



U.S. Department
of Transportation
**Federal Aviation
Administration**

AC 120-85

Date: 6/20/05

ADVISORY CIRCULAR



AIR CARGO OPERATIONS

Flight Standards Service
Washington, D.C.

Initiated By: AFS-300

PREFACE

Proper cargo loading is essential for safe flight operations. The air carrier must have procedures in place to ensure that employees and vendors are properly trained in the process, the loading is properly completed, and that cargo restraints and loading devices are properly maintained. The loading personnel, flightcrew, and flight engineer must all take responsibility to ensure that the process is completed correctly.

This advisory circular (AC) responds to safety recommendations made by the National Transportation Safety Board after an accident in which basic steps were not followed during the loading of the accident flight. Adhering to the recommendations in this AC is one means (but not the only means) for air carriers to better manage their air cargo operations.

/s/

James J. Ballough
Director, Flight Standards Service

CONTENTS

| | Page |
|---|----------|
| CHAPTER 1. GENERAL INFORMATION..... | 1 |
| CHAPTER 2. OPERATIONAL PROCESSES AND PROCEDURES..... | 3 |
| Section 1. General..... | 3 |
| Section 2. Weight and Balance Procedures | 4 |
| Section 3. Cargo Handling System Components, Smoke Barriers, and Installed Nets..... | 6 |
| Section 4. Maintenance of ULDs and Other Cargo Restraint Devices..... | 11 |
| Section 5. Cargo Weigh Scales..... | 18 |
| Section 6. Cargo Restraint and Airplane Loading and Unloading | 20 |
| Section 7. Load Supervision, Load Verification, and Air Carrier Audits | 29 |
| Section 8. Training..... | 31 |
| CHAPTER 3. CERTIFICATION | 37 |
| Section 1. General..... | 37 |
| Section 2. Airplane Configuration..... | 37 |
| Section 3. Unit Load Devices (ULD) | 41 |
| CHAPTER 4. ADMINISTRATIVE INFORMATION..... | 45 |
| APPENDIX 1. RELATED REGULATIONS (2 pages)..... | 1 |
| APPENDIX 2. REGULATORY AND GUIDANCE MATERIAL (2 pages)..... | 1 |
| APPENDIX 3. DEFINITIONS RELATED TO AIR CARGO OPERATIONS (2 pages) | 1 |
| APPENDIX 4. ACRONYMS AND ABBREVIATIONS (1 page) | 1 |
| APPENDIX 5. SUGGESTED STRUCTURAL DATA FOR PASSENGER-TO-CARGO CONVERSION PROJECT (3 pages)..... | 1 |
| APPENDIX 6. PASSENGER-TO-CARGO CONVERSIONS SUPPLEMENTAL TYPE CERTIFICATE DATA PACKAGE FOR SYSTEMS AND EQUIPMENT (3 pages)..... | 1 |
| APPENDIX 7. DESIGN CRITERIA FOR OUTWARD OPENING DOORS (1 page) | 1 |
| APPENDIX 8. TRANSPORT CATEGORY AIRPLANE ICA CHECKLIST (4 pages)..... | 1 |

CHAPTER 1. GENERAL INFORMATION

100. PURPOSE.

a. This AC provides air carriers with recommended procedures for managing air carrier cargo operations. It provides recommendations about what items should be included in an air carrier cargo operations system. Developing and using these comprehensive procedures is key to establishing a safe and efficient cargo management system. This AC contains recommendations for Original Equipment Manufacturers (OEM), Parts Manufacturer Approval (PMA) holders, Technical Standard Order (TSO) holders, and airplane owners and operators who manufacture their own parts. The AC provides guidance for the certification of unit load devices (ULD), restraints, and airplane cargo handling systems.

b. This AC is not mandatory and does not constitute a regulation. This AC presents recommendations for an acceptable means, but not the only means, to manage air cargo operations.

101. BACKGROUND.

a. This air cargo operations AC was developed after considering the following National Transportation Safety Board (NTSB) safety recommendations, and specifically in response to A-98-47.

(1) **A-98-44.** Require all Title 14 Code of Federal Regulations (14 CFR) part 121 air carriers to provide flightcrews with instruction on mistrim cues that might be available during taxi and initial rotation, and require air carriers using full flight simulators in their training programs to provide flightcrews with special purpose operational training that includes an unanticipated pitch mistrim condition encountered on takeoff.

(2) **A-98-45.** Conduct an audit of all part 121 supplemental cargo operators to ensure that proper weight and balance documents are being used, that the forms are based on manufacturer's data or other approved data applicable to the airplane being operated, and that Federal Aviation Administration (FAA) principal inspectors confirm that the data are entered correctly on the forms.

(3) **A-98-46.** Require carriers operating under part 121 to develop and use loading checklists to positively verify that all loading steps have been accomplished for each loaded position on the airplane and that the condition, weight, and sequencing of each pallet is correct.

(4) **A-98-47.** Require training for cargo handling personnel and develop advisory material for carriers operating under part 121 and principal operations inspectors that addresses curriculum content that includes but is not limited to, weight and balance, cargo handling, cargo restraint, and hazards of misloading, and require all operators to provide initial and recurrent training for cargo handling personnel consistent with this guidance.

b. This AC also incorporates resolutions to those categories of concern in the Cargo Strategic Action Plan and the follow on Air Cargo System Implementation Plan. A group chartered by the Aircraft Maintenance Division, AFS-300, to address the issues detailed in the

NTSB Safety Recommendations, developed these plans. The categories and issues identified include:

- (1) Certification of airplane cargo handling systems, ULDs, and alteration of airplanes for the carriage of cargo.
- (2) Maintenance of airplane cargo handling systems and ULDs.
- (3) FAA oversight of air carriers and their procedures when carrying cargo both in passenger and all cargo operations.

102. DISTRIBUTION.

| If you are— | You should review— | Also note that— |
|---|---|---|
| An air carrier carrying cargo under part 121, or a vendor | All chapters, but specifically Chapter 2. | Cargo includes passenger checked baggage, freight, hazardous materials (hazmat), dangerous goods, and company materials. Cargo does not include passenger carry-on baggage. |
| An OEM, PMA, or TSO holder | All chapters, but specifically Chapter 3. | |
| An entity repairing, altering, or modifying airplanes for the carriage of cargo | All chapters, but specifically Chapter 3. | |

103. DOCUMENT ORGANIZATION. This AC consists of four chapters and several appendixes. Chapter 1 contains general information about the AC. Chapter 2 addresses operational processes and procedures. Each section within Chapter 2 addresses a separate operational aspect of air carrier air cargo operations. Chapter 3 addresses issues related to regulatory certification requirements of ULDs, restraint devices, and cargo handling systems installed on airplanes. Chapter 4 tells how to get more information regarding this AC. Finally, the appendixes contain information such as the regulatory basis of the AC, a list of related publications, related definitions, acronyms, passenger-to-cargo conversion information, outward-opening cargo door information, and a checklist for developing Instructions for Continued Airworthiness (ICA).

CHAPTER 2. OPERATIONAL PROCESSES AND PROCEDURES

Section 1. General

200. PURPOSE. This chapter informs air carriers of the importance of providing necessary guidance to loading personnel for proper cargo buildup, weighing and restraint, and airplane loading and unloading.

201. RECOMMENDATIONS GIVEN.

a. The FAA considers the following a recommended minimum level of detail that should be included in an air carrier's manual that is essential to air cargo operations. These recommendations are discussed in more detail throughout this chapter. This is not an all-inclusive list. To safely transport cargo an air carrier must:

(1) Have procedures in its manual for control of weight and balance for both airplanes and ULDs.

(2) Have procedures in its manual for loading and unloading all types of cargo, including bulk loaded cargo and cargo contained in ULDs.

(3) Have procedures to restrain cargo in airplane compartments, including main deck, lower deck, fore and aft compartments, or pods, in accordance with the requirements of the airplane manufacturer's weight and balance manual, Supplemental Type Certificate (STC) weight and balance supplement, or other FAA-approved weight and balance document for certified ULDs, uncertified ULDs, or bulk loaded cargo.

(4) Have procedures in its manual for the use of miscellaneous restraint devices in cases that may not be specified by the applicable airplane manufacturer weight and balance manual, approved STC supplement, or other FAA-approved data.

(5) Have procedures in its manual to control the use and calibration of weigh scales.

(6) Have procedures in its manual to control the repair of ULDs, airplane cargo loading systems, cargo restraint devices, and other miscellaneous airplane cargo handling equipment required for loading or unloading the airplanes. This also includes installed nets and installed smoke barriers.

(7) Have procedures in its manual system for the control of all manuals, manual revisions, and service bulletins (SB) applicable to air cargo operations. These procedures should ensure the air carrier:

(a) Communicates (supplies address and contact) to equipment manufacturer, STC holders, and other necessary entities, where to send manuals, manual revisions, SBs, and letters.

(b) Has current versions of the manuals.

(c) Has all applicable SBs, letters, and manual revisions incorporated into its maintenance and repair procedures.

(d) Provides authorized maintenance personnel and vendors with current manuals, manual revisions, SBs, and letters.

NOTE: Under part 121, section 121.137, all maintenance manuals must be under the control of the air carrier even if they are located at a remote site.

b. An air carrier should recognize that its airplane manufacturer weight and balance manuals, STC supplements to the weight and balance manual, or other FAA-approved data may not provide the information required for the air carrier to adequately manage carriage of cargo. This AC contains minimum guidelines for air cargo operations. If the procedures provided by the airplane manufacturers do not contain sufficient detail and guidance, an air carrier may incorporate supplementary FAA-accepted procedures to ensure loading personnel have the guidance necessary to maintain safety of flight. An air carrier should also have a training program in place for cargo buildup, airplane loading, and airplane unloading.

Section 2. Weight and Balance Procedures

202. USING AN AIRPLANE'S WEIGHT AND BALANCE MANUAL TO DEVELOP A WEIGHT AND BALANCE CONTROL PROGRAM. Each type-certificated, transport category airplane has an FAA-approved weight and balance manual that contains information that enables an air carrier to develop a weight and balance control program. This information may include, but is not limited to:

a. Loading limitations, including limitations on empty or unoccupied positions with missing or damaged restraints.

b. Information on airplane cargo restraint systems, for example, the airplane cargo handling system, installed nets, ULDs, and other restraint devices.

c. Requirements for special cargo loads, such as cargo that is frangible, crushable, incompressible, sharp, or oversized.

d. A list of ULDs compatible with the cargo handling system.

e. Airplane operating weights.

f. Information for the determination of an airplane's center of gravity (CG).

g. Weight limitations for each compartment and zone, when applicable.

h. Fuel loading data.

i. Samples of load sheets and manifests, and how to use those documents.

j. Load schedules.

203. OTHER CONSIDERATIONS WHEN DEVELOPING A WEIGHT AND BALANCE CONTROL PROGRAM. The airplane manufacturer weight and balance manual for a particular airplane is the basis for an air carrier weight and balance control program. For airplanes converted to cargo from passenger operations and for airplanes with other modifications, such as an airplane cargo handling system, a weight and balance supplement describing the modification's effect on the airplane is FAA-approved and issued as part of an STC or amended type certificate (TC). Air carrier weight and balance manuals should be based on airplane's weight and balance data or, if applicable, equivalent STC, amended TC, or other FAA-approved data.

204. CONTENTS OF AN AIR CARRIER'S WEIGHT AND BALANCE MANUAL.

a. Airplane Basic Operating Weight Control. Air carrier airplanes must conform to the basic operating weight provided by the airplane manufacturer, STC holder, TC holder, and buyer-furnished equipment weight and balance requirements, and airplane operations and maintenance manuals.

b. Zone and Compartment Weight Limitations. Air carrier airplanes must conform to all zone weight limitations and compartment weight limitations under the airplane manufacturer, TC holder, and STC holder weight and balance requirements, other FAA-approved weight and balance requirements, and any other information provided.

c. CG Range Limitations. The air carrier must include in its weight and balance manual, or other manual, reference charts and tables that provide FAA-approved weight and CG range limitations.

d. Airplane Weight. Air carrier airplanes must conform to the airplane manufacturer's weight and balance requirements. The air carrier also should establish procedures on how to weigh the airplanes in accordance with the airplane manufacturer's weight and balance manual requirements or other FAA-approved or accepted methods, such as the current edition of AC 120-27, Aircraft Weight and Balance Control.

e. Airplane Major Alteration Requirements.

(1) When an air carrier accomplishes a major alteration to an airplane that changes the weight and balance requirements and/or limitations, the FAA will approve a weight and balance supplement or other control document, such as an STC, FAA Form 337, Major Repair and Alteration, or other weight and balance reports. This supplementary information describes the effect of the alteration on the airplane.

(2) The air carrier should have a procedure in place to ensure all supplemental information developed, issued, and approved for that airplane is incorporated into the air carrier weight and balance control program. An air carrier should apply the most restrictive ranges of the alteration incorporated to the operation of that airplane. For example, if multiple STCs apply, the air carrier should use the STC with the most restrictive weight and balance limitations when incorporating the supplemental information into the air carrier weight and balance control program.

(3) In cases of multiple STCs applied to a single airplane, the STCs should be evaluated for effect on each other and the appropriate limitations applied. At a minimum, an air carrier should include the supplemental information described above and cross-reference the supplemental information in the air carrier's weight and balance manual. In addition, the air carrier should organize the supplemental information in a way that facilitates use by loading personnel. Finally, the air carrier should include the supplemental information in the air carrier's weight and balance manual and any charts or tables that indicate proper weight and CG range limitations.

f. Airplane Cargo Handling System Limitations. The air carrier must conform to and apply the weight and balance and CG limitations of the airplane's cargo handling systems, as established by the TC holder, STC holder, or other FAA-approved data. The air carrier should apply the most restrictive limitations considering all major alterations made to the airplane.

g. Supernumeraries. An air carrier should establish procedures for carrying supernumeraries, where applicable. See Chapter 3 for further discussions of supernumeraries. At a minimum, the procedures should address the following:

(1) A method for calculating the weight of the supernumeraries and their carry-on and checked baggage, such as actual weight or average weight (see AC 120-27, as amended, for guidance on how to calculate weights).

(2) Any special procedures or limitations the air carrier may require when carrying supernumeraries aboard an airplane. These limitations may be specified as part of the type design in the type certificate data sheet or a limitation associated with the 14 CFR part 25 exemption for the carriage of supernumeraries.

(3) Instructions for documenting the weight of supernumeraries and for communicating the information to the pilot in command or other authorized, trained, and qualified personnel for determining weight and balance.

