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INTEGRATED LOGISTICS SUPPORT PLANNING

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SUMMARY OF REVISIONS: This directive supersedes National Weather Service Instruction (NWSI) 30-3102, "*Integrated Logistics Support Planning"*, dated November 20, 2002. Changes made reflect NWS Headquarters reorganization effective April 1, 2015.

Signed — October 20, 2017
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Director, Office of Observations

Integrated Logistics Support Planning

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1. Introduction. The National Weather Service (NWS) warning and forecast mission requires extensive application of electronic equipment and systems for environmental monitoring, data acquisition, data processing, and product dissemination. Extensive upgrade and product improvement efforts are scheduled for such systems within the NWS, and comprehensive support of these systems is required to be planned. This document describes an Integrated Logistics Support (ILS) planning process and provides policy and guidance for application of ILS principles to NWS systems. The ILS factors discussed in this chapter apply whether maintenance and logistics support are performed in-house or obtained through contracts.

Individuals' assigned responsibility for managing development and support of nationally deployed NWS equipment are responsible for determining, implementing, and managing the maintenance support of the equipment. The lead NWS office managing a particular program is designated as the Program Office (PO). The PO is responsible for ensuring funding is available for initial support infrastructure which may include site spares, depot spares, depot repair parts, and systems and equipment for depot test and repair.

1.1 Purpose. The purpose of this chapter is to provide NWS-wide ILS planning policy and guidance for new initiatives, upgrades and modifications, and replacements of equipment and systems for all NWS programs. The policy and guidance are intended to ensure coordination, consistency, standardization, and comprehensive consideration of all relevant support factors when equipment program changes are planned. The goal is to provide the most reliable and cost-effective maintenance and logistics support programs possible by ensuring that related support is adequately considered in the initial design and/or selection of systems and equipment. This approach is necessary to assure that NWS is able to meet its mission objectives.

1.2 Scope. The material presented in this chapter has broad application in support planning for all NWS equipment and systems. The principles presented apply equally well on minor equipment upgrades and on major system acquisitions. A comprehensive planning approach is provided, but it should be streamlined and tailored to the specific needs of the program.

1.3 The Integrated Logistics Support (ILS) Process. ILS is concerned with the efficiencies achieved by systematic planning, implementation, and management of maintenance and logistics support resources throughout a system's useful life. In many cases, the impact of maintenance and logistics support factors will directly affect decisions made in equipment selection and/or design. In some cases, it can be the controlling issue in the selection and/or design process. For this reason, the ILS process is required to be initiated as early as possible in the planning stages of a project, due to the critical nature and potential impact of maintenance and logistics factors on the overall project costs, performance, and reliability.

ILS is realized through the proper integration of maintenance and logistics support elements with each other and through the application of related considerations to the decisions made on the design of the equipment or system. The principle ILS elements are:

1. Maintenance

2. Workload and staffing

3. Training

4. Supply support

5. Facilities

6. Test and support equipment

7. Computer resources support

8. Technical data,

9. Transition

10. Funding

When system change is encountered (new initiative, upgrade, replacement), the impact to each ILS element is required to be considered. Under ILS, the importance of trading off operational and support requirements from the earliest phases of system change is recognized. In most cases, support represents a major portion of the total cost of a project. By integration of ILS considerations into the conceptual planning and through the entire design and development process, support costs during later operation may be significantly reduced and/or operational availability of the system may be increased without a significant increase in cost.

In addition to integrating support planning into the entire design and development process, it is also fundamental to the ILS concept that the ILS elements be integrated with each other into a total support system. When any element is changed or proposed for change, the effect on all other elements is required to be formally considered on the total support system and the necessary adjustments that need to be made.

In applying the concept of ILS to equipment or a system, it is important to maintain a proper perspective. ILS is not an end in itself but exists only to support development of logistics support and operation of the system. Support problems will vary according to the complexity and cost of the involved systems.

The ILS process should also result in the development of various support products which provide the methods and means for accomplishing the various aspects of support. These products, once developed, will be used in the day-to-day ongoing maintenance and support of the system or equipment. Examples of these products would be vendor and NWS generated documentation, special maintenance tools, software maintenance and test programs, sparing philosophy, tracking systems, etc. It is imperative that all necessary support products are identified early in the process and that all contractor- furnished products are included as specific deliverables in the initial contracts. Any NWS generated products are required to be planned and scheduled as well.

