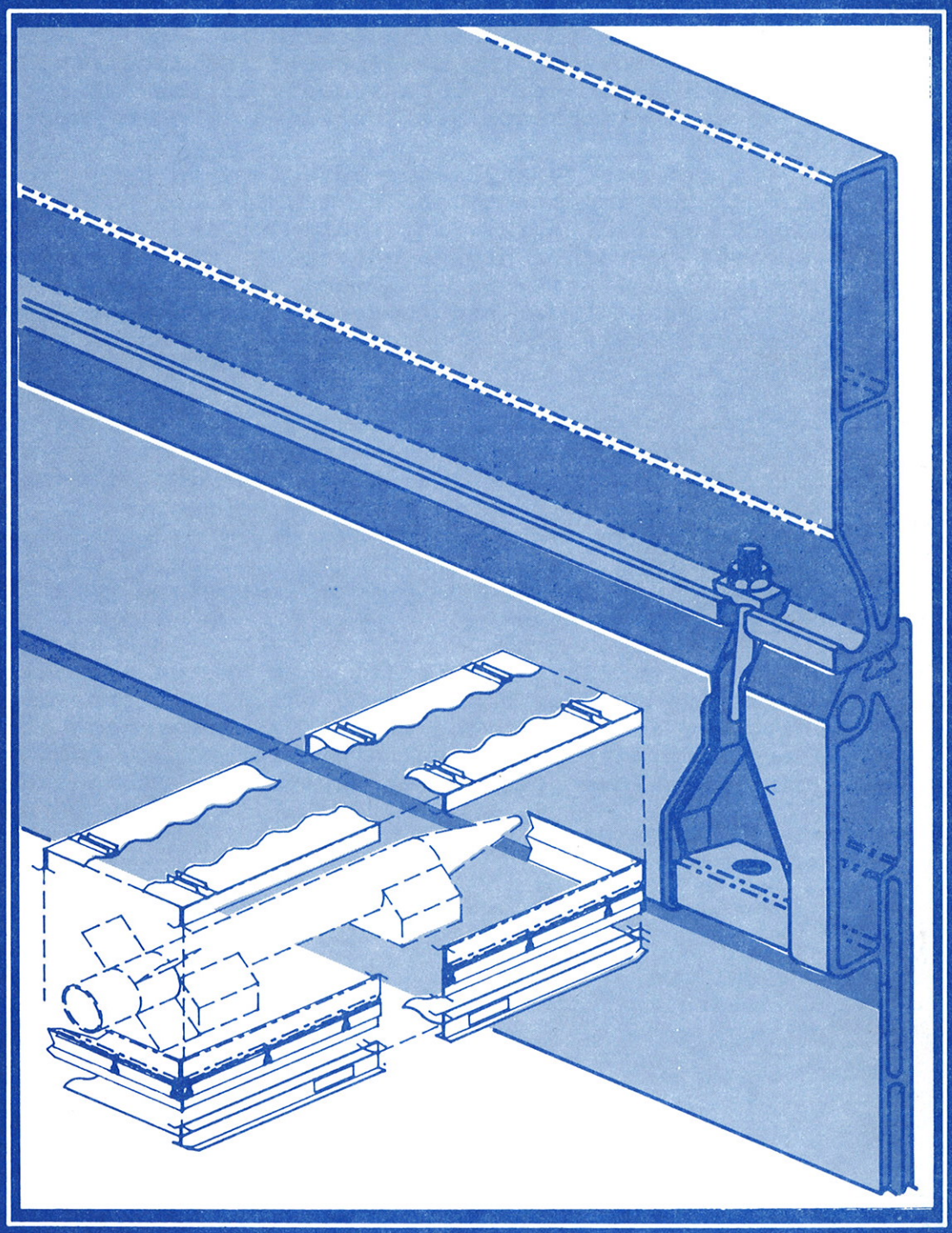
ANNUAL REPORT

1986



AIR FORCE PACKAGING EVALUATION AGENCY

WRIGHT PATTERSON AIR FORCE BASE DAYTON OHIO 45433

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE LOGISTICS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

1. The Air Force Packaging Evaluation Agency provides a leadership role in the development and application of packaging engineering technology. A summary of the Agency's projects and major accomplishments are contained in this report.

2. In the past year, major advancements have been realized through the implementation of a whole new set of current computer-aided engineering equipment and the development of improved container design concepts. These new designs will cut costs, reduce risk, and increase reliability of the containers used to protect our high cost, complex weapons from the hazards of shock, vibration, and sometimes very harsh environmental conditions.

3. We look forward to future significant achievements by the Agency. Many new highly talented people have joined the work force and we can expect a substantial improvement in the application of new engineering technology. Most important will be advances in container system designs, packaging material selection/application, guidance provided to other major Air Force commands, and continued improved interface with other Department of Defense components.

4. Industry plays a critical part in the overall progress made to improve package engineering throughout the world. We hope to encourage industry along with other government activities, to share information concerning new technology that may help us jointly achieve greater improvements in packaging.

FOR THE COMMANDER

William J. Friel

WILLIAM J. FRIEL
Colonel, USAF
DCS/Distribution

AFPEA MISSION

THE AIR FORCE PACKAGING EVALUATION AGENCY PROVIDES THE DEPARTMENT OF THE AIR FORCE WITH AN ENGINEERING CAPABILITY THAT IS AVAILABLE TO ALL MAJOR COMMANDS AND TO CERTAIN OTHER FEDERAL AGENCIES. TO ASSURE DYNAMIC ENGINEERING AND TECHNICAL PROGRESS IN PACKAGING, THE AFPEA INVESTIGATES, DESIGNS, DEVELOPS, TEST, AND EVALUATES CONTAINERS, MATERIALS, METHODS, AND TECHNIQUES.

- AFPEA IS RESPONSIBLE FOR AN AVERAGE OF 70 PROJECTS
- MAINTAINING 52 SPECIFICATIONS AND STANDARDS
- AF CUSTODIAN AND COORDINATION OF OVER 350 SPECIFICATIONS AND STANDARDS
- LEAD SERVICE ACTIVITY FOR TESTING IN 12 ASSIGNED AREAS.

