

CATERPILLAR CHROME PLATE REPLACEMENT TECHNOLOGY

Otto J. Rajtora
June 16, 2010

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 16 JUN 2010		2. REPORT TYPE		3. DATES COVERED 00-00-2010 to 00-00-2010	
4. TITLE AND SUBTITLE Caterpillar Chrome Plate Replacement Technology				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Caterpillar,100 North East Adams Street,Peoria,IL,61629				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES DOD Vehicle Workshop, 15-16 June 2010, Grand Rapids, MI. Sponsored by SERDP/ESTCP.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 40	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

CATERPILLAR IS...

MAKING PROGRESS POSSIBLE

- World's largest manufacturer of construction and mining equipment, diesel and natural gas engines and industrial gas turbines
- Technology leader in construction, transportation, mining, forestry, energy, logistics and electric power generation
- #1 or #2 for each industry we serve with a 2010 goal of market leadership for every major product group on every continent

Worldwide Locations

- Dealer Main Stores
- Manufacturing Facilities
- Office and Other Facilities
- FG Wilson, MaK, Perkins, Solar Distributors
- Progress Rail Locations
- Parts Distribution Centers

Joliet, IL

CATERPILLAR IS... MAKING PROGRESS POSSIBLE

- The most technologically advanced products and services
- A passion for exceeding our customer's expectations
- A long history of financial strength



Most important ... a global team of more than 240,000 talented individuals—including employees, dealers and suppliers—committed to enabling progress and opportunity.

Product Range

We will meet the challenges we face by helping customers meet the challenges they face. From massive to mini, world-class Cat® machines and engines match versatility and range with performance and productivity to meet virtually any need.



CAT 797B Mining Truck

CAT D11T Track-Type Tractor

CAT 216B Series 2 Skid Steer Loader

“...we strive to make the intelligent choices that will allow both our company and our planet to prosper. Ultimately, we believe the sustainability of our world and the sustainability of our business are inseparable.”

Jim Owens, Chairman and CEO

Caterpillar Inc.

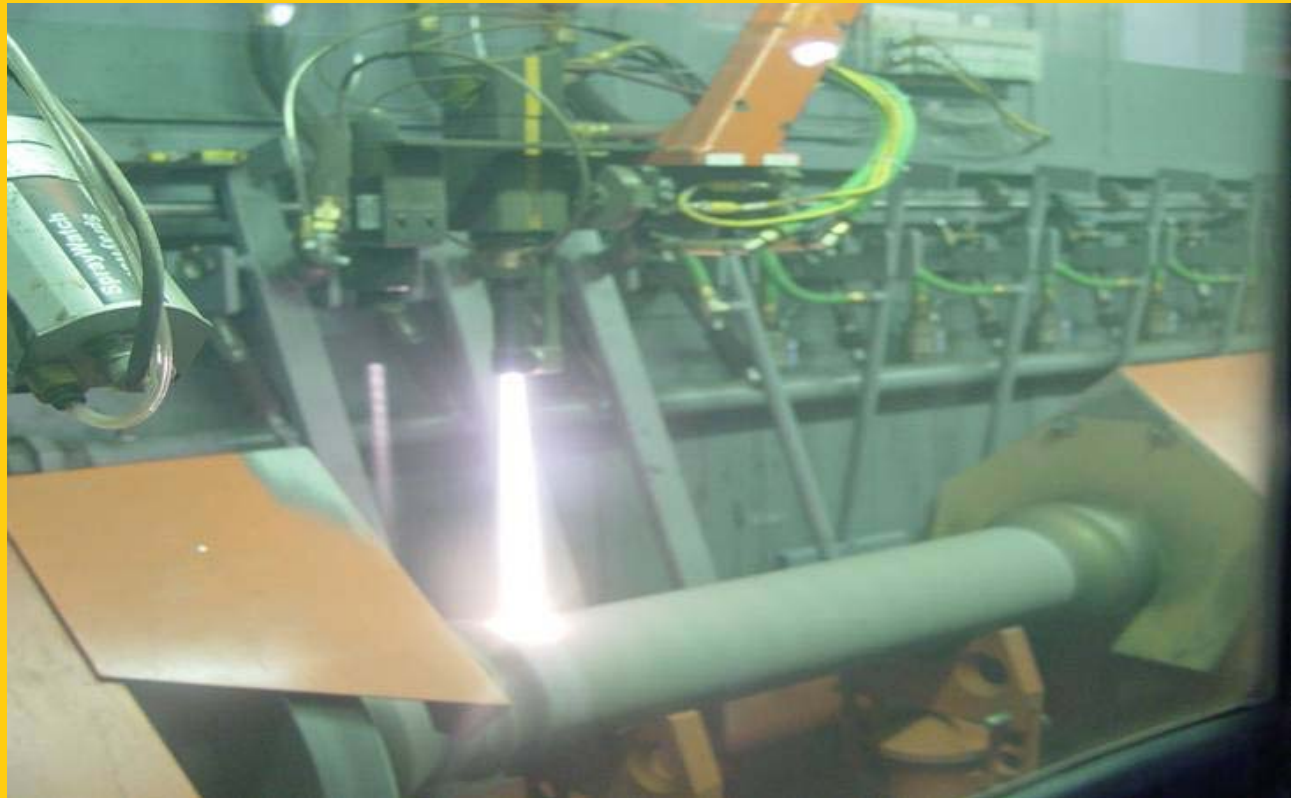
Sustainable Manufacturing in Action: Cat® Advanced Surfacing Technology (AST)



