Algona Mill Truck Dispatching Automation

Final Report
November 2006

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This research was initiated by Murphy-Brown, LLC (MB), to automate the company’s truck dispatching activities. The company’s goals were to move away from a manual truck dispatching program, improve the economy of truck usage, and capitalize on truck back haul.

The research team observed MB’s current manual truck dispatching operations at a MB mill in Algona, Iowa, and spoke with staff at the Algona site. A Hy-Vee distribution center in Chariton, Iowa, which recently acquired an automated truck dispatching system, was visited to evaluate Hy-Vee’s automated dispatching operations. An internet search for truck routing software vendors was also completed. The Algona mill’s automated truck dispatching system requirements were then compiled using all of these resources. Lastly, a teleconference was held to discuss the application of automated truck dispatching software from Paradox Software Consulting, Inc., and the results were positive.

This report recommends that Paradox Software Consulting, Inc., be selected to supply an automated truck dispatching program to MB. Paradox is currently providing other services for MB, and Paradox can meet or exceed the system requirements detailed in this report.
# TABLE OF CONTENTS

ACKNOWLEDGMENTS ............................................................................................................ IX

INTRODUCTION ...........................................................................................................................1
    Project Background ..............................................................................................................1
    Research Tasks ....................................................................................................................1

CURRENT OPERATIONS FOR MURPHY-BROWN, LLC .............................................................3

REVIEW OF PARADOX AUTOMATED ROUTING TOOL AND CONTINUOUS MOVE
PLANNER ....................................................................................................................................7
    Paradox Automated Routing Tool .......................................................................................7
    Continuous Move Planner ...................................................................................................8

REVIEW OF A ROUTING PROGRAM USED BY THE HY-VEE, INC., DISTRIBUTION CENTER .................................................................................................................................9

INTERNET SEARCH FOR OTHER TRUCK ROUTING PROGRAMS ......................................10

SYSTEM REQUIREMENTS AND RECOMMENDATIONS FOR TRUCK ROUTING
SOFTWARE ...................................................................................................................................11
    Truck Routing Software System Requirements ....................................................................11
    Recommended Truck Routing Software from Paradox Software Consulting, Inc ...............11

SUMMARY ...................................................................................................................................13

APPENDIX A. PRESENTATION BY RON HOLLENBECK ......................................................A-1

APPENDIX B. ALGONA MILL DATA SHEETS .......................................................................B-1

APPENDIX C. AUTOMATED TRUCK ROUTING SOFTWARE ..................................................C-1

APPENDIX D. EMAIL FROM MICHAEL CRUM .....................................................................D-1

APPENDIX E. RESULTS OF INTERNET SEARCH ....................................................................E-1
LIST OF FIGURES

Figure 1. Basic existing dispatch process ........................................................................................4
Figure 2. Overview of dispatch activities ........................................................................................5
Figure 3. Dispatch decision process requirements ...........................................................................6
ACKNOWLEDGMENTS

The author would like to thank Murphy-Brown, LLC, for sponsoring this research and would like to thank the following personnel from Murphy-Brown, LLC, for their input and guidance: Bart Borg, Brian Reding, Ron Hollenbeck, Gayle Odland, and Larry Meyer. Special thanks are also extended to Jim Moore, Assistant Vice President for Transportation at Hy-Vee, for generously taking the time to enlighten the author and provide an overview of Hy-Vee’s distribution system.
INTRODUCTION

Murphy-Brown, LLC (MB), a livestock production company headquartered in Warsaw, NC, initiated the research described in this report. The company’s goal was to automate its truck dispatching activities and to achieve the following objectives:

1. Move away from a manual truck dispatching program
2. Improve the economy of truck usage
3. Capitalize on truck back haul

To achieve these objectives, MB required an automated truck dispatching program that could interface with its already existing Taylor Feed AS 400 database (Taylor Feed).

Project Background

On January 13, 2006, representatives of MB attended a meeting at the Iowa State University Research Park with staff from the Center for Transportation Research and Education (CTRE). The following were present at the meeting:

- Bart Borg, Director of Feed Operations, MB
- Ron Hollenbeck, Western Operations Feed Manager, MB
- Brian Reding, Transportation and Logistics Manager, MB
- Steve Andrle, Director, CTRE
- Duane Smith, Associate Director of Outreach, CTRE
- Zach Hans, Research Engineer, CTRE

Research Tasks

As a result of this meeting, CTRE proposed the tasks listed below. The tasks define the issues surrounding MB’s current manual truck dispatching operations and chart a direction for future MB automated truck dispatching operations.

*Task 1.* CTRE staff will solicit data from MB staff that document current manual truck dispatching operations. This data gathering will include contact with MB personnel located in Smithfield, Virginia. CTRE will be interested in samples of data entered into MB’s system and the system’s supporting software and programming requirements.

*Task 2.* CTRE staff will spend a day at a MB mill in Algona, Iowa, observing the operations, interviewing dispatchers and other employees as needed, and collecting data samples and reports.

*Task 3.* CTRE staff will prepare an interim report that documents the findings of the data collection activities and defines MB’s goals for automating the truck dispatching operations. An investigation into commercial dispatching software will also be
conducted. Included in this interim report will be recommendations for the optimization of truck routes from the Algona plant to the trucks’ various destinations.

Task 4. CTRE staff will revise the interim report as needed.

