



**ALCOA**  
— ★ ★ ★ ★ —  
**DEFENSE**

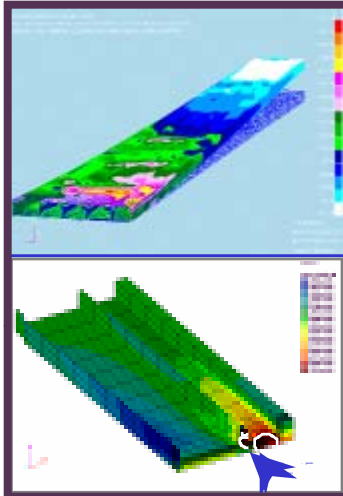
LIGHTER, FASTER, STRONGER

# Engineered Surfaces & Advanced Tribology (ESAT)

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# Focus for Navy Shipbuilding




**1** **Structural Design**

Alcoa is a proven industry partner in providing design solutions for aluminum structures and draws on a wealth of propriety tools and models



**2** **Alloy Development**

Alcoa is a leader in aluminum alloy research and development and has led in custom breakthroughs in close cooperation with industry partners



**3** **Marine Coatings**

Alcoa's coatings expertise promises to address critical fire resistance, friction and non-skid issues and can be delivered as a systems solution to the Navy



**4** **Joining Technology**

Alcoa's advances in next-generation joining technology has made it an industry leader in Friction Stir Welding and related process tool development



# ESAT Technology Marketing Study

**The political and budgetary climates are right for considering ESAT**

- Congress has shown interest in reducing operations & maintenance costs overall, and corrosion-prevention research in particular has been robust
- Light weighting in the interest of energy savings is a significant driver



**To understand current and projected limitations of further use of Aluminum for defense customer applications**

- Manufacturing issues
- Performance in fire & high temperature exposure
- Concerns about corrosion, sensitization, ballistic performance, etc



**To articulate how ESAT innovations can equip Alcoa aluminum products with characteristics desirable to defense customers**

**Fire  
Barriers**

**Non Skid**

**Insulation**

**Anti  
fouling**

**Corrosion  
Protection**

**Wear &  
Durability**

**Chemical  
Absorption**

**Self-  
Cleaning**

**Signature  
Control**

**Sealing &  
Self-Healing**

**Color  
Change**



**To gain feedback to help prioritize and focus developments to help meet customer's needs**



# Engineering Surface to Lower Alcoa Production Costs

**Applying Engineered Surfaces  
Competency to Eliminate  
Recurring Maintenance &  
Reliability Problems**

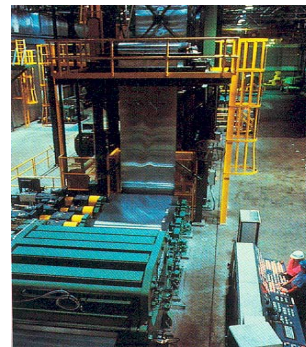
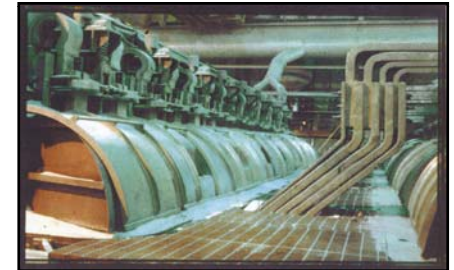
**Benefits of Engineered Surface  
Currently Used to Eliminate  
Waste in Alcoa's Processes**

- Longer tool life
- Better surface quality
- Greater reliability
- Lower costs
- Lower EHS footprint

