



“High power, digitally controlled, efficient, RF designs and solutions”

Introduction to Nautel and NS Series LF High Power Amplifier

SONAR Applications



High **Power** RF Solutions

About Nautel

- **42 Years**
- **250 employees**
- **40 designers/engineers**
- **Stable self funded growth**
- **Privately held/zero debt**
- **RF Design, Prototyping, Manufacturing**
- **ISO 9001 USA and Canada Plants**
- **Award winning exporter**



High **Power** RF Solutions

Nautel Standard Products:

AM



J1000



XR3 & XR6



XR12



NX25



NX50



NX100-NX800

FM



VS Series



NV3.5, NV5, NV7.5, NV10, NV15, NV20, NV30, NV40

Navigation



Vector Series NDB/DGPS/Navtex



NDB/DGPS/Navtex Antenna Tuning Units



NL Series Next Generation Loran



LF Antennas

RF Power



HF Amplifier



Custom Impedance
Matcher



Plasma RF Power
Sources



NS Series
LF High Power Amplifier



NG Series
Weather Radio Transmitters



High Power RF Solutions

What Nautel**Power** does...

RF Amplifiers

- High power
- Compact
- Ultra-reliable
- Efficient
- Digitally controlled



RF solutions:

- SI
- OEM
- Custom
- Manufacture
- Prototype



Industries

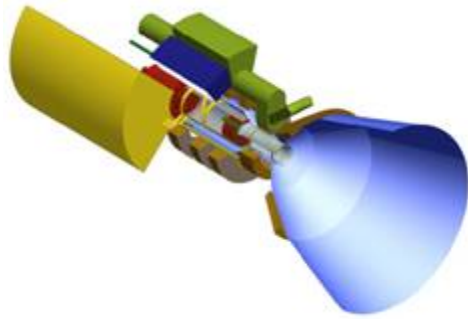
- Aerospace
- Defense
- Oil & Gas
- Research
- Navigation
- Industrial
- Broadcast

Specific Design Capabilities

- Solid state amplifier design from 100 kHz to 200 MHz
- Antenna Design and Computer Simulation
- Analog and Digital Communications theory
- RF matching, combining, filtering at high power/voltages
- RF Magnetics
- Power Supplies
- Digital Hardware Design
- Digital Signal Processing
- Data Communications Systems
- Networking and TCP development

Example: Plasma Rocket RF Amplifier

Rocket manufacturer subcontracted Nautel to build high powered and high efficiency amplifiers for space



- Ad Astra required extremely efficient, high power amplifiers for plasma rocket engine prototype
- Contacted Nautel to develop and build 50kW and 180kW amplifiers for first and second stage of the rocket
- Amplifiers are solid-state, water cooled with efficiency over 97% DC to RF conversion
- Status: working prototype in vacuum chamber
- Space station testing planned for 2013



