ADVANCEMENTS IN

OVERHEAD STOWAGE BIN ARTICLE RETENTION

The retention of passenger baggage in airplane stowage bins during flight is of industrywide interest. Many operators have developed detailed guidelines for passenger carry-on baggage that include maximum allowable baggage size, weight, and quantity. Airplane manufacturers also are incorporating new design features into stowage bins to enhance article retention. However, it is the proper loading of the overhead stowage bins that ultimately will reduce baggage-retention-related incidents.

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Every year worldwide, an estimated 4,500 airline passengers and crew are injured when items fall out of overhead stowage bins. This averages to approximately 12 injuries per day. The volume, weight, and loading of baggage inside a stowage bin significantly affect baggage retention and the risk of injury. Reducing the number of baggage-retention-related injuries requires an understanding of the following:

1. Types of overhead stowage bins currently in use.
2. Proper loading of stowage bins.
3. Stowage bin design enhancements to improve article retention.

1 TYPES OF OVERHEAD STOWAGE BINS CURRENTLY IN USE

Overhead stowage bins were never designed to replace the checking of baggage for transport in the cargo compartment of the airplane. In fact, early airplane models, such as the 707, 727, and 737, provided a limited overhead stowage. These appropriately named "hat racks" were limited to stowing emergency equipment and soft items such as coats, hats, blankets, and pillows.

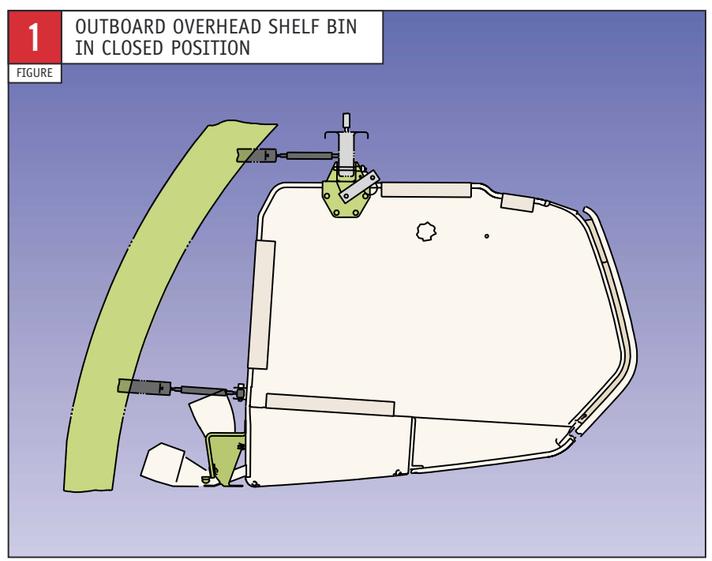
But as the type and quantity of passenger carry-on baggage evolved, so did stowage bin designs. Stowage bin capacities have increased, and the designs have changed to better accommodate the sizes and geometry of carry-on baggage.

Currently, there are three types of overhead stowage bins: shelf, pivot, and translating bins. Individual bin size generally is determined by the length of the airplane, interior arrangement, carry-on baggage requirements, and the spacing of the body frames to which the bins are attached. Standard shelf bins range in length from 15 to 88 in. Standard pivot and translating bins are 15 to 44 in long.

The shelf bin is the most common design (fig. 1). Its door opens outward and up. It is most often found as an outboard overhead stowage bin on older interior designs delivered on both single-aisle and twin-aisle airplanes. The pivot and translating bin designs have a controlled rate of opening and provide good visibility during opening and closing because the door opens out and down (figs. 2 and 3). Pivot and translating bins are common on both single-aisle and twin-aisle airplanes. Stowage bin designs have evolved over the years and depend on the available space within the airplane. Table 1 on the following page summarizes the types of stowage bins available by airplane model. The maximum load capability of each stowage bin is identified on load-limit placards displayed on the interior surface of each stowage bin.

