

NAME: Timothy Wayne Cook

POSITION TITLE: President & CEO

EDUCATION/TRAINING:

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
US Marine Corps, 29 Palms, Ca.	Certificate	7/1977	Aviation Communications Systems Repair
US Marine Corps, 29 Palms, Ca.	Certificate	3/1979	Advanced Communications Systems Management
US Navy, Memphis, Tn.	Certificate	2/1986	Advanced Air Traffic Controls Systems Management
US Marine Corps, New Orleans, La.	Certificate	1/1988	Information Systems Management
US Marine Corps, Memphis, Tn.	Certificate	5/1990	Cryptographic Materials Management
US Marine Corps, Memphis, Tn.	Certificate	4/1991	Advanced Administration
US Marine Corps, Memphis, Tn.	Certificate	6/1992	Professional Communications
US Marine Corps, Memphis, Tn.	Certificate	2/1994	Government Contract Negotiations
University of Canterbury, Canterbury, UK	BSc.	1/1995	Engineering Technology
US Marine Corps, San Diego, Ca.	Certificate	6/1995	Total Quality Management Coach
University of British Columbia, Vancouver, BC	---	1/2005	Research Methods (audit)
University of Central Lancashire, Preston, UK	MSc. (Merit)	6/2006	Health Informatics

#### **A. Personal Statement**

I have the experience in leadership and training, expertise and motivation necessary to successfully carry out the proposed research project. During my United States Marine Corps (USMC) career I managed groups of people in a variety of challenging environments. I had budgeting responsibilities for maintenance and deployment of equipment in excess of \$100M. My career was highlighted by the award of a Navy and Marine Corps Commendation Medal for the development of several projects based on networking information systems in the transition from terminal based mainframes to distributed local area network interfaces to those mainframes. The award was for the documented improvements in productivity of several areas of administration and budgeting.

Upon retirement from the USMC I took employment in a distributed healthcare information environment where I over-saw a large data migration and new client implementation project. I worked with biomedical device engineers to interface devices to the network and insure quality control and calibration of the devices. During this time I became aware of the poor quality of data interfaces and especially the practice management systems used in clinical practice.

Due to my passion for open source software development I decided to launch (late 1997), what I thought would be a simple six month project to develop an open source practice management application. Little did I know

this was the beginning of a fascinating journey into a new career of complex information challenges. As I researched the area and realized that the practice management functions should be driven by the data entered into an EMR, this made me aware of the existence of various controlled vocabularies with conflicting granularity of definitions for concepts as well as conflicting definitions and management practices for information concepts by domain experts such as physicians, nurses or pharmacists. Building an EMR based on an early concept of what is known today as Multilevel Model Driven Technologies (MMDT), I was approached by investors to go commercial with the product. We eventually parted ways based on conflicting interests, I wanted to solve the information management and interoperability problem and their focus was only on running a profitable EMR business.

I then had an opportunity to take on formal education in the area to help solidify my understanding of the problems. After completing this educational phase on: "Contextual Persistence in Complex Information Systems: An analysis of storing and retrieving information in an electronic health record." (2006) Cook, T.W., M.Sc. Thesis, University of Central Lancashire, Lancashire School of Health and Medicine, I dedicated my time to *really* solving this semantic interoperability problem.

In order to focus on this I had to make it my full time passion with no distractions and just a smattering of consulting gigs to help make ends meet.

During this focused research period I also made sure that I stayed in touch with current advances in many areas of health informatics by participating in online discussions and hosting forums and mailing lists in order to engage a global community around this issue. I established professional knowledge exchange with experts in the areas of Health Informatics, Semantic Web and Linked Data, especially those working with the emerging technology space around the Resource Description Framework (RDF) and the Web Ontology Language (OWL) and using these core specifications to build semantic networks using ontologies and graph databases. These mailing lists and forums have been hosted by the World Wide Web Consortium (W3C), specifically the Health Care and Life Science (HCLS) Working Group, the International Health Terminology Standards Development Organisation (IHTSDO), specifically the Implementation Special Interest Group (SIG), Health Level Seven® INTERNATIONAL (HL7), the *openEHR* Foundation (where I was a member of the Architecture Review Board for five years) and other standards and specifications organizations. I also founded and was the first Chair of the American Medical Informatics Association (AMIA) Open Source Working Group and I was a founding member of the international Open Source Health Care Alliance (OSHCA).

