

# EXHIBIT B

**DECLARATION OF DR. RICARDO VALERDI**

**I. INTRODUCTION**

1. I, Ricardo Valerdi, have been asked by Ameranth, Inc. ("Ameranth") to opine on the technological innovations described in U.S. Patent 9,747,651 ("651 patent") dated August 29, 2017. I have been also asked to opine on the state of the art of computer technology at the time of the '651 patent and how improvements disclosed in the '651 patent improved the state of the art of computer technology at the time of the '651 patent.

**II. EXPERIENCE AND QUALIFICATIONS**

2. The details of my education, work experience, research, and publications (including publications authored in the last 10 years) are summarized in my curriculum vitae ("CV") attached hereto as Attachment A of this declaration.

3. I received a Bachelor of Science degree in Electrical Engineering from the University of San Diego, a Masters in Systems Architecture and Engineering from the University of Southern California, and a Ph.D. in Industrial and Systems Engineering from University of Southern California.

4. I am a Full Professor, with tenure, at the University of Arizona in the Department of Systems & Industrial Engineering. Previously, I was on the faculty at the Massachusetts Institute of Technology in Cambridge, MA and was a Visiting Professor at the United States Military Academy in West Point, NY.

5. I have provided consultant services for the United States Government (i.e., Department of Defense and Department of Energy), and other governments and major contractors in the areas of product development. I also teach university classes – cost estimation and sports analytics – and have supervised dozens of graduate students in engineering and given presentations on product development and related topics in Mexico, Costa Rica, Brazil, Spain, Italy, England, India, China, and Australia.

6. My industry experience includes a variety of engineering roles at Motorola (in the wireless communications division) and SpaceX (in the space rocket production department). My experience at Motorola included the development of voice and data systems connected via wireless communication networks. This is similar to the '651 patent in the areas of wireless computing, handheld and remote communications to databases, fixed and free format messaging, and audio quality validation over fixed and mobile wireless networks.

7. I am a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE), the largest engineering professional society in the world.

8. I have received numerous awards for my research including the Frank Freiman Award for Lifetime Achievement in Cost Estimation and Parametric Modeling (highest award given by the International Cost Estimating & Analysis Association), Distinguished Visiting Fellowship at the Royal Academy of Engineering (United Kingdom), and elected as a Foreign Member of the Mexican Academy of Engineering. I have received best paper awards in the Defense Acquisition Research Journal, Conference on Predictive Models in Software Engineering, and Symposium of the International Council on Systems Engineering.

9. I have over 100 publications in journals, magazines, and conferences relating to a broad range of technologies including cybersecurity, autonomous systems, virtual reality, and electronic medical records.

10. Of most relevance to this matter are the following publications:

Ryan, T., Valerdi, R., Total Cost of Ownership: An Approach for Estimating UAS Costs, in *Operations Research for Unmanned Systems*, Cares, J. R. and Dickmann, J. Q. (Eds.), Wiley, 2016.

This article describes various attributes of intelligent systems (e.g., military unmanned drones) that drive their total ownership costs.

Latt, L. D., Monreal, J., Smith, K., Mertz, J., Patterson, J., Valerdi, R., Head, K. L., "Impact of electronic medical record implementation on orthopaedic clinic workflow," 127<sup>th</sup> Meeting of the American Orthopaedic Association, Montréal, Canada, June 18-21, 2014.

This article describes a mobile application connected to a database utilized for storing time motion data of physicians in an orthopaedic clinic.

Thebeau, D., Reidy, B., Valerdi, R., Gudagib, A., Kurra, H., Al-Nashifb, Y., Hariri, S., Sheldon, F., "Improving cyber resiliency of cloud application services by applying Software Behavior Encryption (SBE)," Conference on Systems Engineering Research, Redondo Beach, CA, March 21-22, 2014.

This article describes in part an intelligent algorithm for improving computer security using a moving target defense strategy.

Hess, J., Agarwal, G., Cowart, K., Deonandan, I., Kenley, C. R., Mikaelian, T. and Valerdi, R., "Normative and Descriptive Models for Test & Evaluation of Unmanned and Autonomous Systems of Systems," 20<sup>th</sup> INCOSE Symposium, Chicago, IL, July 2010.

This article describes a framework for testing intelligent systems with emergent behaviors (e.g., military unmanned drones).

Deonandan, I., Valerdi, R., Lane, J. and Macias, F., "Cost and Risk Considerations for Test and Evaluation of Unmanned and Autonomous Systems of Systems," 5<sup>th</sup> IEEE International Conference on Systems of Systems Engineering, Loughborough, UK, June 2010.

This article describes in part an intelligent decision support system for testing military unmanned drones.

### **III. COMPENSATION**

11. The rate of compensation for my work in this case is \$650 per hour. My compensation is based solely on the amount of time that I devote to activity related to this matter and is in no way affected by any opinions that I render or the outcome of any particular matter.

**IV. MATERIALS CONSIDERED**

12. My opinions, expressed herein, and preparation of this declaration are based on the information I have reviewed in the materials listed in Attachment B of this declaration.

**V. SUMMARY OF OPINIONS**

13. The technologies described and claimed in the '651 patent contain at least the following three inventive concepts that enhance computer technology: (1) being able to understand and convert both fixed format<sup>1</sup> and free format messaging - unstructured data<sup>2</sup> such as in an e-mail/text message or via voice to text conversion (Claim 1: a; Claim 2: a; Claim 3: a), (2) being able to concurrently handle both free and fixed format messaging through a variety of communication conversions (Claim 1: f and g; Claim 2: f and g; Claim 3: f, g, and h), and (3) being able to make and execute intelligent decisions by accessing and applying intelligent automated assistant technology (Claim 1: a and f; Claim 2: a and f; Claim 3: a and f).

14. As will be shown below, the prior art did not have the ability to perform the above unconventional inventive concepts captured in the cited claim elements. It was not until the inventions – and their non-conventional combinations disclosed, taught, and claimed in the '651 patent – that these non-conventional combinations exist.

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<sup>1</sup> Fixed format messages are comprised of structured data, which have clearly defined patterns making them easily understood by computers. As an example in the hospitality industry, structured data may be the day of the week (e.g., "Wednesday").

<sup>2</sup> Unstructured data are comprised of information that do not have a pre-defined format. Handling unstructured data is not trivial. Many difficulties arise because unstructured data is cumbersome to analyze due to the unpredictable lengths and meanings of number and letters. Unstructured data exponentially increases the number of possible combinations that must be anticipated, quickly surpassing Moore's Law (that computing power doubles approximately every two years). Furthermore, unstructured data leads to the same word contain multiple meanings (e.g., may vs. May). The increased complexity and unpredictability of unstructured data results in an increased need for computing power and more sophisticated natural language processing algorithms. As an example, unstructured data may be a sentence with instructions (e.g., "I would like my reservation to be for my husband and I, we are celebrating our anniversary on Wednesday next week and would like a table by the window.")

## **VI. LEVEL OF ORDINARY SKILL IN THE ART**

15. In determining the characteristics of a hypothetical person of ordinary skill in the art of the '651 patent, I considered several things, including the type of problems encountered in the art, the solutions to those problems, the speed with which innovations are made, the sophistication of the technology, and the education level of active workers in the field. Finally, I reflected on my experience in and around the year 2005 and considered the scientists and engineers whom I had collaborated with and with whom I had worked.

16. I determined that a person with a level of ordinary skill in the art for the '651 patent in or around 2005 would have been someone with a minimum of a Bachelor's degree in Engineering (e.g., Computer Engineering or Software Engineering) or equivalent experience. Typical work experience in complex computer systems, for instance in the industrial automation industry, for such a person would be between 5-15 years in a technical role.

17. In addition, a person of ordinary skill in the art (POSITA) would need some exposure to hospitality applications and their functionality in order to leverage industry-specific ontologies.<sup>3</sup> The POSITA's understanding of the ontology of operations for the particular hospitality application being developed and deployed would be needed to (1) intelligently program and (2) set up the system.

18. The specific skillset needed to build this type of system is in the areas of software development, communication conversions, database design, Application Programming Interfaces, computer networking, and wireless communications.

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<sup>3</sup> An ontology is a set of concepts and categories in a subject area or domain that shows their properties and the relations between them. In the hospitality industry, this might include date/time/place/party size/party name. See for example: Snae, C., & Bruckner, M. (2008, February). FOODS: a food-oriented ontology-driven system. In 2008 2nd IEEE International Conference on Digital Ecosystems and Technologies (pp. 168-176). <https://doi.org/10.1109/DEST.2008.4635195>

## VII. BACKGROUND

19. One of the earliest digital food orders was a pizza from Pizza Hut<sup>4</sup> in 1994, followed shortly by waiter.com<sup>5</sup> in 1995 yet these primitive ordering systems did not include any wireless handheld computers. Ameranth introduced remote wireless handheld ordering in September 1999.<sup>6</sup> This was followed by GrubHub's look-up website for restaurants in 2004.<sup>7</sup> The Pizza Hut and GrubHub solutions were simple, fixed format, menu-based food ordering systems with very limited capabilities and lacked the ability to process, understand, and execute unstructured data.

20. The field of speech and voice recognition was also in a primitive stage in the early 2000s. While IBM and DARPA<sup>8</sup> successfully demonstrated speech recognition computers in the 1960s and 1970s, these computers could only understand a limited number of words in English and required a lot of processing power and memory. In the 1980s, computers with faster processors arrived which cleared the way for the development of speech recognition systems for consumers. In 1990, Dragon Dictate was the first speech recognition product available to consumers, which sold for \$9,000 per copy and required extensive training in order to recognize different voices.<sup>9</sup> Dragon Dictate was inadequate in its early years because of its inability to filter out environmental noise, resulting in a high error rate.<sup>10</sup> In some cases, the Dragon software had a lower accuracy and required more editing time than a human transcription service.<sup>11</sup>

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<sup>4</sup> [https://www.huffpost.com/entry/pizza-hut\\_n\\_3894981](https://www.huffpost.com/entry/pizza-hut_n_3894981)

<sup>5</sup> [https://www.paloaltoonline.com/weekly/morgue/restaurants/1995\\_Dec\\_29.EATOUT29.html](https://www.paloaltoonline.com/weekly/morgue/restaurants/1995_Dec_29.EATOUT29.html)

<sup>6</sup> U.S. Patent 6,384,850 filed in September 1999 and issued in 2002. See: McNally, Keith R., William H. Roof, and Richard Bergfeld. "Information management and synchronous communications system with menu generation." U.S. Patent 6,384,850, issued May 7, 2002.