1.4 ILS Planning During Acquisition of Major Systems. Acquisition can be defined in four phases: concept and exploration, demonstration and validation, full-scale development, and production. Program activities and ILS planning activities that take place during acquisition are discussed below. These activities apply to major systems acquisitions but can be tailored to small projects.

1.4.1 Concept and Exploration. Overall program activity involves identification of agency mission needs for equipment and exploration and selection of alternative equipment concepts for the application. ILS planning is primarily directed toward the evaluation of alternative maintenance concepts in relation to alternative support concepts for supply support, test and support equipment, facilities, and personnel. A spares model should be included as part of the overall sparing philosophy developed during this phase. Based on these trade-off studies and maintenance task analyses, the system maintenance concept is defined.

1.4.2 Demonstration and Validation. Overall program activity involves development and testing of prototype equipment to evaluate selected equipment against mission and program objectives; to assess risk and uncertainty; to estimate acquisition and ownership costs; and to evaluate capabilities of the contractor(s). The critical ILS requirements are identified and validated, and a preliminary ILS plan is developed. These are accomplished through refinement of the maintenance concept; the continued updated input to the logistics support analysis; and the identification of standard test and support equipment, available facilities, training devices, transportation capabilities, and mandatory support-related design constraints. It is during this phase that draft versions of technical, provisioning, and other support documentation are developed and pilot sessions of the training courses are developed and finalized.

1.4.3 Full-Scale Development. Overall program activity involves applying the knowledge gained from prototype equipment to the development and operational test of initial product units. ILS planning is directed toward the identification and validation of the adequacy of maintenance resources for each level of maintenance (on-site, regional, central). The ILS plan is updated and validated during development and operational testing to ensure that the defined maintenance and logistics requirements can be properly trained before deployment. The actual training sessions should be tied to the deployment schedule and involved personnel should receive training approximately two months before deployment at their site.

1.4.4 Production. Overall program activity involves quantity production and inspection of equipment and subsequent delivery to field sites. ILS assessments are conducted on early production units, and the ILS plan is executed, usually by the PO in concert with regional engineering representatives. Interim support, either contractor or Government, may be required until appropriate organizations have assumed ILS responsibilities (e.g., warranty repair). Sufficient pipe line spares will be available when the first system is fielded. The lack of sufficient spares will delay deployment and formal system commissioning. During deployment, ILS methods may need to be revised when indicated by a review of field data or when equipment improvements or modifications have been made.

2. Responsibilities. It is the responsibility of each PO within the NWS to give proper thought and attention to ILS factors for projects that will require NWS resources (funding, staff time, etc.) for support. For major projects, original equipment costs are often a small percentage

of total equipment life-cycle costs (LCC). Therefore, for major projects, an ILS Manager position will be established to chair a multi-disciplined ILS team that is responsible for maintenance and logistics development on these projects. NWS ILS planning will be accomplished in accordance with this manual and will be fully coordinated with the OBS.

It is the responsibility of the PO to define engineering, testing, maintenance, logistics support, and facilities requirements for all development and procurement activities supporting the NWS.

3. ILS Planning Policy. ILS planning policy is provided in the following sections.

3.1 Application. ILS planning will be considered and documented for all equipment or system changes including new initiatives, upgrades or modifications, and replacements.

The amount of planning required is usually proportional to the complexity and cost of the change and may range from several hours to many months.

3.2 Coordination. There will be early coordination among all organizational units affected (present and future) by the change. This includes all that will be involved during acquisition (concept and exploration, demonstration and validation, full-scale development, and production), implementation, operation, and maintenance. Interagency maintenance opportunities should be considered.

3.3 Design Considerations. When system change involves design or redesign, ILS considerations will be included in the equipment specifications or requirements documentation.

3.4 Use of Existing Maintenance and Supply Systems. Existing maintenance and supply systems and procedures described in NWS PD 30-21, *System Maintenance* and in NWS Manual 30-3101, *Supply Manual and Catalog* will be one alternative considered for maintenance and logistics support. In most cases, use of these systems will provide the most economical approach and avoid unnecessary redundancy. They also provide significant data capture to allow efficient management of support programs.

