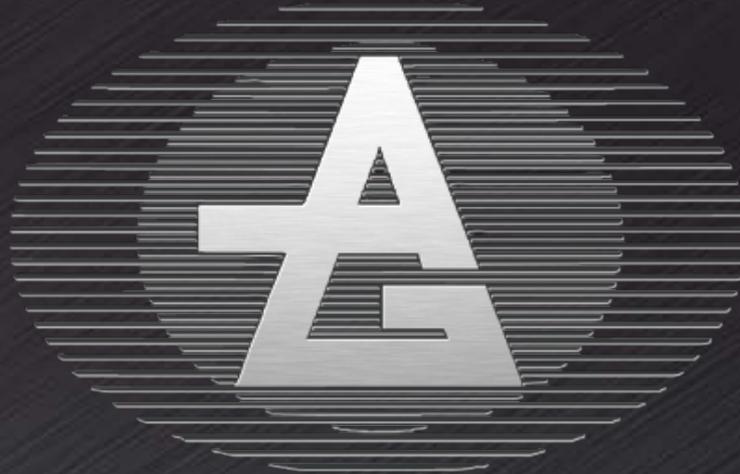


Tagnite PEO Process for Gearbox Overhaul



TECHNOLOGY APPLICATIONS GROUP
EXCELLENCE IN MAGNESIUM SURFACE PROTECTION

ASETSDefense 2012
San Diego, CA August 27 – 30, 2012

Bill Elmquist – President

Report Documentation Page

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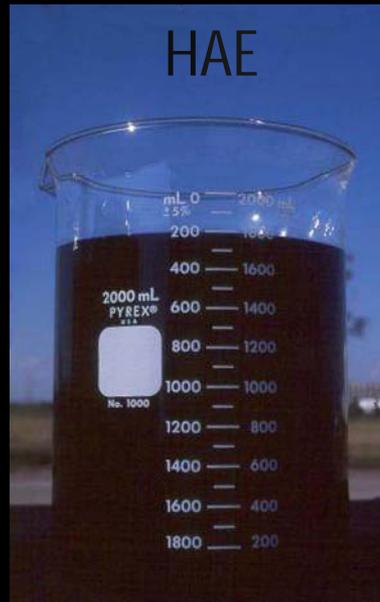
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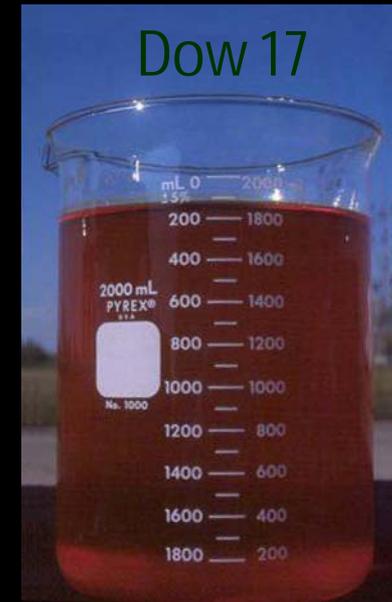
Environmentally Clean Magnesium Finishing



5% * chemical concentration



25%* chemical concentration

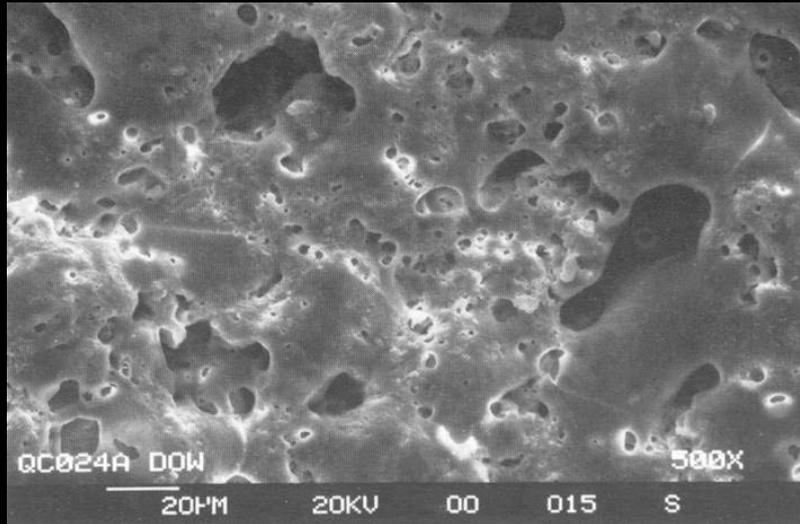


56% * chemical concentration

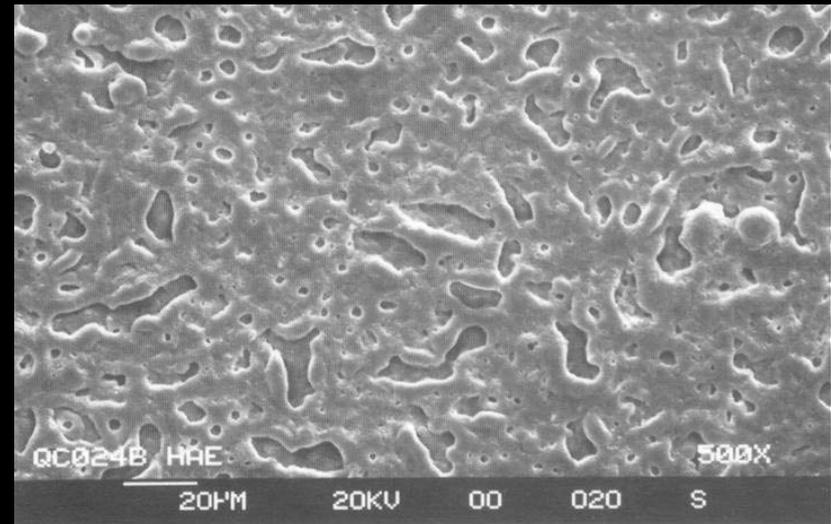
HAE contains heavy metals; Dow 17 contains heavy metals and chromium

