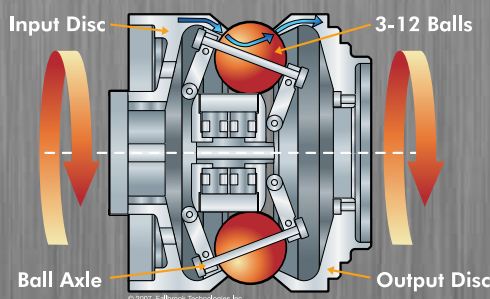




The NuVinci CVP is a power management system for engine accessories that enables unprecedented ability to change accessory loads and outputs on the fly for improved performance and dramatically higher accessory output (up to 75% improvement demonstrated) at low engine speeds while maintaining reliable accessory operation at high engine speeds.

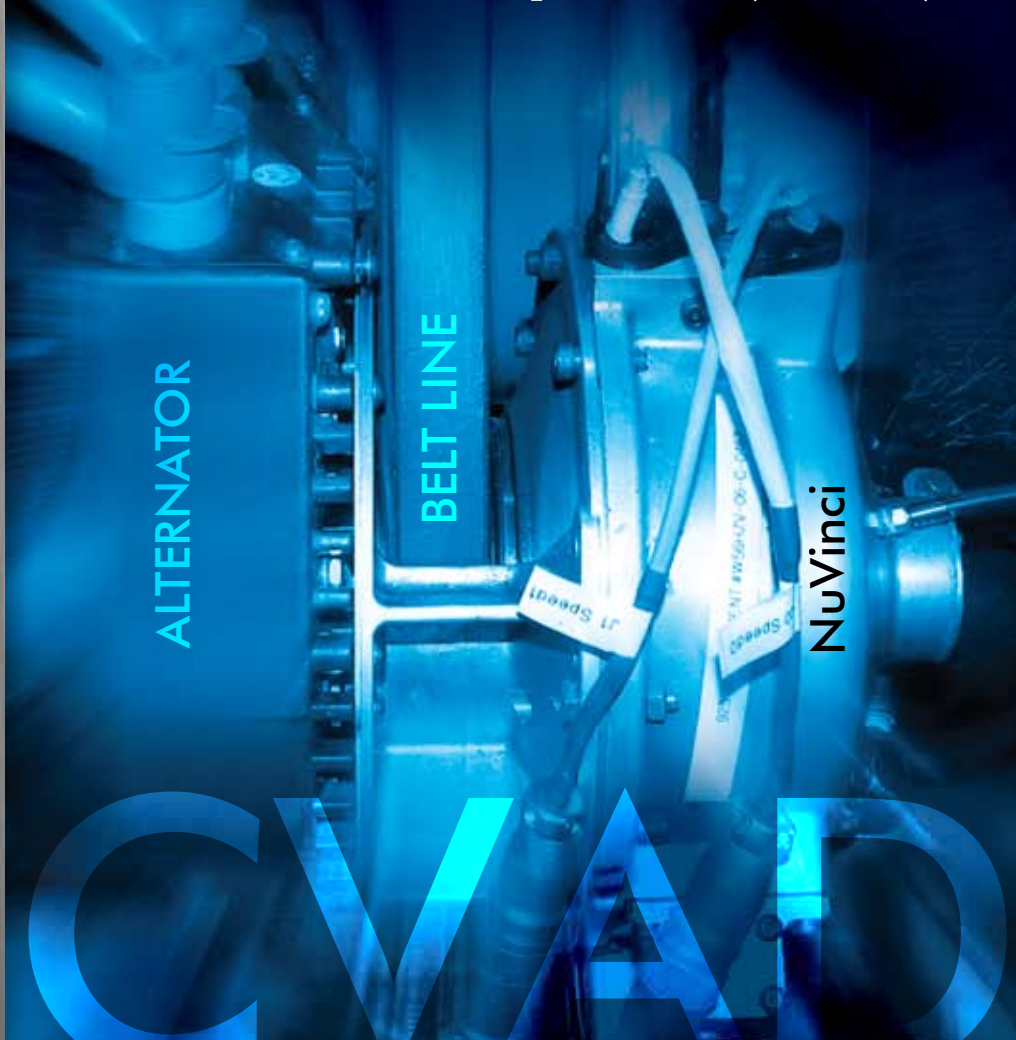


The NuVinci CVP does this by offering an infinite number of speed ratios between its high and low ratio extremes, with programmable instantaneous, smooth and continuous ratio changes. Operation is completely seamless and transparent to the driver.

**Problem: Underpowered alternators for mission-critical needs**

Military, transit bus and commercial vehicles share a common alternator problem – namely that a belt-driven alternator doesn't make rated electric power during engine idling. This is because, at idle, the alternator speed falls below its rated speed. Sizing the pulley ratio to spin the alternator faster (beyond rated speed) at idle may cause the alternator to over-speed and fail.

**Extracting more power from an alternator using NuVinci® technology and a Continuously Variable Accessory Drive (CVAD).**



A CVAD using the NuVinci continuously variable planetary (CVP) transmission improves alternator performance by decoupling the engine speed from the alternator speed, enabling the alternator to produce maximum current regardless of engine RPM.

**NuVinci technology delivers:**

- Better alternator performance
- Quiet, smooth operation
- Compact packaging



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## Solution: A CVAD using the NuVinci® CVP

A NuVinci-based CVAD improves alternator power at low engine speeds, with minimal complexity, easy installation and low cost.

