

NATIONAL WORKSHOP ON

**AVIATION SOFTWARE SYSTEMS FOR THE SECOND CENTURY OF FLIGHT:
DESIGN FOR CERTIFIABLY DEPENDABLE SYSTEMS
(HCSS-AS)**

RESEARCH AND ROADMAP

October 5-6, 2006

Alexandria, VA

<http://chess.eecs.berkeley.edu/hcssas/>

CALL FOR POSITION PAPERS

INVITATION

The High Confidence Software and Systems (HCSS) Coordinating Group (CG) of the Federal Networking and Information Technology R&D (NITRD) Subcommittee, Committee on Technology of the National Science and Technology Council invites you to submit a position paper for a workshop on *Aviation Software Systems for the Second Century of Flight: Design for Certifiably Dependable Systems* (HCSS-AS). The Federal government recognizes that the rapidly increasing software and system complexity of aviation systems makes the development of high integrity, high confidence aviation software and systems a crucial issue for the future of military and civilian aviation systems.

The purpose of the HCSS-AS workshop is to provide an open, working forum for leaders and visionaries concerned with Aviation Software Systems from industry, government, research laboratories, and academia, with the goal of developing a roadmap to overcome crucial aviation software and systems issues and challenges facing the specification, design, certification, and testing of aviation software systems. In addition, the workshop will serve the goals of bringing together practitioners (from government and industry) with the academic community interested in high confidence systems technologies and mathematical and computational techniques for systems verification and validation. The workshop will also treat the issues of education: how do we bring verification and validation issues into the university classroom?

By submitting a position paper, you will have an opportunity to provide technical facts and information that potentially can help shape the future direction of HCSS-AS. Due to the workshop's ambitious schedule, position papers are requested by September 1, 2006. The position papers will be used to select invitees to the workshop, which is scheduled for October 5-6, 2006. Invitees will have the opportunity to provide further input to the HCSS-AS roadmap.

WORKSHOP TOPICS and APPLICATION AREAS

The following themes are considered critical in the development and production of future HCSS-AS that are safe, secure, and reliable. (Subareas listed under each topic are meant to be indicative, rather than exhaustive).

1. Certification Issues
 - a. What should the certification criteria be?
 - b. How do you certify non-deterministic or adaptive systems?
 - c. Overlap between software and other parts of the system
 - d. Security issues
2. Costs or Barriers to Innovation
 - a. Design for certification
 - b. Lifecycle issues, costs of upgrades, etc.
 - c. Design for reuse
3. Methods
 - a. Verification and validation (V&V)
 - b. Automated tools for V&V
 - c. Experimental platforms
 - d. Metrics
4. Systems Issues
(Guaranteed performance of a system in which software is a key part)

- a. Human/software integration issues
 - b. Hardware/software integration issues
 - c. Integration with procedures
 - d. Integration with environment
5. Emergent Issues
 - a. Adaptive non-deterministic systems
 - b. Human/software interactions
 6. Education

Application domains in which we are interested in considering these topics are:

- Air Traffic Management (ATM)
- Unmanned Aerial Vehicles (UAVs)
- Flight control
- Command and Control (C&C)
- Communication, Navigation, and Surveillance (CNS) systems
- Aircraft and infrastructure integration
- Satellite and space system control

BACKGROUND AND SCOPE

Software related issues are the “Achilles Heel” of modern aviation system development. Traditional embedded software development is characterized by low level programming, ad hoc approaches, stand-alone and static implementations, custom systems, little code re-use. This results in prolonged design schedules, excessive cost, limits in functionality, and difficulty in maintenance, upgrades, and retrofits. In such systems, verification and validation is labor intensive and expensive. These issues are exacerbated for critical systems where high integrity requirements yield certification challenges and barriers.

It is also important to note that current processes are inefficient and inadequate for future needs. Looking ahead, increased functionality in aerospace systems will lead to added complexity. There is a move towards networked, interconnected systems, and a need for distributed computation models. These new designs will feature reconfigurability, adaptability, and dynamic modifications. Mixed initiative systems will be featured: it is not understood how to incorporate the human element into modeling, verification, and validation. Code correctness and safety concerns will be paramount, as will security issues.