<sup>7</sup> <https://www.businessinsider.com/grubhubs-ceo-on-the-shock-of-outgrowing-three-offices-in-a-few-short-years-2012-2>

<sup>8</sup> Defense Advanced Research Projects Agency is part of the U.S. Department of Defense

<sup>9</sup> [https://www.pcworld.com/article/243060/speech\\_recognition\\_through\\_the\\_decades\\_how\\_we\\_ended\\_up\\_with\\_siri.html](https://www.pcworld.com/article/243060/speech_recognition_through_the_decades_how_we_ended_up_with_siri.html) (see page 2 of article)

<sup>10</sup> Hawley, M. S. (2002). Speech Recognition as an Input to Electronic Assistive Technology. *British Journal of Occupational Therapy*, 65(1), 15–20. <https://doi.org/10.1177/030802260206500104>

<sup>11</sup> Singh, M., Pal, T. R., (2011). Voice Recognition Technology Implementation in Surgical Pathology: Advantages and Limitations. *Archives of Pathology & Laboratory Medicine* 135(11), 1476-1481 <https://doi:10.5858/arpa.2010-0714-OA>



21. The first interactive voice response system, VAL from Bell South, was released in 1996 but was plagued with problems of accuracy. Similar problems existed in early versions of Microsoft's Vista voice-recognition system first released in 1996.<sup>12</sup> One of the technical challenges at the time was that algorithms for Natural Language Processing were not optimized to handle the variety of voice inputs from different human voices.<sup>13</sup>

22. Apple first introduced speech recognition in its MacOS operating systems in 1993, but the commands were limited to terminology preprogrammed in the computer, had problems with background noise, different pronunciations of the same word, and the inability to block applications by Parental Controls without an administrator's permission.<sup>14</sup> Apple's iPhone did not include voice recognition technologies until 2008, and researchers behind this application claimed that users could get gibberish results at times.<sup>15</sup> Siri, Apple's personal digital assistant, was first released in 2011 on the iPhone 4s.<sup>16</sup> Thanks to advancements in computer processing power, faster internet connection speeds, and improved natural language processing, Siri applied statistical analysis to decipher the meaning behind questioners' sentences.

23. Google began the development of voice recognition technologies around 2004, and in 2007 launched a free 411 service called GOOG-411.<sup>17</sup> The system would accept verbal commands to look up business listings and "worked at about 70% efficiency."<sup>18</sup> Google's development team admitted "...the 411 service didn't exist solely because Google wanted to help people out — it also gave Google a vast amount of voice data, allowing it to improve its speech recognition technology

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<sup>12</sup> <https://www.pcworld.com/article/126613/article.html>

<sup>13</sup> Lapata, M., & Keller, F. (2005). Web-based models for natural language processing. *ACM Transactions on Speech and Language Processing (TSLP)*, 2(1), 3-es. <https://doi.org/10.1145/1075389.1075392>

<sup>14</sup> [https://en.m.wikipedia.org/wiki/Speakable\\_items](https://en.m.wikipedia.org/wiki/Speakable_items)

<sup>15</sup> <https://www.pcworld.com/article/153871/search.html>

<sup>16</sup> [https://www.pcworld.com/article/242479/what\\_makes\\_siri\\_special\\_.html](https://www.pcworld.com/article/242479/what_makes_siri_special_.html)

<sup>17</sup> <https://techcrunch.com/2011/02/13/the-power-of-voice-a-conversation-with-the-head-of-googles-speech-technology/>

<sup>18</sup> <https://techcrunch.com/2010/10/08/google-411/>

for the voice services that are now present throughout Android and on many other phones, including the iPhone, BlackBerry, Nokia S60, and Windows."<sup>19</sup>

24. The field of intelligent automation was still in development in the mid-2000s, with researchers citing, among others, challenges in the areas of monitoring and diagnosis.<sup>20</sup> The complexity of such automation systems resulted in the development of industry standard IEC 61499<sup>21</sup> to address challenges in validating architectures for industrial automation systems.<sup>22</sup> Despite the progress in defining generic architectures and guidelines for intelligent automation systems, implementation problems remained.<sup>23</sup> For example, the combination of intelligent interfaces using human speech and systems that used intelligence did not exist and intelligent system applications, including intelligent automation, at or from remote wireless handheld computing devices was virtually nonexistent due to the very limited computing power and the lack of high-speed wireless connectivity that existed at the time.

25. In the hospitality industry, in particular, significant work was still needed in or around 2005 to advance the digital delivery and data management of remote, location-based tourism systems.<sup>24</sup>

26. Thus, as discussed above, no prior art discloses or renders the specific inventive features of the claims conventional, and none of the prior art understood, handled, or converted fixed

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<sup>19</sup> <https://googleblog.blogspot.com/2010/10/goodbye-to-old-friend-1-800-goog-411.html>

<sup>20</sup> Gilabert, E., & Arnaiz, A. (2006). Intelligent automation systems for predictive maintenance: A case study. *Robotics and Computer-Integrated Manufacturing*, 22(5-6), 543-549. <https://doi.org/10.1016/j.rcim.2005.12.010>

<sup>21</sup> IEC 61499-1:2012, Function blocks - Part 1: Architecture

<sup>22</sup> Vyatkin, V., Hanisch, H. M., Karras, S., Pfeiffer, T., & Dubinin, V. (2006). Rapid engineering and re-configuration of automation objects aided by formal modelling and verification. *International Journal of Manufacturing Research*, 1(4), 382-404. <https://www.inderscienceonline.com/doi/abs/10.1504/IJMR.2006.012252>

<sup>23</sup> Vyatkin, V. V. (2006). The potential impact of the IEC61499 standard on the progress of distributed intelligent automation. *International journal of manufacturing technology and management*, 8(1-3), 107-125. <https://www.inderscienceonline.com/doi/abs/10.1504/IJMTM.2006.008801>

<sup>24</sup> P. Hawking, et al., "Emerging issues in location based tourism systems," *International Conference on Mobile Business (ICMB'05)*, Sydney, NSW, 2005, pp. 75-81. <https://ieeexplore.ieee.org/abstract/document/1493591>

and free format messaging to make and execute intelligent decisions by accessing and applying intelligent automated assistant technology as described in the '651 specification or explained in the claims (e.g., Claim 1: a, f, and g; Claim 2: a, f, and g; and Claim 3: a, f, g, and h).

**VIII. U.S. PATENT NO. 9,747,651**

27. Claim 1 of the '651 patent states:

1. A rule capable intelligent automated assistants (IAA) system for use with remote wireless handheld computing devices and the internet, comprising:

a) at least one hospitality software back-office application with at least one IAA-based interface and enabled to execute one or more rules while communicating via free format messaging and at least one interface with fixed format messaging communications with web browsers for communicating bi-directionally with two or more different remote wireless handheld computing devices;

b) a master database containing data and parameters of the at least one hospitality software application pursuant to a master database file structure with predefined formats and specific fields and which is accessible through a database application programming interface (API);

c) at least one computer server, with associated data storage capabilities for the at least one hospitality software application, and the master database;

d) at least one application software based communications control module (CCM) integrated with the hospitality application software and enabled to interface with at least one communications protocol;

e) at least one web server enabled by the CCM to concurrently communicate via the internet with two or more different remote wireless handheld computing devices;

f) at least one wireless handheld remote computing device with at least one IAA mobile application and user interface with free format messaging that enables access to and communications with the back office hospitality software application and its IAA-based interface;

g) at least one other wireless handheld remote computing device which uses a web browser based user interface with fixed format messaging to access and communicate with the back office hospitality application software;

h) at least one external application programming interface for fully integrating via the internet the hospitality back office software application with one or more non hospitality software applications;

wherein the system elements are enabled to communicate bi-directionally in real time via the back office hospitality application software and the database API and the communications control module while utilizing the parameters and data of the master database file structure in interfacing the back office hospitality software application between and with the two or more remote wireless handheld computing devices with their different user interfaces while maintaining consistency with the master database.

28. Claim 2 of the '651 patent states:

2. A rule capable intelligent automated assistants (IAA) system for use with remote wireless handheld computing devices and the internet, comprising:

a) at least one hospitality software back-office application with at least one IAA-based interface and enabled to execute one or more rules while communicating via free format messaging and at least one mobile software application based interface with combined free and fixed format messaging communications for communicating bi-directionally with two or more different remote wireless handheld computing devices;

b) a master database containing data and parameters of the at least one hospitality software application pursuant to a master database file structure with predefined formats and specific fields and which is accessible through a database application programming interface (API);

c) at least one computer server, with associated data storage capabilities for the at least one hospitality software application, and the master database;

d) at least one application software based communications control module (CCM) integrated with the hospitality application software and enabled to interface with at least one communications protocol;

e) at least one web server enabled by the CCM to concurrently communicate via the internet with two or more different remote wireless handheld computing devices;

f) at least one wireless handheld remote computing device with at least one IAA mobile application and user interface with free format messaging that enables access to and communications with the back office hospitality software application and its IAA-based Interface:

g) at least one other wireless handheld remote computing device which uses a mobile hospitality software application based user interface with combined free and fixed format messaging to access and communicate with the back office hospitality application software;

h) at least one external API for fully integrating via the internet the hospitality back office software application with one or more non hospitality software applications;

wherein the system elements are enabled to communicate bi-directionally in real time via the back office hospitality application software and the database API and the communications control module while utilizing the parameters and data of the master database file structure in interfacing the back office hospitality software application between and with the two or more remote wireless handheld computing devices with their different user interfaces while maintaining consistency with the master database.

29. Claim 3 of the '651 patent states:

3. A rule capable intelligent automated assistants (IAA) system for use with remote wireless handheld computing devices and the internet, comprising:

a) at least one hospitality software back-office application with at least one IAA-based interface and enabled to execute one or more rules while communicating

via free format messaging and at least one interface with web browsers with fixed format messaging communications and with at least one mobile software application interface with fixed format messaging communications for bi-directional communications with three or more different remote wireless handheld computing devices;

b) a master database containing data and parameters of the at least one hospitality software application pursuant to a master database file structure with predefined formats and specific fields and which is accessible through a database application programming interface (API);

c) at least one computer server, with associated data storage capabilities for the at least one hospitality software application, and the master database;

d) at least one application software based communications control module (CCM) integrated with the hospitality application software and enabled to interface with at least one communications protocol;

e) at least one web server enabled by the CCM to concurrently communicate via the internet with three or more different remote wireless handheld computing devices;

f) at least one wireless handheld remote computing device with at least one IAA mobile application and user interface via free format messaging that enables access to and communications with the back office hospitality software application and its IAA-based interface;

g) at least one other wireless handheld remote computing device which uses a web browser based user interface with fixed format messaging to access and communicate with the back office hospitality application software;

h) at least one other wireless handheld remote computing device which uses a mobile hospitality software application based user interface with fixed format messaging to access and communicate with the back office hospitality application software;

i) at least one external API for fully integrating via the internet the hospitality back office software application with one or more non hospitality software applications;

wherein the system elements are enabled to communicate bi-directionally in real time via the back office hospitality application software and the database API and the communications control module while utilizing the parameters and data of the master database file structure in interfacing the back office hospitality software application between and with the three or more remote wireless handheld computing devices with their different user interfaces while maintaining consistency with the master database.

