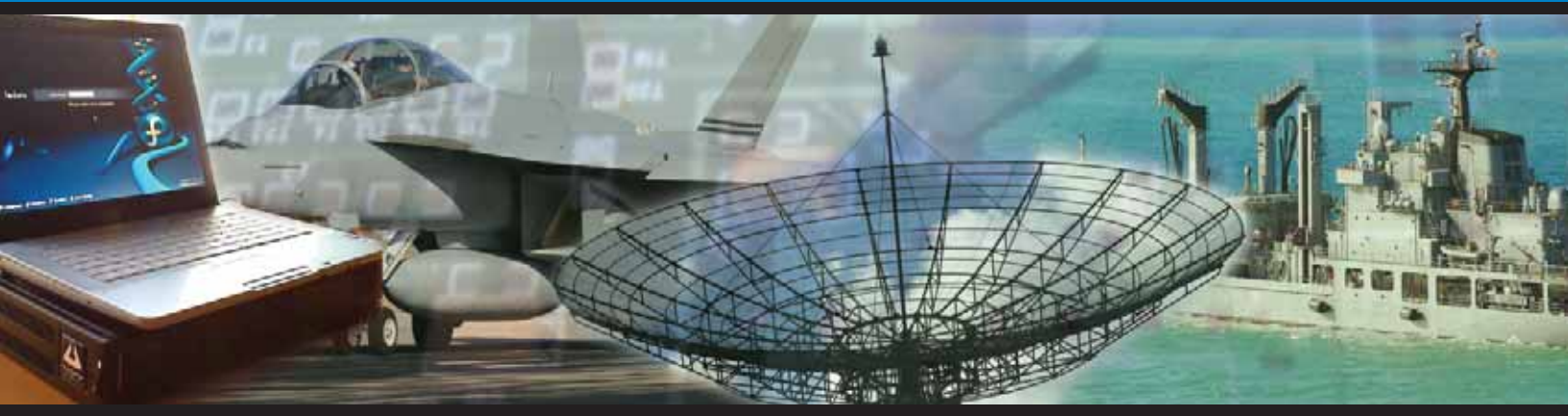
SPACE coast

Communication Systems, Inc.

Defining Open Architecture Software Radio

SOAR

SCA Open Architecture Radio



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Let Your Next Software Radio Project SOAR

Space Coast Communication Systems, Inc. has been a leader in SCA-based software radios for almost 10 years. We have participated in several large- and small-scale JTRS-related development projects and continue to be amazed by how many programs are impeded—rather than enabled—by their development environments.

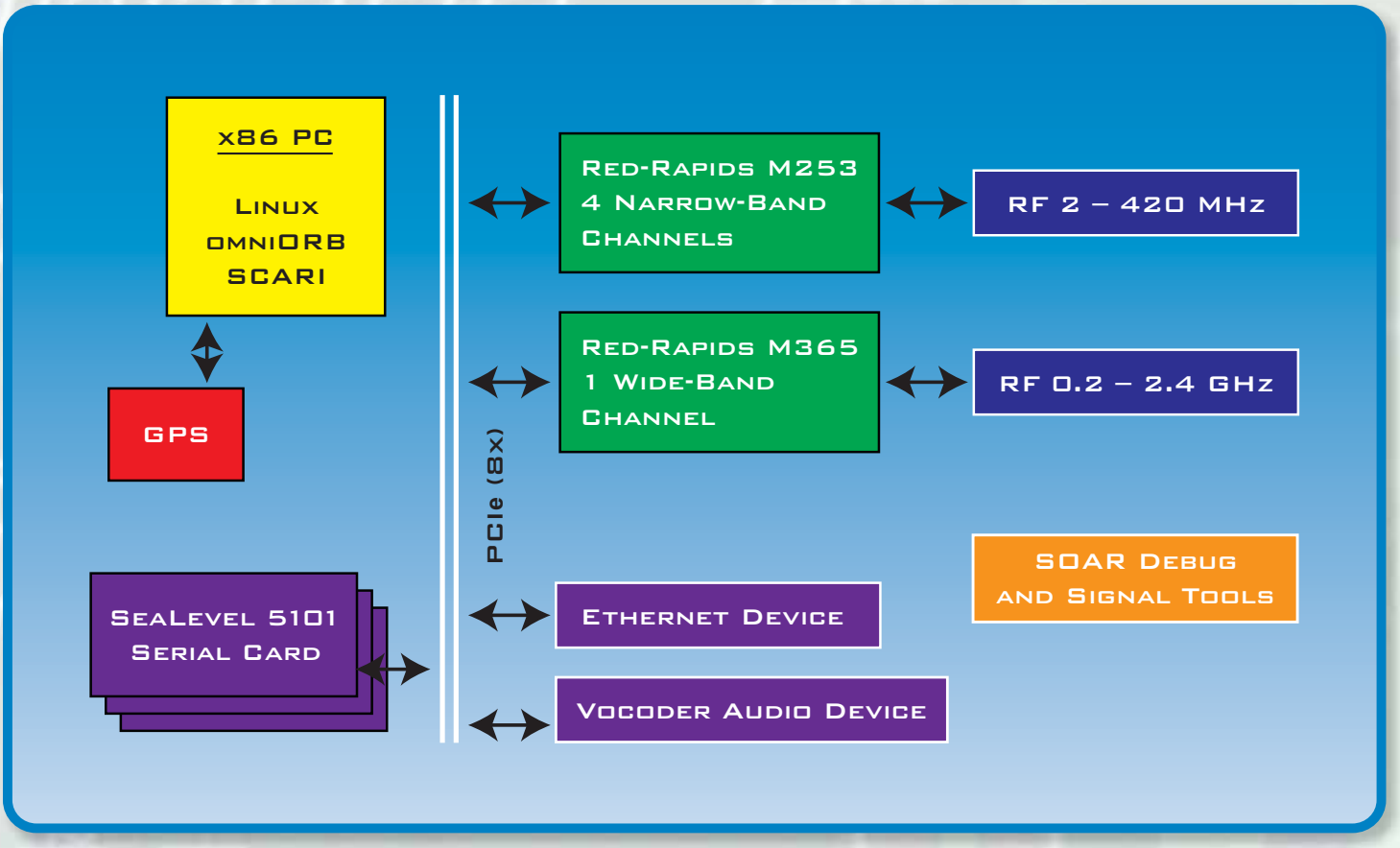
SOAR (SCA Open Architecture Radio) is more than just a software development environment. It is a complete baseband-to-RF software radio packaged as a 19-inch rack mount PC with associated RF and baseband equipment. While your production radio is under development, SOAR plays a vital role as host to your ported and newly developed waveforms.

