April 19, 2022

William S. Hammack
William H. and Janet G. Lycan Professor
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Education

PhD 1988	Chemical Engineering	University of Illinois at Urbana-Champaign
MS 1986	Chemical Engineering	University of Illinois at Urbana-Champaign
BS 1984	Chemical Engineering	Michigan Technological University

Employment

Carnegie Mellon University (Pittsburgh)
September 1988-1992, Assistant Professor
September 1992-December 1997, Associate Professor

University of Illinois at Urbana-Champaign
December 1997-August 2003, Adjunct Associate Professor
August 2003 - August 2006, Associate Professor (w/ tenure)
August 2005-August 2006, Jefferson Science Fellow, U.S. Department of State
August 2006-present, Professor
August 2007-August 2008 Fellow, Academy for Entrepreneurial Leadership
August 2008-August 2010, Fellow, iFoundry
August 2014-December 2018, Donald and Dolores Morris Scholar
January 2019-present, William H. and Janet G. Lycan Professor

Professional Association/Society Memberships

American Physical Society (Fellow), American Association for the Advancement of Science (Fellow), American Institute of Chemical Engineers, Materials Research Society, National Association of Science Writers

Awards and Honors

National

Member, National Academy of Engineering, 2022

Public Service Award, National Science Board, 2020

The Public Service Award honors individuals and groups that have made substantial contributions to increasing public understanding of science and engineering in the United States. These contributions may be in a wide variety of areas that have the potential of contributing to public understanding of and appreciation for science and engineering, including: media, education, training programs, and entertainment.

Hoover Medal, 2020

This 14 kt gold medal "commemorates the civic and humanitarian achievements of engineers." It is conferred upon an engineer whose professional achievements and personal endeavors have advanced the well-being of humankind." Administered by a board representing five engineering organizations: The American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Chemical Engineers, the American Institute of Mining, Metallurgical and Petroleum Engineers and the Institute of Electrical and Electronics Engineers.

Ralph Coats Roe Medal, 2020, American Society of Mechanical Engineers

This Gold Medal, and a $12,000 prize, "recognizes an outstanding contribution toward a better public understanding and appreciation of the engineer's worth to contemporary society."

Carl Sagan Award for the Public Appreciation of Science, 2019, Council of Scientific Society Presidents
First Prize, 2011, Science OnLine Film Festival (inaugural prize)
Fellow, 2009, American Association for the Advancement of Science (AAAS)
Fellow, 2009, American Institute of Physics
Jefferson Science Fellow, 2005, U.S. Department of State
Science Writing Award, 2004, American Institute of Physics
James T. Grady-James H. Stack Award, 2004, American Chemical Society
Distinguished Literary Contribution Furthering the Public Understanding of the Profession, 2004, IEEE
President's Award, 2003, American Society for Engineering Education

Silver Reel National News & Commentaries, 2003, National Federation of Community Broadcasters
Science-in-Society Award, 2002, National Association of Science Writers
Service to Society Award, 2002, American Institute of Chemical Engineers
Edwin F. Church Medal, 2002, American Society of Mechanical Engineers
Camille Dreyfus Teacher-Scholar, 1993, Dreyfus Foundation
ACS/Exxon Fellowship in Solid State Chemistry, 1992, American Chemical Society

Local
The Advisors List 1999-2001, top 10% of Advisors in College of Engineering
SCS Excellence in Teaching Award of the School of Chemical Sciences, 2001
Public Engagement Award, University of Illinois-Urbana, 2012

Publications and Creative Works

See addendum

Keynote/Plenary Lectures

1. "William Albert Noyes" for the Noyes Centennial, University of Illinois, Urbana, IL September 13, 2002.
2. "Ben Franklin the Engineer," University of Pennsylvania, 150th Anniversary Celebration for the School of Engineering & Applied Science, September 26, 2002.
3. "The Role of Media in a Young Faculty Member's Career", November 2002, AIChE Meeting, Indianapolis, Indiana.
4. "Six Rules to Use When Adopting New Technology" Beta Phi Mu Honors Society, November 9, 2002, Urbana, Illinois.
5. "How Engineers should talk to the public," Illinois Society of Professional Engineers, Champaign, IL, February 21, 2003.
6. "Inspiration from a pop can", keynote for the Illinois Science Olympiad, April 5, 2003, Champaign, Illinois.
7. "What role do science journalists play in creating a scientifically-literate public?" National Press Club, Washington D.C., October 24, 2003.
8. "Engineering & Life: The Stories Behind the Stuff" Office of Legislative and Public Affairs Science Communicator Lecture, National Science Foundation, April 16, 2004.
9. "Teaching the public about engineering and technology," Jefferson Laboratory, Department of Energy, Newport News, VA, April 20, 2004.
10. "The Hidden World of Engineering", Jefferson Lab Popular Science Series, Jefferson Laboratory, Department of Energy, Newport News, VA, April 20, 2004.
11. "How engineers should talk to the public" Biopolis, Singapore, March 2, 2005.