Early derivatives of twin-aisle airplanes typically used the pivot or translating bins for the center or inboard overhead stowage bins, and shelf bins for the outboard overhead stowage bins. MD-11 airplanes, however, were offered with two overhead bin configurations. Some used a translating or articulating center overhead stowage bin, while others used a center shelf bin. Newer twin-aisle airplanes such as the 777 and 767-400 have a more open interior aesthetic design that uses outboard pivot bins and inboard or center translating bins.

1 FIGURE OUTBOARD OVERHEAD SHELF BIN IN CLOSED POSITION

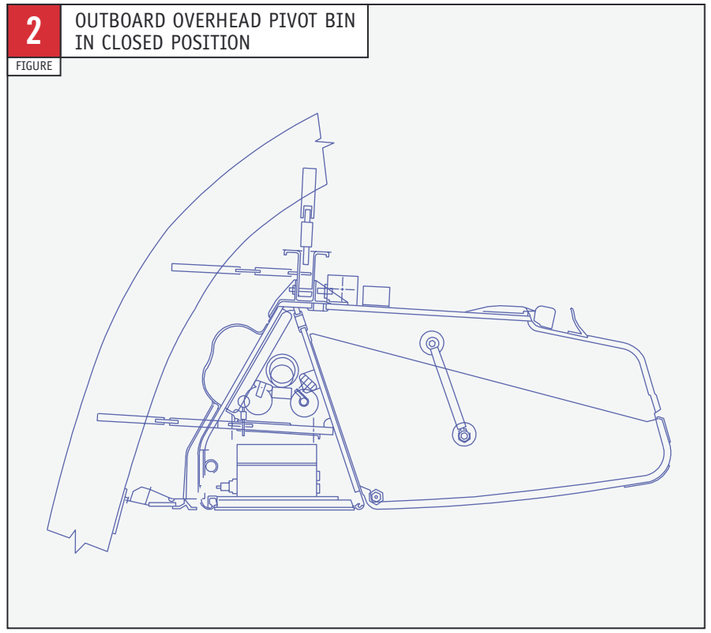


2 PROPER LOADING OF STOWAGE BINS

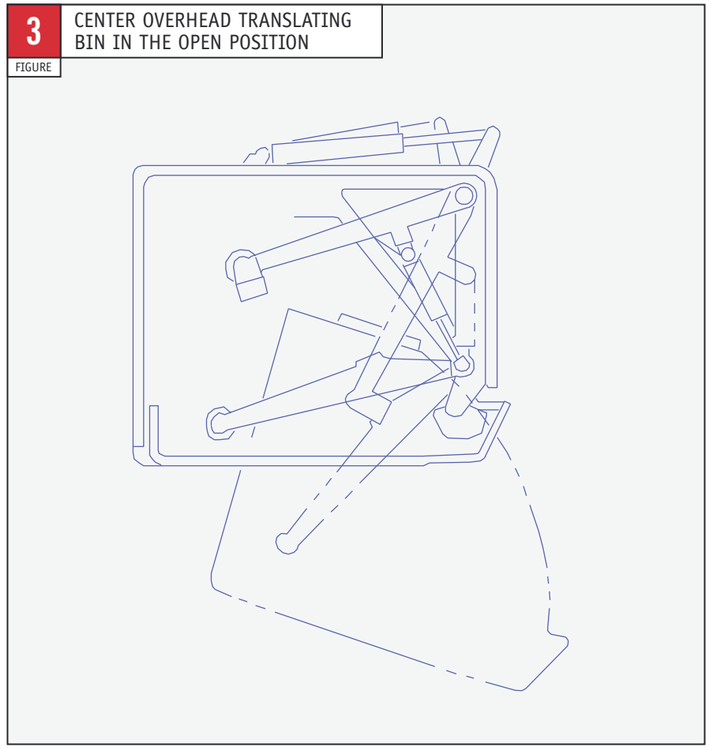
Today, many travelers want in-flight access to items such as laptop computers, briefcases, and bags. There also is an increasing trend for passengers to place as much carry-on baggage in the overhead stowage compartments as possible. Consequently, many operators have developed detailed guidelines for passenger carry-on baggage. These guidelines establish maximum allowable baggage size, weight, and quantity.