What is AST?

- Caterpillar developed HVOF Coating and Finishing Technology for Chrome Plate Replacement

- High
- Velocity
- Oxygen
- Fuel



What is HVOF?

- HVOF is a process which applies a flame sprayed coating to a special steel to create a very durable and smooth coating without the use of toxic chemicals.
- HVOF is an effective replacement for a process known as Hard Chrome Plating.

Before AST: Chrome Plate

Chrome Plating used Hexavalent-Chrome, which is very toxic and a known carcinogen



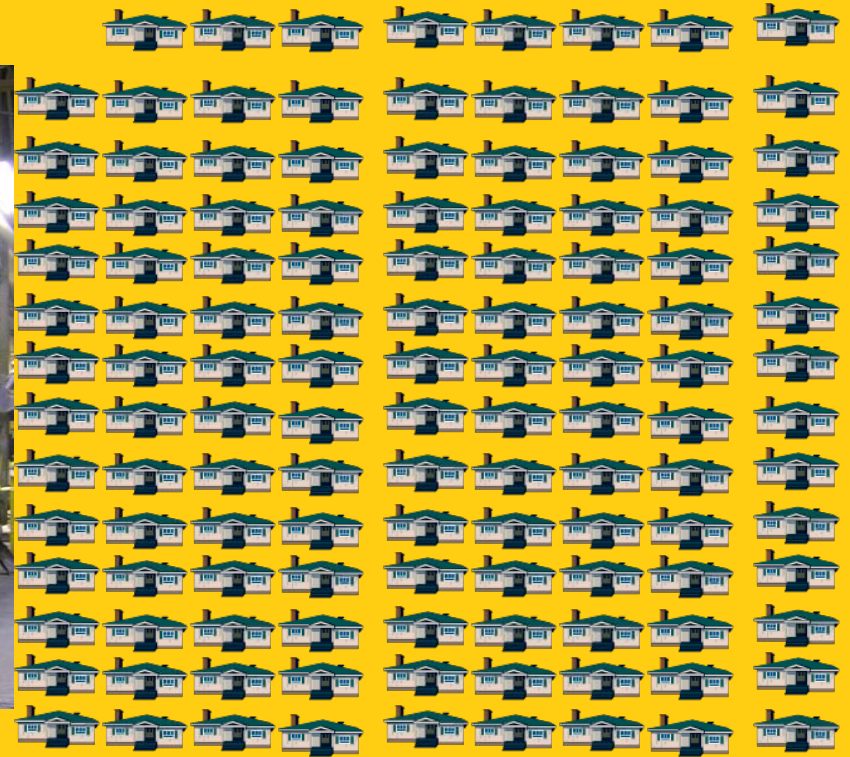
Before AST: Chrome Plate

In 1999, Chrome Plating consumed 52,000+ pounds of Chromic Acid at Joliet.



Before AST: Chrome Plate

The plant consumed over 1.3 Million Kwh of electricity per year just for chrome deposition, enough to power 126 Homes!!



