

Johnson Space Center-Houston, Texas



TECHNOLOGY FOR SPACE STATION EVOLUTION - A WORKSHOP DATA MANAGEMENT SYSTEM	SYSTEMS DEVELOPMENT & SIMULATION DIVISION	
	EF2/G. C. BLACKBURN	JANUARY 1990

SPACE STATION DISPLAYS AND CONTROLS TECHNOLOGY EVOLUTION

GREG C. BLACKBURN
SYSTEMS DEVELOPMENT MANAGER
FOR
SPACE STATION DMS DISPLAYS & CONTROLS
(713) 483-1517

167

N938-27718
 163600
 58-18



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- **A HISTORICAL PERSPECTIVE**
- **MAJOR DEVELOPMENT OBJECTIVES**
- **CURRENT DEVELOPMENT ACTIVITIES**
- **KEY TECHNOLOGY AREAS**
- **TECHNOLOGY EVOLUTION ISSUES**



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• **A HISTORICAL PERSPECTIVE**

- **DEDICATED DISPLAYS & CONTROLS (D&C) IN PAST PROGRAMS**
 - **ORBITER HAS OVER 1,200 DEDICATED SWITCHES**
 - **MULTIFUNCTIONAL D&C HAS BEEN LIMITED**
- **LIMITED ONBOARD DATA PROCESSING**
- **MUCH OF DATA RECORDED OR TELEMETERED TO THE GROUND FOR PROCESSING**
- **EXTENSIVE GROUND MONITORING OF ALL SYSTEMS**
- **OPTIMIZATION OF PROGRAM OBJECTIVES**
 - **CREW INTERFACE CONSIDERED SECONDARY**



TECHNOLOGY FOR SPACE
STATION EVOLUTION - A WORKSHOP

DATA MANAGEMENT SYSTEM
SPACE STATION DISPLAYS & CONTROLS
TECHNOLOGY EVOLUTION

SYSTEMS DEVELOPMENT & SIMULATION DIVISION

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JANUARY 1990

• **MAJOR DEVELOPMENT OBJECTIVES**

- **LOWER COSTS, IMPROVE MAINTENANCE/RELIABILITY**
- **MINIMIZE PARTS/SKILL OBSOLENCE**
- **MINIMIZE POWER, WEIGHT, VOLUME CONSUMPTION**
- **PROVIDE A DESIGN WHICH ALLOWS FOR INFUSION OF NEW TECHNOLOGY**
- **REDUCE CREW'S OVERALL WORKLOAD**
- **MAXIMIZE FLIGHT SAFETY AND CREW EFFICIENCY**
- **PROVIDE A SOFTWARE RECONFIGURABLE INTERFACE**
- **MINIMIZE THE USE OF PAPER ON-ORBIT**



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• **CURRENT DEVELOPMENT ACTIVITIES**

- **DISTRIBUTED SYSTEM ARCHITECTURE**
- **CREW COMMAND AND CONTROL INTERFACE VIA
MULTIPURPOSE WORKSTATIONS**
 - **MULTIPLE MULTIFUNCTION DISPLAY DEVICES**
 - **KEYBOARD**
 - **CURSOR CONTROL DEVICE**
 - **PROGRAMMABLE SWITCHES**
 - **HAND CONTROLLERS**



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• KEY TECHNOLOGY AREAS

- COLOR FLAT PANEL TECHNOLOGY
 - COLOR ACTIVE MATRIX LIQUID CRYSTAL DISPLAYS
 - LARGE COLOR PLASMA DISPLAYS
- ADVANCED PROCESSORS
 - LATER GENERATION GENERAL PURPOSE PROCESSORS
 - ADVANCED GRAPHICS PROCESSORS
 - HIGHER DENSITY MEMORIES



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• **KEY TECHNOLOGY AREAS (CONTINUED)**

- **NEW AND IMPROVED CREW I/O DEVICES**
 - **VOICE RECOGNITION**
 - **VOICE SYNTHESIS**
 - **ADVANCED CURSOR CONTROL**
- **ADVANCED MANIPULATOR/ROBOTIC CONTROL**
 - **HAND CONTROLLER TECHNOLOGY**
- **IMPROVED CREW INTERFACE SOFTWARE**
 - **NEW CREW INTERFACE TECHNIQUES**
 - **USE OF AI/EXPERT SYSTEMS**



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• TECHNOLOGY EVOLUTION ISSUES

- MATURITY OF COLOR FLAT PANEL TECHNOLOGY
- NO SPACEFLIGHT EXPERIENCE WITH ADVANCED INTERACTIVE MULTIPURPOSE SOFTWARE SYSTEMS
 - DEFINITION OF DISPLAY FORMATS
 - DEFINITION OF GRAPHIC OBJECTS
 - EFFICIENT NAVIGATION THROUGH A HIGH NUMBER OF DIFFERENT FORMATS
 - ELIMINATION OF DEDICATED SYSTEM D&C PANELS



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• **TECHNOLOGY EVOLUTION ISSUES (CONTINUED)**

- **MATURITY AND UTILIZATION OF AI/EXPERT SYSTEM TECHNOLOGY IN A SPACECRAFT**
- **CREW ACCEPTANCE OF A WORKSTATION INPUT VIA VOICE COMMAND**
- **DANGER OF MAKING CREW BORED (MACHINE MINDERS)**
- **LATER INCORPORATION OF NEW TECHNOLOGY**
 - **DIFFICULTY IN UPGRADING AN EXISTING OPERATIONAL NASA SPACECRAFT**
 - **ON-ORBIT CHECK-OUT/VERIFICATION**