AIR FORCE PACKAGING EVALUATION AGENCY
HQ AFLC/DSTZ
JACK E. THOMPSON, DIRECTOR
AUTOVON 787-2638

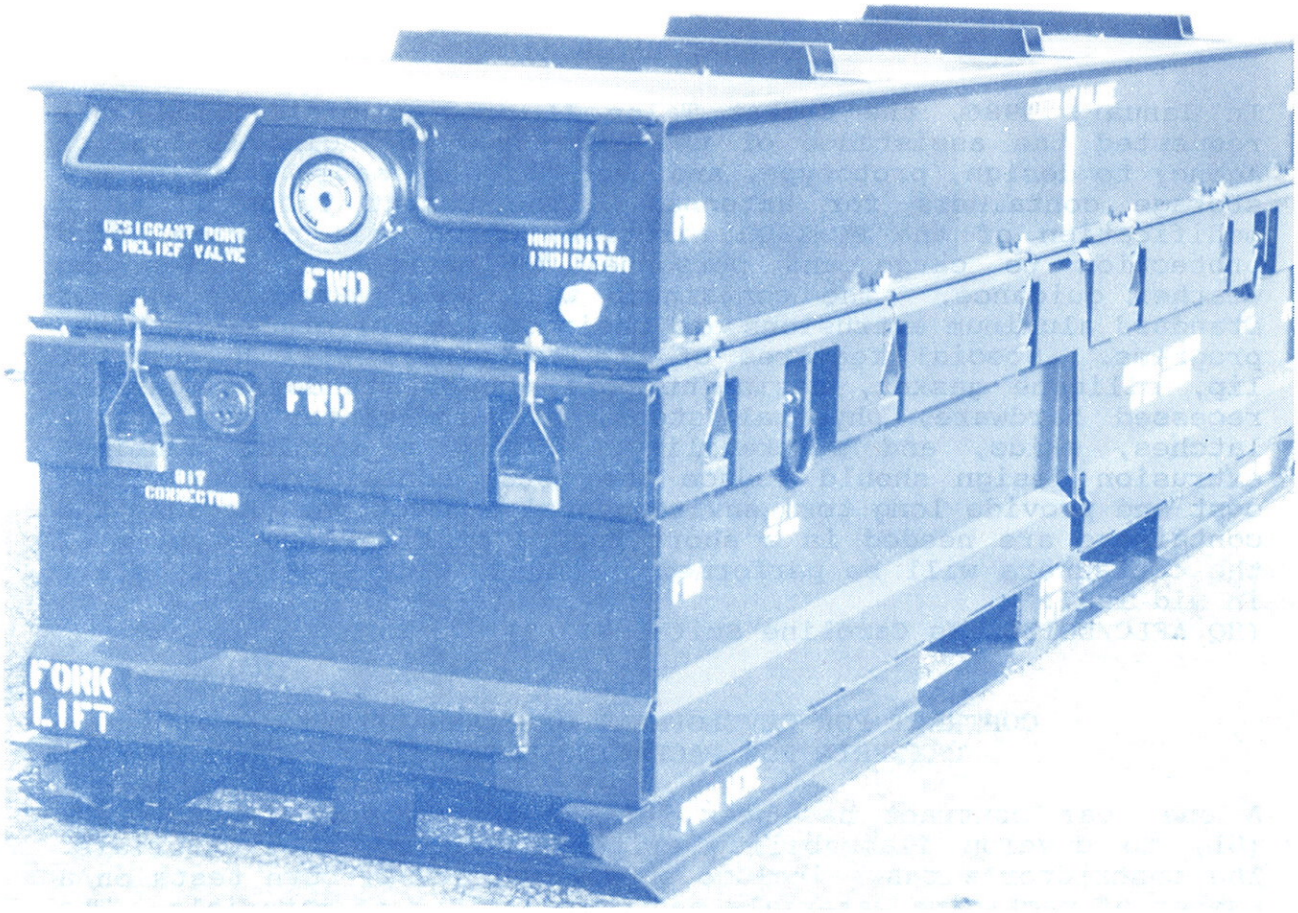
DESIGN BRANCH
HQ AFLC/DSTZD
RALPH ZYNDA, CHIEF
AUTOVON 787-3362

MATERIALS ENGINEERING BRANCH
HQ AFLC/DSTZT
M. A. VENETOS, CHIEF
AUTOVON 787-4234

1986 ANNUAL REPORT ITEMS

NEW ITEMS

1. ALUMINUM CONTAINER DESIGN CONCEPT
2. COMBAT TALON II
3. CONTRACT FOR DEVELOPMENT OF FLAMMABILITY CRITERIA FOR PACKAGING MATERIALS
4. PERFORMANCE ORIENTED PACKAGING (POP) OF HAZARDOUS MATERIALS
5. 30MM AMMUNITION CONTAINER EVALUATION
6. F-16 300 GALLON NESTED FUEL TANK CONTAINERS
7. LOW ALTITUDE NAVIGATION OF TARGETING INFRARED NIGHT
8. DEVELOPMENT OF PACKAGING SYSTEM FOR LIGHTWEIGHT AVIONICS
9. EVALUATION OF AIRCRAFT PROTECTIVE COATINGS
10. EVALUATION OF HUMIDITY INDICATORS
11. CHEMICAL COMPATIBILITY TESTING OF BARRIER MATERIALS
12. EVALUATION OF 3M MONITOR MARK INDICATOR
13. EVALUATION OF PELESPAN MOLD-A-PAC MATERIAL



ALUMINUM CONTAINER DESIGN CONCEPT

The Air Force Packaging Evaluation Agency (AFPEA) has developed a modular container design concept using standard aluminum extrusions. The extrusions enable flexibility in dimensioning without the expense of purchasing additional extrusions each time dimensions change. The modular container design can be easily modified using the Computer-Aided Design System (CADS). CADS provides an easy interface between AFPEA and the Air Logistics Centers to modify the container design as program requirements change. This approach will save a considerable amount of manhours, lead time and cost in new container development.
(HQ AFLC/DSTZD, Mr Ted Hinds, 73362)

COMBAT TALON II

In January 1986, the Combat Talon II program office (ASD/AFZ) requested the assistance of the Air Force Packaging Evaluation Agency to design, prototype, and test three reusable shipping and storage containers for antennas. The Combat Talon II is a modification of the MC-130H aircraft, which will provide added protection to cargo and personnel by terrain following and weather guidance. The containers will make extensive use of standard aluminum extrusions and basic designs of other container programs. Special features of the containers will be a water lip, silicone gasket, desiccant port, cover standoffs, gasket, recessed hardware, physical stops, over-the-center cam action latches, skids, and stackability. Using a modular aluminum extrusion design should reduce the total container acquisition cost and provide long term environmental protection. Because the containers are needed in a short period of time, prototyping of the containers will be performed in-house, with testing to start in mid 1987.
(HQ AFLC/DSTZD, Ms Caroline Smith, 73362)

CONTRACT FOR DEVELOPMENT OF FLAMMABILITY CRITERIA FOR PACKAGING MATERIALS

A one year contract has been let to Underwriters Laboratories (UL) to develop flammability criteria of packaging materials. The contractor's tasks include performing actual burn tests on a number of packaging materials and combinations of materials. The contract is a follow-on effort to a contract recently completed by Ohio State University (OSU). The OSU effort developed the equipment and performed a limited number of burn tests.

