A leap to success for Frog Legs, Inc.

by John Roberts, CIRAS

While watching a wheelchair rugby game in Colorado, two avid bicyclists from California hit on an idea for a new company that they ultimately located in Iowa.

Mark Chelgren and Dave Carr are the founders of Frog Legs, Inc., a company that manufactures wheelchair suspension systems. Chelgren is president and Carr serves as chief engineer for the business, which is based in Carr's hometown of Vinton, Iowa. Here's their story:

Carr, a graduate of Iowa State, and Chelgren met while living in California. They were part of a group of people who enjoyed social events like RAGBRAI, the Register's Annual Great Bike Ride Across Iowa, and other outings. During a get-together in Colorado, Chelgren and Carr had a chance to see a wheelchair rugby game, and while watching the game, they noticed a similarity in the suspension systems of wheelchairs and bicycles. That led to a discussion on how to use their knowledge of bicycles to improve the shock absorption of wheelchairs.

They enlisted the help of Bryan Christie, an ISU alum who serves as their technical consultant in his spare time. A new company – Frog Legs, Inc. – was born.

Their first product was a swivel caster assembly for the front of wheelchairs. The design uses a polyurethane cylinder, which acts as a shock absorber to cushion jolts caused by obstacles.

Benefits for the users include:
• less trauma to the wheelchair and rider
• improved mobility and durability of chair
• reduced chance of lower extremity spasms (a common problem for those with paralysis)

Objective
While promoting their new product, they were encouraged to contact the College of Engineering at Iowa State University.

During a get-together in Colorado, Chelgren and Carr had a chance to see a wheelchair rugby game, and while watching the game, they noticed a similarity in the suspension systems of wheelchairs and bicycles.
CIRAS News is published quarterly by the Center for Industrial Research and Service and edited by the CIRAS publications team: Jim Black, Editor; Jon Clancy, Joanne Hansson, Carol Melvin, Dan Meyer, Jeff Mohr, Pam Reinig, and John Roberts. Design and production by Engineering Publication and Communication Services, Iowa State University.

Articles may be reprinted with the following credit line: “Reprinted from CIRAS News, [insert date of issue], a publication of Iowa State University’s Center for Industrial Research and Service.” Please send a copy of the reprint to CIRAS News.

EPCS 99431
Eli Goldratt:
Teaching the Theory of Constraints across the Iowa Communications Network

by Jeff Mohr, CIRAS

According to Lisa Bagley of the Goldratt Satellite Program, Iowa had the largest attendance of any open site in the world. This success was made possible only through the cooperation of several resources available through ISU. CIRAS would like to thank the following organizations and people for their contributions in making the Goldratt Satellite Program such a success in Iowa:

- ISU College of Engineering
  - Dr. David Bergland
  - Dr. Howard Meeks
- ISU Extended & Continuing Education
  - Gregg Cameron
  - David Anderson
- ISU College of Veterinary Medicine
  - David White
- ISU Instructional Technology Services
  - Gary Alexander
- Iowa Manufacturing Technology Center
- Iowa Cable Network

Photo courtesy of IPRT

How can 299 people take the same class at the same time and never meet each other, or the presenter, face-to-face? It’s easy if you use the technical wizardry of the Iowa Communications Network (ICN). The ICN technology is an excellent way to minimize travel and still provide personal contact between presenters and attendees.

Nearly 300 people in Iowa took part in the Goldratt Satellite Program from March 3 to May 5. Dr. Eli Goldratt, the originator of the Theory of Constraints (TOC), presented the program. Dr. Goldratt is also the author of several best-selling management books such as The Goal, It’s Not Luck, and Critical Chain.

The program consisted of eight three-hour sessions presented live by Goldratt in the Netherlands and simultaneously broadcast via satellite around the world. The broadcast provided an organization-wide overview of how the principles and concepts of TOC can have a positive impact by focusing departmental efforts on global optima, rather than local or departmental optima. During the course of the program, Goldratt covered topics such as production, project management, distribution, marketing, sales, management, strategy, and measurements.

