Milk Transport Security and Traceability System

For presentation to Dairy farmers of America
August 17, 2009
Kansas City, MO
Disclosure

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Funding:
The Milk Transport Security and Traceability System was developed at the University of Kentucky with $2.8 million funding from the Department of Homeland Security through the National Institute for Hometown Security.

   Prototype project, $1.5 million, Jan 2006 to Dec 2008
   Technology Optimization, $1.3 million, Aug 2008 to Feb 2010

Project Objective:
Develop and implement a bulk milk transport security system that would add to the security infrastructure of the United States.

Test Schedule:
“NY Test” - Test the Data Management System (Handheld and Database) at AgriMark and DMS Northeast September 7, 2009
“KY Test” - Test the Milk Transport Security System (complete system) in Kentucky starting September 28, 2009.
Dairy industry collaboration

Dairy Processors
– Agri-Mark, Inc. NE facilities
– Flav-O-Rich Dairy
– Southern Belle Dairy (Prairie Farms)
– Winchester Farms Dairy (Kroger)

Milk Marketing Agencies
– Agri-Mark, Inc.
– Dairy Marketing Services Northeast
– Dairy Farmers of America Mideast Council
– Southeastern Graded Milk Producers Association

Milk Transportation Companies
Alan Wilson Trucking
Obreza Trucking
Slayback Milk Transport

Dairy Public Sector
KY Department of Public Health
USDA MA Dallas

Tanker Manufacturers/Modifiers
Bluegrass Tank and Equipment
Starr Stainless
Walker Transport

“Working with our collaborators has provided a unique opportunity to develop a big picture solution while providing sufficient attention to relevant details from all users.”
Why bulk food? Why dairy?

- U.S. Department of Homeland Security (DHS) has targeted bulk food contamination because it poses a high consequence health threat.

- The four features of milk that pose concerns:
  - Bulk milk’s large batch size
  - Accessibility
  - Thorough mixing during processing
  - Rapid turnaround at retail and
  - Rapid consumption
Homeland Security Project

• National Institute for Hometown Security
  – Non-profit R & D organization

• Development projects for critical infrastructure
  – Design
  – Develop
  – Deploy
Future requirements?

Universal Goals of Proposed Legislation & Rulemaking

- Preparedness
- Detection
- Response
- Recovery
Future requirements?

• Homeland Security Presidential Directive-9
  • National Incident Management System
  • National Response Plan
  • National Infrastructure Protection Plan
  • National Preparedness Goals

• Food Protection Plan

• Food Safety Enhancement Act of 2009 (H.R. 2749)
  • H.R. 875 Food Safety Modernization Act
  • H.R. 759 FDA Globalization Act
  • H.R. 1332 Safe Food Enforcement, Assessment, Standards, and Targeting (FEAST) Act
  • S. 510 FDA Food Safety Modernization Act
  • S. 1804 National Agriculture and Food Defense Act of 2007
A Comprehensive Approach
Food Protection, Traceability & Operations

Security protocols
– Who
– Why
– When
– Where
– What

System ID Features
– Equipment
– Personnel
– Locations
– Events/interactions

Result
Surveillance → Traceability → Protection
Data gathering → Information → Efficiency
Guiding Principles for System Development

• Operate within current milk transport infrastructure
• Information remains with the milk
• Provide redundant data storage
• Compliant with industry requirements
• Provide security and accountability
• Flexibility, adaptability
• Data gathering and management, accuracy
The combination of the Handheld Device, Database, and Transport Monitoring System combine to provide a comprehensive solution for:

1. Securing bulk milk during transport
2. Automation of milk data collection and other processing operations
3. Providing traceability of bulk milk
Milk Transport Security and Traceability System

Data Management System
- Database
- Handheld

Milk Transport Security System
- Database
- Handheld
- Transport Monitoring System

* denotes overlap or connection between systems.
Milk Transport Security and Traceability System

**Computer Systems**

1. Handheld Device and Printer
2. Data Server
3. Transport Monitoring System
Milk Transport Security and Traceability System

1. Handheld Device and Printer

Intermec® CN3

Zebra® QL 220
Milk Transport Security and Traceability System

2. Data Server

Software – IBM DB2 back-end language
MS Visual Studio 9.0 with .NET framework 3.5 and C#.NET is used as the front-end language  DRAFT
Milk Transport Security and Traceability System

3. Transport Monitoring System

- Control Module Enclosure
- Dome Lock
- User Interface Panel
- Auxiliary Battery
- GPS, Cell Phone, Wi-Fi Antennae
- Tank Wall Temperature Sensor
- Ice – Water Bath Temperature Sensor
- Rear Door Lock
Emergency Break on Lock, requires 80-90 lb-ft of torque to twist off and a 1-1/8” wrench