30. The inventions claimed in the '651 patent enhance the functionality of a computer system by: (1) being able to automatically understand, convert, and execute both structured and unstructured data, (2) being able to concurrently execute both free and fixed format messaging through a variety of communication conversions, and (3) being able to make intelligent decisions by

accessing and applying intelligent automated assistants technology.

31. Further, as detailed in the above Background section, prior to 2005, the combination of enabling technologies disclosed in the '651 patent to accomplish this type of integrated functionality did not exist and was non-conventional.

32. A POSITA would not have been able to develop such an intelligent system prior to July 2005 without the disclosures of the '651 patent specification because, at the time, mobile handheld devices had limited processing power needed to handle intelligent decision making, data conversion technologies were inadequate, wireless networks were too slow and nobody had conceived of nor demonstrated how a computer system would be able to automatically understand, convert, and execute both structured and unstructured data, be able to concurrently execute both free and fixed format messaging through a variety of communication conversions, and be able to make intelligent decisions by accessing and applying intelligent automated assistants technology.

33. Thus, the inventions claimed in the '651 patent were not available prior to July 2005, and were neither routine nor conventional. The claimed inventions were innovative and enhanced the operation of computer systems using remote wireless handheld devices.

34. The claims as understood by a POSITA, after reading the specification and reviewing the figures, provide a roadmap for how to develop a computer system optimized for hospitality applications (e.g., online reservations using a handheld device that utilizes both fixed and free format messaging and intelligent automated assistant technologies). The claims themselves also guide a POSITA and provide a roadmap of how to build and integrate the disclosed computer system. Namely, the '651 patent includes: an architecture, measures of effectiveness and performance, and technical guidance and requirements.

35. The architecture<sup>25</sup> of the system is described in the claims and includes a clear example of how the components of the system integrate and intercommunicate is specified and shown in Figure 10 "Ameranth 21<sup>st</sup> Century Communications Integration With Conversion Technologies." Accordingly, the architecture contains the framework and components necessary to implement the system and prescribes the arrangement and integration of the components needed to take advantage of the innovative technical functionality described in the '651 patent.

36. As an example, with reference to claim 1, of particular importance are the "Communication Conversions" components (indicated with the red arrows added for emphasis), which generally correspond to the claimed "at least one hospitality software back-office application with at least one IAA-based interface and enabled to execute one or more rules while communicating via *free format messaging* and at least one interface with *fixed format messaging* communications with web browsers for communicating bi-directionally with two or more different remote wireless handheld computing devices" (Claim 1: a; *See also e.g.*, Claim 2: a; Claim 3: a), "at least one wireless handheld remote computing device with at least one IAA mobile application and user interface with *free format messaging* that enables access to and communications with the back office hospitality software application and its IAA-based interface" (Claim 1: f; *See also e.g.*, Claim 2: f; Claim 3: f), and "at least one other wireless handheld remote computing device which uses a web browser based user interface with *fixed format messaging* to access and communicate with the back office hospitality application software." (Claim 1: g; *See also e.g.*, Claim 2: g; Claim 3: g, h) (emphasis added).

37. The "Ameranth Middleware/Framework" in the center of Figure 10 includes the

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<sup>25</sup> Defined as "the set of principal design decisions made about a system; it is a characterization of the essence and essentials of the application" (p. 24 in Taylor, R. N., Medvidovic, N., Dashofy, E. M., Software Architecture: Foundations, Theory, and Practice, Wiley, 2009.)

"communications control module" (blue arrow added for emphasis) (e.g., "communications control module" in Claim 1: d, *See also* e.g., Claim 2: d; Claim 3: d) which provides a single point of entry for all hospitality applications (5:24).

38. At the time of the invention, the communications control module improved "web servers" which it enables (Claim 1: e; *See also* e.g., Claim 2: e; Claim 3: e) and was not conventional (because unlike prior/conventional web servers e.g., using 'forms' - *see* 19:39-56), it concurrently handled both free and fixed format messaging from multiple and different remote wireless handhelds, and integrated with intelligent automated assistant technology, enabled to perform intelligent decisions in real time (considering multiple criteria and rules) for hospitality market users (e.g., placing orders or making reservations). The communications control module also enabled the use of multiple and different Application Programming Interfaces ("API's") and integration between both hospitality and non- hospitality applications.

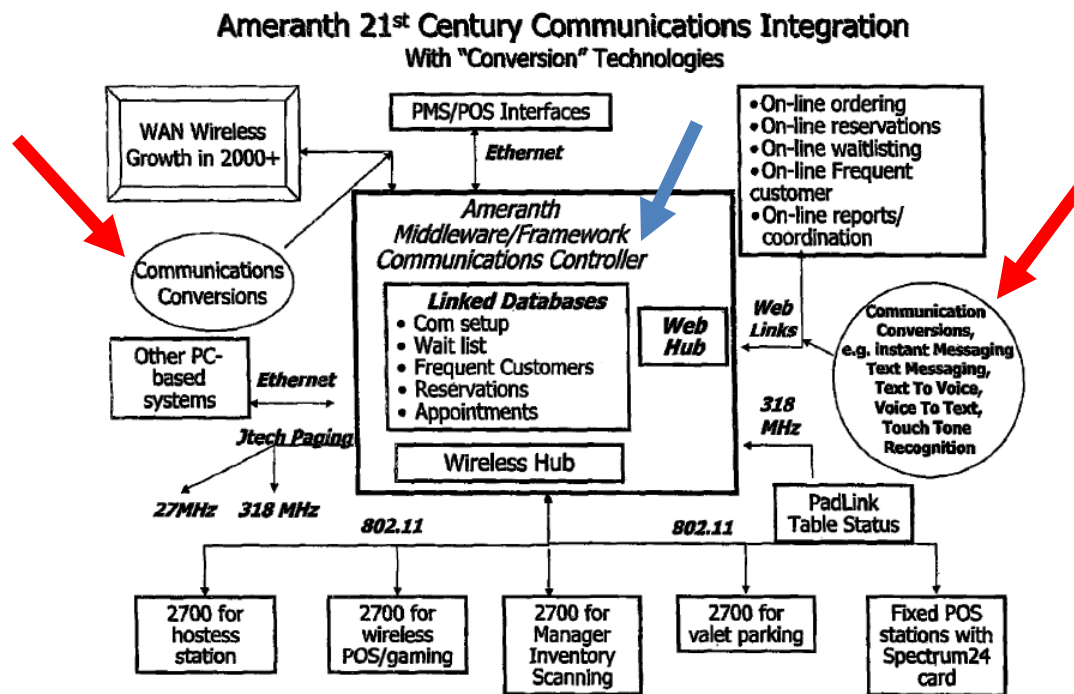


Fig. 10

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39. The measures of effectiveness and measures of performance<sup>26</sup> are specified throughout the '651 patent as summarized in the following Table. These are important in the implementation of the claimed system because they indicate how the system should be built and tested. The existence of specific measures of effectiveness and measures of performance gives the developer clear objectives to implement the system.

Column:line number(s) in '651 patent	Measure
2:3-4	Accuracy (by improving the non-optimal operator interface)
2:5	Speed (by reducing the time criticality of ordering)
3:45-46	Reduction of time and cost (among servers in the hospitality industry)
3:63-65	Increased productivity (from increased table turns from shorter order taking and check paying times)
20:39-46	Efficiency (by eliminating unnecessary querying or checking)
21:31-32	Efficiency (with respect to computational speed and equipment)

40. The technical requirements<sup>27</sup> are specified throughout the '651 patent as summarized in the following Table (not an exhaustive list) and are described in e.g., Claim 1: a-h; Claim 2: a-h, and Claim 3: a-i. These requirements are necessary to guide the implementation of the system and its associated enabling technologies (e.g., databases, wireless communications, API's, unstructured data conversion, and/or menu digitization).

Column, line number(s) in '651 patent	Technical Requirement(s)	Claims 1, 2 and 3 ¶
1:32-34	Digital input device...via the internet, wireless link, smart phone...	1:a, f, g; 2:a, f, g; 3:a, f, g
3:10-12	...entry, management and communication of information from the operator as well as to and from another computer, Web page, menu, remote digital device using a hardwired connection, the internet or a wireless link	1:c, d, e, g; 2: c, d, e; 3: c, d, e
3:59-62	...handwritten screen captures and/or voice recorded message captures coupled with the standard menus and modifiers...	1:a, f; 2:a, f; 3:a, f

<sup>26</sup> Correspond to the accomplishment of objectives and desired results of a system <http://acqnotes.com/acqnote/tasks/measures-of-effectivenessrequirements>

<sup>27</sup> Statements used for defining a design solution.