12. “The Hidden World of Engineering” Singapore Science Center, Singapore, March 3, 2005.
13. “How to teach engineering to non-majors”, NSF-NAE Conference on Technological Literacy, Washington, DC February 18, 2005.
14. Keynote “Annual Meeting for GK-12 Project Teams" National Science Foundation, Washington DC, March 10, 2007.
15. “Tech Myths: What You Think You Know That Isn’t True" National Academies Beckman Distinctive Voices Lecture, Irvine California. May 2, 2007.
16. Keynote for University of Louisville Engineering Expo [invited] March 1, 2008, Louisville, Ky
17. Speech for the Council for Chemical Research [invited] April 28, 2008, St. Louis
18. National Academies Talk July 2010
19. Booz Allen Hamilton Distinguished Colloquium Series in Electrical and Computer Engineering, University of Maryland, College Park, September 9, 2011
20. Hoover Medal Lecture, AIChE Annual Meeting, November 8, 2021.

Career Narrative

Hammack has pioneered multidisciplinary engineering education, public outreach, and service to the profession through development and communication of internet- delivered content. As a superb communicator, he makes engineering understandable and compelling to others. He accomplishes this through development and distribution of re-usable internet-delivered content, which are. viewed today by millions of users of all ages and backgrounds. These are crystal-clear and technically accurate descriptions, which explain the engineering principles behind every-day objects. They also capture the values, the core principles, and the appeal of the engineering profession.

Hammack began his communication outreach by producing hundreds of award-winning public radio commentaries. But he also recognized that the world of internet delivery would come to dominate, especially for reaching young people. He began producing videos about everyday objects that embody important Engineering concepts. Hammack discovered in himself an ability to make things understandable and interesting to the lay public. His videos provide compelling descriptions of engineering design considerations, of manufacturing techniques, as well as fascinating descriptions of natural phenomena (like droplets). He can wax rhapsodic over the design of a modern, high-tech soda can. His videos and commentaries allow a large audience to experience and understand Engineering as a creative profession.

The impact of his work draws on the large reach of internet content that he provides. His YouTube channel has attracted a dedicated core of 1.1 million subscribers with over 70 million views. Hammack’s entire body of work is released with a broad Creative Commons license

which allows others to use and reuse his videos free of charge. This results in large and diverse uses of his videos. Followers include school children and young people, high-school and college students, teachers, medical and business professionals, the general-public, retired people, and seasoned engineers. Examples of his videos include: the ingenious design of an aluminum beverage can (>15M views); fiber optic communication cables (6.3M); plastic injection molding (3.6M); microwave ovens (4.2M), even the Engineering of a disposable diaper (600K views). His videos enable countless applications: workforce training (GM, Disney); polymer science courses (Germany, Turkey); K-12 education (India, Australia); and re-starting adult education after 50 years of military rule in Myanmar.

At a higher level, his portfolio of videos and other works provide:

- Innovative new ways to educate over a broad range of topics.

- They reach out to all ages and give examples of how to communicate with those who do not have technical backgrounds. They seed the next generation of engineers through use in K-12 and home-schooling.

- They provide public service to millions who share content globally, and enjoy access to a vast digital commons with information that they can copy, distribute, edit, re-mix, and build upon, all within the boundaries of copyright law.

Humanity benefits in many ways from a public that appreciates both Engineering, and its role in addressing societal problems. Hammack is our profession's ambassador to the world.

Addendum: Publications and Creative Works

Master's Thesis Title
W.S. Hammack, *Effect of Pressure on intervalence electron transfer*. Master's Thesis, University of Illinois, Urbana, Illinois, 1986.

Doctoral Thesis Title
W. S. Hammack, *Effect of Pressure on Intramolecular Charge Transfer and Spin Crossover Materials*. PhD Thesis, University of Illinois, Urbana-Champaign, Illinois, 1988.

Chapters in Books
W.S. Hammack, G.C. Serghiou, and R.R. Winters, "Reversible pressure-induced amorphizations," *Structure of noncrystalline solids* edited by Pye, L. D., LaCourse, W.C., and Stevens, H.J. (Taylor & Francis, London, 1992), p. 208.

Books

1. *Why Engineers Should Grow a Long Tail: A Primer on Using New Media to Inform the Public and to Create the Next Generation of Innovative Engineers* Articulate Noise Books (2010) ISBN Paperbound 978-0-615-39555-5 ebook 978-0-9839661-2-8

   Summary Often the details of new media get lost in an alphabet soup that usually begins with an "i" - the iPod, the iPad, the iTouch. Yet the essence of new media is not in these devices, but in their use. This short primer shows engineers how to think about new media by focusing on the deeper issues of communicating in this new user- generated era. Readers will grasp the mindset of new media; an understanding that will long outlast the latest social networking tools. It will empower practicing engineers to develop new, powerful ways to help the public understand what engineers do and why engineering is important; but perhaps most importantly this primer gives engineers the foundation for reaching the next generation of innovative engineers.

