

BASIC BASIC BASIC

Basic Avionics System Integration Concept

BASIC is a NAVAIRDEVCCEN activity supported by NAVAIR 360 and dedicated to improving the transition of technology from the development laboratory to operational systems.

BASIC supports the:

Program Managers

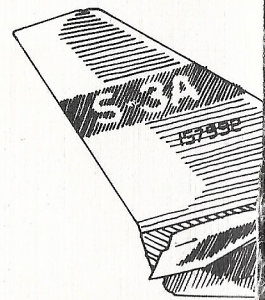
- by providing a technology data base, assessment of avionic subsystem alternatives, and a focal point for project experience with avionic systems

Technologists

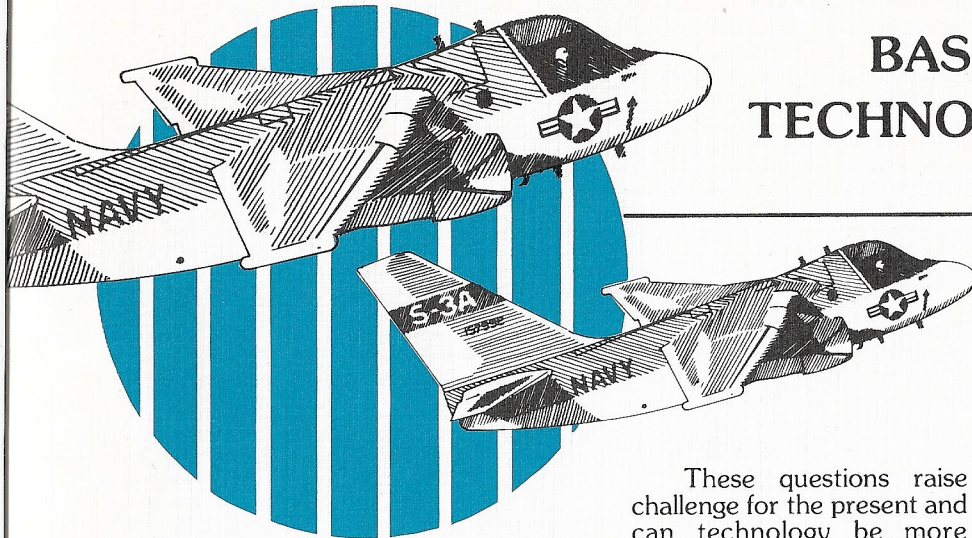
- by providing a system environment to validate their development products

Systems Integrators

- by performing as a technology that investigates system integration problems through the application of distributed processing, system processing, system partitioning, crew function automation, fault identification, and recovery



BASIC . . . IS GETTING TECHNOLOGY ON BOARD



TECHNOLOGY DEVELOPMENT AND TRANSITION

The Navy spends millions of dollars each year on the development of new technology. Many highly skilled and staunchly dedicated people spend years developing new components for better radar, display, communications, navigation, and so on . . .

- But how do these components find their way onto a new weapon system platform?
- How do program managers become aware of all the work being done in laboratories that may have application to their needs?
- How can these new technologies be properly evaluated to the program manager's satisfaction and within his budget and schedule constraints?
- How can the Navy achieve a better return on technology investment dollars?

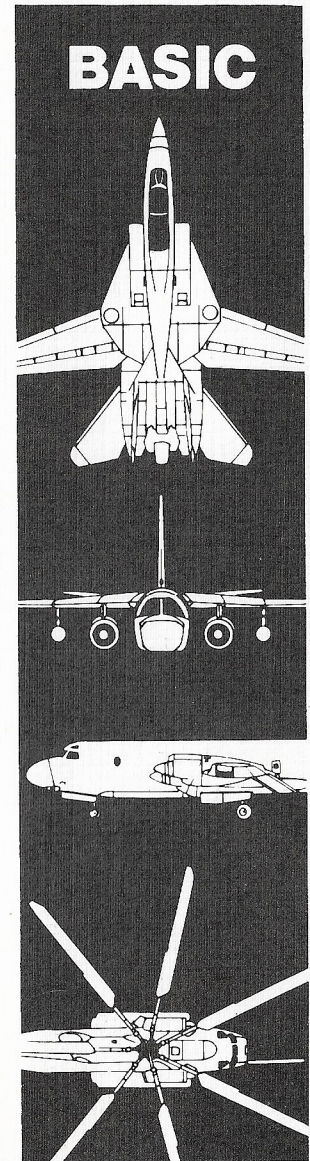
These questions raise a serious challenge for the present and future. How can technology be more effectively transitioned to platform and fleet utilization?

For avionics technology, BASIC is the best answer.

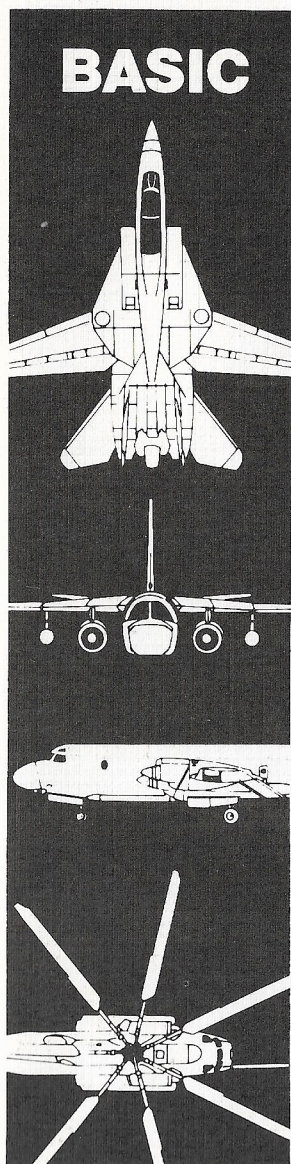
WHAT IS BASIC?