Section 3. Cargo Handling System Components, Smoke Barriers, and Installed Nets

205. CLASSIFICATION OF CARGO COMPARTMENTS DESIGNED TO ACCEPT AND RESTRAIN CARGO. Airplane cargo compartments are designed to accept and restrain cargo in various ways. Cargo compartments are classified as class A, B, C, or E in parts 25 and 121, depending on accessibility and fire protection requirements. Some cargo compartments accept ULDs and some do not. In general:

a. Class A compartments are accessible to the flightcrew for fire fighting, usually from the flight deck or from areas adjacent to the flight deck.

b. Class B compartments are accessible to the flightcrew for fire fighting. Such compartments are usually on smaller airplanes such as business jets that have been altered for all-cargo operations.

c. Class C compartments are used on passenger airplanes for the carriage of baggage or other cargo. These compartments require a fire suppression and detection system that is controlled from the pilot or flight engineer station; the compartment is not accessible to the flightcrew during flight.

d. Class E compartments are on all-cargo airplanes. These compartments are on both the main deck and lower lobe areas and require fire detection systems, and are not accessible to the flightcrew during flight.

206. CARGO COMPARTMENTS DESIGNED TO ACCEPT ULDs. Cargo compartments designed to accept ULDs are equipped with an airplane cargo handling system designed to restrain ULDs in the airplane. Cargo handling systems are also designed as a conveyance for ULDs, allowing them to move easily in and out of the airplane. The cargo handling system comprises various assemblies such as restraint locks, side rails, and ball and roller conveyors. In addition, some cargo handling systems are powered. Cargo handling systems may be installed in main deck and/or lower deck compartments. When the flightcrew and/or supernumeraries are seated on the same deck forward of the cargo handling system, a smoke barrier and 9G net or rigid 9G bulkhead is installed between the cargo handling system and the flightcrew and supernumeraries.

207. CARGO COMPARTMENTS THAT ARE NOT DESIGNED TO ACCEPT ULDs. Cargo compartments not designed for ULDs are called bulk compartments. Bulk compartments may have vertical or horizontal nets. Depending on the design and purpose of the net, it may restrain cargo from shifting vertically, longitudinally, and laterally within the compartment or from shifting onto the cargo door or cargo door area within the compartment. Bulk compartments are designed to provide inherent protection for airplane systems and structure against damage from shifting cargo for all flight and landing conditions.

208. SUBSTITUTING CARGO HANDLING SYSTEM COMPONENTS. An air carrier may substitute airplane cargo handling system components under several different procedures, depending on the certification method for the components being substituted. Substitution also may involve the replacement of cargo handling system components with those of another design, or replacement of subcomponents of an airplane cargo restraint assembly with those of another design.

209. PROCEDURES FOR SUBSTITUTING A CARGO HANDLING SYSTEM COMPONENT. In cases in which an air carrier substitutes a cargo handling system component, the air carrier should have a procedure that addresses the following:

- a. The load bearing components that the air carrier may substitute.
- b. The level of substitution, such as a complete assembly or parts of an assembly, the air carrier allows and the conditions that support each process.
- c. The FAA-approved data used.

NOTE: Cargo handling system components are certificated under the following methods: PMA, TSO, Production Certificate (PC), TC, amended TC, STC, and under rules governing owner-produced parts.

210. SUBSTITUTING PMA PRODUCTS. An air carrier may substitute airplane cargo handling system components manufactured under a PMA, provided the PMA holder has established eligibility for installation on the airplane and provides resulting airplane limitations. Installation data and any limitations may be found in the following sources:

- a. Component maintenance manual (CMM);
- b. Manufacturer's illustrated parts catalog;
- c. Air carrier instructions based on approved data from the FAA, the airplane manufacturer, or STC holder; and
- d. Manufacturer's SBs or service letters.

211. SUBSTITUTING TSO PRODUCTS. An air carrier may substitute cargo handling system components manufactured under a TSO, provided the air carrier has procedures to determine whether the unit is eligible for installation. An air carrier may substitute products approved under TSO using information from the following sources:

- a. SBs.
- b. STC.
- c. Airplane manufacturer's TC.
- d. CMM.
- e. Manufacturer's illustrated parts catalog.

212. SUBSTITUTING PC, TC, AMENDED TC, AND STC PRODUCTS. Parts can be approved through the PC, TC, amended TC, and STC processes. Instructions for interchangeability of cargo handling system components are covered under the instructions accompanying these processes. An air carrier may substitute these components using the following source documentation for these processes:

- a. Type certificate data sheets.
- b. SBs, service letters, or equivalent FAA-approved data.
- c. Manufacturer's ICA.

213. SUBSTITUTING OWNER-PRODUCED PARTS. Part 21 permits an owner to manufacture parts for use on its own airplane. In such cases, an air carrier should have processes in place to:

- a. Identify in its maintenance program components manufactured for the airplane cargo handling system.
- b. Ensure the parts it manufactures are not sold or distributed for use by another air carrier or vendor.
- c. Show its owner-produced parts meet the equipment manufacturer cargo handling system type design.
- d. Maintain the continued airworthiness of the owner-produced part.

214. ADDRESSING CARGO HANDLING SYSTEM COMPONENT DISCREPANCIES. An air carrier may address airplane cargo handling system component discrepancies by replacing or repairing the applicable component. If the air carrier discovers systemic problems with the reliability of its components, the air carrier should report such problems to the component manufacturer.

215. REPLACING A CARGO HANDLING SYSTEM COMPONENT. An air carrier may replace a cargo handling system component with a new, rebuilt, overhauled, or repaired serviceable component. This component should be eligible for installation on the particular airplane.

216. REPAIRING A CARGO HANDLING SYSTEM COMPONENT.

a. An air carrier may repair a component on the airplane, in its own shops, or at a repair vendor using FAA-approved or -accepted data, per the requirements of 14 CFR part 43. The repair vendor may be under the direct control of an air carrier or a vendor the air carrier designates. The air carrier has primary responsibility for determining that the component meets applicable regulatory requirements and the repair vendor is authorized to repair the component.

b. Cargo handling system components repaired by a vendor should undergo a receiving inspection in accordance with air carrier procedures. Documentation also should accompany the component to (1) confirm each component is certified as serviceable and (2) provide traceability to the data used for repair. The documentation should include the following:

- (1) Identity of the company that owns the component;
- (2) FAA repair station certificate number, if applicable, and vendor name;
- (3) Component part number;
- (4) Component serial number, if applicable;
- (5) Component nomenclature;

- (6) Component times and/or cycles (if applicable);
- (7) Quantity of components;
- (8) Specifications used for repair;
- (9) Certification statement of procedures used;
- (10) Traceability documentation; and
- (11) Signature of an authorized agent.

c. The air carrier should retain its repair records in accordance with its established procedures to comply with the requirements of part 121, section 121.380.

217. CARGO HANDLING SYSTEM COMPONENTS IN THE MINIMUM EQUIPMENT LIST (MEL).

a. **Dispatch Deviation Procedures.** An air carrier must ensure the airplane MEL contains adequate instructions or references the appropriate manual for dispatch deviation procedures that describe the following:

- (1) Total number of items installed and minimum number required for dispatch;
- (2) Loading limitations because of missing or defective equipment;
- (3) References showing where loading restrictions are found;
- (4) The appropriate category for repair; and
- (5) Instructions for ensuring MEL limitations are included in weight and balance computations and the load plan.

b. **Procedures for Inoperative or Missing Cargo Handling System Components.** An air carrier must include procedures within the air carrier MEL for inoperative or missing cargo handling system components. These procedures should include any requirements for:

- (1) Reconfiguration of the airplane, if necessary;
- (2) Voiding of adjacent positions, if necessary;
- (3) Accounting for limitations;
- (4) Notification to flight crewmembers of the missing components; and
- (5) Instructions for ensuring MEL limitations and/or restrictions are included in weight and balance computations and the load plan.

218. INSTALLED NETS IN THE MAINTENANCE PROGRAM. An air carrier maintenance program should contain procedures for the maintenance and inspection of installed vertical and horizontal cargo compartment nets and 9G barrier nets.

a. The program should encompass:

- (1) In-house or third-party vendor repair procedures;
- (2) Receiving inspection procedures; and
- (3) Serviceability limitations.

b. The air carrier should list third-party vendors on its approved vendor listing and include any required inspection item requirements.

Section 4. Maintenance of ULDs and Other Cargo Restraint Devices

219. CATEGORIZATION OF ULDS AND OTHER CARGO RESTRAINT DEVICES. ULDs and other airplane cargo restraint devices are composed of two general categories, primary and supplemental. An air carrier should have procedures to control the airworthiness and subsequent operational serviceability of ULDs and other restraint devices whether used as a primary or a supplemental restraint.

220. TYPES OF ULDS AND OTHER RESTRAINT DEVICES.

a. **Certified ULDs.** Certified ULDs should meet the requirements of TSO-C90, Cargo Pallets, Nets, and Containers; STC requirements, if applicable; or other FAA-approved certification requirements. The air carrier should have on file an FAA approval letter, certificate, or other certifying document, such as a conformance certificate provided by the ULD equipment manufacturer, for all of its certified ULDs.

b. **Uncertified ULDs.** The air carrier should have documentation from the ULD equipment manufacturer stating to which design criteria the ULD is manufactured. These design criteria may be industry standards such as Society of Automotive Engineers (SAE) Aerospace Standard (AS) 1677, General Requirements for Uncertified Cargo/Baggage Containers; International Standards Organization (ISO) publication no. 4118, Non-certified Lower-deck Containers for Air Transport; International Air Transport Association (IATA) ULD Technical Manual (UTM) 50; or other FAA-accepted standard.

c. **Cargo Nets.** Most air carrier weight and balance manuals recognize a TSO cargo pallet/net as a primary restraint for unitized cargo. A cargo net is the only restraint device that conforms to the shape of the cargo while providing restraint in all directions so that the load is spread to the net fittings and pallet edge rails. Deviation from the use of approved cargo pallet/net as a primary restraint may require the cargo to be airplane compartment restrained, if loaded in a compartment certified for compartment restraint, or restrained by cargo straps or other approved devices as provided in the airplane's weight and balance manual or STC supplemental weight and balance manual. The air carrier manual should have policies and procedures in place to address this issue.

d. Other Cargo Restraint Devices. Cargo restraints such as straps, chains, ropes, and nets not part of pallet/net combinations that are approved for use by the airplane manufacturer weight and balance documentation, STC holder documentation, or other FAA-approved data may be used by the air carrier. Their use should be addressed in the air carrier's manual.

221. DETERMINING IF A ULD IS COMPATIBLE WITH THE AIRPLANE IT IS TO BE LOADED ON. It is critical to the safety of flight for the air carrier to have procedures in place to confirm that each ULD loaded aboard an airplane is compatible with the airplane regardless of whether the air carrier or a vendor of the air carrier owns the ULD. Not all ULDs are FAA-approved as compatible with all airplanes. Therefore, an air carrier should have procedures to:

- a.** Ensure certified and uncertified ULDs are compatible with the airplane and do not present a hazard to the airplane.
- b.** Ensure uncertified ULDs meet either UTM 50, AS 1677, or ISO 4118, or another FAA-accepted standard.
- c.** Inform employees and vendors loading airplanes converted from passenger to all-cargo by an STC that it could be subject to ULD requirements that differ from other STC conversions or production airplane configurations in the air carrier fleet.
- d.** Ensure personnel understand that compatibility and limits or restrictions may exist between the same type of airplanes that have STC conversions and may have also been produced by a TC holder as a freighter. The following list is an example of the differences that may be found between production freighters and converted freighters.

- (1) Airplane weight limits.
- (2) Cargo zone index changes forward/aft body.
- (3) CG limits.
- (4) Forward and aft body structure loading limits.
- (5) Fuel index tables.
- (6) Individual compartment maximum loads.
- (7) Lateral cargo unbalances.
- (8) Main deck door opening variances.
- (9) Maximum allowable loads limited by restraint.
- (10) Maximum allowable takeoff weight limits.
- (11) Maximum area load limits.

(12) Maximum cargo zone load limits (includes cumulative loads above and below deck).

(13) Maximum cumulative loads aft to forward.

(14) Maximum floor landing limits.

(15) Maximum ramp weight limits.

(16) Maximum ULD gross weight restrictions by airplane position.

(17) Missing inoperative cargo restraint limits.

(18) Reduced over wing zone capabilities.

(19) ULD height restrictions.

(20) Asymmetrical load limits.

(21) Zero fuel weight restrictions.

e. Compare the size of the main and lower deck compartment door openings with the contour and dimensions of ULDs to be loaded. An air carrier should take into consideration any height restriction within the airplane cargo compartments.

f. Ensure approved ULD limitations are maintained in the manual. An air carrier should base these limitations on data from applicable airplane weight and balance manuals, STC supplemental weight and balance manuals, or other FAA-approved sources. The limitations should identify which ULDs are compatible with specific airplanes and should be easily accessible by all affected persons.

NOTE: The limitations section of the aircraft flight manual (AFM) or AFM supplement may include information from the airplane weight and balance manual.

g. Ensure its airplane weight and balance manual or other appropriate manual states which ULDs may be carried aboard the airplane on the main deck or lower lobes, as appropriate. In certain instances, particularly with an airplane's lower lobes, certain compartments may be certified to carry bulk or restrained cargo or both. The weight and balance manual or other appropriate manual should identify the ULDs by the type qualified to be carried aboard the airplane in consideration of the airplane and cargo handling system capabilities.

h. Ensure uncertified ULDs are not used in any compartment of all-cargo or combination airplane unless they are authorized or if tiedown instructions are provided on how to restrain them as bulk cargo.

i. Ensure employees and vendors do not combine a net and pallet that are not compatible with each other.

222. INSPECTIONS AN AIR CARRIER PERFORMS AFTER PURCHASING A CERTIFIED ULD.

a. New Certified ULDs. When an air carrier purchases new certified ULDs, it should perform a first article inspection (see Appendix C) of the ULD received to ensure it conforms to type design and is eligible for installation on the air carrier's airplanes. The equipment manufacturer should issue conformity certificates on subsequent deliveries of new ULD equipment.

b. Used Certified ULDs. When an air carrier purchases used certified ULDs, it should perform an airworthiness inspection conducted by appropriately trained FAA-certificated airman if records are not provided to determine airworthiness of the ULD. Upon completion of the inspection, the air carrier issues a serviceable tag verifying the airworthiness of the ULD before placing it into service. After the initial inspection, the air carrier should then maintain its own maintenance inspection and repair records for the ULD. If the ULD has appropriate records to verify its airworthiness, then the air carrier should perform a receiving inspection in accordance with its procedures.

223. PURCHASE OF AN UNCERTIFIED ULD. When purchasing new or used uncertified ULDs, the air carrier should:

a. Obtain the manufacturer's current CMMs and illustrated parts list, subsequent manual revisions, service letters, or SBs.

b. Verify that the manufacturer establishes clearly defined and tested serviceability limits in accordance with IATA, SAE, or ISO standards, or other standard acceptable to the FAA.

c. Provide a trained, qualified, and authorized person to perform a quality audit of manufacturing sites where the ULDs are manufactured and assembled.

d. Check that the manufacturer designs all ULD equipment to allow venting during changes in air pressure, if required.

e. Check that only Original Equipment Manufacturer (OEM)-approved parts were used during manufacturing.

f. Check that the manufacturer issues spare part conformity certificates.

g. Perform a first article inspection of the ULD received is performed to ensure its airworthiness.