A fifth task, to develop a second phase designed to meet MB’s truck dispatching automation goals, was also proposed during the initial meeting. However, it has been recommended that Paradox Software Consulting, Inc., undertake this task. This task would include describing specific tasks to be pursued, a potential time frame for accomplishment, and a draft budget.
CURRENT OPERATIONS FOR MURPHY-BROWN, LLC

To begin documenting MB’s current manual truck dispatching operations, the research team first met in Algona, Iowa, on May 23, 2006. The following attended the meeting:

- Bart Borg, Feed Operations, MB
- Brian Reding, Transportation and Logistics, MB
- Ron Hollenbeck, Feed Manufacturing, MB
- Gayle Odland, Business Systems, MB
- Larry Meyer, Dispatch, MB
- Duane Smith, Associate Director of Outreach, CTRE

Ron Hollenbeck provided an overview of the MB operations at Algona. A copy of his presentation is included in Appendix A. In addition, Larry Meyer provided a copy of the data sets used in MB’s dispatching operations. The data sets are included in Appendix B and consist of the following:

1. SDI feed files from Taylor Feed
2. Nursery files
3. Sow files
4. Sow finishing files
5. Nursery files
6. and 7. Mill 15 outstanding orders, morning download
8. and 9. Feed dispatch report
10. Data input query
11. Load-out report to the mill
12. Driver’s load-out daily report

After discussing these data sets and reports, the research team defined the following desirable qualities that an automated system would include:

1. Ability to be imported to other locations within the MB system
2. Ability to accept data from Taylor Feed
3. Ability to use GPS coordinates for each grower and for the mill site (the Algona mill has these) in the dispatching operations
4. Ability to calculate the time or distance the trucks travel for purposes of haul payment
5. Ability to upload feed orders to the mill system
6. Ability to provide the level of data now available from Taylor Feed
7. Ability to download the dispatching data to Taylor Feed

The basic existing dispatching process is illustrated in Figure 1. A grower initiates the process by calling into the SDI system located in West Virginia. The order information is then loaded into Taylor Feed. For the next step, the feed orders are downloaded to the Algona mill. This download is completed twice per day, once in the morning and once in the afternoon. After the dispatching has been completed, the order and dispatching data are transferred to WEM Speak.
and WEM Load Out, where files are transferred back into Taylor Feed for historical records and for accounting purposes.

![Diagram](image)

**Figure 1. Basic existing dispatch process**

The specific steps in this dispatching process are shown in Figure 2. The figure illustrates the individual activities, the location at which they occur, and the mechanism used (software, manual operation, etc.).

The requirements of the dispatching decision process are illustrated in Figure 3. The beginning of the process is defined as the point at which a grower calls in a feed order. The information captured includes order number, grower number, lot and bin numbers, pounds of feed to be delivered, and delivery date.

When the order data is downloaded to the Algona mill, two initial decisions must be made: (1) what zone the order fits into and (2) whether the order is a special mix or one of the standard mixes. Once these two decisions have been made, the system determines whether the order consists of a full load or a partial load. If the order is for a full load, the system identifies a truck available for delivery. If the order is for a partial load, the system searches for other partial loads in the same zone and completes the delivery in such a way that a full load is transported to the grower(s). As the orders are assigned to the available trucks, the distance to the grower and the round-trip time is calculated to determine when the various trucks will next be available at the Algona mill for other dispatches. The truck report and the mill report are then generated and combined into a summary report. The Algona mill receives this report, and it is uploaded to Taylor Feed.

Figure 3 also shows two large, red arrows that indicate the interface locations between the Algona mill and Taylor Feed. If the truck dispatching process in Algona is to be automated, an interface program will need to be developed.
Figure 2. Overview of dispatch activities
Figure 3. Dispatch decision process requirements
REVIEW OF PARADOX AUTOMATED ROUTING TOOL AND CONTINUOUS MOVE PLANNER

The Algona research team determined that an automated dispatching system for MB would need to meet the following requirements:

- Download to Windows-based applications and allow for interfacing with Taylor Feed
- Manage partial load orders
- Plan for multiple stops
- Allow scheduling of back haul orders
- Specify the order delivery times
- Specify the pickup times for back haul orders
- Complete one-way routing
- Complete round-trip routing
- Route to zones

The Paradox Automated Routing Tool (PART) and Continuous Move Planner (CMP) are two software products currently being used in other divisions of MB to route trucks automatically. Both of these products were reviewed to determine how well they would meet the routing requirements defined by the Algona research team.

Paradox Automated Routing Tool

PART is a “routing and scheduling” tool that produces optimum routes for a given set of orders or shipments while meeting predetermined requirements such as time windows and service times. The program is a standalone Windows-based application with a user-friendly interface. PART consists of data management, Geographic Information Systems (GIS), and scheduling modules. All the data and solutions can be exported as text files to Microsoft Word or Excel.

The program has the following features:

- Order data are displayed in a spreadsheet format.
- Routes are created to build closed-loop and one-way vehicle routes.
- Scheduling algorithms are used and have the flexibility to change assignments.
- Reports are exported as text files and imported into Microsoft Word or Excel
- PART runs in all Microsoft Windows operating systems.
- PART utilizes PC Miler or MapPoint routing and scheduling engines.
- Planning is done by the day of the week and date, and the dates of the planning horizon can be set manually.
- PART is not currently set up to match partial loads or create truckload deliveries.

In summary, it appears that PART would meet many of the requirements determined by the Algona research team. The question to ask now is, “Can the program be modified to meet the other requirements?” This question was further investigated during the presentation by Paradox Software Consulting, Inc., as discussed below.
Continuous Move Planner

CMP is a truckload tour/continuous move building tool that can generate optimal matches of truckload moves. It is a standalone Windows-based application with a user-friendly interface. The program has the following features:

- CMP can be used either as a network building tool or a daily execution tool for dispatching truckloads.
- Solutions can be exported as text files into Microsoft Word or Excel.
- Data input is in the form of flat files.
- Origin-destination data, such as grower addresses, can be imported into CMP.
- Time calculations can be based on user-defined speed zones.
- The program utilizes PCMiler as a routing program.
- The dispatcher can manually make changes to the schedule.