4:2-3	...capture handwritten information...	1:a, f; 2:a, f; 3: a, f
4:10-12	...universal languages and an unlimited set of information to be manually communicated and exchanged	1:d, e, h, 2: d, e, h; 3:d, e, h
4:32-33	...record voice message...using her handheld device integral [sic] microphone...	1:a, e, f; 2: a, e, f; 3:a, e, f
4:45-46	...voice recognition technologies can be utilized to convert the manual operator inputs into text messages...	1:a, d; 2:a, d; 3:a, d
13:7-10	...converted into one or more messages (e.g., text messages and/or instant messages), and/or text-to-voice functionality...	1:a, d; 2:a, d; 3:a, d
13:38-40	...text-to-voice functionality may be employed, for instance, in appointment, waitlist, and/or restaurant operations	1:a, f, h; 2:a, f, h; 3:a, f, h
13:42-45	...text-to-voice, and/or two-way interactivity, and/or may involve communication via landline telephones, cellular telephones, and/or wireless devices	1:a, f, g, h; 2: a, f, g, h; 3: a, f, g, h
14:34-38	Such automated messaging might, for example, involve an automated telephone call wherein some or all of the information provided by the user is automatically converted to spoken words (e.g., via text-to-voice)...	1:c, f, g; 2:c, f, g; 3:c, f, g
14:42-44	...wherein some or all of the information provided by the user is automatically converted to text and/or data and conveyed to the appropriate entity	1:a, b, d; 2:a, b, d; 3:a, b, d
14:53-57	In placing such a telephone call and/or sending such a message the computer might, for example, use integrated and/or peripheral telephone access hardware and/or voice synthesis hardware...	1:a, f; 2:a, f; 3:a, f
15:1-3	...the computer might convey (e.g., subsequent to automatic conversion of information provided by the user) the desired appointment and/or reservation to the entity	1:b, c, d, g, h; 2: b, c, d, g, h; 3: b, c, d, g, h
15:22-27	...spoken responses might, for instance, be automatically converted, captured, and/or stored, and presented to the user (e.g., via the web page, telephone call, and/or messaging)...	1:a, c, f; 2:a, c, f; 3:a, c, f
15:42-45	...such a relayed voice message might, for instance, be presented to the user in a manner analogous to that discussed above (e.g., via web page, telephone call, and/or messaging)...	1:a, b, e, g; 2: a, b, e, g; 3: a, b, e, g
15:48-53	...the computer might, for example, make note of the selection, and/or process and/or store the selection for integration with one or more operations discussed herein (e.g., synchronization)...as show in Fig. 10...	1:b, c, e; 2:b, c, e; 3:b, c, e, i

16:7-9	...such functionality could, in various embodiments, occur without human action on the part of the user and/or provider of the webpage...	1:f, g; 2:f, g; 3:f, g
16:10-15	The computer might, in various embodiments, act to pursue multiple entities in parallel...for example, present to the user results and/or progress of its work (e.g., as appointment and/or reservation availability results), and/or allow the user to select from presented possibilities a desired choice...	1:a, f; 2:a, f; 3:a, f
16:16-23	...multiple entities so pursued might, in various embodiments, be automatically chosen by computer...for example...multiple search criteria...previously established (e.g., stored) user unique lists (e.g., a list of user's 15 favorite restaurants)...	1:a, b, c, f; 2:a, b, c, f; 3:a, b, c, f
16:32-38	...the computer might be able to employ one or more telephone calls, web pages, emails, pages, facsimiles, instant messages, and/or text messages conveying (e.g., subsequent to automatic conversion of information provided by the user) the desired appointment and/or reservation, and/or seeking responses from the entity...	1:a, c, d, g; 2: a, c, d, g; 3: a, c, d, g
16:38-43	...the computer might be able to receive and/or interpret (e.g., with automatic conversion of information provided by the entity) one or more telephone calls, web pages, emails, pages, facsimiles, instant messages, and/or text messages conveying the entity's responses...	1:a, c, d, f; 2: a, c, d, f; 3: a, c, d, f
17:1-4	...one or more statistics might be stored, updated, and/or generated, and/or one or more reports might be stored, updated, and/or generated (e.g., as shown in Fig. 10)	1:b, c, f; 2:b, c, f; 3:b, c, f
17:18-20	Communication of such alerts might, for instance, be performed...via automated telephone call employing text-to-voice...	1:d, h; 2:d, h; 3:d, h
17:26-27	...the user might be informed by way of web page, email, page, telephone call (e.g., employing text-to-voice)...	1:a, f, g; 2:a, f, g; 3:a, f, g
17:66-67	...greeted with text-to-voice speech prompting for code and password to be entered via touch tone keypad and/or be spoken...	1:a, b; 2:a, b; 3:a, b
18:1-5	...text-to-voice speech might then prompt the user to employ touch tone keypad and/or voice in increasing inventory...and/or employ touch tone keypad and/or voice in specifying one or more new inventory values...	1:a, b, c, g; 2: a, b, c, g; 3: a, b, c, g
18:50-56	The functionality discussed above may be employed in a number of ways...including reservations, appointments, and/or wait listing for entities such as, for example, restaurants, hotels, casinos, hair salons, pet groomers, and/or repair services (e.g., plumbers)...	1:a, b, c, d, g, h; 2: a, b, c, d, g, h; 3: a, b, c, d, g, h
21:48-51	...at least one hospitality software back-office application with at least one IAA-based interface and enabled to execute one or more rules while communicating via free format messaging...	1:a, c, f, g; 2:a, c, f, g;

		3:a, c, f, g, i
22:5-10	...at least one wireless handheld remote computing device with at least one IAA mobile application and user interface with free format messaging that enables access to and communications with the back-office hospitality software application and its IAA-based interface...	1:a, c, f, g; 2:a, c, f, g; 3:a, c, f, g, i
24:22-24	...functionality for two or more communications conversions one of which includes automated text conversions...	1:a, d; 2:a, d; 3:a, d
24:29-36	...the hospitality application includes food/drink ordering, integrated with a customer frequency/rewards application...event ticketing...hotel reservations...	1:c, d, g, h; 2: c, d, g, h; 3: c, d, g, h, i

41. Together, the architecture, measures of performance and effectiveness, and technical requirements contained in the '651 patent would serve as a roadmap for a POSITA as to how to build and implement the intelligent automated assistant system described in the claims.

42. As summarized in the Background section above, the ability to use mobile devices to accept and understand unstructured data, convert unstructured data, and leverage intelligence capabilities, including remote, wireless handheld computers had not been integrated into a holistic system prior to 2005. The claims of the '651 patent overcome the lack of cohesiveness between the independent parts by creating a new system whose functionality is significantly greater than the parts individually.

43. The claims of the '651 patent overcome the following problems: (1) providing the ability to accept and automatically execute free format messaging (Claims 1, 2, 3) which provide the ability to handle and understand unstructured data, and (2) providing intelligent automated assistants technology (Claims 1, 2, 3) which provide the ability to make decisions such as those described below.

44. An example of intelligent decision making specified in the '651 patent is the ability to create a reservation via remote access (13:55-14:30) which is described in Claim 1: a, c, f, g, h; Claim 2: a, c, f, g, h; and Claim 3: a, c, f, g, h. This includes the ability to remotely select criteria

(e.g., location, type, and/or price range), provide choice alternatives (e.g., first, second, third choices), communicate via free text formats, and execute intelligent automated assistant technology to provide an integrated solution that optimizes the inputs provided.

45. Another example of intelligent decision making specified in the '651 patent is the scenario where "...the computer might convey (e.g., subsequent to automatic conversion of information provided by the user) the desired appointment and/or reservation to the entity...the computer might further convey the source of the entity..." (15:1-53) which is described in Claim 1: a, c, d, f; Claim 2: a, c, d, f; and Claim 3: a, c, d, f. This includes the ability for the computer to convey intelligence and acting independently.

46. Another example of intelligent decision making specified in the '651 patent is the scenario for creating appointments or reservations (16:46-17:21) which is described in Claim 1: a, b, c, f, g; Claim 2: a, b, c, f, g; and Claim 3: a, b, c, f, g. This includes the ability to use restaurant inventory, user preferences, automatic conversion (such as e-mail or voice to text), and usage statistics to produce an optimal result.

47. The claimed inventions of the '651 patent include a back-office hospitality software application having an intelligent interface which (a) communicates bi-directionally with two or more different remote wireless handheld computing devices, (b) understands both free format and fixed format messaging, and (c) executes rules using intelligent automation from multiple criteria (at least from (i) the free and/or fixed format message and (ii) external remote sources that are related to the free and/or fixed format message), and (d) provides a set of results based on (a), (b) and (c) in a free format message format to at least one of the remote wireless handheld computing devices over the internet. These claimed inventions were not available before July 2005, and they were neither routine nor conventional. The claimed inventions were innovative and enhanced the operation of computer systems using remote wireless handheld devices.

48. As embodied in the claims, the inventive steps in the '651 patent include (1) being able to understand and convert both fixed format and free format messaging - unstructured data such as in an e-mail/text message or via voice to text conversion (Claim 1: a; Claim 2: a; Claim 3: a), (2) being able to concurrently handle both free and fixed format messaging through a variety of communication conversions (Claim 1: f and g; Claim 2: f and g; Claim 3: f, g, and h), and (3) being able to make and execute intelligent decisions by accessing and applying intelligent automated assistant technology (Claim 1: a and f; Claim 2: a and f; Claim 3: a and f).

49. The inventor, in the '651 patent, provided a concrete application that improved computer technology and solved a variety of problems – demonstrated in the hospitality industry – which can be applied to other industries.<sup>28</sup> The inventor did more than simply apply current technology to an existing problem. As embodied in the claims, the innovations of the '651 patent were a significant enhancement and improvement to remote computer systems using handheld devices because they were able to automatically understand, convert, and execute both structured and unstructured data, were able to concurrently execute both free and fixed format messaging through a variety of communication conversions, and were able to make intelligent decisions by accessing and applying intelligent automated assistants technology. The specification and claims provide concrete examples to the POSITA of the improvements and enhancements and specifically how to perform them, as discussed above.

50. The claims of the '651 patent are directed to IAA functionality and do not extend beyond the specific technical problems they are solving (e.g., handling and understanding structured and unstructured data, including via mobile handhelds, and to enable the intelligent automated

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<sup>28</sup> Industries requiring "reservations and wait list management" (1:55) such as "restaurants and/or casinos" (13:52) and "plumber or other repair service, a hair salon, a healthcare establishment (e.g., a doctor's office, dentist's office, or hospital), or a pet groomer" (13:57-59). This may include "food/drink ordering" (Claim 6), "event ticketing" (Claim 7), or "hotel reservations" (Claim 8).

assistant technology to make intelligent decisions).

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 5<sup>th</sup> day of April, 2020.



By \_\_\_\_\_

Ricardo Valerdi, Ph.D.

