Continuously Variable Planetary Transmissions – A New Technology

Fallbrook Technologies Inc. (Fallbrook) has created a new, scalable transmission that can improve the performance and efficiency of just about any machine with a transmission. For example, this technology can improve vehicle fuel economy, increase wind turbine performance while reducing costs, and even help bicyclists take on steep hills. With the use of rotating and tilting balls between the input and output components of a transmission, Fallbrook Technologies has created the NuVinci® continuously variable planetary transmission (CVP).

NuVinci CVP: Revolutionizing Mechanical Transmission-Based Products

Instead of the traditional gear and clutch mechanisms found in conventional transmission, the NuVinci continuously variable transmission can change seamlessly through an infinite number of speed ratios between maximum and minimum values. The technology is applicable to products that use a transmission, including bicycles, electric vehicles, outdoor power equipment, agricultural equipment, automobiles and wind turbines.

How does a CVP work?

The NuVinci transmission uses a set of rotating balls between the input and output components of a transmission that tilt and vary the output speed of the transmission. Tilting the balls changes their contact diameters with the discs, which varies speed smoothly and seamlessly. As a result of its infinite number of ratios within its range, the NuVinci CVP improves acceleration, performance and powertrain efficiency over conventional transmissions.

Advancing Public Policy Objectives

Improving Fuel Economy: The NuVinci CVP is designed to reduce energy consumption through its seamless speed changing characteristics, allowing the power input of any fuel driven engine to operate in its most efficient speed range, leading to improved performance and reliability, as well as reduced fuel costs.

Promoting Renewable Energy Deployment: In wind turbine applications such as those being developed by Fallbrook’s spin-off company Viryd Technologies, CVPs are designed to lower the cost of electricity and make small wind turbines affordable and easier to deploy and maintain. We believe this will help move America towards its goal of 20% wind power by 2030.

Government Role in Meeting the Technology Potential

The innovation is here, however government support is critical to help bridge the gap from R&D to commercialization and to provide industry a driver to integrate these cutting-edge transmissions into a new wave of efficient machines.

See NuVinci technology videos on the Fallbrook website: www.fallbrooktech.com/nuvinci-technology.
Who We Are

Fallbrook Technologies Inc. is a technology development company headquartered in Cedar Park, Texas and has its primary operations and product development activities also located in Cedar Park with employees and other operations in China and Europe. Fallbrook has a comprehensive patent portfolio of 500 patents and pending applications worldwide that has previously been named the #1 patent portfolio in the transportation sector by The Patent Scorecard™.

Fallbrook received the 2012 North American Frost & Sullivan Growth Capital Investment Opportunity Award in the Powertrain Market. Frost & Sullivan stated: “The Company exhibits all the features of a superior market participant that deserves close attention from investors looking for opportunities.”

Other awards:

Real-World Implementation

The CVP is widely applicable technology. Fallbrook is targeting the following key markets:

- Automotive-class applications
  - Primary transmissions
  - Variable speed accessory drives (DeltaSeries™)
- Electric vehicles (including low-speed/urban vehicles)
- Bicycles and other 2 wheelers
- Stationary and off-road equipment
- Industrial equipment
- Wind turbines

In Production Now:

- In 2007, Fallbrook introduced the first continuously variable transmission for bicycles now in its second generation (NuVinci N360™).
- In 2011, Fallbrook introduced an intelligent automatic shifting system NuVinci Harmony™ incorporating the N360.
- In March 2011, Fallbrook acquired the business of Hodyon, which now operates as a wholly-owned subsidiary, manufactures auxiliary power units (APUs) and sells/distributes them via a US-based dealer network to the heavy truck industry.

Auxiliary power units (APUs) are used on by the heavy trucking industry to replace idling the trucks main engine during a driver’s down time. APUs are small diesel or battery powered idle reduction devices that provide the truck’s sleeper compartment with heating, air conditioning, and 110v hotel type power. A heavy-duty log-haul truck spends an average of 2,400 hours per year idling during non-driving down time, burning an average of one gallon of diesel fuel per hour. A diesel APU burns an average of .25 gallons of diesel fuel per hour, significantly reducing fuel consumption and diesel emissions.

In an independent evaluation, Southwest Research Institute confirmed that a CVP-enhanced APU will provide up to 24% additional fuel savings versus conventional APUs.

Production of a next generation NuVinci CVP-enabled APU is planned.
Recently Signed License Agreements:

- Signed an exclusive licensing agreement for commercial vehicles and certain off-highway primary transmissions with Allison Transmission Holdings Inc. (NYSE: ALSN)
- Signed an exclusive licensing agreement for automotive and certain off-highway primary transmissions with Dana Holding Corporation (NYSE: DAN).
- Signed an exclusive licensing agreement with Team Industries, Inc. for use of *NuVinci* CVP technology in North America and Europe for electric and gasoline light vehicle applications.

Growth Plans: Fallbrook is currently developing a number of additional applications of *NuVinci* technology for other markets with near-term commercial potential. Licensing agreements and/or product launches for one or more entries in each of the following markets are planned for during the period 2012 to 2014:

- *NuVinci* DeltaSeries™ continuously variable accessory drives (CVADs) for automotive (car and truck) alternators, air conditioning compressors and superchargers.
- Industrial equipment where use of the *NuVinci* CVP will allow energy source to operate at its most efficient point, resulting in energy savings while providing variable torque and variable speed output.
- Lawn care equipment where the *NuVinci* CVP will replace hydrostatic drives and offer improved performance and reduced noise.
- Small wind turbines in which the *NuVinci* CVP will provide a variable drive speed to match wind speed with the input speed needed by the generator, capturing more of the power available from the wind and reducing reliance on expensive voltage-regulation power electronics.

For more information and contacts, visit [www.fallbrooktech.com](http://www.fallbrooktech.com).