Complete outside contract maintenance, not using any NWS infrastructure, can be expensive. It may be best suited to equipment with a two-year or shorter life cycle or equipment at only one or a few sites. The NWS equipment support infrastructure is flexible enough to allow for a number of support options. For example, on-site or depot spares may or may not be needed, parts may be repairable or disposable, the repair depot may provide repair itself, or the repair depot may arrange for outside warranty or contracted repairs. Site technicians with on-site spares are most important when rapid restoration times are needed. Risk to NWS of losing repair capability may be minimized by seeking multiple repair vendors or using in-house capabilities. Deviation from these standard maintenance and supply approaches will be supported by a strong rationale, such as increased benefits or cost savings.

3.5 Maintenance Training. Appropriate planning and early participation by NWS Training Center representatives will be required to ensure an effective and stable maintenance training program. Contractor-developed maintenance manuals will typically be the text books used for formal training. Generally, the training concept will be based on fault isolation and system restoration techniques, with emphasis on troubleshooting rather than theory, and will emphasize use of built-in test equipment, diagnostic firmware, and terminal-accessed fault isolation algorithms. Where appropriate, laboratory sessions will simulate troubleshooting of failed systems.

In addition to hardware maintenance courses, consideration will be given to other training requirements such as systems administration, software maintenance, team leadership, and equipment operations. Site electronics staff are usually the designated systems administrators and frequently must answer questions from meteorological operations personnel on equipment operations.

Consideration of cost-saving training alternatives are required--less resident training, use of computer-based instruction, application of modern distance learning concepts, etc.

3.6 Evaluation and Demonstration. Each system change will be subjected to an evaluation and operational demonstration process. The extent of each analysis to be conducted will be tailored, within monetary constraints, to each specific type of equipment and acquisition phase. Each major acquisition should be subjected to operational, maintenance, and logistics demonstrations during full-scale development.

4. Contents of an ILS Plan. Typical contents of an ILS plan are discussed in this section. The contents should be tailored to the specific project and type of equipment. The policies, objectives, and/or standards established by this chapter will be included in the ILS plan by reference. The duplication of this information in each ILS plan is discouraged. Major acquisitions, such as the Advanced Weather Interactive Processing System (AWIPS), require lengthy and comprehensive planning. Routine system changes usually do not require the same depth of planning, but the project manager will consider the relevance of each ILS topic and plan accordingly. A typical table of contents for an ILS plan is provided in exhibit 1.

4.1 Introduction. The introduction section may contain background information, such as project mission or purpose, description of the system being acquired or the equipment being changed, and external dependencies. It is generally brief and makes reference to other detailed documentation (program or project development plan, technical plan, system requirements, etc.), rather than repeating this information.

4.2 Maintenance. This section describes the maintenance concepts and approaches that are envisioned for a new or changed system. These are developed very early in planning for system change. One major thrust should be the exploitation of new technologies that will permit significant reductions in the number and duration of maintenance tasks and personnel skill requirements. Savings in spare parts, storage space, transportation needs, and most importantly, in maintenance personnel will result. To reap full benefit from these potential savings, the most advantageous maintenance approach for each system will be developed and implemented with due consideration given to its current status and its expected operational constraints. Typical factors to consider include:

1. Incorporate maintenance requirements into the equipment performance specifications.

2. Strive for standardization.

3. Exploit current technology and consider use of off-the-shelf items.

4. Design for high reliability such as redundancy of critical items.

5. Design operational backup features into equipment.

6. Design for easy maintenance access to facilitate parts replacement.

7. Stress use of built-in test and calibration equipment.

8. Strive for module replacement and reduced need for resident maintenance training.

9. Design for automatic testing of modules at the depot repair facility.

10. Secure proprietary data rights consistent with support concept.

The maintenance discussion should contain a description of the requirements and tasks to be accomplished for achieving, restoring, or maintaining the operational capability of the system. It should include periodic (e.g., preventive or scheduled) and corrective maintenance particulars at each level of maintenance. It is the basis for determining and acquiring all other support element requirements. See NWS PD 30-21, *Systems Maintenance*.