# ATTACHMENT A



## RICARDO VALERDI

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### PERSONAL INFORMATION

Born: Ensenada, Mexico; August 12, 1977  
Citizenship: U.S. & Mexico (dual)  
Security Clearance: U.S. Department of Defense (Secret)

### ACADEMIC POSITIONS

2018 – Professor, Department of Systems & Industrial Engineering  
*University of Arizona*  
2017 – PAC-12 Faculty Athletics Representative  
2017 – Director, Sports Management Program, Eller College of Mgmt.  
2011 – 2017 Associate Professor, Department of Systems & Industrial Engineering  
*University of Arizona*  
2005 – 2011 Research Associate & Lecturer  
Engineering Systems Division, *Massachusetts Institute of Technology*

### INDUSTRY EXPERIENCE

2017 Production Consultant, *SpaceX*, Hawthorne, CA  
2003 – 2005 Senior Member of the Technical Staff, *Aerospace Corporation*, Los Angeles, CA  
1998 – 2002 Systems Engineer, *Motorola*, San Diego, CA

### EDUCATION

2005 Ph.D. in Industrial & Systems Engineering, *University of Southern California*  
Dissertation: The Constructive Systems Engineering Cost Model  
Advisor: Barry Boehm, TRW Professor of Software Engineering  
2002 M.S. in Systems Architecture & Engineering, *University of Southern California*  
1999 B.S./B.A. in Electrical Engineering, *University of San Diego*

### ACADEMIC EXCHANGES

2018 Visiting Professor, United States Military Academy, West Point, NY (sabbatical)  
2017 Visiting Professor, Universidad Politécnica de Madrid, Spain (sabbatical)  
2015 Visiting Fellow, University of South Australia, Adelaide, Australia (summer)  
2014 Visiting Fellow, Bath University, United Kingdom (fellowship)

**HONORS**

- 2019 Outstanding Faculty Mentor, University of Arizona Office of the Provost
- 2016 Foreign Member, Mexican Academy of Engineering
- 2016 Best journal article of the year, *Systems Engineering Journal*
- 2015 Frank Freiman Award for Lifetime Achievement in Cost Estimation and Parametric Modeling (highest award given by the International Cost Estimating & Analysis Association)
- 2015 NCAA MindMatters Concussion Education Program winner (\$25,000 cash + \$75,000 development budget)
- 2015 IIE Innovations in Curriculum competition, 2<sup>nd</sup> Place
- 2014 Royal Academy of Engineering (UK) Distinguished Visiting Fellow
- 2014 Estimator of the Year, Galorath Inc.
- 2013 Best paper award, 11<sup>th</sup> Conference on Systems Engineering Research
- 2012 Best journal article of the year, *Defense Acquisition Research Journal*
- 2011 Best paper award, 7<sup>th</sup> Conference on Predictive Models in Software Engineering
- 2011 IEEE Distinguished Contribution Award (6<sup>th</sup> Int. System of Systems Conference)
- 2011 Best paper award, 21<sup>st</sup> INCOSE Symposium
- 2010 IEEE Senior Member grade
- 2010 Best Thesis Advisor, MIT Technology & Policy Program
- 2010 Finalist, best paper competition in *Defense Acquisition Review Journal*
- 2009 Best journal article of the year, *Systems Engineering Journal*
- 2009 Best paper award, 7<sup>th</sup> Conference on Systems Engineering Research
- 2009 Best Thesis Advisor, MIT Technology & Policy Program
- 2008 INCOSE Outstanding Achievement Award (via Space Systems Working Group)
- 2005 Best paper award, 27<sup>th</sup> International Society of Parametric Analysts Conference

**OTHER ACTIVITIES**

- 2014- Faculty Fellow, Gila Hall (2014) and Likins Hall (2015) at the University of Arizona
- 2013- Founder and Chief Scientist, Science of Sport (Educational not-for-profit focused on STEM outreach). Consultant for professional sports teams on STEM education: Arizona Diamondbacks, San Diego Padres, Colorado Rockies, Washington Nationals, Los Angeles Angels of Anaheim, Adelaide Bite (Australia), Adelaide Crows (Australia), Los Angeles Galaxy, LAFC, Houston Dynamo, Seattle Sounders, Los Angeles Dodgers, Atlanta Braves, Texas Rangers
- 2012-2015 Visiting Scientist, Software Engineering Institute – Carnegie Mellon University
- 2012-2018 Editor-in-Chief, *Journal of Cost Analysis and Parametrics*
- 2010-2015 Founder and Co-Editor-in-Chief, *Journal of Enterprise Transformation*
- 2008-2009 Board of Directors (Treasurer), International Council on Systems Engineering
- 2006-2016 Co-director, Systems Engineering and Architecting Doctoral Student Network
- 2005- Visiting Associate, USC Center for Systems & Software Engineering

**MAJOR PRESENTATIONS AND WEBINARS**

- 2019 Congreso Internacional de Excelencia Empresarial (San Juan, Costa Rica)
- 2019 LA84 Summit on Play Equity in Sports (Los Angeles, CA)
- 2018 Systems Thinking Institute (Milwaukee, WI)
- 2018 SATURN/Carnegie Mellon University Conference (Dallas, TX)
- 2018 Department of Energy Cost Estimation Community of Practice (Las Vegas, NV)

2017 National Youth Science Camp (Charleston, WV)  
2017 Universidad Carlos III de Madrid (Madrid, Spain)  
2017 Universidad Politecnica de Catalonia (Barcelona, Spain)  
2017 Politecnico de Madrid (Madrid, Spain)  
2016 Colorado State University Systems Engineering Program (Fort Collins, CO)  
2015 Mexican Academy of Engineering (Mexico City, Mexico)  
2014 TEDxTucson: Science of Baseball  
2014 Costing Research at Bath – Industry Workshop (Bath, UK)  
2014 World Automation Congress (Kona, Hawaii)  
2014 Instituto Tecnológico y de Estudios Superiores de Monterrey (Hermosillo, México)  
2013 National Systems Conference, IIT Jodhpur (Rajasthan, India)  
2013 2do Congreso Internacional de Ingeniería de Sistemas INCOSE-México (Puebla, México)  
2013 Defence Systems Innovation Centre (Adelaide, Australia)  
2013 IEEE Computer Society/Lockheed Martin Webinar: Optimizing Optimism: Why Engineers Should Be More Like Las Vegas Bookies  
2012 IIE Webinar: How to Publish Your Work  
2012 IEEE Computer Society/Lockheed Martin Webinar: The Economics of Reuse  
2012 International Council on Systems Engineering (Rome, Italy)  
2012 International Function Points User Group Conference (Phoenix, AZ)  
2012 National Youth Science Camp (Charleston, WV)  
2012 West Virginia Youth Science Camp (Charleston, WV)  
2012 Cranfield University (Cranfield, UK)  
2012 CSIRO (Melbourne, Australia)  
2012 Defence Science Technology Office (Adelaide, Australia)  
2012 University of South Australia (Adelaide, Australia)  
2012 Universidad Carlos III de Madrid (Madrid, Spain)  
2011 Universidad Autónoma Popular Estado de Puebla (Puebla, México)  
2011 IEEE Computer Society/Lockheed Martin Webinar: What Every Engineer Should Know About Systems Thinking  
2011 Instituto Nacional de Pesquisas Espaciais (São José dos Campos, Brazil)  
2010 IEEE Computer Society/Lockheed Martin Webinar: Systems Engineering Cost Estimation  
2010 MIT & Harvard Club of Colombia (Bogotá, Colombia)  
2010 International Function Points User Group Conference (São Paulo, Brazil)  
2010 Through Life Support and Costing Conference (London, U.K.)  
2010 Chinese Academy of Sciences, Institute of Software (Beijing, China)  
2010 Systems Engineering Day, University of Texas El Paso  
2009 Universidad Politécnica de Madrid (Madrid, Spain)  
2009 Innovative Electronics Manufacturing Research Centre, Loughborough University (U.K.)  
2009 Shingo Prize, Instituto Tecnológico de Monterey (Querétaro, México)  
2009 Centro de Estudos e Sistemas Avançados do Recife (Brazil)  
2008 Telespazio (Rome, Italy)  
2008 Estimating and Managing Through-Life Costs, University of Bath (U.K.)  
2008 Economics of Human Systems Integration, Air Force Office of the Surgeon General (Arlington, VA)

- 2008 Raytheon Measurement Community of Practice (Garland, TX)
- 2008 Encuentro Internacional de Tecnologías de la Información (Puebla, México)
- 2007 Joint Alliance of Companies Managing Education for Technology Symposium (Phoenix, AZ)
- 2007 Centro de Investigación en Matemáticas (Zacatecas, México)
- 2006 COSYSMO Symposium, BAE Systems (Loughborough, U.K.)
- 2006 Lockheed Martin Measurement Workshop (Orlando, FL)

### **BOOKS, BOOK CHAPTERS**

- Meade, K., Ramirez, J., Valerdi, R., and Muthukumar, S., Changing behavioral intentions and enhancing campus sustainability efforts with systems thinking education, in *The Contribution of Social Sciences to Sustainable Development at Universities*, Zint, M. and Leal, W. In press.
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- Valerdi, R., *Angels Science of Baseball Curriculum (5<sup>th</sup>-8<sup>th</sup> Grades)*, Los Angeles Angels of Anaheim Foundation, 2014.
- Cizaire, C. and Valerdi, R., Heathrow Terminal 5: Cost Management for a Mega-Construction Project, in Gorod, A., White, B., Ireland, V., Ghandi, S. J. and Sauser, B. (Eds.) *Case Studies in System of Systems, Enterprises, and Complex Systems Engineering*, CRC Press, 2014.
- Valerdi, R., *Arizona Diamondbacks Science of Baseball Curriculum (4<sup>th</sup>-8<sup>th</sup> Grades)*, Arizona Diamondbacks Foundation, 2013.
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Valerdi, R., *Science of Olympic Sports (5<sup>th</sup>-8<sup>th</sup> Grades)*, LA84 Foundation, Los Angeles, CA, 2019.

Valerdi, R., *Dodgers Science of Baseball (3<sup>rd</sup>-5<sup>th</sup> Grades)*, Los Angeles Dodgers Foundation, Los Angeles, CA, 2019.

Valerdi, R., *Royals Science of Baseball (3<sup>rd</sup>-5<sup>th</sup> Grades)*, Kansas City Youth Academy, Kansas City, MO, 2019.

Valerdi, R., *Sounders Science of Soccer (5<sup>th</sup>-8<sup>th</sup> Grades)*, RAVE Foundation, Seattle, WA, 2018.

Valerdi, R., *MLB Urban Youth Academy Science of Baseball (4<sup>th</sup>-7<sup>th</sup> Grades)*, Major League Baseball Youth Foundation, New York, NY, 2016.

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Valerdi, R., *Washington Nationals Science of Baseball (2<sup>nd</sup>-6<sup>th</sup> Grades)*, Washington, D.C., 2015.

Valerdi, R., *Galaxy Science of Soccer Curriculum (3<sup>rd</sup>-5<sup>th</sup> Grades)*, Los Angeles Galaxy, 2014.

