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Macauley is Research Co-Director and Senior Fellow at Resources for the Future, Inc. (RFF), a nonprofit research organization established in 1952 at the request of the President of the United States. RFF conducts independent research, primarily in economics and other social science, on environmental, energy, and natural resources issues.

Education

Ph.D., Economics, 1983, The Johns Hopkins University, Baltimore, Maryland.
M.A., Economics, 1981, The Johns Hopkins University, Baltimore, Maryland.
B.A., Economics, 1979, College of William and Mary, Williamsburg, Virginia.

Positions Held

2009 to present Research Director, Resources for the Future, Washington, DC
1993 to present Senior Fellow, Resources for the Future, Washington, DC
1995 to 2009 Director of Academic Relations and Programs, Resources for the Future, Washington, DC

2008, 2006 Visiting Professor, Johns Hopkins University, Department of Economics
1999 – 2000
1989 – 1995

1996 Visiting Professor, Princeton University, Woodrow Wilson School of Public Affairs

1983 – 1993 Fellow, Resources for the Future

1979 – 1983 Policy Analyst, Communications Satellite Corporation, Washington, DC

Major Professional Activities

Offices and Memberships on Boards of Directors and Other Boards:

- National Research Council/National Academy of Sciences: Space Studies Board, 2007 – 2011; also Executive Committee, Space Studies Board
- National Research Council/National Academy of Sciences: Aeronautics and Space Engineering Board, 2004 – 2007
- National Center for Atmospheric Research Trustee-at-large, 2010-2013
- American Astronautical Society: Board of Directors, 2007-2012
- College of William and Mary, Board of Advisors, Thomas Jefferson Public Policy Program, President, 1997-2005; Advisor 2005 - present
- The Johns Hopkins University Applied Masters' Degree Program, Advisory Council
- Women in Aerospace, Board of Directors, 1996-2003, 2006-2009; Vice-Chair 2006-2007
- Columbia University, NASA Socioeconomic Data and Applications Center (SEDAC), Chair, User Working Group

Appointments:

- Advisory Committee for the 1988 ITU World Administrative Radio Conference, Federal Communications Commission
- Panels convened by the Committee on Science and Technology of the U.S. House of Representatives and the American Institute of Aeronautics and Astronautics
- Organizing Committee for 1988 and 1989 of the Annual Telecommunications Policy Research Conference; Chair, 1989-1990
- Review panel, NASA Remote Sensing Commercialization Research Announcement
- Panels by the Space Studies Board, National Research Council
- Task Force on Priorities in Space Research, Space Studies Board, National Research Council
- Review panel, Congressional Budget Office, Spectrum Management Workshop
- Advisory panel, Earth Observations Project, U.S. Congress, Office of Technology Assessment
- Ad Hoc Group on Data Exchange and Charging, American Meteorological Society
- Subcommittee on Space Debris, International Astronautical Association
- Planning Committee, National Meeting, American Astronautical Society
- Space for America Committee, American Astronautical Society
- Space Activities and Society Committee, International Academy of Astronautics
- Study Group, John Heinz III Center for Science, Economics, and the Environment
- Chair, Congressionally mandated "Economic Study of Space Solar Power"
- NASA Space Science Advisory Committee
- NASA Space Science Outreach and Public Education Committee
- National Research Council, Board on Physics and Astronomy, Helium Reserve Committee
- National Research Council, Space Studies Board, Steering Group on Space Applications and Commercialization
- National Research Council, Aeronautics and Space Engineering Board, Committee for Independent Assessment of the NASA Investment Strategy in Space Solar Power
- National Research Council, Review of a Technology Assessment on Concentrating Solar Power Energy Systems
- National Research Council, Aeronautics and Space Engineering Board, Steering Committee for Workshops on Human and Robotic Exploration and Development of Space
- National Research Council, Space Studies Board, Workshop Study on Earth Observations and Applications from Space: A Community Assessment and Strategy for the Future
- National Research Council, Space Studies Board, Review Team for Science Roadmaps for the National Aeronautics and Space Administration
- International Futures Program, Organization of Economic Cooperation and Development (OECD), Paris, France: OECD, winter 2004 (with David Chen), contribution on earth observations and energy security
- Interagency Modeling and Atmospheric Assessment Center Senior Advisory Group, US Department of Homeland Security
- National Research Council, Space Studies Board, Use of Spectrum for Scientific Purposes
- National Research Council, Aeronautics and Space Engineering Board, Member
- National Research Council, Space Studies Board
- National Research Council, Space Studies Board Executive Committee
- NASA Applied Sciences Advisory Group
- NOAA Climate Working Group
- NASA Socioeconomic Data and Applications Center (SEDAC), Chair, User Working Group
- National Center for Atmospheric Research, Trustee At-Large
- US Carbon Cycle Science Steering Group
- National Research Council, Committee on Space Debris
- National Research Council, Committee on Interim Review of the Earth Sciences Decadal Survey
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Member:

