In summary, I will state that NTDC is implementing the DOD and Navy policy in several ways. A committee has been established by the Technical Director to make recommendations regarding the application of integrated circuits in training equipment. The committee will consider such factors as system partitioning, reliability, maintainability, and life cycle cost. It will also be a goal of this committee to generate guideline documentation regarding screening and testing of integrated circuits, modular construction and discard at failure guidelines.

DESIGN DATA DOCUMENTATION (ENGINEERING REPORTS)

C. R. FORD
ASW Tactics Trainers Division
S. KOTEEN
Visual, Space, and Aviation Trainers Division
Naval Training Device Center

Engineering and logistic support data for any given trainer development program may require a minimum of formal documentation or may represent a significant amount of paperwork. The criteria that establish the quantity of design data documentation that must be furnished to produce successfully an acceptable trainer varies, of course, with the complexity of the trainer. For a most complex trainer, documentation in the form of reports, lists and drawings would be necessary to satisfy both engineering and logistic support requirements. Each of these data items is intended to serve a specific purpose. For our discussion today, we will only concern ourselves with the area of engineering reports.

The primary mission of the Naval Training Device Center is to contribute to the Navy's operational readiness by developing training devices for training agencies and other Fleet activities. The fidelity of the simulation of a training device is ultimately appraised by the user activity. For training devices which simulate actual operational equipment, the appraisal consists of an assessment of the degree of learning that has been imparted to the trainees through utilization of the training device as compared with the operational equipment. This assessment effectively evaluates the degree of success by both the contractor and the Naval Training Device Center in meeting the stated needs of the user activity.

The Naval Training Device Center engineering project team has the responsibility for transforming the Fleet requirements into the quantitative technical language that forms the basis for mutual understanding between the contractor and the Government for the development of a training device. As so often is the case, the development of a training device parallels the development of the operational hardware. In such cases it is not possible to convert Fleet requirements into the necessary total quantitative requirements for a contractor to construct the training device.

In the normal course of events related to a negotiated type of procurement for a typical weapons system trainer, the NTDC project engineer will prepare a procurement package utilizing the data available at the time. Pertinent data available from the operational equipment

supplier during the trainer precontract period are conveyed to the potential training device contractor in the form of performance specifications. The specifications and the procurement package then become the basis for preparation of an invitation for bid.

Technical proposals prepared by an offeror in response to an invitation for bid represent the offeror's presentation of his best effort and plans to impart to the procuring agency how the offeror will attempt to meet the specification requirements. After technical evaluation of the proposals and negotiation with the most acceptable offeror resulting in an award, it becomes incumbent upon the contractor to search out the actual parameters of the operational equipment. The operational parameters, set forth in the form of reports supplied to the NTDC project engineer, become the basis for establishing the criteria for the trainer.

In the early days of NTDC the requirements for design reports for aviation training devices were integral with the general specifications for operational flight trainers. During fiscal year 1958, with an increase in procurement, the deluge of proposals and reports imposed a burden on both the contractor and the NTDC engineer. It became difficult to evaluate these proposals and reports fairly and objectively. Such were the conditions that dictated the need for standardization of reports in order for the NYDC engineer to receive relevant engineering data and to inform the contractor of the specific data required. This modest start in standardization was the beginning of the "Design Data Documents" series. Figure 168 shows the evolution of this documentation series.

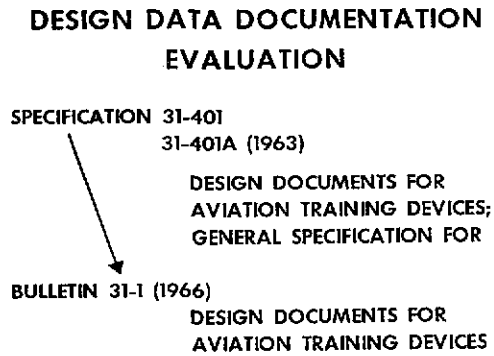

Figure 168.

Historically, Specification 911-500 and its A revision were generalized aviation trainer specifications contraining requirements for engineering reports. However, Specification 315-401 was the first requirements specification specifically devoted to standardization of data requirements for aviation training devices. With experience gained after specifying this document in procurements, refinements resulted in the addition of several weapons systems reports. This specification was reissued in 1961 as 31-401.

With added experience in additional procurements, data documentation items such as drawings and photographs were separated from this specification to be covered by individual documents. Additions included the General Arrangement Report and explicit detail for the

instructor and trainee area reports. And, with the introduction of the digital computer to simulation, a standardized report requirement was added to the specification and it was revised and reissued in 1963 as 31-401A.

Once again, as progress was made in the simulation field, NTDC has attempted to streamline the reporting documentation requirements. The current Bulletin 31-1 does not represent any radical departure from specification 31-401A, but it does permit use of this standardized document for reporting purposes for the procedures type of trainers, updating of tactics trainers, and the separation of communication/navigation from the aircraft systems criteria report.

Now that we have completed our history of aviation reports requirements, let us see what the reports do for both the contractor and the procuring agency. If we follow a typical cycle by both the NTDC project engineer and the prospective supplier of an air warfare weapons system trainer, we can appreciate the significance of some of the major engineering reports required in the contract. As a point of information, engineering report requirements as well as all other reports and data items specified to be prepared as a contractual item will each be specified to be prepared as a contractual item will each be specified as a line item on DoD Form 1423. This form, part of a contract, is a convenient means used throughout the Department of Defense by all procuring activities as the standard procurement medium for obtaining software items.