4.3 Workload and Staffing. This section describes the impact that a new or changed system is expected to have on Government support personnel. Workload increases may lead to a requirement for site staffing increases. Changes in site staffing levels will be coordinated with and approved by the Chief Financial Officer. The PO will support preparation of maintenance workload analyses. Workload is required to be evaluated for hardware and software (e.g., systems administration) aspects of the support requirement.

4.4 Training. This section describes the maintenance training required for the equipment or system. Both contract and in-house training alternatives should be considered. For less rigorous training, nonresident training alternatives, such as computer-based instruction and distance learning, may be appropriate. The policy of section 3.5 should be followed in the development of training requirements.

4.5 Supply Support. The supply support process expected to be used for the equipment or system is described in this section. Maintaining operational availability, under diverse conditions of use, depends directly on the availability of the right supplies at the time and place they are needed. Supply support is an essential element of the ILS plan and is required for the timely provisioning, distribution, and inventory replenishment of spares, repair parts, and special supplies. Supply planning for spare and repair parts will be based on technical input from system developers, maintenance planners, and engineers. Additional guidance on spares requirements is available in NWS M30-3103, *Provisioning Guide*.

The supply support process typically consists of:

1. Developing, validating, and analyzing provisioning spares documentation and logistics support data.

2. Determining, finding, and furnishing the range and quantity of support items necessary to support prototype equipment during the various test phases.

3. Determining and finding the range and quantity of support items necessary to operate and maintain the equipment or system for an initial operational period.

4. Routine funding of replenished items for the supply system.

Supply support planning will consider all spare parts for the life of the system. Spare parts will be identified for each project assembly. These spare parts include repairable line replaceable units (LRU), consumables, and piece parts used in the repair of all components. For each part identified, an estimate of failure rate, decision on repair or discard, current unit cost of the part, alternative part source and expected years of continued manufacture will be obtained.

Additional amounts of spares should be purchased if system expansion is a possibility because of the resulting increased spares requirement, or if planned, to release spares for use in system expansion.

Take into account the future availability of spare and repair parts when performing supply support planning. Pay particular attention to the impact of obsolescence on system maintainability. Guidance on how to manage obsolescence in contained in NWSI 30-3105, *Diminishing Manufacturing Sources*.

Supply support planning will consider the entire process of spare parts management: receive, warehouse and storage, issue, packing, handling, transportation, status control and replenishment of stock, depot repair and automatic test equipment, and quality assurance. Each of these functions is discussed below.

1. <u>Receive</u>. This function includes unloading, inspection, and processing of material shipments and related documentation.

2. <u>Warehouse and storage</u>. This function includes identification and specification of the storage environment, space requirements, need for stock rotation and consideration of shelf life, and stock maintenance (e.g., charging of stored batteries).

3. <u>Issue</u>. This function includes the controlled release of material for distribution to authorized sites.

4. <u>Packing</u>. Adequate planning for preservation packaging, packing, and marking should be in accordance with NWS standard specifications and ensure that the

products involved are adequately protected from the hazards of the environment to which they will be subjected and that the marking and labeling, both internal and external, ensure safe and expeditious handling and use. See NWS I 31-3104, Packing and Marking.

5. Handling. Handling concepts and constraints will be defined early in the program and planning developed to ensure that any jigs, slings, fixtures, or other special handling equipment can be designed, developed, and supplied in sufficient time to permit their use when required. Handling concepts and constraints include consideration of special handling equipment required during storage.

6. Transportation. Transportability of equipment and logistics items will be a major consideration in system design. The required type of transportation, together with any special needs, will be stated in the system's development specifications. Transportation planning will ensure that the mode of transportation meets program schedules and priorities and that other requirements such as preservation, packing, marking, shipping dimensions, and hazard precautions are developed in conformance with this mode of transportation, as well as any secondary or emergency modes of transportation which may apply. A transportability assessment may be conducted and updated during each acquisition phase. Transportability should be tested during an operational demonstration, if any.

7. Status control and replenishment. This function includes determination of buy quantities of stock items using inventory management techniques, economic order quantity principles, and procurement of replenishment stock to ensure items are not subject to back order.