Before AST: Chrome Plate

The process used 14,000,000 gallons of water a year



Before AST: Waste Treatment

Chroming required 12,000,000 gallons of water a year to be treated on site



Before AST: Waste Treatment

Hex-Crome is a hazardous air pollutant that must be removed from emissions



Before AST: Waste Streams

**727,000 Pounds of Solid Hazardous Waste was generated
in 1999 alone!**

That's equal to almost nine Cat[®] 740 Trucks



The AST Process: Replacing Chrome



AST Process –

HIGH VELOCITY OXYGEN FUEL (HVOF) COATING and FINISHING

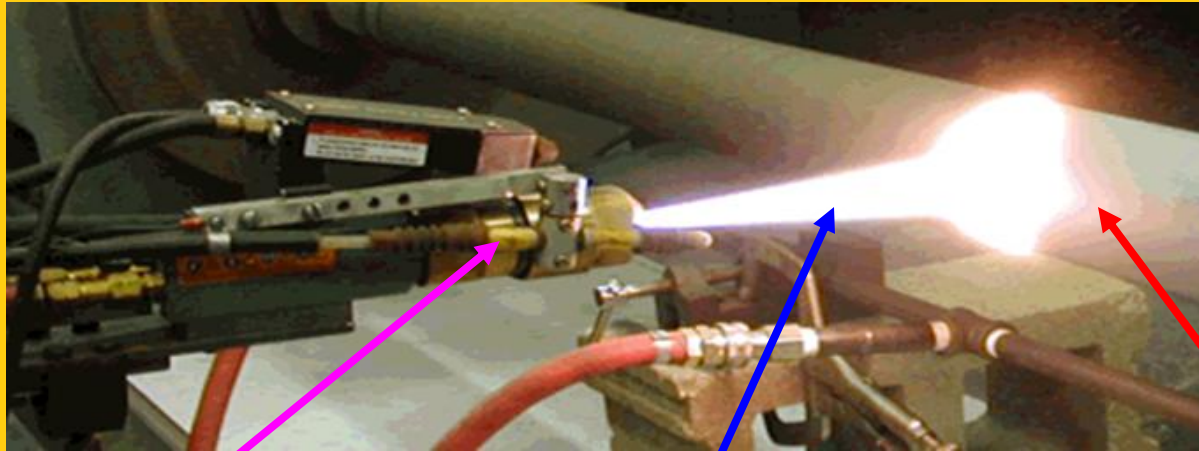


AST: HVOF Coating Load/Unload Station



— 4 m between centers, 0.8 m swing, 2300 kg

HVOF Spray Process



INPUTS:

- Air
- Nitrogen
- Fuel (Propylene, Methane, Kerosene)
- Oxygen
- HVOF Powder Flow

HVOF COATING PARAMETERS:

- Particle Velocity
- Particle Temperature
- Particle Flux

OUTPUT:

- Dense HVOF Coating
(~1000 Knoop)

AST: HVOF Spray Completed



AST: Finish Grinding



AST: After Finishing



AST: Field Application



AST: Field Application

(100 Ton Front Strut @ Ky)



AST: Field Application

(100 Ton Rear Strut, @ Ky)



AST vs. Chrome Plate:

950F WHEEL LOADER LIFT CYLINDER RODS
(In a Mexican Salt Mine)

AST has much
superior corrosion resistance

Chrome Plate @ 682 hrs.



AST Coating @ 3,200 hrs.



AST vs. Chrome Plate:

A Win-Win for all

— HVOF Coating

- RC 90 Hardness
- Generates No Hazardous Waste
- 200+% Seal Life
- Superior Corrosion Resistance

— Chrome Plate

- RC 68 Hardness
- Process Generates Extensive Hazardous Waste
- Seals Degrade
- Cracked layer allows Corrosion to undercut coating

AST: ~~Reduced Impact~~ NEAR ZERO IMPACT

- ZERO** Toxic airborne emissions
- ZERO** Gallons of effluent released to the Des Plaines River
- ZERO** Pounds of Hazardous waste shipped to landfills



AST reduces Caterpillar Joliet's
Total Hazardous waste by **85%**

AST: Safer

- Minimizes a hazardous air pollutant
- Reduced the number hazardous chemicals on site



AST: Better Quality

- Increased hardness
- 4x or more increase in wear resistance
- 2x improvement in seal life



Caterpillar continues to demonstrate that a strong focus on social responsibility and sustaining the environment contributes to delivering strong financial results and creates profitable growth opportunities.

Sustainable Manufacturing in Action:

Cat AST



© 2009 Caterpillar Inc. All Rights Reserved

CAT, Caterpillar, their respective logos, "Caterpillar Yellow" and the POWER EDGE trade dress, as well as corporate and product identity used herein, are trademarks of Caterpillar and may not be used without permission.