The major objectives of the UL contract are to develop additional burn test data, further refine the test methodology and equipment and provide a list of independent laboratories capable of performing the test. The findings resulting from this contract will be used to incorporate improved test procedures and requirements in packaging material specifications.
(HQ AFLC/DSTZT, Mr Ted P. Smith, 74519)

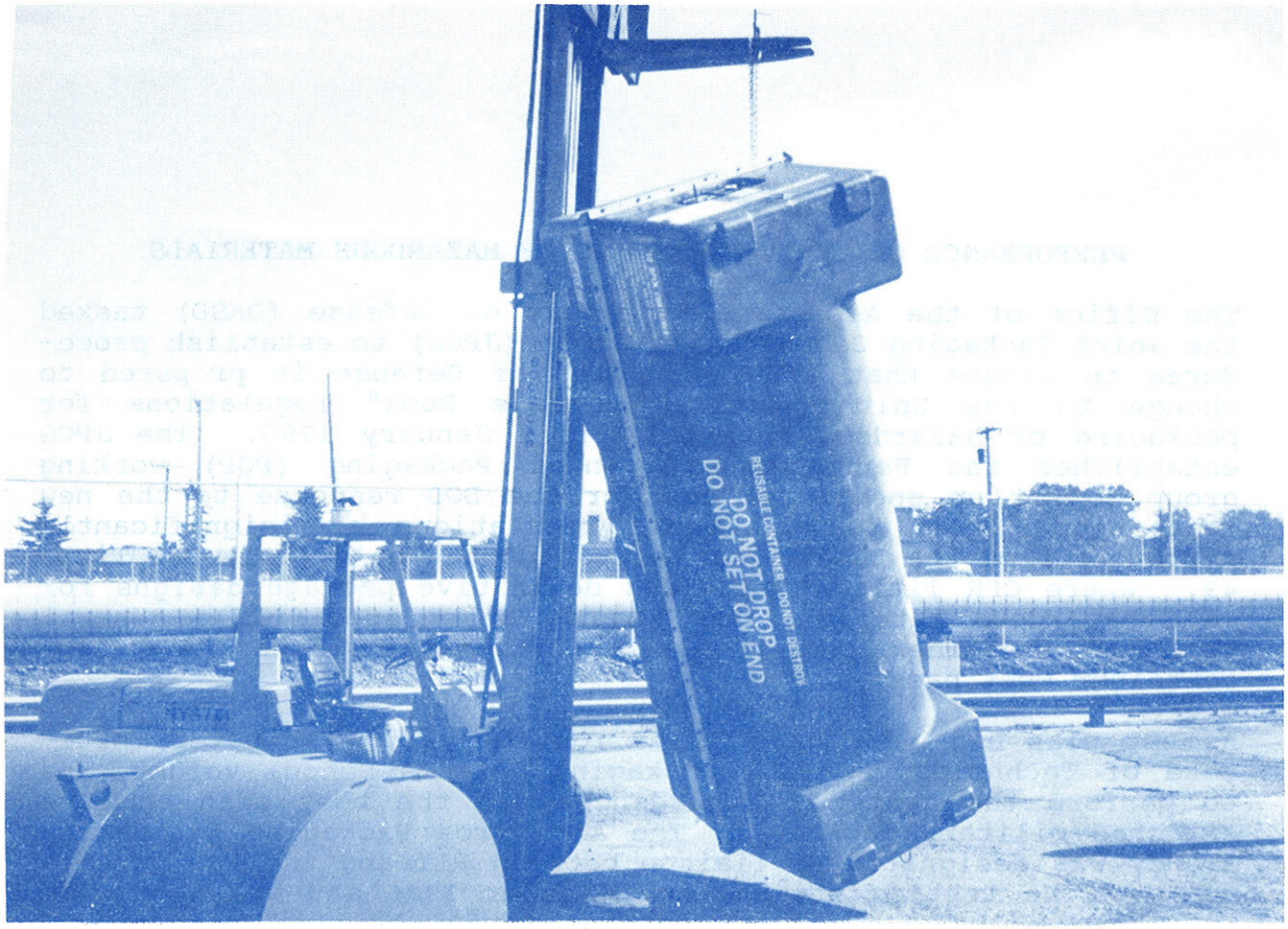
PERFORMANCE ORIENTED PACKAGING OF HAZARDOUS MATERIALS

The Office of the Assistant Secretary of Defense (OASD) tasked the Joint Packaging Coordinating Group (JPCG) to establish procedures to ensure that the Department of Defense is prepared to change to the United Nations "Orange Book" regulations for packaging of hazardous materials by 1 January 1990. The JPCG established the Performance Oriented Packaging (POP) working group to set up specific plans for the DOD response to the new regulation. The "Orange Book" regulations are significantly different from the Department of Transportation's (DOT) CFR Title 49. Where CFR Title 49 provides definitive package designs for each hazardous material, the "Orange Book" specifies a general type of container and specific performance tests which the container must pass.

A test plan has been established for DOD use. Rochester Institute of Technology's (RIT) Packaging Science School volunteered to perform the tests in accordance with the test plan on some selected military packages. The Air Force Packaging Evaluation Agency was designated as liaison between RIT and the POP working group. The testing started in November 1986 and will continue until March 1987. The data generated will be used to evaluate the test plan, develop a central data bank for test results and provide test results on some hazardous materials packages.
(HQ AFLC/DSTZT, Mr Ted P. Smith, 74519)

30MM AMMUNITION CONTAINER EVALUATION

At a request from Ogden Air Logistics Center, an investigation into container deficiencies associated with corrosion of 30mm ammunition has been initiated. The objective of the project is to minimize corrosion and solve other container related problems. Battelle Laboratories has recently conducted a study to determine the extent of the corrosion problem. The containers involved (CNU-309/E, CNU-309A/E, CNU-332/E, CNU-332A/E and CNU-383) are used to store 30mm War Readiness Materiel, primarily in Europe. During 1987, work will be conducted to determine the practicality and cost of (1) upgrading existing containers to provide the protection needed, (2) reducing corrosion by means other than container modification, and (3) controlling the environment in which the containers are stored.
(HQ AFLC/DSTZD, Mr Mark Boals, 73362)