**Refinery  
Process**



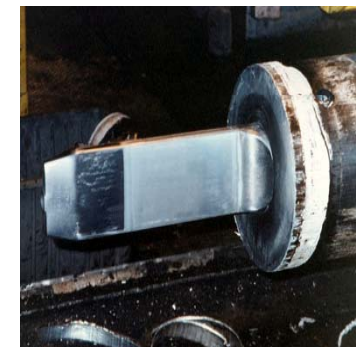
**Smelting  
Process**



**Rolling  
Process**



**Forging  
Process**



**Extrusion  
Process**

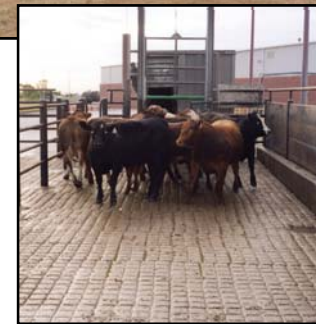
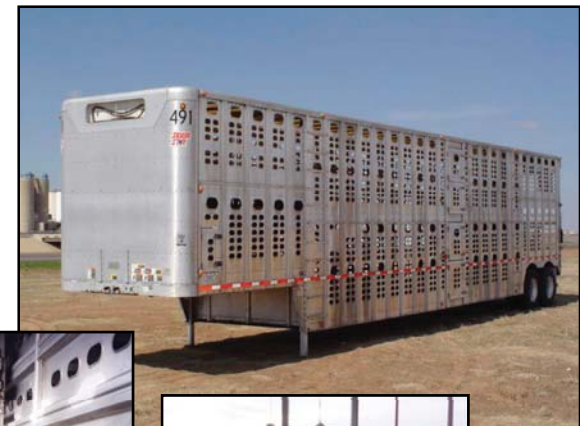


# Engineering Surface to Enhance Product Performance – Our Humble Beginnings

Applying Process Technology to Product Innovation to Turn Fabricating Process Success into Value-Added Products

## Coating Applications

- Truck bed liners
  - Low-friction, corrosion-resistant and wear-resistant
- Livestock trailer beds
  - Corrosion-resistant and anti-slip
- Prototype coated cast aluminum brake rotors





# Dura-Bright® Surface Treatment for Wheels

- Unique wheel product
- Not a coating or finish
- Patented treatment that penetrates the aluminum
- Keeps wheels bright and shiny
- Easy to clean; no scrubbing or polishing
- Regular soap and water washes
- Corrosion-resistant
- Low maintenance
- Durable
- Extended wheel service life
- Cost-effective
- Extremely positive market response





# Alcoa Dura-Flange™

*Who says you can't use aluminum for high-wear applications?*



## Alcoa Dura-Flange™ Technology

- Reduces or eliminates rim flange experienced by mass transit carriers and heavy/severe service haulers
- Provides a low-cost protective coating
- Reduces long-term wear
- Maintains strength of aluminum
- Enhances safety

# Durable Turbine Blades

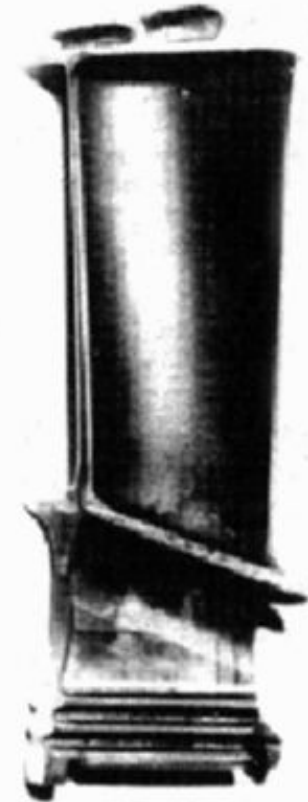
## Improve Heat Resistance

Jet engine temperatures exceed >2000 F – hot enough to weaken titanium alloys. Thermal barrier coatings have been developed that enable titanium to survive in this extreme environment.

Application of similar technology allows the use of aluminum in high-temperature environments without the fear of substrate melting and buckling – a route to lightweight, durable structures.



Uncoated



Coated



# ESAT Technology Marketing Questions

- Who are the key organizations and/or people we should meet?
- Which of these functionalities are of greatest interest with respect to current needs?

Fire  
Barriers

Non Skid

Insulation

Anti  
fouling

Corrosion  
Protection

Wear &  
Durability

- In which specific application?
- Which of these functionalities are of greatest interest with respect to emerging needs?
- Is there an issue with Aluminum that you or your customers would like to see a step change in performance?