High **Power** RF Solutions

Example: VHF Transmitters

US Government contracted
Nautel to build VHF transmitters

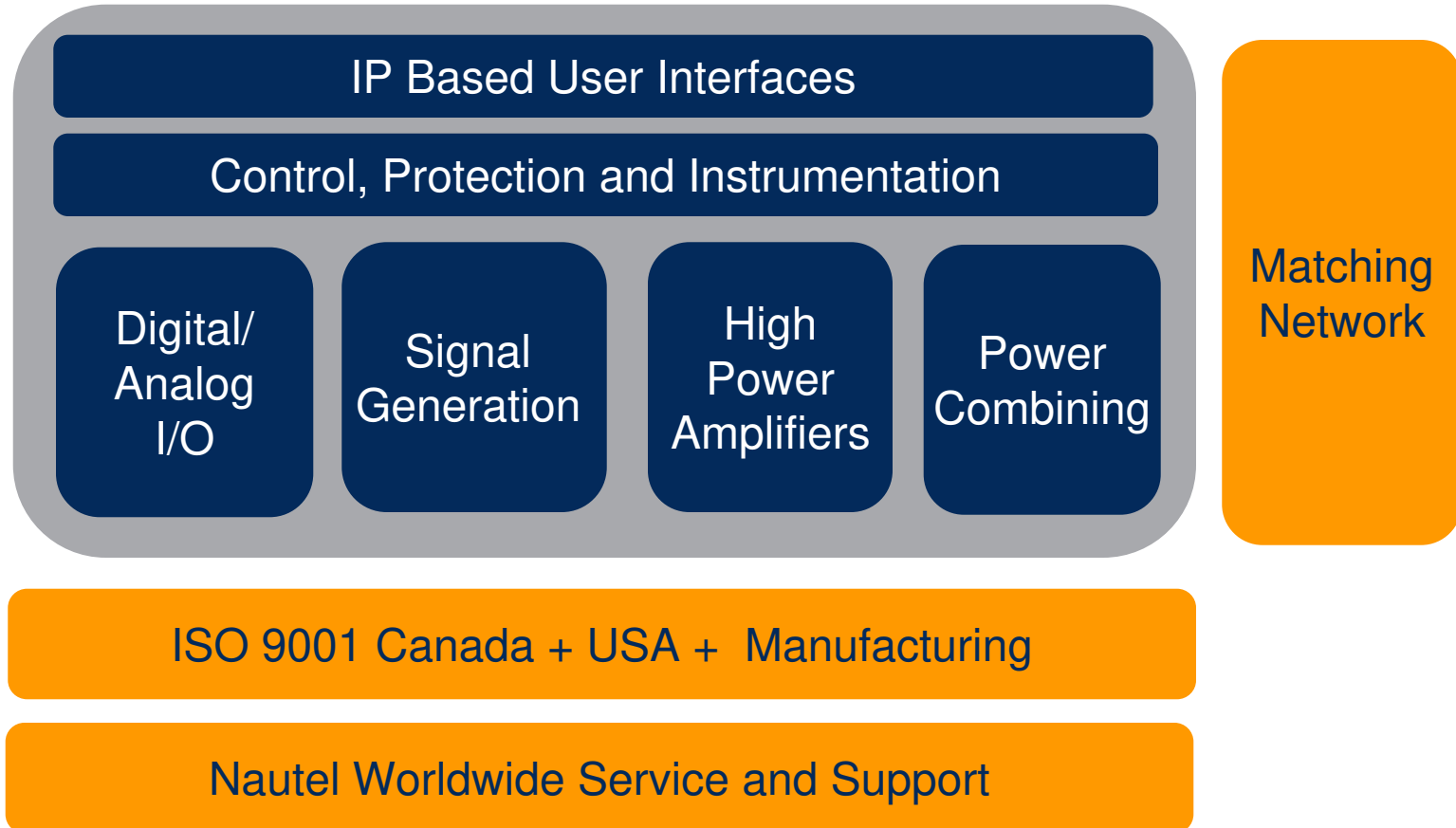


- Agency used older transmitter technology
- Requirement: efficient systems with new functionality
- Close collaboration with the customer on design, requirements, manufacture/delivery and training



Elements of a NautelPower Solution

“High Power Digitally Controlled RF Solutions”



Local and Web Interface Options

Interface Options:

- Advanced User Interfaces
- Deep drill-down diagnostics
- Remote/local identical
- Extensive data logging
- Traditional character display options
- Built-in instrumentation
- SNMP
- HTML/XML



Control, Instrumentation, Protection



Extensive Control:

- Temperature
- Fan speed
- Phase angle
- Reverse loop
- Power, voltages
- Redundant controls
- Outputs for local site control



Digital and/or Analog I/O

Broad I/O options:

- Digital
- IP Protocols
- Analog protocols
- Input redundancy/failover
- Balanced lines

