

# Manufacture of Advanced Battery Metal Containers & Components

HTTM LLC



Program Coordinator

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May 16, 2012

Project ID: ARRAVT013

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# Project Overview

## Timeline:

- Start date: May 1, 2010
- End Date: April 30, 2013
- Project is on time and proceeding as planned

## Barriers:

- Materials/processing feasibility
- Rapidly evolving cell technology
- Customer product changes
- Customer/market uncertainty

## Budget

- Total project funding: \$10.2M
- DOE share: 49%
- HTTM share: 51%
- Budget used to date\*: 41%

## Partners:

- H&T Battery Components
- Trans-Matic Manufacturing Co.
- H&T Produktions Technologie
- Karotech Inc.

\*as of March 30, 2012



# Relevance

## Objectives:

- Produce metal containers and components (such as cover assemblies) for use in advanced (li-ion, NAS, ...) battery cells.
  - Develop a skilled technical workforce
  - Add manufacturing equipment and processing capability

## Impact:

- HTTPM is currently in production on four new battery container programs with two new customers (US & Europe).
  - Staffing has included addition of 9 new FT employees + 19 FTE. Hiring is on plan.
  - Purchased over \$4 mil. in new equipment. Capital procurement is on plan.
- HTTPM is developing three new prismatic container programs with these customers.



# Relevance

- HTTM is currently the only US manufacturer of large format, metal battery containers and cover assemblies





# Approach

## Business

**Past Success + New Capabilities  
= New Business Opportunities**

### Business Approach:

- Form a JV from Heitkamp & Thumann and Transmatic.
  - Apply 100 years of deep draw experience into development and manufacture of advanced battery containers.
- Leverage existing facilities and assets from both parents. Use ARRA grant funding only on new equipment and technology.
- Leverage existing business relationships with OEM's to successfully penetrate their advanced battery divisions.
- Implement a Business model which calls for producing advanced battery containers, not just li-ion deep drawn cans.
- Demonstrate to customers that metal containers are the preferred construction to ensure safety and durability.
- Utilize flexible equipment and processes. Must accommodate both cylindrical and prismatic metal containers.



# Approach

## Product Development

Innovation, Development, Prototyping,  
Design and Process Validation

### Product Development Approach:

- Establish JDA's with customers to ensure efficient transfer of manufacturing "know how" into state of the art designs.
  - Drives "design for manufacturability"
- Advanced battery container concepts are developed in the Advanced Product Development (APD) group
- Sophisticated forming simulation software is run to determine manufacturing feasibility and tooling attributes.
- Rapid prototyping techniques are used to make affordable mockups for design validations.
- In-house prototype and production tool build capabilities ensures customer designs and HTTM techniques are kept confidential.
  - High level of vertical integration



# Approach

## Project Management

## Project Phases for each Customer Program

Phase 1



Phase 2



Phase 3



Phase 4



Phase 5

- Establish relationships with leading Battery OEM's. Engage with NDA's, technical meetings, mockups, etc.
- Co-develop the battery container components. Build prototype tooling and produce parts for design and process validation. Secure production purchase order.
- Design and build production component tooling. Build or modify production facilities as required. Hire and train staff.
- Gain customer approval of production product. Ship production orders and ramp-up manufacturing output.
- Add manufacturing capacity as sales volume increases. Drive continuous improvement to improve the product quality and reduce cost.



# Project Accomplishments

## Advanced Battery Component Development and Manufacturing

HTTM has successfully entered the advanced battery container market and is in the following Project Phases with several OEM Advanced Battery manufacturers:

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
5 OEM's	2 OEM's	0 OEM's	1 OEM	1 OEM

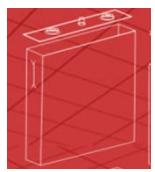
HTTM is developing advanced battery containers, cans and covers/assemblies and is becoming an established “go-to” company for battery container systems.