2. *How Engineers Create the World: The Public Radio Commentaries of Bill Hammack* Articulate Noise Books (2011) ISBN Paperbound 978-0-9839661-0-4 ebook 978-0-9839661-1-1

   Summary In over 200 delightful short essays Bill captures the creativity and impact of engineers. He talks of their spectacular achievements - jets, satellites, skyscrapers, and fiber optics—but draws his deepest insights from the everyday, the quotidian. He finds beauty, elegance and meaning in Ferris wheels, Tupperware, Slinkys, mood rings, waterless urinals and Velcro. Delivered originally on public radio between 1999 and

2005, each essay is a small slice of the world created by engineers. The essays also illuminate and inform about the important topics of our day by showing how intertwined engineering and technology are with terrorism, security, intellectual property and our cultural legacy.

3. *Eight Amazing Engineering Stories: Using the Elements to Create Extraordinary Technologies* (with Patrick Ryan & Nick Ziech) Articulate Noise Books (2012) ISBN Paperbound 978-0-9839661- 3-5 eBook 978-0-9839661-4-2

   Summary A companion volume to the fourth series of EngineerGuy videos, Eight Amazing Engineering Stories reveals the stories behind how engineers use specific elements to create the material world around us. In eight chapters, the EngineerGuy team exposes the magnificence of the innovation and engineering of digital camera imagers, tiny accelerometers, atomic clocks, enriched uranium, batteries, microwave ovens, lasers, and anodized metals. In addition, short primers cover the scientific principles underlying the engineering, including waves, nuclear structure, and electronic transitions. "In Depth" sections cover entropy, semiconductors, and the mathematics of capacitors.

4. *Albert Michelson's Harmonic Analyzer: A Visual Tour of a Nineteenth Century Machine that Performs Fourier Analysis* (with Steve Kranz and Bruce Carpenter) Articulate Noise Books (2014) ISBN Paperbound 978-0983966173, Hardcover 978-0983966166

   Summary This book celebrates a nineteenth-century mechanical calculator that performed Fourier analysis by using gears, springs and levers to calculate with sines and cosines—an astonishing feat in an age before electronic computers. One hundred and fifty color photos reveal the analyzer's beauty though full-page spreads, lush close-ups of its components, and archival photos of other Michelson-inspired analyzers. The book includes sample output from the machine and a reproduction of an 1898 journal article by Michelson, which first detailed the analyzer. The book is the official companion volume to our YouTube video series on the machine.

5. *Michael Faraday's The Chemical History of a Candle with Guides to the Lectures, Teaching Guides & Student Activities* (with Don DeCoste) Articulate Noise Books (2015) ISBN Hardcover (Casebound) 978-0-9838661-8-0, paperback 978-1-945441-00-4, eBook 978-0-9839661-9-7

   Summary This book introduces modern readers to Michael Faraday's great nineteenth-century lectures on The Chemical History of a Candle. This edition is a companion book to the popular EngineerGuy YouTube series of the lectures. This books contains supplemental material to help readers appreciate Faraday's key insight that

"there is no more open door by which you can enter into the study of science than by considering the physical phenomena of a candle." Through a careful examination of a burning candle, Faraday's lectures introduce readers to the concepts of mass, density, heat conduction, capillary action, and convection currents. They demonstrate the difference between chemical and physical processes, such as melting, vaporization, incandescence, and all types of combustion. And the lectures reveal the properties of hydrogen, oxygen, nitrogen, and carbon dioxide, including their relative masses and the makeup of the atmosphere. The lectures wrap up with a grand, and startling, analogy: by understanding the chemical behavior of a candle the reader can grasp the basics of respiration. To help readers understand Faraday's key points this book has an "Essential Background" section that explains in modern terms how a candle works, introductory guides for each lecture written in contemporary language, and seven student activities with teaching guides.

6. *Fatal Flight: The True Story of Britain's Last Great Airship* Articulate Noise Books (2017) ISBN Hardcover 978-1-945441-01-1, eBook 978-1-945441-02-8, Paper 978-1-945441-03-5, Audiobook 978-1-945441-04-2

Summary *Fatal Flight* brings vividly to life the year of operation of R.101, the last great British airship—a luxury liner three and a half times the length of a 747 jet, with a spacious lounge, a dining room that seated fifty, glass-walled promenade decks, and a smoking room. The British expected R.101 to spearhead a fleet of imperial airships that would dominate the skies as British naval ships, a century earlier, had ruled the seas. The dream ended when, on its demonstration flight to India, R.101 crashed in France, tragically killing nearly all aboard. Combining meticulous research with superb storytelling, *Fatal Flight* guides us from the moment the great airship emerged from its giant shed—nearly the largest building in the British Empire—to soar on its first flight, to its last fateful voyage. The full story behind R.101 shows that, although it was a failure, it was nevertheless a supremely imaginative human creation. The technical achievement of creating R.101 reveals the beauty, majesty, and, of course, the sorrow of the human experience. The narrative follows First Officer Noel Atherstone and his crew from the ship's first test flight in 1929 to its fiery crash on October 5, 1930. It reveals in graphic detail the heroic actions of Atherstone as he battled tremendous obstacles. He fought political pressures to hurry the ship into the air, fended off Britain's most feted airship pilot, who used his influence to take command of the ship and nearly crashed it, and, a scant two months before departing for India, guided the rebuilding of the ship to correct its faulty design. After this tragic accident, Britain abandoned airships, but R.101 flew again, its scrap melted down and sold to the Zeppelin Company, who used it to create LZ 129, an airship even more mighty than R.101—and better known as the *Hindenburg*. Set against the backdrop of the British Empire at the height of its power in the early

twentieth century, *Fatal Flight* portrays an extraordinary age in technology, fueled by humankind's obsession with flight.