224. CHECKS TO PERFORM WHEN RECEIVING ANY ULD. An air carrier should have a trained, qualified, and authorized person perform a receiving inspection check on all ULDs it receives in accordance with the air carrier's procedures. The receiving acceptance check procedures should include a process, instructions, and guidelines to:

a. Check each ULD before it is put into service.

b. Review the required documentation for new and repaired items to ensure the item is airworthy.

c. Conduct a visual inspection of the ULD.

NOTE: FAA-certificated personnel do not need to conduct receiving acceptance checks. The air carrier may designate a person to conduct the checks, provided he or she is trained, authorized, and qualified. Receiving acceptance checks are not used to determine the airworthiness of a ULD. A repair vendor or the ULD equipment manufacturer already determined the airworthiness of the ULD when it was returned to service.

225. RESPONSIBILITY FOR ULD MAINTENANCE AND REPAIR. An air carrier is responsible for ULD maintenance and repair regardless of whether it is performed internally by the air carrier or by a vendor.

226. MAINTAINING ULD REPAIR RECORDS. An air carrier should have procedures for retaining ULD (certified and uncertified) repair records to comply with the regulations. An air carrier may maintain its own records, or allow repair vendors to maintain the records provided the air carrier can access them upon request within a reasonable period of time.

227. PROCEDURES FOR MAINTAINING AND REPAIRING ULDs. An air carrier should have procedures for the maintenance and repair of certified and uncertified ULDs. The procedures should be the same for both types of ULDs, except for establishing appropriate damage limits and specific repair procedures. The procedures should:

a. Clearly state the data upon which maintenance and repair are based.

b. Address transporting damaged ULDs aboard its airplane to a repair station, provided they do not pose a hazard to the safety of flight. This would include restraining the ULD as bulk cargo if necessary.

c. Address how frequently the air carrier or repair vendor should check ULD tare weights and how it should mark updated tare weights on ULDs. The air carrier should manage control of ULD tare weights by documenting them and retaining the documentation in accordance with air carrier procedures.

228. STANDARDS FOR REPAIR OF ULDs. An air carrier should have procedures to ensure that:

a. Personnel are qualified to repair its ULDs.

b. Repair of its ULDs is done in accordance with its maintenance program.

c. Parts for ULD repair meet or exceed equipment manufacturer standards and are approved by the airplane manufacturer or by the air carrier's processes using FAA-approved data.

d. The appropriate current data is available to repair the ULD, including, but not limited to, air carrier maintenance manuals, airplane manufacturer maintenance manuals, SBs, Airworthiness Directives, or other FAA-approved data.

e. The tare weight of each ULD is checked in accordance with the air carrier's procedures.

f. The new tare weight is marked on each ULD in accordance with the air carrier's procedures.

g. The repair of ULDs and associated components or articles is in accordance with 14 CFR Part 43, whether the air carrier or a repair vendor performs the repairs.

h. Provide the air carrier with appropriate repair documentation.

229. USE OF A REPAIR STATION/VENDOR TO REPAIR ULDs.

a. An air carrier should conduct audits of the repair stations it uses to ensure they comply with its maintenance program requirements.

b. An air carrier should provide its repair vendors with written authorization to repair its ULDs and all necessary data and manuals for repair of its ULDs.

230. RETURNING A ULD TO SERVICE. An air carrier should have procedures for repairing unserviceable ULDs and approving them for return to service. As required by part 43, only appropriately trained and FAA-certificated airmen are authorized to return a ULD to service. The airmen should return ULD equipment to service under the requirements of the applicable CMM or air carrier instructions. FAA-approved repair stations operating under 14 CFR part 145 should return ULDs to service in accordance with air carrier procedures.

a. An air carrier may use FAA-approved or -accepted data in place of the requirements of the manufacturer's CMM or an air carrier may choose to strictly follow the manufacturer's maintenance procedures. An air carrier also may choose to use a combination of FAA-approved or -accepted data and the manufacturer's maintenance procedures. Regardless, an air carrier should make it clear in its manual system which data is to be used.

b. An air carrier's continuing analysis and surveillance system (CASS) should be used to verify the performance and effectiveness of its cargo handling system maintenance program and provide corrections to any deficiencies discovered in the program.

231. IDENTIFYING OR REVISING DAMAGE LIMITS. It is important that the air carrier specify damage limits for ULDs and any related restraint equipment. The air carrier may use the damage limits provided by the manufacturer or may develop its own damage limits with FAA acceptance. If the air carrier chooses to develop its own damage limits, it should:

a. Establish a procedure for developing the new damage limits.

b. Provide the FAA with data to support its new damage limits.

- c. Obtain FAA acceptance before using the new damage limits.

232. STANDARDIZATION OF DAMAGE LIMITS ACROSS AN AIR CARRIER'S FLEET OF AIRPLANES. An air carrier may standardize damage limits across its fleet of airplanes. FAA approval is not required if the air carrier applies the most restrictive damage limits categorized by the type of ULD in its fleet. An air carrier publishing less restrictive damage limits should provide the FAA with engineering data to support its decisions.

233. EXCEEDING ALLOWABLE DAMAGE LIMITS. A container with damage to the shell that exceeds allowable damage limits may be accepted for use by installing an approved net over the shell and using it as a pallet/net combination provided it is approved for use in this configuration. A reduced weight requirement may be necessary when an air carrier uses this procedure. The air carrier should develop procedures for using the damaged ULD with a net.

234. ESTABLISHING USAGE LIMITS FOR CARGO STRAPS. A cargo strap manufacturer may not necessarily provide damage limits. If this information is not provided, an air carrier should use the following guidance for a 5,000-pound cargo strap. Do not use if:

- a. A buckle latch mechanism will not lock or stay engaged. This allows the web to slip while under tension, or may result in the web binding or being out of alignment;
- b. Attached fittings, hooks, and rings are bent, cracked, broken, or missing; and
- c. Webbing is partially cut or torn, knotted, unraveling, or has loose or missing sewn stitches.

235. ADDITIONAL PROCEDURES FOR CARGO NETS. An air carrier may want to have additional procedures for cargo nets such as:

- a. Assigning a unique marking or serial number to nets and placarding that marking or number on the nets;
- b. Placarding nets with their damage limits;
- c. Attaching an identification tag to the air carrier's nets; and
- d. Ensuring proper storage when not in use to prevent damage.

236. TEMPORARY INSTALLATION OF RESTRAINTS ON A CARGO NET.

- a. An air carrier may temporarily install restraints on a cargo net provided that:
 - (1) The temporary restraints are airplane manufacturer or STC-approved.
 - (2) The air carrier has a process in the manual system that addresses the use and limits of temporary restraints.
 - (3) The personnel that install the temporary restraints are trained, qualified, and authorized.

b. The air carrier may install temporary restraints to address items such as, but not limited to:

(1) Using a bridge strap to bridge cut or otherwise damaged ropes, or missing or damaged fittings;

(2) Installing temporary fittings and hooks to compensate for damaged or missing fittings, in accordance with equipment manufacturer or air carrier procedures; and

(3) Installing net corner lashing lines and supplemental lashing lines.

237. PERFORMING CHECKS BEFORE USING ULDS OR OTHER CARGO RESTRAINT DEVICES. An air carrier should perform an operational check for damage before using ULDS (that is, movement or buildup) and other restraint devices, and a final serviceability check before loading cargo aboard the airplane.

238. PURPOSE OF OPERATIONAL CHECKS. Operational checks are not intended to determine a ULD's airworthiness. Instead, they are performed to ensure the ULD or other restraint devices do not have obvious damage greater than their damage limits. An air carrier should not use ULDS or other restraint devices with damage greater than damage limits specified.

239. INDIVIDUALS WHO MAY PERFORM OPERATIONAL CHECKS. FAA-certificated airmen do not have to perform operational checks. Air carriers should train, qualify, and authorize personnel to perform serviceability checks. The air carrier procedures should identify who performs these checks and when.

240. ULDS THAT FAIL AN OPERATIONAL CHECK. An air carrier should have a procedure for clearly marking or identifying ULDS and other restraint devices that fail operational checks. The method for identifying equipment that failed should clearly distinguish these items from serviceable equipment so the air carrier or cargo loading vendor does not inadvertently place them into service. A procedure should be in place for individuals to report damage to the persons responsible for maintaining the ULD.

NOTE 1: Clerical, data entry, or other errors of omission resulting in the misidentification or removal from service of a ULD may be corrected and the ULD returned to service, provided the air carrier has a procedure in its manual system for identifying and correcting such errors.

NOTE 2: Operational checks are not intended to be part of an air carrier CMM inspection program.

Section 5. Cargo Weigh Scales

241. RESPONSIBILITY FOR ENSURING THE WEIGHT OF LOADED CARGO IS ACCURATE. An air carrier is responsible for ensuring the weight of cargo loaded aboard its airplane is accurate. Scale tolerances established by scale equipment manufacturers or tolerances

based on FAA-accepted data may be used. The air carrier's weight and balance program should account for allowed tolerances to maintain the certified weight and balance limitations.

242. ENSURING WEIGH SCALES ARE ACCURATE. An air carrier should have a program to ensure the periodic check of the accuracy of scales used for weighing cargo. A periodic functional check should be performed using weights that approximate the weight typical of the loads usually placed on the air carrier's airplane. As an alternative, the air carrier should use the weight recommended by the scale manufacturer for a periodic functional check (see "Periodic functional checks" below). Frequent checks and periodic calibrations are necessary to ensure an air carrier accurately weighs the cargo loaded on its airplane (see "Periodic calibrations" below).

243. ENSURING WEIGH SCALES ARE CALIBRATED. An air carrier should conduct periodic calibration of scales to ensure they are appropriately serviced and accurate to a known standard. Calibration records should show that scales are calibrated in accordance with a standard established by the appropriate country, state, or local government regulations, such as the standards of the National Institute of Standards and Technology (NIST) or an equivalent standard acceptable to the FAA. An air carrier may also use the standards recommended by the scale manufacturer.

NOTE: For more information on the standards provided by NIST, visit NIST's Web site at <http://www.nist.gov/>.

244. MAINTAINING RECORDS OF CALIBRATION CHECKS. An air carrier should keep a record of its scale calibrations. These records should meet the following criteria:

a. The records should be in the English language. If the records are not in the English language, air carriers should have the records interpreted, when necessary. If the air carrier cannot provide an English language interpretation of air carrier records, that air carrier should allow those individuals using the scales to inspect the scales and perform a functional check onsite to ensure scale accuracy.

b. The air carrier should establish procedures to maintain the records.

245. PERFORMING FUNCTIONAL CHECKS ON WEIGH SCALES.

a. **Procedures.** An air carrier should have procedures to ensure that scales used for weighing cargo undergo a functional check between scale calibrations. A functional check should consist of field-testing the scale's accuracy with a specific item of a known weight.

b. **Frequency.** At a minimum, the air carrier should ensure that functional checks are performed at the intervals specified in the air carrier's procedures or the scale manufacturer's recommendations. However, the air carrier also should conduct the functional checks at intervals commensurate with the frequency of scale use; that is, conduct functional checks more often for scales that are more frequently used.

c. Recordkeeping. An air carrier should have a method of recording when functional checks are performed. The air carrier should maintain functional check records in accordance with accepted procedures. These records should include the following information:

- (1) The identification number of the scale;
- (2) The date and time of the functional check;
- (3) The name or the initials of the person who performed the functional check;
- (4) The applied known weight of the item used for the functional check;
- (5) The weight registered by the scale for the applied known weight; and
- (6) The difference between the applied known weight and the registered weight.

NOTE: If the registered weight recorded for the item of an applied known weight is outside the tolerances specified for the scale in the air carrier's procedures, the air carrier should not use the scale until it is inspected and calibrated.

246. ITEMS FOR WHICH AN AIR CARRIER SHOULD KNOW THE TARE WEIGHT.

Authorized loading personnel using equipment such as dollies, slave frames, containers, and carts to weigh cargo on a scale should know the tare weight of this equipment so they can subtract this weight from the total weight to arrive at the cargo weight. An air carrier should determine the tare weight of this equipment by weighing it on a calibrated scale.

247. REWEIGHING LOADING EQUIPMENT FOR TARE WEIGHT AFTER MAINTENANCE, REPAIR, OR MODIFICATION. Immediately following any repair, maintenance, or modification of equipment such as dollies, slave frames, containers, and carts, the air carrier should provide a new tare weight by reweighing the equipment. Air carriers should establish a method to communicate new tare weights to air carrier loading personnel before they use the equipment to weigh cargo on a scale. An air carrier may communicate the tare weight by stenciling it on the equipment or by providing notices to air carrier loading personnel.

Section 6. Cargo Restraint and Airplane Loading and Unloading

248. AIR CARRIER PROCEDURES FOR CARGO RESTRAINT AND AIRPLANE LOADING AND UNLOADING.

a. An air carrier should have accepted procedures for ULD buildup, loading and unloading, and restraining cargo in its manual system. The procedures should include the bulk loading and unloading of cargo, both compartment restrained and restrained by other devices, if the air carrier permits. The procedures should be in accordance with the air carrier weight and balance manual and be based on airplane manufacturer, STC, or other FAA-approved data.

b. An air carrier should have specific procedures for all types of cargo restraint devices the air carrier is authorized to use (for example, installed nets, the cargo handling system, certified ULDs, uncertified ULDs, and other restraints).

249. AIR CARRIER PROCEDURES ON ULD BUILDUP AND CARGO RESTRAINT.

An air carrier's procedures regarding ULD buildup and cargo restraint should address the following topics.

a. **ULD CG Limits.** The procedures should address how to maintain the longitudinal, lateral, and vertical CG limits of a built-up ULD. The air carrier should consider the following guidelines when developing the procedures:

(1) Place sturdier, heavier, and larger cargo pieces on the bottom of the load and evenly distribute them over the length and width of the pallet base.

(2) Place smaller, lighter, and fragile cargo pieces on top and evenly distribute them from the center over the length and width of the ULD.

(3) Level off the cargo loaded in the ULD when less than full.

(4) Interlock or overlap small pieces when practical.

NOTE: From Compliance Document for ULD Center of Gravity Control on B-727 P-F Aircraft, dated October 2000.

b. **Voided Space in ULD.** To minimize voided space within a ULD and between cargo pieces, the air carrier should consider using the following:

(1) Supplemental restraint devices to restrain cargo within a container when less than full; and

(2) Dunnage in voided spaces.

c. **Cargo Contours.** The air carrier should have procedures on how to contour cargo loads for the airplane's interior dimensions when using a pallet/net combination, pallet/strap combination, or other restraint methods/devices. The air carrier should consider using techniques such as contour templates or charts. Also, the air carrier should consider procedures for operational conditions in which variance in contouring might occur, for example, when an aisle to access hazmats or to ensure the integrity of a particular load is needed. The air carrier also should account for height restrictions if required by the airplane's weight and balance manual, supplemental weight and balance manual, or other FAA-approved data.