The ARRA Grant project completion level is 41%. It is on schedule and on budget. Project work to date reflects HTTM's success with customers, including our ability to commercialize newly developed products.

For the projects in Phase 4 and 5, production tooling and equipment are in place and manufacturing has begun. Production shipments are being made to the domestic and global locations of US based OEM's

Job creation has occurred and continues. Personnel have been hired and trained during the development and launch phase of these customer projects.





# Technical Accomplishments and Progress

## Launch / Manufacturing

- Successful commercialization of metal battery cans and cover assemblies in the US.
  - Launched five new products with two new customers. All PPAP's were complete by Q4 2011
  - Launched new processes including: swaging, laser welding, helium leak testing, in house aqueous cleaning
  - New equipment:
    - Manual cover assembly & test cell
    - Automated cover assembly & test cell
    - Aqueous can wash system

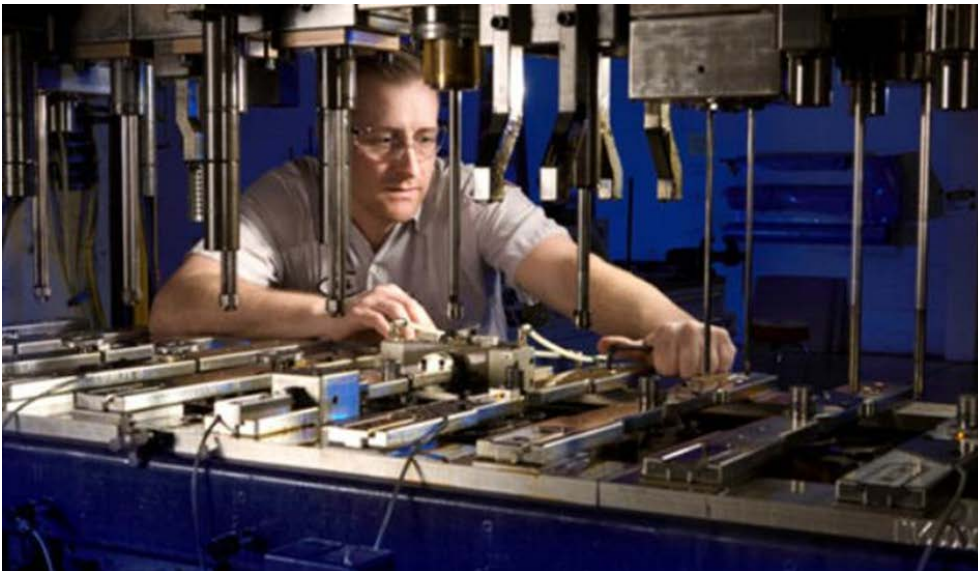




# Technical Accomplishments and Progress

## Development / Tooling

- Development Accomplishments:
  - Hermetically sealable battery container (with safety vent) and cover assembly that can be automatically assembled by OEM customers.
  - In-house tool design and manufacturing process for consistently stamping an integral safety vent feature in the can or cover.
    - The tooling/process can be adjusted to achieve specific burst pressure mean values within a controlled range.





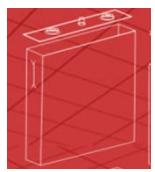
# Technical Accomplishments and Progress

## Testing and Validation

- Testing Accomplishments:
  - Designed and built a high precision digital probe for measuring the thickness of the critical pressure burst disc.
  - Designed and built a safety vent burst tester that enables ongoing production validation and lot verification testing.







