MARTIJN IJTSMA

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EDUCATION

Doctor of Philosophy in Aerospace Engineering August 19th, 2016 - August 3rd, 2019
Georgia Institute of Technology, United States

- Dissertation title: "Computational Simulation of Adaptation of Work Strategies in Human-Robot Teams"
- Advisor: Dr. Amy Pritchett
- Committee: Dr. Karen Feigh, Dr. Matthew Johnson, Dr. John-Paul Clarke, Dr. Glenn Lightsey,
- Coursework focused on systems design, optimization, flight mechanics, and control
- Certificate program (Tech to Teaching) for preparing future faculty and develop teaching skills

Master of Science in Aerospace Engineering September 2013 - June 2016
Delft University of Technology, Netherlands

- Thesis title: "Adaptive Automation Based on Air Traffic Controller's Decision-Making"
- Advisor: Dr. ir. Clark Borst
- Committee: Dr. ir. René van Paassen, Dr. ir. Joost de Winter, Dr. ir. Max Mulder, Ir. Gustavo Mercado-Velasco
- Coursework focused on control and simulation of aerospace vehicles

Bachelor of Science in Aerospace Engineering September 2010 - July 2013
Delft University of Technology, Netherlands

EXPERIENCE

Assistant Professor in Human Systems Integration September 2019 - Present
Department of Integrated Systems Engineering, The Ohio State University
Department of Mechanical and Aerospace Engineering, The Ohio State University

- Research on operations of heterogeneous multi-agent systems in naturalistic, high-complexity environments. This includes the study of human-AI/robot teaming and distributed work in high-stakes systems. We use a combination of multi-agent cognitive modeling & simulation, control theory, systems theory, and field research to analyze and support resilient performance. Domains of practice include air traffic management, spaceflight operations, smart mobility, and disaster response.
- Leading a team of graduate and undergraduate research assistants as part of the Cognitive Systems Engineering Lab (CSEL)
- **External Funding & Proposals**
  - Federal Aviation Administration: Pilot Interactions with Advanced Flight Deck Technologies. Status: *In Progress*. $1m to OSU
  - NASA: Contingency Planning Toolkit for Advanced Air Mobility Phase 2. Status: *In Progress*. $140k total award, **$163k to OSU**
  - National Science Foundation: CAREER: Making Robots More Cooperative Agents: Controlling Costs of Coordination Through Graph-Based Models of Joint Activity. Status: *In Progress*. **$554k to OSU**
  - 99P Labs: Designing for Human-AI Teaming in Smart Mobility. Status: *In Progress*. **$162k to OSU**
  - Federal Aviation Administration: Reliance on Automated or Complex Flight Deck Systems in Commercial Aircraft: Evaluating Compliance to 14 CFR 25.1302(c) and 25.1329(i). Status: *In Progress*. **$90k to OSU**
  - NASA: Contingency Planning Toolkit for Advanced Air Mobility Phase 1. Status: *Completed*. $140k total award, **$42k to OSU**

- Ohio Federal Research Network: Interoperability, Resiliency, and Contingency Management for Ohio UAS Operations. Status: *Completed*. $1.4M total award, **$150k to OSU**
- Phase I STTR AFWERX Agility Prime: Rapid Mission Planner for UAV Operations. Status: *Completed*. $150k total award, **$45k to OSU**

- **M.S. and Ph.D. Advising**
  - Emily Barrett – M.S. Integrated Systems Engineering. Graduated August 2021
  - Stephanie Duros – M.S. Integrated Systems Engineering. Graduated August 2022
  - Kathleen Albert – M.S. Integrated Systems Engineering. Graduated December 2022
  - Jacob Keller – M.S. Integrated Systems Engineering. Graduated May 2023
  - Renske Nijveldt – M.S. Integrated Systems Engineering. Graduated May 2023
  - Kenneth Cassidy – M.S. Integrated Systems Engineering, Graduated May 2023
  - Joan Smith – M.S. Integrated Systems Engineering
  - Connor Kannally – Ph.D Integrated Systems Engineering
  - Abhinay Paladugu – Ph.D. Integrated Systems Engineering
  - Abigail Post – Ph.D. Integrated Systems Engineering
  - Sal Hargis – Ph.D. Integrated Systems Engineering