Valerdi, R., *Angels Science of Baseball Curriculum (5<sup>th</sup>-8<sup>th</sup> Grades)*, Los Angeles Angels of Anaheim Foundation, 2014.

Valerdi, R., *Arizona Diamondbacks Science of Baseball Curriculum (4<sup>th</sup>-8<sup>th</sup> Grades)*, Arizona Diamondbacks Foundation, 2013.

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Bukhari, H., Valerdi, R. and Ward, D., "Quantifying Risk of Acquisition Portfolios," *IEEE Systems* (under review).

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- Madachy, R. and Valerdi, R., "Risk Analysis and Mitigation with Expert COSYSMO," *24<sup>th</sup> Forum on COCOMO and Software Cost Modeling*, Cambridge, MA, November 2009.
- Liu, K., Valerdi, R., Rhodes, D. and Greene, F., "Better Early Estimation of Human Systems Integration Effort as a Means of Reducing Life Cycle Cost," *24<sup>th</sup> Forum on COCOMO and Software Cost Modeling*, Cambridge, MA, November 2009.
- Valerdi, R., "Using Cost Models to Capture Project Risk: A Knowledge-Based Approach," EADS/ECALAS Alumni Conference, Madrid, Spain, October 2009.

- Valerdi, R., "Economic Impact of Reuse on Systems Engineering, 4<sup>th</sup> Annual Innovative Electronics Manufacturing Conference, Loughborough University (U.K.), September 2, 2009.
- Valerdi, R., "Achieving Enterprise Excellence," Shingo Prize Mexico - ITESM Queretaro, August 2009.
- Valerdi, R. and Rhodes, D. H., "Report from the 2009 Workshop of INCOSE's Systems Engineering & Architecting Doctoral Student Network (SEANET)," *INCOSE INSIGHT*, Vol. 12, No. 2, pp. 50-51, July 2009.
- Adcock, R., Pyster, A. and Valerdi, R., "A Draft Reference Curriculum for Software Engineering Master's Programs," *INCOSE INSIGHT*, Vol. 12, No. 1, p. 40, April 2009.
- Valerdi, R. "INCOSE's Operations and Finances: Looking Back at 2008 and Forward to 2009," *INCOSE INSIGHT*, Vol. 12, No. 1, pp. 45-46, April 2009.
- Valerdi, R., "Heuristics and Biases in Software Cost Estimation," Recife Summer School - Centro de Estudos e Sistemas Avançados do Recife (Brazil), February 17, 2009.
- Valerdi, R., Fortune, J. and Wheaton, M. J., "Estimating the Cost of Systems Engineering for Space Systems," *INCOSE INSIGHT*, Vol. 11, No. 5, pp. 34-38, December 2008.
- Fortune, J., Valerdi, R. and Wang G., "Systems Engineering Reuse: A Report on the State of the Practice," *23<sup>rd</sup> Forum on COCOMO and Software Cost Modeling*, Los Angeles, October 2008.
- Valerdi, R. and Rhodes, D. H., "Report from the 2008 Workshop of INCOSE's Systems Engineering & Architecting Doctoral Student Network (SEANET)," *INCOSE INSIGHT*, Vol. 11, No. 3, pp. 53-54, July 2008.
- Rhodes, D. H. and Valerdi, R., "Enabling Research Synergies Through a Doctoral Research Network for Systems Engineering," *INCOSE INSIGHT*, Vol. 10, No. 3, pp. 17-18, July 2007.
- Lane, J. and Valerdi, R., "System of Systems Engineering Cost Modeling: What Makes it Different from Traditional Systems Engineering Cost Modeling," *22<sup>nd</sup> Forum on COCOMO and Software Cost Modeling*, Los Angeles, November 2007.
- Valerdi, R., Srinivasan, J. and Nightingale, N., "From Good to Lean: The Bottom Line Impact of Lean Thinking," Lean Aerospace Initiative Conference, Cambridge, MD, April 2007.
- Collar, E. and Valerdi, R., "Role of Software Readability on Software Development Cost," *21<sup>st</sup> Forum on COCOMO and Software Cost Modeling*, Herndon, VA, November 2006.
- Valerdi, R., El Fatatry, A. and Wang, G., "Counting the Cost," *The System – BAE Systems (Systems Engineering Innovation Centre)*, pp. 1-2, Summer 2006.

Wang, G. and Valerdi, R., "Cost Effective? An Architecture-Based Cost Estimation Model," *The System* – BAE Systems (Systems Engineering Innovation Centre), p. 3, Summer 2006.

Valerdi, R. and Nightingale, D., "Coupling Lean Thinking and Systems Thinking at the Enterprise Level," *15<sup>th</sup> Industrial Engineering Research Conference*, Orlando, FL, May 2006.

Valerdi, R., "Industry Calibration Results for COSYSMO," *INCOSE Los Angeles Chapter Mini Conference*, Los Angeles, CA, June 2005.

Valerdi, R., "Systems Engineering: What's In a Name?" *14<sup>th</sup> Industrial Engineering Research Conference*, Atlanta, GA, May 2005.

Valerdi, R. and Lane, J., "Steps Toward Model Unification for Software, Systems Engineering and Systems of Systems," *19<sup>th</sup> Forum on COCOMO and Software Cost Modeling*, Los Angeles, CA, October 2004.

Valerdi, R., "COSYSMO Working Group Report," *INCOSE INSIGHT*, Vol. 7, No. 3, pp. 24-25, October 2004.

#### **RESEARCH FUNDING**

\$20,000, Lockheed Martin Advanced Technology Laboratories for cost modeling for Artificial Intelligence-enabled platforms (2020).

\$25,000, University of Arizona Consortium on Gender-Based Violence for the enhancement of the Step UP! Bystander Intervention Program through Systems Thinking (2020). Collaboration with the Department of Intercollegiate Athletics.

\$25,000, Sandia National Laboratories for a workshop on storytelling with models (2019).

\$20,000, Sandia National Laboratories for cost estimation of nuclear weapon systems (2019).

\$15,000, University of Arizona Office of Research, Discovery & Innovation for a pilot study to improve student-athlete wellbeing through the use of a self-care app (2019). Collaboration between the Andrew Weil Center for Integrative Medicine, Athletics Department, and College of Engineering.

\$148,000, Office of Naval Research for the development of a taxonomy and ontology for expeditionary cyber systems applied to cognitive radio (2018).

\$147,970, U.S. Military Academy at West Point for sabbatical (2017).

\$30,000, Raytheon Missile Systems for the tailoring of a cost model for agile projects (2016).

\$120,000, U.S. Navy Acquisition Research Program for the validation of Leading Indicators for Systems Engineering using Bayesian Belief Networks (2016).

\$100,000, NCAA Mind Matters Challenge for the development of a virtual reality smart phone app to improve concussion education among student athletes and soldiers (2015). Collaboration with the UA College of Medicine and Athletics Department. Led to the creation of a new company Concussion Discussion, LLC.

\$120,000, U.S. Navy Acquisition Research Program for Cost Model for Autonomous Systems (2015).

\$20,000, Confluentcenter for Creative Inquiry Faculty Collaboration Grant for an analysis of baseball swing mechanics from a biomedical and artistic perspective (2014). Collaboration between College of Engineering, School of Dance, and College of Medicine.

\$120,000, U.S. Navy Acquisition Research Program for Making Big Data, Safe Data: A Test Optimization Approach (2014).

\$5,000, Raytheon Missile Systems for the development of a systems engineering productivity metric (2013).

\$33,000, Raytheon Integrated Defense Systems for the tailoring of a systems engineering cost model (2013).

\$120,000, U.S. Navy Acquisition Research Program for Modeling "Should Cost" and "Will Cost" Using Model-Based Systems Engineering (2013).

\$792,484, Air Force Office of Scientific Research, DDDAS-based Resilient Cyberspace (2012-2016). Joint project with UA Electrical & Computer Engineering and Oak Ridge National Laboratory.

\$9,000, University of Arizona Green Fund for the development of a systems thinking educational module to promote sustainable behaviors among freshmen residents (2012). Joint project with UA Residence Life & Systems Thinking in Schools Project.

\$95,880, Raytheon Network Centric Systems for the Independent Validation and Assessment of Integrated Fixed Towers for border security (2012).

\$30,000, Raytheon Missile Systems for the calibration of a systems engineering cost model (2011).

\$125,000, Lockheed Martin for the evaluation of cost, risk and technical scalability of Ocean Thermal Energy Conversion plants (2011).

\$22,000, MIT-Brazil Seed Fund for Systems Engineering a Brazilian Pico-satellite: A Focus on Test & Evaluation (2011). Joint project with Brazilian Space Agency.

\$120,000, The Aerospace Corporation for the development of a predictive model to quantify the economic benefits of reuse in the context of systems engineering (2010).

\$50,000, U.S. Air Force Acquisition Chief Process Office for a study on reform approaches for rapid acquisition programs (2010).

\$20,000, IBM Center for the Business of Government for a report on credible and accurate cost estimates (2010).

\$120,000, U.S. Navy Acquisition Research Program for the development of a prediction market to improve cost estimation of DoD weapons systems (2009). Joint project with Iowa State University.

\$208,121, U.S. Air Force Acquisition Chief Process Office for the development of a methodology for risk assessment of a portfolio of programs (2009).

\$3,819,746, U.S. Army White Sands Missile Range for the development of a decision support system for Unmanned & Autonomous Systems of Systems test & evaluation (2009-2011). Joint project with University of Southern California and University of Texas Arlington.

\$427,620, U.S. Air Force Office of the Surgeon General for the development of a cost model and leading indicators for Human Systems Integration (2008-2010).

\$40,000, U.S. Air Force Space & Missile Systems Center for a pilot study of systems engineering cost estimation in the space systems context (2007).

\$40,000, The Aerospace Corporation for an exploration of boundary objects as a framework for understanding the interfaces between systems integrators and the U.S. Air Force (2007).

\$75,000, BAE Systems North America for the development of a cost model for capabilities-based acquisition and enterprise architecting (2005-2007).

#### **EDUCATIONAL/OUTREACH PROGRAM FUNDING**

\$10,000, IBM Faculty Award for the development of teaching modules using Watson Analytics using baseball examples (2015).

\$8,000, GaN Corporation for the continuation of the Arizona Science of Baseball STEM outreach program at the Tucson Boys & Girls Club and Tucson Children's Museum (2015).

\$500, University of Arizona Student/Faculty Interaction Grant - Office of the Senior Vice President for Student Affairs and Enrollment Management (Fall 2014).

