Nissan CVT briefing
(Continuously Variable Transmission)

Aug. 22, 2006
Nissan Motor Co., Ltd.

Yo Usuba
Senior Vice President
Agenda

1. The Powertrain concept
2. The History of Nissan CVT and Plans for Future Applications
3. CVT Expansion in North America
4. What is CVT?
5. XTRONIC CVT
6. CVT for 3.5L Engines
7. Summary
1. The Powertrain concept
1-1. The Powertrain concept

Ultimate Powertrain

- CO2 reduction
- Fuel Efficiency
- Emission
- Cleaner Emissions

- Emotion
- Performance
- Power
1-2. The Powertrain concept

- Emotion
- CVT
- Efficiency
- Emission
2. The History of Nissan CVT and Plans for Future Applications
2-1. Changes in CVT

The History of Belt CVT

<table>
<thead>
<tr>
<th>1st Generation</th>
<th>2nd Generation</th>
<th>3rd Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5L Use</td>
<td>Hyper-CVT</td>
<td>XTRONIC-CVT</td>
</tr>
<tr>
<td>2.0~2.5L Use</td>
<td>Primera</td>
<td>MURANO</td>
</tr>
<tr>
<td>1.3~1.8L Use</td>
<td>(Micra)</td>
<td>SENTRA</td>
</tr>
</tbody>
</table>

- MAXIMA ALTIMA (New-XTRONIC)
- VERSA (XTRONIC)
- TIIDA
- CUBE
- LA FESTA
- MURANO

FY91 FY96 FY01 FY06
2-2. Progress of Nissan CVT Global Sales

- By FY07, global sales expected to have quadrupled to about 1 million units compared with FY04.
2-3. Global Expansion

- Release of cars fitted with CVT to more than 100 countries in the future

- Adopted in FY04
- Adoption planned for FY07

- Altima
- Teana (天籁)
- Maxima
- Murano
2-4. Adoption of Global Expansion

- Ratio of Cars Fitted with CVT vs. AT

Denominator: AT and CVT

Europe:
- FY04: AT 96%, CVT 4%
- FY07: AT 70%, CVT 30%

Japan:
- FY04: AT 79%, CVT 21%
- FY07: AT 46%, CVT 54%

GOM (includes China):
- FY04: AT 99%, CVT 1%
- FY07: AT 76%, CVT 24%

North America:
- FY04: AT 92%, CVT 8%
- FY07: AT 52%, CVT 48%
2-4. Adoption of Global Expansion

- Ratio of Cars Fitted with CVT vs. AT

- Denominator: AT and CVT
3. CVT Expansion in North America
3-1. Comments from North American CVT Customers

North American customers are extremely satisfied with CVT

Typical comments:
- Very positive (good), no hesitation or downshift when going uphill
- Feels more powerful because it operates much more smoothly

- JD Power: Results of '06 U.S. APEAL Survey

![Bar chart showing satisfaction levels of different vehicle models. The chart indicates higher satisfaction for NISSAN Murano CVT compared to Company A 4-AT, Company B CVT, Company C 5-AT, and Company A 4-AT. Source: JD Power Results of '06 APEAL Survey.]
3-2. Comments from North American CVT Customers

- Levels of satisfaction were extremely high among those who purchased CVT

Q: Before purchasing a vehicle,

which did you think has better performance: AT or CVT?

Q: After purchasing a CVT fitted vehicle,

which do you think has better performance: AT or CVT?

(Internal survey result)
3-3. Plans for CVT Expansion in North America

- Expand sales of CVT-fitted vehicles sevenfold in the North American market in FY06
3-4. JATCO Mexico CVT Plant
4. What is CVT?
4-1. What is CVT?

- The CVT provides smooth and stepless ratio changes.
4-2. Special Features of CVT

Stepless shifting of gear ratios for enhanced driving pleasure and fuel efficiency
4-3. CVT Efficiency (Fuel) (1)

CVT changes gears smoothly so cars consume fuel efficiently.

![Graph showing CVT efficiency comparison with AT.](chart.png)

- Optimum area of fuel efficiency ratio

---

`ń

Engine Revolutions (rpm)

Engine Torque (Nm)

CVT

AT

Optimum area of fuel efficiency ratio
4-3. CVT Efficiency (Fuel) (2)

AT can only use set gear ratios so large changes in engine revolutions means it is difficult to use fuel efficiently while driving.

