

## HISTORY OF THE TRANSONOVA AMPLIFIERS

Jim Strickland - November 1999

The Transnova design originated at Acoustat about three years before it became a part of the David Hafler Company in 1984. The Transconductance Nodal Voltage Amplifier was granted U.S. Patent 4,467,288 in 1985. Three years later in 1987, both companies became part of Rockford Corporation. The Acoustat division was later sold to Audio Physics of Italy and Hafler continues today as part of Rockford.

The Hafler DH-200 introduced in 1977 was way ahead of its time due to David Hafler's discovery of the Hitachi lateral MOSFETs for the output devices. Acoustat's electrostatic loudspeakers worked very well with the Hafler amplifiers, but the mindset of the high-end audiophile of the day insisted on trying to use more expensive amplifiers (which often did not work as well)--asking also for an Acoustat amplifier.

Research began about 1980 by analyzing and modifying DH-200 amplifiers. We began to realize that using the new MOSFETs was a great idea, but was akin to "...putting a jet engine on a DC-3." The performance jump in power-gain, bandwidth, robustness and simplicity was tremendous. Merely substituting MOSFETs for unity-gain bipolar stages of older practice made a better amplifier, but underused the new devices by at least a factor of ten.

The FETs were capable of giving both current and voltage gain with reserves to spare. If this could be made to work, a simpler, shorter-path amplifier would be possible--and should sound better. However, the way to do this was not immediately obvious. If the output devices were connected like tubes, with grounded sources (cathodes), output taken off the drains (plates) and driven on their gates (grids), so much gain and phase delay would be added that ultrasonic instability would be likely under demanding loads.

After a while something amazing was observed: If an output local feedback loop RC network terminated not into an input resistor, but into an infinite-impedance current signal driver, there would be no loss of device voltage gain, but the stage would also have 100% negative feedback, with reduced distortion, noise, output impedance, phase shift etc. This method was described in the patent as *anisotropic* feedback.

As Rockford came to the idea of building a flagship amplifier, the 9500 was born. This amplifier combined the more polished front end of Hafler with the Acoustat output principle. These amplifiers were introduced as part of the 9000 Series in 1991.

In 1995 Hafler moved to exclusively making Professional amplifiers and the 9500 was altered to have balanced inputs using the amplifier core itself to provide the balance function--with a little help from J-FET buffers to raise the inverting-side impedance--yielding the 9505. In 1995 all Hafler Pro amps adopted Transnova.

In 1996, Hafler Amplifiers were converted to Surface Mount Technology (SMT), resulting in greater ruggedness, and more board space for auxiliary circuitry needed in professional sound. At this time an important innovation was made in the J-FET input / internal driver circuitry. A method was found to increase the driving-current headroom by 5-10 times in the MOSFET-driver stage--while obtaining Class A linearity and low stage heating. Two U.S. Patents have been granted on this circuit, entitled *Dynamically Invariant AB Linear Operation*. Some refer to this circuit by the acronym, Diablo.

In 1998 Hafler introduced its first amplified monitor speaker, the TRM8, with both bi-amped channels Transnova. This speaker is the preferred reference that many recording engineers and artists depend on for their most critical monitoring.