

**Silicon Valley Expert Witness Group, Inc.**  
**Consultant Curriculum Vitae**

**Stephen B. Heppe, D.Sc.**

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**Expertise**

- GPS and DGPS Technology
  - Direction-finding and Positioning
  - Communications Control Systems
  - Cellular communications
  - Mobile Satellite Services
  - Satellite Communications
  - Surveillance Systems
  - VHF Aeronautical Communications
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**Professional Summary**

Dr. Heppe has 30 years of technical and managerial experience for FAA, DoD, NASA, other US Government agencies and commercial and international clients. In the area of communications engineering, specific areas of technical expertise include:

- RF communications including project experience in:
  - cellular telephony (performance testing of cellular phones; base station technology assessment of HTSC, smart antennas, tower top systems; pico-cell infrastructure; mobile cellular systems including VDL-4, 802.11 and EPLRS networking)
  - satellite communications (FAA, DoD and NASA programs as well as Globalstar)
  - aeronautical communications (FAA, DGPS (WAAS and LAAS), international standardization of VDL-4, augmentations of VDL-4 supporting integrated services, aeronautical satcom (Globalstar), and small robotic aircraft)
- Spacecraft and space system design including project experience in:
  - Payload design (FAA satcom system design)
  - Spacecraft bus elements (TDAS, Brilliant Pebbles, ISS video-conferencing)
  - Constellation (Navy proliferated satcom, FAA, MILSATCOM architecture)
- Communications analysis over linear and nonlinear channels
  - Militarily significant channels (highly ionized/disturbed/obstructed)
  - Commercial channels (multipath/fading for communications and GPS)
- Anti-jam and low probability of intercept system design (DSCS, Milstar, BP)
- Detailed communications engineering disciplines including:
  - coding theory
  - modulation theory
  - network analysis
  - traffic loading studies
  - propagation studies

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Dr. Heppe is currently Vice President and Chief Scientist for Insitu, a manufacturer of small robotic aircraft. He works in the office of the CTO and offers particular expertise in aircraft avionics including data radios, GPS navigation, satellite communications, video processing and RF transmission.

Prior experience includes:

- Support for the international development and standardization of a VHF radio communications protocol for aircraft networking and GPS positioning (VDL-4)
- Spectrum engineering and sharing studies for a Big LEO satellite communications system (Globalstar); Gateway siting and coordination; GPS/GNSS interference assessments; aeronautical support
- Architectural development for a future mobile satellite communications system intended to support airborne users
- Design and engineering support for various space-based Government systems, envisioned and operational, including Defense Satellite Communications System (DSCS), the Strategic Defense System (SDS), Space-Based Radar (SBR), Milstar, NASA's Tracking and Data Relay Satellite System (TDRSS) and its follow-ons
- Various Naval satellite communications systems and the network for the US Air Force Consolidated Space Operations Center (CSOC).

Commercial work includes design of a candidate SATCOM system for Saudi Arabia, design of a VSAT network for domestic US customers, and support for the Globalstar mobile satellite service system noted above. Dr. Heppe also led the communications engineering effort for the design, development and successful flight testing of a line-of-sight data link for a precision approach landing system relying on differential GPS.

Experience in the area of navigation includes:

- GPS position and velocity determination for aircraft, spacecraft and ground vehicles
- Differential GPS, and automatic dependent surveillance (ADS).

Specific project experience in the area of navigation and GPS positioning includes:

- Design, development and successful flight test of a DGPS precision approach and landing system for the US Marine Corps
- Concept development for GPS-based navigation systems for the International Space Station, the Strategic Defense System (SDS), Space-based Radar (SBR) and commercial ground vehicles
- Standards development for the DGNSS Instrument Approach System: Special Category I (DIAS:SCAT-I; RTCA/DO-217), and participation in RTCA SC-159 regarding the Wide Area Augmentation System and local augmentations for Category II/III operations
- Support to the US Navy for the ground-based augmentation system (GBAS) intended to support GPS-based precision approach and landing.