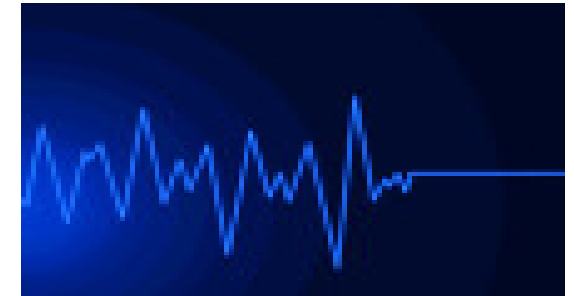


Signal Generation and Analysis



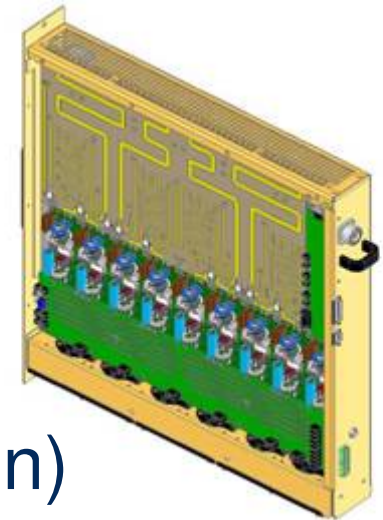
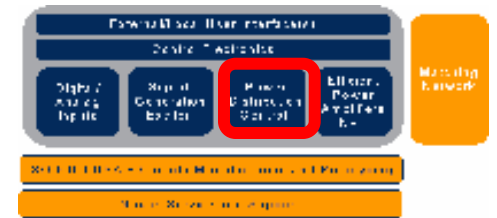
Precision signal control:

- Adaptive pre and post processing
- Signal shaping
- Digital signal processing
- Nanosecond precision
- Fast Protection
- Output matching compensation



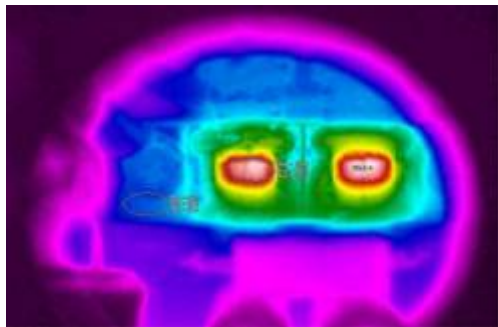
Power Distribution

- Redundant architectures
- Combiner networks
- Modular design
- Extreme reliability
- Phase angle balancing
- Minimize THD (Total Harmonic Distortion)



Efficient Power Amplifiers

- Frequencies: 5Hz – 200MHz
- Amplifier Efficiencies: Up to 98%
- Watts to megawatts
- Modular
- Hot swappable



Thermal Analysis



Power Module

High **Power** RF Solutions

ISO 9001 Manufacturing

- ISO 9001
- Integrated:
 - Sheet metal to completed racked solution
- Manufacture in US or Canada
- Fast prototyping
- Milspec design

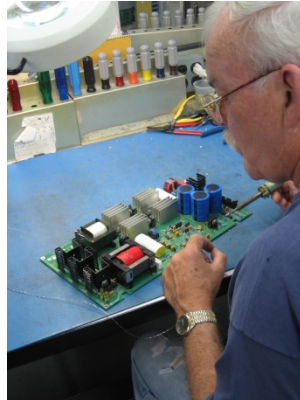


High Power RF Solutions

Nautel Production...



Computerised Fabrication Shop



PWB Assembly



Light Assembly



Final Assembly



Final Production Test



Packing and Shipment



High **Power** RF Solutions

Nautel Quality...