# Technical Accomplishments and Progress

## New Manufacturing Techniques – Servo Press

- New design features in Advanced Battery Cell containers:
  - Complex burst disc configurations
  - Tight corner radii/tolerance control and larger container sizes improve energy capacity for large format cells
- .....make it necessary to invest in new Production Equipment
  - Full servo capability in a deep draw stamping press
  - Press is 70% complete. Will be on HTTM floor: Q3, 2012





# Technical Accomplishments and Progress

## Project Milestones

Milestone	Planned Start Date	Planned Completion Date	Status and Comments
DOE Kickoff	6/2/2010	6/2/2010	Completed
Customer Award of Business	4/1/2010	11/1/2010	Completed
Initial Equipment Ordered	7/20/2010	12/30/2010	Completed
Initial Equipment Installed & Validated	10/20/2010	6/1/2011	Completed
PPAP Complete	2/1/2011	9/1/2011	Completed
Delivery of Servo Press	6/1/2011	8/1/2012	On Time
Prototype Development of New Prismatics	9/1/2011	6/1/2012	On Time

HTTM has successfully entered the advanced battery container market and is in the Production phase of several customer projects.



# Collaborations / Partnerships

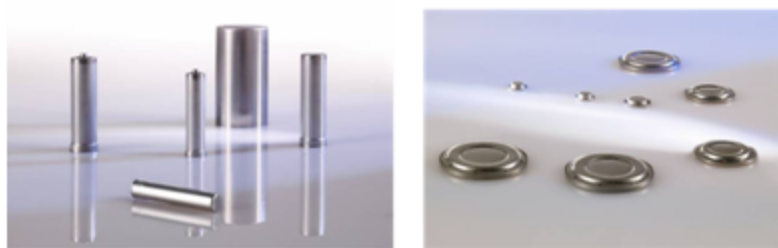
## HTTM Joint Venture Parents



H&T Battery Components

<http://www.ht-group.com/divisions/ht-battery-components>

- World's largest producer of consumer battery containers.
- Production from four facilities (US, Germany, China and Singapore) exceeds 8 billion units per year



**Energizer**

**DURACELL**

**Vinergy**

**VARTA**

**SAFT**

**CEGASA**  
INTERNACIONAL

Beyond Excellence  
**Bexel**

**555**  
**PURE ENERGY**

**RAYOVAC**

**ROCKET**

**TADIRAN**  
BATTERIES

**trans-matic**

<http://transmatic.com/>

- Global leader in the development and production of precision engineered deep drawn stampings for automotive and other industries.
- Production from three facilities (US and China).



**IR** Ingersoll Rand

**Continental**

**BorgWarner**

**RAIN-BIRD**

**SIEMENS**

**NGK**

**EMERSON**  
Climate Technologies

**Kwikset**  
THE BEAUTY OF STRENGTH™

**TI Automotive**

**Johnson**  
Controls

**SAFT**

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**DENSO**

**COOPER/STANDARD**  
AUTOMOTIVE

**Husqvarna**

**Maxwell**  
TECHNOLOGIES

**BOSCH**

**Sensata**  
Technologies

**Ford**

**Tyco**  
Electronics



# Collaborations / Partnerships

## HTTM Technical Partners



<http://www.karotechinc.com/>

- Experts in deep draw stamping for battery applications.
- Component Development
  - Vent / Burst Disc
  - Current Interrupt Device (CID)
- Short run processing
  - Laser Welding



H&T ProduktionsTechnologie

<http://www.ht-pt.com/>

- Products include:
  - Conventional Presses
  - Servo Controlled Presses
  - Transfer Systems
  - Tooling

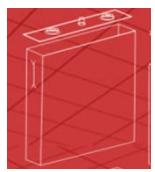


# Future Work

2012 and beyond...

- Aggressively Market New Capabilities to New Customers
  - Pursuing additional business with Asian Battery Manufacturers
- 300 Ton Servo Press
  - Scheduled for delivery in Q3 2012
  - HTTM will be able to produce even larger advanced cell containers
- Continue development of new Products:
  - Energy and Power Cell Prismatic Containers and Cover Assemblies for all markets & applications
- Continue development of a new Manufacturing Process:
  - New, proprietary material joining technology
  - Applications: Terminal assembly, cover-to-can seal
    - ✓ Faster than laser weld, electron beam, ...





# Summary

## A Successful Project:

### Product



HTTM has developed technically / commercially viable metal container products for the global advanced battery market.