CATERPILLAR®
TODAY'S WORK. TOMORROW'S WORLD.™

Caterpillar Remanufacturing

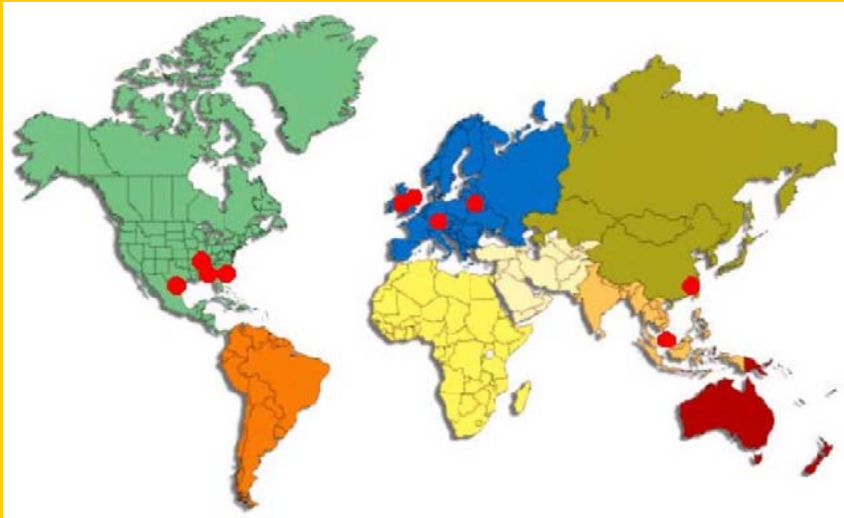
June 15-16, 2010



Who is Cat Remanufacturing?

- We are the global leader in providing differentiated and integrated Reman and Life Cycle products and services to our customers.
- We leverage and continuously improve our capabilities to be: :
 - The partner of choice for Customers-Cat & Non-Cat
 - The industry leader in applying Technology
 - The recognized leader in Sustainable Development
 - The industry leader in Safety, Quality, Velocity, and Cost.

Our Global Footprint...



Resources

- 37 years of experience
- 18 facilities
- 2.4M sq ft of manufacturing
- 4,000 employees dedicated to reman
- Leverage Cat R&D spend

Products

- 2.3M units (139M lbs) recovered
- +6000 different products
- Full line servicing Cat engines & machines
- Remanufacturing & Sustainable Solution services for 3rd party OEMs
 - Auto, truck, rail, industrial, military



Services We Provide...

Dealer Channel Services
Used Parts
Marketing
Product Engineering
Pricing

New Product Intro.
Reman Strategy
Customer Service
Obsolescence Mgmt
Production Transition

Core Processing
Core Purchase
Transportation
Packaging Design
Customs
Core Criteria