- American Economic Association
- Outstanding Young Women of America
- Media Resource Service of the Scientists' Institute for Public Information
- Editorial Board, *Space Policy*
- Editorial Board, *Astropolitics*
- Women in Aerospace
- International Academy of Astronautics
- American Institute of Aeronautics and Astronautics
- American Astronautical Society

Congressional Testimony and Briefings

- "Offshore Deepwater Drilling and Incentives to Invest in Containment," US House of Representatives, Committee on Science, Space, and Technology, Subcommittee on Energy and the Environment, 6 April 2011
- "Earth Observations in a National Space Strategy," Senate Committee on Commerce, Science and Transportation, 18 March 2011 (at invitation of AIAA)
- "Calibrating Data, Calibrating Results: Using Earth Observations Information in Quantitative Elements of Climate Policy Design and Evaluation," Senate Committee on Commerce, Science, and Transportation, 21 September 2009 (at invitation of AIAA)
- "Space and Economic Growth," Senate Committee on Commerce, Science and Transportation, 27 July 2009 (at invitation of AIAA)
- "Commercial Space." U.S. House of Representatives, Subcommittee on Space and Aviation, April 20, 2005.
- "Advantages and Disadvantages of Prizes in a Portfolio of Financial Incentives for Space Activities." U.S. House of Representatives, Committee on Science, July 15, 2004.
- "The Economics of Satellite Solar Power." U.S. House of Representatives, Committee on Science, Subcommittee on Space and Aeronautics, September 7, 2000 (delivered by John S. Fini).
- "Financing Commercial Space Ventures." U.S. House of Representatives, Committee on Science, Subcommittee on Space and Aeronautics, July 18, 2000.
- "The Commercial Space Act of 1997: Commercial Remote Sensing." U.S. House of Representatives, Committee on Science, Subcommittee on Space and Aeronautics, May 21, 1997.
- "The Omnibus Space Commercialization Act of 1996 and the Space Business Incentives Act" H.R. 1953. U.S. House of Representatives, Committee on Science, March 5, 1996.

Agency Reviewer: National Science Foundation; National Academy of Sciences; National Aeronautics and Space Administration; Federal Aviation Administration Office of Commercial Space Transportation; U.S. Congress, Office of Technology Assessment; U.S. Congress, Congressional Budget Office; Federal Communications Commission, US Geological Survey.

Academic Reviewer: *American Economic Review*, *RAND Journal*, *Land Economics*, *Contemporary Economic Policy*, *Journal of Industrial Organization*, *Journal of Environmental Management*, *Bulletin of the American Meteorological Society*, *Space Policy*, *Energy Policy*, *Astropolitics*, *Climate Policy*, *Journal of Environmental Economics and Management*

Consultant: Benner, Burnett and Coleman, Washington, DC; Conner and Winters, Tulsa, Oklahoma; Shooshan and Jackson, Washington, DC; Space Development Services, Washington, DC; National Aeronautics and Space Administration; EUROCONSULT, Paris; U.S. Congress, Office of Technology Assessment; Boeing Corporation; SAIC; Federal Aviation Administration; Jackson Kelly LLC.

Special projects: October 1998 -- Spearheaded joint effort of Mount Vernon and Women in Aerospace for U.S. space shuttle flight of replica flag flown by George Washington during the Revolutionary War; flag now on display at Mount Vernon.