* Approximations

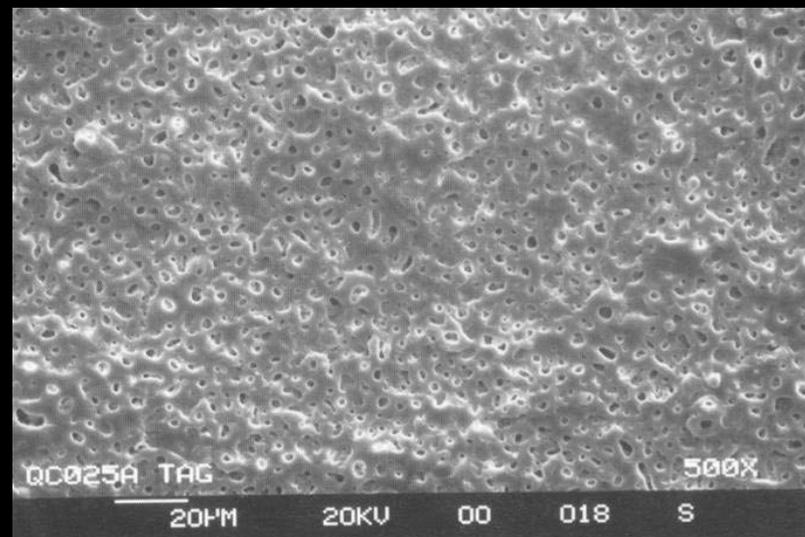
Coating Morphology



Dow 17



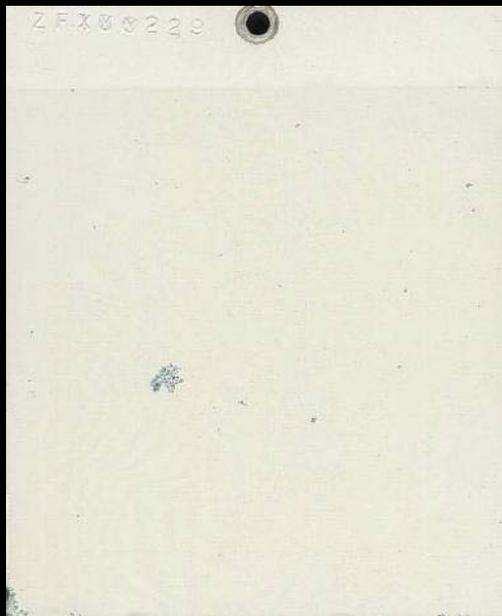
HAE



All photos shown at
500x magnification.

TAGNITE®

Superior Corrosion Resistance



TAGNITE®



HAE



DOW 17

TAGNITE®, HAE & Dow 17 (Type I) on magnesium alloy
ZE41 after 168 hours in salt spray

Only Tagnite Provides Inherent Corrosion Resistance



CH-53



AH-6



F-35 Fighter



F-22 Fighter



MD 500/600



USMC EFV



AH-64 Apache



Pratt & Whitney PT-6 Engine



KC-135 Tanker

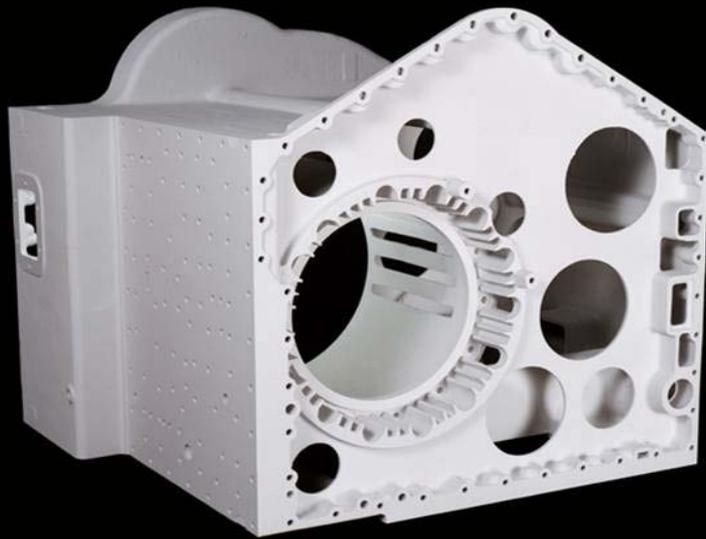


B-52 Bomber



Pratt & Whitney 308 Engine

Widely Specified



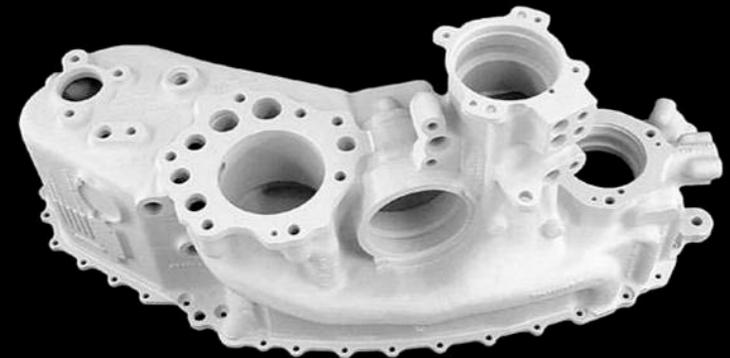
Magnesium Transmission Housing



Magnesium Oil Pan



Magnesium Gearbox



Magnesium Jet Engine Gearbox

Environmentally Clean Magnesium Finishing Since 1994

Why Anodize a Magnesium Component During Overhaul

- Magnesium Corrosion is a Costly Issue Affecting Most All DoD Platforms
- Current Overhaul Coatings are Mostly Chromate Conversion Based Processes That Provide Little Corrosion Protection
- These Poor Performing Conversion Coatings Have Resulted in High Life Cycle Costs for Most Magnesium Components