\$500, University of Arizona Student/Faculty Interaction Grant - Office of the Senior Vice President for Student Affairs and Enrollment Management (Spring 2014).

\$7,500, Dorrance Family Foundation for the support of the Arizona Science of Baseball STEM outreach program (2014).

\$500, University of Arizona Student/Faculty Interaction Grant - Office of the Senior Vice President for Student Affairs and Enrollment Management (Fall 2013).

\$419,741, U.S. Department of Education in support of the STEM Futures Grant to develop systems engineering curriculum and experiential components at Arizona Western College (2013-2016).

\$336,141, Arizona Diamondbacks Foundation for the establishment of the Diamondbacks Science of Baseball STEM outreach program (2013-2015).

\$1,000, Hughes Federal Credit Union for the support of the Arizona Science of Baseball STEM outreach program (2013).

\$10,000, University of Arizona Outreach College for the development of "SIE 454A/554A Systems Engineering" for online delivery (2013).

\$3,000, Zuckerman Community Outreach Foundation for the support of the Arizona Science of Baseball STEM outreach program (2012).

\$15,000, GaN Corporation for the establishment of the Arizona Science of Baseball STEM outreach program (2012).

\$10,000, University of Arizona Outreach College for the development of "SIE 464-564 Cost Estimation" for online delivery (2012).

#### **INVENTION DISCLOSURES AND INTELLECTUAL PROPERTY**

Medical Task Recorder for Clinical Settings – University of Arizona Technology Licensing Office (November 2013)

Science of Baseball STEM Curriculum – University of Arizona Technology Licensing Office (October 2013) Resulted in a University of Arizona spinoff company (Science of Sport) that generates revenue to the University through a license agreement.

Smart Phone App for Improving Risk Intelligence – University of Arizona Technology Licensing Office (December 2012)

#### **LITIGATION CONSULTING**

*Sikorsky Aircraft Corporation; Lockheed Martin Systems Integration-Owego* (2007)

- Jurisdiction: U.S. Government Accountability Office
- Counsel: Sheppard Mullin
- Nature of suit: Protest
- Contribution: Expert report

*United States ex rel. Hooper v. Lockheed Martin Corp.* (2014)

- Jurisdiction: U.S. District Court for the Central District of California
- Counsel: Crowell Moring
- Nature of suit: False Claims Act
- Contribution: Expert report

*Acceleration Bay LLC v. Activision Blizzard, Inc.* (2017)

*Acceleration Bay LLC v. Electronic Arts, Inc.*

*Acceleration Bay LLC v. Take-Two Interactive Software, Inc., Rockstar Games, Inc., 2K Sports, Inc.*

- Jurisdiction: U.S. Federal District Court, District of Delaware

- Counsel: Kramer Levin
- Nature of suit: Patent infringement
- Contribution: Expert report, deposition

*Centripetal Networks, Inc. v. Keysight Technologies, Inc. and IXIA (2018)*

- Jurisdiction: U.S. District Court, Eastern District of Virginia
- Counsel: Kramer Levin
- Nature of suit: Patent infringement
- Contribution: Expert report, deposition, testimony at trial

*Next Payment Solutions, Inc. v. CLEAResult Consulting, Inc. (2018)*

- Jurisdiction: U.S. District Court, Northern District of Illinois
- Counsel: Law Offices of Susan Bogart/Padda Law Group
- Nature of suit: Trade secrets
- Contribution: Expert report, deposition, mediation support

*Finjan, Inc. v. Eset, LLC (2018)*

- Jurisdiction: U.S. District Court, Northern District of California
- Counsel: Kramer Levin
- Nature of suit: Patent infringement
- Contribution: Expert report, deposition

*VSP Labs, Inc. v. Pro Fit Optics, Inc. (2018)*

- Jurisdiction: Superior Court of California, County of Sacramento
- Counsel: Walsh Law Firm
- Nature of suit: Breach of contract
- Contribution: Expert report, deposition

*Mercury Air Cargo Inc. v. Kronos Data Systems Inc. (2019)*

- Jurisdiction: Superior Court of California, County of Los Angeles – Central District
- Counsel: Burns & Moss Law Firm
- Nature of suit: Breach of contract
- Contribution: Expert report, deposition

*Finjan, Inc. v. Cisco Systems (2019)*

- Jurisdiction: U.S. District Court, Northern District of California
- Counsel: Kramer Levin
- Nature of suit: Patent infringement
- Contribution: Expert report, deposition

*Finjan, Inc. v. Juniper Networks (2019)*

- Jurisdiction: U.S. District Court, Northern District of California
- Counsel: Kramer Levin
- Nature of suit: Patent infringement
- Contribution: Expert report

*Finjan, Inc. v. Bitdefender, Inc. (2019)*

- Jurisdiction: U.S. District Court, Northern District of California
- Counsel: Kramer Levin
- Nature of suit: Patent infringement
- Contribution: Expert report

*Irth Solutions, Inc. v. Apex Data Solutions and Services, LLC. And Kyle Murphy (2019)*

*Irth Solutions, Inc. v. Atlantic Infracrac, LLC.*



*Irth Solutions, Inc. v. Diversified Underground, LLC.*

*Irth Solutions, Inc. v. S&S Utilities Engineering, LLC.*

- Jurisdiction: Western District of New York
- Counsel: Wilson, Elser, Moskowitz, Edelman & Dicker
- Nature of suit: Trade secrets
- Contribution: Consulting expert

*Edwards Technologies, Inc. v. Videro AG and Videro, Inc.* (2019)

- Jurisdiction: International Centre for Dispute Resolution
- Case Number: 01-19-0002-0653
- Counsel: Greenberg, Glusker, Fields, Claman & Machtinger LLP
- Nature of suit: Breach of contract
- Contribution: Arbitration support

*Centripetal Networks, Inc. v. Cisco Systems, Inc.* (2019)

- Jurisdiction: U.S. District Court, Eastern District of Virginia
- Case Number: 2:18-cv-00094-HCM-LRL
- Counsel: Kramer Levin
- Nature of suit: Patent Infringement
- Contribution: Expert report

*Florida East Coast Railway, LLC v. Envio, Inc. f/k/a Profit Tools, Inc., Valsoft Corporation, Inc.* (2020)

- Jurisdiction: New Hampshire Superior Court
- Case Number: 219-2018-CV-00425
- Counsel: Wilson, Elser, Moskowitz, Edelman & Dicker
- Nature of suit: Breach of Contract
- Contribution: Expert report

## **TEACHING & STUDENT SUPERVISION**

### **Courses**

At the University of Arizona

HNRS195I-018 The Science of Baseball (new Freshman Honors Seminar at UA) Fall 2013; Fall 2014; Fall 2015; Fall 2016

HNRS195I-019 Social Networks (new Freshman Honors Seminar at UA) Fall 2012

SIE 464/564 Cost Estimation (new course at UA) Spring 2012; Spring 2013; Spring 2014; Spring 2015; Spring 2016; Spring 2017; Spring 2019

SIE 454A/554A The Systems Engineering Process; Fall 2011; Fall 2012; Fall 2013; Fall 2014; Fall 2015; Fall 2016

MGMT 359 Sports Analytics (new course at UA) Summer 2017; Fall 2018

SIE 432/532 Sports Analytics (new course at UA) Summer 2019

At the United States Military Academy

SE 385 Decision Analysis; Spring 2018

At the Massachusetts Institute of Technology

ESD.361 Cost Estimation & Measurement Systems (new course at MIT); Fall 2007; Fall 2008; Fall 2009; Fall 2010

### **Graduate Thesis Supervision**

Jake Obradovich, M.S. Systems Engineering, UA (2016)

Edward Enhelder, M.S. Engineering Management, UA (2016)

Dario Altamirano, M.S. Engineering Management, UA (2016)

Sandeep Punj, M.S. in Industrial Engineering, UA (2015)

Greg Wolf, M.S. in Engineering Management (2015)

Keith Allen, M.S. in Systems Engineering (2015)

Tommy Ryan, M.S. in Systems Engineering (2015)

Lucia Cardenas Duarte, M.S. in Engineering Management (2015)

Matt Yalung, M.S. in Systems Engineering (2015)  
Sudhee Dwivedi, M.S. in Engineering Management (2014)  
Danny Thebeau, M.S. in Systems Engineering (2014)  
Siva Ram Kumar Muthukumar, M.S. in Industrial Engineering, UA (2013)  
Kenny Wilson, M.S. in Industrial Engineering, UA (2013)  
Omar Sankari, M.S. in Industrial Engineering, UA (2013)  
Jose Monreal, M.S. in Systems Engineering, UA (2013)  
Ben Reidy, M.S. in Industrial Engineering, UA (2013)  
Kenji Hernandez, M.S. in Industrial Engineering, UA (2013)  
Hassan Bukhari, S.M. in System Design & Management, MIT (2012)  
Alex Horell, Aero/Astro, MIT (2012)  
Matias Raby, S.M. in Technology & Policy, MIT (2012)  
Shylesh Muralidharan, S.M. in System Design & Management, MIT (2012)  
Francisco Zini, S.M. in System Design & Management, MIT (2012)  
Dan Marticello, S.M. in System Design & Management, MIT (2012)  
Arlan Sheets, S.M. in System Design & Management, MIT (2011)  
Dennis Evans, S.M. in System Design & Management, MIT (2011)  
Rafael Marañón-Abreu, S.M. in System Design & Management, MIT (2011)  
David Hwang, joint S.M./MBA in Leaders for Global Operations program, MIT (2011)  
Nathan Perkins, S.M. in Technology & Policy, MIT (2011)  
Avi Latner, S.M. in System Design & Management, MIT (2011)  
Indira Deonandan, S.M. Aero/Astro & Technology & Policy, MIT (2010)  
Mike Nair, S.M. in System Design & Management, MIT (2010)  
Kris Cowart, S.M. in System Design & Management, MIT (2010)  
Dave Morgan, S.M. in System Design & Management, MIT (2010)  
Taroon Aggarwal, S.M. in System Design & Management, MIT (2010)  
Leyla Abdimomunova, S.M. in System Design & Management, MIT (2010)  
Cheri Burgess, S.M. in System Design & Management, MIT (2010)  
Ellen Czaika, S.M. in System Design & Management, MIT (2010)  
Kevin Liu, S.M. in Technology & Policy, MIT (2010)  
Marc Giombetti, M.S. in Computer Science, Technical University of Munich (2010)  
Charbel Rizk, S.M. in System Design & Management, MIT (2010)  
Craig Blackburn, S.M. in Technology & Policy and Aero/Astro, MIT (2009)  
Andrew Tiongson, S.M. in System Design & Management, MIT (2009)  
Augustine Tibazarwa, S.M. in System Design & Management, MIT (2009)  
Christian LaFon, S.M. in System Design & Management, MIT (2008)  
Takahiro Endo, S.M. in System Design & Management, MIT (2008)  
Tim Aykroyd, S.M. in System Design & Management, MIT (2008)  
Jim Casey, S.M. in System Design & Management, MIT (2007)  
Allan Fong, S.M. in Aero/Astro, MIT (2007)  
Ken Huang, S.M. in System Design & Management, MIT (2007)  
David Schiller, S.M. in System Design & Management, MIT (2006)