Recent Presentations:

Academic: Stanford University, MIT, Princeton University, Johns Hopkins University, Johns Hopkins University –School of Advanced International Studies, University of California-San Diego, University of California-Berkeley, US Air Force Academy, University of Washington, College of William and Mary, George Mason University, George Washington University, International Space University, University of Colorado, Widener University, University of Maryland-College Park, University of Pennsylvania, Carnegie Mellon University, Wharton School of the University of Pennsylvania, Cal Tech, Jet Propulsion Laboratory, University of Alabama, American Economic Association, Southern Economic Association, Western Economic Association, Eastern Economic Association

US Nongovernmental: National Academy of Sciences, Center for Strategic and International Studies, American Meteorological Society, American Enterprise Institute, National Economists' Club, National Bureau of Economic Research, Women's Council on Energy and Environment, The White House Project

International Governmental: UNESCO, GEO, UNFAO, Government of Japan, Embassy of Finland, OECD

US Government: US Congress (testimony and briefings), US Department of Energy, US Department of Commerce, US Department of Transportation, NOAA, NASA, USGS, FAA, National Institute of Standards and Technology, Goddard Space Flight Center, Dryden Space Flight Center, Huntsville Space Flight Center, US Global Change Research Program

Other: Ditchley Foundation (United Kingdom), Electric Power Research Institute, ARCS Foundation

Recent Keynote Presentations:

National Academy of Sciences, NASA, USGS, Earth Science Information Partnerships, US Global Change Research Program National Assessment, National Institute of Standards and Technology

Selected Awards

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| 2006 | <i>Federal Aviation Administration:</i> Award for outstanding support of the rulemaking on licensing and safety requirements for the commercial space launch industry |
| 2002 | <i>National Aeronautics and Space Administration:</i> Award for contributions to policy development for US earth observations |
| 2001 | <i>International Academy of Astronautics</i> (elected to Full Membership) |
| 1994 | <i>Top 25 "Rising Stars," National Space Society</i> |
| 1984 | <i>Resources for the Future,</i> Investment in People and Ideas Award |

Selected Grants and Other Research Support:

- 1987 – 1995: \$990,000 Earth Science Valuation Research, US National Aeronautics and Space Administration
 1989: \$50,000 The Economics of a "Launch Voucher," US Department of Transportation, Resources for the Future, and the Lockheed Martin Corporation
 1989-1990: \$110,000 Economic Incentives for Regulating Toxic Substances (co-investigator), US Environmental Protection Agency

1995-1997: \$300,000 Modeling the Prospective Value of Investment in Space Technology (co-investigator), California Institute of Technology

1999-2002: \$600,000 Electronic Waste, Waste Shipments, and Recycling Policy (co-investigator), Government of Japan

2000: \$150,000 Modeling Interstate Shipments of Municipal Solid Waste (co-investigator), US Environmental Protection Agency

2000-2001: \$70,000 Commercial Space Transportation Third-Party Liability, US Department of Transportation, Federal Aviation Administration under auspices of SAIC, Incorporated

2003-2005: \$300,000 Earth Science Valuation Studies and Modeling for Energy, Water and Oceans, and Public Policy, US National Aeronautics and Space Administration under auspices of SAIC, Incorporated

2004-2005: \$25,000 Commercial Space Transportation Third-Party Liability, Volpe National Transportation Systems Center under auspices of The Aerospace Corporation

2004: \$20,000 International Agreements and the Earth Observation Summit, American Meteorological Society Summer Policy Colloquium

2005: \$20,000 Environmental Risks, American Meteorological Society Summer Policy Colloquium

2005: \$20,000 Modeling the Societal Value of the Multi-Angle Imaging SpectroRadiometer, Jet Propulsion Laboratory

2004-2006: \$275,000 Space, Energy, Climate, National Science Foundation/National Aeronautics and Space Administration/Electric Power Research Institute

2006-2007: \$100,000 Earth Observations and Climate, US National Aeronautics and Space Administration under subcontract with SAIC, Incorporated

2007: \$100,000 Sustainable Waste Management and Recycling Policies, Standards, and Practices under subcontract with the RAND Corporation