7. *The Things We Make: The Unknown History of Invention from Cathedrals to Soda Can* Sourcebooks(forthcoming March 23, 2023) ISBN Hardcover 978-1-7282-1575-4

Summary *The Things We Make* shares with a popular audience, for the first time, the details of the powerful, revolutionary and, oddly, unknown engineering method that has influenced readers lives intimately, deeply, and lastingly. The book features human stories, perception-changing histories of invention, and accessible explanations of technology. These stories reveal a panorama of human creativity across millennia and continents. They hear of technologies invisible to them, yet which profoundly affect their lives. The stories in the book will delight, but its implicit message is deeper. A fuzzy understanding of the engineering method impoverishes the national conversation about the technological forces that influence our lives; an ignorance of how engineers work and invent deters the public from their civic duty to shape these forces. And bringing the engineering method to national attention can start a conversation about how we create innovative engineers who will battle climate change and other catastrophes.

Articles in Journals

1. W.S. Hammack, H.G. Drickamer, M.D. Lowery, and D.N. Hendrickson, "Effect of pressure-induced freezing on the energy of the intervalence transfer electronic absorption band of mixed-valence complexes, *Chem. Phys. Lett.* **132**, 231 (1986).
2. M.D. Lowery, W.S. Hammack, D.N. Hendrickson, and H.G. Drickamer, "Effects of ion aggregation on the intervalence transfer band of the mixed-valence biferrocenium cation in solution," *J. Am. Chem. Soc.,* **109**, 8019 (1987).
3. U. Sinha, M.D. Lowery, W.S. Hammack, D.N. Hendrickson, and H.G. Drickamer, "Pressure effects on the intervalence transfer electronic absorption band of mixed-valence bis(fulvalene) diiron monocation in various media," *J. Am. Chem. Soc.,* **109**, 7340 (1987).
4. W.S. Hammack, M.D. Lowery, D.N. Hendrickson, and H.G. Drickamer, "Pressure effects on the intervalence-transfer electronic absorption band of the mixed-valence creutz-taube ion in various media," *J. Phys. Chem.*, **92**, 1771 (1988).
5. W.S. Hammack, H.G. Drickamer, M.D. Lowery, and D.N. Hendrickson, "Effect of pressure-induced freezing on the energy of the intervalence electronic absorption band of a binuclear mixed-valence complex," *Inorg. Chem.*, **27**, 1307 (1988).
6. W.S. Hammack, H.G. Drickamer, and D.N. Hendrickson, "Effect of pressure on the charge-transfer band of the $[Fe(CN)_6]_4$-dimethyl viologen ion pair," *Chem. Phys. Lett.*, **151**, 469 (1988)
7. W.S. Hammack, A. J. Conti, D.N. Hendrickson, and H.G. Drickamer, "Pressure-induced spin-state interconversion of $[Fe(6\text{-Me-Py})_3Tren](ClO_4)_2$ in solution," *J. Am. Chem. Soc.*, **111**, 1738 (1989).
8. W.S. Hammack, D.N. Hendrickson, and H.G. Drickamer, "Pressure-induced solvatochromism of the charge-transfer transitions in pyridinium betaines," *J. Phys. Chem.*, **93**, 3843 (1989).
9. G.C. Serghiou and W.S. Hammack, "Pressure-induced crystalline-to-noncrystalline transformations of barium fluorozirconates: A probe of the medium range order of noncrystalline solids," *J. Chem. Phys.* **95** (1991) 5212.
10. G.C. Serghiou and W.S. Hammack, "Pressure-induced disordering in α-$SrZrF_6$: implications for the role of the countercation in glassy $SrZrF_6$" , *J. Chem. Phys.* **96** (1992) 6911.
11. G.C. Serghiou, R.R. Winters, and W.S. Hammack, "Pressure-induced amorphization and reduction of T-Nb_2O_5," *Phys. Rev. Lett.* **68** (1992) 3311.
12. G.C. Serghiou, R.R. Winters, and W.S. Hammack, "Pressure-induced transformations of β-$BaZr_2F_{10}$ and its relationship to glassy $BaZr_2F_{10}$", *J. Phys.: Conds. Matter.*, **10** (1992) 7617.