BASIC is a new concept of doing technology transition and integration — a better way of doing the business of weapon system development. With today's rapidly developing, more complex technology, BASIC is fast becoming the ONLY way to do business. It is a concept that has been implemented and is ready to provide:

- A team of experts equipped to tackle your critical systems and technology problems
- A laboratory for technology evaluation and demonstration
- An adaptive avionics suite ready to support concept formulation and validation
- A concept that works for you - now!



TECHNOLOGY TRANSITION: HIT OR MISS

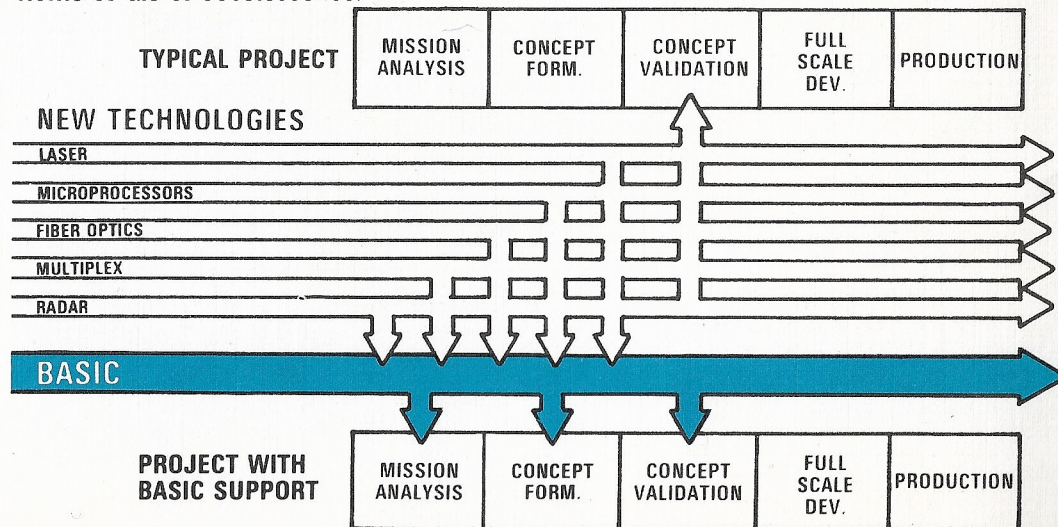


One key to developing more capable aircraft is the infusion of advanced technology. Work is constantly underway in a variety of areas, such as communications, radar, acoustics, navigation, and electro-optics, just to name a few. While this broad technological thrust is continuously moving forward, specific platform requirements arise. The avionics suite for an emerging platform should result from carefully matching the latest technology to mission requirements. But this does not always happen; technologies have historically not been ideally matched to requirements. Often technologies are developed to advance the state-of-the-art and, with little regard to where end products would be used, what missions they would fulfill, and when they would be required. Also, some good technology has come to fruition when no platform application was available. The new component may eventually find a home or die of obsolescence.

Naval planning and guideline documents are being issued to improve technology transition by identifying plans for future platforms, potential mission objectives, and areas for technology improvement. This is a beginning . . . but BASIC provides a more complete answer to technology transition by:

- Continuously investigating emerging technologies
- Integrating new technologies early within an avionics systems environment
- Evaluating and demonstrating the applicability of new technology to platform needs
- Providing a validated data base for subsystem selection

Each emerging platform can be thought of as having a "window of opportunity" when new technologies can be



THERE'S A BIG JOB AHEAD FOR PROGRAM MANAGERS

incorporated. Normally, this is a short period during concept validation but the work being done by BASIC can effectively expand this important "window of opportunity" for technology transition.

The Navy needs more capability in the fleet. This means that new and better technology must be incorporated into components and systems and must get on board new or modified platforms. A program manager is assigned during early concept formulation and given the task of putting together a better weapon system within the constraints of a restricted schedule and an austere budget. He must sift through mountains of information, usually consisting of paper studies (sometimes conflicting), and determine which technologies will fulfill his requirements. Many new advances will not receive consideration due to lack of time and funding. The more promising components must be thoroughly analyzed, tested, evaluated, and demonstrated before they can be seriously considered for integration into a new weapon system or prototype. Many new components with potentially more capability will be dropped in favor of previously proven components because of high risk and possible impact on the schedule. As a result, the maximum benefit from investments in technology development is not obtained.

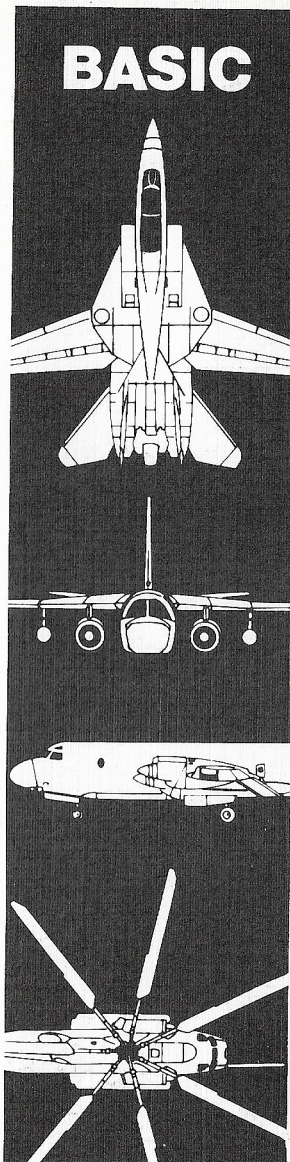
BASIC PROVIDES THE KEY STEP — EARLY INTEGRATION

The days of mission dedicated aircraft and system dedicated components are over. Many new aircraft weapon systems must perform multiple missions to provide