F-16 300-GALLON NESTED FUEL TANK CONTAINERS

At the request of Ogden Air Logistics Center, a project was established to resolve the problem of severe corrosion on fuel tanks due to water entrapment. Four of the affected containers were shipped to the Air Force Packaging Evaluation Agency for investigation/determination of the cause(s) of water entry and to provide corrective measures and instructions. Corrective measures found necessary to prevent water intrusion included replacement of the cable-type hoisting mechanism with a solid metal hoisting ring; replacement of the warped access door with a new, sturdier access door; sealing of a defective joint line where the molded flange was laminated into the container (top and bottom) shell; and replacement of the solid rubber gasket with a more resilient hollow rubber gasket. An interim test report containing details of the findings and recommended repair measures was completed and distributed. Also, detailed container repair procedures were prepared as an appendage to Technical Order 35E20-4-8-2 and distributed for implementation.
(HQ AFLC/DSTZD, Mr Prisciliano Quijas, 73362)

LANTIRN Container Design

The Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) program office requested assistance from the Air Force Packaging Evaluation Agency for container design guidance for its prime contractor. Container requirements had been documented in a specification but deviated from the standard practice of testing a container in accordance with MIL-STD-648 and Federal Test Method Standard No. 101. To change contract requirements would increase costs and delay the program. However, a decision was made to select a more functional design and durable material for the container.
(HQ AFLC/DSTZD, Mr Ted Hinds, 73362)

DEVELOPMENT OF PACKAGING SYSTEM FOR LIGHTWEIGHT AVIONICS

The Air Force Packaging Evaluation Agency currently has under development and evaluation a container system for protection of small, shock-sensitive, lightweight items such as gyros and electronic components. Previous experience has shown that design of cushioning systems for these types of items can be difficult and time-consuming; conventional design techniques using dynamic cushioning performance curves are not effective in many instances.

The system being evaluated consists of two multi-purpose containers. The smaller of the containers will provide 15G protection for items up to 4 pounds in weight and up to 7-1/2x7x6-1/4 inches in size. The larger container provides 15G protection for items in the 4 to 10-pound weight range and up to 9x9x9-1/2 inches in size.

The packs consist of a fiberboard inner container, a polyurethane cushioning system, and a full telescopic fiberboard exterior container. The two pack designs are being developed to provide low cost 15G protection for a wide variety of items as an alternative to development of custom-designed individual packs.
(HQ AFLC/DSTZT, Mr Larry A. Wood, 74519)

EVALUATION OF AIRCRAFT PROTECTIVE COATINGS

In support of the Aerospace Maintenance and Regeneration Center (AMARC), reported deficiencies in the performance of Spraylat coating materials were investigated. An on-site visit was made to review procedures, equipment, and facilities used in Spraylat coating operations in January 1987. It is believed that the problems encountered in the application of Spraylat coatings, e.g., pin holing, cracking, and peeling, can most likely be resolved by the observance of specification requirements and the implementation of the manufacturer's recommendations. Recommended corrective measures include changes in the solids content of the base coat material and the exclusive use of Class 6 (MIL-C-6799) top coat material in lieu of Class 5 material. In addition, it was determined that precautions should be taken to ensure that Spraylat materials are not exposed to freezing temperatures during transport or storage.
(HQ AFLC/DSTZT, Mr Avery D. Watson, 77445)

EVALUATION OF HUMIDITY INDICATORS

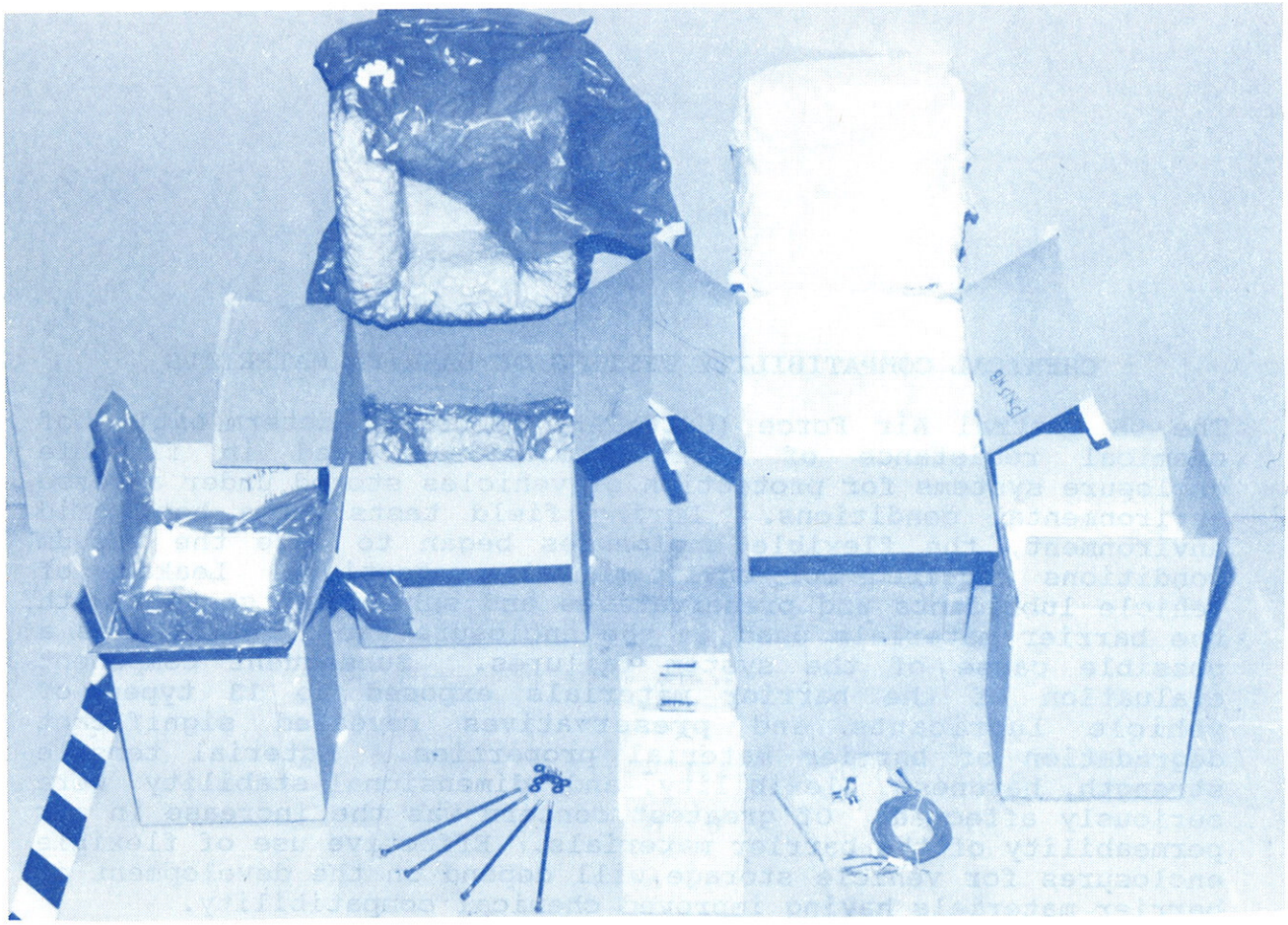
At the request of Warner-Robins Air Logistics Center, the Air Force Packaging Evaluation Agency recently investigated the cause of reversible humidity indicators turning white in field applications. It was found that cycling of humidity levels above and below the threshold level of the indicator caused the chemical coloring material to leach out of the indicating element. Results of our evaluation indicate the service life of the reversible humidity indicator is approximately inversely proportional to the level of humidity exposure.
(HQ AFLC/DSTZT, Mr Carey Scott Gravenstine, 77445)