2007-2008: \$95,000 Modeling the Valuation of Moderate Resolution Earth Observations Imagery in Application to Regulation and Management of Natural Resources, US Department of Interior

2002-2007: \$100,000 for administration of Andrew W. Mellon Foundation Grant to Resources for the Future for Fellowship Awards

2007-2009: \$500,000 Climate Modeling Conferences (co-investigator), US Environmental Protection Agency

2007-2008: \$45,000 Technology and Innovation, Jackson Foundation

2007: \$20,000 Cost Estimation and Cost Overruns for Natural Resources Infrastructure, American Meteorological Society Summer Policy Colloquium

2008-2009: \$360,000 Modeling Benefits from Earth Observations (principal investigator), US National Aeronautics and Space Administration

2007-2009: \$965,000 Domestic Policy for Adapting to a Changing Climate (co-investigator), Smith Richardson Foundation

2009: \$365,000 Improving Forest Measurement and Monitoring (principal investigator), Alfred Sloan Foundation

2009 – 2005: \$983,000 Incorporating MODIS Data into Water Quality Monitoring (principal investigator), US National Aeronautics and Space Administration

2010: \$89,750 Water Quality and Economic Valuation (co-investigator), US Geological Survey

2010: \$50,000 Value of Information Workshop (principal investigator), US National Aeronautics and Space Administration

2011: \$20,000 Forest Carbon and Climate Policy (principal investigator), US Geological Survey

2011: \$128,500 Land Use and Extreme Precipitation Events: A Case Study in Green Bay (co-investigator), US National Oceanic and Atmospheric Administration

2011: \$75,000 US National Carbon Monitoring System, Science Definition Team (principal investigator), US National Aeronautics and Space Administration

2011: \$30,000 US National Carbon Monitoring System, Value of Information for Biomass Measurements (principal investigator), US National Aeronautics and Space Administration

Selected Peer-Reviewed Publications: Journal Articles, Books, Book Chapters

Books:

The Value of Information: Methodological Frontiers and New Applications (edited; with Ramanan Laxminarayan), Springer (forthcoming).

Using Economic Incentives in Regulating Toxic Substances (with Karen Palmer and Michael Bowes) (Washington, DC, Resources for the Future), 1992.

Economics and Technology in U.S. Space Policy (editor) (Washington, DC, Resources for the Future), 1987.

Articles and Book Chapters:

“Seeing the Forests and the Trees: Technological and Regulatory Impediments for Global Carbon Monitoring” (with Nathan Richardson), *Berkeley Technology Law Journal*, forthcoming.

“Forests in Climate Policy: Technical, Institutional, and Economic Issues in Measurement and Monitoring” (with Roger Sedjo), *Mitigation and Adaptation Strategies for Global Change*, forthcoming.

“Forest Carbon Offsets: Possibilities and Limitations” (with Roger Sedjo), *Journal of Forestry*, forthcoming.

“National Security and the Environment: The Role of Earth Observations,” in *Strategic Issues in Space Policy* (Eligar Sadeh, ed), forthcoming.

“Measurement Issues for Forests in Climate Policy,” *Greenhouse Gas Emission Modeling and Measuring* (Washington, DC: National Academies Press), March 2011.

“Earth Observations in a National Space Strategy,” *Astropolitics* 2010, 8; 205-219.

Valuing Information: Methodological Frontiers and New Applications for Realizing Social Benefits, *Space Policy* (with Ramanan Laxminarayan), November 2010 26(4): 249-251.

“Public-Private Co-Production of Risk: Government Indemnification of the Commercial Space Launch Industry,” *Risk, Hazards, and Crisis in Public Policy* (with Carolyn Kousky and Tim Brennan), 2010, 1(1).

“From Science to Applications: Determinants of Diffusion in the Use of Earth Observations,” *Journal of Terrestrial Observation* (with Joe Maher and Jhih-Shyang Shih), Spring 2010, 2(1).

“Commercial Space Actors” (with David Chen), in *The Politics of Space: A Survey*, Eligar Sadeh, ed. (New York: Routledge), 2010.