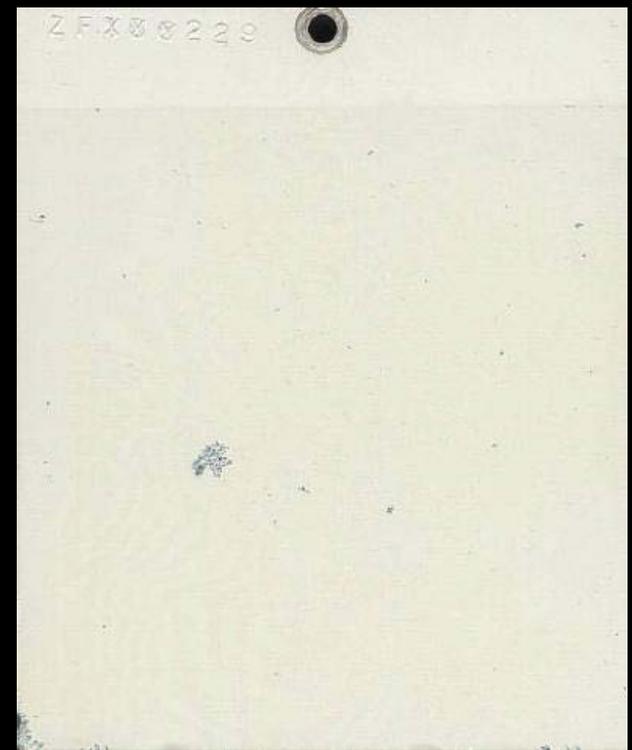
Superior Corrosion Resistance Without the Environmental Headaches of Hexavalent Chromium



Dow 19 Chromate
Conversion 9 Hours
Salt Fog Exposure

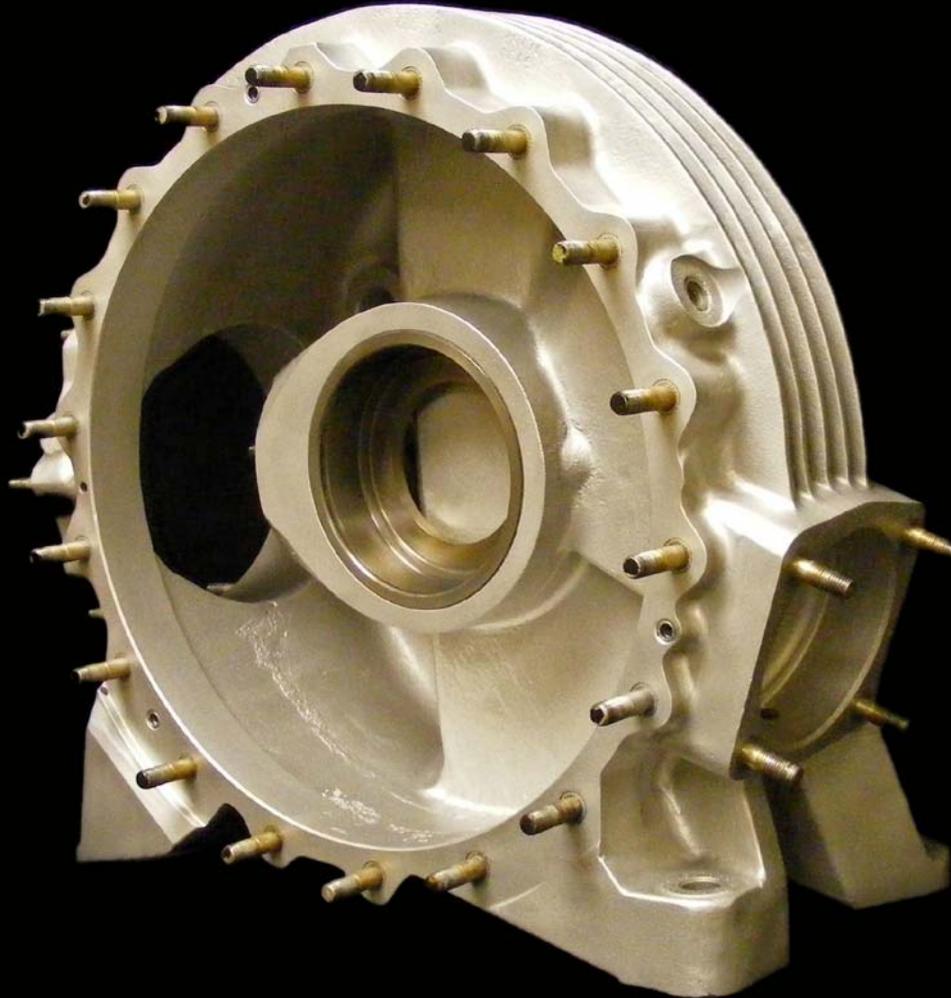


Dow 7 Chromate
Conversion 9 Hours
Salt Fog Exposure



Tagnite Anodize
168 Hours Salt Fog
Exposure

Why Use An Ineffective Chromate Conversion Coating During Overhaul?