In summary, it appears that CMP can perform many of the same functions as PART, but does not take partial loads and configure them into full loads and does not have the capability to route back hauls.
After meeting with the Algona research team and discussing PART and CMP, there was general agreement that utilizing an existing software program would be better in the long term than having Iowa State University develop an application that may prove to be difficult to modify or support in the future. Duane Smith was asked to research some of the major trucking entities in the state of Iowa to determine the routing programs they were using and to gauge the extent to which the programs were meeting their needs. The three firms identified were Hy-Vee, Inc.; Casey’s General Stores, Inc.; and Farner Bocken Company. These are all non-carrier firms: they do not haul for a fee, but rather move products to a location. Michael Crum, Associate Dean for Graduate Programs and Professor of Logistics and Supply Chain Management at Iowa State University, was approached for contact persons at each of these firms. Dr. Crum’s e-mail response is included in Appendix D. He only had a reference for Hy-Vee, Fred Houseman.

When Mr. Smith contacted Hy-Vee and asked for Mr. Houseman, he was directed to Jim Moore, Assistant Vice President for Transportation, who had recently guided Hy-Vee through the process of selecting a truck routing program. Mr. Smith scheduled a trip to the Hy-Vee distribution center in Chariton, Iowa, on June 29, 2006, to meet with Mr. Moore. At the time of Mr. Smith’s visit, Hy-Vee had recently gone through a selection process for a load building and truck routing program. A committee of Hy-Vee employees and users was established to make the selection. The committee took some time to come to a conclusion, but selected Supply Chain Logistics from Carey, North Carolina. The contact person at Supply Chain Logistics was Carl Hatt. (Mr. Smith did not contact Mr. Hatt because the documentation material from Hy-Vee was dated and because the dispatching program from Supply Chain Logistics did not match MB’s requirements.) Two programs were utilized to design Hy-Vee’s routing system, Route Pro and SSA Global. The routing system has the following characteristics:

- Geographical areas are used for zones.
- Optimum truck routes can be selected based on mileage or travel time.
- Back hauls can be scheduled for return trips.
- Truck routing results can be edited manually.

Mr. Moore did not recommend this system for the MB application. Hy-Vee employees had entered the data, which was a lengthy process. Moreover, program support does not include on-site visits by the provider, but instead involves phoning technical support personnel to talk the technician through troubleshooting steps.

However, Mr. Moore recommended another product that he had researched, but which the Hy-Vee committee did not select. The product, called TruckStops, is provided by Microanalytics. Mr. Moore provided Mr. Smith with a notebook containing the documentation he had reviewed. Mr. Smith reported the findings of his visit to the Algona research team.
INTERNET SEARCH FOR OTHER TRUCK ROUTING PROGRAMS

In addition to visiting Hy-Vee, Mr. Smith completed an internet search for additional truck routing programs and found that several are available. Appendix E presents selected results from the internet search, including information from the following sources:

- Apian Logistics
- Business Mileage and Routing Software
- Cube Route
- Dynamic Routing
- InterGis Advanced Routing, Scheduling, and Dispatching
- Optrak
- ServMan Route Management
- Truck Dispatching Innovations
- TruckStops Routing and Scheduling Software

Other truck routing resources are available, but the products above appear to represent most commercially available truck routing software systems. These products have the following features in common:

- PCMiler and/or Microsoft MapPoint routing software
- User-friendly software interface
- Software that runs on PCs with Microsoft products
- Capability of creating distribution zones
- Use of time, distance, or weight to build loads
SYSTEM REQUIREMENTS AND RECOMMENDATIONS FOR TRUCK ROUTING SOFTWARE

After meeting with the Algona research team and observing the existing routing operations firsthand, visiting a major trucking operation that had recently selected a truck routing system (Hy-Vee), and completing an internet search for truck routing software vendors, Mr. Smith recommended that the Algona research team select a commercial product or engage the services of an organization that develops truck routing software and that can provide support and upgrades in the future.

Truck Routing Software System Requirements

The truck routing system requirements that MB needed to be aware of included the following:

- Ability to interface with Taylor Feed software
  - Download the grower’s feed orders
  - Upload the dispatching data for accounting purposes
  - Export reports into Microsoft products
- Ability to combine partial loads efficiently into economic full loads
- Ability to manage back haul demands
- Allowance for manual editing of truck routing software output
- Capability of creating and dispatching to zones

Recommended Truck Routing Software from Paradox Software Consulting, Inc.

To review a proposal for developing an automated truck dispatching system, a teleconference interview was arranged on August 8, 2006, with Paradox Software Consulting, Inc. The Paradox representatives included the following:

- Bob Glenn
- Bhushan Veerapaneic

The MB representatives included the following:

- Bart Borg
- Brian Reding
- Ron Hollenbeck
- Gayle Odland

Mr. Smith also attended the teleconference.

As mentioned in the discussion of PART and CMP, Paradox already provides services to MB. Therefore, before this teleconference, Paradox had downloaded the morning and afternoon orders from Taylor Feed and had successfully used this data to route trucks. Mr. Glenn outlined the MB system requirements, while Mr. Veerapaneic provided visual support for the Paradox
automated truck dispatching software using the data that had been downloaded from Taylor Feed. The demonstration of the Paradox automated truck dispatching system illustrated the following:

- Routing can be completed by time or by distance.
- Routing results can be edited manually by the dispatcher.
- PC Miler and Microsoft MapPoint are used for routing.
- The program can complete one-way routing.
- The system provides for back haul routing and scheduling.
- The system can recognize zones, and there is no limit to the number of zones.
- Paradox already provides an interface with Taylor Feed in another application.
- The following reports may be exported to Microsoft Excel:
  - Order summary
  - Route summary
  - Truck report (tons, miles, times, etc.)
- Orders may be moved around in the routing program using a “click and drag” function.
- The system, once developed for the Algona mill operations, can be exported to other MB locations.

Based on the features of the Paradox routing system, the system meets or exceeds the requirements described by the Algona research team.
SUMMARY

The research team for this project first discussed MB’s current manual truck dispatching operations with the Algona mill staff and visited the Algona site. Mr. Smith then visited the Hy-Vee distribution center in Chariton, Iowa, and completed an internet search for truck routing software vendors. The Algona mill’s automated truck dispatching system requirements were compiled using all of these resources. A teleconference was then held to discuss the application of the Paradox Software Consulting, Inc., automated truck dispatching software, and the results were positive.