13. R.R. Winters, G.S. Serghiou, and W.S. Hammack, "Observation and explanation of the reversible pressure-induced amorphization of $Ca(NO_3)_2/NaNO_3$", *Phys. Rev. B.*, **46** (1992) 2792.
14. R.R. Winters, A. Garg, and W.S. Hammack, "High-resolution electron microscopy of pressure-amorphized α-quartz", *Phys. Rev. Lett*. **69** (1992) 3751.
15. R.R. Winters and W.S. Hammack, "Pressure-induced amorphization of R-Al_5Li_3Cu: a structural relation among amorphous metals, quasi-crystals, and curved space," *Science* **260** (1993) 202.
16. G.C. Serghiou and W.S. Hammack, "Pressure-induced amorphization of wollastonite ($CaSiO_3$) at room temperature," *J. Chem. Phys.* **98** (1993) 9830.
17. J.L. Robeson, R.R. Winters, and W.S. Hammack, "Pressure-induced transformations of the cristobalite phases of $GaPO_4$ and $AlPO_4$," *Physical Review Letters* **73** (1994) *1644*.
18. R.R. Winters and W.S. Hammack "Pressure-induced distortions of $Pb(NO_3)_2$ isomorphs. *Phys. Rev. B, Condens. Matter* **53** (1996) 14089.
19. F.E. Bernardin and W.S. Hammack "Pressure-induced disordering of sodium potassium sulfates and chromates", *Phys. Rev. B, Condens. Matter* **54** (1996) *7026*
20. W.S. Hammack, "Sounding an alarm in the sky", *Technology Review* March/April 1999, p. 104.
21. Meyer, K.; Hammack, W.; Curran, A., "The Miracle of Everyday Objects", *Carnegie Mellon Magazine* Fall 1999.
22. "Numbers & Life" Engineering Outlook, Volume 41, Issue #2, 2002.
23. W.S. Hammack, "Terry Bicycles" *Engineering Outlook*, September 2003.
24. W.S. Hammack, "The Great Discovery Since Fire" *American Heritage Invention & Technology*, Spring 2005, volume 20, issue 4.

Radio pieces for Public Radio

Radio pieces produced for American Public Media's **Marketplace**
Topic/Title Broadcast Date

1. Concorde October 23, 2003
2. Partial Zero Emission Vehicles February 10, 2004
3. Oil Reserves April 26, 2004
4. Potholes June 10, 2004
5. Landlines vs. Cellphones August 4, 2004
6. Environmental Impact /Microchip December 10, 2004
7. Recycling & Green Design April 1, 2005
8. YouTube & New Media September 19, 2006
9. Death of VHS (*Morning Report*) December 19, 2006
10. Nanotechnology July 31, 2007

11. Beach reads: 'The Pentagon's New Map' August 14, 2007
12. DVD Format (*Morning Report*) October 1, 2007
13. Sputnik October 4, 2007

Radio Pieces for Public Radio distributed by Illinois Public Radio

Topic/Title Broadcast Date

† indicates the piece also appeared on Radio National Australia's *Science Show*

1. Phone August 31, 1999
2. Plastic Bottle September 7, 1999
3. Pop Can top September 14, 1999
4. Television September 21, 1999
5. Power outage September 28, 1999
6. Nylon & underwear October 5, 1999
7. Bathtubs October 12, 1999
8. Microchip October 19, 1999
9. Roman Engineering October 26, 1999
10. Stall Warning November 2, 1999
11. Theremin November 9, 1999
12. Zara Witkin November 16 1999
13. Typefaces & Bolts November 23, 1999
14. Tunnels November 30, 1999
15. Wind-up Radio December 7, 1999
16. Razor December 13, 1999
17. VCR December 21, 1999
18. Digital data December 28, 1999
19. Muzak January 4, 2000
20. Mass Production January 11, 2000
21. Windshield Wipers January 18, 2000
22. Typewriter January 25, 2000
23. Clocks & Imperialism February 8, 2000
24. Packaging February 15, 2000
25. Photocopier February 22, 2000
26. Housework & Technology February 29, 2000
27. Technological optimism March 7, 2000
28. Plastic Bottle March 14, 2000
29. Airships March 21, 2000
30. Tupperware March 28, 2000
31. Spam April 4, 2000
32. Project Gutenberg April 11, 2000