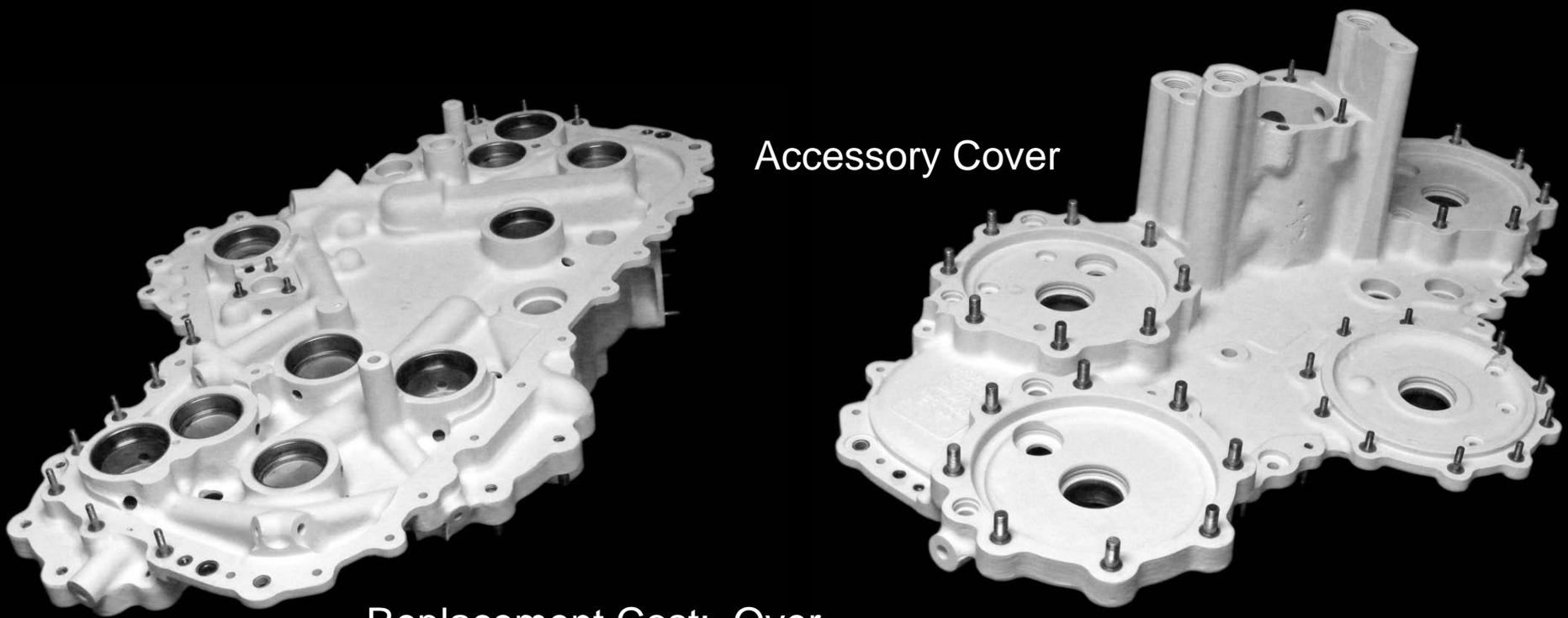
Because You Can't Anodize in Presence of Ferrous Metal Inserts. Chromate Conversion Coatings are Compatible with Ferrous Metal Inserts.

The Solution is to
Mask The Ferrous
Metal Inserts to Allow
Successful
Anodization to Occur

Successfully Anodized
After Masking:

6 Steel Bearing Liners
42 Helicoils
52 Studs

Why Spend Hours Masking Ferrous Metal Inserts to Allow Anodization When Chromate Conversion Coatings Are Inexpensive and Easy to Apply?



Replacement Cost: Over \$45,000

Because Magnesium Castings are Expensive And Require Long Lead Times to Replace

Masking Ferrous and Anodizing Could Allow Overhaul Parts to be Better Protected Than OEM New

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Matting Faces are Often Times Re-Machined After Bearing Liners are installed. This Now Bare Magnesium is Then Typically Treated with a Chromate Conversion Coating