Consequently, this report recommends that Paradox Software Consulting, Inc., be selected to supply an automated dispatch truck routing program to MB. Paradox is currently providing other services for MB, the company has successfully downloaded growers’ order data from Taylor Feed and completed a truck routing exercise, and the company can meet or exceed the system requirements detailed in this report. In addition, Paradox can export the results of the Algona mill project to other MB operations and will provide long-term system support and upgrading opportunities.
Murphy-Brown, Inc.
Dispatching Program
January 13, 2006

Murphy-Brown Production
Locations

Western Operations
Sow Operations (Company-owned
and contract)
Missouri = 50,000   Iowa = 23,000
Illinois = 13,000   Colorado = 34,000
Oklahoma = 75,000   Kansas = 5,000
Utah = 60,000
Total of 260,000 sows

Total of about 5.5 million market pigs
Murphy-Brown produces approximately 14% of pork raised in the U.S.

All Sites

Algorithm Sites
Background

- Dispatch Department in Algona
  - Staff of Two
  - Dispatch for 500+ Grower Sites (Primarily Iowa)
  - Process Feed Orders for Seven States
    - Iowa, Illinois, South Dakota, Missouri, Kansas, Oklahoma, Colorado
  - Process Feed Orders for 28 tollmills and 4 Company Owned Mills

Background

- Algona Mill
  - Delivers 12,000 Tons of Feed Weekly
  - Approximately 500 Loads per Week
  - Need to load a truck every 16.5 minutes
  - Utilize 3 Company Owned Trucks and 29 Contract Trucks
  - Sites are Primarily Located in Western Iowa (West of I-35)
Home Bases

Current Dispatching Process
- Growers call Safe Data to place order
- Orders are placed by bin number and lot number
- Orders are downloaded into our Taylor System twice each day and printed
  - Taylor assigns feed type, feed order number
- Orders are manually paired together to obtain full truck loads
  - Correct distribution of number of loads and delivery locations to balance the day and week

Current Process Continued
- Once all orders are paired together and balanced, the order file is dumped into an Access Program.
  - Track number and load times are assigned
- Load sheets are printed for each truck
  - Schedule for each truck for next 24 hours
- File is uploaded to our mill control system for loading

Integrated Feed System
- Internal Mills

Objectives of Desired Program
- Accept a download of the feed order from Taylor
- Utilize GPS Coordinates to most efficiently dispatch loads
  - Panning at split loads
- Indicate the number of miles for each load
  - Will be used for paying of contract haulers
- Assign a load number for each load
- Follow DOT Regulations
- Print a Dispatch by Truck
  - Can use current Access program
- Upload Orders to Mill Control System

Objectives
- Reduce System that can be Applied to Other Locations
  - Tenosha, Milford, Missouri, etc
Variables

- Number of Trucks Used per Day
- Designating Region for Last Load of the Day (Load Home)
- Ability to Lock Specific Trucks into a Region for Delivery
  - Iowa Falls Trucks
  - Opportunity to Expand this Function in Future

Variables

- Assign Dispatching Priority of Specified Trucks
  - Company Short-Haul Filled First
    - Iowa Falls Trucks Filled in that Region
  - Load Size
    - Usually 24 Tons or More
  - Hours of Operation for Each Truck
  - Maximum Miles Per Day
    - To meet DOT Regulations

Variables

- Medication Sequencing Process
  - Food type prioritizes
- Loads Needed Each Day
  - # Long Loads
  - # Mid Range Loads
  - # Short Loads

Next Step(s)

- Define Timeline
- CTRE Evaluation and Second Meeting to Answer Questions, etc.
- Budgetary Proposal by March 1

Thank You
### OUTSTANDING ORDERS

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<td>MKT Code: CO</td>
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<td>5608</td>
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<td>MANILLA IA 6532055</td>
<td>Load Time</td>
<td>5 am</td>
<td>Truck Number</td>
<td>1010</td>
<td>Driver Number</td>
<td>77</td>
<td>Start Time</td>
<td>End Time</td>
<td>LBS Loaded</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>BENZ 2, MARY 5864 270TH ST</td>
<td>Bin Number</td>
<td>7222</td>
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<td></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>MELVIN IA 2607187</td>
<td>Load Time</td>
<td>10 am</td>
<td>Truck Number</td>
<td>1010</td>
<td>Driver Number</td>
<td>77</td>
<td>Start Time</td>
<td>End Time</td>
<td>LBS Loaded</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td>BENZ 2, MARY 5864 270TH ST</td>
<td>Bin Number</td>
<td>7217</td>
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<td>MELVIN IA 2607187</td>
<td>Load Time</td>
<td>10 am</td>
<td>Truck Number</td>
<td>1010</td>
<td>Driver Number</td>
<td>77</td>
<td>Start Time</td>
<td>End Time</td>
<td>LBS Loaded</td>
<td></td>
</tr>
</tbody>
</table>
PART

PARADOX AUTOMATED ROUTING TOOL

PRODUCT REVIEW

OCTOBER, 2002
GENERAL PRODUCT DESCRIPTION

OVERALL FUNCTIONALITY

PART is a Routing & Scheduling tool that sequences a given set of stops or shipments following Department of Transportation rules while meeting predefined customer service requirements (time windows and service times). It is a stand-alone Windows based application with a friendly user interface. The ease of use is the strength of the system. PART is designed to manage tactical and operational route planning. It can be easily interfaced with the Order processing and dispatching systems to provide an integrated solution through ASCII data file transfers.

PART consists of Data Management, Geographic Information System (GIS), Routing, and Scheduling modules. Presentation features of PART include route maps, reports, and charts. All the data and solutions can be exported as text files into MS Word or MS Excel. The GIS module was built using Microsoft Map Point & PC*Miler’s development tools (Mapping engine) and provides a geographic view of the routing solution. Its presentation features include route maps, order distribution, and road networks. Routing and Scheduling modules use proprietary solver engines built based on proven mathematical models to generate optimal solutions. The scheduling module includes Gantt charts to present the vehicle schedules in a spatial (time) view. Various reports and export options allow the solution to be presented in numerous user-defined formats.