33. Electronic Comm April 18, 2000
34. Nylon April 25, 2000
35. Railroads May 2, 2000
36. Sears Tower May 9, 2000
37. Bathtubs May 16, 2000
38. Violin May 23, 2000
39. Roller Coaster May 30, 2000
40. Garbage Dump June 6, 2000
41. Bread making June 13, 2000
42. Elevator June 20, 2000
43. Air Conditioner June 27, 2000
44. Kodak & Cameras July 4, 2000
45. Machine Gun July 11, 2000
46. Hammond Organ July 18, 2000
47. Yeats & Radio July 25, 2000
48. O-ring August 1, 2000
49. Steadicam August 8, 2000
50. Vacuum Cleaner August 15, 2000
51. Airplane take-off August 22, 2000
52. Coffee Maker August 29, 2000
53. Head Skis September 5, 2000
54. Grain Elevators October 10, 2000
55. Microchip October 17, 2000
56. Reading Jekyll and Hyde October 24, 2000
57. Pumpkin Masters October 31, 2000
58. Voting Machine November 7, 2000†
59. Beatles November 14, 2000
60. Lava Lamp November 21, 2000
61. e-books November 28, 2000
62. Velcro December 5, 2000
63. Video games December 12, 2000
64. Scotch tape December 19, 2000
65. Theremin December 26, 2000
66. Typewriter January 2, 2001
67. Potholes January 9, 2001
68. Gas lighting January 16,2001
69. Ultrasound imaging January 23, 2001
70. Violins January 30, 2001
71. New vs. Old Technology February 6, 2001
72. Glass February 13, 2001

73. Super Soaker February 20, 2001
74. Contact Lenses February 27, 2001
75. Matches March 6, 2001
76. Demolition March 13, 2001
77. Pop Can Top -retape March 20, 2001
78. Bose wave radio March 27, 2001
79. Claude Shannon April 3, 2001
80. Cell Phone April 10, 2001
81. Microchip April 17, 2001
82. Ping Putter April 24, 2001
83. Air Conditioner May 1, 2001
84. Cornstarch peanuts May 8, 2001
85. Moen faucet May 15, 2001
86. Energy & IT May 22, 2001
87. Knight/Paper bag May 29, 2001
88. Digital Data June 5, 2001
89. Linux June 12, 2001
90. Composting Toilets June 19, 2001
91. Bolts June 26, 2001
92. Jefferson and Science July 3, 2001
93. Roller Coasters July 10, 2001
94. Ice cream July 17, 2001
95. Color Reproduction July 24, 2001
96. Internet July 31, 2001
97. Air Conditioning August 7, 2001
98. Superglue August 14, 2001
99. Electric cars August 21, 2001
100. Hammond Organ August 28, 2001
101. Bicycles September 4, 2001
102. Cigarette machine September 11, 2001
103. Technology & Terrorism September 18, 2001
104. Concrete October 2, 2001
105. Technological Optimism October 9, 2001
106. Face Recognition October 16, 2001
107. Birth of E-mail October 23, 2001
108. Pop Rocks candy October 30, 2001
109. Anthrax November 6, 2001
110. Mauve November 13, 2001
111. Cooking a turkey November 20, 2001
112. High-tech swimsuits November 27, 2001

113. Leonardo da Vinci December 4, 2001
114. The Beatles December 11, 2001
115. Numbers & Life December 18, 2001
116. Erector sets December 25, 2001
117. Atomic Clocks January 8, 2002
118. Tolkien & Technology January 15, 2002
119. Corks January 22, 2002
120. Muzak January 29, 200
121. Olympic Torch February 5, 2002
122. Glowing hockey puck February 12, 2002
123. Head Skis February 19, 2002
124. The Ice Hotel February 26, 2002
125. Gridlock Sam March 5, 2002
126. Voice Mail March 12, 2002
127. Batteries in the Refrigerator March 19, 2002
128. Color Film March 26, 2002
129. Online shopping April 2, 2002
130. Gore-Tex April 9, 2002
131. Mood Ring April 16, 2002
132. Disk vs. Disc April 23, 2002
133. Surveillance Tags April 30, 2002
134. Terry Bicycles May 7, 2002
135. Slinky May 14, 2002
136. Strobe photography May 21, 2002
137. Roller Coasters May 28, 2002
138. Constance Tipper June 4, 2002
139. Thomas Stockham June 11, 2002
140. Violins June 18, 2002
141. Satellite Communication June 25, 2002
142. Directional Sound July 2, 2002
143. The Nautilus Machine July 9, 2002
144. Roman Engineering July 16, 2002
145. Vaseline July 23, 2002
146. Cruise control July 30, 2002
147. GPS August 6, 2002
148. Geiger Counters August 13, 2002
149. Phillips Screws August 20, 2002
150. Production Engineering August 27,2002
151. The Saxophone September 3, 2002
152. Technology & Terrorism September 10, 2002

153. Iridium Satellites September 17, 2002
154. Rolodex September 24, 2002
155. Bathtub October 1, 2002
156. Tupperware October 8, 2002
157. Thomas Midgley October 15, 2002
158. Clocks & World Domination October 22, 2002
159. Glo-Sheet October 29, 2002
160. Diapers November 5, 2002
161. Nitrogen Production November 12, 2002
162. Frisbee November 19, 2002
163. Jell-O November 26, 2002
164. Waring Blender December 3, 2002
165. Landfills December 10, 2002
166. Jet take-off December 17, 2003
167. Mathematics of Lines December 24, 2003
168. The Swatch Watch December 31, 2003
169. Henry Dreyfuss January 7, 2003
170. Shower curtains & fluid flow January 14, 2003
171. Muzak January 21, 2003
172. Tolkien & technology January 28, 2003
173. Shuttle landing February 4, 2003
174. Remote control February 11, 2003
175. Coltan February 18, 2003†
176. Zildjian Cymbals February 25, 2003
177. Why a chair? March 4, 2003
178. Environment & microchips March 11, 2003
179. Hydrogen as fuel March 18, 2003
180. Clarence Birdseye March 25, 2003
181. Computer Mouse April 1, 2003
182. Counting Crowds April 8, 2003
183. Adam Osborne April 15, 2003
184. Potholes April 22, 2003
185. Google April 29, 2003
186. Glass May 6, 2003
187. SARS May 13, 2003
188. Concorde May 20, 2003
189. HeLa Cells May 27, 2003
190. Ice Cream June 3, 2003
191. SCUBA June 10, 2003
192. Duct tape June 17, 2003

