Worthington Automotive

For 60 years, we have been North America’s premier, value-added steel sheet processor, providing our automotive customers with the widest range of capabilities, products and services.

- Automotive is Worthington’s largest market segment
- Over 200 ship-to locations that include over 2,750 active parts
- NAFTA footprint supplying material into the US, Canada & Mexico
- OEM qualified as a mill & service center supplier.
- Ship directly into OEM facilities, Tier 1 & Tier 2 suppliers
- Supplier of steel and aluminum materials & services via our JV’s with TWB, ArtiFlex, WSP and Serviacero Worthington

- Industry leader of Cold Rolled Strip steel for powertrain and transmission
- Approved supplier of HR & CR HDG via our Delta OH & Monroe MI facilities
- Full line supplier of steels for Automotive including AHSS and PHS grades.
- Robust commitment to forecast accuracy, S&OP planning & predictive analytics
- Company-wide team approach to review, manage & launch complex programs
- Comprehensive commercial approaches including price risk management & mill matrix pricing options.
Industry Leading Capabilities

- Pickling
- Tension Leveling & Temper Rolling
- Slitting
- Oscillate Slitting
- Laser Blanking
- Configured Blanking
- Cold Rolled Strip
- Galvanizing
- Annealing
- Primacoat / Dry-Lube
- Tailor Welded Blanks
- Cut-to-Length

- Low carbon steels
- High carbon steels
- Alloy steels
- HSLA, AHSS and UHSS
- Aluminum
REGULATORY WEIGHT SAVINGS GOALS:
7% MASS REDUCTION = 270 POUNDS (MIX DEPENDENT AND APPLIED ACROSS THE FLEET)

Mass reduction strategies are variable based on vehicle size and architecture; larger passenger cars and light trucks have greater mass reduction targets as compared to smaller vehicles and based on the entire fleet.

Over 70% of the passenger cars will require mass reduction between 263 pounds per vehicle and 350 pounds per vehicle.

Nearly 30% of the light trucks will require mass savings of approximately 840 pounds.

Annual weight reduction targets goes from ~20 lb’s per year for 2015 to 2020 to ~34 lb’s per year for 2021 to 2025 or 7% reduction from 2015.

**Calculations are averages for the entire fleet**

Source: Ducker Analysis, Draft TAR Chapter 13
CLOSING THE COMPLIANCE GAP IS A MULTISTEP PROCESS

Where is the Weight: Light Vehicle Mass Distribution

Body & Closure 25%
Chassis Suspension & Steering 13%
Engine 15%
Transmission & Driveline 12%
Fuel & Exhaust 6%
Interior 5%
Glass, Paint, Trim 5%
Wheels & Tires 4%
All Others 4%
Electronical & Electronics 1%
Braking 1%
HVAC 1%
Bumpers

Level 1 - Material Substitution
One to One Part/Material Substitution: Closures, Bumpers, Knuckles, Control Arms etc.

Level 2 - Holistic Weight Saving Designs
Parts Consolidation, Multi-Form & Multi Material: sub-frames, front end modules, shock towers, door rings etc.

Level 3 -
Glazing/glass, coatings, interiors, etc.

Body parts, closures, bumpers, chassis and suspension parts are the prime candidates for further weight reduction

Source: Ducker Analysis
Confidential © Ducker Worldwide
It is unlikely there are breakthrough lightweight materials awaiting discovery – refinement of what is available today.

- New applications of body and structural aluminum for a growing number of applications: replacing stamped & welded mild steel
- Mg castings for seat frames as well as closure inner panels perform well when paired with aluminum outer panels
- Carbon fiber as structural patch-work to enable further light-weighting is beneficial
Automotive Material Replacement – Lightweighting

• **Body Structure & Chassis**
  – Low Carbon to HSS and AHSS (re-enforcements, non load-path structure, etc…)
  – HSS to AHSS and Press hardened (load path components, roll-over, torsional rigidity)
  – Closures to Aluminum (inners and outers: deck lid, hood, door, fenders)
  – Non-load path components to HPDC & VDC - Aluminum and Magnesium
  – Structures to Aluminum Sheet, but also:
    • Part consolidation into Aluminum HPDC (typically at structural nodes)
    • Al extrusions replacing stamped or roll formed steel sections
    • Movement towards HSS and AHSS in BOF vehicle chassis
  – Safety parts to PHS and PQS (experimentation with energy absorption parts)
  – Tailor Welded and Tailor Rolled blank usage increasing
  – Laminates for lightweighting and NVH
  – Carbon Fiber Reinforced Plastics

• **Interior Systems**
  – Low Carbon to HSS, AHSS & custom designed grades
  – Mixed / customized solutions
    » Castings, Tubular Sections, Extrusions, Other

**Key Material Shifts**

Sheet steel in strengths approaching 1800MPA at time of processing.