“Economics and Technology in Space Policy” (with David Chen), encyclopedia entry in *Space Exploration and Humanity, Volume 2*, Stephen B. Johnson, ed. (California: ABC Clio), 2010, 1075-1079.

“The U.S. Department of Commerce and the US Aerospace Industry,” encyclopedia entry in *Space Exploration and Humanity, Volume 1*, Stephen B. Johnson, ed. (California: ABC Clio), 2010, 477.

“Waste Not, Want Not: Economic and Legal Challenges of Regulation-Induced Innovation in Waste Technology and Management,” forthcoming, *Journal of Solid Waste Technology and Management*.

“Earth Observations in Social Science Research for Management of Natural Resources and the Environment: Identifying the Landsat Contribution,” *Journal of Terrestrial Observation* 1(2), Spring 2009, 31-53.

“The Supply of Natural Resources Information Infrastructure: Issues in the Theory and Practice of Estimating Costs,” *Space Policy*, 24 (2) 2008, 70-79.

“Uses and Limitations of Observations, Data, Forecasts, and Other Projections in Decision Support for Selected Sectors and Regions” *US Climate Change Science Program, Synthesis and Assessment Report Product 5.1* (co-editor, with Fred Vukovich), September 2008. At <http://www.climate-science.gov/Library/sap/sap5-1/final-report/>

“Earth Observations and its Economic Value in Agriculture Decision Support,” in *US Climate Change Science Program, Synthesis and Assessment Product 5.1*, “Uses and Limitations of Observations, Data, Forecasts, and Other Projections in Decision Support for Selected Sectors and Regions,” September 2008. At <http://www.climate-science.gov/Library/sap/sap5-1/final-report/>

United States Civil Space Policy: Report of a Workshop (with Joseph Alexander), National Research Council, Washington, DC, 31 March 2008.

“Environmentally Sustainable Human Space Activities: Can Challenges of Planetary Protection be Reconciled?” *Astropolitics*, September – December 2007, 5(3), 209-236.

“Ascribing Societal Benefit to Applied Remote Sensing Data Products: An Examination of Methodologies Based on the Multi-angle Imaging SpectroRadiometer Experience,” (with David J. Diner) *Journal of Applied Remote Sensing*, Vol. 1, September 2007.

“Satellite Solar Power: Renewed Interest in an Age of Climate Change?” (with Jhih-Shyang Shih) *Space Policy*, May 2007.

“The Value of Information: Measuring the Contribution of Space-Derived Earth Science Data to Resource Management,” *Space Policy*, v. 22, no. 4, November 2006, pp. 274-282.

“Flying in the Face of Uncertainty: Human Risk in Space Activities,” 6 *Chicago Journal of International Law* 131, Summer 2005.

“Public Policy: Inducing Investments in Innovation,” Chapter 11 in R. David Simpson, Michael A. Toman, and Robert U. Ayres (eds.), *Scarcity and Growth Revisited: Natural Resources and the Environment in the New Millennium*, Washington, DC: RFF Press, 2005, pp. 225-249.

“A Herculean Task? Economics, Politics, and Realignment Government in the Case of U.S. Polar-Orbiting Weather Satellites,” *Space Policy*, vol. 19, 2005, pp. 249 - 259.

“Private Markets, Contracts, and Government Provision: What Explains the Organization of Local Waste and Recycling Markets?” (with Margaret Walls and Soren Anderson) *Urban Affairs Review*, May 2005.

“Advantages and Disadvantages of Prizes in a Portfolio of Financial Incentives for Space Activities,” *Space Policy*, vol. 21, no. 2, May 2005, pp. 121 - 128.

“Is the Vision of the Earth Observation Summit Realizable?” *Space Policy*, vol. 21, February 2005, pp. 29-39.

“Smarter Budgeting for Space Missions, in *New Approaches on Energy and the Environment: Policy Advice for the President*, Richard D. Morgenstern and Paul R. Portney, eds (Washington, DC: Resources for the Future), Chapt. 19, 2004.