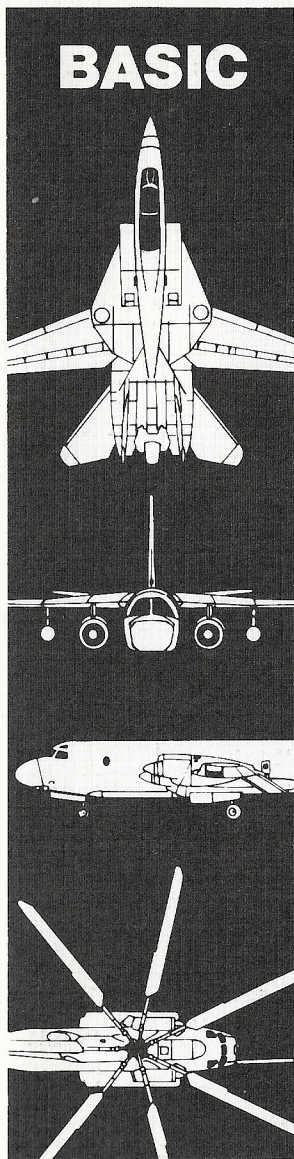
maximum effectiveness. New electronic components are shared by several systems and can perform many functions. Subsystems have historically been developed independently with their own sensors, controllers, displays, and processors. But with a continued emphasis on reliability, and weight and cost reduction, and with the rapidly increasing capability of integrated circuits, large scale integration and micro-processors, functions will be distributed throughout the aircraft; components will be multimode, multifunction, and shared among systems. These more complex system configurations place a much greater burden on the INTEGRATION task. Alternative, total system architectures must be studied early and results must ensure that each component is properly matched within the system and fully utilized.

Program managers cannot afford to wait until late in concept validation for the solution to these complex system problems. However, with present acquisition schedules, concept validation is the first time a functioning system may be put together.

The BASIC laboratory can provide the needed early integration of avionics technologies and make integration and systems technology part of the system design process. With BASIC, a functioning system can be configured early during concept formulation and be modified or augmented throughout the design process.



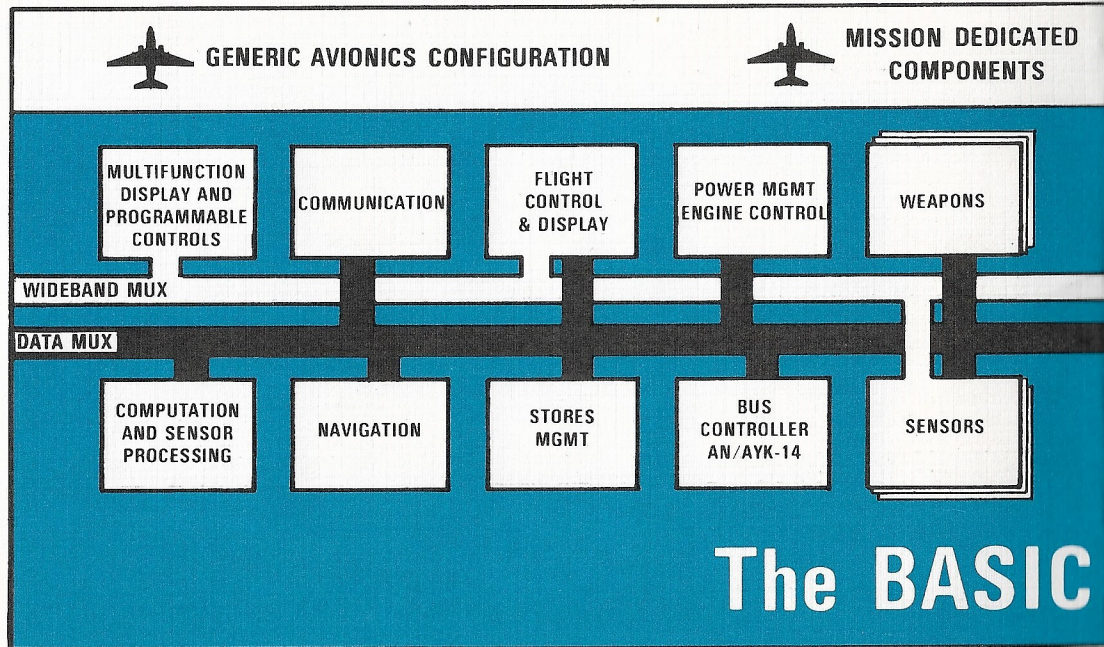
BASIC ANATOMY



The BASIC program has a growing team of professionals who are experts in the fields of software development, hardware integration, and computer applications. They are putting together, in the BASIC lab, a generic avionics suite which includes functions of control, display, data processing, data distribution, communication, navigation, stores, and power management. Starting with this core, components or simulators can be added to create any type of avionics configuration to functionally emulate various mission-oriented systems such as ASW, AEW, and AAW aircraft. Also, alternative technologies or system architectures can be configured and interchanged to evaluate various

approaches to a specific mission-oriented avionics system. In this way, BASIC permits system integration to be part of the design process.

At the heart of the BASIC lab is a multiplex data transfer system. The use of the data bus permits easy avionics reconfiguration by adding, deleting, or interchanging subsystems or components whether they be breadboard, advanced or engineering development, or production models. Where components or subsystems are not available, simulated signals can be used. In addition to the inherent adaptability afforded by the data bus, the BASIC lab also makes use of programmable displays and controls.