Extending my information gathering and maintaining contact with experts I had previously worked with; I hosted (for one year) a one on one interview web show of global celebrities in health informatics. Guests included; Dr. Ed Hammond, Dr. Ted Shortliffe, Dr. Patti Brennan, Dr. Martha Adams, Mr. Grahame Grieve, Dr. Dipak Kalra, Dr. Bill Hersch, among others. The archives are available on YouTube by searching for a playlist of "Healthcare IT Live!".

Based on my experiences and interactions with other experts in the field I established my ground rules for a solution to the problem of *computable semantic interoperability*: (1) It must be implementable; (2) It must reuse existing, proven technologies; (3) It must be comprehensive.

The obvious choice for implementation technology was the ubiquitous eXtensible Markup Language (XML) suite of tools. Using the latest specifications and tools for model structures and adding RDF and OWL for semantics, we built a MMDT-based, minimalistic, cross-domain solution for computable semantic interoperability. It required simply backing up and looking at the problems from a high level and then diving into the details to discover a valid approach to a solution. Moving back and forth between levels with constant testing insured a comprehensive and implementable system.

Based on the most recent research results and artifacts from the Multi-Level Healthcare Information Modeling (MLHIM) project we have produced the cross-domain; Shareable-Structured-Semantic Model (S3Model) specifications and tools, opening up the possibility to use RuleML technologies for clinical guidelines and other rule-based encoded constraints.

My current goal is to produce a real world implementation that is meaningful and demonstrative of the S3Model technology, then expand the educational material and tools for broader use in global domain modeling.

1. Cavalini LT, Cook TW. Use of XML Schema Definition for the development of semantically interoperable healthcare applications. In: Jeremy Gibbons; Wendy McCaull. (Org.). Lecture Notes in Computer Science. Springer Berlin Heidelberg 2014; 8315: 125-45.
2. Cavalini LT, Cook TW. Semantic interoperability of controlled vocabularies in medicine: A case study of the International Statistical Classification of Diseases "Tuberculosis" subset. *Comput Ind*2015; 69: 30-4.

3. Cook TW, Cavalini LT. Clinical decision support systems and advanced diagnostic imaging. JAMA 2015; 314: 1518.
4. Menezes PM, Cook TW, Cavalini LT. Convergence of Health Level Seven Version 2 messages to Semantic Web technologies for software-intensive systems in telemedicine trauma care. Healthc Inform Res 2016; 22; 22-9.

## **B. Positions and Honors**

### **Positions and Employment**

1976-1997	US Marine Corps; MSgt. (retired)
1997-2000	Information Systems Operations Manager, Baptist Hospitals, Union City, TN
2000-2002	President & CTO, Free Practice Management, Inc., Miami, FL
2002-2004	President, Open Paradigms, LLC South Fulton, TN
2004-2006	COO, CHASE Health Informatics, Inc. Edmonton, AB
2006-2015	Independent health informatics consultant, US, UK and Brazil
2007-2009	Visiting Researcher, Fluminense Federal University, Niterói, RJ, Brazil
2008-2014	International Collaborator, Natl. Institute of Science and Technology, Petrópolis, Brazil
2014-	High Level Grantor, Rio de Janeiro State University, Rio de Janeiro, RJ, Brazil
2015-	Present President & CEO, Data Insights, Inc., Union City, TN

### **Other Experience and Professional Memberships**

2000-2004	Founder and Member, American Medical Informatics Association Open Source WG
2004-2009	Founding member, Architecture Review Board, openEHR Foundation
2009-	Member, World Wide Web Consortium Healthcare Life Sciences Working Group
2011-	Member, Intl. Health Terminology Standards Development Org. Implementation SIG
2012-	Member, National Information Exchange Model, Healthcare Domain

### **Honors**

1979	Marine Corps Good Conduct Award
1982	Marine Corps Good Conduct Award
1983	Navy Meritorious Unit Citation
1985	Marine Corps Good Conduct Award
1989	Organized Marine Corps Reserve Medal
1992	National Defense Medal
1993	Organized Marine Corps Reserve Medal
1994	Navy and Marine Corps Commendation Medal
1996	Navy Meritorious Unit Citation
2001	Linux Medical News Open Source Achievement Award

## **C. Contribution to Science**

My contribution to science is the full implementation of my current research work on semantic interoperability. This was my passion to solve and now it is my passion to see the implementation and dissemination of the knowledge.