CHEMICAL COMPATIBILITY TESTING OF BARRIER MATERIALS

The US Central Air Force (USCENTAF) requested determination of chemical resistance of barrier materials used in flexible enclosure systems for protection of vehicles stored under adverse environmental conditions. During field tests in a hot, arid environment, the flexible enclosures began to lose the vacuum conditions required for environmental protection. Leakage of vehicle lubricants and preservatives and subsequent contact with the barrier materials used in the enclosure was identified as a possible cause of the system failures. Subsequent component evaluation of the barrier materials exposed to 13 types of vehicle lubricants and preservatives revealed significant degradation of barrier material properties. Material tensile strength, hardness, flexibility, and dimensional stability were seriously affected. Of greatest concern was the increase in air permeability of the barrier materials. Effective use of flexible enclosures for vehicle storage will depend on the development of barrier materials having improved chemical compatibility.
(HQ AFLC/DSTZT, Mr Avery D. Watson, 77445)

EVALUATION OF 3M MONITOR MARK INDICATOR

New products which provide expanded packaging capability often require evaluation to determine if they function reliably in the distribution environment. To this end, the 3M Monitor Mark Indicator, which registers exposure to a temperature of 41 degrees F or less, was evaluated. The indicators were subjected to rough handling and vibration tests prior to temperature calibration to determine whether typical conditions encountered in shipment would affect their reliability. Temperature testing involved cooling the indicators from 70 degrees F to 40 degrees F in 5 degree increments. The indicators were found to be extremely accurate, actuating at a threshold temperature of 40 degrees F. Indicators with different actuation temperatures are available, for example, 32 degrees F. Their small size and pressure-sensitive adhesive backing facilitate mounting on the inner wall of a shipping container.
(HQ AFLC/DSTZT, Mr M. A. Venetos, 74234)



EVALUATION OF PELESPAN MOLD-A-PAC MATERIAL

Based on the Air Force Packaging Evaluation Agency's lead service responsibilities, the Army Materiel Command, Packaging, Storage, and Containerization Center requested the agency to evaluate the new Pelespan Mold-A-Pac, loose-fill cushioning material produced by Dow Chemical Company. This new concept in loose-fill dunnage is primarily based on the product called "Pelespan", a loose-fill bulk cushioning material. The addition of a latex bonding agent presented a possible solution to the sifting and settling problems typically experienced with the use of loose-fill materials. Due to the interest expressed in MPS as a possible alternative to foam-in-place (FIP) cushioning, special attention was given to identify performance characteristics of the new material. Unlike FIP, Pelespan Mold-A-Pac does not require special precautions or safety equipment due to material toxicity. A series of 30 inch free-fall drops were performed on FIP and MPS filled containers. The Pelespan Mold-A-Pac provided better protection for lightweight items with static bearing stresses between 0.1 and 0.4 psi; however, items with greater bearing stresses caused the material to lose its adhesive-bound integrity during impact, returning Pelespan Mold-A-Pac performance back to the typical loose-fill characteristics. The FIP material was found to be superior to MPS in its ability to retain material integrity and reliability after a series of free-fall impacts. (HQ AFLC/DSTZT, Mr Carey Scott Gravenstine, 77445)

1986 ANNUAL REPORT ITEMS

UPDATED ITEMS

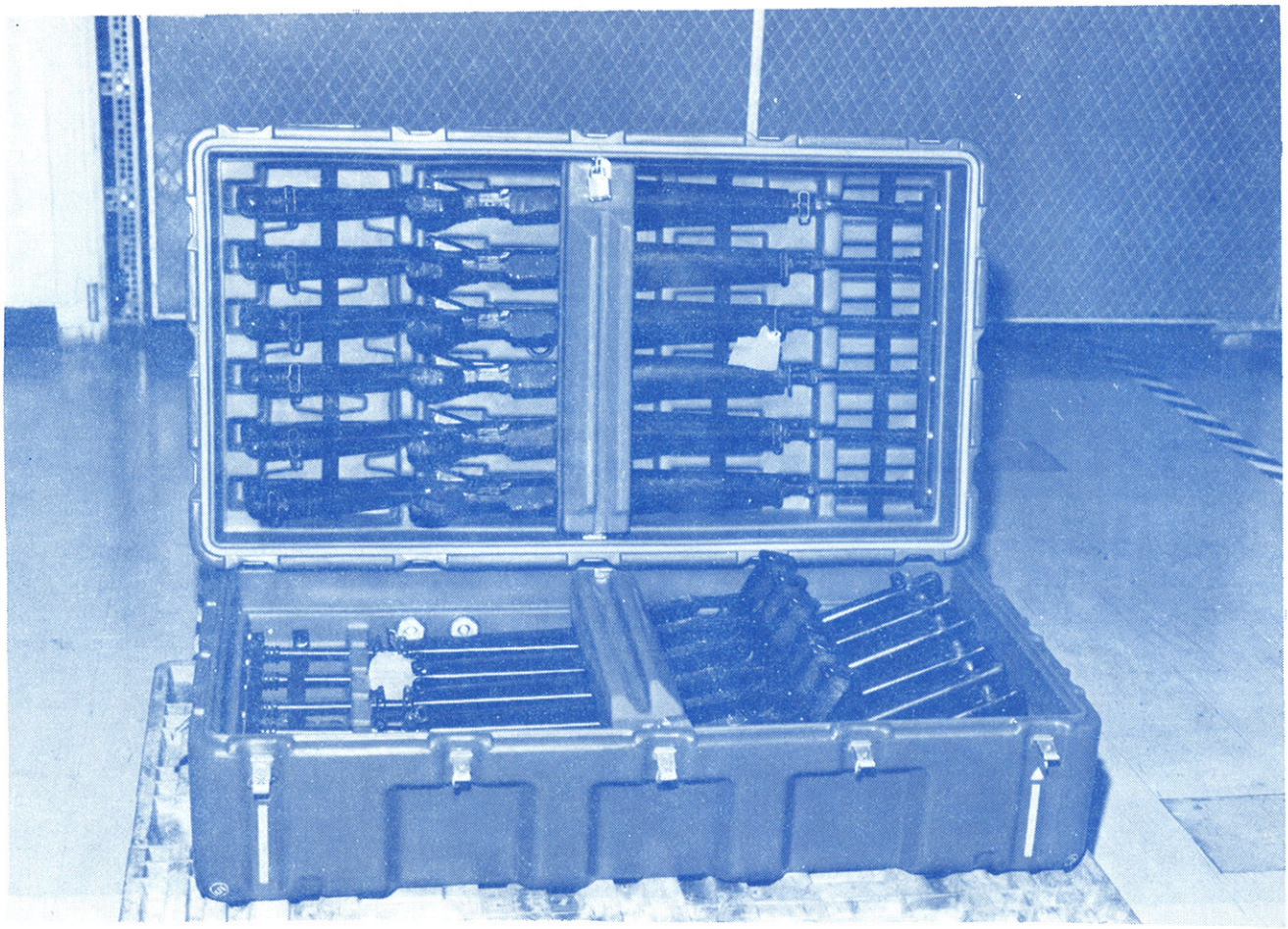
1. INVESTIGATION OF MULTIPAK SHIPPING DAMAGE
2. SHELTERED EQUIPMENT CORROSION PROTECTION
3. M-16 WEAPONS CONTAINER
4. COMPUTER-AIDED DESIGN SYSTEM
5. CLEATED CORRUGATED PLASTIC CONTAINER
6. MAVERICK MISSILE CONTAINER
7. SOUTHWEST ASIA STORAGE TEST