BASIC'S ANALYSIS CAPABILITY

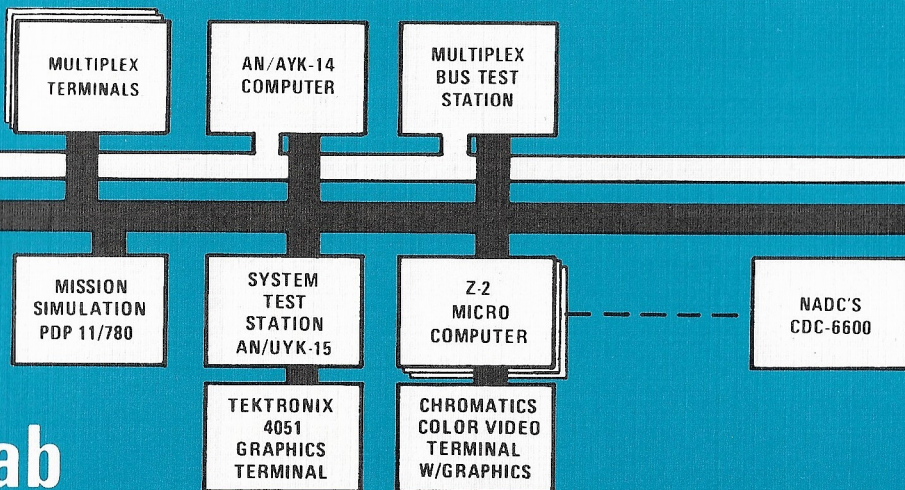
Once the avionics configuration has been selected and the components and simulation inputs are assembled in the lab, BASIC has the capability to conduct a thorough analysis of the avionics and produce valuable test data.

The laboratory is equipped with ample computational power — two AN/AYK-14 computers, several Z-2 microcomputers, and an AN/UYK-15 which serves as the system test station. A PDP 11/780 computer and associated software provide the lab with mission simulation capability. In addition, NAVAIRDEVCCEN's CDC 6600 computer can be directly connected to the laboratory for the purpose of simulation or

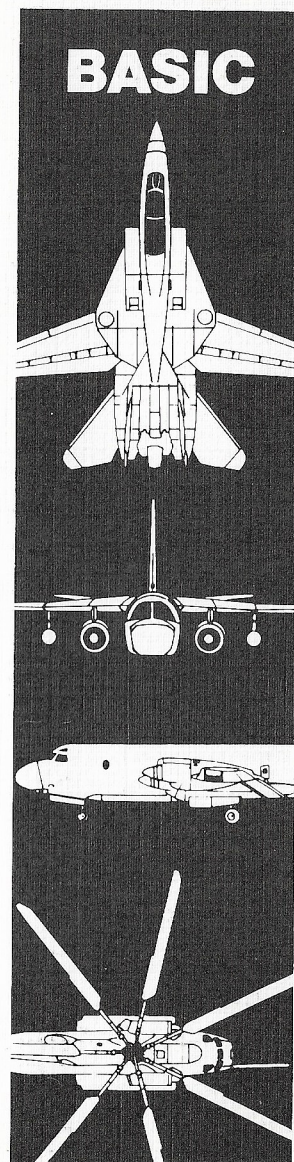
analysis. A General Computer Simulation System (GCSS) on the CDC 6600, has been used by the BASIC team for analysis of system processing requirements such as memory sizing, cueing, and allocation of functions (system architecture). A Chromatics color video terminal with graphics display capabilities was recently added and will be used for specialized output and to evaluate the application of color as a tactical decision aid.

The primary test computer, the AN/UYK-15, is equipped with an extensive set of peripherals including a Tektronix 4051 graphics terminal which will produce hard copies of actual test data.

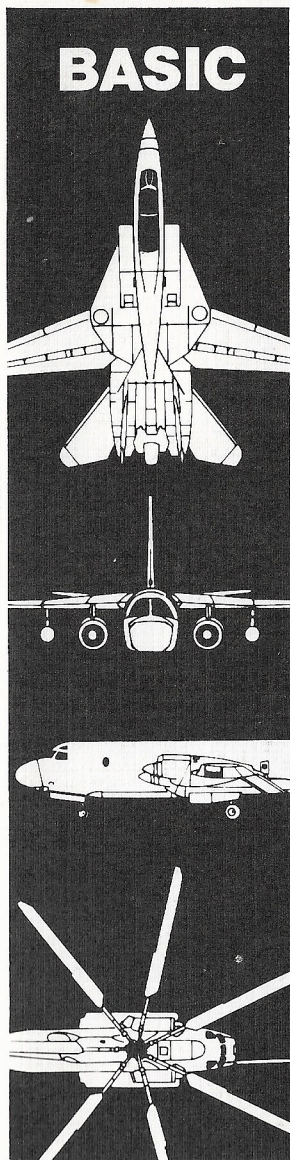
BASIC'S SIMULATION, TEST, AND EVALUATION CAPABILITY



Lab



BASIC IS GROWING AS THE "MATCHMAKER"



New technologies from all sources are being considered by BASIC to improve the laboratory's capability and for evaluation of project applications. New system integration problems are being solved nearly everyday.

The BASIC lab provides the forum where new technologies and platform developers can meet. The BASIC team is constantly keeping cognizant of new technological developments and BASIC provides a facility where technologists can have their components integrated into a fully functioning avionics suite.

Platform developers have already taken and will continue to take advantage of BASIC's facilities, expertise, and experience with solving system integration problems. The multiplex system, computers, simulation, and test and evaluation equipment are set up and ready to go. The expense of a complete new laboratory facility is eliminated. A particular avionics suite can be configured in a short time using the latest available technology. While some operational platforms already have their own laboratories, they are normally of a fixed configuration designed for life-cycle support. BASIC's easily adaptable facility can be applied to existing platforms for R&D of new hardware, software, and human factors concepts.

NEW TECHNOLOGY IS GETTING ON BOARD BASIC

New technologies are continually being evaluated and most of these are being permanently incorporated into the laboratory configuration.

Multiplex

At the heart of the BASIC laboratory is the multiplex data bus which permits flexibility and adaptability. A number of multiplex techniques, including a MIL-STD-1553 bus, fiber optics, and frequency division multiplex, are being investigated in the laboratory.

A MIL-STD-1553B voice multiplex system is being included in the lab to demonstrate expanded utilization of the bussing system.

Distributed Microprocessor Architecture

Various architectures for distributed microprocessors are under investigation to identify effective implementation of fault identification and recovery procedures.