Using Figure 169 as a reference for a typical simplified procurement cycle, we can readily see the actions undertaken by both the NTDC Project Team and the offeror. Technically speaking, during the contract definition phase, all contractors are offerors. After contract award, the successful offeror becomes a contractor. After procurement package preparation and request for proposals have been issued, offerors will prepare proposals designed to convey to the procuring agency the offeror's best engineering judgments on how to design and construct a trainer that will meet the specification requirements. The procuring agency, in our case, NTDC, must then select the one proposal that will best satisfy the requirements with due consideration of cost, implementation and support.

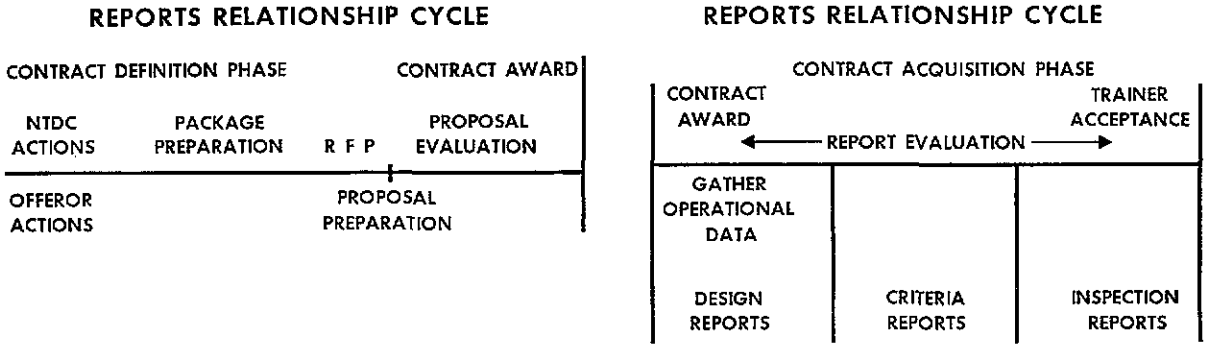

Figure 169.

At the start of the contract acquisition phase, the contractor must immediately begin to collect the operational equipment data in order to prepare designs and establish criteria. Since this hypothetical procurement parallels the operational equipment manufacture, a design freeze for the equipment will be established early after contract award, and a data freeze point afterward.

The first reports the contractor will be required to submit will be design reports. Normally they would cover the general arrangement, the instructor's station, trainee station, simulation design and other like design reports. This category of design reports are detail expansions of the information presented in the technical proposals and after approval, become the contractual design basis for the trainer. The General Arrangement Report will provide the physical layout of the overall trainer, the relationship of the trainee station to the instructor station, computer area, aisle space and general configuration of the trainer. The Simulation Design Reports define the contractor's proposed techniques to be used to provide the required simulation for each system. Using a landmass simulation as an example, the report will describe the techniques and equipment to be used to design the generations of landmass video signals. If the simulation was for a subsurface target detection system, the report would describe how the presentations and subsurface target detection systems will be simulated. Again, approval of the design reports permits the contractor to proceed with detail design and fabrication.

After all operational equipment data and parameters are definitized, the contractor will submit the criteria reports. These are the quantitative values that must be achieved for the trainer to simulate the operational hardware. The reports will specify the complete operational characteristics of the operational equipment, and the parameters and tolerance limitations to be achieved in the trainer. When the trainer characteristics differ from the operational equipment capabilities, justification must be included for the variation. In a capsule description, the criteria reports are the quantitative requirements for the trainer. Approval of the criteria reports constitutes operating limits of the trainer.

Inspection procedures reports contain the step-by-step procedures to be used to verify that the trainer hardware does operate and function as intended. "As intended" may appear to be a broad term, but it has actually been defined by both the specifications and the criteria reports. Each requirement specified in the specifications, and the data collected and presented in the criteria reports, determine the inspections and the limits and tolerances of operation and function. This direct relationship is a part of the report requirements.

To summarize, the design reports convey and establish configuration and design techniques, the criteria reports (based upon operational hardware) establish the quantitative requirements, and the inspection procedures reports establish the methods to verify that the trainer will do what the specification and quantitative requirements stipulate.

We have seen the evolution of the NTDC data requirements documents leading to the present Bulletin 31-1 for aviation training devices and generally described the purpose served by the design, criteria, and inspection procedures reports. If we go back to our first figure, you will note that the design data documentation specifications were updated every few years. The current Bulletin 31-1 is now almost two years old. It would seem that it is time for a new document to be published. We have had some discussions with representatives from industry concerning this document and received suggestions which indicate a need for better definitions of the tactics design reports and the tactics criteria reports. Changes for the digital computer report have also been indicated. I would like to state at this time that comments from industry are most welcome, and these comments, together with suggestions from our own engineers for simplifications and methods to streamline the data reporting task for both the contractor and the NTDC project engineer, are currently under consideration for the next revision of this air warfare bulletin. Concurrent with this review, the Sea Warfare Department and the Land Warfare Department are each developing parallel documents for report requirements in their respective areas. Our ultimate objective is to coordinate the requirements of all the engineering departments in one document and standardize and minimize to the maximum extent practicable.