Selected relevant publications include:

- a) Cavalini LT, Cook TW. Knowledge engineering of healthcare applications based on minimalist multilevel models. In: 14th IEEE International Conference on e-Health Networking, Applications and Services (HealthCom 2012), 2012, Beijing, p. 431-434.

- b) Cook TW, Cavalini LT. A multilevel-model driven social network for healthcare information exchange. In: LinkQS 2014: Linking the Quantified Self Workshop - 25th ACM Hypertext and Social Media Conference (Hypertext 2014), 2014, Santiago. Available at: [http://ceur-ws.org/Vol-1210/LQS\\_03.pdf](http://ceur-ws.org/Vol-1210/LQS_03.pdf).
- c) Cook TW, Nogueira JRM, Cavalini LT. Knowledge management of controlled vocabularies in medicine and the semantic interoperability challenge. In: Alfonso Perez Gama. (Org.). Knowledge engineering: principles, methods and applications. 1ed. New York: Nova Publishers, 2015, p. 57-78.
- d) Luz MP, Nogueira JRM, Cavalini LT, Cook TW. Providing full semantic interoperability for the Fast Healthcare Interoperability Resources Schemas with Resource Description Framework. In: IEEE 2015 International Conference on Healthcare Informatics (ICHI), 2015, Dallas, p. 463-466.

Complete List of Published Work in MyBibliography:

<http://www.ncbi.nlm.nih.gov/sites/myncbi/1PyrAxbHiSKQo/bibliography/41432552/public/?sort=date&direction=ascending>

## D. Research Support

### Ongoing Research Support

FAPERJ 14/2014      Cook (PI)      10/22/14-10/21/16

A comprehensive clinical decision support environment

The goal of this project is to investigate and implement MLHIM based data models and interfaces to networked and standalone healthcare devices for use in the home for connectivity to a web-based *longitudinal medical record home*. Including the ability to implement decision support and warnings using this shared personal medical record.

Role: PI

FAPERJ 18/2014      Cavalini (PI)      09/01/14-08/31/16

FAPERJ 06/2015      Cavalini (PI)      01/01/15-12/31/17

Analysis of the performance of the multilevel model driven approach on healthcare data management

The goal of this project is to compare software performance of the MLHIM specifications and the other multilevel model driven technologies, the *openEHR* specifications and the ISO 13606 family of standards.

Role: Co-Investigator

FAPERJ 41/2013      Cavalini (PI)      07/01/14-06/30/16

Emergent Group for Research and Innovation on Health Information Technologies

The goal of this project is to develop and mature the MLHIM specifications, producing proofs of concept of the achievement of semantic interoperability using this technology.

Role: Co-Investigator

UERJ UDT/2014      Cavalini (PI)      10/01/14-09/30/16

Technological development unit in Multilevel Healthcare Information Modeling

The goal of this project is to produce innovative software applications based on the MLHIM specifications that can evolve to an industry scale production.

Role: Co-Investigator

### Completed Research Support

FAPERJ 06/2013      Saade (PI)      01/01/14-12/31/15

Research on decision and diagnostic support systems to aging related diseases

The goal of this project was to develop a decision support system for the early detection of dementia, based on the MLHIM specifications.

Role: Co-Investigator

CNPq 15/2008

Feijóo (PI)

09/01/08-08/31/14

National Institute of Science and Technology – Medicine Assisted by Scientific Computing

The goal of this research network was to develop nationwide projects on medicine assisted by scientific computing. The Multilevel Healthcare Information Modeling (MLHIM) Laboratory was a member of this network, with the goal of studying and testing the existing healthcare informatics standards and develop the MLHIM specifications.

Role: International Collaborator