CIRAS and Iowa State University’s College of Engineering sponsored the program in Iowa. The signal was downlinked at Iowa State University’s Veterinary Medicine Complex by David White, the TV/AV Coordinator. The program was then simultaneously sent out over the ICN to 15 different sites across the state located in community colleges, high schools, National Guard armories, and Mount Mercy College. White’s technical expertise was invaluable in making the program a success.

Each session was videotaped and shown at four additional locations on a delayed schedule in order to provide flexibility for those who wished to attend but could not commit to the live schedule.

Continued on page 4
According to CIRAS’ agreement with the Goldratt Satellite Program, all videotapes were destroyed within two weeks of their live airdate.

After each one of Dr. Goldratt’s three-hour presentations, an additional 30-minute question and answer session was offered in Iowa. CIRAS’ Tim Sullivan and ISU’s Dr. David Bergland hosted the Q & A sessions from the ICN room at the downlink site.

Additional TOC expertise was provided by Dr. Howard Meeks of ISU and Suzan Shanley, a certified associate of the Goldratt Institute. Attendees at all 15 sites could ask questions on camera. The questions were then answered for everyone’s benefit almost as if all attendees were in the same room.

Three companies that are undergoing TOC implementations offered a bonus session in Iowa that consisted of presentations on specific topics. Bill Colville of Monroe Tables in Colfax discussed experiences with TOC as applied to production. Jim Merideth of Fox Engineering in Ames covered project management implementation. Suzan Shanley related her experiences in implementing the TOC distribution solution.

Attendees paid $500 each and came from over 70 different manufacturers and organizations across the state from both the private and public sector. In a survey distributed to the attendees, over 75% of the respondents said, “I think TOC will work here. Let’s start figuring out how to implement it.” One of the attendees went so far as to comment, “It’s worth any amount of money. I wish all employees in the company could take the program.”

Anyone wanting more information on TOC can access the CIRAS website at http://www.ciras.iastate.edu/. The website also contains a recommended list of books and other websites that can be used as additional TOC resources. You may also contact the following people who are trained in the TOC principles and Thinking Processes:

Tim Sullivan
CIRAS, Jonah’s Jonah
x1sully@exnet.iastate.edu
515-965-9355

Jim Black
CIRAS, Jonah
x1jblack@exnet.iastate.edu
515-294-1507

Verl Anders
CIRAS, Jonah
x1vander@exnet.iastate.edu
515-294-1316

Jeff Mohr
CIRAS, Jonah
x1jmohr@iastate.edu
515-294-8534

Dr. David Bergland
ISU College of Engineering
Jonah’s Jonah
Sshanley@aol.com
515-963-8698

Dr. Howard Meeks
ISU College of Engineering
Jonah’s Jonah
hdmeeks@iastate.edu
515-294-2131

Robert C. Tvrdik has retired
by Jim Black, CIRAS

Robert C. Tvrdik, a field staff member for CIRAS since January 1985, has taken early retirement effective April 3. Over his career, Tvrdik served as CIRAS field agent for 24 counties in southwest Iowa. He helped his clients identify and analyze industrial and management problems, then connected these clients with the latest information and possible solutions.

In addition, he worked statewide with companies on key human resources issues including interviewing/hiring processes, performance appraisals, employee motivation and supervisory training, plus strategic planning.

Tvrdik intends to remain active in retirement. He is helping the Missouri Valley Presbytery set up a new church as well as promoting training services in the Omaha area for the Schneider~Shepard Consulting Group (EDGE Learning Institute). “Most rewarding so far has been spending time with my granddaughter while attempting to get my golf game back in shape,” Tvrdik said. He had the “thrill of a lifetime” recently by attending the Masters Golf Tournament in Augusta, Georgia.

Bob and his wife, Penny, live in Omaha. We wish them all the best (and many birdies) in his new life.
Two members of the CIRAS staff were recently honored for outstanding efforts. Additionally, CIRAS recently presented its own service award.

**National recognition for Anders**

**Verl Anders,** Operations Manager for CIRAS, received national recognition for coordinating the preparation of a feasibility study that acquired federal loan guarantees for an ethanol production venture. The project, “Feasibility Study of Sunrise Energy Cooperative,” was selected as being outstanding in the business assistance category of the National Association of Management and Technical Assistance Centers (NAMTAC) Project of the Year Awards competition. The award was presented at the NAMTAC Awards Banquet held in San Antonio, Texas.

