

High Performance Software Defined Radio

– An Open Source Design –

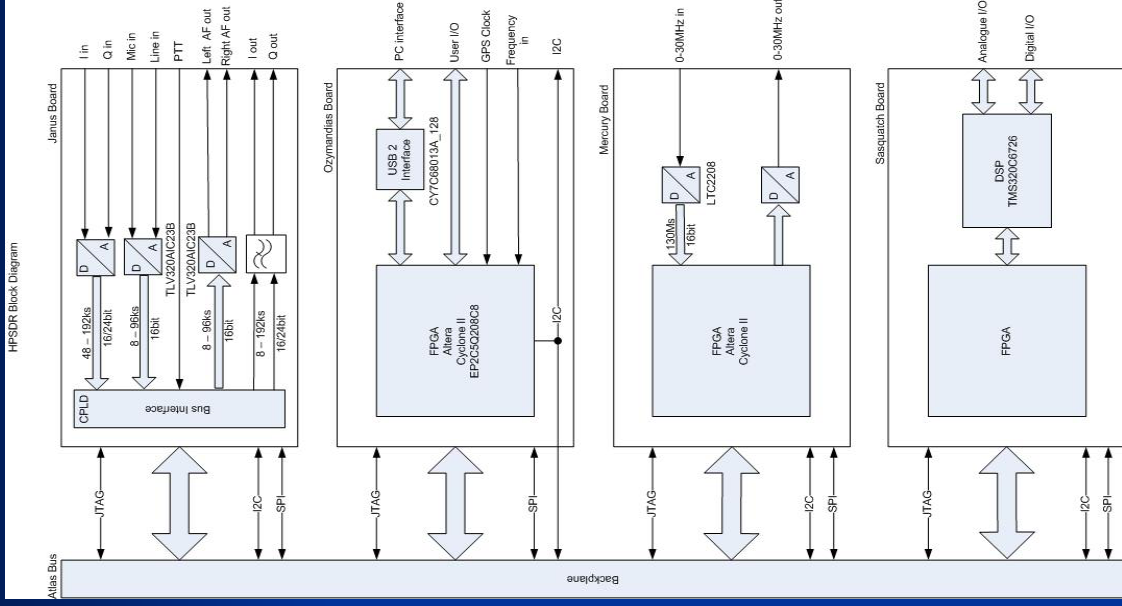
Lyle Johnson, KK7P
Dayton Hamvention 2006

HPSDR: What's It All About?

- The High Performance Software Defined Radio (HPSDR) is an All-Volunteer Project to Create High Tech Modules for Experimentation and Advancing the Radio Art.
- The designs are Open Source.
 - Software
 - Hardware
 - Programmable Logic (FPGA, CPLD)
- Translation: A Bunch of Geeks Having a Good Time.

HPSDR: What Is It, Really?

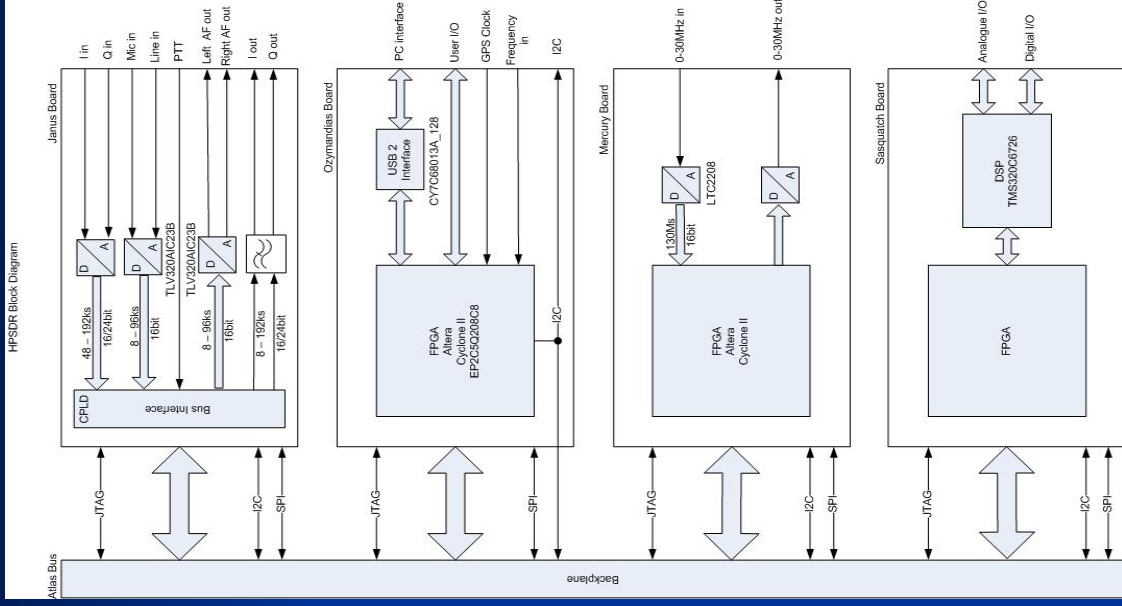
- Standalone SDR
- No PC Required
- Control of SDR-1000
- Superior Quality Sound Card
- Delta 44, Presonus (Exit Stage Left)
- Spectrum Analyzer (cf. SDR-14)
- USB Interface
- Multiple Plug-In Modules



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Or, like the Accountant said when asked what 2+2 equals, “What would **you** like it to be?”