- **Teaching**
  - ISE 3700 – Introduction to Cognitive Systems Engineering (SP20, SP21, SP22, SP23, SP24)
  - ISE 7720 – Cognitive Systems Engineering: Models and Methods (AU20, AU21, AU22, AU24)
  - ISE 5740 – Human-Centered Automation (AU21, AU22, AU23)

Graduate Research Assistant August 2016 - August 2019
Cognitive Engineering Center, Georgia Institute of Technology

- **Projects**
  - NASA Human Research Program: Objective Function Allocation Method for Human-Automation/Robotic Interaction using Work Models that Compute
  - NASA Space Technology Research Grant: Technologies for Mixed-Initiative Plan Management for Human Space Flight

Research Intern October 2014 - March 2015
Cognitive Engineering Center, Georgia Institute of Technology

- **Projects**
  - NASA Aviation Safety Program: Scenario Based Methods for Verification of Authority and Autonomy

Teaching Assistant November 2012 - July 2014
Delft University of Technology, Netherlands

- Taught in recital-style classrooms, mentored student groups in project-based learning, and graded exams and project assignments.
  - Dynamics, AE1130-II, Dr. Sergio Turteltaub
  - Aerospace System Design, AE2111-I, Dr. Nando Timmer
  - Test, Analysis & Simulation, AE2223-I, Dr. Mirjam Snellen

Mathematics and Chemistry Teacher December 2011 - September 2015
Stichting Studiebegeleiding Leiden, Netherlands

- Mentored high school students in preparation for their final exams, collaboration with the University of Leiden.

PUBLICATIONS

Journal Articles

5. Keller, J.R., **IJtsma, M.**, Newton, E.K. (2023). Examining autonomous flight safety systems from a cognitive systems engineering perspective: Challenges, themes, and outlying risks. *Journal of Space Safety Engineering, 10*(1), 76-81. https://doi.org/10.1016/j.jsse.2022.11.005

4. **IJtsma, M.**, Borst, C., Mulder, M., & Van Paassen, M.M. (2022). Evaluation of a Decision-Based Invocation Strategy for Adaptive Support for Air Traffic Control. *IEEE Transactions on Human-Machine Systems, 52*(6), 1135-1146.

3. Ma, L. M., **IJtsma, M.**, Feigh, K. M., and Pritchett, A. R. (2022). Metrics for Human-Robot Team Design: A Teamwork Perspective on Evaluation of Human-Robot Teams. *ACM Transactions on Human-Robot Interaction, 11*(3). 1-36.

2. **IJtsma, M.**, Ma, L.M., Pritchett, A.R., & Feigh, K.M. (2019). Computational Methodology for the Allocation of Work and Interaction in Human-Robot Teams. *Journal of Cognitive Engineering and Decision Making, 13*(4), 221-241.

1. Pritchett, A. R., Bhattacharyya, R. P., & **IJtsma, M.** (2016). Computational Assessment of Authority and Responsibility in Air Traffic Concepts of Operation. *Journal of Air Transportation, 24*(3), 93-101.

Manuscripts in Review

3. Barrett, E., Paladugu, A., & **IJtsma, M.** (In Review). Multi-Agent Simulation to Envision Communication Strategies in Future Air Mobility Operations. *AIAA Journal of Aerospace Information Systems.*

2. **IJtsma, M.**, Keller, J., Albert, K., McSherry, L. (In Review). Investigating How Robotic Cooperative Competencies Relate to Strategy Selection in Human-Robot Joint Activity. *International Journal of Social Robotics.*

1. Kannally, C., Paladugu, A., Nijveldt, R., McSherry, L. & **IJtsma, M.** (In Review). An Exploratory Study of Contextual Control Modes in Teamwork. *Human Factors.*

Manuscripts in Preparation

2. **IJtsma, M.** (2022). A Review of Designing Resilient Human-Machine Teams: Towards Dynamic and Formative Interaction Design. *Theoretical Issues on Ergonomics Science.*

1. **IJtsma, M.** (2022). Modeling of Human-Robot Interaction Strategies for Formative Design. *IEEE Transactions on Human-Machine Systems.*

Book Chapters

1. **IJtsma, M.**, Ma, L.M., Feigh, K.M., & Pritchett, A.R. (2019). Analysis of Work Dynamics for Objective Function Allocation in Manned Spaceflight Operations. In M.A. Vidulich & P. Tsang (Eds.), *Improving Aviation Performance through Applying Engineering Psychology, Advances in Aviation Psychology.* In press.