Fiber Optics

A fiber optics bus developed by IBM will be delivered to the BASIC laboratory for extensive testing and evaluation. A video multiplex demonstration unit provided by Univac under contract to NAVAIRDEVCON has been evaluated in the laboratory.

Software Development

A universal executive for distributed processing is currently being developed by the BASIC team.

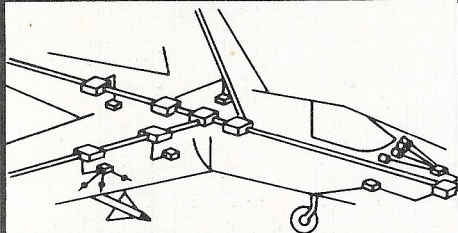
Display System

A multimode Advanced Integrated Display System (AIDS) display (built with commercially available components) is part of the BASIC lab avionics core.

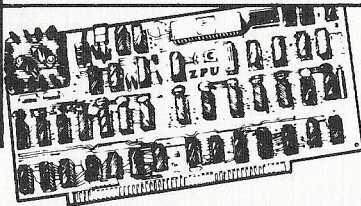
Ring Laser Gyro Navigation (RLGN)

A test program of the RLGN MIL-STD-1553A interface is being conducted in the laboratory.

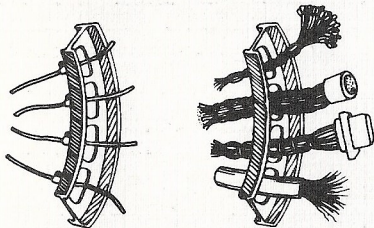
MULTIPLEX



**DISTRIBUTED
MICROPROCESSORS**



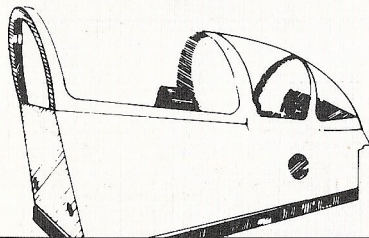
FIBER OPTICS



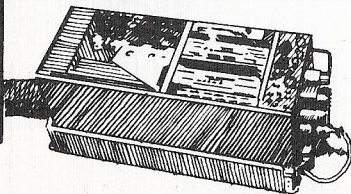
**SOFTWARE
DEVELOPMENT**



AIDS



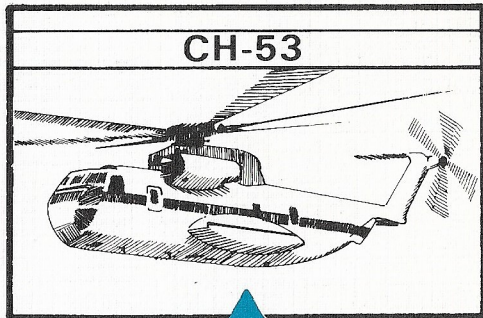
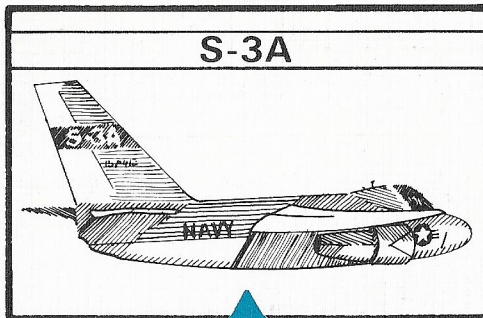
**RING LASER
GYRO NAV**



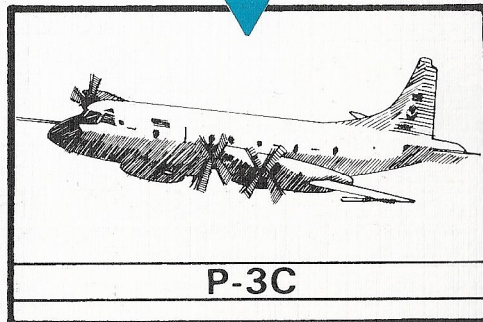
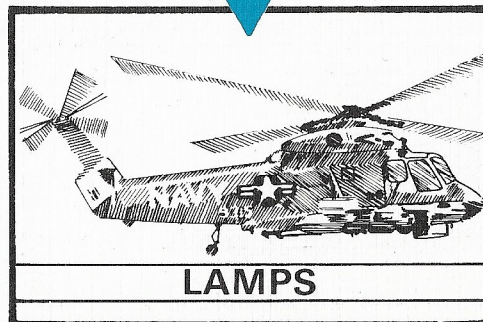
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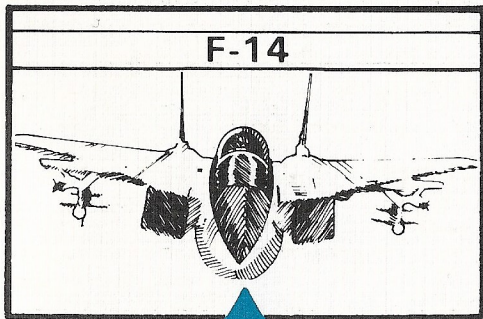
PROJECTS ARE GETTING ANSWERS FROM BASIC

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**PROJECT
MANAGER**





PROJECTS BEING SUPPORTED BY BASIC:

S-3A

BASIC is planning the demonstration of the applicability of bussing and distributed processing for off-loading of the over-burdened S-3A avionics processor.

CH-53

In conjunction with the CH-53 Program Office, BASIC is integrating the Army/Marine Position Locating Reporting System (PLRS) and the Army's Integrated Aircraft Communication System (IACS) for interoperability with other subsystems.

F-14

Tactical decision aids are being implemented into the BASIC laboratory for demonstration and evaluation.