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Dr. Heppe's areas of technical expertise include navigation accuracy determination, temporal and geographic studies of system effectiveness, architectural development, specification development, flight testing of hardware/software systems, and cost/benefit studies for government and commercial customers. Dr. Heppe participated in RTCA Task Force 1, which developed the aviation industry position on appropriate transition planning to a GNSS-based navigation and surveillance architecture. He was the Chairman of RTCA/SC-159 WG6 (Interference issues for GNSS) and teaches a course on DGPS data link technology.

Experience in the area of communications control includes protocol development for the STDMA system noted above, as well as network design and control segment design for DSCS, Milstar, SBR, the SDS, and commercial SATCOM networks. Areas of technical expertise include protocol development, multi-access techniques, rain adaptation, fault detection/isolation/response, routing algorithms and overall network management.

Experience in the area of surveillance includes concept development and engineering analysis of GPS-based Automatic Dependent Surveillance (ADS) systems for en route and surface applications. Additional experience in the area of surveillance, specifically radar signal processing and direction finding, derives from Dr. Heppe's doctoral research and dissertation entitled "Iteratively Convergent Methods of Signal Characterization Based on Eigenspace Analysis." This work combines the popular MUSIC technique for signal characterization with adaptive beamforming and optimization strategies to simultaneously enhance DF performance for low-level signals, while reducing computational load.

### **Employment History**

From: 2002      **Insitu, Inc.**  
To:      Present      Bingen, WA  
Position: *Vice President and Chief Scientist*  
Roles include the corporate technology roadmap, concept development for new engineering initiatives, design reviews, safety reviews, incident analysis and maintenance of the company's IP portfolio. Dr. Heppe was responsible for the RF communications and GPS subsystem of the company's small robotic aircraft product line.

From: 1997      **ADSI**  
To:      2002      Bethesda, MD  
Position: *President*  
Dr Heppe was President of ADSI, a start-up company dedicated to air/ground data networking for civil aviation using VDL4. Over a five year period, ADSI was successful in developing flight-qualified hardware and software which resulted in successful flight testing of

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the radio technology and associated networking software. Dr. Heppe's responsibilities included system architecture development, system simulation, international standardization, test planning, technical marketing and investor relations.

From: 1994      **Telenergy**  
To: Present    Hood River, OR  
Position: *President*

Dr. Heppe provides consulting services through Telenergy in the area of telecommunications, satellite communications and GPS positioning and navigation. His project experience includes:

- Systems engineering and standards development for a GNSS-based time-synchronized self-organizing TDMA concept for VHF data link communications in support of civil aviation
- Tradeoff analysis of alternative data link technologies at VHF and L-band
- Evaluation of GPS-based and GNSS-based navigation performance in an environment containing RF interference
- Support for the development of new international frequency standards associated with low-Earth orbiting (LEO) Mobile Satellite Service (MSS) systems
- Interference studies between LEO MSS systems and the Microwave Landing System (MLS).

In the area of international standards development and spectrum coordination, Dr. Heppe was a member of the U.S. delegation to WRC-95, has experience in ITU SG4, WP4A and WP8D, and has participated in ICAO/AMCP, ICAO/GNSSP and the ICAO Special COM/OPS Divisional meeting (1995).

Dr. Heppe teaches several courses on GPS, RF communications and interference and jamming with Navtech Seminars and GPS Supply.