8. Depot repair and automatic test equipment. This function includes planning for piece part repair of LRUs, including the possible operation and maintenance of automatic test equipment (both hardware and software). Consideration should be given to troubleshooting, repair, test, quality control, and return to stock of defective items received from the field for repair.

   The National Reconditioning Center, the NWS repair depot and inspection center, can provide such services as: capture of maintenance data, tracking of vendor repairs, ensuring warranty credit, first look maintenance (ensuring parts sent to vendors are in fact defective, and returning good parts to stock to save time and money and increase spare levels), in-house repair, recommending reliability improvements, implementing modifications, and obsolescence monitoring.

   Depending on the services desired and anticipated volume, the repair depot may need any of the following to be initially provided: a system for repair; component level documentation including schematics, parts lists and theory of operation; factory training, component parts; special test equipment or test fixtures; and automatic test equipment.

9. Quality assurance. This function includes planning for inspection and Government acceptance of new or repaired equipment and other supplies. It can provide quality assurance on all aspects of supply support. The function is also performed at the repair depot and acts as a gatekeeper for anything going into warehouse stock. Inspection at the facility may or may not be part of initial field deployment. Requirements to implement this function usually include a sample equipment system for duplicating as many field conditions as practical. This system may be in addition to anything provided the repair function.

4.6 Facilities. Facilities impacts are described in this section. Facilities impacts concern requirements for real property and electrical power. Real property includes all buildings, land, and related improvements required for operation and support of systems, such as access roads, weather equipment siting, security fencing, environmental conditioning, and dedicated spares. Electrical power includes utility lines, emergency power generators, uninterruptible power systems, and lightning protection. Space management, office and equipment safety, public access, and "human" engineering are also facilities considerations. Environmental compliance and safety issues will also be discussed.

4.7 Test and Support Equipment. The test and support equipment approach expected to be used for the equipment or system is described in this section. Test and support equipment concepts are identified along with the definition of the system concept and are refined throughout the life of the system. Decisions relating to automatic test equipment, built-in test equipment, design for testability, and other test, measurement, and diagnostic equipment are made early in the system life and will be updated and refined as knowledge and experience are gained on the system. Acquisition of maintenance and logistics support for the test and support equipment is part of the ILS planning process. Application of the national test equipment calibration program will be considered for project equipment which is required to remain calibrated to perform its test function.

The purpose of the test and support equipment program is to ensure that required test and calibration instrumentation are available for fault isolation and repair activities. The ability to perform periodic and corrective maintenance may depend on the test and support equipment. Standardization and consideration of opportunities to share test and support equipment among equipment program areas to fulfill common needs are a part of the planning process.

4.8 Computer Resources Support. The tasks, procedures, and functions to be performed in support of computer hardware, software, and firmware are defined in this section. This process will identify factors that provide for an orderly transition of software support responsibilities for operational, systems administration, and diagnostic software from the development contractor (if any) to the software support organization. Defining these factors will also provide an overview of necessary activities, events, and milestones. Possible discussion topics include the following for operational, systems administration, and diagnostic software:

1. Organizational responsibilities

2. Software development standards

3. Documentation requirements including reporting

4. Software testing methods

5. Quality assurance

6. Software configuration management

7. Distribution of upgrades

8. Software maintenance

9. Special resource requirements (e.g., hardware, workforce, and training) for establishing computer resources support

4.9 Technical Data Including Documentation. Technical data requirements and responsibilities for the equipment or system are discussed in this section. Technical data is recorded information used to define a design and to produce, support, operate, or maintain equipment or systems. Examples of recorded technical data include engineering drawings, specifications, standards, technical reports and data sheets, provisioning documentation, catalog item identifications, technical information packages, software listings and documentation, maintenance manuals, and maintenance and modification notes.

Technical data will be obtained in a format that allows compatibility, usability, and portability within various logistics elements with minimal change. In support of the NWS modernization initiatives, acquisition of new or updated technical data will be in an electronic format to the maximum extent possible and will be suitable for viewing on commercial electronic delivery systems such as PCs, laptop computers, or system/equipment display devices with minimum reformatting requirements.