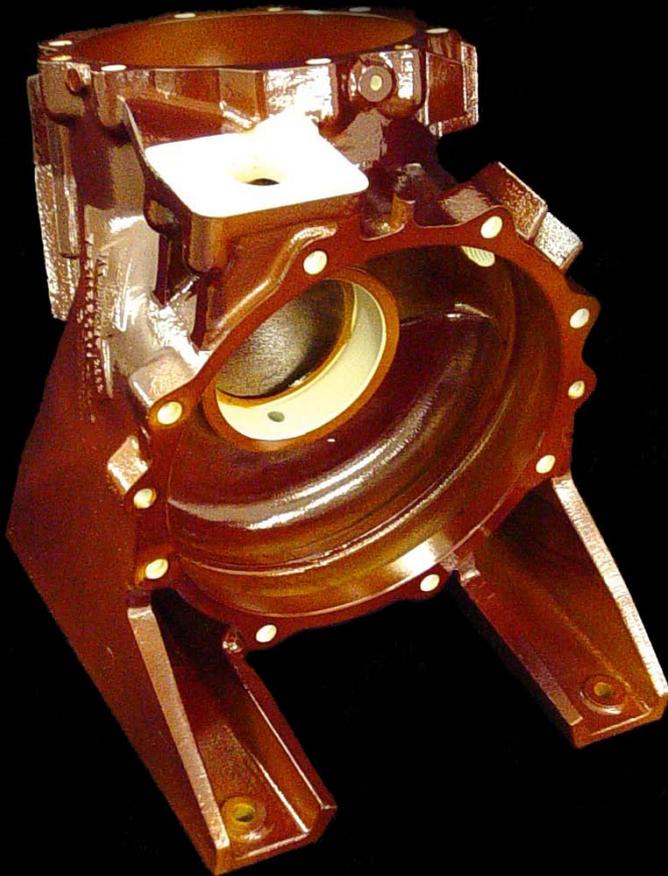
Before Bearing Liner
Installation



Post Bearing Liner
Installation Machining

Next Step – Apply
Chromate Conversion
Coating to Now Bare
Magnesium

Before Bearing Liner
Installation

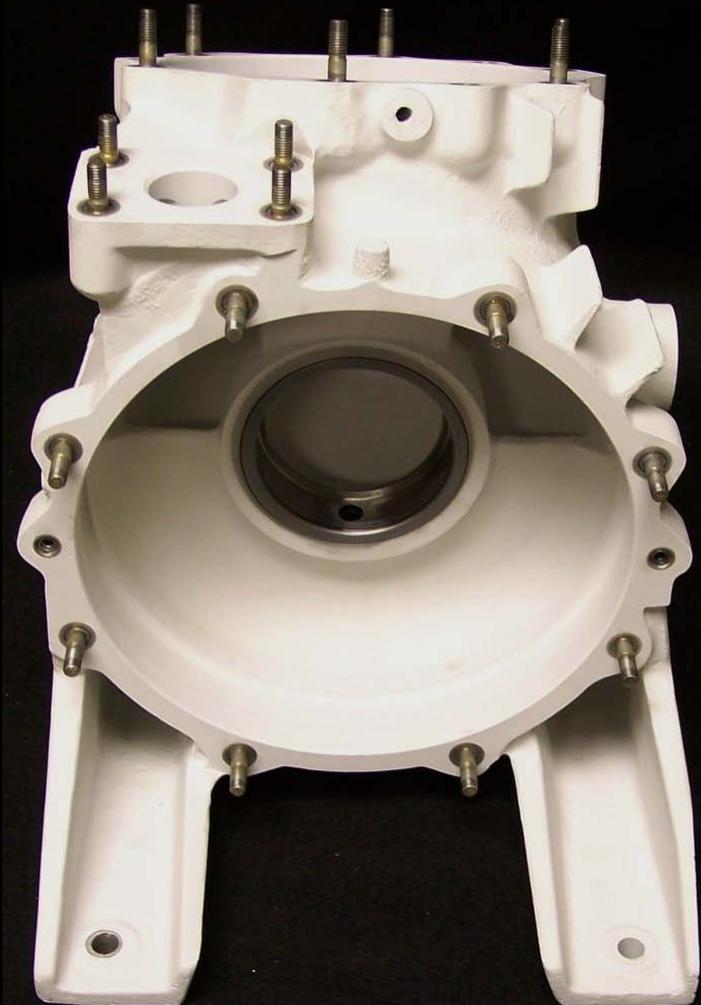
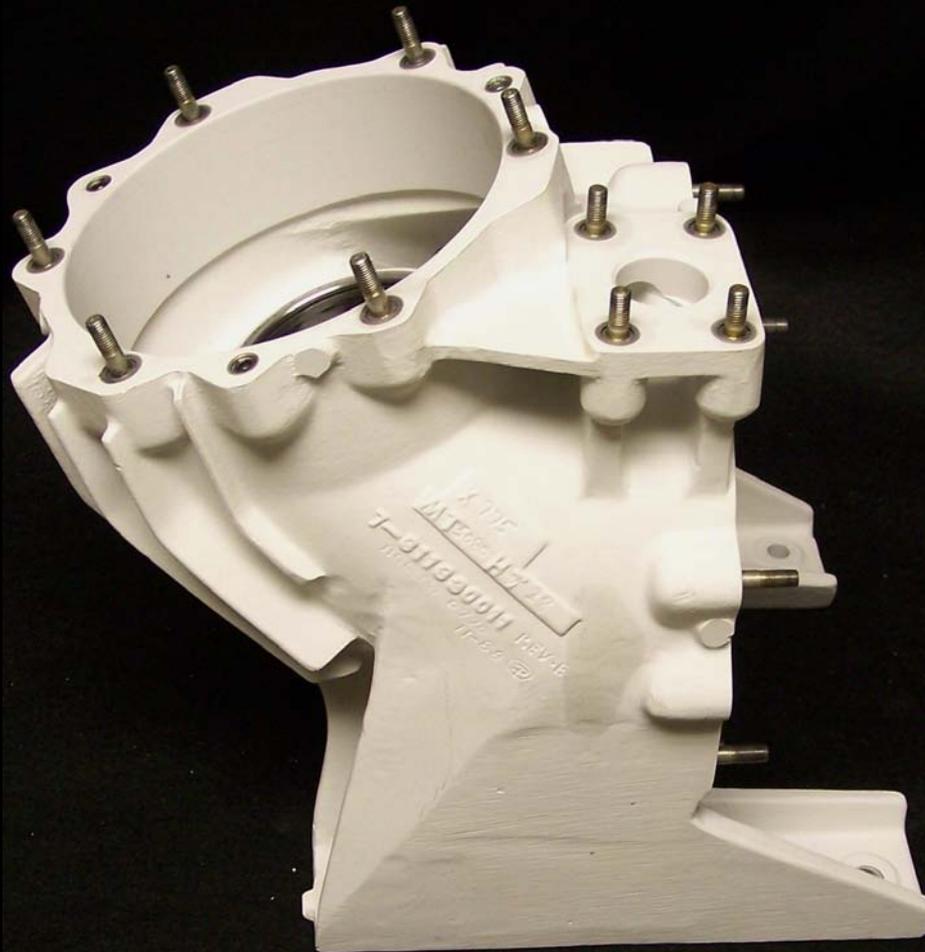