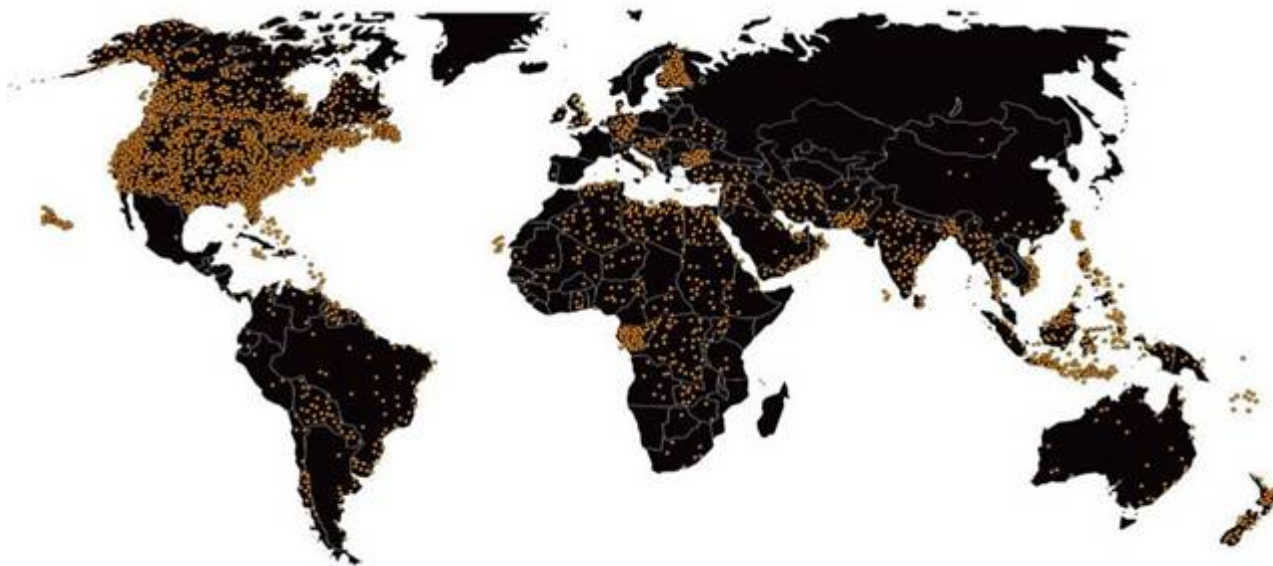
- ISO9001:2008 registered/certified
- products built to stringent quality standards
- industry leading features, performance, and reliability
- pride and craftsmanship of dedicated professionals
- assembled by a team of individual people - no assembly robots
- production staff with an average of 15 years experience
- Nautel controls every aspect of production
....from workmanship to electrical components to sheet metal fabrication



High **Power** RF Solutions

Worldwide operations

- 177 countries
- Over 10,000 deployed transmitters
- Dedicated support team
- Support for even 30 year old products

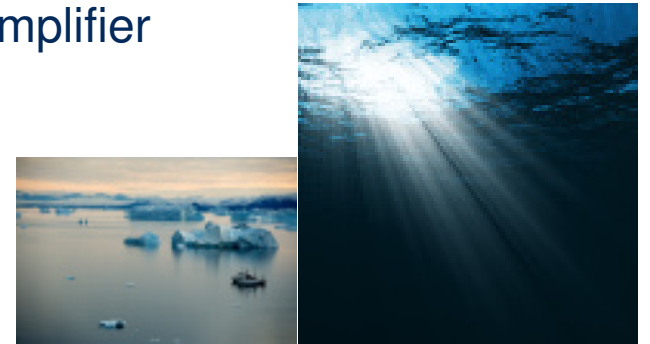


Sonar Amplifier Case Study

Naval customer subcontracted Nautel to build high power amplifier for sonar system



- Navy challenged to find product that could meet strict operational requirements
- Nautel, partnered with a transducer manufacturer
- Designing and built 22kW sonar amplifier
- Hot swappable power supplies
- Over 90% efficient
- Broadband capabilities



“the most compact 22kW we have ever seen!”