NOTE: Unique loading and restraint procedures may apply when handling specialized cargo such as animals, oversized cargo, cargo overhangs, uniquely shaped cargo, unstable cargo, or cargo unable to be loaded in ULDs or bulk compartments.

d. ULD Identification Tags. The procedures should include the use of tags to identify ULDs loaded aboard air carrier airplanes, especially when using pallet/net or pallet/strap combinations because their identification is not always visible. The air carrier may use electronic tagging if it is approved for use by a STC or other FAA-approved means for the particular airplane.

NOTE: Electronic tagging may present a concern about interference with onboard avionics equipment. The air carrier should ensure that if it carries electronically tagged ULDs, they are FAA-approved for use on the particular airplane on which the ULD is loaded.

e. ULD Weight Limits. The air carrier should include procedures to ensure the weight of cargo does not exceed the ULD gross weight or area load limits if stated by the ULD manufacturer.

f. Operational Checks. The procedures should include how to check the condition of ULDs and other restraint devices for damage before using them, and how to perform the operational checks to ensure any damage does not exceed damage limits. The air carrier should base the serviceability checks on the information from the equipment manufacturer, in the STC, or other data acceptable to the FAA.

g. Fastening Container Components. The air carrier's procedures should address the correct method of positive closure and locking of container nets, curtains, and rigid or flexible doors after buildup. The air carrier should base these procedures on information provided by the container manufacturer, STC holder, or other source with information acceptable to the FAA.

h. Fastening a Cargo Net to a Pallet. The air carrier's procedures should address how to fasten a cargo net to a pallet properly after buildup. The air carrier should base these procedures on information supplied by the pallet/net manufacturer, STC holder, or other source with information acceptable to the FAA.

250. AIR CARRIER PROCEDURES ON CARGO LOADING AND UNLOADING. An air carrier's procedures regarding airplane loading and unloading should address the following topics:

a. Sill Guards (If Applicable). The air carrier's procedures should address the use of sill guards and instructions for attaching and detaching them. If an air carrier stows sill guards in the airplane when they are not in use, the procedures should include the proper stowage in the airplane.

b. Tail Post (If Applicable). The air carrier's procedures should address the use of a tail post (nonstructural device), if the air carrier requires its use to measure the distance between the airplane's tail section and the ground during loading and unloading. The procedures should include instructions on attaching, detaching, and using it. If an air carrier stows the tail post in the airplane when it is not in use, the procedures should include the proper stowage in the airplane.

c. Tail Stand (If Applicable). The air carrier's procedures should address the use of a tail stand (structural device), if the air carrier requires its use to prevent the airplane from tipping on its tail during loading and unloading. The procedures should include instructions on attaching, detaching, and using it.

d. Tail Tipping Avoidance. The air carrier's procedures should address the methods to ensure the airplane will not tip on its tail during loading and unloading (for example, step loading and unloading of cargo, or nose gear tethering).

e. Airplane Doors, Nets, and Smoke Barriers. The air carrier's procedures should address the proper use of cargo compartment and bulkhead doors, installed nets, and smoke barriers.

f. Airplane Floor and ULD Base Load Limits. The air carrier's procedures should address the airplane's floor load limits (area load or linear-running load limits) if the air carrier allows cargo to be loaded directly on the airplane's floor. The procedures also should address floor load limits for a ULD base if the ULD manufacturer has a limit. An air carrier should base these procedures on information from the airplane manufacturer, STC weight and balance manual or supplement, or other FAA-approved data. In addition, the procedures should address how to distribute (shore) the weight of cargo having a load bearing weight greater than a floor load limit. For more information, see paragraph 9 of this Section.

g. Airplane Weight Limits. The air carrier's procedures should address the weight limits for airplane cargo positions, floors, zones, and compartments, and measures to ensure the air carrier does not exceed them. The air carrier should base these limits on information from the airplane manufacturer, STC weight and balance manual or supplements, or other FAA-approved data.

h. Airplane CG Range Limits. The air carrier's procedures should address the CG range limits for the airplane as well as longitudinal, lateral, and vertical CG limits for cargo positions. The procedures also should address measures to ensure an air carrier does not exceed these limits. The air carrier should base these procedures on information from the airplane manufacturer, or STC weight and balance manual or supplements, or other FAA-approved data.

i. Cargo Access Aisle. The air carrier's procedures should address a method for creating a flightcrew access aisle to cargo requiring access during flight, such as certain hazmats or live animals.

j. Airplane Damage Avoidance. The air carrier's procedures should address the measures to ensure damage does not occur to the cargo handling system, cargo liners, smoke detectors, light fixtures, fire retardant flow nozzles, and other similar devices during loading and unloading.

k. Airplane Damage Notification. The air carrier's procedures should address the methods to notify flight crewmembers or authorized maintenance personnel of a damaged, missing, or inoperative cargo compartment, cargo handling system, installed net, or smoke barrier and related components. These procedures should include a general guideline or list of what specific items cargo loaders should report to flight crewmembers or authorized

maintenance personnel, such as holes in the cargo compartment liner, and damaged or missing cargo handling system restraints and rollers, and installed nets and smoke barriers.

l. Cargo Clearance. The air carrier's procedures should address the minimum clearance (distance) requirements between cargo and cargo compartment liners, light fixtures, smoke suppression systems, smoke detectors, and other similar devices.

m. Cargo Handling System. The air carrier's procedures should address the proper use of the airplane's cargo handling system to restrain ULDs. All cargo handling system restraints must be engaged for loaded ULDs and in voided positions. Engaging cargo restraints in voided positions is essential to prevent cargo shift resulting from floor lock failure.

NOTE: Only FAA-certificated airmen may adjust cargo handling system components by physical removal and reinstallation. However, if adjustment or repositioning of a component is part of the operational instructions of the cargo handling system, trained, qualified, and authorized loading personnel may accomplish the adjustment.

n. Bulk Loaded Cargo. The air carrier's procedures should address the measures to ensure it properly loads bulk cargo in cargo compartments and pods authorized for bulk cargo. The air carrier should not bulk load cargo in a cargo compartment or pod unless the airplane manufacturer's weight and balance manual or STC authorizes it and it is included in the air carrier manual system. If the airplane manufacturer's weight and balance manual or STC does not contain sufficiently detailed guidance for bulk loading cargo, the air carrier should establish procedures to ensure the safety of flight that address:

(1) Cargo clearance. The minimum clearance (distance) requirements between cargo and light fixtures, smoke detectors, and other similar devices.

(2) Load distribution. Evenly distributing (spreading) the cargo within compartments and pods over their length, width, and height.

(3) Airplane nets. The proper use of installed nets.

(4) Airplane smoke barriers. The proper use of installed smoke barriers between cargo and flight crewmembers and passengers.

o. Special Cargo Loads. The air carrier's procedures should address that special cargo loads may require special handling or restraint with restraint devices other than a ULD. These loads may require supplemental or primary restraints with straps or other restraint devices. See the following sections on primary and supplemental restraints other than ULDs. The air carrier should consider establishing procedures for the following types of special cargo loads, based on procedures approved for the airplane manufacturer, STC holder, or procedures developed by other persons and FAA-approved:

(1) Rigid cargo;

(2) Frangible cargo;

- (3) Sharp cargo;
- (4) Oversized or overhang cargo;
- (5) Reels, spools, or pipes;
- (6) Motor vehicles and other wheeled cargo;
- (7) Human remains;
- (8) Foodstuff, feed, and postal mail;
- (9) Live animals; and
- (10) Dangerous goods.

p. Small Live Animals. The air carrier's procedures should address the carriage of animals such as mice, rats, dogs, and cats typically shipped in self-contained boxes or containers and typically loaded with other cargo in bulk compartments and ULDs. The procedures should address measures to:

- (1) Reduce the risk of animals escaping their containers while in the airplane.
- (2) Identify animals that have escaped from their containers in the airplane.
- (3) Remove escaped animals from the airplane.

q. Large Live Animals. The air carrier's procedures should address the carriage of animals such as horses and cattle typically shipped in special containers, stalls, or penning systems that are STC-approved or approved by other FAA means. The procedures should address measures to:

- (1) Verify the special containers, stalls, or penning systems are approved for the airplane.
- (2) Ensure special containers, stalls, or penning systems are properly installed in the airplane.
- (3) Protect the airplane from damage by animal waste (urine or solid waste).
- (4) Manage out-of-control animals in the airplane.
- (5) Remove animal waste from the airplane.

NOTE 1: Under 14 CFR part 382, the Department of Transportation distinguishes between service animals, such as seeing-eye dogs, and all other animals kept as cargo, such as pets. Under part 382, an animal that a passenger can properly identify as a service animal must be permitted to accompany the passenger at the passenger's seat. Treat animals not

classified as service animals under part 382 as pets and handle them as a special cargo load as discussed above.

NOTE 2: Under the revised 14 CFR part 119, the term “animal” is defined as a warm or cold-blooded animal that, at the time of transportation, is being kept as a pet in a family household in the United States. For this AC, “live animals” refers to all animals transported as cargo, regardless of whether they are kept as pets as defined in part 119. The air carrier should, however, be aware of the new incident reporting requirements of part 119, section 119.72.

251. USE OF CARGO RESTRAINT DEVICES OTHER THAN ULDs AS PRIMARY RESTRAINT DEVICES. An air carrier may use other restraint devices as the primary restraint of cargo to a pallet or airplane floor seat track or rings if it is authorized by the airplane manufacturer weight and balance manual and/or STC supplementary weight and balance manual, or other FAA-approved means. The approved document also should include serviceability limits and operational and repair procedures, and meet the flammability requirements of part 25.

252. PROCEDURES FOR USE OF DEVICES OTHER THAN ULDs. If an air carrier allows the use of straps and other restraint devices as primary cargo restraints, it should have procedures for their use. These procedures should be based on the information provided by the airplane manufacturer, STC holder, or by other sources acceptable to the FAA, such as SAE standards, IATA standards, or the standards used by the U.S. Armed Services. These procedures should address:

a. Installing straps or other restraint devices to airplane floor tracks, rings, or hardware. An air carrier should recognize in its procedures that there might be reduced load limits and minimum separation requirements between tiedown points if using the same airplane floor track, ring, or hardware for multiple tiedowns.

NOTE: Avoidance of minimum separation requirements may over stress the airplane floor attachments.

b. Using and attaching straps or other restraint devices to the pallet base tiedown track (commercial pallets) and rings (military pallets).

c. Installing straps or other restraint device to the pallet base tiedown track (commercial pallets) and rings (military pallets) in accordance with ULD manufacturer requirements, if applicable.

NOTE: The air carrier should use care when positioning straps on cargo to prevent contact with sharp edges or irregular surfaces. The strap must not be prone to slippage from its intended position on cargo, and the air carrier should engage the lock mechanism so the strap is taut. However, the strap should not be overtightened. Air carriers should address minimum tiedown separation requirements for pallets because most airplane manufacturers do not address the use of primary or supplementary tiedowns in their manuals.

d. Calculating the number of other restraint devices required for a given cargo load based on the restraint criteria provided in the airplane's weight and balance manual or in other FAA-approved data.

e. Calculating the number of straps or restraint devices required should be based on the device's rated strength and limiting factors that may be specified in the airplane's weight and balance manual or its supplement. The weight and balance manual or its supplement may require strength reductions of the strap or other restraint devices based on limiting factors such as airplane sidewall or floor angles and the strength of attachment hardware.

NOTE: The best method to determine the effectiveness of a strap or other restraint devices is that the reaction to load must be in the same direction as force is applied. Consideration should be given to strap installation angle and resulting reduction in available restraint.

f. Properly arranging straps or other restraint devices around the cargo or attached to the cargo. The instructions should include how to correctly clinch adjacent net panels together with the net corner lashing rope and secure the end of the rope to the net panel to prevent disengagement.

g. The requirement to restrain cargo in accordance with the airplane's ultimate load conditions described by the airplane weight and balance manual or its supplement. The air carrier should consider that these devices have to provide restraint in the forward, aft, vertical, and side directions.

NOTE: The FAA does not recommend that an air carrier tie multiple pieces on a pallet with straps or other restraint devices without an approved TSO net encompassing the load. Cargo, because of its size, condition, or shape that cannot be netted should be loaded singly on a pallet.

253. USE OF SUPPLEMENTAL CARGO RESTRAINT DEVICES. An air carrier may use other restraint devices to supplement the primary restraint of cargo to a pallet or airplane floor provided the supplemental restraints do not prevent the primary restraints from restraining the cargo as designed and applied.

254. AIR CARRIER PROCEDURES FOR SUPPLEMENTAL CARGO RESTRAINT DEVICES. If the use of other restraint devices as supplemental cargo restraints is allowed, an air carrier should have procedures for their use. These procedures should be based on the information provided by the airplane manufacturer, STC holder, or by other sources acceptable to the FAA, such as SAE, IATA, or the standards used by the U.S. Armed Services. These procedures should address:

a. Using and attaching other restraint devices to the airplane's installed seat track (tiedown track) and/or tiedown rings;

b. Using and attaching other restraint devices to the pallet base tiedown track (commercial pallets) and rings (military pallets); and

- c. Properly arranging other restraint devices around the cargo or attached to the cargo.

255. PROCEDURES FOR CARGO SHORING. Airplane floors and some pallet bases have a load bearing weight limit (also called a floor load limit). Shoring is a technique used to distribute the weight of a cargo piece over a greater area than its load bearing area (also called a footprint or contact area). Cargo pieces with a load bearing weight greater than a load bearing weight limit require shoring. The air carrier should have procedures that address the:

- a. Materials (for example, wood planks and plywood) acceptable for use in shoring;
- b. Calculations or methods for determining the amount and thickness of shoring materials; and
- c. Methods for applying shoring material to the cargo piece.

256. BLOCKING AND BRACING TECHNIQUES. An air carrier may need to stabilize some cargo pieces (for example, large cable reels, motor vehicles and other wheeled cargo, and odd-shaped cargo pieces) before applying cargo restraints (nets, straps, and other restraint devices). The air carrier should use blocking and bracing techniques to stabilize such cargo pieces. The air carrier's procedures should address the:

- a. Materials (for example, wood planks and plywood) acceptable for blocking and bracing;
- b. Calculations or methods for determining the amount and thickness of blocking and bracing materials; and
- c. Methods for applying blocking and bracing materials to the cargo piece.

257. CARGO LOADING PROCEDURES FOR COMBI-CONFIGURED AIRPLANES. Airplanes configured for carrying passengers and cargo on any deck that contains both cargo and passengers (combi-configured airplanes) may require special cargo loading procedures. The air carrier should have procedures to load such airplanes. These special procedures should be based on the requirements established by the airplane manufacturer, STC holder, or other FAA-approved data.

258. USING VENDORS (EXCLUDING MILITARY) TO INTERLINE OR BUILD UP ULDs. The FAA recognizes that it is common practice for an air carrier, either foreign and/or domestic, to interline built-up ULDs (see Appendix C). The originating air carrier's employees, forwarders, contractors, and customers may have built up interlined ULDs. The FAA also recognizes it is common practice for an air carrier's foreign and domestic forwarders, contractors, and customers to build up ULDs and perform other services, such as airplane loading and unloading, and handling. The use of third parties reduces the need for the air carrier to employ loading personnel or to contract directly for these services at a particular location.