**5AT**

Limited to set gear ratios

**CVT**

This area can be used

Optimum area for efficient fuel consumption
5. XTRONIC CVT
XTRONIC CVT
5-1. Improved Fuel Efficiency (1)
5-1. Improved Fuel Efficiency (2)

- Further increasing the range of gear ratios for the XTRONIC CVT has created superb acceleration and increased fuel efficiency.
5-1. Improved Fuel Efficiency (3)

The gear ratio range for the third generation XTRONIC CVT expanded to 6.0

XTRONIC CVT

1st Generation

2nd Generation

3rd Generation

March/Cube Versa

March/Cube Tiida

March

March/Cube

Prime

Lafesta

Maxima/Altima

Sentra

Versa

FY90 FY00 FY10

FY90 FY00 FY10

Gear Ratio Range

FY90 FY92 FY97 FY04

FY00

March Primera Cube

FY00

Murano

FY04

Cube

Murano

FY04

5A/T

6A/T

5A/T

6A/T
5-1. Improved Fuel Efficiency (4)

- Expanding the lockup area from conventional CVT models further improves fuel efficiency.
5-2. Improved Performance (1)

- Emotional
  - Smooth, Pleasant Drive
- CVT
- Efficiency
  - Fuel Efficiency
- Emission
5-2. Improved Performance (2)

- Smooth, agile drive
- Quality of response
  - 1. Improved gear change response
  - 2. Closely supervised gear change pattern
  - 3. The optimum gear change pattern for predicted customer acceleration needs
- Linear response
- Smoothness of acceleration
  - 4. Natural acceleration sensation
5-2. Improved Performance (3)

1. Improved gear change response

- With an improved gear change control system, the time used to shift gears is greatly reduced.
2. In all driving conditions, CVT provides a smooth gear change to suit customers' need for a more natural, powerful sensation of acceleration.

3. CVT offers the optimum gear change pattern which predicts customers' need for acceleration on roads and driving conditions which are constantly changing.
5-2. Improved Performance (5)

4. Creating a natural sensation of acceleration

Natural acceleration geared to increasing engine revolutions was realized through the addition of a linear mode control system.
6. CVT for 3.5 L Engines
6-1. Nissan CVT Line-up

- The line-up of large capacity CVT for 3.5L engines

<table>
<thead>
<tr>
<th>Engine Size</th>
<th>Car Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5L</td>
<td>Tiida</td>
</tr>
<tr>
<td>2.0L</td>
<td>Serena</td>
</tr>
<tr>
<td>2.4L</td>
<td>Murano</td>
</tr>
<tr>
<td>3.2L</td>
<td></td>
</tr>
<tr>
<td>3.5L</td>
<td></td>
</tr>
</tbody>
</table>

- Nissan

- Audi

- Ford

- Toyota

- Honda

Cars: Tiida, Serena, Murano, A4, A6, Vits, RAV4, Airwave, Odyssey, Freestyle.
6-2. The Technology which made CVT Possible for 3.5 L Engines (1)

- Optimum hydraulic control technology
  Offers a large power capacity for optimum clamping power (to clamp the belt) according to conditions
6-2. The Technology which made CVT Possible for 3.5 L Engines (2)

- Use of new oil

Use of special CVT oil enables CVT belt to operate smoothly without slipping
6-2. The Technology which made CVT Possible for 3.5 L Engines (3)

- Use of a special surface treatment (shot peening) for pulleys

When the surface hardens, it can withstand intense power

Shot peening method

Shot peening is the process of cold forming the surface of a part by means of a propelled stream of round hardened steel shot.
7. Summary
7-1. XTONIC CVT (1)

- **Plans for future CVT**
  2. North America expansion. Sevenfold in North American market in FY06

- **Benefits of CVT**
  - Low fuel efficiency
    1. Expanded gear ratio
    2. Expanded lockup area
  - Smooth, agile drive
    1. Improved gear change response
  - Linear response
    2. Closely supervised gear change pattern
    3. The optimum gear change pattern for predicted customer acceleration needs
  - Smoothness of acceleration
    4. Natural acceleration sensation
7-2. XTONIC CVT (2)

- Emotion
  Agile smooth performance

- Efficiency
  Low fuel efficiency

- Emission

CVT
Thank you for your kind attention.