During this session, you will learn how...

- Statistical Forecasting can synchronize consumer demand and vehicle production
  - Manufacture the right types and numbers of vehicles at the right time (Demand-Driven Forecasting)

- Predictive Models can synchronize consumer demand and Dealer inventory
  - Determine the right mix of models and options to deliver the right vehicles to the right dealers at the right time (Fastest Moving Vehicle).
Benefits

- Match customer demand with plant production
- Match vehicle configuration with plant capacity restrictions
- Optimize plant production schedules
- Improve Dealer Order Management
- Improve Inventory Management (reduce Days on Lot)
What is Forecasting?

The process of coming up with a best unbiased guess about the future.

Estimating in unknown situations.

Estimating future trends by examining and analyzing available information.

Estimating how a condition will be in the future.
What’s different about Statistical Forecasting?

- Ability to separate signal from noise.
- Remove human bias/prejudice/“gut instinct.”
- Tease out subtle patterns in the data.
- Bound uncertainty about the future: confidence intervals.
- Identify important “drivers” to enable “what if” scenario modeling ability.
- Assess the impact and repeatability of events.
- Address data issues.
- Address structural issues (hierarchies).
Results Of Poor Forecasting

Forecast Error

Over-forecast
- Excess Inventory
- Inventory Holding Cost
- Transshipment cost
- Obsolescence
- Reduced Margin

Under-forecast
- Order Expediting Cost
- Higher Product Cost
- Lost “Sales” Cost
- Lost Companion Product Sales
- Reduced Customer Satisfaction

Taken from: “How to measure the impact of a forecast error on an enterprise?” by Kenneth B. Kahn
Best In Class Companies in Demand Forecasting are…

- 2X as likely to have increased market share
- 56% more likely to have improved gross profit margin
- 1.5X more likely to improve order fulfillment
- 3X more likely to have forecast accuracy > 70%

Source: Aberdeen Group, June 2010
How Important is a Good Forecast?

- A rather simple view that sums it all …

Source: AMR/Gartner, January 2005
Vehicle Demand Management

Strategic Level

Demand Forecast

Business plan

Demand Plan

Business Objectives

Production Plan

Production Constraints

Operation Level

“How many cars can be sold?”

“How many cars can we produce & ship?”
Vehicle Demand Forecast

- **Input Data**
  - Sales History
  - Predictor Variables

- **Demand Forecast Modeling**
  - Modeling for Existing car
  - Modeling for New car

- **Demand Plan**
Demand Forecast (sample)
Value of Demand-Driven Forecasting

- Provides forecasts at appropriate hierarchy
- Provides ancillary information for reporting, benchmarking
- Provides for improved Production Planning
- Provides flexible forecasting window – based on business needs
- Provides closed loop feedback with Dealer forecast
- Provides feed for predictive model
  - Forecast future demand using both history and external factors.
  - Use forecasted values of customer demand as better predictors for Dealer “recommended orders”.
  - The “recommended orders” should reflect what customers are likely to want going forward rather than what they may have wanted in the past.
1) Both are a **prognostication about the Future**, and 2) Both **Model Past Behavior**

<table>
<thead>
<tr>
<th>Predictive Modeling</th>
<th>Time Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time <em>Independent</em></td>
<td>Time Dependent</td>
</tr>
<tr>
<td>“Causal” (relationship) focused</td>
<td>Interval oriented</td>
</tr>
<tr>
<td>Categorical, continuous or discrete</td>
<td>Continuity assumed</td>
</tr>
<tr>
<td>Seldom weights more recent observations</td>
<td>Weights more recent performance</td>
</tr>
</tbody>
</table>

**Forecasts tell you how many vehicles will be sold in July; Predictive Models tell you who will buy vehicles.**
‘Fastest Moving Vehicle’ – A Four Step Process

Step 1: Group (cluster/segment) dealers by product sales history
- Body Model
- Engine/Powertrain
- Paint & Trim
- Options

Step 2: Analyze Dealer sales history by cluster including external factors in effect when the car was sold and create Days on Lot (DOL) scoring formulas

Step 3: Score historical sales by cluster applying current external factors to determine predicted DOL

Step 4: Apply Allocation, Availability and Restrictions along with vehicles score and present dealer with ideal order mix

Dealer Recommendations
The Four Steps to ‘Fastest Moving Vehicle’

- **Step 1:** Group dealers together in Clusters based on similar characteristics from their past purchase behavior
  - NOT based on geography
  - Look at product specific attributes such as:
    - Body Model
    - Engine/Powertrain
    - Paint
    - Trim
    - Other options
  - Provides for a ‘Dealer View’
  - Improves the predictions
The Four Steps to ‘Fastest Moving Vehicle’

- **Step 2:** Analyze the sales history for each dealer cluster
  - Determine the impact each characteristic has on Days On Lot
    - Body Model, Powertrain
    - Paint, Trim
    - MSRP, Options
    - Dealer Size, etc.
  - Create a *Fastest Moving Vehicle* scoring formula for each cluster
  - Use the formula to predict Days On Lot for any new configuration of vehicle
  - Provide these Days on Lot values to be used in Step 3 in combination with other factors
The ‘Fastest Moving Vehicle’ Formula …

Predicted Days On Lot: **74**

1. Sales history analyzed - assigns an estimate for options available for each characteristic

2. Estimates added together along with a Base value for the nameplate to determine the predicted Days on Lot

3. Estimates will show trends and can be fed into Demand Planning
The Four Steps to ‘Fastest Moving Vehicle’

- **Step 3:** Add additional factors to the model that have influence on Days On Lot
  - External factors that show influence on the purchase decision
    - Lease/Loan Rates
    - Advertising
    - Incentives
    - Price of Gas
  - Improves the accuracy of the recommendation
  - Can be enhanced with additional factors as needed
    - Competitive offerings
    - Dealer demographics

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*It’s just a longer Cryptex*
The Four Steps to ‘Fastest Moving Vehicle’

- **Step 4: Apply Allocation, Availability and Restrictions**
  - If Dealer has available Allocation continue optimizing against availability and restrictions
  - Apply current restrictions against scored history
    - Establishes creditability with the Dealers
  - Review Dealers current store and in-transit inventory
    - Optimize dealer mix using availability and restriction free recommendations
    - Utilize both predicted Days On Lot and cluster proportions to arrive at ideal mix

![Diagram of a funnel](image)

- **Scored Vehicles**
- **Apply Restrictions** (but maintain them for scoring and validating to the dealers)
- **Optimize against availability**
- **Suggested Orders**
‘Fastest Moving Vehicle’

Analyze Vehicle Characteristics

Cluster Dealers & Predict Days on Lot

Apply External Factors

Body Model
Engine/Powertrain
Paint & Trim
Options

Allocation, Availability, Restrictions

Dealer Recommendations
Value of ‘Fastest Moving Vehicle’

- Increase inventory turns by reducing Days On Lot
- Reduce Stock Outs and Over Stocks
- Better match the Dealers inventory to their customer demand
- Present configurations that are build-able and ship-able, no more “restriction” held orders
- Feed immediate customer demand into manufacturing
- Provide OEM and Dealer with vehicle data to aid in decision-making (i.e., regional differences, DOL, highest volume sales, etc.)
- Utilize the same history to create a “True” Demand Forecast
- Build stronger Dealer relations by providing them with an automatic process to better manage and control their inventory