Wiendahl asks – is more activity needed

S. Lu suggests that continuous participation is goal of WCN WG

H.P. Wiendahl suggest that more activity will come from people that have a need – i.e. changability WG may be good customer as they have needs that can be addressed by ECN

Y. Jin: need to work on developing joint projects

ACTION ITEM: add area to the website where people can post interests and identify potential collaborators

W. ElMaraghy suggests a next page to the roadmap – what are the problems that belong to the different boxes on the roadmap

ACTION ITEM: W. ElMaraghy will initiate joint project on to detail the problems that belong to the different boxes on the roadmap

Schuh and Lu discuss approaches to joint project

H.P. Wiendahl counsels us to go slow and results will follow.

M. Tseng – very little research methodology appears to exist – wants to collaborate with others who are interested in research methodology

S. Lu comments that ECN fits into the mixed qualitative and quantitative approach and is difficult to address – there are many opportunities for research

## **6. Action items for the next meeting and related responsibilities.**

ACTION ITEM: survey of ECN related papers will be done by R. Wilhelm and W. ElMaraghy

ACTION ITEM: initiate joint research project (solicit collaborators on the ECN website)



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ACTION ITEM: Industrial Case Studies – Bob Ford will supply case study from aerospace industry

ACTION ITEM: Industrial Case Studies – need to gather more

ACTION ITEM: Group authored book

Special ECN meeting at 2005 CIRP Design Seminar in Shanghai

**7. Miscellaneous**

**8. Closure**