In addition to generating optimal routing and scheduling solutions, PART enables benchmarking an existing solution. Existing routes can be imported into the system ‘as is’ and calculated to reproduce the benchmark solution. The solution can then be generated in PART and compared to the benchmark solution.

DATA MANAGEMENT

Orders can be imported into PART in the form of ASCII files. The data import wizard guides users through the setup process for importing Order data into the system. Minimal data entry is required during the setup. All the user settings are stored in the system so that repeated imports of the same format will not require further data entry, minimizing user errors.

PART’s Data View presents Order data in a spreadsheet format. This view enables users to sort the orders based on different criteria (Load, City, Zip Code, Service Time etc.), get more details on any Order by double clicking on a row, and provides drag and drop features. This view presents a text representation of the data imported into the system.

As the solution is developed, the Data View updates automatically to reflect the changes.
GEOGRAPHIC INFORMATION SYSTEM (GIS)

The GIS module consists of Mapping, Geo coding, and Path finding functionality. PART uses the mapping libraries of Microsoft Map Point or PC*Miler to Geo code and plot the locations and draw routes on the Map. The display of various geographic features (stops, routes, roads, highways, states etc.) of the Map is user configurable. Map View also provides Zoom In/Out and Pan features for adjusting the view. Geo coding is automatically done before plotting the locations on the Map when users choose to open the Map View. The Path finding feature can be used to generate driving directions for a specific route or all routes in the system. The driving directions report is generated in the form of a text file that can be imported into MS Word or MS Excel and configured further according to requirements. Actual highway miles via the road network from Microsoft Map Point or PC*Miler’s database is used for generating the directions report.

PART currently uses the highway and street level mapping capabilities of Microsoft Map Point or PC*Miler. PART also provides a plug and play capability for using the mapping tools of other vendors.
The routing engine uses proven routing algorithms to create optimal routes. Distance and time calculations required by the routing engine are run using Microsoft Map Point or PC*Miler’s Server or BatchPro utility. When using the Server utility the calculations are done on an as needed basis, while using the BatchPro utility all the calculations are done in one instance and used repeatedly as required. These calculations can be done based on City and State combination, Zip Codes, or Latitude and Longitude values. The calculated distance and time values are automatically saved into a file that can be used for later use when using the same Stop data. After building the Routes and determining the optimal Stop sequence for each route, PART schedules them following the different restrictions and constraints predefined by the user. Planning cycles can be defined by actual calendar days and Routes are simulated by day of the week and date.

Parameters
Routing parameters in PART let the users specify various restrictions and constraints. In addition to the Planning cycle, Customer/Master time windows and DOT rules, constraints could be defined for maximum route distance, route time, number of stops, layovers, wait time etc. Vehicle definitions are also used to constrain Routes in terms of availability and capacities.
SCHEDULING

PART uses robust scheduling algorithms to schedule the routes within a predetermined planning horizon. The Vehicle to Route assignments is presented on a Gantt chart. The chart provides the users the ability to change the assignments, route departure times, and days manually. The Gantt chart can be configured (time scale of 1 day to 4 weeks), printed or saved for presentations.

A major strength of PART’s schedule charts is the graphic representation of the different events (driving, arrivals, layovers, waits etc.) that occur on a route as it is occurs within a planning horizon. Each event is presented in a different configuration (color or size of the bar) to distinguish them from each other. At any time the complete (statistics and manifest) information of a route can be obtained by double clicking on any bar that corresponds to it on the chart. The labels on the bars distinguish routes on the chart. When a route is dragged and dropped (at a different time or day or resource) it is automatically re-simulated and scheduled to check feasibility of the move. In case of infeasible moves users are warned of violation but are let to decide on forcing the move. Important resource statistics are also presented on the chart for quick reference.
While scheduling routes for a driver, PART ensures that the DOT regulations are complied with by considering the rules in rolling 24-hour periods (normal 10-hour driving and 15 hour duty restrictions for any 24-hour period for a driver).

REPORTS & EXPORTS

Various reports can be created and printed. Order Summary, Route Summary, and Route Manifest reports can be viewed and printed. Along with the driving directions’ reports these reports can be exported as text files and imported into MS Word or MS Excel for further configuration. A summary of the routing and scheduling solution is presented in the form of Summary Statistics, which can be printed.

Sample Report

The Route Manifest report is shown in the following figure. This report includes a summary of all the key statistics of all the routes in the system in addition to detailed manifest information for each route. Manifest information includes Stop information (City, State, and Zip Code) and arrival and departure information at each Stop. Manifest also lists the other events on the route (layovers and waiting at stops).
### Route Manifest Report

#### Statistical Information for Route - 1

<table>
<thead>
<tr>
<th>Order</th>
<th>Deak Unit</th>
<th>Customer</th>
<th>State</th>
<th>Zip Code</th>
<th>Travel Time</th>
<th>Arrival Time</th>
<th>Service Time</th>
<th>Loadout</th>
</tr>
</thead>
<tbody>
<tr>
<td>624</td>
<td>53</td>
<td>Newport News</td>
<td>VA</td>
<td>23606</td>
<td>07:33</td>
<td>08:04</td>
<td>00:20</td>
<td>08</td>
</tr>
<tr>
<td>381</td>
<td>24</td>
<td>Norfolk</td>
<td>VA</td>
<td>23502</td>
<td>00:37</td>
<td>09:01</td>
<td>00:20</td>
<td>09</td>
</tr>
<tr>
<td>428</td>
<td>28</td>
<td>Chesapeake</td>
<td>VA</td>
<td>23320</td>
<td>00:16</td>
<td>09:37</td>
<td>00:20</td>
<td>06</td>
</tr>
<tr>
<td>655</td>
<td>59</td>
<td>Virginia Beach</td>
<td>VA</td>
<td>23454</td>
<td>10:21</td>
<td>11:26</td>
<td>00:20</td>
<td>10</td>
</tr>
<tr>
<td>Layover</td>
<td>A DEPOT</td>
<td>Wilkes Barre</td>
<td>PA</td>
<td>18765</td>
<td>08:03</td>
<td>11:54</td>
<td>00:20</td>
<td>19</td>
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</table>