### Customer Orders



HTTM has secured production orders with OEM Battery companies and launched high volume production manufacturing.

### Funding



The DOE ARRA Grant funds have been utilized for equipment, personnel and other product development and equipment costs.

### On Schedule



The Project is on schedule and on budget.

### Equipment



Most production equipment is on-site with process validation complete.

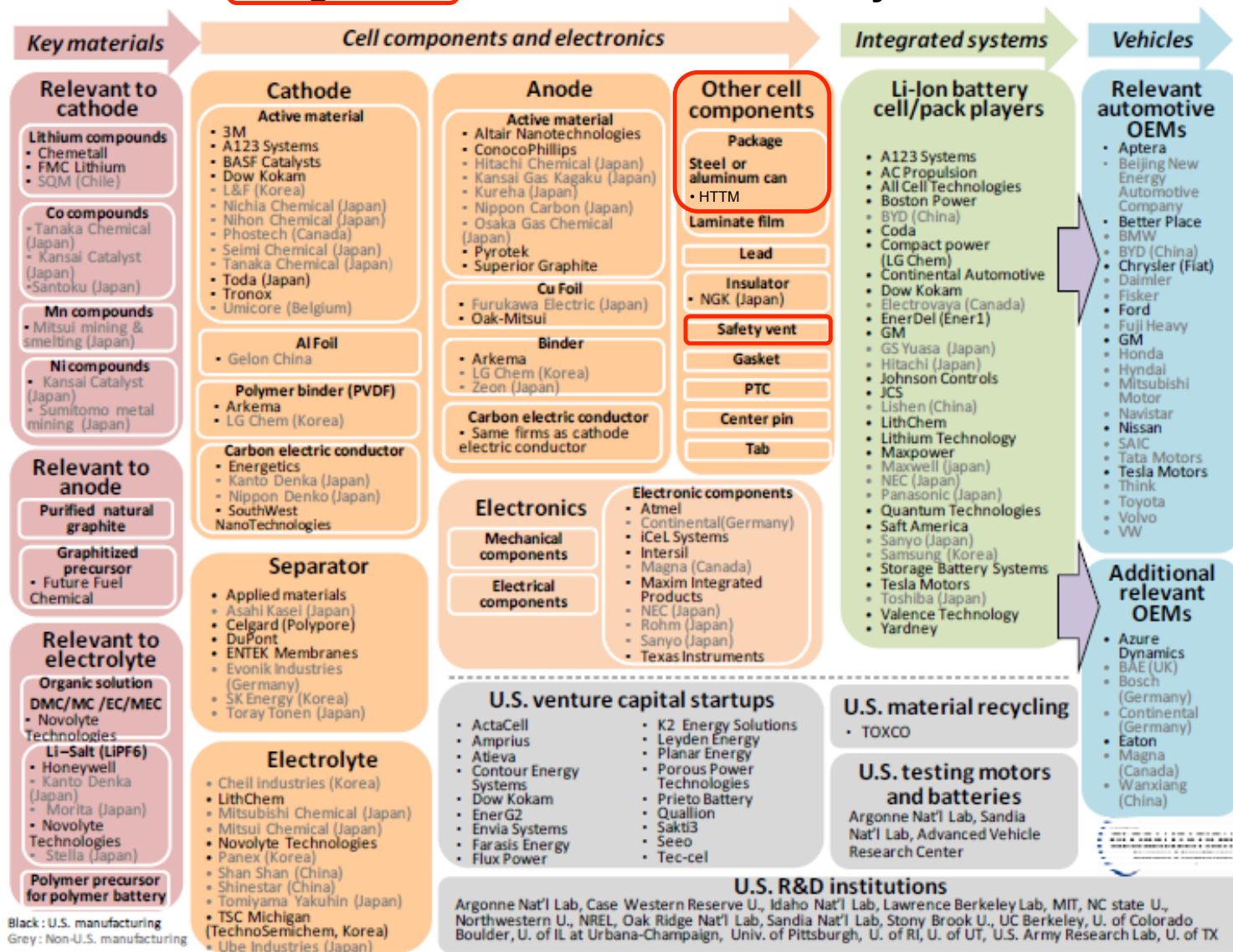
### Staffing



Personnel have been hired as planned. As the launch progresses, staff will be added according to production ramp-up schedules.

