Developing the Entrepreneurial I/UCRC - An IMS Experience

Jay Lee

NSF Industry/University Cooperative Research Center on Intelligent Maintenance Systems (IMS)

Univ. of Cincinnati
Univ. of Michigan
Missouri Univ. of S&T
Univ. of Texas-Austin
Outline

► Brief Introduction of IMS

► IMS Strategy in Marketing, Outreach, and Spin-offs

► NSF ICorps and New Start-Up Company

► Summary
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A system that enables equipment to achieve and sustain near-zero breakdown performance, and ultimately transform product condition data to useful information for improved productivity, knowledge, and asset utilization.
IMS Core Key Technology & Value

**Methodology**

Watchdog Agent® Toolbox

**Predictive Monitoring Solution**

**WATCHDOG AGENT® TOOLS**

**HEALTH ASSESSMENT**
- Logistic Regression
- Statistical Pattern Recognition
- Self-organizing Maps

**HEALTH DIAGNOSIS**
- Support Vector Machine
- Self-organizing Maps

**SIGNAL PROCESSING & FEATURE EXTRACTION**
- Neural Networks
- Gaussian Mixture Model
- Auto-Associative NN

**PERFORMANCE PREDICTION**
- Time Domain Analysis
- Frequency Domain Analysis
- Time-frequency Analysis
- Autoregressive Moving Average
- Recurrent Neural Network

**HEALTH ASSESSMENT**
- Wavelet Analysis
- Principal Component Analysis
- Expert Extracted Features

**RUL**

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The IMS Consortium

ALSTOM
HIWIN
TOYOTA
Parker
SIEMENS
API
P&G
OMRON
FORCAM
SPIRIT AEROSYSTEMS
GE
GE Aviation
TechSolve
Eaton
GOODYEAR
AVETEC
GM
Honeywell
BorgWarner
CATERPILLAR
Missouri S&T
FMTC
THE UNIVERSITY OF MICHIGAN
University of Cincinnati
Center for Intelligent Maintenance Systems

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Global Industry Partners (75)

LEGEND:
• Active Member
• Past Member

CANADA
• Syncrude

USA
• ARL
• API
• AITRI
• GM
• Wodward
• P&G
• Idaho Nati Lab
• Ingersoll Rand
• Parker Hannifin
• Spirit Aerosystems
• National Instruments
• 21st Century Systems
• Avetec
• Eaton
• Kistler
• Boeing
• Chevron
• GE Aviation
• Goodyear
• Honeywell
• TechSolve
• Applied Materials

GERMANY
• FORCAM
• ePS & RTS (Siemens)

BELGIUM
• FMTC

FINLAND
• Kone

FRANCE
• Alstom

SPAIN
• Tekniker

BRAZIL
• CETA/SE NAI

HONGKONG
• Metron Hongkong Ltd.

CHINA
• Shaanxi Automobile
• Beijing Shenzhou Software
• Sinovel
• AITRI Shanghai
• Sanyi Heavy Industry
• Baoshan Iron & Steel
• Samsung

KOREA
• Samsung

JAPAN
• Omron Corporation
• Hitachi
• Komatsu
• Mitsubishi Heavy Industry
• Nissan
• Toshiba Corporation

TAIWAN
• HIWIN Technologies Corp.
• Ideas III
• ITRI
• PMC
• PSI
• Delta Electronics
• Tongtai Machine Tool

HONGKONG
• Metron Hongkong Ltd.

Siemens TTB
• Bosch
• McKinsey & Co.
• United Technologies
• We Energies

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Understand the unmet needs and identify gaps of current product and service systems.

Give short course to company members.

Develop short course for societies and major conference IEEE, PHM, etc.

Give public short course to industry in overseas.
IMS Marketing Strategy

Avoid

Solve

Visible

Invisible

Utilize New Knowledge/Technologies For Value-added Improvement

Problem Solving Through Continuous Improvement and Standard Work

Value Creation using Smarter Information For Unknown Knowledge

Utilize New Methods/Techniques to Solve The Unknown Problems
Getting, Keeping and Growing Customers

Getting Customer Diagram

Conferences → Brochures → Demo / Pilot Project → Sale of Predictive Monitoring System (MVP) → Referrals

Tradeshows
Website
Articles
Word of Mouth
Advertising

Awareness
Interest
Consideration
Purchase

Presentations
Short Course
Unbundle
Up-Sell
Cross-Sell

Growing and Keeping Customers
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NSF ICorps Team Members

David Siegel (EL)
PhD Student-Mechanical Engineering.
Winner of the 2009 and 2011 Prognostics and Health Management Data Challenge.

Jay Lee (PI)
Ohio Eminent Scholar and L.W. Scott Alter Chair Professor.

Richard Robison (IM)
CEO of Affinima LLC in Cincinnati, Ohio.
Extensive experience in software development and business technical consulting businesses.
## Business Canvas

### The Business Model Canvas

#### Key Partners
- Investors
- Global network of universities and research institutions
- Hardware providers
- Trade/Conference organizations

#### Key Activities
- Software design
- Customized system development
- Services (training and consultant, etc)

#### Value Propositions
- Improved equipment uptime
- Avoid expensive equipment failures through early problem anticipation and avoidance
- Avoid production and process line downtime
- Value-added service to OEM products

#### Customer Relationship
- Webinars and industry network meetings
- Demos and pilot projects
- Service
- Training

#### Customer Segments
- End users of equipment
- OEMs

#### Key Resources
- NSF I/UCRC IMS
- Human Personnel

#### Channels
- Direct sales
- OEM sales
- Resale Partners
- Tradeshows
- Conferences and workshops

#### Cost Structure
- Licensing cost
- Software development
- Marketing
- Human resources

#### Revenue Streams
- Software licensing and maintenance
- Turnkey monitoring systems
- Service contracts
- Consultant and training
- Projects

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### Getting Out of the Building (Customer List)

<table>
<thead>
<tr>
<th>Week 1 (16 total)</th>
<th>Week 2 (11)</th>
<th>Week 3 (11)</th>
<th>Week 4 (16)</th>
<th>Week 5 (9)</th>
<th>Week 6 (9)</th>
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<td>Toyota - TMMK</td>
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<td>GE Global Research (M)</td>
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<td>Greater Cincinnati Water Works</td>
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<td>Beet Technologies</td>
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</table>
Most of our customer visits were not members of the IMS Center consortium (64%).

With 5 in person visits the past week, exactly 50% of the total meetings were in person (36 and 36).

Feedback summary shows that as we focused more, we obtained more positive customer discovery results and more validated hypotheses.
Conclusions

► **Attitude** → Care about Customer’s Value
► **Belief** → Contagious and Compelling Vision
► **Curiosity** → Seek and Find Gaps of Members
► **Diligence** → Relentlessly Sale and Recruit Members
► **Execution** → Deliver What You Promised
Thank You!

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