193. Laundry Machine June 24, 2003
194. Jefferson & Science July 1, 2003
195. Three Gorges Dam July 8, 2003
196. Wind Power July 15, 2003
197. Spam e-mail July 22, 2003
198. Fiber Optics July 29, 2003
199. LEO—the first computer August 5, 2003
200. The Beetle August 12, 2003
201. Memory Metals August 19, 2003
202. Strollers August 26, 2003†
203. Superglue September 2, 2003
204. The Blackout September 9, 2003
205. Sliced Bread September 16, 2003
206. Typewriter September 23, 2003
207. Television September 30, 2003
208. Railroads October 7, 2003
209. Kodak Cameras October 14, 2003
210. Clocks Conquer the World October 21, 2003
211. Theremin October 28, 2003
212. Hazel Bishop November 4, 2003
213. Computer Viruses November 11, 2003
214. Cryonics November 18, 2003
215. Cooking a Turkey November 25, 2003
216. Microwave Oven December 2, 2003
217. The Telegraph December 9, 2003
218. Tolkien & Technology December 16, 2003
219. Neon Lighting December 23, 2003
220. The Electric Chair December 30, 2003
221. Champagne January 6, 2004
222. Atomic clocks January 13,2004
223. Flu Vaccines January 20, 2004†
224. Projectiles January 27, 2004†
225. Thomas Stockham February 3, 2004
226. Oil Reserves February 10, 2004
227. PZEV February 17, 2004
228. Black Boxes February 24, 2004†
229. Lego March 2, 2004
230. Pompeii March 9, 2004†
231. Electronic Voting March 16, 2004†
232. Velcro March 23, 2004†

233. Obsolete Technologies March 30, 2004†
234. The Escapement April 6, 2004†
235. The Science of Easter & Passover April 13, 2004†
236. Fahrenheit 451 April 20, 2004†
237. Computer & Terrorism April 27, 2004
238. TiVo May 4, 2004†
239. Boeing 7E7 Dreamliner May 11, 2004†
240. Blackout Report May 18, 2004†
241. Tunnels May 25, 2004
242. Risk June 1, 2004
243. Rapid Prototyping June 8, 2004†
244. Text messaging June 15, 2004†
245. Private Space Flight June 22, 2004†
246. Jefferson & Science June 29, 2004†
247. Zeppelins July 6, 2004
248. Los Angeles Water Supply July 13, 2004
249. Plasmas July 20, 2004†
250. Tour de France July 27, 2004†
251. RFID August 3, 2004
252. Roller Coaster August 10, 2004
253. Blue LED August 17, 2004
254. Plain old telephone service August 24, 2004
255. Olympics & Technology August 31, 2004
256. Nanotechnology September 7, 2004†
257. Origami September 14, 2004
258. VCR September 21, 2004
259. Coltan September 28, 2004†
260. Environment & microchips October 10, 2004
261. Diapers October 12, 2004
262. Proportional spaced type October 19, 2004†
263. Container ships October 26, 2004†
264. Voting machine November 2, 2004†
265. Nylon November 9, 2004
266. Sears Tower November 16, 2004
267. Cooking a turkey November 23, 2004
268. Packaging November 30, 2004
269. Jet Take Off December 7, 2004
270. Scotch tape December 14, 2004
271. Mathematics of Lines December 21, 2004
272. Wind-up radio December 28, 2004

273. Year in review January 4, 2005†
274. Laundry Machines January 11, 2005
275. Blue LED January 18, 2005
276. Why a chair? January 25, 2005
277. Codes & the Internet February 1, 2005
278. The High-Tech Razor February 8, 2005†
279. Ferris Wheels February 15, 2005
280. Corks February 22, 2005†
281. Thomas Midgley March 1, 2005
282. Mood Ring March 8, 2005
283. Bob Kearns March 15, 2005
284. Dyson Vacuums March 22, 2005
285. Green Design March 29, 2005
286. Barbara McClintock April 5, 2005†
287. John von Neumann April 19, 2005†
288. Richard Feynman April 26, 2005†
289. Moore's Law May 3, 2005†
290. Housework May 10, 2005
291. Firefox May 17, 2005
292. iPod & Intellectual Property May 24, 2005
293. Power Plants May 31, 2005
294. Clarence Birdseye June 7, 2005
295. VOIP/911 June 14, 2005
296. Remote Control June 21, 2005
297. Jefferson & Science July 5, 2005
298. Technology & Baseball July 12, 2005
299. Color Film July 29, 2005
300. Waterless Urinal July 26, 2005
301. QWERTY Keyboard August 2, 2005
302. Reflections on Radio Series August 9, 2005