259. AIR CARRIER PROGRAM FOR VENDORS (EXCLUDING MILITARY) TO USE IN ULD BUILDUP OR LOADING. Given that it is common practice for an air carrier to carry cargo loads that vendors have built up or loaded, an air carrier should have a program that

ensures vendors perform cargo buildup and loading in accordance with the air carrier's procedures. Under such a program, an air carrier should have procedures to:

- a. Train vendor employees, train a vendor employee to train other vendor employees (train-the-trainer method), or accept the vendor's training program and procedures provided they meet or exceed the standards established in the air carrier training program and procedures.
- b. Designate a trained, qualified, and authorized person to oversee the vendor services to ensure the vendor performs the services in accordance with the air carrier procedures.
- c. Audit vendors for compliance with air carrier procedures and training programs.

NOTE: An air carrier accepts full responsibility to ensure vendor employees are sufficiently trained and qualified and adhere to air carrier procedures.

Section 7. Load Supervision, Load Verification, and Air Carrier Audits

260. SUPERVISING CARGO LOADING. An air carrier should designate a trained, qualified, and authorized person or persons, such as an employee or vendor, as a load supervisor to ensure:

- a. All cargo is properly built up, weighed, and restrained.
- b. Average baggage weights are accounted for (Ref. AC 120-27).
- c. ULDs and other restraint devices are in serviceable condition and properly used.
- d. The airplane is correctly loaded and unloaded in accordance with its procedures.
- e. All documents, such as load plans or load verification forms, are accurate and properly completed before submission to flight crewmembers or other authorized, trained, and qualified personnel.
- f. Flight crewmembers or authorized maintenance personnel are notified of damaged, missing, or inoperative cargo compartment, cargo handling system, installed cargo net, or smoke barrier components.

261. HOW TO VERIFY CARGO WAS LOADED PROPERLY. Air carriers should designate personnel to provide information about how the airplane was loaded to the pilot in command, or to air carrier's authorized, trained, and qualified loading personnel. The designated loading personnel may provide loading information on one or more forms, and may present it in hardcopy or electronic form. They may include additional information and certifications based on air carrier-specific requirements, such as carrying hazmats or live animals. Air carriers should note that this information does not impact the requirements for a load manifest required under section 121.665 of the regulations.

262. INFORMATION NEEDED TO VERIFY CARGO IS LOADED PROPERLY. The information submitted to the pilot in command or the air carrier's authorized, trained, and qualified loading personnel should include:

- a. The flight date.
- b. The flight number.
- c. The airplane tail number.
- d. The origin station of the flight leg.
- e. The destination of the flight leg.
- f. For cargo carried in ULDs, the ULD numbers.
- g. The weight of each ULD loaded aboard the airplane.
- h. The weight of the bulk cargo, by compartment or position, as applicable.
- i. The location of special cargo loads.
- j. A certification statement verifying that:
 - (1) All ULD locks are up.
 - (2) All installed nets or smoke barriers are properly attached.
 - (3) All ULDs loaded are in an operational condition.
 - (4) All cargo was loaded in accordance with air carrier cargo loading procedures.
 - (5) Tail stand or post was removed, as applicable.
 - (6) All cargo was loaded aboard the airplane as depicted on the load plan form, verification form, or other similar documents.
- k. The signature, or electronic equivalent, of the load supervisor or other authorized, trained, and qualified loading personnel.

263. MAINTAINING RECORDS OF CARGO LOADING VERIFICATION INFORMATION. Air carriers must have procedures to retain a completed and signed copy, or electronic equivalent, of the document(s) containing the information listed in paragraph 3 above with the load manifest in accordance with sections 121.695 or 121.697 of the regulations, as applicable.

264. PERFORMING CARGO BUILDUP OR LOADING AUDITS. Air carriers should have a program acceptable to the FAA for periodic cargo buildup and loading audits. This

program should include audits of sufficient scope and frequency to ensure that loading personnel are following air carrier cargo loading procedures.

Section 8. Training

265. AIR CARGO TRAINING PROGRAMS. Air carriers should develop an air cargo training program. The employee training should, at a minimum, explain how the individuals are to handle their functions according to the air carrier's procedures.

266. TRAINING PROGRAM COMPONENTS. The air carrier's training program should include:

- a. A curriculum acceptable to the FAA.
- b. Procedures for maintaining training records in accordance with the air carrier's policy or applicable regulations.
- c. Recurrent training requirements and intervals.
- d. A description of the training program elements. The program may consist of one or more of the following elements:
 - (1) Classroom sessions;
 - (2) On-the-job training;
 - (3) Computer-based training; or
 - (4) Other training methodologies air carriers consider appropriate.
- e. A periodic review and update of the program.
- f. Proper identification of the individuals authorized to provide the training.
- g. General awareness and familiarization with hazmats training.

267. IDENTIFYING INDIVIDUALS WHO NEED TRAINING. An air carrier should have procedures to properly identify those individuals who need training. An air carrier should provide training to its own loading personnel as well as vendor loading personnel. These individuals typically include:

- a. Airplane loading personnel;
- b. Maintenance personnel;
- c. Flight crewmembers;
- d. Dispatchers;

- e. Purchasing agents;
- f. Receiving personnel;
- g. Freight forwarders and customers; and
- h. Cargo sales employees and general cargo sales agents.

268. INDIVIDUALS WHO SHOULD RECEIVE ULD TRAINING. All air carrier and vendor personnel involved in the loading of cargo should receive ULD training.

269. ELEMENTS THE ULD TRAINING PROGRAM SHOULD CONTAIN. The air carrier should develop a training program that:

a. Ensures all loading personnel are aware that each ULD has set damage limits and are aware of individual ULD damage limits.

b. Ensures that if a ULD's damage limits are modified, the air carrier notifies all appropriate loading personnel and the training program is modified to reflect the new limits.

c. Includes ULD identification. This should include a review of unique ULDs and identify the risks of loading a ULD that is not authorized for loading aboard the airplane.

d. Includes recurrent training for all loading personnel involved in ULD buildup. Air carriers should determine the time and type of recurrent training appropriate to type of operation. Air carriers should require requalification and reauthorization training if loading personnel involved in ULD buildup are no longer considered properly trained, qualified, and authorized.

270. STANDARDS TO WHICH AIRPLANE AND GROUND HANDLERS SHOULD BE TRAINED. An air carrier should have procedures to train all its airplane, ground handlers and contract vendors to its standards.

271. USE OF OUTSIDE COMPANIES TO PROVIDE TRAINING. An air carrier may designate an individual employed by a third-party airplane or ground handling company or freight forwarder who is authorized to train that company's employees. The air carrier should have procedures to approve the program.

272. TRAINING VENDORS. An air carrier should have procedures in place to ensure each repair vendor trains its maintenance personnel on the air carrier's ULD repair procedures. The air carrier's procedures should include an audit of the repair vendor's training program.

273. OTHER TRAINING FOR LOADING PERSONNEL. An air carrier should have procedures to ensure it trains its loading personnel in accident/incident reporting procedures.

274. DETERMINING WHICH AIR CARRIER EMPLOYEES SHOULD RECEIVE WEIGHT AND BALANCE TRAINING. All air carrier loading personnel involved with weight and balance calculations for airplane and CG control, and all air carrier loading personnel

involved in cargo buildup and cargo loading should receive general awareness training on weight and balance principles.

275. TRAINING TOPICS FOR LOADING PERSONNEL AWARENESS WEIGHT AND BALANCE TRAINING. The air carrier's awareness training should be at a general subject matter level and include the following:

- a. Familiarization of varying airplane weights based on the manufacturer's requirements;
- b. The importance of conforming to and applying airplane manufacturer, TC holder, STC holder, or other FAA-approved requirements and zone or compartment limits;
- c. The importance of accurate weight and balance calculations; and
- d. The importance of proper communication among various personnel.

276. TRAINING TOPICS FOR PERSONNEL OR CONTRACTORS INVOLVED WITH WEIGHT AND BALANCE AND CG CALCULATIONS. The air carrier's training course for personnel or contractors involved with weight and balance and CG calculations should include, at a minimum, the following:

- a. Conforming and applying weight limitations by position, zone, or compartment of an airplane in accordance with the airplane manufacturer requirements;
- b. Determining CG limits for the airplane;
- c. Loading the airplane in accordance with CG limits;
- d. Calculating weight and balance and CG in accordance with air carrier procedures to include automated or manual calculation systems;
- e. Notifying the flightcrew of the weight and balance of the airplane;
- f. Accounting for the effect of weights of crews, supernumeraries, and baggage; and
- g. Communicating weight and balance or CG issues to personnel involved with cargo loading.

277. DETERMINING WHICH AIR CARRIER EMPLOYEES SHOULD RECEIVE CARGO HANDLING SYSTEM TRAINING. An air carrier should provide cargo handling system training to its maintenance personnel, load personnel, and managers.

278. CARGO HANDLING SYSTEM TRAINING TOPICS. Air carriers should have a program that provides adequate instruction to maintenance personnel who perform cargo repair duties. Personnel who supervise loading should have sufficient training to ensure passenger baggage and cargo is loaded and restrained in accordance with procedures. Air carriers should qualify all personnel including management under a training program that includes, at a minimum, the following subject matter in the training process for load managers and supervisors:

- a. Loading procedures and their effect on airplane performance consequences;
- b. Potential hazards to flight caused by improper loading;
- c. Airplane cargo handling system procedures and serviceability, including accounting for damaged or missing restraint devices; and
- d. The purpose and use of various restraint systems authorized for each airplane type the air carrier operates.

279. TRAINING FOR PERSONS RESPONSIBLE FOR INSPECTION AND REPAIR OF ULDs AND CARGO HANDLING SYSTEMS. Persons responsible for the inspection and repair of ULDs and cargo handling systems should undergo training that includes the following:

- a. Company policies and procedures for the inspection and repair of ULDs and cargo handling systems;
- b. Receiving inspection requirements for ULDs before acceptance for use; and
- c. MEL and configuration deviation list procedures related to the removal or deferral of restraint components from the airplane.

280. INFORMATION THE AIR CARRIER SHOULD PROVIDE TO ITS FLIGHTCREW ABOUT AIR CARGO. Applicable to the type of operator, an air carrier's flight operations training should adequately inform the flightcrew, at a minimum, of the following:

- a. Potential hazards to flight caused by improper loading;
- b. Procedures used to ensure the airplane weight is correct;
- c. Procedures to report unserviceable ULDs;
- d. Loading and weight limitations for the removal or deferral of cargo restraint components;
- e. Proper load configurations when using nets, straps, or containers;
- f. Special requirements when loading and restraining unusual loads; and
- g. General awareness and familiarization hazmats training.

281. REVIEWING THE AIR CARGO TRAINING PROGRAM IN AIR CARRIER SAFETY MANAGEMENT PROGRAMS. An air carrier's continuing analysis and surveillance system (CASS) should include an evaluation of the air carrier's cargo training program performance and effectiveness. The air carrier also may use an internal evaluation program to review its training program. The air carrier should ensure it has procedures to periodically review the training program and make changes as necessary.

282. RETAINING TRAINING RECORDS.

a. An air carrier should determine the appropriate time for retaining its training records, in accordance with the type of operation, frequency of recurrent training, and accepted training program. The air carrier should have procedures that require it to keep such records.

b. If an air carrier conducts the training, the air carrier should maintain the records. If the vendor conducts the training, the vendor should maintain the records if the air carrier approves. The air carrier or the vendor may maintain the training records in electronic form or hardcopy.

283. TRAINING RECORD CONTENTS. At a minimum, an air carrier's training records should contain the following information:

- a.** The name of the person trained;
- b.** The initial training date and most recent recurrent training date;
- c.** A description, copy, or the location of training material used;
- d.** The name and location of the person that provided the training; and
- e.** Certification that the person was tested and successfully completed training.

CHAPTER 3. CERTIFICATION

Section 1. General

300. PURPOSE. This chapter provides guidance for demonstrating compliance with 14 CFR requirements pertaining to the certification and continued airworthiness of transport category airplanes (for example, combi, passenger, all-cargo, commuter, regional) used for the carriage of cargo, including cargo handling systems, ULDs, and other primary restraints.

301. INFORMATION PROVIDED. This chapter includes guidance on data and information for the conversion of passenger airplane to freighters or combi service and content of applicable information in relevant weight and balance documents.

Section 2. Airplane Configuration

302. CERTIFICATION REQUIREMENTS FOR CARGO-CARRYING AIRPLANES.

An airplane designed to carry cargo, whether it is an all-cargo airplane, combination cargo-passenger airplane, or passenger airplane, has special access requirements, structural modifications to accommodate unique loading conditions, restraint devices, appliances, and measures to ensure the security of cargo throughout the operational envelope of the airplane. If an air carrier incorporates any of these design features or modifications into the airplane design, it needs to meet the certification requirements of the appropriate airworthiness standards (14 CFR part 25 or CAR 4b, as applicable), and have documents providing ICA. Appendix H provides an ICA checklist.

303. DIFFERENCES BETWEEN A BULK LOAD AND NONBULK LOAD CARGO COMPARTMENT. A cargo compartment will be categorized or defined as bulk load or nonbulk load.

a. Bulk Load. An airplane with a bulk load cargo compartment should have provisions inherent in the design and construction that prevent bulk cargo from:

(1) Shifting and damaging airplane systems and structures, and

(2) Shifting to the extent that the airplane CG exceeds the certified limits. The provisions inherent in the design include the requirement that the construction of the airplane ensures that unrestrained cargo, when subjected to the flight, ground, and landing loads of the appropriate airworthiness standards, cannot damage airplane systems and structure by impact.

b. Nonbulk Load. An airplane's systems and structures are protected with a nonbulk load cargo compartment by ULDs and the cargo restraint system. The ULDs and other load restraints will ensure that the cargo structural loads are only applied to the airplane through the ULD-airplane interface of the cargo restraint system. The ULDs and cargo restraint system must meet the airplane certification requirements with regard to the retention of cargo (e.g., TSO-C90c, which provides certification requirements for the specification of the ULDs).

304. FREIGHTER CONVERSIONS. The FAA has issued STCs to convert the configuration of certain transport-category airplanes from passenger carrying to *cargo* carrying. These freighter conversions entail modifications such as:

- a. Removing the passenger interior;
- b. Modifying the structure to accommodate changes in structural loading resulting from the carriage of cargo and the installation of cargo restraint systems;
- c. Installing a cargo interior;
- d. Installing main deck cargo doors; and
- e. Altering hydraulic, pneumatic, and electrical systems.

