National Research Council
- Committee on -
Autonomy Research for Civil Aviation

Overview and Summary of Activities
10 October 2013
STATEMENT OF TASK

• **Develop a National Research Agenda for Autonomy in Civil Aviation**
  – Prioritized set of integrated and comprehensive technical goals and objectives
  – … of importance to the civil aeronautics community and the nation

• **Consider**
  – current state of the art in autonomy research and applications, including non-aviation sources
  – current national guidance on research goals and objectives

• **Describe**
  – forms and applications of autonomy reviewed
  – potential contributions of autonomy to civil aviation … evolved and ‘game-changers’ … with a 10-20 year focus
  – technical and policy barriers to operational systems and implementation
  – key challenges and gaps to be addressed by a national research agenda for autonomy in civil aviation

• **Outline**
  – a prioritized set of research projects that
    • enable development of CONOPS
    • lead to development, integration, testing and demonstration
    • predict system-level effects to the NAS
    • define approaches to verification & validation … and certification
  – The outline should be developed with due consideration of required resources and organizational partnerships, and it should describe potential contributions and roles of U.S. research organizations
PARTICIPANTS

• Dr. John-Paul B. Clarke, Co-Chair, Associate Professor of Aerospace Engineering, Georgia Institute of Technology
• Dr. John Lauber, Co-Chair, Private Consultant, (former NTSB)
• Mr. Alan Angleman, NRC, Study Director
• Dr. Brent Appleby, Deputy to the Vice President Engineering for S&T, C.S. Draper Laboratory
• Dr. Ella Atkins, Associate Professor, Department of Aerospace Engineering, University of Michigan
• Mr. Anthony Broderick, Consultant (former FAA)
• Mr. Gary Cowger, Chairman & CEO, GLC Ventures, LLC
• CAPT Noah Flood, Delta Airlines
• Dr. Michael S. Francis, Chief, Advanced Programs and Senior Fellow, United Technologies Research Center
• Dr. Eric Frew, Associate Professor & Director, Research & Engineering Center for Unmanned Vehicles, University of Colorado
• Dr. Andrew Lacher, Senior Principal, UAS Integration Research Leadership, The MITRE Corporation
• Dr. John Lee, Emerson Electric Professor, Department of Industrial and Systems Engineering, University of Wisconsin
• Dr. Kenneth M. Rosen, President, General Aero-Science Consultants, LLC
• Dr. Lael Rudd, Autonomy Development Lead, Northrop Grumman Aerospace Systems
• Dr. Trish Ververs, Engineer Fellow, Honeywell Aerospace
• Mr. Larrell Walters, Head of the Sensor Systems Division, University of Dayton Research Institute
• Dr. David Woods, Professor, Institute for Ergonomics, The Ohio State University
• Dr. Edward L. Wright, David Saxon Presidential Chair, Department of Physics and Astronomy, University of California, Los Angeles
STUDY PLAN

• Interviews and presentations to study team
  – NASA (sponsor) perspective … and current program overview
  – Aviation issues
  – Autonomy & other related relevant technologies (e.g. robotics, communications, …)
  – Non-aviation applications of autonomy and implications (e.g. automotive, space, …)
  – Policy perspectives
  – Other issues/factors that influence the agenda

• Schedule … 4 meetings
  ➢ July 10-12 Washington, DC
  ➢ August 27-29 Irvine, CA
  – November 13-14 Washington, DC
  – December 16-18 Irvine, CA (Closed meeting)

• Deliberate, discuss, integrate, adjudicate, achieve consensus …

• Prepare study report for NRC release
1st MEETING OVERVIEW

- Keck Center, Washington, DC … July 10-12, 2013
- Introductory Comments (Chairs, NRC) … Participant Introductions
- Open sessions (Presentations)
  - NASA ARMD Perspective … Shin, Irvine, Pearce, Cavalowsky, Rohn, Waggoner
  - NASA Programs
    - Autonomy-related research … C Moore, NASA HQ, Advanced Space Exploration
    - Autonomy-related research … Dr. M Scwabacher, NASA STMD Autonomous Systems
  - Roadmap for US Robotics … H Christensen, Georgia Tech
  - DSB Task Force – “Role of Autonomy in DOD Systems” … B Appleby, Draper Labs
  - Perspectives on Autonomy Research … D Mindell, MIT
  - Perspectives on Autonomy Research…K Arthur, Aviation Dev’t Directorate, Ft Eustis
  - Drones – A Tipping Point in Technology … M Cummings, MIT/Duke
  - Closed Loop Autonomous Control – Outer/Inner Space, K Rajan, Monterey Bay Aquarium Research Institute
  - Perspectives on Autonomy Research, AF Research Lab … J Overholt, K Kearns, Human Effectiveness Directorate
- Closed session
2nd MEETING OVERVIEW

• Beckman Center, Irvine, CA August 27-29, 2013
• Open sessions (Presentations)
  – Perspective of NAC UAS Subcommittee Chair…Langford, Aurora Flight Sciences
  – Challenges and barriers to UAS Integration into the NAS…Monk, CSSI, Inc.
  – Autonomy and AI in Space Exploration…Chien, JPL
  – Perspectives on autonomy in ground vehicles…Bishop, Bishop Consulting
  – Perspective on cybersecurity, vehicle assurance, IT for autonomous systems…Johnson, Honeywell
  – AFRL work on V&V…Clark and Smith, Autonomous Control Branch, AFRL
  – Ethical, Legal and Public Perception/Policy issues…Wallach, Yale and Walker Smith, Stanford University
  – Systems Architecture for Autonomous Systems…Vos, Athena Technologies
  – Autonomous Systems for Ground Vehicles…Nass & Storke, Stanford University
  – Robotics and Autonomous Systems…Hebert, Mellon University
  – Control and Dynamical Networked Systems for Autonomy…Murray, Caltech
  – FAA Perspective on UAS…Williams, FAA
  – Developments from Open Source UAV community…Anderson, 3DRobotics
  – AutoMax Overview and Update…Kopardekar & Alexandrov, NASA LaRC
• Closed session (Committee discussions)
FUTURE SPEAKERS

• Vic Riley, Boeing, Cockpit systems (confirmed)
• Nat Beuse and Tim Johnson, NHTSA (confirmed)
• Young Kim, Bosh Agriculture (confirmed)
• Terry Fogarty, K-MAX program (invited)
• Patricia Gruber, Battelle, Navy concepts of operations (confirmed)