Figure 1 illustrates the CVAD's "U" drive power path configuration. Power comes in from the belt, transfers it to one traction ring, through the planet balls, and brings the power out of the other traction ring. Tilting the balls provides a smooth ratio transition from overdrive, providing high alternator speeds at low engine speeds, to underdrive, when the alternator might be operated at speeds slower than engine speed.

The CVAD enables control of output speed (see red line in Figure 2), independent of engine speed (the white line). At engine idle, output speeds may be increased, providing more power to the alternator. At higher engine speeds (such as accelerating from a stop or cruising), accessory speeds may be reduced, saving energy. The NuVinci CVP also shifts quickly, helping to smooth out transients.

## Results:

The graph in Figure 3 illustrates the improvements in alternator performance possible with a NuVinci-equipped CVAD. A typical-high performance alternator (grey curve) does not provide full power at low engine speeds (less than 1200RPM). A NuVinci-equipped CVAD alternator (red curve) enables optimal alternator operation, even at low engine speeds. The green area represents the increase in alternator current generated at low RPM, as compared to a standard alternator. Depending upon the duty cycle, this can result in 75% more delivered power.

### The NuVinci-equipped CVAD offers:

- Increased power at idle
- Increased capacity for front-end accessories
- Opportunity to downsize accessory capacity
- Ability to reduce alternator load to reduce engine startup torque requirements
- Improved battery life

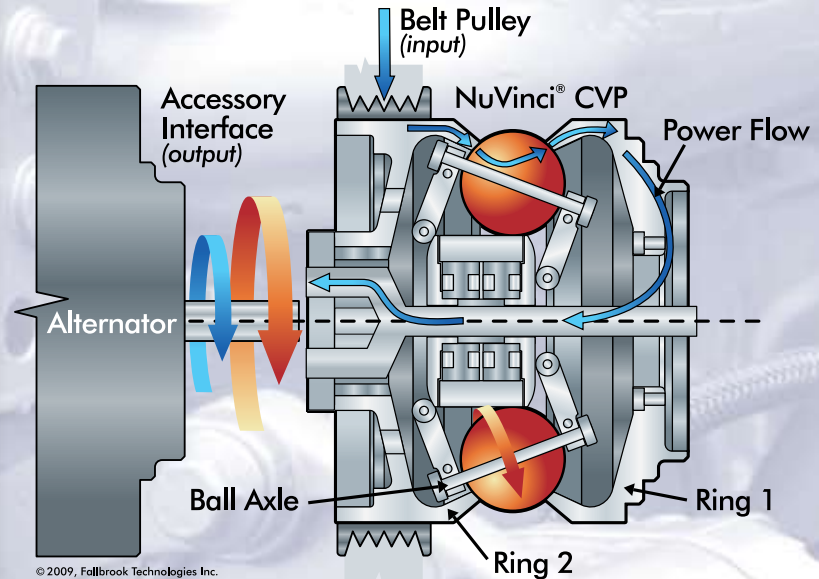
### Become a NuVinci Development Partner

Fallbrook Technologies currently is selecting NuVinci CVP development partners in several key cleantech/heavy duty market areas. Becoming a development partner gives you first-strike capability in reaching your market with innovative new products, as well as access to the comprehensive and unmatched NuVinci technology portfolio of over 325 patents and patent applications worldwide.

For more information, visit [www.nuvinci.com](http://www.nuvinci.com).  
Contact: [info@fallbrooktech.com](mailto:info@fallbrooktech.com)

**(888)-NUVINCI**

Figure 1. Power at Idle - Alternator Accessory



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Figure 2. Speed Comparison

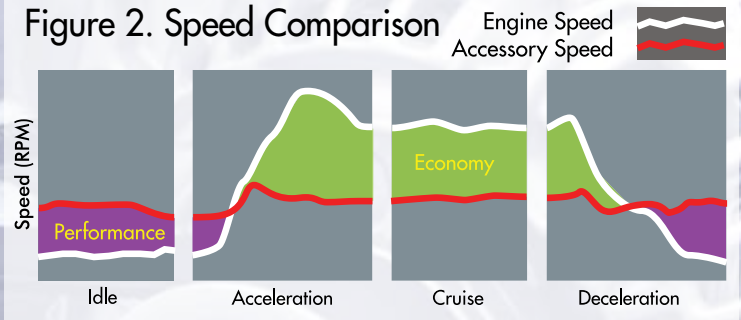
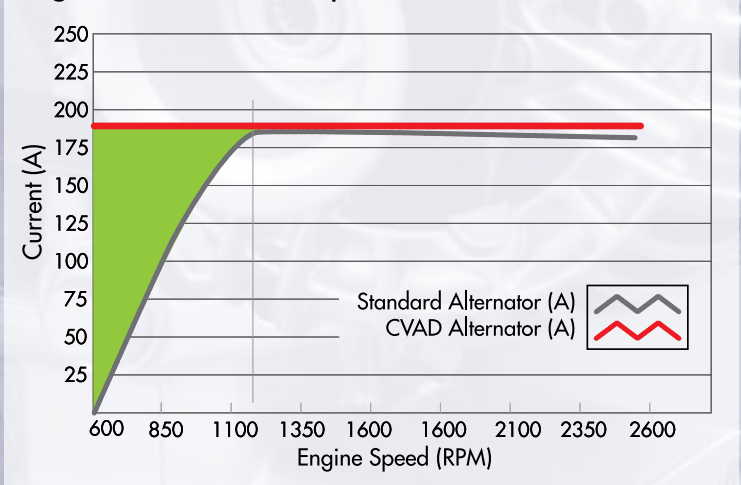


Figure 3. CVAD Comparison



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