305. FEATURES OF CARGO RESTRAINT SYSTEMS.

a. The cargo restraint system installed in an airplane is a critical design feature. The cargo restraint system is the primary means of ensuring the cargo loads introduced into the airplane structure are properly distributed, and all items of mass are restrained from movement or from damaging critical airplane systems when subjected to flight, landing, and ground operational loads, and from the loads resulting from emergency landing conditions. The cargo restraint system may include barriers, ULDs, nets, straps, chains, tiedowns, and floor locks. A cargo restraint system must have sufficient strength under the certification requirements to restrain the cargo safely and must ensure the cargo will not shift and block or reduce access to emergency exits, obstruct the flow of required fire retardants, and interfere with other design features, such as flight controls, that are critical to the safety of flight. The minimum requirements are defined in the appropriate Airworthiness Standards. An air carrier should determine whether the protection of passengers and crew from shifting cargo during emergency landing conditions is to be accomplished by the cargo restraint system or provided by a barrier. This decision affects the airplane's structural requirements, ULDs, and cargo restraint system. Guidance and restraint system configurations are provided in AC 25-5, Installation Approval on Transport Category Airplanes of Cargo Unit Load Devices Approved as Meeting the Criteria in NAS 3610; AC 25-18, Transport Category Airplanes Modified for Cargo Service; and TSO-C90c.

b. The cargo restraint system and the devices used to restrain the cargo to the airplane structure are appliances.

306. ENSURING THE INTEGRITY OF A CARGO RESTRAINT SYSTEM. Even though the original design of a cargo restraint system may be in compliance with the applicable certification regulations, the installation of the system may not be adequately defined. Inspections of some airplanes have revealed wrong part number locks installed, missing locks, damaged equipment needing repair or replacement, and modifications made to the cargo restraint system that appeared to compromise its integrity. To maintain the integrity of the cargo restraint system, the air carrier should ensure that replacement parts are approved for the cargo restraint system components on which they are installed. It is important also to note that the operating environment for cargo restraint systems is generally more severe than what most airplane structures ensure. Many traditional marking methods are not permanent in this environment. To

ensure the integrity of its system, an air carrier should ensure that its cargo restraint system markings are permanent.

307. FIRE PROTECTION DESIGN FEATURES OF AIRPLANES THAT ARE ESSENTIAL TO OPERATIONAL SAFETY. While AC 25-18 discusses the various classes of cargo compartments and associated fire protection requirements, for the purpose of this AC, it is important to emphasize the dependence on the continued airworthiness of certain FAA-approved design features in cargo compartments that are essential to operational safety. For class A and B compartments, ensuring accessibility by a crewmember and availability of an approved fire extinguisher is critical to safety in the event of hazardous quantities of smoke or fire. For the class C and E compartments, the functions of specific design features must be preserved to ensure operational safety. The integrity of the cargo compartment liner, as it often serves the dual purpose of fire and smoke containment while providing ventilation paths for decompression events, must be maintained and the decompression features must be uncompromised. Smoke detectors, and for class C compartments, fire suppression equipment, are the essential equipment required for operational safety.

308. DEFINITION OF A SUPERNUMERARY. Section 121.583 allows for the carriage of certain persons aboard an airplane without complying with certain passenger-carrying requirements of part 121. These persons are commonly referred to as supernumeraries. They may be carried aboard an airplane because of their necessity for the safety of the flight, their relationship with the air carrier, or by virtue of certain knowledge and abilities attributed to them through selection and mandatory training.

309. INSTALLING ACCOMMODATIONS FOR SUPERNUMERARIES ON AIRPLANES CERTIFICATED UNDER PART 25.

a. Part 25 does not contain provisions similar to part 121 for installing accommodations for supernumeraries. Therefore, a TC holder or an air carrier must petition for and receive an exemption under 14 CFR part 11 from the sections of part 25 to install accommodations for supernumeraries. The FAA reviews each petition for exemption on its own merits. The enhanced capabilities of supernumeraries over passengers allows the FAA to issue an exemption in certain instances from selected type design requirements normally imposed for the safety of passengers. In all cases, however, the desired result is the retention of all passenger safety features to the maximum extent reasonable, when all factors are considered, and an overall level of safety for supernumeraries comparable to that afforded to passengers. Under part 11, the FAA grants an exemption if it finds the exemption is in the public interest and will provide a level of safety equivalent to that provided under the regulations.

b. The FAA has granted exemptions from part 25 to allow air carriers to install accommodations for supernumeraries. In addition to persons necessary for the safe conduct of the flight (for example, large animal handlers), exemptions have been granted for the transportation of personnel. The exemptions usually involve only a few supernumeraries and the accommodations are located immediately aft of the flight deck, which is consistent with the intent of section 121.583. In granting the exemptions, the FAA had concerns with allowing accommodations for supernumeraries outside the flight deck. The FAA wants exemption holders to:

- (1) Provide a suitable means for preventing smoke penetration into this occupied area.
- (2) Find each supernumerary physically fit.
- (3) Brief each supernumerary on emergency equipment and procedures.
- (4) Ensure each supernumerary's willingness to use the emergency equipment and means of emergency egress provided.
- (5) Comply with any other requirements of the exemption.

c. The FAA may have additional concerns based on the particular airplane configuration or other features and may require an exemption holder to provide palletized flightcrew rest modules and access to the cargo compartment to care for live animals.

310. MODIFICATIONS AND ALTERATIONS THAT COULD IMPACT WEIGHT AND BALANCE. While the impact of a modification or alteration may be evident with many changes to weight and balance, the impact of some modifications are not readily evident, for example:

a. A modification to incorporate a winglet may change the cargo loading limitation over the wing box.

b. The change in zero fuel weight may alter airplane fore and aft CG limits.

c. The conversion of class D cargo compartments to class C heightens the concern of the potential for damage to certain design features in the class C compartment intended to sense smoke and discharge a fire retardant when necessary.

d. The addition of an auxiliary fuel tank depending on its installation may or may not change the zonal payload weight limits on the structure above the tank.

311. DESIGN ELEMENTS THAT COULD AFFECT THE CARGO LOCATION. The cargo airplane design should accommodate expected uncertainties in cargo center of mass location normally associated with operational accuracies and tolerances. The effect on structural loads resulting from the expected variations in cargo CG location expected in operation must be considered in computing cargo restraint system and cargo deck loads. Unless the CG of the cargo is actually measured, the assumed location of cargo CG is based on the envelope that is achieved in operation. This expected variation should be accommodated in the design and is normally identified as a CG position loading limitation on the airplane. These limitations are normally selected so that they can be achieved by the application of loading procedures. Cargo loading procedures for bulk and nonbulk (e.g., contained in a ULD) should be reviewed to ensure the cargo CG is within the assumed envelope to avoid safety issues with the cargo restraint system and the affected airplane structure.

312. DEFINITION OF ICAs. ICAs are a set of instructions as referenced in part 21, section 21.50 and part 25, section 25.1529 of the regulations that provide information on how to properly maintain a product in an airworthy condition, including any inspections or other

procedures, as necessary, to prevent catastrophic failure of the product. Without acceptable ICAs, a product cannot be maintained in an airworthy condition. Appendix G provides additional information on the scope of the ICA to be considered as a function of the original design and/or modifications to a transport airplane.

313. DESIGN APPROVAL PROJECTS THAT REQUIRE ICAs. In accordance with section 21.50(b), all design approval applicants must submit an ICA as part of the type design for approval.

314. DESIGN APPROVALS. A design approval is any approved change or amendment of the type design granted by the FAA or its designees that defines or alters the approved configuration of an airplane, airplane engine, propeller, part, or appliance. The following are classified as design approvals and are subject to the requirements of section 21.50(b):

- a. TCs.
- b. Amended TCs.
- c. STCs.
- d. Amended STCs.
- e. PMAs.
- f. TSO authorizations.
- g. Major repairs and alterations approved by FAA Form 337.

Section 3. Unit Load Devices (ULD)

315. CLASSIFICATION OF ULDS. While ULDs (that is, containers or pallets/net combinations) are part of the cargo restraint system, they deserve some special emphasis regarding associated issues. Apart from obtaining an STC for the design approval for a ULD, TSO-C90 provides the certification requirements for the specification of the ULD by reference to National Aerospace Standard (NAS) 3610, Cargo Unit Load Devices. This specification provides a formal means for classification of ULDs for which certain strength capabilities have been demonstrated. This does not, however, approve the installation or use of the ULD in an airplane where the protection of the airplane's systems and structure depends upon the integrity of the ULD. Implicit in the classification of a ULD is the vertical restraint configuration used to establish the ULD type and strength capabilities. As appropriate to the type design, the specification of which ULDs are compatible with the particular airplane should be identified in the airplane weight and balance or cargo loading document. This is the primary means for ensuring the proper ULDs are used in the operation of the airplane.

316. USING QUALIFIED NETS AND STRAPS.

a. Net and pallet combinations are defined as ULDs by NAS 3610. NAS 3610 also defines load capability for particular net and pallet combinations. If nets other than those

approved for use with particular pallets under TSO-C90 are used to restrain cargo on pallets, they must be properly qualified and approved regarding the type of cargo being restrained and the effects of shoring the payload on the pallet. If approved for use, the arrangement and the number of straps and their attachment to airplane structure should also be qualified in the OEM reference documents. The strength capability of tiedown hardware should be provided along with any limitations on use or acceptable configuration. Failure by the OEM to include sufficient information for the proper use of nets and straps may impose the burden of obtaining approval for use on the operator and may result in a failure by an air carrier to ensure proper restraint of the cargo and a possible unsafe condition.

b. Some approved cargo restraint systems permit the use of tiedown straps as a primary restraint means. These systems generally provide the instructions for determining the quantity and arrangement of straps required to properly restrain the cargo. In many cases the strap specification provided by the OEM may be provided only as a required strap rating, for example, “5,000-Pound Rated Straps.” In this situation, the operator is responsible for obtaining FAA approval for the particular straps that it is using. The operator should have procedures for selecting or defining straps that meet the requirements of the approved cargo restraint system, ensuring that the purchased or manufactured straps meet the OEM requirements, and have procedures in place that ensure the continued airworthiness of the straps. The straps approved for use by the operator should be uniquely identified (i.e., manufacturer part number) in the operator’s operating manuals.

c. With cargo restraint systems that permit the use of tiedown straps as a primary means of restraint, typically the approval is for tiedown to the airplane’s structure, through installed tracks and fittings. These systems do not generally address the use of straps to restrain cargo to pallets, nor does approval to TSO-C90 standards address this issue. If an operator does wish to use straps as a primary means of restraint to a TSO-C90 pallet, the FAA must approve this. In obtaining approval, the operator must provide the data necessary to demonstrate compliance with the appropriate regulations. This would include, but is not limited to:

(1) Establishing strap rating requirements.

(2) Providing a method to determine the appropriate quantity of straps and their arrangement. In determining this, it must be demonstrated that the orientation of the straps secures the load for all loading conditions and that the loads in the straps do not exceed the strap rating, nor do the strap loads exceed the capability of the pallet tiedown fittings or tracks. It must also be demonstrated that the use of tiedown straps does not introduce loads into the pallet that would exceed the approved strength of the pallet with regard to distributing the load from the pallet tiedown to the cargo restraint system latches, or the strength of the latches.

(3) Provide the limitations for use of the straps. For example, a limitation might be that the use of the straps as a primary restraint of cargo to a TSO-C90 pallet may only be applicable to a single piece of cargo, or packaged or crated goods, where the cargo or package container is inherently strong enough to be restrained by straps or keep the contents from dispersing.

317. CG OFFSET LIMITS.

a. A ULD specification document, like NAS 3610, specifies in part the CG offset for which a ULD should have demonstrated the specific strength requirements. Failure to adhere to the CG offset limits in operation jeopardizes the ability of the ULD to restrain the load and the ability of the airplane to safely react to the loads imposed by the ULD.

b. The design of the cargo floor and cargo restraint system is based on the assumption of what loads would be applied to the floor beams. The assumptions used in the design of the floor may not necessarily be the same as the ULD limits, and ULD CG offset limits for some airplanes are more restrictive than the TSO-C90 limits. The floor loads should include the total distributed load of the cargo in the ULD and the CG offset that may apply.

c. If the designer of the airplane structural system and cargo loading systems has assumed only a limited CG offset that the systems must react to, the air carrier must ensure the loaded cargo is within these design assumptions. Failure of an air carrier to adhere to the limitations of the design will impact the safety of operation.

CHAPTER 4. ADMINISTRATIVE INFORMATION

400. HOW TO OBTAIN COPIES OF PUBLICATIONS.

a. The CFRs and those ACs for which a fee is charged may be obtained from the Superintendent of Documents at the following address. A listing of the CFRs and current prices is located in AC 00-44, Status of Federal Aviation Regulations, and a listing of all ACs is located in AC 00-2, Advisory Circular Checklist.

Superintendent of Documents
P.O. Box 371954
Pittsburgh, PA 15250-7954

b. To order free ACs, contact:

U.S. Department of Transportation
Subsequent Distribution Office
M-30
Ardmore East Business Center
3341 Q 75th Avenue
Landover, MD 20785

c. You may view and print the CFRs and Aircraft Certification Service and Flight Standards Service ACs on the FAA Web page located at <http://www.airweb.faa.gov/rgl>.

401. ADDITIONAL INFORMATION. For information concerning this AC, contact the Air Carrier Maintenance Branch, AFS-330, at (202) 267-3546. Submit direct comments regarding this AC to:

U.S. Department of Transportation
Federal Aviation Administration
Aircraft Maintenance Division, AFS-300
800 Independence Avenue, SW.
Washington, DC 20591

APPENDIX 1. RELATED REGULATIONS

1. Title 14 of the Code of Federal Regulations (14 CFR) part 21, Certification Procedures for Products and Parts. Part 21, Subpart E, Supplemental Type Certificates. Part 21, Subpart K, Approval of Materials, Parts, Processes, and Appliances. Part 21, Subpart O, Technical Standard Order Authorizations.
 - a. Section 21.21, Issue of type certificate: normal, utility, acrobatic, commuter, and transport category aircraft; manned free balloons; special classes of aircraft; aircraft engines; propellers.
 - b. Section 21.50, Instructions for continued airworthiness and manufacturers maintenance manuals having airworthiness limitations sections.
 - c. Section 21.101, Designation of applicable regulations.
 - d. Section 21.303, Replacement and modification parts.
2. Part 25, Airworthiness Standards: Transportation Category Airplanes.
 - a. Section 25.23, Load distribution limits.
 - b. Section 25.301, Loads.
 - c. Section 25.787, Stowage compartments.
 - d. Section 25.853, Compartment interiors.
 - e. Section 25.855, Cargo or baggage compartments.
 - f. Section 25.857, Cargo compartment classification.
 - g. Section 25.858, Cargo or baggage compartment smoke or fire detection systems.
 - h. Section 25.1519, Weight, center of gravity, and weight distribution.
 - i. Section 25.1529, Instructions for continued airworthiness.
 - j. Section 25.1581, Airplane flight manual, general.
 - k. Section 25.1583(c), Weight and loading distribution.
 - l. Appendix F to part 25.
 - m. Appendix H to part 25, Instructions for Continued Airworthiness.
3. Part 43, Maintenance, Preventive Maintenance, Rebuilding, and Alteration.
4. Part 45, section 45.15, Replacement and Modification Parts.
5. Part 119, Certification: Air Carriers and Commercial Operators.