- "Regulation on the Final Frontier," *Regulation Magazine*, vol. 26, no. 2, Summer 2003, 36-41.
- "Dealing with Electronic Waste: Modeling the Costs and Environmental Benefits of Computer Monitor Disposal," with Karen Palmer and Jih-Shyang Shih, *Journal of Environmental Management*, vol. 68, no.1, May 2003, pp. 13-22
- "Spatially and Intertemporally Efficient Waste Management: The Costs of Interstate Trade Restrictions" (with Eduardo Ley and Stephen Salant), *Journal of Environmental Economics and Management*, vol. 43, no. 2, March 2002, pp. 188-218.
- "An Economic Assessment of Space Solar Power as a Source of Electricity for Space Based Activities" (with James F. Davis), *Space Policy*, February 2002.
- "Economics of Space," Chapter 10 in *Space Politics and Policy*, Eligar Sadeh (ed.), Boston, MA: Kluwer Academic Publishers, 2002, pp. 181-200.
- "Cutting through Environmental Issues: Technology as a Double-Edged Sword" (with David Austin), *Brookings Review*, Winter 2001, vol. 19, no. 1, pp. 24-27.
- "Enforcing Environmental Regulation: Implications of Remote Sensing" (with Timothy J. Brennan), in *Improving Regulation: Cases in Environment, Health and Safety*, Paul Fishbeck and Scott Farrow, (eds.), Washington, DC: Resources for the Future, 2001.
- "Estimating Future Benefits from ATP Funding of Digital Data Storage" (with David Austin), in *The Advanced Technology Program: Assessing Outcomes*, Charles W. Wessner (ed.) (Washington, DC, National Academy Press), 2001.
- "Solid Waste Reduction and Resource Conservation: Assessing Goals of Government Policy" (with Margaret Walls), in *Public Policies for Environmental Protection*, Paul Portney and Robert Stavins (eds.), Resources for the Future, 2000.
- "Report: Can Power from Space Compete?" *Space Policy*, February 2000, vol. 16, no. 4, pp. 283-285.
- "Restricting the Trash Trade" (with Eduardo Ley and Stephen Salant), *American Economic Review*, May 2000, vol. 90, no. 2, pp. 243-246.
- "NASA's Affiliated Research Center Program: Bridging Basic Research and the Quality of Life" (with Bruce A. Davis), *Journal of Photogrammetry and Remote Sensing*, November 2000.
- "Heredity or Environment: Why is Automobile Longevity Increasing?" (with Bruce Hamilton), *Journal of Industrial Economics*, June 1999, vol. 47.
- "Allocation of Orbit and Spectrum Resources for Regional Communications: What's At Stake?" *Journal of Law and Economics*, October 1998, pp. 737-764.
- "Managing Foreign Participation in Government-Funded Applied Space Research and Product Development" (with David Austin, David Simpson, and Mike Toman), *Space Policy*, August 1997, pp. 203-214.
- "Technology and Coordination: Antitrust Implications of Remote Sensing Satellites" (with Tim Brennan), *Antitrust Bulletin*, Summer 1997, pp. 477-502.
- "The Impact of Uncertain Environmental Liability on Industrial Real Estate Development: Developing a Framework for Analysis" (with Jim Boyd, Winston Harrington and Mary Elizabeth Calhoun), *Journal of Law, Economics, and Real Estate*, Spring 1996, vol. 12, no. 1.
- "Exchanging Environmental Resource Management for Peaceful Space Practices: Blue Sky or 'Blue Sky?'," in *Space Power Interests*, Peter Hayes (ed.), Westview Press, 1996.
- "Remote Sensing Satellites and Privacy: A Framework for Policy Assessment" (with Tim Brennan), *Law, Computers, and Artificial Intelligence*, vol. 4, no. 3, 1995.

"NASA's Earth Observations Commercialization Application Program: A Model for Government Promotion of Commercial Space Opportunities," *Space Policy*, February 1995, vol. 11, no. 1, pp. 53-66.

"Close Encounters of the Trash Kind," *Journal of Policy Analysis and Management*, vol. 13, no. 3, 1994, pp. 560-564.

"In Pursuit of a Sustainable Space Environment: Economic Issues in Regulating Space Debris," in *Preservation of Near-Earth Space for Future Generations*, John A. Simpson (ed.), Cambridge University Press, 1994.