# HTTM Value Chain Position

HTTM is an **integral link** in the Advanced Battery Value Chain





# Contact Information

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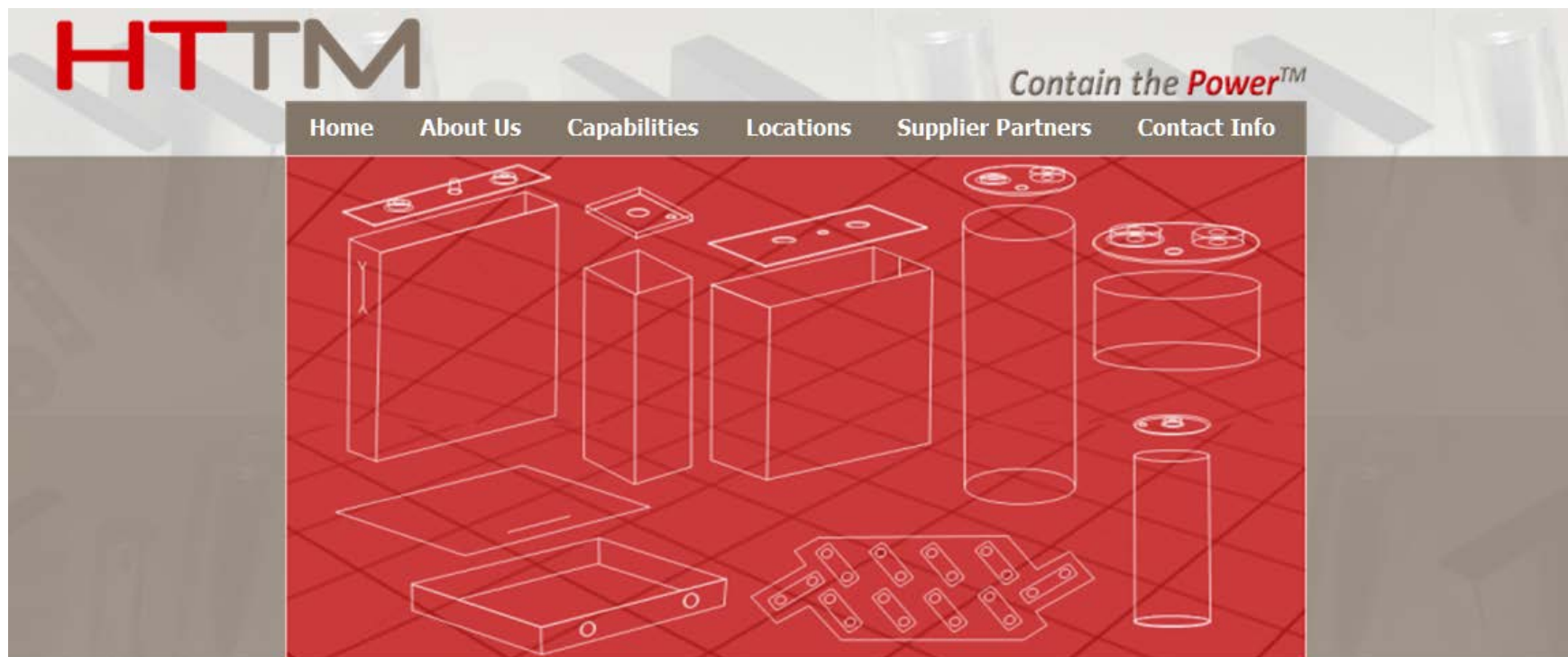
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