From: 1978      **Stanford Telecommunications, Inc.**

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To: 1994

### *1991-1994: Director, FAA Navigation and Landing Systems*

Responsible for business development and engineering management related to the FAA's evolution toward satellite-based navigation systems such as the NAVSTAR/GPS. Supported the FAA and the Volpe National Transportation Systems Center in this broad area through several contract vehicles. Specific tasking included architectural and performance studies of unaugmented GPS as well as local and wide-area Differential GPS (DGPS) alternatives, requirements definition for specific systems, and specification development. Participated in the RTCA's Task Force 1, and was one of the principal authors of the Minimum Aviation System Performance Standard for DGNSS Instrument Approach Systems: Special Category I (MASPS for DIAS: SCAT-I), RTCA/DO-217. Dr. Heppe led a design team focused on the extension of AMSS to Air Traffic Control (ATC) and other flight-critical/high priority services. This 12-month effort, funded by the FAA, developed a full system architecture tailored to future ATC, AAC and AOC communications as well as continued support to Airline Passenger Communications (APC) such as telephony. The study investigated alternative satellite constellations from LEO to GEO, alternative modulation techniques for air/ground connectivity, control strategies, satellite payload design tradeoffs, avionics design and ground earth station design, management requirements and redundancy/sparing strategies. User avionics included both low-cost omni-directional equipment sets for General Aviation as well as high-performance steerable units for air carrier/air taxi. Cost estimates for the overall system, as well as required user charges, were based on assessment of the spacecraft payload and bus design, launch alternatives, ground segment architecture, non-recurring expenses, program management and replenishment costs, and reasonable investment recovery strategies. The study supports FAA policy and decision-making as the NAS transitions from a predominantly ground-based architecture to one that relies more heavily on satellite technology for CNS.

### *1985-1991: Director, DoD SATCOM Systems Engineering*

Provided management and technical direction of systems engineering activity related to military satellite communications systems (DSCS, Milstar and other MILSATCOM systems), space-based defense systems such as SDS and Space Based Radar (SBR), and space-based navigation systems (e.g., GPS, and augmentations of GPS required for civil aviation). Customers included the U.S. Air Force, SDIO, Martin Marietta and Lockheed. During this time period, Dr. Heppe led broad architectural studies of intersatellite and

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space/ground communications alternatives for highly proliferated satellite constellations, and a detailed communications systems design effort for the “Brilliant Pebbles” and their earth stations.  
*1978-1985: Principal Engineer/Manager and Prior Positions*  
Various positions with increasing responsibility from 1978 to 1985. Supported a multitude of satellite communications and navigation projects including:

- BCAS (a forerunner of the TCAS collision avoidance system)
- DSCS, Milstar, TDRSS, ATDRSS and GPS
- Prototype/flight test of a precision landing system

From: 1977      **General Electric Space Division**  
To: 1978      Valley Forge, PA  
Projects included the Defense Satellite Communications Program, LANDSAT D and NIMBUS G (a weather satellite).

### **Litigation Support Experience**

Date:	2007-8	Orrick Herrington
Case		Global Locate v. SiRF
Project:		Patent Infringement
Status:		Ongoing
Date:	2007	Kirkland & Ellis
Case		Parker Freeland v. Iridium World Communications Ltd., et. al.
Project:		Securities Case
Status:		Settled
Date:	2006-7	Sanders & Parks
Case		Comtech v. Radyne
Project:		Patent infringement
Status:		Settled
Date:	2006-8	Holland & Knight
Case		Discrete Wireless v. Coleman Technology
Project:		Breach of contract
Status:		Ongoing
Date:	2006	Fish & Richardson
Case		E-Watch v. March Networks
Project:		Patent infringement
Status:		Settled
Date:	2005-6	DBJG, LLP