Realism: SOAR is a complete environment—software and hardware—and includes Serial Device, Audio Device, Vocoders, Ethernet and MHAL.

Completeness: SOAR implements the entire set of JTRS Public APIs.

Openness: All SOAR software is open source without proprietary frameworks or drivers. We represent a community of developers committed to the concept that our software radio enables customers to innovate and prosper. As a result, there is no risk of ongoing hidden infrastructure costs or expensive field engineering support.

SOAR Hardware Block Diagram



Operating Environment

The OE is composed of Fedora Linux, the omni-ORB and the SCARI-OPEN Core Framework. SCARI-OPEN is the SCA Reference Implementation, in Java, produced by the Communications Research Center (CRC) Canada. SOAR can be upgraded to include CRC's industrial grade C++ Core Framework.

The Fedora Linux Operating System (OS) supports nearly all of the SCA Appendix B, POSIX AEP (Application Environment Profile). Based on the 2.6 Linux kernel, the OS supports true priority-based, pre-emptive process control and threading. The 2.6 kernel process control provides isolation enforcement of protected memory spaces in support of high security applications. In the form of *pthreads*, the 2.6 kernel also supports multi-tasking in a single memory space for fast, real-time context switching.

omniORB was originally developed at Olivetti Research Ltd. omniORB is a small footprint, fast Object Request Broker that is minimum CORBA compliant. omniORB is currently maintained and supported by Apasphere Ltd., Cambridge, UK. The ORB is supported by a Name Service, Event Service and Log Service (part of the CF).

JTRS JPEO Public APIs

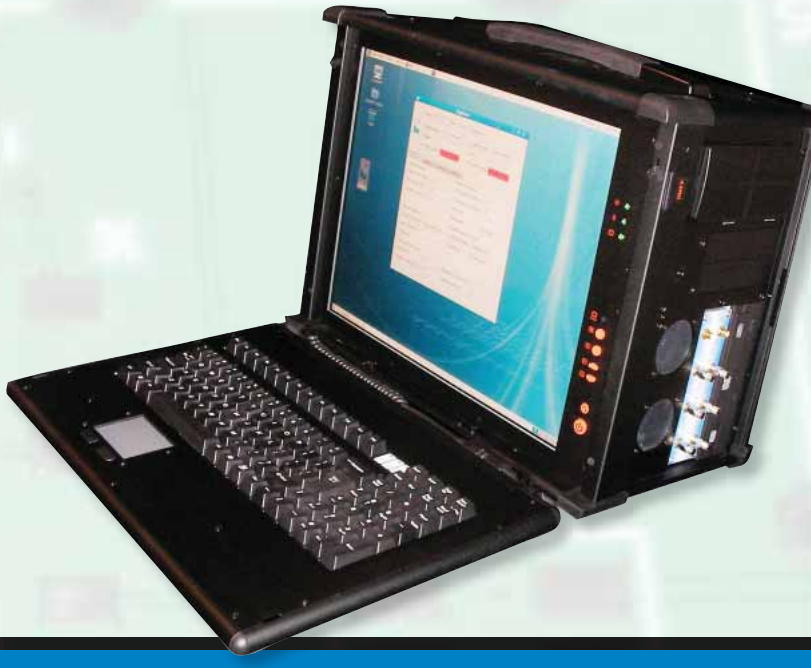
SOAR is populated with a complete set of Application Program Interfaces (APIs) published in April 2007 by the Joint Tactical Radio System (JTRS) Joint Program Executive Office (JPEO).