**CIRAS representative honored by Extension Service**

**Dan Meyer,** CIRAS field representative for southeast Iowa, was awarded the ISU Extension Achievement Award. The award recognizes a single outstanding effort by an individual.

Meyer was recognized for his leadership efforts in developing a manufacturing consortium called “NetSourcing.” With extensive background in business and manufacturing, Meyer recognized that there were many small manufacturers in his area who were good at product development but did not have the ability to market their services. In 1996 he organized a local resource team to develop a cooperative manufacturing consortium which has become known as “NetSourcing.”

**Robert Harris receives new CIRAS Award**

**Robert S. Harris,** Interim Director, Center for Advanced Technology Development (CATD), is the first recipient of the Lloyd Anderson Superior Service to Industry Award. The award was recently established by the Center for Industrial Research and Service (CIRAS) to recognize faculty and staff at Iowa State University who serve industry in the state by assisting them with their processes and products.

The award was named to honor Lloyd Anderson, a well-known friend of Iowa industry who served ISU for over 30 years. As CIRAS’ Interim Director from 1989-1995, he set up the structure that has allowed CIRAS to provide services to Iowa industries.

Harris has consistently demonstrated a strong loyalty and high level of service to ISU and Iowa industry. Through his positions of responsibility at CATD and the Ames Lab, he has shown effective leadership skills in all areas of industrial outreach.

**Lloyd Anderson presents Robert Harris the Lloyd Anderson Superior Service to Industry Award.**
We'd like to introduce our newest staff members.

**CIRAS adds two new staff**

Carol Smith is the person behind the friendly voice you hear when you call the Center for Industrial Research and Service. Smith serves CIRAS as receptionist, secretary, and meeting planner. Her organizational skills are a great asset to us.

February marked the beginning of her 25th year at ISU. She previously worked as a secretary in Resources/Collections at the Parks Library. Smith says she is glad to be working with so many interesting people. “Life is definitely not boring at CIRAS.” Her motto is “Share your smile – it increases your face value.”

Joanne Hansson is another new face in the central office. She is an editorial assistant and will be working with the CIRAS News publications team. Hansson held positions at the Center for Agricultural and Rural Development (CARD) and the ISU Foundation before joining CIRAS last December.

**CIRAS has role in ABC exhibit**

A full-scale, working replica of the Atanasoff-Berry Computer has become a major attraction at museums, Iowa State alumni receptions, and educational events throughout the nation. The team that coordinates and moves the 750-pound display includes three CIRAS representatives – Jon Clancy, Steve Vanderlinden, and John Van Engelenhoven. The group is often assisted by John Erickson, retired supervisor of the Engineering Services Group, Ames Lab Technical Shop. Erickson was instrumental in reconstructing the replica.

The ABC replica is a tribute to computing pioneers John Atanasoff, a physics and math professor, and Clifford Berry, a graduate student. The two designed and built the world’s first electronic digital computer at Iowa State from 1939 to 1942.

The ABC computer was unveiled more than a year ago at the National Press Club in Washington, D.C., and has been on tour ever since. Recently, it was displayed in the Iowa State Memorial Union as part of Alumni Days. The display also included papers and other memorabilia from Atanasoff, donated by his family to Iowa State.

The ABC replica will be on display at the Ames Heritage Story Center Museum, 417 Douglas Ave., from July 11 through Aug. 10. Regular museum hours are Mondays (5-9 p.m.), Wednesdays (10 a.m. to 2 p.m.), Saturdays (10 a.m. to 5 p.m.) and Sundays (2-5 p.m.). Museum staff hope to open the museum everyday during the week of July 19.

The ABC Computer replica will be at the Iowa State Fair, Aug. 12-22. The computer will be on display at Iowa State University’s fair booth in the Varied Industries Building.
Iowa Companies Assistance Program helps small firms

by Dan Meyer, CIRAS

The Iowa Companies Assistance Program (ICAP), a branch of the Ames Laboratory Materials Preparation Center, provides up to 40 hours of free technical assistance on various materials, mechanical testing, composition analysis and comparison, and the preparation and fabrication of specialty materials. Here’s how ICAP assisted four Iowa firms.