Post Bearing Liner
Installation Machining



Next Step – Apply
Chromate Conversion
Coating to Now Bare
Magnesium

Solution – Mask Ferrous Metal Inserts and Apply Chromate Free Anodize



Post Bearing Liner Installation Machining

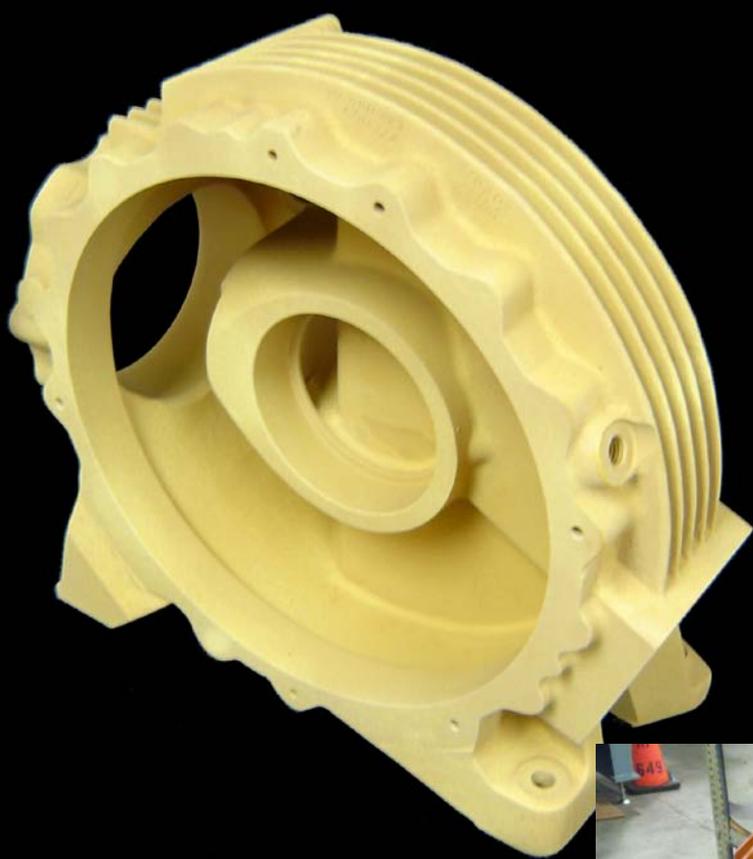
Next Step – Apply Chromate Conversion
Coating to Now Bare Magnesium

Before Bearing Liner Installation



Solution – Mask Ferrous Metal Inserts and Apply Chromate Free Anodize





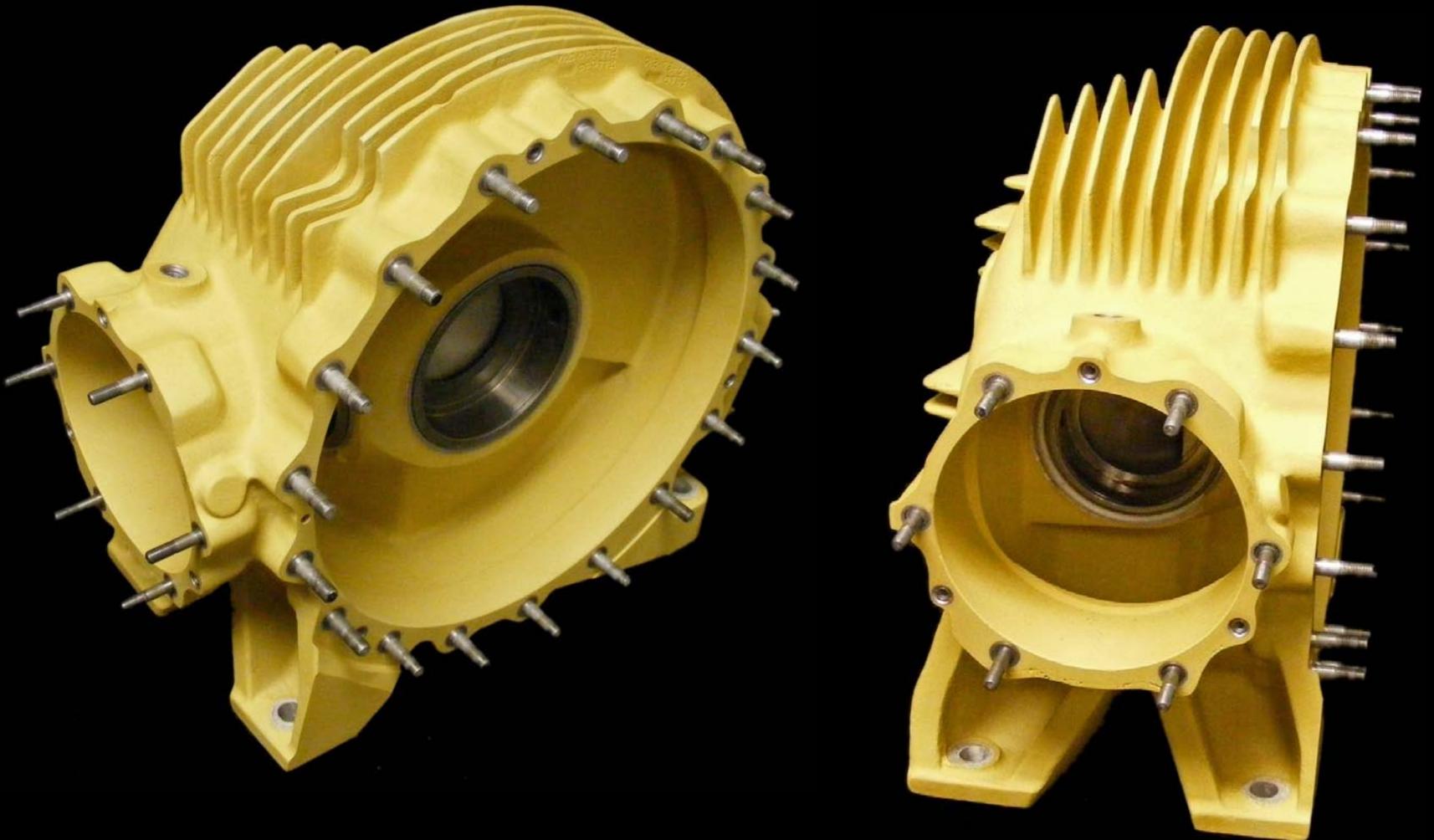
Post Bearing Liner Installation
Machining