Conference Proceedings

Fully Reviewed

4. **IJtsma, M.**, Lassiter, W., Feigh, K.M., Savelsbergh, M., & Pritchett, A.R. (2019). *An Integrated System for Mixed-Initiative Planning of Manned Spaceflight Operations.* Paper presented at the 2019 IEEE Aerospace Conference, Big Sky, MT.

3. Baltrusaitis, M., Feigh, K.M., **IJtsma, M.**, Lassiter, W., Pritchett, A.R., & Savelsbergh, M. (2018). *Technologies for Mixed-Initiative Plan Management for Human Space Flight.* Paper presented at the International Conference on Automated Planning and Scheduling, Delft, Netherlands.

2. Ma. L.M., **IJtsma, M.**, Feigh, K.M., Paladugu, A., & Pritchett, A.R. (2018). *Modelling and Evaluating Failures in Human-Robot Teaming Using Simulation.* Paper presented at the 2018 IEEE Aerospace Conference, Big Sky, MT.

1. **IJtsma, M.**, Bhattacharyya, R.P., Pritchett, A.R., & Hoekstra, J. (2015). *Computational Assessment of Different Air-Ground Function Allocations.* Paper presented at the 11th USA/Europe Air Traffic Management Research and Development Seminar, Lisbon, Portugal.

Abstract Reviewed

18. Kannally, C., Smith, J. & **IJtsma, M.** (2023). *Human-AI Teaming in the Automotive and Mobility Industry: Guiding Design to Support Joint Activity.* Paper presented at the Human Factors and Ergonomics Society Annual Meeting, Washington DC.

17. Fernandes, A., Wilson, S., **IJtsma, M.**, Paladugu, A., Davis, T. & Lichty, J. (2023). *Contingency Planning Toolkit for Emerging Air Mobility Ecosystems.* In AIAA AVIATION 2023 Forum (p. 3552). San Diego

16. Paladugu, A., Fernandes, A., Wilson, S., Davis, T., Lichty, J., **IJtsma, M.** (2023). *Evaluating Envisioned Air Mobility Architectures Using Computational Simulations of Work.* Paper presented at the International Symposium on Aviation Psychology. Rochester, NY.

15. **IJtsma, M.** (2022). *Situated Work in Teams: Modeling Coordination through Extending Strategies Analysis and Contextual Control.* Paper presented at the Human Factors and Ergonomics Society Annual Meeting, Atlanta, GA.

14. Paladugu, A., Nijveldt, R., Cassidy, K., & **IJtsma, M.** (2022). *Strategy Selection in Teams: Exploring How Teams Coordinate Responses to Time Pressure.* Paper presented at the Human Factors and Ergonomics Society Annual Meeting, Atlanta, GA.

13. Nijveldt, R., & **IJtsma, M.** (2022). *Cognitive Task Analysis of Contingency Management in Future Unmanned Aircraft Systems Traffic Management.* In AIAA AVIATION 2022 Forum (p. 3620). Chicago

12. Duros, S., Lo, J., Cassidy, K., & **IJtsma, M.** (2022). *Development of a Dynamic Model of Adaptation in Distributed Work Systems.* Paper presented at AIAA Scitech 2022 Forum.

11. Keller, J., **IJtsma, M.**, & Newton, E. K. (2021). A Critical Examination of Autonomous Flight Safety Systems from a Cognitive Systems Engineering Perspective: Challenges, Themes, and Outlying Risks. 72nd International Astronautical Congress (IAC) Proceedings, Dubai, United Arab Emirates

10. Keller, J., & **IJtsma, M.** (2021). *Requirements for Computational Approaches to Analyzing Resilience in Human-Machine Teams.* Paper presented at the Human Factors and Ergonomics Society Annual Meeting, Baltimore, MD.

9. Albert, K., & **IJtsma, M.** (2021). *Modeling the Effects of Machine Rigidities on Joint Work Strategies.* Paper presented at the Human Factors and Ergonomics Society Annual Meeting, Baltimore, MD.

8. Barrett, E., **IJtsma, M.** (2021). *Modeling Contingency Management in Unmanned Aircraft Systems Traffic Management.* Paper presented at the International Symposium on Aviation Psychology, Corvallis, OR.

7. Ma, L., Ye, S., **IJtsma, M.**, Feigh, K.M., & Pritchett, A.R. (2020). *An Experimental Refinement of Computational Models of Human-Robot Teams.* Paper presented at AIAA Scitech 2020 Forum.