"Land Remote Sensing Policy Act—Analysis Reveals Deficiencies, Implications," *GIS World*, vol. 6, no. 7, July 1993, pp. 42-47.

"In Pursuit of Cost Effective Regulation of Toxic Chemicals," in *Enhancing Environmental Quality through Economic Growth*, American Council on Capital Formation, December 1993.

"Collective Goods and National Sovereignty: Conflicting Values in Global Information Acquisition," in *Space Monitoring of Global Change*, Sally Ride and Gordon MacDonald (eds.), 1992.

"Advanced Materials," in *Competitiveness in Metals: The Impact of Public Policy*, Merton J. Peck, Hans H. Landsberg, and John E. Tilton (eds.), London, Mining Journal Books, 1992.

"The NASA Budget: For Whom, For What, and How Big?" in *Space Policy Alternatives*, Radford Byerly (ed.), San Francisco, Westview Press, 1992.

"Highway Robbery: Social Costs of Hazardous Materials Incidents on the Capital Beltway" (with Theodore Glickman and Paul R. Portney), *Transportation Research Record*, No. 1313, 1992.

"Supplying Earth Observation Data from Space," (with Michael A. Toman), *Space Policy*, February 1992.

"Providing Earth Observation Data from Space: Economics and Institutions" (with Michael A. Toman), *American Economic Review*, vol. 81, no. 2, May 1991, pp. 38-41.

"Determinants and Consequences of the Public-Private School Choice" (with Bruce Hamilton), *Journal of Urban Economics*, vol. 29, no. 3, May 1991.

"Communications in Space: Economics and Public Policy Issues," in *Telecommunications, Values, and the Public Interest*, Sven Lundstedt (ed.), Ablex Press, 1990.

"Consumption of Fuelwood and Other Household Cooking Fuels in Indian Cities," (with J. Dunkerley, M. Naimuddin, and P.C. Agarwal), *Energy Policy*, vol. 18, no. 1, January/February 1990.

"Rethinking Space Policy: The Need to Unearth Economics," in *Space Policy Reconsidered*, Radford Byerly (ed.), Westview Press, 1989.

"Fuelwood in Urban Areas: A Case Study of Raipur, India" (with M. Naimuddin, P.C. Agarwal, and J. Dunkerley), *The Energy Journal*, vol. 10, no. 3, July 1989, 157-180.

"Launch Vouchers for Space Science Research," *Space Policy*, vol. 5, no. 4, November 1989, 311-320.

"No Free Launch: Efficient Space Transportation Pricing" (with Michael A. Toman), *Land Economics*, vol. 65, no. 2, May 1989, 91-99.

"Tracing News Orbits: Cooperation and Competition in Global Satellite Development" (book review), *Information Economics and Policy*, September 1988.

"Economic Issues in Innovation in Satellite Communications" in *Space Communications Research and Development R&D*, Washington, DC, Space Applications Board, National Research Council, March 1988, pp. 191-197.

"The Contribution of a Partnership between Economics and Technology," in *Economics and Technology in U.S. Space Policy*, M. K. Macauley (ed.), Washington, DC, Resources for the Future, 1987.

"Space Transportation Policy: Commercial Policies and International Competition," in *Economics and Technology in U.S. Space Policy* (see above) (with Michael A. Toman), 1987.

"Out of Space? Regulation and Technical Change in Communications Satellites," *American Economic Review*, vol. 76, no. 1, May 1986.

"Risk Aversion and the Insurance Value of Strategic Oil Stockpiling" (with Michael A. Toman), *Resources and Energy*, vol. 8, no. 2, 1986.

"Recent Behavior of Urban Population and Employment Density Gradients," *Journal of Urban Economics*, vol. 18, September 1985.

"Slicing the Geostationary Pie: Property Rights in Orbit" (with Paul R. Portney), *AEI Journal on Regulation*, July/August 1984.

"Ras Maden Koentjaraningrat" (book review), *Third World Anthropology Research Bulletin*, Spring 1979.

Other Selected Publications

(Government Reports, Short Articles, Op-Eds and Commentaries, Discussion Papers)

Op-eds and Commentary:

"Calibrating the Science and Economics of Climate Policy," *Space News* 29(42), 26 October 2009, 21-22.