LAMPS

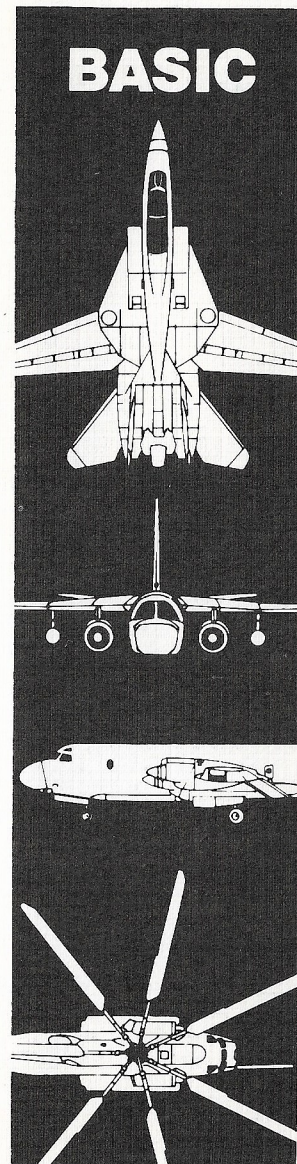
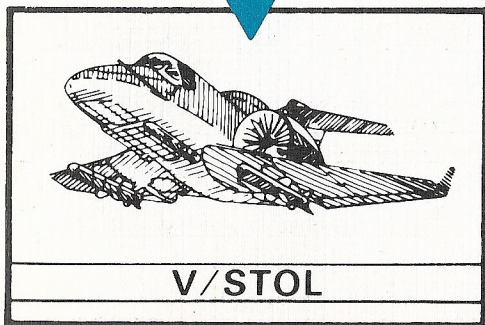
Support has been provided for integration of the LAMPS AN/AYK-14 and the MIL-STD-1553 bussing system in the LAMPS test facility.

P-3C

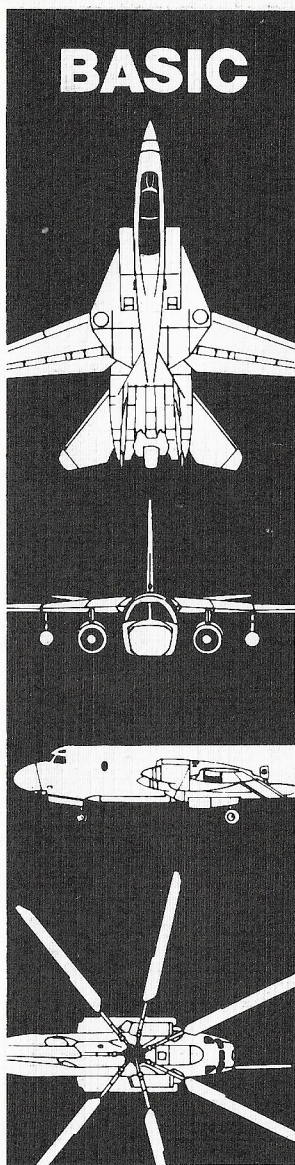
Support will be provided for the implementation and demonstration of P-3C tactical decision aids.

V/STOL

The BASIC program has provided integration planning support to the V/STOL office. In addition, the BASIC lab has investigated alternative processing architectures which could be applicable to V/STOL A/C systems.



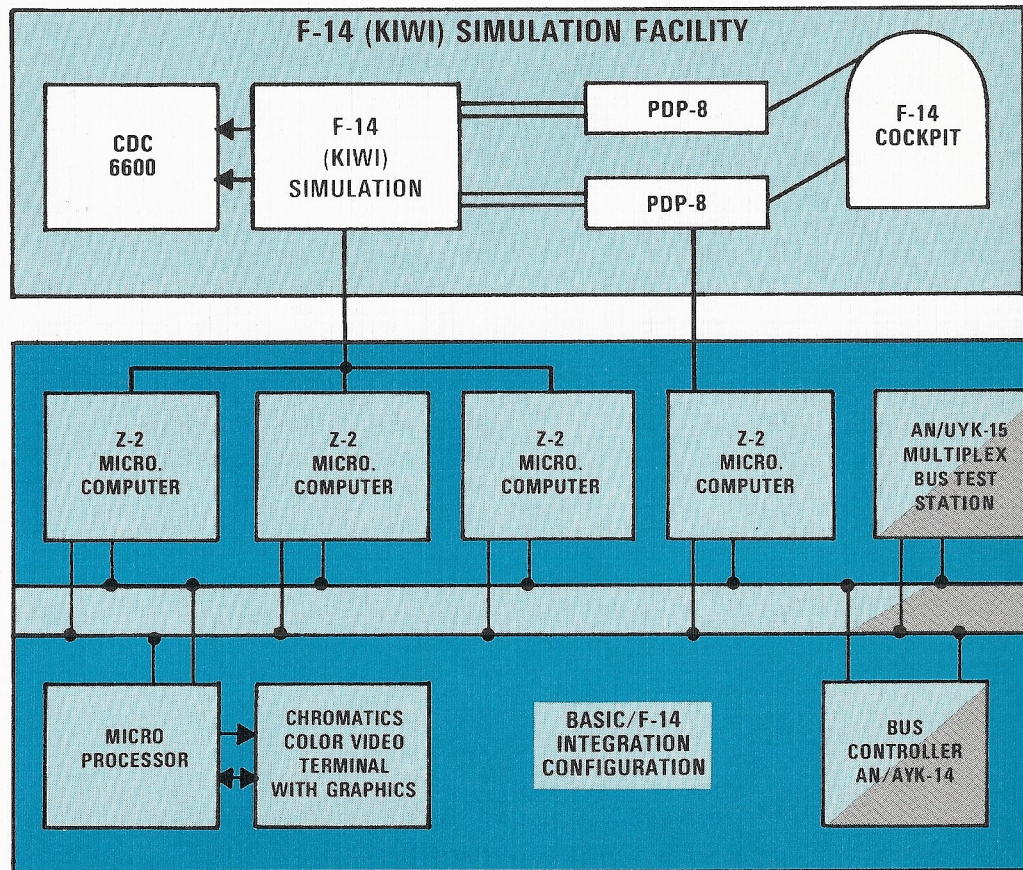
BASIC IS SOLVING REAL PROBLEMS



To provide more insight into how BASIC's capabilities can and are being used, two current projects are illustrated to demonstrate BASIC's role in solving real systems problems.