-
- a. Section 119.49, Contents of operations specifications.
 - b. Section 119.72, Reports by air carriers on incidents involving animals during air transport.
 6. Part 121, Operating Requirements: Domestic, Flag, and Supplemental Operations. Part 121, Subpart G, Manual Requirements.
 - a. Section 121.153, Aircraft requirements: General.
 - b. Section 121.363, Responsibility for airworthiness.
 - c. Section 121.367, Maintenance, preventive maintenance, and alteration programs.
 - d. Section 121.373, Continuing analysis and surveillance.
 - e. Section 121.375, Maintenance training programs.
 - f. Section 121.419, Pilots and flight engineers: Initial, transition, and upgrade ground training.
 - g. Section 121.422, Aircraft dispatchers: Initial and transition ground training.
 - h. Section 121.693, Load manifest: All certificate holders.
 7. Part 145, Repair Stations.
 8. Part 382, Nondiscrimination on the Basis of Disability in Air Travel. Section 382.55(a)(1), Miscellaneous provisions.

APPENDIX 2. REGULATORY AND GUIDANCE MATERIAL

Advisory Circulars (AC) (current editions)

1. AC 00-58, Voluntary Disclosure Reporting Program.
2. AC 20-62, Eligibility, Quality, and Identification of Aeronautical Replacement Parts.
3. AC 21-1, Production Certificates.
4. AC 25-5, Installation Approval on Transport Category Airplanes of Cargo Unit Load Devices Approved as Meeting the Criteria in NAS 3610.
5. AC 25-9, Smoke Detection, Penetration, and Evacuation Tests and Related Flight Manual Emergency Procedures.
6. AC 25-18, Transport Category Airplanes Modified for Cargo Service.
7. AC 120-16, Air Carrier Maintenance Programs.
8. AC 120-27, Aircraft Weight and Balance Control.
9. AC 121-27, Guide for Air Carriers, Freight Forwarders, and Shippers in Obtaining Information Dealing With the Transportation of Hazardous Material by Air.
10. AC 145-9, Guide for Developing and Evaluating Repair Station and Quality Control Manuals.

Federal Aviation Administration (FAA) Orders, Forms, Bulletins, And Technical Standard Orders (current editions)

1. FAA Order 8120.2, Production Approval and Certificate Management Procedures, as amended.
2. FAA Form 337, Major Repair and Alteration.
3. FAA Form 8130-3, Authorized Release Certificate, Airworthiness Approval Tag.
4. Technical Standard Order (TSO)-C90, Cargo Pallets, Nets, and Containers.

Cargo AC Development Information

1. Air Cargo System Implementation Plan, March 2003.
2. Cargo Strategic Action Plan, April 2002.
3. Compliance Document for ULD Center of Gravity Control on B-727 Aircraft, October 2000.
4. Civil Reserve Air Fleet Aircraft Procedures for the U.S. Military, FM 55-9.

Industry Information

1. International Air Transport Association (IATA) Aerospace Recommended Practice (ARP) 1334, 5486, 5595, and 5597.
2. IATA Airport Handling Manual.

3. IATA ULD Technical Manual (UTM).
4. International Standards Organization (ISO) Publication No. 4118, Non-certified Lower-deck Containers for Air Transport.
5. National Aerospace Standard (NAS) 3610, Cargo Unit Load Devices.
6. Society of Automotive Engineers (SAE) Aerospace Standards:
 - AS 1677, General Requirements for Uncertified Cargo/Baggage Containers
 - AS 1131C, Pallet Net
 - AS 1491B, Interline pallet (NAS 3620 Class II)
 - AS 1492B, Pallet Net
 - AS 4041, Air Mode General Purpose Containers
 - AS 4041A, Intermodal Container AS 1130F, Air-Surface Pallet
 - AS 5385A, Cargo Restraint Straps—Design Criteria and Testing Methods
 - AS 5896A, Lower Deck Certified Containers
 - AS 36101, ULD Load Distribution Model
7. Society of Automotive Engineers (SAE) Aerospace Recommended Practice (ARP):
 - ARP 1334, Ground Equipment Requirements for Compatibility with Aircraft Unit Load Devices
 - ARP 1554B, Automobiles Transport Device
 - ARP 1621B, Horses Transport Stall
 - ARP 1840A, Aircraft Engine Transport Device
 - ARP 5486, Air Cargo Pallets—Utilization Guidelines
 - ARP 5595, Cargo Restraint Straps—Utilization Guidelines
 - ARP 5596, Cargo Shoring Guidelines

APPENDIX 3. DEFINITIONS RELATED TO AIR CARGO OPERATIONS

1. **Approved Parts.** Unless used with reference to another person, means parts approved by the Administrator.
2. **Cargo.** For the purpose of this advisory circular (AC), cargo refers to passenger checked baggage, freight, hazardous materials, dangerous goods, and company materials. Cargo does not include passenger carry-on baggage.
3. **Cargo Handling System/Cargo Restraint System.** A system installed in an aircraft and used to convey and restrain unit load devices (ULD) in the aircraft.
4. **Company Materials.** Company material, commonly called COMAT, is an industry term used by air carriers to describe nonrevenue materials and supplies owned by the air carrier that are shipped by the air carrier in support of its operations.
5. **Certified Unit Load Device (ULD).** A ULD meeting the requirements of TSO-C90, Cargo Pallets, Nets, and Containers, as amended; STC requirements, if applicable; or other FAA-approved certification standards.
6. **Dunnage.** Materials used to support and protect cargo in an aircraft cargo compartment or padding used in a shipping container to protect the container's contents.
7. **Dynamic Load.** Loads imparted on the structure of the aircraft by loaded cargo during taxi, takeoff, cruise, and landing.
8. **First Article Inspection.** Inspection of the first of a manufactured component to ensure compliance with certification and airworthiness requirements.
9. **Frangible (Compressible) Cargo.** Cargo with a density and structure such that it is loose in nature and able to absorb energy during an emergency landing situation, as defined in the aircraft weight and balance document. Compressible cargo may be required in certain positions for protection of the aircraft and its ability to withstand emergency landing conditions, as required by the airplane manufacturer weight and balance documents.
10. **Hazardous Materials.** Materials or substances meeting the definition of hazardous material in Title 49 of the Code of Federal Regulations part 171, section 171.8. Hazardous materials are also referred to as hazmat, dangerous goods, and DGs.
11. **Interlining.** Movement of freight from one air carrier to another. For example, a ULD transferred from a domestic air carrier to a foreign air carrier.
12. **Non-Certified Unit Load Device.** A ULD not certified or approved by the FAA.
13. **Overhang Cargo.** Cargo that is larger in at least one direction than the overall dimensions of the pallet. This includes cargo tied down to more than one pallet.
14. **Oversized Cargo.** Cargo that overlaps the pallet's tiedown track but is within the overall dimensions of the pallet.
15. **Rigid (Non-Frangible) Cargo.** Cargo with a density that is rigid in nature, as defined in the airplane manufacturer's weight and balance document.

- 16. Sharp Cargo.** Cargo that has a piercing or penetrating nature, or cargo with sharp edges or corners.
- 17. Static Load.** Loads imparted on the aircraft structure by loaded cargo while the aircraft is parked.
- 18. Step-Loading.** Loading ULDs on an aircraft by specific sequence, position, and stages.
- 19. Supernumeraries.** Persons that are not members of the crew who are carried on board all-cargo aircraft that do not comply with all passenger carrying requirements of 14 CFR part 121.
- 20. Tare Weight.** The weight of the empty ULD, including its normal complement of loading restraint devices. Also, the empty weight of other material handling equipment (i.e., baggage carts, dollies, etc.) used to weigh cargo on a scale.
- 21. Temporary Restraint Device.** Temporary net restraint fittings installed in place of damaged or missing fittings, or temporary net take-up hooks and net corner lashing lines.
- 22. Unit Load Device (ULD).** A device for grouping, transferring, and restraining cargo for transit.
- 23. Unitized.** Consolidated multiple packages or items loaded into or on a ULD.
- 24. Vendor.** Any person or entity performing a service for the air carrier. This includes, but is not limited to, a freight forwarder, contractor, customer, and another air carrier that performs cargo buildup, airplane loading, and unloading for the air carrier. This also includes repair services provided by an FAA-certificated entity.
- 25. Zone Weight.** Cumulative weight as loaded within a designated zone within the aircraft such as a specific area on the upper deck cargo area plus the cargo loaded on the lower deck directly beneath.

APPENDIX 4. ACRONYMS AND ABBREVIATIONS

| | |
|---------------|--|
| 14 CFR | Title 14 of the Code of Federal Regulations |
| AC | advisory circular |
| CASS | Continuing Analysis and Surveillance System |
| CFR | Code of Federal Regulations |
| CG | center of gravity |
| CMM | component maintenance manual |
| COMAT | company material |
| DG | dangerous goods |
| FAA | Federal Aviation Administration |
| hazmat | hazardous materials |
| IATA | International Air Transport Association |
| ICA | instructions for continued airworthiness |
| ISO | International Standards Organization |
| MEL | minimum equipment list |
| NAS | National Aerospace Standard |
| NIST | National Institute of Standards and Technology |
| OEM | Original Equipment Manufacturer |
| PC | Production Certificate |
| PMA | Parts Manufacturer Approval |
| SAE | Society of Automotive Engineers |
| STC | Supplemental Type Certificate |
| TC | type certificate |
| TSO | Technical Standard Order |
| ULD | unit load device |

APPENDIX 5. SUGGESTED STRUCTURAL DATA FOR PASSENGER-TO-CARGO CONVERSION PROJECT

An applicant should submit the following data to the Federal Aviation Administration (FAA) as structural substantiation in support of a passenger-to-cargo conversion project. This list is not all-inclusive, and each project should be individually evaluated to determine if additional data are necessary. The applicant and the approving authority representative should come to an agreement on the necessary data early in the program as part of the certification plan.

NOTE: Documents with an asterisk (*) are required by Title 14 of the Code of Federal Regulations (14 CFR).

Aircraft Flight Manual.* Identifies all operating limitations, including operating speeds and door operation, and contains allowable aircraft fuel and cargo loading directly or by reference. Any additional information necessary to safely operate the aircraft should also be provided.

Aircraft Loading Document.* Describes the types of cargo containers allowed, how the containers are restrained, and loading requirements when latches are missing or broken. This may be contained in the weight and balance manual. Ensures compatibility of the cargo handling system with the cargo conversion. These modifications have often been incorporated independent of each other. In addition, if the use of tiedown fittings is permitted, the tiedown strength and limitation data should be provided.

Assembly/Installation Drawings.* Details how all parts are assembled and identifies the number and types of fasteners used.

Cargo Restraint System. Designed for all critical ground, flight, and emergency landing loads. This includes seat tracks, pallet locks, side restraints, and roller trays. The 9G rigid barrier or cargo restraint net, if required, and its attachment, and the fuselage surrounding structure must be analyzed for critical payloads.

Certification Plan. Lists all steps necessary to complete FAA certification of the modification. At a minimum, the plan should discuss scope of the project, schedule, use of Designated Engineering Representatives (DER), data submittals, and conformity issues.

Compatibility Evaluation. The applicant evaluates each aircraft to be modified to ensure it is compatible with the Supplemental Type Certificate (STC) modification. The applicant also identifies and evaluates modifications, alterations, or the incorporation of other STCs that change the type design of the aircraft to be modified. The applicant notes and makes accommodations for differences and necessary drawing changes.

Compliance Checklist. Lists all applicable rules from the certification basis of the modification of the aircraft. Also identifies necessary compliance with outstanding Airworthiness Directives (AD) and the methods of compliance.

Configuration Deviations.* Lists all nonconformities with their engineering dispositions.

Damage Tolerance Assessment (DTA).* Required for all 14 CFR part 25 post-Amendment-45-certified aircraft. The applicant should create a DTA for pre-Amendment-45 aircraft in support of a supplement to a standard that is required by an AD. The DTA should evaluate

whether an existing principal structural element has been changed or if one has been created by the modification. Fail-safe requirements should be addressed as necessary.

Decompression Analysis. The substantiation must show that the cargo compartment is designed to withstand the effects of a sudden release of pressure. Consider impact of solid 9G barrier in decompression scenarios (part 25, section 25.365(e); Civil Air Regulations (CAR) 4b.216(c)(4)).

Design Criteria. A list of design, analysis, and production methodologies, and requirements used in creating the modification.

Detail Drawings.* There should be a detail drawing for each part manufactured for use in the modification and some means of controlling the source of all vendor-supplied items.

Door Mechanical Systems. The applicant analyzes the door opening, latching, and locking mechanisms for most critical loads, which should include maximum hydraulic actuator output and possible jam conditions.

Door Surround Structure. The door surround structure must be analyzed for the redistributed loads resulting from the door cutout. This includes the fuselage skin, doublers, sills, headers, footers, surrounding frames, and longerons/stringers, latches, and their attachments. An analysis of the door and the door hinge should also be included.

External Loads Analysis.* Should include most critical aircraft weight distribution at both minimum and maximum weights and critical loading throughout the center of gravity (CG) range, including raised vertical CG, and must consider all points within the operating envelope (that is, gust and maneuver). External loads should also include the effects of loads on pallet locks, load impingement on main deck floors by lower deck, unrestrained cargo, and shift in unit load devices (ULD) or bulk load cargo CG locations consistent with pallet approvals and usage.

Final Documentation. Documentation showing that all structural margins are positive for the critical load case.

Floors. The floor beams, fuselage frames, and posts/struts should be analyzed for the most critical loading conditions.

Flutter Substantiation.* A cargo conversion can change the fuselage stiffness or change the mass distribution, which can have an effect on the aircraft's flutter characteristics, particularly aft cargo doors.

Functional Check.* Performed to ensure proper operation of the main cargo door. The number of open-close cycles are to be decided upon with the aircraft certification office. The test could include determining the mean time between failure of components, validating the failure modes and effects analyses, and monitoring the wear of latches (14 CFR section 25.1301; CAR 4b.601).

Identification of Supplemental Type Certificate Team Members. Identify STC team members and DERs whose experience is commensurate with these kinds of projects (that is, external loads, systems safety assessment, finite element modeling, and validation).

Illustrated Parts Catalog. Catalog of all parts contained in the supplemental type certificate for procurement purposes.

Installation Instructions. Any installation instructions necessary other than what is listed in the installation drawings. Ensure that there are adequate instructions for the installation of cargo compartment liners and floor panels to minimize the use of a shop practice that may result in blind drilling of holes that could induce damage (double-drilled holes and short-edge margins) to floor beam caps and fuselage frames.

Internal Loads Analysis.* Distribution of loads within the affected airframe structure. Load distribution should be validated.

Maintenance Instructions.* Continued airworthiness requirements for the inspection program, which includes the frequency and extent of those inspections.