Next Step – Apply Chromate Conversion
Coating to Now Bare Magnesium

Before Bearing Liner
Installation



Solution – Mask Ferrous Metal Inserts and Apply Chromate Free Anodize



TAG Demo Parts – As Received

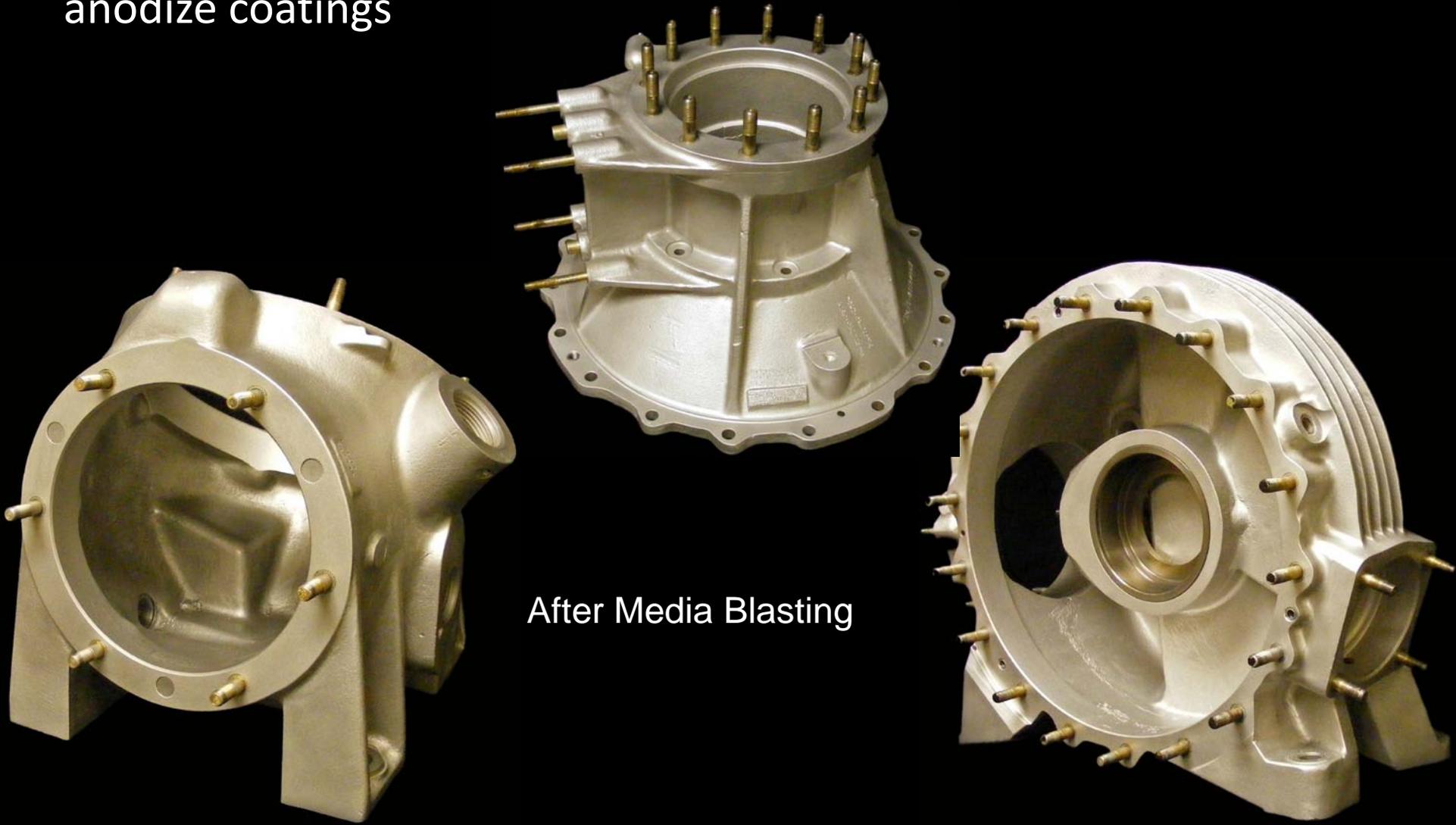
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As received condition of scrap castings as part of an IBIF III project



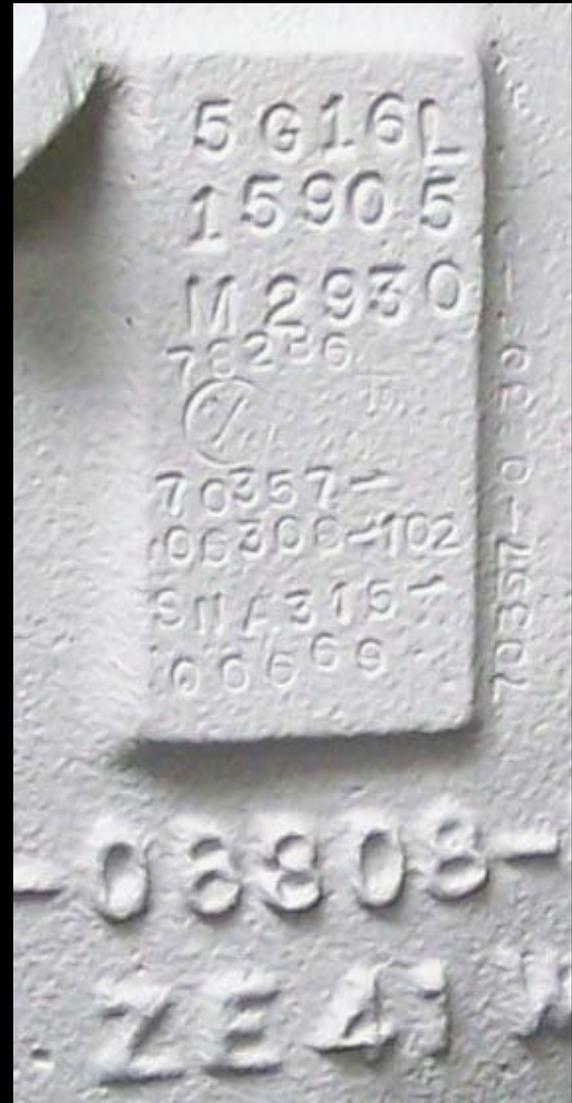
Key to Successful Anodization of Used Magnesium Castings is Starting with a Clean Casting that is free of paint and old anodize coatings