Vacuum Florescent Display, rated -40° F/°C

Water Proof Keypad
Transport Monitoring System

Food Grade Transport Cabinet

Transport Tank Valve Cap
Auxiliary Battery

Power Modes:
- Full (when truck is running)
- Low
- Reserve (100 hours)
- Shutdown
Transport Monitoring System
Transport Monitoring System

Antennae (Cell, Wi-Fi, GPS)

Control Module
Milk Transport Security and Traceability System

Information Input
Milk Transport Security and Traceability System

Information Input by MMA

Database

Internet

Milk Marketing Agency (MMA)

Marketing Agency
- Name
- Address

Dairy Farms
- Owner
- Address
- BTU
- GPS Location
- Bulk Milk Tank
  - Size
  - Manufacturer
  - Calibration chart

Agency (MMA)

Routes
- Farms
Milk Transport Security and Traceability System

Information Input by Transportation Companies

- **Company Information**
  - Name
  - Address

- **Driver Information**
  - Name
  - Address
  - License expiration Date

- **Routes**
  - Name

Database

Transportation Companies

Internet
Milk Transport Security and Traceability System

Information Input by Dairy Processors

Database

Internet

Dairy Processors

Company Information
Name
Address

Plant Information
Silo

Wash Station Information
Name
Style

Town Dairy
Milk Transport Security and Traceability System

Data Collection
Milk Transport Security and Traceability System

Data Collection – Milk Data

- **Manual Entry**
  - Milk Temperature
  - Dip Stick Reading
  - Quality Attributes

- **Auto Entry**
  - Hauler/Sampler
  - Farm ID
  - Tank ID
  - MMA
  - ... etc

Handheld Device

Cell phone

Database

Manual and Auto Pop.
Milk Transport Security and Traceability System

Data Collection – Security - Seal Monitoring System

Handheld device reads barcoded seals

Barcode Reader

- Dome Seals
- Rear Door/Valve Cap Seals
- Seals on Wash Ports
Milk Transport Security and Traceability System

Data Collection – Security - Transport Monitoring System

- Lock Position
- Who Accessed Tank
- Purpose of Access
- GPS Position
- Tank Temperature
- Ice-Water Bath temperature

Data Collected (1 minute intervals)

Cell phone

Database

Transport Monitoring System

Digital Electronic Comm.
Milk Transport Security and Traceability System

Data Collection - Barcode Identification Systems

Handheld Device

Barcode Reader

- BARCODE
  - MILK HAULER/SAMPLER
- BARCODE
  - TRACTOR AND TANKER
- BARCODE
  - DAIRY FARM
- BARCODE
  - FARM BULK MILK TANK
- BARCODE
  - SAMPLE LABEL
- BARCODE
  - SEALS
- BARCODE
  - DAIRY PROCESSOR
- BARCODE
  - MILK RECEIVER

http://www.gceekz1.com
Milk Transport Security and Traceability System

Information and Data Output
Milk Transport Security and Traceability System

Data Output - Printing Operations

Handheld Device → Wi-Fi → Printer Device

- Barn Tickets
- Sample Labels
- Wash tags
Milk Transport Security and Traceability System

Data Output – Server Based Software

Let me see my data?

Server-based Software

Marketing Agencies
Milk Tickets
Security/Quality
Traces

Dairy Processors
Security/quality
Milk tickets
Traces

Transportation Co.
Traces
Milktickets
Corporate Reports

www.endforeclosures.org
Milk Transport Security and Traceability System

Interacting with a Tanker

Where is my tanker?

Server-based Software

Internet

Ping

Database

Cell phone check on 20 minute intervals

Transport Monitoring System
Milk Transport Security and Traceability System

Interacting with a Tanker

Server-based Software

Lock Position; GPS Position; Temperatures; Security Session ID #; Milk Load
Milk Transport Security and Traceability System

**Data Update System**

**Handheld Device**
- Update the local database on handheld on a daily basis

**Cell phone**
- Link to database

**Internet**
- Link to database

- New Driver
- New Route
- BTU Status Change
- New Dairy farm
- Change MMA for bulk Tank
- Extra Milk Sample for farmer Brown
- Message to Farmer Smith
- Alert to check tank therm.
Milk Transport Security and Traceability System