INVESTIGATION OF MULTIPAK SHIPPING DAMAGE

MULTIPAK is a general purpose reusable fiberglass container designed to ship F-16 aircraft radar instrumentation sets ranging in weight from 100 to 300 pounds. Although the MULTIPAK has been used successfully over seven years for shipping old F-16 radar components, an aircraft instrumentation manufacturer recently reported damage to heavier improved generation F-16 radar components. Both in-house and field testing of the container has revealed deficiencies in the equipment mounting brackets resulting in the dislocation of equipment when subjected to severe shock inputs. Several "quick fix" modifications for the 76 containers currently in the system were investigated and recommended to Acquisition Logistics (Policy) Packaging (ASD/ALXP). Neoprene "bumper" pads were located between the load platform and container bottom panel to reduce shock incurred if the platform "bottomed" during impact. Also, shims were installed under the shock mounts to raise the load platform an additional inch above the container bottom, thereby providing extra clearance to prevent bottoming shock impacts. Although these modifications did reduce the level of the shock inputs during impact, the degree of improvement was not enough to achieve the required 15G protection level. Tie-rods linking the hinged mounting brackets did successfully increase bracket rigidity to prevent dislocation of equipment. A decision is pending on the type of design modification before using the container for the heavier later generation F-16 radar components.
(HQ AFLC/DSTZT, Mr Edward P. Moravec, 74519)

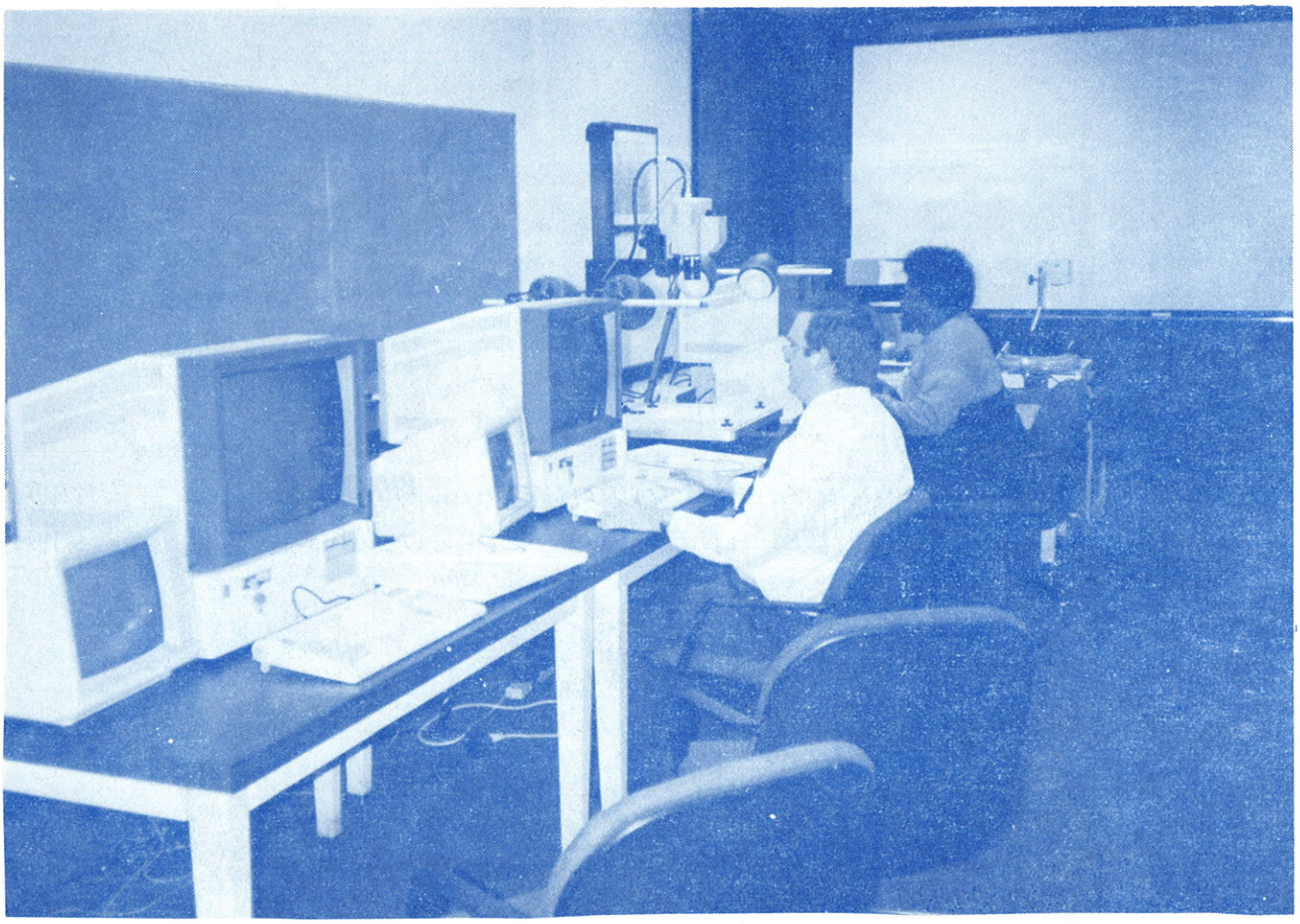
SHELTERED EQUIPMENT CORROSION PROTECTION

Prototypes of the Free Breathing Static Dehumidification system were developed and tested for corrosion protection of equipment in shelters, trailers, or vans during storage and nonoperational periods. It was determined that the Free Breathing Static Dehumidification units performed very well in their draw-down configuration; however, the units did not control the relative humidity for the anticipated 1.8 years during the service phase. It has been concluded that the Free Breathing Static Dehumidification system does not have the capability to control the internal relative humidity in "run-of-the-mill" shelters, trailers, or vans or newly refurbished shelters, trailers, or vans. The Free Breathing Static Dehumidification system would have to be installed in specially designed equipment that has the high level of air tightness required for the Free Breathing Static Dehumidification system to optimumly operate.
(HQ AFLC/DSTZD, Mrs Susan Hughey, 73362)



