



②



MAS BULLETIN

Military Applications Summary bulletins report on technology developments in Europe and the Middle East. The material contained in the Bulletins should in no way be construed as an endorsement of any product or service described therein.

Approved for public release; distribution unlimited

OFFICE OF NAVAL RESEARCH EUROPEAN OFFICE PSC 802 Box 30, FPO AE 09499-0700 Phone (AV)234-4131 (Comm)409-4131

10-91

AUGUST 1, 1991

Papers presented at Advisory Group for Aerospace Research and Development (AGARD) Symposium on Software for Guidance and Control

Background. On 7-10 May 1991, the 52nd Symposium of the Guidance and Control Panel of AGARD was held in Thessaloniki, Greece. Software is increasingly important in guidance and control systems. While embracing a wide range of software, in many cases it is the pacing item in development. Guidance and control software emphasizes

- High integrity considerations
- Hard real-time constraints
- Implications of a still evolving hardware and systems architecture
- Need to meet delivery schedules with high productivity under the constraints of onerous customer requirements for documentation and visibility in light of strong defense and airworthiness standards and requirements.

Since much guidance and control software is required early in the flight testing, time schedules are frequently short. Typically, software development is undertaken in the context of still-evolving requirements and developing program phases.

This symposium covered:

- **General requirements on the software**
High integrity, real-time performance, software sizing and estimating, productivity, influence of hardware architecture, quality, security, fault tolerance, and configuration management standards
- **Software requirements capture**
Specification methods, formal languages (e.g., VDM, Z), interaction with simulation and animation, graphical techniques, and high level test specification
- **Design methods and support environments for real-time software**
Commercially available tools and methods for (e.g., Yourdon, SADT, Jackson), other current methods, comprehensive/integrated toolsets, application domain oriented techniques, real-time issues, test specification generation, transformation techniques, and support environments (e.g., APSEs, IPSEs)
- **Coding techniques**
High level languages (e.g., Ada), object oriented languages, requirements for high integrity, software for distributed processors, and coding for knowledge based systems
- **Verification validation and certification**
Testing, scrutinizing, test coverage, equivalence proving, assurance, and certification.

For copies of the following papers, contact the Office of Naval Research European Office.

1. **A survey of available tools and methods for software requirements capture and design**
D. Thewlis, GEC-Marconi Ltd., Stanmore, Middlesex, United Kingdom (U.K.)
2. **Tool supported software development - Experiences from the EFA Project**
W.M. Fraedrich, Federal Ministry of Defense, Bonn, Federal Republic of Germany (FRG)

3. **Military and civil software standards and guidelines for guidance and control**
K.W. Wright, Smiths Industries Aerospace & Defence Systems, Cheltenham, U.K.
4. **Guidance software development workshop**
D. Caignaut, J-L. Lebrun, SEXTANT Avionique, Villacoublay, France (FR)
5. **Software development workstation**
H. Robin, J-C. Mielnik, SEXTANT Avionique, Villacoublay, FR
6. **AGLAE - Aerospace software engineering works**
J. Harmon, F. Bois, M. Vazeilles, D. Mousseau, AEROSPATIALE, Service E/ETEL, Chatillon s/Bagneux, FR; F.Y. Villemin, CNAM-CEDRIC, Paris, FR
7. **Software design considerations for an airborne command and control workstation**
P. Kuhl, B. Muth, P. Keihorn, R. Vissers, Domier Luftfahrt GmbH, Friedrichshafen, FRG
8. **Formal specification for satellite telemetry: a practical experience**
M. Lemoine, J-M. Huffien, ONERA-CERT/DERI, Toulouse, FR
9. **Formal verification of a redundancy management algorithm**
J. Draper, GEC Avionics, Rochester, Kent, UK
10. **A methodology for software specification and development based on simulation**
G. Fernández de la Mora, R. Minguez, S. Khan, J.R. Villa, SENER, Madrid, Spain (SP)
11. **Network programming: a design method and programming strategy for large software systems**
L. Schuberth, J. Kutscher, W.J. Grunewald, Forschungsinstitut für Funk und Mathematik, Wachtberg-Werthoven, FRG
12. **The data oriented requirements implementation scheme**
Ms. C.M. Thomas, British Aerospace (Dynamics) Ltd., Stevenage, U.K.
13. **Process/object-oriented ADA software design for an experimental helicopter**
K. Grambow, Elektronik-System GmbH, München, FRG
14. **Code generation for fast DSP-based real-time control**
H. Hanzelmann, A. Schwart, H. Henrichfreise, dSPACE digital signal processing and control engineering, Paderborn, FRG
15. **Computer aided design of weapon system guidance and control with Predictive Functional Control technique**
D. Cuadrado, P. Guerchet, Thomson-CSF/DSE, Bagneux, FR; S. Abu El Ata-Does, ADERSA, Verrières-le-Buisson, FR
16. **A practical experience of ADA for developing embedded software**
C. Goethals, C. Grandjean, Dassault Electronique, Saint Cloud, FR
17. **The development of a requirement specification for an experimental active flight control system for a variable stability helicopter - an ADA simulation in JSD**
G.D. Padfield, RAE, Flight Dynamics Division, Bedford, U.K.; R. Bradley, University of Glasgow, Department of Aerospace Engineering, U.K.; A. Moore, LBMS, U.K.

93 10 5 105~

18. **Software methodologies for safety critical systems**
W.C. Dolman, A.M. Ashdown, Lucas Aerospace, Electronic Systems Division, Birmingham, U.K.; T.C. Moore, Ministry of Defence, London, U.K.
19. **CAMP: Common ADA missile packages**
B.E. Mullins, Armament Directorate, Wright Laboratory, WL/MNAG, Eglin AFB, Florida, U.S.
20. **Development and verification of software for flight safety critical systems**
H. Afzali, A. Matissek, LITEF GmbH, Freiburg, FRG
21. **Reusable software approach to software generation**
A.P. DeThomas, WRDC/FIGX, Wright-Patterson AFB, Ohio, U.S.;
D. Dewey, Boeing military systems, Seattle, Washington, U.S.;
S. Wilson, LOCUS Co., Fairfax, Virginia, U.S.

22. **Automated Software Generation Approaches - Fourth Generation Languages**
P. Chinn, GEC Ferranti Defence Systems, Buckinghamshire, U.K.;
K.A. Helps, Smiths Industries A&Ds, Cheltenham, U.K.
23. **Transformation Methods**
P. De Bondell, Aérospatiale - STS/L, Les Mureaux, FR;
M. LeMoine, ONERA-CERT/DEPI, Toulouse, FR
24. **Knowledge based approach to software generation**
W. Mansel, MBB, Deutsche Aerospace, Ulm, FRG; H. Roschmann,
TST, Deutsche Aerospace, Ulm, FRG

ONR Europe point of contact: CDR Dennis R. Sadowski, USN,
Aerospace Systems Technology Officer.

Distribution:
Standard
Aero/Flight Dynamics
ADA
Science Advisers
Aero/Sig Proc

OFFICE OF NAVAL RESEARCH
EUROPEAN OFFICE
PSC 802 BOX 30
FPO AE 09499-0700

A-1

MASBULLETIN MASBULLETIN MASBULLETIN