#### Manifest Information for Route - 10

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<th>State</th>
<th>Zip Code</th>
<th>Travel Time</th>
<th>Arrival Time</th>
<th>Service Time</th>
<th>Loadout</th>
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<td>3</td>
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<td></td>
<td></td>
<td>11:41</td>
<td>00:11</td>
<td>01:30</td>
<td>11:11</td>
</tr>
</tbody>
</table>

### CONSOLIDATED VIEW (TEXT + MAP + TIME)

![Consolidated View](image_url)
TECHNOLOGY

Developed in Visual C++ using Object Oriented Design (OOD) methodology and Component Object Model (COM) concepts. Uses industry standard STL (Standard Template Libraries) and streaming techniques for efficient data storage, retrieval, and persistence. PART does not require any database drivers or software.

KEY FEATURES & BENEFITS

- PART’s technical architecture is based on Object Oriented design principles, which enable plug and play of functionality. For example, any Mapping engine can be used in PART instead of that of Microsoft Map Point or PC*Miler. Similarly the Routing and Scheduling engines can be swapped as and when needed.
- Complete visibility of the routing and scheduling solution through Data (text based), Map (geographic), and Schedule (Gantt chart) views.
- Consolidated view of all the routing entities (Depots, Orders, Routes, and Vehicles).
- Industry standard Microsoft Map Point or PC*Miler distances and times used for routing and scheduling. Users are also provided with the ability to specify maximum driving speed irrespective of the speeds used by Map Point or PC*Miler.
- Turn by turn driving directions for all routing solutions.
- Planning is done by the day of the week and date. Start and End dates of the planning horizon can be set using a user friendly Calendar.
- Routing and scheduling solutions for the whole of North America. Street level routing (based on latitudes and longitudes) for US.
- Configurable Maps and Gantt charts. Spatial (Gantt chart) view of the routes indicates different events like arrivals, waits, and layovers etc. that happen as the route is simulated within the planning horizon. Real-time simulation runs in the background as the routes are moved around on the Gantt chart to reflect changes in departure times and route events.
- Comprehensive reports and exports of data and solution. Summary Statistics can be printed.
- User friendly and interactive interface, facilitating shorter learning curve for new users. Easy to setup the problem with minimal data entry.

For Pricing Information Please Call Toll Free: 888-713-2245

Paradox Software Consulting, Inc.
5082 S.E. Inkwood Way
Hobe Sound, FL 33455
CMP

CONTINUOUS MOVE PLANNER

PRODUCT REVIEW

OCTOBER, 2002
GENERAL PRODUCT DESCRIPTION

OVERALL FUNCTIONALITY

CMP is a truck load tour building tool that can generate optimal matches of truck load moves for a given set of Origin-Destination (Leg) pairs, where each Origin-Destination pair identifies a truck load move. It is a stand-alone Windows based application with an extremely user friendly interface. Problem setup and solution generation requires minimal user interaction virtually eliminating the learning curve on the system.

CMP needs the geographic information about the locations that constitute each Origin-Destination pair (Leg). It consists of data management and continuous move planning engine modules. Solutions can be exported as text files into MS Word or MS Excel. Data input is in the form of flat files. CMP uses powerful matching algorithms to generate the different continuous moves.

Each continuous move in CMP consists of a set of moves and can start and end at a user defined Domicile. The set of moves consists of loaded and empty moves/legs. When trying to match the loaded moves input by the user the system needs to build an empty move if required to move the truck from the previous loaded leg’s Destination location to the next loaded leg’s Origin location. If the user specifies a set of Domiciles (locations where the trucks are domiciled), CMP tries to build continuous moves starting from and returning to those Domiciles. In the absence of Domiciles each continuous move starts from and returns to the same location, which is the Origin location of its first loaded leg.

DATA MANAGEMENT

Origin-Destination data can be imported into CMP in the form of ASCII files. The data import wizard guides users through the setup process for importing Origin-Destination pair data into the system. Very minimal data entry is required during the setup. All the user settings are stored in the system so that repeated imports of data of same format will require absolutely no data entry, minimizing user errors.

CMP’s data views present legs and continuous moves data in spreadsheet format. These views enable users to sort the data based on different criteria, get more details on any Leg or Continuous move by double clicking on a row, and provide a text representation of the data imported into the system.

As the solution is developed, the data views update automatically to reflect the changes.
BUILDING CONTINUOUS MOVES

CMP uses robust matching algorithms to build continuous moves from the imported Origin-Destination pairs. The algorithms are controlled by the user-defined parameters.

Parameters

The matching algorithm is currently controlled by three parameters: 1) Empty Distance Percentage, 2) Maximum Continuous move Distance, and 3) Minimum Continuous move Distance. Empty Distance Percentage controls the ratio of the total empty distance (deadhead) on the continuous move to its total distance (sum of empty and loaded distances). The empty distance or deadhead results from the empty legs/moves of the truck between a pair of loaded legs/moves whenever required. Maximum and Minimum continuous move distances control the distance a truck can run on any continuous move and thereby control the number of loaded legs on a continuous move. Additional constraints include equipment types and weeks of availability. Any number of parameters/constraints can be added to the matching algorithm. Cost and Time constraints are being built into the engine at this time.
The distance and time calculations required by the matching algorithm are obtained from different sources. CMP’s proprietary engine is the quickest in terms of rate of running the
calculations. Microsoft’s Mappoint and ALK’s PC*Miler are the other alternatives supported at this time. Included in both these options is the ability to use air distances and actual road distances. Air distances are calculated at a faster rate than the road distances.