HPSDR: What's It Do?

- Initially, a High-Performance Sound Card for QSD and QSE Radios.
 - SDR-1000
 - SoftRock Series
 - Homebrew
- It Will Soon Add Features Like the SDR-14
 - Digitize the Entire HF Band in Real Time
 - Spectrum Analyzer
 - Incredibly Flexible Receiver

Open Source Hardware?

- Many Hams are Familiar with the Gnu Public License for Software
 - The source code is freely available to anyone who asks
 - Any changes you make must be made freely available to anyone who asks – you can't alter it and make it “proprietary”
- We are Providing the Hardware and Logic Designs Under the Same Provisions
 - The designs are freely available to anyone who asks
 - Any changes you make must be freely available to anyone who asks – you can't alter it and make it “proprietary”

HPSDR: How Is It Designed?

- Community Discussions
 - <http://hpsdr.org>
 - Wiki:
http://hpsdr.org/wiki/index.php?title=HpsdrWiki:Community_Portal
 - Email Reflector/Discussion Group
- Someone Proposes a Project and Leads It
 - They get to be called the Designer
 - Community Discusses It
 - Designer Designs It
 - Design is Reviewed
 - Comments Evaluated

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 - Re-Design Until Designer Says, “Enough, Already!”

ATLAS – Foundation

- ATLAS is a passive backplane that all other modules plug into.
- ATX 20 pin Power Connector
 - Recycle that Old PC
- DIN 41612 96-pin Connectors
- First Module
 - No Software!
 - But is it SDR?
- Designer: N8VB

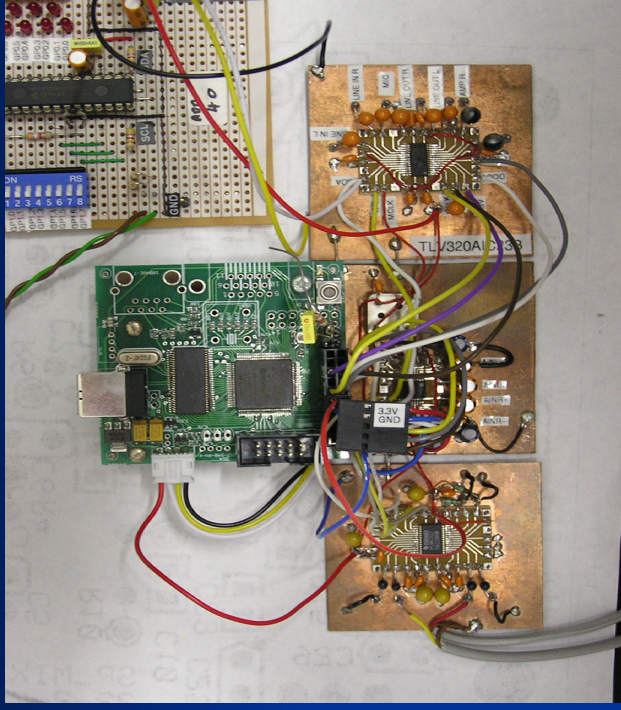


Ozymandias – Ruler

- Ozymandias was a King in Ancient Times.
- OZY is the Module that Controls the Initial HPSPDR Systems.
- USB 2.0 PC Interface
 - Cypress FX2 Controller
 - 8051 Processor Core
 - 35 Megabytes/Second
- Altera Cyclone II FPGA
 - User Definable Logic
- Loosely based on:
 - Xylo (<http://www.fpga4fun.com>)
 - USRP
(<http://www.comsec.com/wiki?UniversalSoftwareRadioPeripheral>)
- Designer: N8VB



Janus – Having It Both Ways



- Analog -> Digital
 - Very High Performance
 - QSD
- Digital -> Analog
 - QSE
- Full Duplex
- International Design Team
 - Phil, VK6APH (Hardware, Verilog)
 - Bill, KD5TFD (Software)
 - Support from KK7P, N8VB