Welding Productivity

Workers at a firm in southeastern Iowa needed 75 minutes to prepare and butt weld the ends of large T-shaped bars of hard rail steel. The CIRAS field agent asked Paul Berge of ICAP to suggest a faster process. Berge suggested the “thermit” process, which now does the job in less than 10 minutes. (Thermit, a mixture of fine aluminum and an iron oxide used for certain welding processes, produces intense heat when ignited.)

Foundry Scrap Reduction

To keep an important customer’s business, an established aluminum foundry had to reduce its scrap rate. The scrap was caused by tiny holes in the castings. When asked to help determine the cause of these holes, ICAP devised a solution for the problem in less than six weeks. The solution hinged on analyzing the gases involved. Everybody was happy with the results.

Materials Selection

After outsourcing most of its product, a conveyor-manufacturing firm began experiencing many chain failures. ICAP analyzed the metals involved and recommended a more suitable material for this application. The problem was solved in less than two weeks.

Process Parameters

ICAP is also available to analyze and perfect proposed products or processes for start-up companies. For example, one entrepreneur came up with the idea of combining the paraffin by-product of a refining process with sawdust to make fuel pellets. ICAP determined recommended temperatures and methods for the process. The client was happy with the results. In another example, an inventor sought evaluation of the thermal feasibility of a heat/cold exchange system to be used in a home-based pasteurizing machine. Each of the preceding solutions was determined within the first 40 hours of involvement by ICAP so there were no costs to the firms requesting assistance.

A review of one CIRAS field specialist’s records shows more than eight recent examples of using this unique assistance program. To access this assistance program to help increase your company’s productivity and profitability, contact Paul Berge or Tom Lagrasso, Ames Laboratory, Iowa State University, 111 Metals Development, Ames, IA 50011-3020. Telephone: 800/884-8548. Fax: 515/294-8727. The e-mail address is: icap@iastate.edu or contact your area CIRAS Industrial Specialist.
Utilize CIRAS Services

Facilitation - CIRAS will lead your management team in planning for the future. CIRAS facilitators are skilled manufacturing professionals who will not dictate to you what to include in the plan, nor will they prescribe your future. CIRAS facilitators will, however, help you answer the three questions on which strategic planning is based:

- Where are we now?
- Where do we want to be?
- How do we get there?

Assistance - In the process of answering the three key questions, CIRAS will assist you with:

- Analyzing the company and its management functions
- Writing a mission statement or reviewing the current one
- Setting goals for the future
- Planning a course of action
- Developing a twelve-month action plan for implementing your goals

Discover the Benefits of Strategic Planning

- Create a shared vision among your management team
- Increase communication among the management team
- Improve productivity
- Increase sales and profits
- Develop a twelve-month plan of action for the future
- Improve human resources
- Identify goals and objectives for everyone in the company

Explore the Opportunity

To learn more about Strategic Planning, contact Jim Black, Verl Anders, or your local CIRAS representative. Or call the CIRAS central office in Ames at 515-294-3420; FAX 515-294-4925. If you are connected to the Internet, visit our web site at http://www.ciras.iastate.edu or contact us by e-mail at ciras@exnet.iastate.edu.

J im Black  
phone: 515-294-3420  
fax: 515-294-4925  
email: x1jblack@exnet.iastate.edu

Verl Anders  
phone: 515-294-3420  
fax: 515-294-4925  
email: x1vander@exnet.iastate.edu

CIRAS - Where you find solutions
Utilize CIRAS Services to support your Theory of Constraints (TOC) efforts

Training

“Jonah” Course
- 2 weeks
- Goldratt Institute certified, in-depth training on the use of the Thinking Processes.

“What is the Goal? An Introduction to the Theory Of Constraints”
- 1 day (1/2 day version available.)
- Highly interactive workshop that introduces the basic concepts of TOC and its various applications.

“What is Drum/Buffer/Rope? An Introduction to TOC in Production”
- 1 day
- Highly interactive workshop that introduces the basic actions needed to implement TOC in Production.