Committee Member or External Examiner

Keith Allen, Ph.D. in Systems & Industrial Engineering, University of Arizona (2018);  
in progress

Christopher Oster, Ph.D. in Systems Engineering, Stevens Institute of Technology  
(2015); in progress

Ross Arnold, Ph.D. in Systems Engineering, Stevens Institute of Technology (2015); in progress  
Michael Edwards, Ph.D. in Systems Engineering, University of South Australia (2015); in progress  
Leone Young, Ph.D. in Systems Engineering, Stevens Institute of Technology (2015); in progress  
Xuan-Linh Tran, Ph.D. in Systems Engineering, University of South Australia (2014)  
Chris Miller, Ph.D. in Systems Engineering, George Washington University (2011)  
Mohammad Saravi, Ph.D. in Mechanical Engineering, University of Bath (2010)  
Tsoline Mikaelian, Ph.D. in Aero/Astro, MIT (2009)  
Caroline Lamb, Ph.D. in Aero/Astro, MIT (2009)  
Jesal Bhuta, PhD. in Computer Science, USC (2007)  
Jatin Raj, M.S. in Computer Science, San Diego State University (2006)  
Doctoral Thesis Advisor or co-Advisor  
James Dianics, Ph.D. in Systems & Industrial Engineering, UA (2016)  
Matt Dabkowski, Ph.D. in Systems & Industrial Engineering, UA (2016)  
Mauricio Pena, Ph.D. in Industrial & Systems Engineering, USC (2012)  
Jorge Aguilar Cisneros, Ph.D. in Software Engineering, Universidad Popular Autonoma Estado de Puebla, Mexico (2009)  
Jared Fortune, Ph.D. in Industrial & Systems Engineering, USC (2009)

### **Undergraduate Advising**

Mentor, UA International Student Exchange Program with Chile (2014 – 2015)  
Mentor, Arizona Science, Engineering, & Mathematics Scholars Program (ASEMS) (2014-present)  
Advisor, UA chapter of the Society of Hispanic Professional Engineers (2013-present)  
NASA Space Grant Intern (2012)  
Arizona Assurance Scholars, UA (2012, 2013)  
Freshman Advisor, MIT (2006 – 2011)

### **SERVICE**

#### **Outreach**

Founder, Science of Sport - STEM outreach program for K-12 teachers and students

Licensed to the Arizona Diamondbacks (2013)  
Licensed to the Adelaide Bite (Australia) (2013)  
Licensed to the Los Angeles Angels of Anaheim (2014)  
Licensed to the San Diego Padres (2014)  
Licensed to the Colorado Rockies (2015)  
Licensed to the Washington Nationals (2015)  
Licensed to Major League Baseball (2016)  
Licensed to Atlanta Braves (2017)  
Licensed to Oakland Athletics (2018)  
Licensed to Texas Rangers (2018)  
Licensed to Kansas City Royals (2018)  
Licensed to Los Angeles Dodgers (2018)

Creator of RoboCup Jr. curriculum, soccer robotics program for Arizona schools, that

teaches product development, software engineering, and systems engineering  
Used in summer course at UA by engineering undergraduate students  
from ITESM Sonora  
Used in after school program at Sunnyside Unified School District in  
Tucson

**Department Service**

Committee chair for joint Biomedical Engineering/Systems & Industrial Engineering  
faculty search (2016)  
SIE Undergraduate Committee (2015)  
SIE Graduate Committee (2013, 2014, 2015)  
Institutional Review Board representative (2013, 2014, 2015)  
Faculty search committee (2013, 2015, 2016, 2018, 2019)  
Promotion & Tenure Committee for G. Bayraksan (2011), H. Liao (2012), Liu (2013),  
Furfaro (2015), Fan (2018)

**College Service**

Dean of Engineering search committee (2019)  
College Representative, Faculty Senate (2014-2016)  
College of Engineering Post Tenure Review Audit Committee (2015-16)  
Reviewer, College of Engineering PhD Student Fellowships (2015)  
Search Committee, Department of Electrical & Computer Engineering – 5 positions  
(2015)  
Search Committee, College of Engineering Proposal Services Coordinator (2015)  
Search Committee, Assistant Dean of Graduate Education (2014)  
Reviewer, Thomas R. Brown Scholarship (2013)  
Guest lecture for ENGR 102 (freshman design course) Fall 2011, Spring 2012, Fall  
2012, Spring 2013, Spring 2014, Fall 2014, Fall 2015, Fall 2016, Fall 2017, Fall  
2018)

**University Service**

Search Committee, Deputy Director for Title IX, Office of the President (2019)  
Member of the Conduct Advisory Committee (2018 – present)  
Member of the Intercollegiate Athletics Committee (2017 – present)  
Member of search committee for Director of the Race Track Industry Program (RTIP)  
in the College of Agriculture and Life Sciences (2016)  
Member of search committee for Associate Director of Business Development for  
Water and Energy Sustainable Technology (WEST) Center (2016)  
Member of faculty search committee for University-wide cluster hire in Space  
Situational Awareness (2016)  
Faculty Fellow - Gila Hall (2014), Likins Hall (2015, 2016)  
Search committee, Eller College of Management/Technology Licensing Office search  
for embedded Licensing Manager (2013)  
Reviewer, Packard Faculty Fellowships (2013)  
Committee member, Vice President of Research/University of Arizona Foundation  
campus-wide business processes (2012-2014)

**External Service**

Board of Advisors, Systems Engineering Department at the United States Military  
Academy (2015 – present)  
Promotion letter for faculty at SUNY Binghamton (2016)  
Promotion letter for faculty at United States Military Academy (2016)

Promotion and tenure letter for faculty at University of Texas El Paso (2015)

**Editorial Activities**

Editor-in-Chief, *Journal of Cost Analysis and Parametrics* (published three times per year by Taylor & Francis on behalf of the International Cost Estimating and Analysis Association), 2012-present

Founder and co-Editor-in-Chief, *Journal of Enterprise Transformation* (published quarterly by Taylor & Francis on behalf of the International Council on Systems Engineering and Institute of Industrial Engineers), 2010-2015

Selection committee for Editor-in-Chief for *Systems Engineering Journal* on behalf of the International Council on Systems Engineering (2012)

Guest Editor (special issue on cost estimation), *International Journal of Computer Aided Manufacturing* (2010)

Editorial Advisory Board, *Enterprise Information Systems Journal* (since 2007)

Editorial Advisory Board, Complex and Enterprise Systems Engineering Book Series (2008)

**Reviewer**

Taylor & Francis Group; IEEE Software; IEEE Systems Journal; International Journal of E-Collaboration; Information, Knowledge, and Systems Management Journal; Journal of Systems Engineering; Journal of Systems & Software; Empirical Software Engineering Journal; Journal of Engineering Design

**Conferences**

Master of Ceremonies, INCOSE Symposium, Orlando, FL (2019)

Program co-Chair, World Automation Congress, Kona, Hawaii (2014)

Advisory Committee, 37<sup>th</sup> National Systems Conference – Center of Excellence in Systems Science, IIT Jodhpur (Rajasthan, India; 2013)

Lean Enterprise Software and Systems Conference, (Galway, Ireland; 2013)

General co-Chair, 8<sup>th</sup> IEEE International Conference on System of Systems Engineering (Maui, Hawaii; 2013)

Program Committee, 11<sup>th</sup> Annual Conference on Systems Engineering Research (Atlanta, GA; 2013)

Co-Chair, 1<sup>st</sup> Annual Enterprise Transformation Research Workshop (Atlanta, GA; 2013)

Program Committee, 10<sup>th</sup> Annual Conference on Systems Engineering Research (St. Louis, MO; 2012)

Program co-Chair, 6<sup>th</sup> IEEE International Conference on System of Systems Engineering (Albuquerque, NM; 2011)

General Chair, 24<sup>th</sup> International Forum on COCOMO and Software Cost Modeling (Los Angeles, CA; 2009)

Technical co-chair, MIT Lean Aerospace Initiative Conference (2007)

Program Committee, Forum on COCOMO and Software Cost Modeling (2004-present)

Co-Director, INCOSE Systems Engineering & Architecting Doctoral Student Network (SEANET) (2006-present)

Program Committee, Conference on Systems Engineering Research (Los Angeles, CA 2004; Hoboken, NJ 2015)

## **MEDIA COVERAGE**

- "Today's Lesson, Home Run Science. Your Teacher? The Dodgers," *Los Angeles Times* (Bill Shaikin), June 1, 2019 <https://www.latimes.com/sports/dodgers/la-sp-dodgers-science-launch-angle-geometry-elementary-students-20190531-story.html>
- "STEMfooty Partners With Science of Sport," *Adelaide Football Club* (Katie Gloede), May 7, 2019 <https://m.afc.com.au/news/2019-04-30/stemfooty-partners-with-science-of-sport>
- "Sugar Bowl helps bring 'Science of Football' into classrooms," *Crescent City Sports* (Lenny Vangilder), October 26, 2018 <https://crescentcitysports.com/video-sugar-bowl-helps-bring-science-of-football-into-classrooms/>
- "Science of Sport Seeks to Grow Its Impact in STEM Education," *Sportechie* (Jesse Lovejoy), October 19, 2018 <https://www.sporttechie.com/science-of-sport-seeks-to-grow-stem-education/>
- "Crows Launch Innovative STEM Program," September 28, 2018 <http://www.afc.com.au/news/2018-09-28/crows-launch-innovative-stem-program>
- "From UA Engineering to SpaceX to West Point and Back: A Q&A With Ricardo Valerdi," *UA College of Engineering News* (Emily Dieckman), September 14, 2018 <https://news.engineering.arizona.edu/news/ua-engineering-spacex-west-point-and-back-qa-ricardo-valerdi>
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