**Solution and Presentation**

Parameters and Calculation engine settings control the solution. The resulting continuous moves and any unmatched legs are presented in the form of spreadsheets and reports. The reports can be exported as text files and customized in MS Word or MS Excel.

Information on each continuous move or unmatched leg can be obtained by double clicking on the row that corresponds to them. The information dialogs display all the attributes of the continuous moves and the legs. The continuous move information dialog presents both the statistics and the manifest (list of legs in the order of occurrence).
REPORTS & EXPORTS

Touring solution can be exported in the form of text files. These reports consist of detailed information on all the continuous moves and any unmatched legs generated by the algorithm and can be imported into MS Word or MS Excel for further configuration.

Sample Export

The continuous move manifest report includes a summary of all the key statistics of all the continuous moves in the system in addition to the details of the legs (loaded and empty) that are part of them. Displayed below are the snapshots of the two reports generated by CMP, Tour Detail and Unmatched Leg Summary.
UNMATCHED LEGS SUMMARY REPORT

SUMMARY STATISTICS

CMP provides a statistical summary of the touring solution each time the matching algorithm is executed. The summary statistics can be printed out.

<table>
<thead>
<tr>
<th>Number of Continuous Moves</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Number of Loaded Legs</td>
<td>30</td>
</tr>
<tr>
<td>Number of Empty Legs</td>
<td>30</td>
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<tr>
<td>Number of Unmatched Legs</td>
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</tr>
<tr>
<td>Total Loaded Distance</td>
<td>45351.51</td>
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<tr>
<td>Total Empty Distance</td>
<td>30218.19</td>
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<tr>
<td>Load Factor</td>
<td>0.60</td>
</tr>
<tr>
<td>Average Revenue/Distance</td>
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</tbody>
</table>
TECHNOLOGY

Developed in Visual C++ using Object Oriented Design (OOD) methodology and Component Object Model (COM) concepts. Uses industry standard STL (Standard Template Libraries) and streaming techniques for efficient data storage, retrieval, and persistence. CMP does not require any database drivers or software.

KEY FEATURES & BENEFITS

- CMP can be used as an operational decision support tool for matching disparate truckload moves in the most optimal manner. It can handle any number of truckload moves.

- Familiar user friendly interfaces facilitating shorter learning curve. Problem set up is quick and easy, requiring minimal data entry.

- Industry standard distances and times used for matching truckload moves.

- Technical architecture is based on Object Oriented design principles, which enable plug and play of functionality.

- Comprehensive reports and exports of data and solution. Summary statistics can be printed.


For Pricing Information Please Call Toll Free: 888-713-2245

Paradox Software Consulting, Inc.
5082 S.E. Inkwood Way
Hobe Sound, FL 33455
Hi Duane,

I apologize for not getting back to you this morning -- got tied up on some unexpected things today.

The three non-carrier companies that I can think of that might be able to help with the automated dispatch project are: Hy-Vee, Casey Stores, and Farner Bocken. Unfortunately, I do not have a contact at the latter two. However, I know the VP of Distribution at Hy-Vee. Please feel free to contact him and indicate I suggested to do so. His name is Fred Housman and he can be reached at 641-774-7270 and f housman@hy-vee.com

As we discussed last week, the one carrier that has a similar transportation operation to Murphy Farms is Ruan. I think some of your folks have contacts there. If you don’t, please let me know and I’ll check around here.

I’ll continue to think of companies that might be helpful.

Mike

Michael R. Crum
Associate Dean for Graduate Programs
John and Ruth DeVries Chair in Business
Professor of Logistics and Supply Chain Management
Iowa State University
2200 Gerdin Business Building
Ames, IA 50011-1350
(515) 294-8105
mcrum@iastate.edu
APPENDIX E. RESULTS OF INTERNET SEARCH

About Us
Appian Logistics Software

Founded in 1997, Appian Logistics Software has over 15 years of experience and expertise implementing software with forward-looking logistics companies. Appian is acknowledged as an industry leader in providing solutions that work for transportation companies and has been recognized as one of the top 100 Logistics and Supply Chain software providers[1]. Appian Logistics Software has installations at over 700 client sites ranging from 3PL providers, food service industry, and home delivery to field service.

At Appian Logistics Software, our mission is to provide quality routing optimization software that when combined with our new GPS software, generates quality solutions to reduce distribution costs and improve customer service. The key ingredients to our success include:

- Customer service being our number one priority.
- Ensuring user-friendly interface resulting in monies saved.
- Maintaining affordability.
- Return on investment being less than 9 Months.

Appian consistently saves our clients time and money. On average, savings range from 10%–25% and results can be measured within 3 months[2] after implementation.

Because of our commitment to quality, superior customer service, and consistency in providing revolutionary products, Appian Logistics Software has experienced continued growth and expects to remain an industry leader for years to come.

1 Named by Informed Logistics from 1999 - 2006.
2 Actual results may vary but these numbers represent average.
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Appian Logistics Software
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The Online Directory Of Routing Software.
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ourworld.compuserve.com

**ESRI Software**
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Paragon Software Systems
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ProMiles
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Prophecy Transportation Software, Inc.
Providing trucking companies, brokers, shippers, and truckers with load matching services, dispatch and accounting software, trucking software, loads, and truck stop info for transportation companies.
www.mile.com

R*KOM
Manufacturer of software that tracks mileage, expenses and maintenance on any number of vehicles.
www.rkom.com

Rand McNally-TDM, Inc.
Developer of MileMaker(R) and IntelliRoute(R), mileage and routing software. Software includes applications for North America and shows industry-standard HHC mileages and practical routes availability. Software runs on PCs, minicomputers and ...
www.milemaker.com

RoutingGuides
A tool that allows companies to post their routing guides on the Web.
www.routingguides.com

Shallow Water Systems
Software system that allows companies to monitor vehicles and cost.
www.shallowwatersystems.com

Synergistic Systems, Inc.
A software developer and systems integrator expert in mobile data and specializing in the transportation industry.
www.snsys.com

Transportation Software by TDS
Provides a full line of software solutions for the transportation industry. Product line includes fuel tax reporting, accounting, dispatching and maintenance software products.
www.tdsvision.com
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A software developer and systems integrator expert in mobile data and specializing in the transportation industry.
www.syn-sys.com

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15 Day Free Trial Mileage, Routing, Truck Stops
www.ProMiles.com/PMG.asp

Routing Software
Easily manage your fleet with routing software from ServiceCEO
www.insightDirect.com

Routing Scheduling Track
Web-based vehicle routing, scheduling, and dispatch tracking.
www.e-it.com

Maps & Directions
Breathtaking bird’s eye images of on Windows Live Local - General
Maps.live.com

RouteFactory
Custom Solutions for Transport Routing and Territory Optimization
www.systemsviewssoftware.com

Route Accounting Software
Manage route deliveries w/ popular G-Route 2000 & handheld computer!