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	Case	ITT v. Sprint and Samsung
	Project:	Patent infringement
	Status:	Partially settled; re-examination ongoing
Date:	2002-06	Kirkland & Ellis
	Case	Unsecured Shareholders of Iridium v. Motorola
	Project:	Breach of contract
	Status:	Case Decided In Favor Of Defendant At Trial
Date:	2002-03	Heller Ehrman
	Case	ISCO International v. STI and Conductus
	Project:	Patent Infringement
	Status:	Case Decided In Favor Of Defendant At Trial
Date:	2000	Irell & Manella
	Case	Qualcomm v. Hewlett Packard Corporation & Agilent Corp.
	Project:	Patent Infringement
	Status:	Case Settled
Date:	2000-01	Harris Corporation
	Case	Undisclosed
	Project:	Contract Dispute involving GPS-based Radio System
	Status:	Case Settled
Date:	2000	Orrick, Herrington & Sutcliffe (Menlo Park)
	Case	Interwave Communications v. Jetcell, Inc. (Cisco Systems)
	Project:	Patent Infringement involving Corporate Cell Network
	Status:	Case Settled
Date:	2001-02	Morrison & Foerster (San Diego)
	Case	Gemstar v. Echostar & Scientific Atlanta (ITC)
	Project:	Patent Infringement involving Satellite CATV User Interface
	Status:	Closed
Date:	2001	Crosby, Heafey, Roach & May (San Francisco)
	Case	Zoltar Satellite Alarm Systems v. Snaptrack and Qualcomm
	Project:	Patent Infringement involving GPS/Cellular technology for 911
	Status:	Closed

**Patents**

<u>Patent Number</u>	<u>Date</u>	<u>Title</u>
	<u>Issued</u>	

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4,654,854	1987	Method And Apparatus For Decoding Threshold-Decodable Forward-Error Correcting Codes
6,477,359	2002	Diversity reception for aeronautical packet data communications systems
6,873,288	2005	Enhanced GNSS Receiver
6,961,018	2005	Method and Apparatus for Satellite-Based Relative Positioning of Moving Platforms
7,185,261	2007	Multidimensional Turbo Product Code Decoding of Uncoded Data Transmitted Over Diversity Channel
Bahamas 1318	2003	End-to-End Aeronautical Data Network Architecture and Method and Apparatus for Transitioning Thereto
Bahamas 1319	2003	Antenna Technology for Enhanced and Cost-Efficient Operation of Multiple Avionics Systems

**Education**

<u>Year</u>	<u>College/University</u>	<u>Degree</u>
1989	George Washington University	D.Sc., EE/Communications
1982	George Washington University	MS, EE/Communications
1977	Princeton University	BSEE, CS

**Publications**

“Improved Method and Apparatus for Decoding Threshold-Decodable Forward-Error-Correcting Codes” (patent). Describes an improved decoder for a certain class of error correcting codes used on digital channels.

“Viewpoints on Control of Military Satellite Communications,” IEEE Communications magazine, July 1983 (describes current and future adaptive control systems for MILSATCOM).

“Iteratively Convergent Methods of Signal Characterization Based on Eigenspace Analysis,” (Ph.D. Dissertation).

“RF Waveform Synthesis for the SDS,” Dr. Stephen Heppe and Mr. John Farserotu, Milcom '90.

“Waveform Design for SDS Ground-based Interceptors,” Dr. Stephen Heppe and Mr. Laurence Mailaender, Milcom '90.

“Cost Minimization in Large Nonhomogeneous Space Communications Networks,” Milcom '91.

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“Issues for GNSS-Based Precision Approach,” 48th Annual Meeting of the ION, June 29, 1992.

“Flying the Tunnel -- System Engineering Tradeoffs Among Accuracy, Availability, Continuity and Integrity for Category I Precision Approach,” Mr. Bruce DeCleene and Dr. Stephen Heppe, 1994 National Technical Meeting of the ION, January 23-26, 1994.

“A Systems Engineering Approach to Resolving GNSS Interference,” co-authored with Gregory Joyner, Robert Frazier, Nelson Keeler, Woody Phlong, Ed Sayadian and Michael Geyer, presented at the International Symposium on Precision Approach and Automatic Landing (German Institute of Navigation), February 21, 1995.

“Radio Frequency Interference to GNSS: Status, Concerns and Issues,” co-authored with Keith McDonald, presented at GNSS '97, Munich, Germany, 21-25 April, 1997.

### **Professional Associations**

- Member, IEEE
- Member, ION
- Member, RTCA
- Member, Technical Board of Navtech Seminars, in charge of DGPS and Communication Links.

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## **Silicon Valley Expert Witness Group, Inc.**

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