M-16 WEAPONS CONTAINER

The polyethylene M-16 weapon container developed on contract by Warner-Robins Air Logistics Center with Hardigg Industries can hold up to twelve rifles, is lightweight (168 pounds) and provides environmental protection. Cost of the container is estimated at $345 each, with cost savings of $6.29 per rifle for shipping and inspection when compared to the old method. The potential Air Force savings is $240,269 and $3 million for the Department of Defense. A container technical order was procured from Hardigg Industries and is presently being reviewed. It will be up to each major command to determine their requirements and submit their request to the Item Manager. Total Air Force requirement for the M-16 containers is estimated at 20,200. The Item Manager has been allocated approximately $2 million in fiscal year 1987 for the containers.
(HQ AFLC/DSTZD, Mrs Susan Hughey, 73362)



COMPUTER-AIDED DESIGN SYSTEM

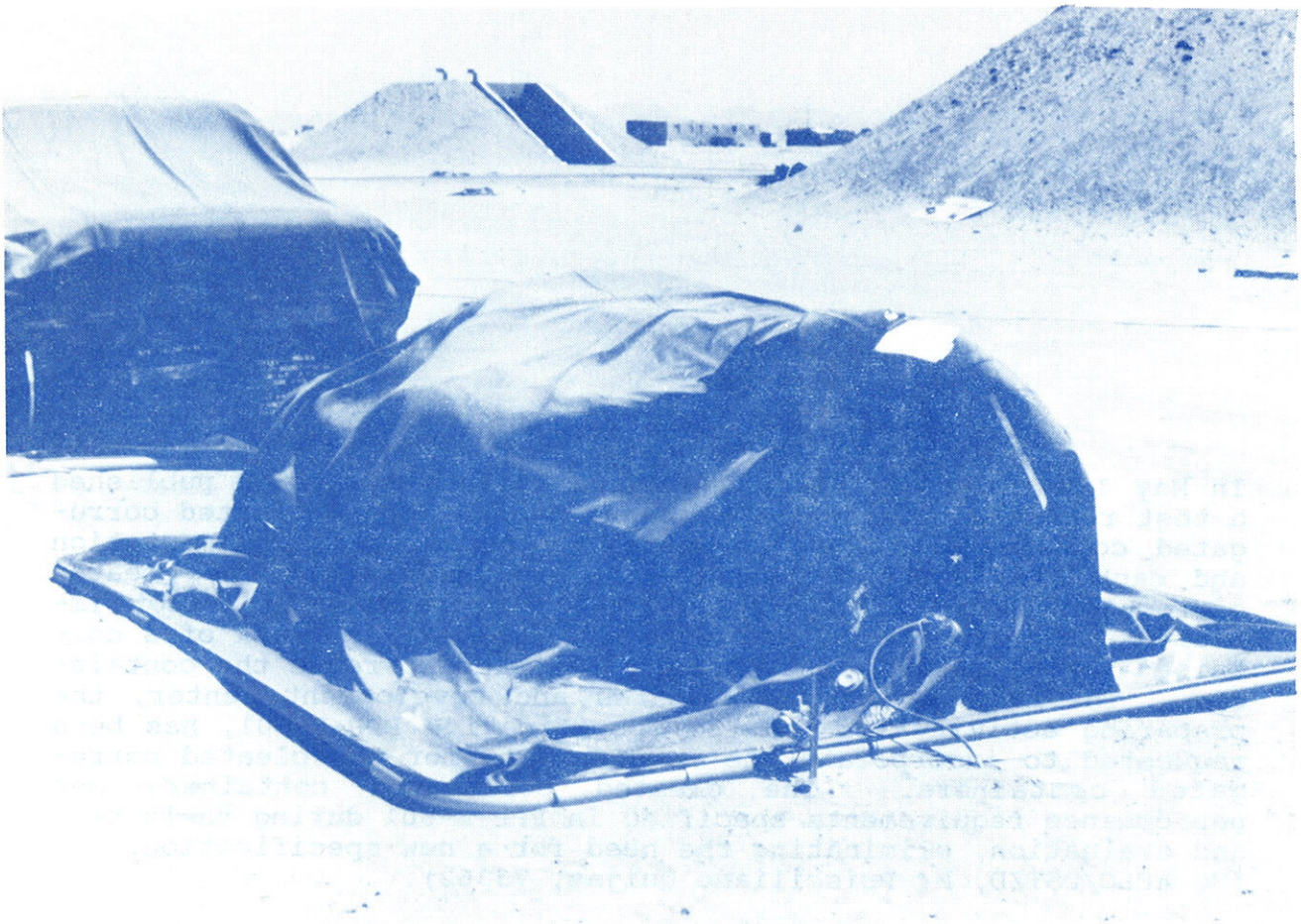
The Computer-Aided Design System used for the development of Special Packaging Instructions (SPIs) will be upgraded and expanded with microcomputers. In fiscal year 1986, a contract was awarded for twenty Computer-Aided Design System microcomputer workstations. The initial delivery and installation to the Air Force Packaging Evaluation Agency has been completed. Each Air Logistics Center will have three work stations, a laser and dot matrix printer and an optical scanner delivered during the second quarter of fiscal year 1987. The upgrade increases the Air Logistics Centers' Computer-Aided Design System capability by 200 percent. The optical scanner offers the ability to scan existing Technical Packaging Orders (TPOs) and SPIs into the system data-bank. The laser printer will simplify and accelerate the plotting of SPIs. The Computer-Aided Design System upgrade will increase the availability, reliability and maintainability of the packaging technical data and related assets.
(HQ AFLC/DSTZD, Mr Ted Hinds, 73362)