Video work

In 2007 Hammack became fascinated by the possibilities of new media. In 2008 he began to experiment with internet-delivered video. His goal was to create well-crafted videos that used the techniques of filmmaking to tell technological stories as clearly and as compellingly as possible. From these initial experiments he created a YouTube channel. Today that channel (*engineerguyvideo*) has over a million subscribers and over seventy million views. The channel introduces engineering to a lay audience by revealing the engineering behind everyday objects and systems. The level of explanation is detailed, but not overwhelming; it is technical but not mathematically rigorous.

IBM Selectric Typewriter & its Digital to Analogue Converter November 7, 2010
The Whiffletree: A mechanical digital-to-analog converter November 7, 2010
Pop Can Stay-on Tab November 14, 2010
Coffee Maker: Pumping water with no moving parts November 22, 2010
Black Box: Inside a flight data recorder November 30, 2010
How the First Transistor Worked December 7, 2010
How a Quartz Watch Works December 14, 2010
Why the Other Line is Likely to Move Faster December 20, 2010
Light Bulb Filament February 28, 2011
How Smoke Detectors Works March 6, 2011
LCD Monitor Teardown March 16, 2011
Cell Phone Design June 4, 2011
Hard Drive Teardown June 5, 2011
Fiber Optic Cables: How they work June 20, 2011
How a Smartphone Knows Up from Down (Accelerometer) May 22, 2012
CCD: The heart of a digital camera (how a charge-coupled device works) May 13, 2012
Anodizing (Or the Beauty of Corrosion) May 29, 2012
How a Laser Works May 31, 2012
How an Atomic CLock works, and Its Use in GPS June 10, 2012
What Keeps Nuclear Weapons from Proliferating June 14, 2012
How a Microwave Oven Works June 25, 2012
How a Lead Acid Battery works June 30, 2012
How Sony's Betamax Lost to JVC's VHS Cassette Recorder June 16, 2014
Stories of Technological Failure June 16, 2014
Why the Dvorak Keyboard Didn't Take Over the World June 16, 2014
PicturePhone June 16, 2014
Theremin: How Science Fiction got its sound July 7, 2014
Coffee Makers: How baseball put them in our homes July 8, 2014
Ferris Wheel: How the Eiffel Tower wasn't good enough July 15, 2014
Wine Corks: Saving Endangered Birds July 17, 2014
Muzak July 17, 2014
How the Donner Party Inspired Food Packaging July 28, 2014
Kodak: How George Eastman revolutionized photography August 5, 2014
How Home Air Conditioning Triumphed Over the Open Air Movement August 11, 2014
The Cigarette Machine: The invention with the greatest economic impact? August 18, 2014
(1/4)Intro/History: Introducing a 100-year-old mechanical computer November 9, 2014
(2/4) Synthesis: A machine that uses gears, springs and levers to add sines and cosines November 9, 2014
(3/4) Analysis: Explaining Fourier analysis with a machine November 9, 2014

(4/4) Operation: The details of setting up the harmonic analyzer November 9, 2014
RMS Titanic: Fascinating Engineering Facts February 6, 2015
The Ingenious Design of the Aluminum Beverage Can April 13, 2015
How a Film Projector Works July 6, 2015
How a Retractable Ballpoint Pen Works September 21, 2015
NERF Blaster: Air restriction mechanism November 9, 2015
Plastic Injection Molding November 20, 2015
How a Wind Up Music Box Works December 8, 2015
Apollo: The Alignment Optical Telescope June 7, 2016
The Engineering of a Disposable Diaper June 14, 2016
DLP Projector Stereolithography 3D Printer August 2, 2017
Fatal Flight: Audiobook: 14 parts, July 18, 2017
The Engineering of the Drinking Bird January 30, 2018
Britain's Giant Airship: R.101 1924-1930 February 6, 2018
Nitinol: The Shape Memory Effect and Superelasticity October 25, 2018
The Engineering of Droplets and their Formation in a Commercial Inkjet Printer May 22, 2019

Series on Michael Faraday's Chemical History of a Candle June 28, 2106
Introduction: The Chemical History of a Candle by Michael Faraday (1/6)
Lecture One: The Chemical History of a Candle - The Sources of its Flame (2/6)
Lecture Two: The Chemical History of a Candle - Brightness of the Flame (3/6)
Lecture Three: The Chemical History of a Candle - Products of Combustion (4/6)
Lecture Four: The Chemical History of a Candle - The Nature of the Atmosphere (5/6)
Lecture Five: The Chemical History of a Candle - Respiration & the Burning of a Candle (6/6)
Plus commentary videos for each of the lectures