New / Reman
Order Processing
Procurement
Supplier Development
Kitting

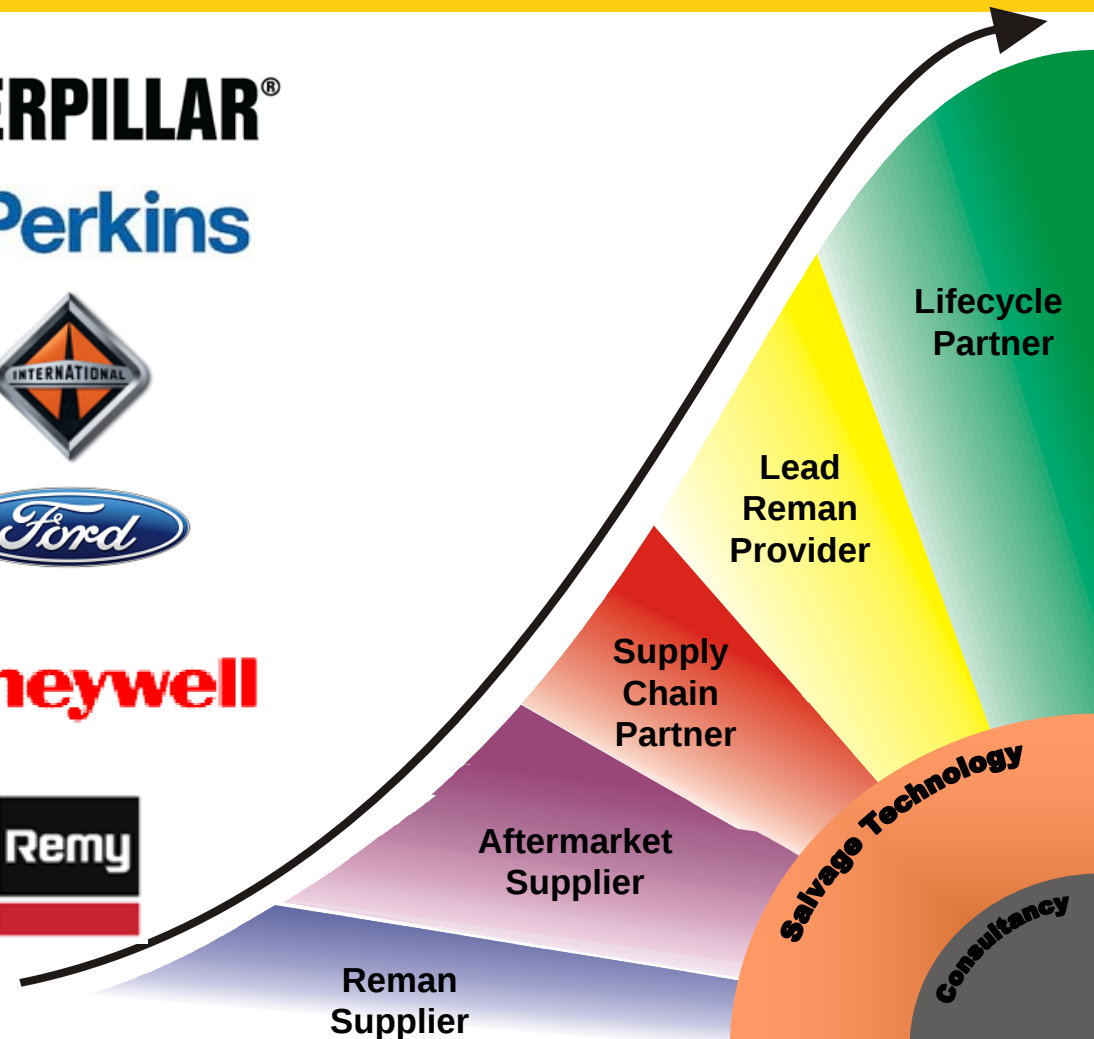
Reman Supplier
Contract Reman

CATERPILLAR®

Perkins



Honeywell



—From Supplier to Lifecycle Management Partner

Typical Non-Caterpillar Reman Products...



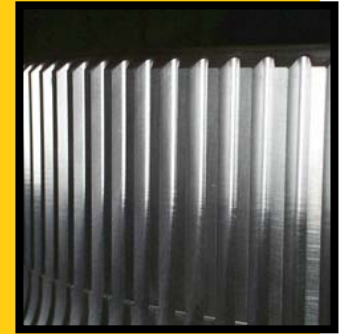
Dragline thrust washer



NASA Valve



Spool shaft



Splined shaft



Stabilizer



Misc. shafts

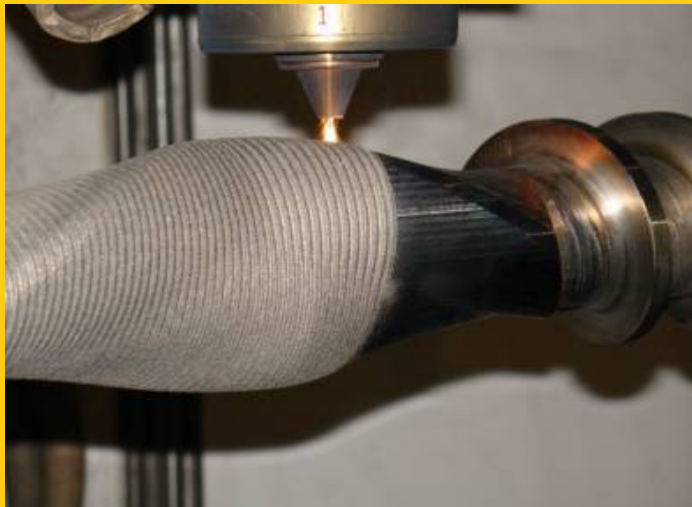


Screw shaft



Rotor

Technology in Process...



HOVF
Recasting
Bore Spray
Laser Cladding



Caterpillar Contact for further Information

- Tony Zampogna – Commercial Manager
 - Caterpillar Remanufacturing – Industrial Solutions
 - Phone : (843) 847-2218
 - E-Mail : Zampogna_Tony_M@Cat.com