“What is 7+7? An Introduction to TOC in Project Management”
- 1 day
- Highly interactive workshop that introduces the basic actions needed to implement TOC in Project Management.

Explore the Opportunity
CIRAS offers the following staff to assist you in your TOC endeavors:

- **Tim Sullivan**, Jonah’s Jonah
  phone: 515-965-9355
  fax: 515-965-9388
  email: x1sully@exnet.iastate.edu

- **Verl Anders**, Jonah
  phone: 515-294-3420
  fax: 515-294-4925
  email: x1vander@exnet.iastate.edu

- **Jim Black**, Jonah
  phone: 515-294-3420
  fax: 515-294-4925
  email: x1jblack@exnet.iastate.edu

- **Jeff Mohr**, Jonah
  phone: 515-294-3420
  fax: 515-294-4925
  email: x1jmohr@exnet.iastate.edu

Assessment
On-site visitation and assessment of TOC opportunities

Implementation Guidance
- Production application
- Project Management application
- Distribution application
- Marketing applications
- Development of solutions to your individual needs using the Thinking Processes

To learn more about Constraint Management, contact any of these gentlemen in the column to your left, your local CIRAS representative, or call the CIRAS central office in Ames at 515-294-3420; FAX, 515-294-4925. If you are connected to the Internet, visit our web site at: http://www.ciras.iastate.edu/toc. You may also contact us by e-mail at ciras@exnet.iastate.edu

CIRAS - Where you find solutions
### CIRAS Management Guides and Tools Index for 1995-1999

<table>
<thead>
<tr>
<th>Issue</th>
<th>Guide or Tool</th>
<th>Topic</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer 1999</td>
<td>Tool</td>
<td>Iowa Companies Assistance Program Helps Small Firms</td>
<td>Dan Meyer</td>
</tr>
<tr>
<td>Winter 1999</td>
<td>Guide</td>
<td>Kaizen (Continuous Improvement) for Small- and Medium-Sized Companies</td>
<td>Jim Black</td>
</tr>
<tr>
<td>Winter 1999</td>
<td>Tool</td>
<td>How to Write a Business Plan</td>
<td>Verl Anders</td>
</tr>
<tr>
<td>Fall 1998</td>
<td>Guide</td>
<td>Hiring Right</td>
<td>Bob Tvrdik</td>
</tr>
<tr>
<td>Winter 1998</td>
<td>Tool</td>
<td>Implementing the Theory of Constraints (TOC) in Production</td>
<td>Tim Sullivan</td>
</tr>
<tr>
<td>Fall 1997</td>
<td>Tool</td>
<td>Engineering Bill of Materials</td>
<td>Jon Clancy</td>
</tr>
<tr>
<td>Summer 1997</td>
<td>Tool</td>
<td>Do You Know What Your Employees Think?</td>
<td>Don Hendricks</td>
</tr>
<tr>
<td>Summer 1997</td>
<td>Tool</td>
<td>Focus Group Research Can Help You Shape Plans</td>
<td>Helen Randall</td>
</tr>
<tr>
<td>Summer 1997</td>
<td>Tool</td>
<td>Cellular Manufacturing – an Alternative to a Larger Warehouse</td>
<td>Wes Merryman</td>
</tr>
<tr>
<td>Fall 1996</td>
<td>Tool</td>
<td>Activity Based Costing</td>
<td>Steve Vanderlinden</td>
</tr>
<tr>
<td>Fall 1996</td>
<td>Tool</td>
<td>Failure Mode and Effects Analysis (FMEA)</td>
<td>Dorothy Lueck</td>
</tr>
<tr>
<td>Fall 1996</td>
<td>Guide</td>
<td>Disaster Management Guide</td>
<td>Jim Black</td>
</tr>
<tr>
<td>Spring 1996</td>
<td>Guide</td>
<td>Get Ready for an OSHA Inspection</td>
<td>Jim Meehan</td>
</tr>
<tr>
<td>Fall 1995</td>
<td>Guide</td>
<td>Continuous Improvement of Maintenance Services at Frigidaire Company</td>
<td>Jim Black</td>
</tr>
<tr>
<td>Fall 1995</td>
<td>Tool</td>
<td>Search for Just the Right Stuff - Use CIRAS Help</td>
<td>William Berkland</td>
</tr>
<tr>
<td>Summer 1995</td>
<td>Guide</td>
<td>Planning for Succession: Letting Go is Difficult</td>
<td>Mary Dana Korman &amp; Steve Swartz [McGladry &amp; Pullen]</td>
</tr>
<tr>
<td>Winter 1995</td>
<td>Guide</td>
<td>Efforts Increase to Add Value to Ag Products</td>
<td>Mary Holz-Clause</td>
</tr>
</tbody>
</table>
Continued from page 1