The F-14 Project Office is in the process of upgrading the F-14's avionics particularly in the area of sensor detection and identification range capability. One

method of improvement being investigated is correlation of several sensor inputs using algorithms and appropriate processing. Since BASIC has readily available processing and analysis capability and can be easily integrated with existing equipment, BASIC has been tasked with evaluating the merits of sensor correlation for the F-14. BASIC will

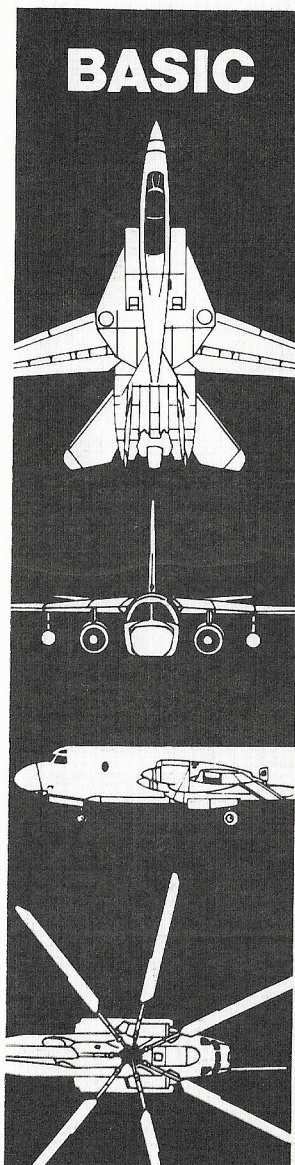
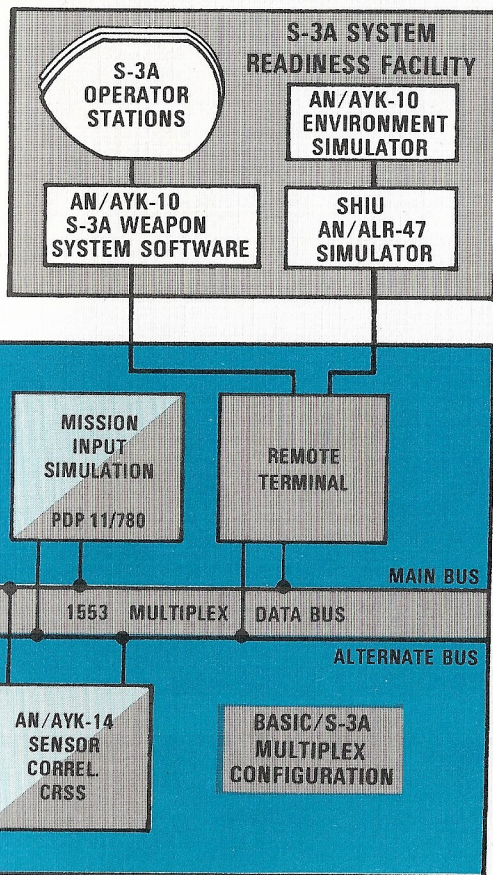


produce hard test results which should verify improved mission performance with multisensor correlation.

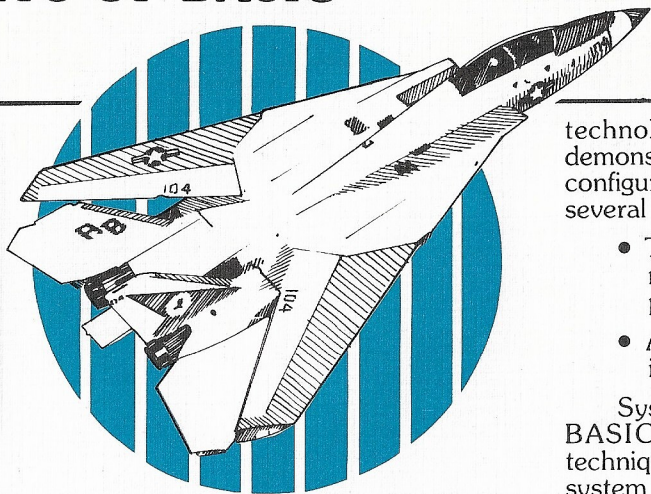
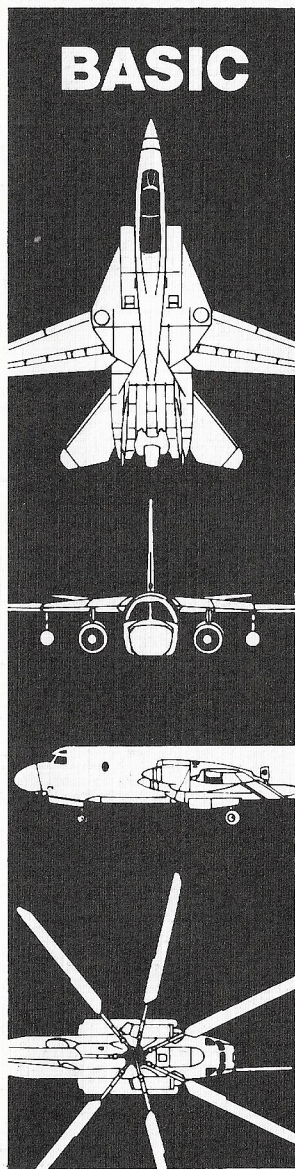
The VS Program Office is going to utilize BASIC to demonstrate and evaluate a distributed architecture. The S-3A has an AN/AYK-10 general purpose digital computer but its memory is fully occupied. It was desirable to off-load some

of the S-3A software and for this demonstration BASIC's AN/AYK-14 was chosen to host the AN/ALR-47 Countermeasures Receiving Set Sub-program (CRSS). Following the successful completion of this demonstration, additional investigations are planned. One effort of particular significance would determine the weight, maintainability, reliability, and survivability benefits of a distributed architecture and multiplex system for the S-3A avionics suite.