Maintenance Manual.* Instructions for continued airworthiness of the modifications.

Master Data List. Lists all process specifications and reports that substantiate the structural strength and damage tolerance of the modification, along with all test reports (that is, flutter, pressurization, finite element method (FEM) validation).

Master Drawing List.* Controls all drawings and process specifications that define design of the modification.

Master Minimum Equipment List. Aircraft Evaluation Group (AEG) approval for dispatch with inoperative components, that is, cargo system locks and cargo door latches.

Methodology Description. Describes the methodology used to define (1) the barrier load distributions and intensities and distribute the barrier loads to the monocoque, and (2) the ULD load distributions and intensities and distribute the loads to the restraint system components and floor.

Pressure Test.* The structure must be designed to withstand (limit load) the maximum pressure relief valve setting combined with flight loads (part 25, section 25.365(a); CAR 4b.216(c)(1)), and the maximum relief valve setting omitting other loads times a factor of 1.33 or 1.67, as appropriate (section 25.365(d); CAR 4b.216(c)(3)). If the modification or conversion involves changes to the pressure barrier, such as a new door installation, it must be pressure tested per part 25, section 25.843 or CAR 4b.376.

Structural Repair Manual. Instructions for repair of the modifications.

Structural Substantiation.* Positive margins of safety should be shown for all modified structures. Assumptions used in any analysis or test must be consistent with how the loads are applied and the way the structure carries these loads. A margin of safety table should be published for each structural analysis.

Weight and Balance Manual.* Describes aircraft fuel and payload distributions and CG restrictions. Defines applicable ULDs. Provides any other relevant information necessary for the safe operation of the aircraft.

APPENDIX 6. PASSENGER-TO-CARGO CONVERSIONS SUPPLEMENTAL TYPE CERTIFICATE DATA PACKAGE FOR SYSTEMS AND EQUIPMENT

1. An applicant should submit the following information to the Federal Aviation Administration (FAA).

a. Certification Plan. Helps determine the scope of the conversion project, that is, full passenger-to-cargo conversion, cargo door-only conversion, or smoke detection system-only conversion, and whether supernumeraries are included. A systems description document may have been included in the certification plan, system failure modes, and effects analyses. It is likely that safety analyses were not prepared; you may have to learn about the system based on drawings and diagrams.

b. Compliance Checklist. Helps determine methods to comply to all applicable Title 14 of the Code of Federal Regulations (14 CFR)/Civil Air Regulations (CAR).

c. Master Data List/Top Drawing List. Helps link the supplemental type certificate drawings/reports down to detailed levels.

2. Based on, or lacking, the above data, the following areas should be reviewed for the conversions to determine that the modifications are safe:

a. Cargo Door. Should include—

(1) Safety analyses (including any latch/lock/pin failures that could cause door to unlock);

(2) Drawings;

(3) Wiring qualification (flammability);

(4) Wiring diagrams/schematics;

(5) Electrical load analysis;

(6) Hydraulic components qualification test;

(7) System pressure proof/burst test;

(8) Any conformity reports (parts, test article, installation);

(9) Flammable fluid fire protection;

(10) Aircraft Flight Manual (AFM) and limitations;

(11) Cargo door opening, closing, and locking mechanisms, including vent door design with its associated power sources (electrical, hydraulics, mechanical), door opening retention system safety during cargo loading, and system isolation during flight; and

(12) Cargo door warning system and its redundancy features (door control panel and cockpit displays, sensors, placards).

b. Continued Airworthiness. Maintenance/overhaul manual, flightcrew operating manual, minimum equipment list (MEL), certification maintenance requirements (if required by safety analyses), and any other relevant information for all systems.

c. Crew Emergency Exit. Interior arrangement drawing and compliance inspection to determine crew accessibility under any cargo loading condition.

d. Critical Component. Drawings, reports, or issue papers addressing means of protection of critical controls, lines, and equipment in the cargo compartment.

e. Smoke Barrier. Should include—

(1) Drawings/installation;

(2) Smoke penetration test plan and report (may be included in the smoke detection system test report);

(3) Flight test report; and

(4) Conformity reports (parts, test article, installation).

f. Smoke Detection System. Should include—

(1) Installation drawings;

(2) A test plan and report (including testing in MEL configuration);

(3) Wiring qualification (flammability);

(4) Wiring diagrams/schematics;

(5) Electrical load analysis;

(6) Technical Standard Order (TSO)-approved smoke detector (or other testing done for a supplemental type certificate);

(7) System control panel qualification and installation;

(8) Flight test report;

(9) Conformity reports (parts, test article, installation);

- (10) Failure modes and effects analyses;
- (11) AFM and limitations; and
- (12) Compliance inspection to determine cargo interference with fire protection features.

g. Supernumerary Occupants (If Applicable). Data should include exemption approvals from the FAA and interior arrangement drawings. This includes all 14 CFR part 25 regulations applied for carriage of passengers such as emergency egress assist means and escape routes, emergency lighting, emergency exit access, seats, safety harness, oxygen equipment and supply, portable breathing equipment, safety equipment, markings and placards, and compliance inspection.

h. Ventilation System. The ventilation may have been modified to provide a means to shut off ventilation to the cargo compartment in case of a fire. Data should include—

- (1) Detailed design/drawings;
- (2) Wiring diagrams;
- (3) Electrical load analysis;
- (4) Safety analyses;
- (5) AFM and limitations; and
- (6) Cockpit smoke evacuation procedures (may be required).

APPENDIX 7. DESIGN CRITERIA FOR OUTWARD OPENING DOORS

The following is an excerpt from a Federal Aviation Administration (FAA) Memorandum to the Director of Airworthiness and Technical Standards of the Air Transportation Association of America ATA, dated March 20, 1992 that defined criteria for outward opening doors.

(1) Indication System:

- (a) The indication system must directly monitor the closed, latched, and locked positions.
- (b) The indicator should be amber unless it concerns an outward opening door whose opening during takeoff could present an immediate hazard to the airplane. In that case, the indicator must be red and located in plain view in front of the pilots. An aural warning is also advisable. A display on the master caution/warning system is also acceptable as an indicator. For the purpose of complying with this paragraph, an immediate hazard is defined as significant reduction in controllability, structural damage, or impact with other structures, engines, or controls.
- (c) Loss of indication or a false indication of a closed, latched, and locked condition must be improbable.
- (d) A warning indication must be provided at the door operator's station that directly monitors the door latch and lock conditions, unless the operator has a visual indication that the door is fully closed and locked. For example, a vent door that monitors the door locks and can be seen from the operator's station would meet this requirement.

(2) Means to Visually Inspect the Locking Mechanism: There must be a visual means of directly inspecting the locks. Where all locks are tied to a common lock shaft, a means of inspecting the locks at each end may be sufficient to meet this requirement provided no failure condition in the lock shaft would go undetected when viewing the end locks. Viewing latches may be used as an alternate to viewing locks on some installations where there are other compensating features.

(3) Means to Prevent Pressurization: All doors must have provisions to prevent initiation of pressurization of the airplane to an unsafe level if the door is not fully closed, latched, and locked.

(4) Lock Strength: Locks must be designed to withstand the maximum output power of the actuators and maximum expected manual operating forces treated as a limit load. Under these conditions, the door must remain closed, latched, and locked.

(5) Power Availability: All power to the door must be removed in flight, and it must not be possible for the flightcrew to restore power to the door while in flight.

APPENDIX 8. TRANSPORT CATEGORY AIRPLANE ICA CHECKLIST

| Requirement | Regulation | Location |
|---|----------------------|----------|
| <input type="checkbox"/> ICA for each engine. | H25.1(b) | |
| <input type="checkbox"/> ICA for each propeller. | H25.1(b) | |
| <input type="checkbox"/> ICA for each appliance required by this AC. | H25.1(b) | |
| <input type="checkbox"/> Any required information relating to the interface of the <input type="checkbox"/> appliances, <input type="checkbox"/> engines and <input type="checkbox"/> propellers with the airplane. | H25.1(b) | |
| <input type="checkbox"/> If ICA are not supplied by the manufacturer of an <input type="checkbox"/> appliance, <input type="checkbox"/> engine or <input type="checkbox"/> propeller installed on the airplane, the ICA for the airplane must include <input type="checkbox"/> the information essential to the continued airworthiness of the airplane. | H25.1(b) | |
| <input type="checkbox"/> Program showing how changes to the ICA made by the applicant or by the manufacturer of products and appliances installed on the airplane will be distributed. | H25.1(c) | |
| <input type="checkbox"/> ICA in the form of a manual or manuals. <input type="checkbox"/> In a practical arrangement. | H25.2(a) H25.2(b) | |
| <input type="checkbox"/> The contents of the manual or manuals must be prepared in the English language. | H25.3 | |
| <input type="checkbox"/> Must include introductory information that includes an explanation of the airplane's features and data to the extend necessary for maintenance or preventive maintenance. | H25.3(a)(1) | |
| <input type="checkbox"/> A description of the <input type="checkbox"/> airplane and its systems and installations, <input type="checkbox"/> engines and its systems and installations, <input type="checkbox"/> propellers and its systems and installations, <input type="checkbox"/> appliances and its systems and installations. | H25.3(a)(2) | |
| <input type="checkbox"/> Basic control and operating information describing <input type="checkbox"/> how the airplane components and systems are controlled and <input type="checkbox"/> how the airplane components and systems are operated including <input type="checkbox"/> any special procedure and limitations. | H25.3(a)(3) | |
| <input type="checkbox"/> Servicing information that covers details regarding <input type="checkbox"/> servicing points, <input type="checkbox"/> capacities of tanks, <input type="checkbox"/> capacities of reservoirs, <input type="checkbox"/> types of fluids to be used, <input type="checkbox"/> pressures applicable to the various systems. | H25.3(a)(4) | |
| <input type="checkbox"/> Location of access panels for <input type="checkbox"/> inspection and <input type="checkbox"/> servicing. | H25.3 (a)(4) | |
| <input type="checkbox"/> Servicing information that covers details regarding <input type="checkbox"/> locations of lubrication points, <input type="checkbox"/> the lubricant to be used. | H25.3(a)(4) | |
| <input type="checkbox"/> Equipment required for servicing. | H25.3(a)(4) | |
| <input type="checkbox"/> Tow instructions and limitations. | H25.3(a)(4) | |

| Requirement | Regulation | Location |
|---|-------------|----------|
| () Mooring information. | H25.3(a)(4) | |
| () Jacking information. | H25.3(a)(4) | |
| () Leveling information. | H25.3(a)(4) | |
| () Scheduling information for each part of the () airplane that provides the recommended periods at which they should () cleaned, () inspected, () adjusted, () tested, () lubricated and () the work recommended at these periods. | H25.3(b)(1) | |
| () Scheduling information for the () airplane's engine(s) that provides the recommended periods at which they should be () cleaned, () inspected, () adjusted, () tested, () lubricated and () the work recommended at these periods. NOTE: This information may be in the FAA-accepted engine ICA. | H25.3(b)(1) | |
| () Scheduling information for the () airplane's auxiliary power unit (APU) that provides the recommended periods at which they should be () cleaned, () inspected, () adjusted, () tested, () lubricated and () the work recommended at these periods. | H25.3(b)(1) | |
| () Scheduling information for the () airplane's propellers that provides the recommended periods at which they should () cleaned, () inspected, () adjusted, () tested, () lubricated and () the work recommended at these periods. | H25.3(b)(1) | |
| () Scheduling information for the () airplane's accessories that provides the recommended periods at which they should () cleaned, () inspected, () adjusted, () tested, () lubricated and () the work recommended at these periods. | H25.3(b)(1) | |
| () Scheduling information for the () airplane's instruments that provides the recommended periods at which they should () cleaned, () inspected, () adjusted, () tested, () lubricated and () the work recommended at these periods. | H25.3(b)(1) | |
| () Scheduling information for the () airplane's equipment that provides the recommended periods at which they should () cleaned, () inspected, () adjusted, () tested, () lubricated and () the work recommended at these periods. | H25.3(b)(1) | |
| () The degree of inspection for each part of the () airplane and its () engines, () auxiliary power unit, () propellers, () accessories, () instruments and () equipment. | H25.3(b)(1) | |
| () The applicable wear tolerances. | H25.3(b)(1) | |

| Requirement | Regulation | Location |
|--|-------------|----------|
| The applicant may refer to an () accessory, () instrument, or () equipment manufacturer as the source of this information if the applicant shows () that the item has an exceptionally high degree of complexity requiring specialized maintenance techniques, test equipment, or expertise. | H25.3(b)(1) | |
| () The recommended overhaul periods and necessary cross references to the Airworthiness Limitation Section. | H25.3(b)(1) | |
| () An inspection program that includes () the frequency and () extent of the inspection necessary to provide for the continued airworthiness of the airplane. | H25.3(b)(1) | |
| () Troubleshooting information describing () problem malfunctions, () how to recognize those malfunctions and () the remedial action for those malfunctions. | H25.3(b)(2) | |
| () Information describing the order and method of () removing and () replacing products (Engines and Propellers) with any necessary precautions to be taken. | H25.3(b)(3) | |
| () Information describing the order and method of () removing and () replacing parts with any necessary precautions to be taken. | H25.3(b)(3) | |
| () Other general procedural instructions including () storage limitations and procedures for () testing system during ground running, () making symmetry checks, () weighing and determining the CG, () lifting, () shoring. | H25.3(b)(4) | |
| () Diagrams of structural access plates and information needed to gain access for inspections when access plates are not provided. | H25.3(c) | |
| () Details for the application of special inspection techniques including radiographic and ultrasonic testing where such process are specified. | H25.3(d) | |
| () Information needed to apply projective treatment to structure after inspection. | H25.3(e) | |
| () All data relative to structural fasteners such as () identification, () discarded recommendations, and () torque values. | H25.3(f) | |
| () A list of special tools needed. | H25.3(g) | |
| () The ICAs must contain a section titled Airworthiness Limitations that is () segregated and () clearly distinguishable from the rest of the document. | H25.4(a) | |
| <p>NOTE: The Airworthiness Limitations Section in the applicant's ICA will be evaluated and approved by the appropriate FAA office.</p> | | |

| Requirement | Regulation | Location |
|--|-------------|----------|
| The Airworthiness Limitations Section must set forth each mandatory replacement time, structural inspection interval, and related structural inspection procedures approved under section 25.571. | H25.4(a)(1) | |
| The Airworthiness Limitations Section must set forth each mandatory replacement time, inspection interval, related inspection procedure, and all critical design configuration control limitations approved under section 25.981 for the fuel tank system. | H25.4(a)(2) | |
| () If the ICAs consist of multiple documents, the Airworthiness Limitations Section required by this paragraph must include in the principal manual. | H25.4(b) | |
| () The Airworthiness Limitations Section must contain a legible statement in a prominent locations that reads; “The Airworthiness Limitations Section is FAA-approved and specifies inspections and other maintenance required under 14 CFR sections 43.16 and 91.403 unless an alternative program has been FAA-approved.” | H25.4(b) | |