DeviceIo
JtrsCorbaTypes
FrequencyReferenceDevice
VocoderService
DeviceIoControl
DeviceIoSignals
DevicePacket
DeviceSimplePacket
GpsDevice
DeviceSimplePacketSignals
DeviceMessageControl
EthernetDevice
DevicePacketSignals
AudioPortDevice
TimingService
Packet
SerialPortDevice
Mhal

SOAR's usage of these publically released APIs means that it can be sold internationally without restriction. (Note: these APIs are not merely wrappers but are fully implemented in hardware.) Hardware devices include Ethernet, Serial Device, Audio Device, GPS Device and MHAL for the radio front end. This is what sets SOAR apart from other SCA-based implementations. It is not just a modem or a "black-side," it is entire radio RF to baseband.

The Vocoder API is implemented in software and supports LPC10, CVSD, MELP and SPEEX.

Pictured below is the ruggedized SOAR unit. As opposed to the 19" rack mount, SOAR-RUG is contained within a single form factor.



Radio Front End

The basic SOAR system is configured with four narrowband channels and one wideband channel. The four narrowband channels are completely independent within a 30 MHz band centered at a 70 MHz Intermediate Frequency (IF). The synthesizer in the narrowband tuner covers a range of 2 MHz (HF) to 420 MHz (UHF). The four channels allow the developer to implement re-transmit capability. The four-channel tuner is based on the Red Rapids M253 Waverunner software radio. The underlying implementation is eight full duplex physical channels packaged as four full duplex virtual channels. This configuration allows the user to switch frequencies anywhere in the 30 MHz band in less than five micro-seconds.

The driver for the M253 software radio was custom developed by Space Coast and is available via the open source model. This low latency driver (< 70 micro-seconds) is able to pass four IQ data streams at 1 M sample per second. This same driver was developed for the Space Coast Explorer IV Satellite Simulator and has been in use 24-7 by numerous companies for the past two years. Normally the developer uses the MHAL interface to the software radio, but underneath is the M253 driver with POSIX system calls—open, close, read, write and ioctl.

Specifications

Digital IF – Narrowband (4 Channels)	
ADC	14-bit
DAC	14-bit
Sample Clock Frequency	93 MHz
ADC SNR	72.5 dB (70 MHz)
Frequency Range	0.1 to 40 MHz
IBW	40 MHz
DAC SFDR	75dB
Rx Phase Noise	-82 dBc/Hz (10 kHz Offset)
Tx Phase Noise	-80 dBc/Hz (10 kHz Offset)
Digital IF – Wideband (1 Channel)	
ADC	14-bit
DAC	16-bit
Sample Clock Frequency	50 – 400 MHz
ADC 3dB Passband	0.1 to 1300 MHz
ADC SNR (AC)	70 dB (20/70/125 MHz)
ADC SFDR (AC)	86/84 dB (20/125 MHz)
DAC IF Frequencies	DC to 300 MHz
DAC SFDR (AC)	75/55 dB (40/250 MHz)
DAC Maximum IBW	160 MHz
Channel Isolation	85 dB (250 MHz)
Phase Noise	-100 dBc/Hz (10 kHz offset)
Internal Reference	10 MHz +/- 1.5 ppm

RF – Narrowband		
2 – 420 MHz	40 MHz BW	50 dB SNR

RF – Wideband		
0.2 – 2.4 GHz	40 MHz BW	50 dB SNR

Synchronous Serial	
Electrical Interfaces Supported	RS-232 RS-422 RS-485
Number of Ports	1
Communications Chip	Z16C32 with built–in DMA Controller
Maximum Data Rate	10 Mbps (burst)
Maximum Data Distance	50 ft (RS-232) 4000 ft (RS-485)
I/O Space	8 bytes
Memory Space	256K
RS-485 Operation	Full Duplex (4-wire) Half Duplex (2-Wire)
Connector	DB-25M
System	
Operating System	Linux 2.6 - Fedora
Vocoders	LPC10 MELP CVSD SPEEX
Ethernet	802.3
GPS	General GPS Function in standard NMEA 0183 v3.0.0 Output Protocol