System and equipment technical manuals and their related maintenance data (maintenance and modification notes) will transition to an interactive electronic environment and will be stored on CD-ROM or on-line. This will reduce the development and maintenance cost but will mandate minimum hardware and software requirements throughout the NWS community. This will also afford maximum utilization of existing and expanding inter-/intranet systems at minimum cost.

Technical data management is the ILS discipline which embraces the identification, coordination, collation, validation, integration, and maintenance of program technical data; planning for the timely and economical acquisition of data; ensuring the adequacy of acquired data for their intended use; and physical management of data items after receipt. Data management also includes development of requirements and specifications needed for contract preparation, supervision of the distribution of data required under the contract, and monitoring the storage, retrieval, and disposal of data. Although physical management of technical data is usually separate from configuration management, configuration management may provide the status accounting (recordkeeping) and audit functions for technical data.

Consideration will be given to purchasing reproducible manufacturing drawings (e.g., Computer-Aided Design compatible or camera-ready copy) sufficiently detailed to allow re-procurement from another source when risk of contractor withdrawal of support for an item is judged high or when an ability to competitively re-procure is required to be ensured.

See NWSPD 30-21, *Configuration and Data Management*.

4.10 Transition. Systems upgrades and replacements may have significant impact on field operations and support. There may be a need to update written operational procedures; for system familiarization and training of both operations and maintenance personnel; for periods of dual operations using both old and new systems. For contracted activities, there may be a need for making the transition from one contractor to another. For transition from contract maintenance to Government maintenance (e.g., after warranty), there may be a need for interim contract support during a transition period. If there are transition requirements, they are discussed in this section. A separate transition plan may be appropriate/necessary.

4.11 Logistics Funding, Responsibilities, and Milestones. Costs of all ILS elements will be included in all budget estimates and Life Cycle Costs (LCC) or partial program cost estimates. LCC estimates will include investment, recurring operations, and maintenance costs so that the complete impact of all program decisions can be evaluated by program managers at all times.

Costs related to equipment installations, such as facilities modifications, relocations, communications changes, and ancillary equipment purchases are part of the program/project costs and will be funded by the program.

ILS responsibilities will be documented to the maximum extent possible. Organizations and responsible individuals will be specified. Major milestones will be described.

4.12 Related Topics. Descriptions of functions which may be needed or impacted by the system change are provided below.

4.12.1 Reliability, Maintainability, Availability (RMA). RMA functions concern establishing system performance and support requirements and designing, testing, and eventual operational monitoring of systems to ensure the meeting of these requirements. Reporting of maintenance and logistics activities is a related function.

4.12.2 Configuration Management (CM). CM functions concern identifying and documenting the functional and physical characteristics of a system, controlling changes to those characteristics, recording and reporting change processing and implementation status, and verifying the accuracy of records versus actual system characteristics. It also involves the establishment of baselines, functional configuration audits, and physical configuration audits. Specific CM policies and guidelines are covered in NWS PD 30-21, *Configuration and Data Management*.

4.12.3 Quality Assurance (QA). QA functions concern establishing system test requirements (development, production, operational), plans, methods, and procedures to verify that systems and system changes meet intended purposes. Follow-on operational monitoring (data quality, equipment inspections) is a QA function.

4.12.4 Life Cycle Cost (LCC). LCC is a costing technique which considers operating, ILS and other costs of ownership, as well as acquisition cost in the award of contracts for hardware and related support. Monitoring systems costs, once operational, can be included as an LCC function.

4.12.5 Standardization. Standardization involves applying a consistent approach in developing system concepts, designs, operational and support procedures, test equipment, use of facilities, etc. Wherever possible, the use of standardized approaches to the various ILS elements is recommended. This approach will normally result in significant cost savings and avoid unnecessary duplication of effort. Through standardization, savings can be realized in the costs of tools, spare equipment, support facilities, hardware, software, and training.

4.12.6 Interagency Support. Interagency support involves considering the possibilities and benefits of interagency program participation. For example, for NEXRAD a central logistics depot function is provided by the NWS to the Departments of Defense and Transportation. Interagency agreements are required to be prepared, coordinated, and approved for interagency support efforts.

Exhibit 1: TYPICAL TABLE OF CONTENTS FOR AN
INTEGRATED LOGISTICS SUPPORT (ILS) PLAN

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