Thus, new approaches, understanding, and breakthroughs are required. Success would be a significant economic and opportunity stimulant: these issues recognized by many organizations but real progress has been slow.

To plan for the HCSS-AS workshop, a one and a half day HCSS-AS Planning meeting was held on November 9-10, 2005 in Seattle WA, at the University of Washington campus. The planning meeting was sponsored by the NITRD Program Federal agencies that participate in the HCSS Coordination Group (CG) and the National Coordination Office (NCO), and by Stanford University.

The planning meeting identified several research themes to be further explored during the HCSSAS Workshop. The objective of the HCSS-AS workshop is to build on the work accomplished at the planning meeting by further analyzing the challenges and approaches that that can help address the findings resulting from this meeting. Our goal is to have a complete mix of the relevant stakeholders (including researchers, developers, certifiers) who can help identify emerging systems and assurance needs. This workshop will result in the second of a series of four technical research needs assessments and roadmaps to inform and guide actions of the HCSS agencies in advancing research towards high confidence systems.

WORKSHOP INVITATIONS

The workshop is by invitation. We encourage potential participants to submit a 1-2 page position paper, using the guidelines set forth below and specifically addressing topics listed above. This will aid the organizers in ensuring that the attendees and topics are well matched.

Government representatives interested in being invited to attend as observers are asked to submit a brief bio with a few sentences describing your interest in HCSS-AS to the organizers.

POSITION PAPER SUBMISSION GUIDELINES

Position papers should be 1-2 pages in length, and should use the style of the author's choice. Each position paper should address at least one of the workshop topics listed above, and answer each of the following three questions:

- 1 What are the three most important challenges?
- 2 What are the three most important information technology research needs?
- 3 What is a possible roadmap for the next 5 to 10 years?

In addition, each position paper should include at most a half-page bio, organization/affiliation, e-mail address, and phone number for each author. Position papers should be addressed to the attention of the HCSS-AS Workshop Program Committee and submitted as directed here: <http://chess.eecs.berkeley.edu/hcssas/> by Friday, September 1, 2006.

Note that submitted position papers will be available on-line and authors are advised not to include any proprietary information that they do not want to disseminate to the public.

IMPORTANT DATES

September 1, 2006: Submission deadline
September 8, 2006: Notification of Acceptance/Rejection
October 5-6, 2006: Workshop dates

VENUE

The workshop will be held on October 5-6, 2006, at the Hilton Alexandria Old Town, in Alexandria, VA.

Hilton Alexandria Old Town
1767 King Street
Alexandria, Virginia 22314
1-703-837-0440

We have reserved a block of rooms at a special rate, and there is an (even better) government rate. Please make reservations early to get these rates. Please visit the website for information on hotel reservations.

INFORMATION

The workshop website <http://chess.eecs.berkeley.edu/hcssas/> provides up-to-date information. For more information or to request to be on the workshop mailing list, please use the contact information on the website.

WORKSHOP ORGANIZERS

Claire J. Tomlin Stanford University, UC Berkeley (Co-chair)
R. John Hansman Massachusetts Institute of Technology (Co-chair)
Jonathan Sprinkle University of California, Berkeley (Co-chair)

PROGRAM COMMITTEE

See the workshop website for the latest list, at <http://chess.eecs.berkeley.edu/hcssas/>

SPONSORING AGENCIES

National Science Foundation
National Coordination Office for Networking and Information Technology Research and Development (NCO/ITRD)

COOPERATING AGENCIES AND PROFESSIONAL ORGANIZATIONS

Air Force Research Laboratory
Federal Aviation Administration
National Aeronautics and Space Administration
ACM SIGBED (Special Interest Group in Embedded Systems)
Hybrid Systems: Computation and Control (HSCC)
IEEE Computer Society TC-RTS (Technical Committee on Real-Time Systems) and Control Systems Society
EMSOFT
RTCA subgroup SC20