CLEATED CORRUGATED PLASTIC CONTAINER

In May 1986, the Air Force Packaging Evaluation Agency published a test report detailing the test and evaluation of cleated corrugated containers. The Air Force has authorized implementation and each Air Logistics Center will gradually adopt the cleated corrugated containers. Factors which may adversely affect implementation are the increasing cost of materials, lack of a container specification, and few opportunities to reuse the containers. The US Army Natick Research and Development Center, the preparing activity for federal specification PPP-B-601, has been requested to incorporate the requirements for the cleated corrugated containers. The cleated corrugated containers met performance requirements specified in PPP-B-601 during their test and evaluation, eliminating the need for a new specification.
(HQ AFLC/DSTZD, Mr Prisciliano Quijas, 73362)

MAVERICK MISSILE CONTAINER

The Air Force Packaging Evaluation Agency has completed the preliminary design of an aluminum Maverick missile container. Level II drawings and a prime item development specification were prepared and a contract awarded to purchase four prototype containers. Ver-Val Enterprise Corporation, a small business minority contractor, is scheduled to build the prototype containers for delivery and testing in early 1987. The containers represent a shift in the container design to the use of special extrusions. The extrusions allow variable dimensions in length, width, and height so that one container style can be used for many different applications.
(HQ AFLC/DSTZD, Mr Ted Hinds, 73362)

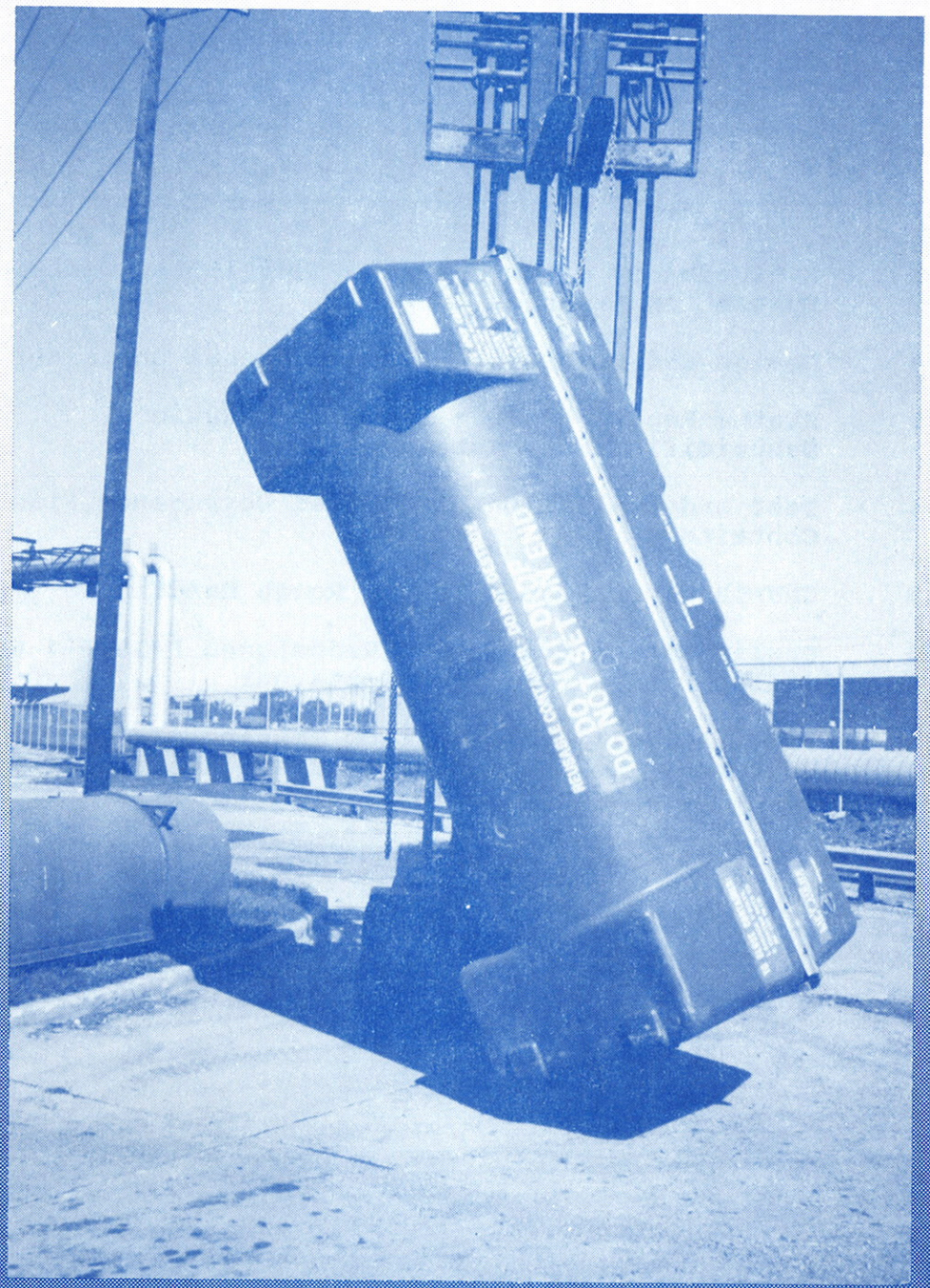


SOUTHWEST ASIA STORAGE TEST

The one year test in Southwest Asia to validate long-term preservation procedures for the storage of vehicles in flexible containers was completed on 6 June 1986. Organizations involved in the project were the Air Force Packaging Evaluation Agency (AFPEA), Warner-Robins Air Logistics Center, and US Central Air Force (USCENTAF). For the duration of the test, eight test vehicles were stored in the flexible containers, while six control vehicles were stored outside. A microprocessor was used to collect data generated from the sensors in the test and control vehicles and an on-site weather station. Throughout the test, AFPEA analyzed the data to determine the actual environmental conditions which the test and control vehicles experienced. At the conclusion of the storage test, a team visited the test site for final observations. It was determined that there were no significant differences between the test and control vehicles. Conclusions were that, with minor changes to the USCENTAF Regulation 77-1, vehicles could be stored outside in the Southwest Asia environment.
(HQ AFLC/DSTZD, Mrs Eileen Foley, 73362)

1986 AFPEA REPORTS

REPORT	TITLE
86-R-01	Evalution of a Low Fragility Multi-Item Container System for Avionics
86-R-02	Design and Development of E3 Antenna Container
86-R-03	Status Report of Free Breathing Static Dehumidification Systems
86-R-04	Test and Evaluation of Cleated Corrugated Plastic Containers
86-R-05	CNU-180/E Container Test - Rough Handling
86-R-06	Qualification Testing of Redesigned F-15/F-4 600 Gallon Bi-Pac Fuel Tank Container
86-R-07	First Article Qualification Testing of F-15 Conformal Fuel Tank Container and Installation Kit for Contract F3657-84-C-0159



ONE TEST IS WORTH A THOUSAND EXPERT OPINIONS