After Media Blasting

After Media Blasting and Tagnite Anodization Small Data Markings Still Clearly Visible

Hand Scripted
S/N still intact





Approved by Many Aerospace and Defense Companies, Brush Tagnite is an Effective Method to Touch-up Magnesium Castings Without Using Hexavalent Chromium



Why Go Through the Expense of Masking Ferrous Metal Inserts? Magnesium Castings are Expensive and Conversion Coatings are Ineffective



Bare ZE41A 9 Hours
Salt Spray Exposure



Dow 7 ZE41A 9 Hours
Salt Spray Exposure



Dow 19 ZE41A 9 Hours
Salt Spray Exposure

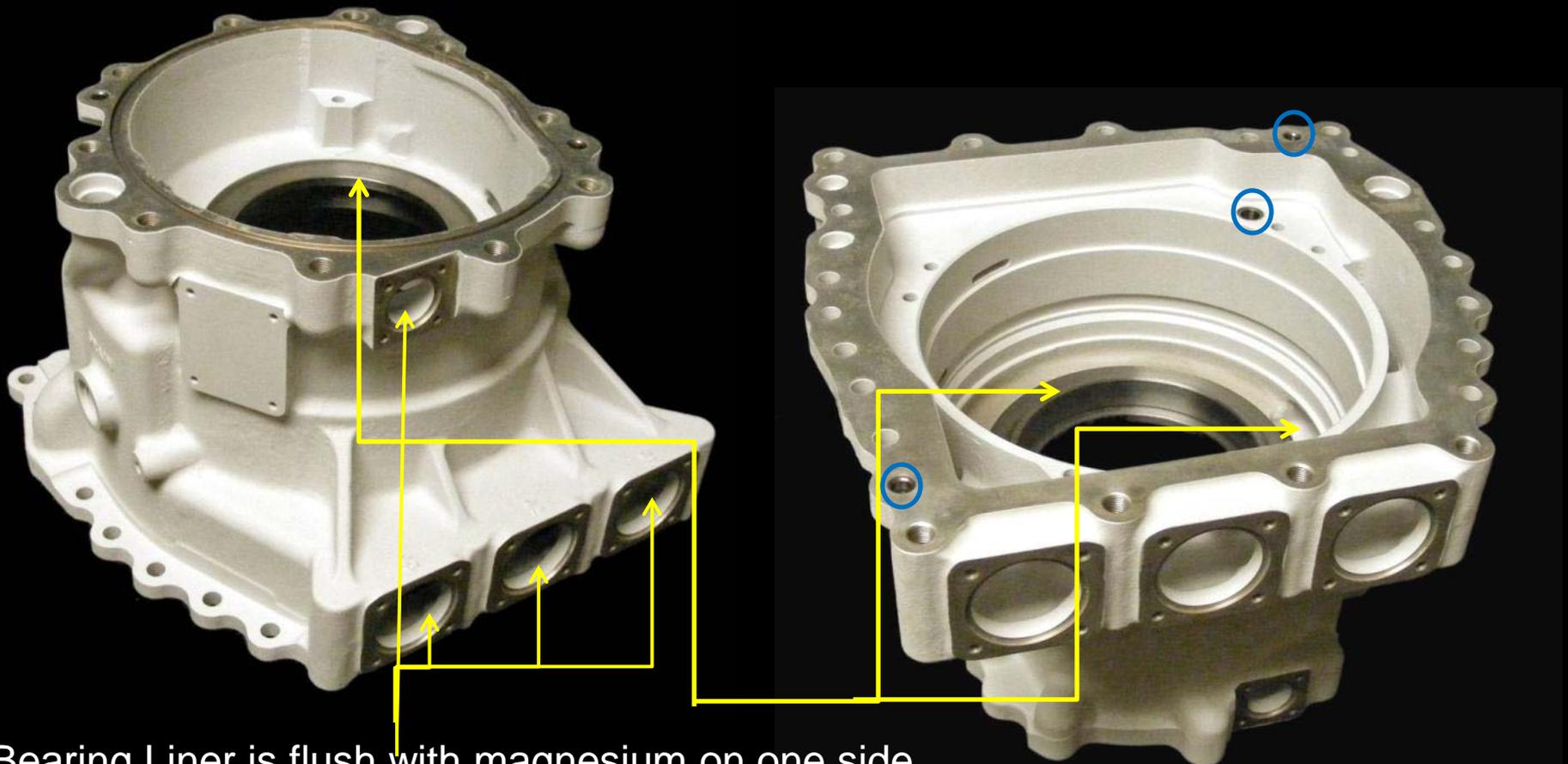
Tagnite In Use Now on Used KC-135 and B-52 Magnesium Components

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- By selecting Tagnite the Air Force was able to eliminate hexavalent chromium and attain corrosion resistance superior to standard chromate conversion coatings typically used during overhaul
- Tagnite has been employed now on 33 different part numbers between the B-52 Bomber and KC-135 Tanker
- Well over 500 KC-135/B-52 Bomber components have been successfully coated with Tagnite.

Over 75 Units of This Production Part Number Have Been Successfully Anodized After Masking Ferrous Metal Inserts.



Bearing Liner is flush with magnesium on one side
And raised above magnesium on other side. On raised side
a core passage way comes directly to bearing liner.

○ Multiple Pressed in
Steel Bushing

Summary

- It is Possible to Avoid Hexavalent Chromium When Finishing New or Used Magnesium Aerospace and Defense Components
- Masking of Ferrous Metal Inserts is Expensive and Time Consuming but that Cost Represents a Small Fraction of the Replacement Cost of the Parts

A large, stylized graphic element consisting of a metallic, teardrop-shaped swoosh that curves from the top left towards the bottom right. The word "TAGNITE" is rendered in a bold, metallic, 3D-style font, appearing to be attached to or emerging from the right side of the swoosh.

TAGNITE



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EXCELLENCE IN MAGNESIUM SURFACE PROTECTION

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