6. **IJtsma, M.**, Ye, S., Feigh, K.M. & Pritchett, A.R. (2019). *Simulating Human-Robot Teamwork Dynamics for Evaluation of Work Strategies in Human-Robot Teams.* Paper presented at the International Symposium on Aviation Psychology, Dayton, OH.

5. **IJtsma, M.**, Ma, L.M., Feigh, K.M., & Pritchett, A.R. (2018). *Demonstration of the "Work Models that Compute" Simulation Framework for Objective Function Allocation.* Paper presented at the Human Factors and Ergonomics Society Annual Meeting, Philadelphia, PA.

4. **IJtsma, M.**, Pritchett, A.R., Ma, L.M., & Feigh, K.M. (2017). *Modeling Human-Robot Interaction to Inform Function Allocation in Manned Spaceflight Operations.* Paper presented at Robotics: Science and Systems, Boston, MA.

3. **IJtsma, M.**, Borst, C., Mercado-Velasco, G.A., Mulder, M., & Van Paassen, M.M. (2017) *Adaptive Automation Based on Air Traffic Controller's Decision-Making.* Paper presented at the International Symposium

on Aviation Psychology, Dayton, OH.

2. **IJtsma, M.**, Ma, L.M., Pritchett, A.R., & Feigh, K.M. (2017). *Work Dynamics of Taskwork and Teamwork in Function Allocation for Manned Spaceflight Operations.* Paper presented at the International Symposium on Aviation Psychology, Dayton, OH.

1. **IJtsma, M.**, Bhattacharyya, R.P., & Pritchett, A.R. (2015). *Computational Simulation of Authority-Responsibility Mismatches in Air-Ground Function Allocation.* Paper presented at the International Symposium on Aviation Psychology, Dayton, OH.

Theses

2. **IJtsma, M.** (2019). *Computational Simulation of Adaptation of Work Strategies in Human-Robot Teams* (doctoral thesis). Georgia Institute of Technology, United States

1. **IJtsma, M.** (2016). *Adaptive Automation Based on Air Traffic Controller's Decision-Making* (master's thesis). Delft University of Technology, Netherlands

INVITED TALKS

- "Modeling and Simulation of Joint Activity to Support Human and Machine Coordination," Rutgers University Department of Industrial Systems Engineering, October 2023
- "Making Machines More Cooperative Agents: Formative Models to Guide Human-Machine System Design," AIAA Intelligent Systems workshop, Boulder, CO, July 2023
- "Making Robots More Cooperative Agents: Evaluating Human-Robot System Designs from a Teamwork Perspective," Aerospace Human Factors New and Emerging Technologies Seminar Series, Federal Aviation Administration, May 2023
- "The Choreography of Work: Computational Modeling to Analyze and Support Coordination in Human-Machine Systems," Southern Ohio Chapter of the Human Factors and Ergonomics Society (HFES), November 2021
- "The Choreography of Work: Computational Modeling to Examine and Support Coordination in Human-Machine Systems," Department of Mechanical and Aerospace Engineering, The Ohio State University, November 2021
- "Computational Models of Work to Study Human-Robot Teaming", Aptima Human-Centered Engineering, February 2020
- "Designing Distributed Cognitive Work Systems", IISE Student Chapter General Body Meeting, The Ohio State University, February 2020
- Aerospace SCOPE Meeting, Battelle Center for Science, Engineering and Public Policy, The Ohio State University, February 2020
- "Predicting Dynamics of Human-Automation Interaction Using Computational Models of Work," Center for Automotive Research (CAR), The Ohio State University, January 2020
- "Computational Models of Work to Study Multi-Agent Sociotechnical System," Department of Integrated Systems Engineering, The Ohio State University, November 2018.

PROFESSIONAL MEMBERSHIPS

Human Factors and Ergonomics Society (HFES) June 2018 - Present
American Institute of Aeronautics and Astronautics (AIAA) December 2020 - Present

HONORS, AWARDS, AND CERTIFICATES

NSF CAREER Award February 2023
The Stanley Nelson Roscoe Best Student Paper Award May 2017
Graduated Cum Laude, MSc degree June 2016
Graduated Cum Laude, BSc degree July 2013
Associate Certification of the Center for the Integration of Research, Teaching and Learning May 2019