While the F-14 and S-3A have existing facilities, they are of fixed configurations necessary for life-cycle support and analysis. Although they provide excellent support for existing platform configurations, these facilities are not intended to have the flexibility required to perform research and development efforts. As demonstrated by these examples, the BASIC lab offers a highly adaptable facility which can be used by various projects to investigate technology and system alternatives.



THE BENEFITS OF BASIC



The BASIC lab meets critical needs of the Program Manager, the technologist, and the systems integrator. For the Program Manager, the BASIC team can provide early recommendations on avionics technology and system architecture. Then with the facilities in the BASIC laboratory, a system can be configured. This system can grow with the project and with applicable technological advances. The Program Manager can benefit from system integration technology that BASIC can provide. Thus:

- The likelihood of incorporating new technologies will be enhanced and their inherent risk will be reduced since new technologies can be easily evaluated within a total avionics system.
- Critical issues can be addressed early without a large investment in facilities; concept validation and the total development cycle may be accelerated.

The technologist will benefit too. BASIC provides a forum for the evaluation of new components regardless of their state of development. Also, new

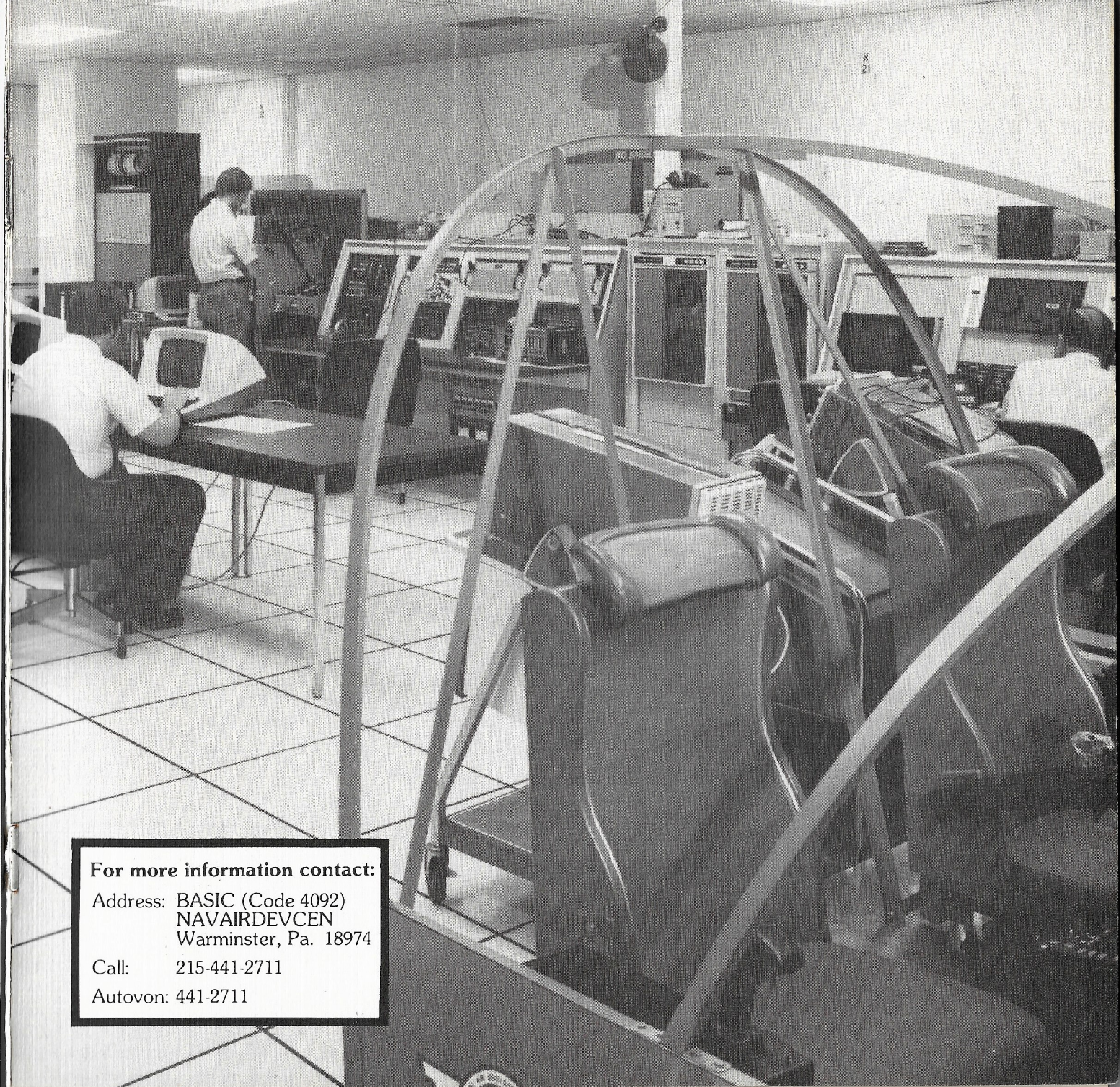
technologies can be evaluated and demonstrated within a total avionics suite configuration and for application to several ongoing projects. As a result:

- There is more likelihood of getting new technologies on board real projects.
- A better return on research investment is realized.

Systems integrators benefit from BASIC's investigations into new techniques such as distributed processing, system partitioning, fault identification and recovery, and automation of crew functions. For example:

- System architecture and component sharing can be addressed early so that the final system solution will have enhanced reliability, maintainability, and interoperability.
- As system integrators benefit, their improved techniques can be passed on to the Program Manager.





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