“I don’t know how we could have pulled this together without the assistance we received from CIRAS. Our association with CIRAS has provided the depth and credibility necessary to market to the durable medical equipment field.”

Dave Carr, chief engineer of Frog Legs, Inc.

for assistance; they needed to prove that their product provided the benefits listed above. The college put them in touch with Don Eichner and John Roberts, the product development team at CIRAS and Kim Bentley from the Center for Advanced Technological Development (CATD). The team from CIRAS and CATD established data on benefits realized, identified potential design improvements, and examined overall durability.

Testing
The entire caster assembly was fully cycled thousands of times. The caster was removed from the cycling machine and inspected for wear or damage. The polyurethane cylinder was also removed and placed in a tensile/compression-testing machine where load and deflection data was collected. The data was plotted to determine the slope, which is the material’s spring constant. The caster was reassembled and the cycle testing continued in 10,000 cycle intervals. Each time the caster components were inspected, the slope of the polyurethane material was checked to determine if the material weakened during prolonged use. This testing also verified that the polyurethane supplier was meeting the specified material characteristics.

Design Improvement
To optimize the caster design, especially the strength to weight ratio, CIRAS contacted Prof. Vinay Dayal of the Aerospace Engineering, Engineering Mechanics Department (AEEM). Working through the Iowa Companies Assistance Program (ICAP), Professor Dayal, with the assistance of a graduate student, modeled the lower fork section of the caster using Finite Element Analysis (FEA) software to examine the structural integrity. This analysis indicates high stress locations.

Nondestructive Evaluation
Frog Legs was concerned about seams appearing in the stem bolts after machining. In response, CIRAS introduced Carr to Dave Utrata, Associate Scientist with the Center for Nondestructive Evaluation (CNDE). Utrata demonstrated nondestructive methods that could be used to detect these flaws prior to machining. This nondestructive evaluation helps eliminate unnecessary machining expense. Another concern for Frog Legs focused on aluminum caster components provided by an outside vendor. The question was whether tempering provided the material characteristics required (i.e., tensile strength). Again, CNDE demonstrated the equipment and method available to verify that these components met specifications.

At the conclusion of this project Frog Legs will receive the machine used to cycle the caster assemblies and the data acquisition device. This equipment will enable the company to perform continuous testing through all design changes and modifications with the objective of producing the safest, most advanced product on the market.

How To Order Reprints of CIRAS Publications
Circle the topics of the reprints you want to order and indicate the quantity of each print. The first publication ordered is $3; additional publications are $1 each. However, each copy of the 50-page “How to Write a Business Plan” is $10. Send your order and payment to: CIRAS, ISU Research Park, 2501 N. Loop Drive, Suite 500, Ames, IA 50010.

Please send the materials I’ve ordered to: Name

Firm

Address

City  State  Zip
Center for Industrial Research and Service
Iowa State University Research Park
Suite 500
2501 North Loop Drive
Ames, Iowa 50010-8286

**Smart Start Workshop**
for business start-ups ($10/person)
ISU Small Business Development Center
2501 North Loop Drive, Suite 615

**To register, contact:**
ISU Business Development Center
515-296-7828

**Shaping Your Veterinary Future**
Strategic planning conference for practicing veterinarians.
Iowa State University

**For information, contact:**
ISU Pappajohn Center for Entrepreneurship
515-296-6532

Tuesday evenings, 6-8 p.m.

August 11-12, 1999