Data Backup System

Data Management System

Handheld Milk and Seal Data Backup

Milk Transport Security System

Database

Handheld

Transport Monitoring System Security Data Backup

Milk Data Backup

Milk Data Backup

Security Data Backup
Milk Transport Security and Traceability System

Food for Thought

- Comprehensive system

- Implementable in parts
  - Most feasible: DMS and MTSS

- Developed over 4 years with advice from DFA personnel and others to develop a national security system for bulk milk transport.
System Operation

Chris Thompson
System Operation
Uploaded Data is Partitioned and Accessed Via Internet

Internet

Transportation company

Milk Marketing Agency

Dairy Processor
All documents have required information

- Tank ID
- Date
- Time
- Temperature
- Hauler info
- Milk weight

Sample label

Zebra® QL 220

Producer record
<table>
<thead>
<tr>
<th>Milk Ticket</th>
</tr>
</thead>
</table>

## Bulk Milk Ticket

<table>
<thead>
<tr>
<th>Local No.</th>
<th>Transient Company</th>
<th>Charge Grade</th>
<th>Security Session #</th>
<th>Wash Tag Information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Deliveries

<table>
<thead>
<tr>
<th>Marketing Agency</th>
<th>Dairy Farmers of America</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Milk Ticket No.</th>
<th>Milk Ticket No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Wash Tag

<table>
<thead>
<tr>
<th>Tank ID #</th>
<th>Date and Time Cleaned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Location</td>
</tr>
<tr>
<td></td>
<td>Cleaned by</td>
</tr>
<tr>
<td></td>
<td>Last Product Sanitized</td>
</tr>
</tbody>
</table>

### Load Summary

<table>
<thead>
<tr>
<th>Load Summary for Load KY10547.1950.029</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

### Comments

- No Comments.
Report Demonstration

Database Entry Sequence

- **Login**
  - Login as MMA (DFA)

- **Query**
  - Date range: January 3, 2008 to current

- **Info**
  - Milk ticket is generated
Database Entry Sequence

**Login**
- Login as UK Homeland Transportation

**Query**
- Security and Quality Report
- Date range: October 1-7, 2008

**Info**
- Obtain summary report with graphs
- Other reports and searches are available
Milk Trace

Milk Transportation Agency

Company Name: UK Homeland Security Project

Company Type: Milk Transportation Agency
Security/Quality Report

Date Range

From: 2008-10-01
To: select

Edit/Add Hauler Information
Logout(UKHomeland)
### Security/Quality Report

**for Milk Ticket** **KY082731539K209**
**for Hauler** **Brian Luck**

<table>
<thead>
<tr>
<th>Component</th>
<th>Security Session</th>
<th>Permit Expiry Date</th>
<th>Dropoffload Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauler Inspection Date Expiry</td>
<td>KY082731539K209</td>
<td>2007-09-12 06:00:00</td>
<td>2008-10-02 14:45:37</td>
</tr>
</tbody>
</table>

Done
## Trace Reports

### Hauler
- **Security Session**: KY082731539K209
- **Wash Date**: 2008-09-29 15:59:26
- **Picked up Date**: 2008-10-02 11:48:17

### Tanker Permit No
- **Security Session**: KY082731539K209
- **Wash Duration Valid**: Yes

### Transport Co.
- **Security Session**: KY082731539K209
- **Wash Start Date**: 2008-09-29 15:39:17
- **Wash Stop Date**: 2008-09-29 15:59:26

### Milk Ticket
- **Security Session**: KY082731539K209
- **Wash Start Date**: 2008-09-29 15:39:17
- **Wash Stop Date**: 2008-09-29 15:59:26

### Security/Quality Report

- **Sample cooler kept above 40°F for longer than 15 minutes.**
- **Security Session**: KY082731539K209
  - **Sample Temperature**: 5.6°C
  - **GPS Time**: 114409
- **Security Session**: KY082731539K209
  - **Sample Temperature**: 6.3°C
  - **GPS Time**: 122640

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**Wash Cycle Temperature**

![Wash Cycle Temperature Chart](chart.png)
Pre-rinse: 60 ° F

Wash: 140 ° F

Sanitize: 80 ° F

~ 40 minutes
Tanker liner temp 40-42º F

Samples and cargo 41º F

Milk sample cooler temp 34º F
Database Access Summary

System users determine permission level

Availability determined by hierarchy:
- User category
- User authorization

Data can be extracted for internal use
Complexities of bulk milk transportation

- Long hauls vs. local supply management
- Volume fluctuations
- Plant supply management: just in time delivery, order changes, demurrage
- Co-mingled loads
- Variability of plant requirements
- Segregation of milk due to “subtle attributes”
- Supplier owned tankers and contract carriers
- Variation in size in transportation firms
- Fuel prices, back haul, compatible food products