<<< Page 1 | Page 2

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Cube Route provides on-demand logistics management solutions to enable transportation and distribution organizations to lower costs, improve customer service and reduce complexity.

On Demand Logistics Management Solutions — Web Based, Hosted

Web Seminar
Listen to Beth Ensio, Aberdeen Group discuss the latest trend in logistics operations for transportation and distribution organizations. Download Now

Driving Value at the Lowest Total Cost of Ownership
Cube Route manages the entire delivery process from the point of order, through the time of delivery, to business analysis.
We offer a complete logistics solution to:

- **Lower Operations Costs**: better route economics, and improved driver performance and visibility into waiting times.
- **Improved Customer Service**: improved on-time arrival, setting of customer delivery windows and notification of order status.
- **Reduced Complexity**: automation of manual processes, more accurate data capture, and universal access to data from any person in the field or in the office.

News
- **December 6, 2006**
  Descartes Completes Acquisition of Cube Route Assets

- **November 20, 2006**
  Descartes Signs Definitive Agreement to Acquire Assets of Cube Route

- **October, 2006**
  Wireless Capabilities: A Must-Have for Fleet Operators

- **September 26, 2006**
  Cube Route Branches Out in New Markets with Village Nurseries
Dynamic Routing Solutions Inc is a logistics service company that specializes in providing vehicle routing solutions to organizations covering different industries utilizing different modes of transportation.

We service you by facilitating the vehicle routing process. We perform dynamic (daily) and static (scheduled) vehicle routing for your organization.

From five to five hundred vehicles, Dynamic Routing Solutions is your answer when your vehicle routing process becomes complex or unmanageable.
Integrated GPS Capability
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Customer Highlights

ARAMARK
ARAMARK chooses InterGIS Solution to Automate Routing, Scheduling and Dispatching Functions.  >More

Free Report
Download a free copy of a recent study:
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*Accurate mapping and routing of field service personnel allows companies to reduce the number of missed SLAs and late arrivals and helps to reduce windshield time by routing technicians efficiently."
Planning your route to the future

Vehicle Routing
Loading and
Scheduling System

Optrak’s vehicle routing software is a powerful and flexible vehicle routing, load planning and scheduling tool. Optrak takes all of your resources into consideration to generate the most cost efficient routes for your trucks and vehicles.

Deployment of Optrak’s award winning vehicle routing software typically leads to a reduction of between 5% and 15% of your transport costs. Administration is streamlined. Mileage and fuel consumption are minimised. Transport utilisation is increased.

This is what our clients say:

"The software gives us high visibility and control throughout the planning process and this is essential in meeting our service commitments.”

Ben Young, General Manager, Wincanton

"I would highly recommend Optrak to other companies looking to introduce automated route planning.”

Andrew Reynolds, Reynolds Logistics
Route Management

In addition to ServMan's recurring order and contract management tools, we offer a suite of add-on tools for managing your Route Based business. Automatically build routes based on weighted criteria on your work orders such as preferred time, work type, and other route/day criteria. Preview route values and summary information as proposed changes prior to committing them to the system. Best of all, ServMan software uses Microsoft's award winning MapPoint mapping engine assuring you that your investment both now and in the future.

- Mobile Solutions for Field Personnel
- Mapping Solutions for Route Management

ServMan ... The Future is Now!

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About Us

Truck Dispatching Innovations are resellers of very affordable desktop truck routing software, along with the latest in GPS and wireless hardware for tracking and communicating with delivery trucks. We integrate the hardware and software, then lend operational and financial expertise to reduce delivery costs. Our target markets are local delivery operations with private fleets of 5-50 vehicles.

By utilizing affordable state-of-the-art technologies TDI can assist you to reduce your delivery costs and increase your customer service.
TruckStops® Routing and Scheduling Software

Producing optimized truck routes since 1983.

Technical Details • The Demo • Support

TruckStops is the leading vehicle routing and scheduling software with over 2,400 systems sold. With TruckStops, our users report cost savings of 10% to 30% on transportation cost. With our routing and scheduling software you will receive savings in: overall route time, miles, driver pay, vehicle maintenance and fuel cost.

Here are some of the benefits of TruckStops:
- Lets businesses reduce delivery cost
- Improves customer service
- Produces cost efficient routes
- Enhances management control
- And more...

Some of the features you will see with TruckStops:
- Handles static or dynamic routes
- Links with Microsoft MapPoint and PC Miler
- Offers turn by turn directions
- Extremely easy to implement and use
- Export optimized vehicle routes to GPS
- And more...

Click here to learn more about the Power, Flexibility and Value of our truck routing and scheduling software.

TruckStops contains the most powerful cost optimization routines available in a commercial routing system. Customers who have compared TruckStops to other routing software tell us that TruckStops equals or better the performance of anything they've seen. TruckStops routinely produces results 3% to 10% better than competing systems in benchmark studies.

TruckStops is the most powerful, easy-to-use tool that is used to route deliveries at more than 2,400 customer sites worldwide, and will help you to cut your transportation costs and increase driver productivity while improving customer service.

Need more information? Use our quick contact form or send email to info@truckstops.com