Software Controlled Sonar Amplifiers

3kW–100kW

Over 40 years experience building solid state switch mode power amplifiers

Nautel Innovations

- Designed for Testability: Built-in Test Equipment/Built-in Self Test
- High operating efficiency
- Sophisticated Remote Control and Monitoring
- Redundant Architecture
- State-of-the-art Digital Exciter

Quick Specs

- Models range from 3kW to 100kW
- 200Hz to 4000Hz
- High density power amplifiers
- Solid State Reliability
- Robust and Flexible
- Modular Serviceability
- Built-in Protection
- Shock Mount Option
- Optimal Air Cooling
- Small Footprint
- High Redundancy
- 0 C to 60 C Operating Temperature
- Designed and Tested to MIL-SPECS
- MTBF > 100,000 hours
- Power and Cost Savings
- Easy maintenance

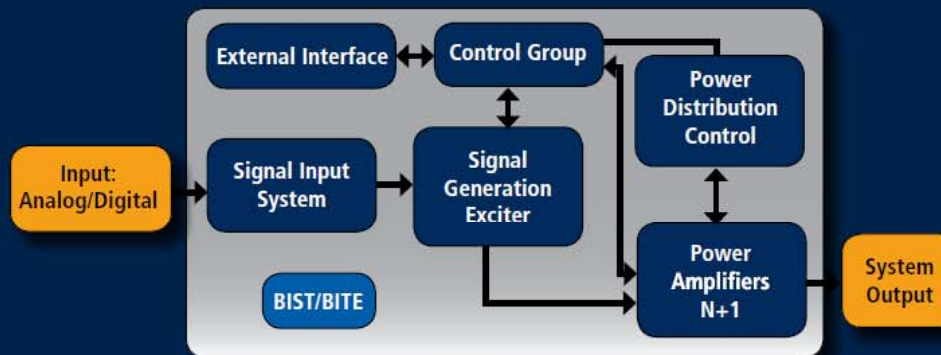


High **Power** RF Solutions

NS Series: High Power Low Frequency Amplifier Technology



SYSTEM OVERVIEW



Nautel has experience both in-water and on-air specializing in simple, reliable, robust solutions to meet our customers demands.

Nautel's design team is dedicated to providing advanced, flexible, affordable power amplifiers to customers seeking anything from off-the shelf equipment to completely custom solutions.



Benefits of a **NautelPower** solution...

Enhanced Capabilities

- Challenging RF requirements
- Extreme operational demands
- Harsh environments
- Precise signal control
- Enhanced data gathering



Nautel Lightweight **Sonar** Module



High **Power** RF Solutions

Benefits of a NautelPower solution...

Lower Cost

- Increased efficiency
- Increased reliability
- Reduced maintenance
- Remote maintenance
- No tube replacements
- Outsourced manufacturing



Strategic Focus

Focus on your core value add, while Nautel does RF



High **Power** RF Solutions

Your Solution:

What Can Nautel Do for You?:

- Design and manufacture RF equipment
 - Transmitters, Receivers, Antennas
 - High Power amplifiers and Power Conversion Devices
 - DSP and FPGA based systems



Learn more: www.nautelpower.com info@nautelpower.com



High **Power** RF Solutions

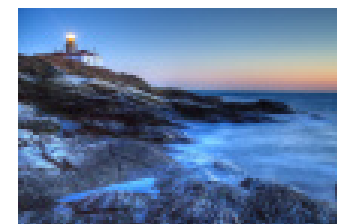
Industry Solutions: Navigation

Solutions:

- High Power RF and audio frequency power systems
- Withstand environment requirements
- Extreme reliability, highly efficient

Applications:

- Aeronautical and marine radio beacons
- DGPS, MF Telegraph, NAVTEX transmitters
- LF/MF transmitting antennas and tuning units
- Position/timing alternatives to satellite navigation
- Tactical navigation/positioning



Industry Solutions: Broadcast

Solutions:

- High Power RF and audio frequency power systems
- Withstand environment requirements
- Fit desired form factor
- Highly efficient
- Milspec



Products:

- MW transmitters: 1kW – 2MW
- FM transmitters: 300W -88kW
- Digital and analog exciters