"The New Economics of Managing the Nation's Waste," RFF Weekly Policy Commentary, 10 August 2009 (with Steve Salant) at <http://www.rff.org/Publications/Pages/The-New-Economics-of-Managing-the-Nations-Waste.aspx> and reprinted in Ian Parry and Felicia Day (eds) *Issues of the Day: 100 Commentaries on Climate, Energy, the Environment, Transportation, and Public Health Policy* (Washington, DC: Resources for the Future), 2010.

"The Economics of New Green Technology Investment: The Case of Satellite Solar Power," *RFF Weekly Policy Commentary*, 23 February 2009 (with Jhih-Shyang Shih). At http://www.rff.org/Publications/WPC/Pages/02_23_09_Satellite_Solar_Power.aspx and reprinted in Ian Parry and Felicia Day (eds) *Issues of the Day: 100 Commentaries on Climate, Energy, the Environment, Transportation, and Public Health Policy* (Washington, DC: Resources for the Future), 2010.

"The Policy Relevance of Science," *Space News* 12 January 2009, vol. 20, issue 3, p. 19 (with Daniel F. Morris).

"A World of Information: In Shadow of Climate Debate, A Comprehensive File on Data about Earth," *The Houston Chronicle*, June 23, 2007 (with William B. Gail and Neal F. Lane).

"Changing Our Perspective," *Space News*, March 26, 2007 (with Roberta Balstad and Anthony Janetos).

"A National Earth-Information Initiative," *Space News*, April 2, 2007 (with William B. Gail and Neal F. Lane).

"Who Collects? Trash Pickup Controlled by Monopolies," *The Charleston Gazette*, July 10, 2006, p. 5A.

"The Priority of Earth Science in the Space Budget," *Space News*, February 7, 2005.

"Look Before you Launch," *The Baltimore Sun*, March 5, 2004, p. 13A.

"Water, Water, Everywhere?" *Space News* 15 (5), February 2, 2004, p. 13.

"Keep Exploring the Final Frontier?" solicited letter to the editor, *The Baltimore Sun*, April 26, 2003, p. 13A.

"Ensuring the Real Potential of Remote Sensing," *Space News*, April 14, 2003 14(15), p. 17.

"Rethinking NASA Centers," *Space News*, February 4, 2002, vol. 13, no. 5, p. 15.

"Commercializing Space," *Space News*, January 29, 2001, vol. 12, no. 4, p. 15.

"Costs Outweighs Benefits of Space Solar Power," *Space News*, June 5, 2000, vol. 11, no. 22, , p. 19.

"Commercialization without NASA," *Space News*, February 16-22, 1998, vol. 9, no. 7, p. 29 (with Tim Brennan).

"A Merger of Science and Commerce," *Space News*, March 31-April 6, 1997.

"Managing Orbital Debris," *Space News*, September 30-October 6, 1996, vol. 7, no. 33, p. 13.

Short Articles, Government and Other Reports, Discussion Papers:

"Prizes, Patents, and Technology Procurement: A Proposed Analytical Framework," *RFF Discussion Paper*, June 2011 (with Tim Brennan and Kate Whitefoot).

"Reforming Institutions and Managing Extremes: US Policy Approaches for Adapting to a Changing Climate" (with Daniel Morris, Raymond J. Kopp, and Richard Morgenstern), *RFF Report* (forthcoming).

"Using Satellites to Sustain Earth," *LiveBetter Magazine*, 2011, May/June, No. 10, at http://www.centerforabetterlife.com/eng/magazine/article_detail.lasso?id=179

"Organizational Design for Spill Containment in Deepwater Drilling Operations in the Gulf of Mexico" (with Robert Anderson, Mark A. Cohen, Nathan Richardson, and Adam Stern), *RFF Discussion Paper 10-63*, January 2011.

"Adapting to Climate Change: The Public Policy Response" (with T. Clements, D. Morris, R. Kopp, and R. Morgenstern), *RFF Issue Brief 10-19*, November 2010.

"Climate Adaptation Policy: The Role and Value of Information," *RFF Issue Brief 10-10*, May 2010.

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