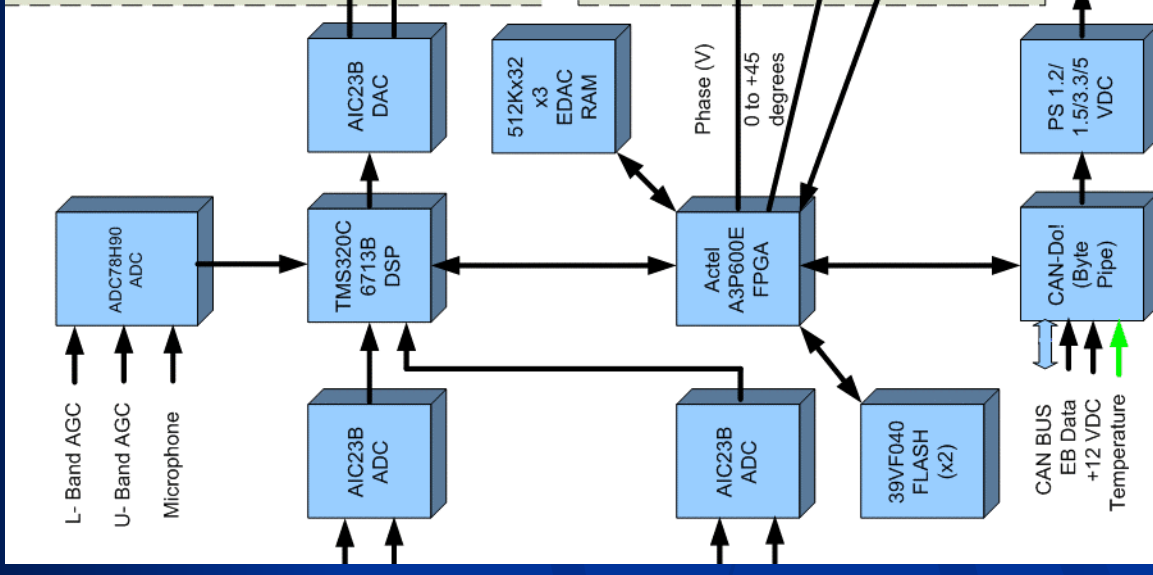
Mercury – That Dude is Fast!

- 16-bit ADC Running at 130 MHz!
- Linear Technology LTC2208 ADC
- Sample entire HF Spectrum in Real Time
- Cyclone II FPGA
 - Digital Down Converter
 - Typical Bandwidth Reduction to 200 kHz
 - User Defined Features
- USB
 - On-board FX2 for Standalone Applications
- Designer: N8VB



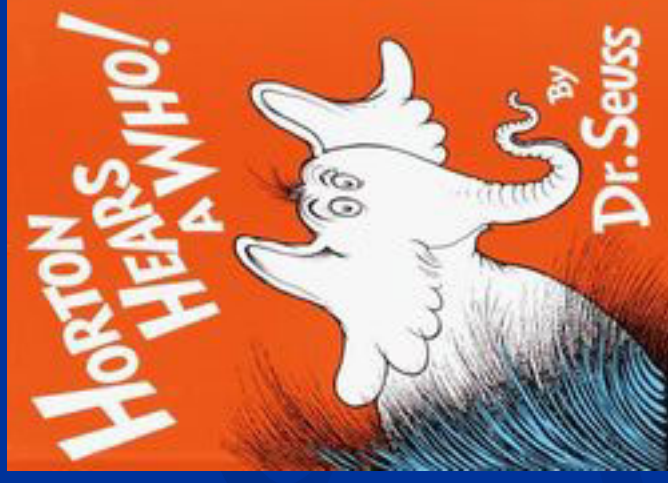
Sasquatch – Big and Bad

- Based on AMSAT SDX Core
- High Performance Floating Point DSP
 - TI TMS320C6726
 - Don't Need No Stinkin' PC
- Flash Memory
 - No Other Controller Required
 - Standalone Applications
- Analog and Digital I/O
 - Analog For QSD/QSE
 - Digital for EER
- FPGA
 - Envelope Elimination and Restoration (EER)
 - HELAPS to AMSATters
 - Super High Efficiency Transmitters
- Designer: KK7P



HORTON – It Pays to Listen

- Receiver Module
- Integrates ADC of Janus with QSD
- So far, just a proposal



Gibraltar – Stable as a Rock

- System Reference Oscillator
 - 10 MHz Output
 - Additional Frequencies Simultaneously
- GPS Disciplined
 - Long Term Accuracy
- Still in Early Discussions



Proteus – Have It Your Way!

- Module with:
 - IC Footprints
 - Power Supply Regulators
 - ATLAS Bus Connector



- Breadboard for Prototyping Your Designs

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- Module with:
 - IC Footprints
 - Power Supply Regulators
 - ATLAS Bus Connector
- Breadboard for Prototyping Your Designs
 - This means **YOU**
 - It's All About Having Fun

Pinocchio – The Extender

- ATLAS-based Extender
- Allows Probing and Troubleshooting While Operating
- Designer: KK7P



CASMIR

- 0 – 2.5 GHz Tx Card
- Four Versions:
 - HF: 0 – 30 MHz
 - VHF: 50 – 250 MHz
 - UHF: 400 – 800 MHz
 - Low Microwave: 1.0 – 2.5 GHz
- Based on Analog Devices AD834X Modulators
 - Used on USRP
- Based on Tx Side of JANUS
- Designer: N3NP

HPSDR: Where to Get Modules

- Volunteers are Making Boards Available
 - Not Kits, Just Boards (so far)
 - Just Facilitating, No Warranty
- Join the Ham SDR Group at <http://www.hamcdr.com>
 - Register
 - Click on Projects...
- Thanks to WA8SRA for Hosting

HPSDR: Your Radio

- This is a Community Effort
- Designed by Hams in the Traditional Amateur Spirit
 - Time and Talent Freely Given
 - Anyone Can Participate
 - Everyone Can Learn
 - International Participation

HPSDR

THANK YOU!