More PHS / AlSi coated products

More Aluminum Sheet

More complex products with special set-ups & handling
Considerations:
- Safety
- Process set-up / control
- Handling equipment loading (transfer rolls, shears)
- Increased cutting surface wear (erosive wear and chipping)
- Leveling (capability, product range)
- Higher press / die loads
- Long-Term base equipment wear

Materials:
- HSLA 700 MPA & higher
- Dual Phase
- Press Hardening
- Martinsitic
- Multi-Phase
- TRIP
- Generation 3

Service Center Equipment – Steel Sheet

Source: AIS/GMDX, Ducker Analysis
Service Center Equipment - Aluminum

Considerations:
- Coil Size
- Leveling
- Oiling / Lube
- Surface contamination
- Scrap segregation
- Coil Storage

Source: LMC Automotive, Ducker Analysis
Equipment Capabilities – Need to add value to the diverse new material mix

- Curvilinear welding
- Tailor welded coils
- Tailor welding of AHSS
- Tailor welding for hot formed parts
- Aluminum Tailored blanks

- “Higher” Strength Low Alloy
- Advanced and Ultra High Strength Steels
- Press Hardenable Steels
- Aluminum
- Specialty Properties
- Specialty / Improved Surface
- Specialty Lubricants

- Coil Fed Laser Blanking
- Surface Inspection System
- New Blanking Capabilities
Automotive Service Center Model is Changing

- Vehicle Lightweighting is forcing significant change to traditional supply models
  - Increase in number of materials utilized by OEM’s
    - Shift away from traditional materials
      - Aluminum substitution
      - Steel strengths going higher
      - Laminates
    - Part Specialization
      - Dimensional diversity
      - Grade diversity
    - Fewer qualified suppliers
    - New material characteristics
      - Incoming Shape
      - Work Hardening
      - Surface / Coating
  - Increasing number of Vehicle Platforms
    - Higher number of items to manage
    - Tendency towards higher inventory requirements
    - Increasing tooling costs

Sources: U.S. Department of Energy Vehicle Technologies Program; Center for Automotive Research, IHS Automotive

Improving Equipment Capabilities to align with material trends

Product Development to align portfolio with changing needs

Continual Improvement of Supply Chain Management practices
Supply Chain Management - The New “Norm”

• Demand Planning and S&OP crucial to success
  • Product Diversity increasing – Increased # inventory items
  • More internal scheduling constraints
  • Mill batching of specific chemistries / materials - causing larger product pull than modeled optimum
• Material aging considerations forcing:
  • Enhancements to existing inventory control systems for more visibility
  • Strict adherence to inventory policies
• Higher inventory carrying costs due to higher material value
• Options for replacement material upon shortage reduced – Safety factors increased
  • Fewer qualified / capable mills
  • Fewer cross-part application opportunities
  • Extended Supply chains
• Speed of change increasing
Forecasting and optimization are complex

“Our forecasting software has the latest technology. Unfortunately, our hardware is a legacy system.”

“Come on! It can’t go wrong every time...”

“It was someone from corporate’s idea to improve our inventory turns.”
Successful Supply Chain Management requires COMMUNICATION, COLLABORATION and INTEGRATION.

- Up the supply chain to:
  - Suppliers & Suppliers’ suppliers
  - Plants & Sister plants
  - Outside processors

- Down the supply chain to:
  - Customers
  - Distribution centers
  - Sister plants
  - Transportation Partners

Demand

Forecasting
Demand Planning
Order Management
Distribution Planning

Volume
S&OP

Mix
Master Scheduling/MRP

Strategic Planning

Business Planning

Supply

Capacity Planning
Supply Planning

Industry 4.0?
Summary

Automotive Lightweighting directly influences how automotive service centers operate

Material substitutions in the automobile manufacture will significantly challenge existing equipment capabilities – requiring capital improvements, new operating procedures and a heightened focus on safety

Given the rapid market changes, an integrated supply chain management approach is essential to business success
THANK YOU