It is important for passengers and cabin crew to use discretion when loading these items into overhead stowage bins and when replacing an item that has been used during flight. Although it may be tempting to load

2 FIGURE OUTBOARD OVERHEAD PIVOT BIN IN CLOSED POSITION



3 FIGURE CENTER OVERHEAD TRANSLATING BIN IN THE OPEN POSITION



1 TABLE — OVERHEAD BIN SYSTEMS BY AIRPLANE MODEL

Airplane model	Bin system
717	Outboard shelf
737-300/-400/-500	Outboard shelf
737-600/-700/-800/-900	Outboard shelf
747-100/-200	Outboard pivot
	Center pivot
747-300	Outboard shelf
	Outboard pivot (zone A)
	Center pivot
747-400	Outboard shelf
	Outboard pivot (zone A)
	Outboard pivot optional (zone B)
	Center pivot
757	Outboard shelf
767-200/-300	Outboard shelf shallow
	Outboard shelf deep
	Center translating
767-400 new-look interior	Outboard pivot
	Center pivot
777-200/-300	Outboard pivot
	Center translating
DC-9	Outboard shelf
MD-11	Outboard shelf
	Center shelf
	Center translating
MD-80 contemporary deep-rack interior/ extended spatial concept interior	Outboard shelf
	Outboard shelf
MD-90 extended spatial concept interior	Outboard shelf

the bin to capacity regardless of the size or weight of the item, where items are placed inside a stowage bin significantly affects baggage retention. Proper awareness of baggage characteristics during the loading process can greatly reduce article-retention incidents.

The most stable, flat, and heavy items should be placed on the bottom of the stowage bin interior. This would include items with hard exterior surfaces or corners, blunt edges, or smooth surfaces such as suitcases, laptop computers, briefcases or boxes (fig. 4a). The next items to be loaded should be those that are more difficult to stack because they are uneven in shape and weight distribution. This would include garment bags, gym bags, cameras, and camera bags (fig. 4b). Softer, more lightweight items should be placed on top of all other items in the overhead stowage bins. This would include pillows, blankets, coats, newspapers, and magazines, which are less likely to cause injury or damage if they dislodge when the overhead stowage bin door is opened (fig. 4c).

Special caution should be used when stowing items such as baggage trolleys, baby strollers, sporting equipment, and excessively large or heavy parcels. Items with extremely awkward shapes or heavy weights cannot be securely stacked above or under other items. Alternative stowage locations — such as in closets, under seats, or in cargo compartments — should be considered first because these items have a higher potential to cause injuries or damage if they become dislodged when the overhead stowage bin door is opened.

Before takeoff, the stowed baggage should be stable with the overhead stowage bin door open. The stowage bin door should not be used to compress or stabilize the baggage when closing because there is a higher risk that articles may become dislodged when the stowage bin door is opened. Because the door opens outward and up on a shelf bin, extra care should be taken when opening this type of stowage bin to ensure that items that may have shifted in flight do not become dislodged. The pivot and articulating bins have a controlled rate of opening and provide good visibility because the door opens out and down. All overhead stowage bin doors should be opened slowly and in a controlled manner to prevent articles from falling out.

4a FIGURE — PROPER LOADING OF STOWAGE BINS — STABLE, FLAT, HEAVY, ITEMS ON BOTTOM

4b FIGURE — PROPER LOADING OF STOWAGE BINS — ITEMS OF UNEVEN SHAPE AND WEIGHT IN MIDDLE

4c FIGURE — PROPER LOADING OF STOWAGE BINS — SOFTER, LIGHTER-WEIGHT ITEMS ON TOP

3 STOWAGE BIN DESIGN ENHANCEMENTS TO IMPROVE ARTICLE RETENTION

Even if an overhead stowage bin is properly loaded before takeoff, it is possible that items removed during flight may not be properly reloaded. An improperly loaded overhead stowage bin has a higher probability of becoming unstable during routine flight maneuvers than does a properly loaded bin.

To address this issue, Boeing has incorporated a variety of overhead stowage bin enhancements to reduce the risk of carry-on items becoming dislodged when the overhead stowage bin door is opened. The design enhancements include warning placards and secondary restraint devices.

Warning placards. The 6- by 1.25-in placards are posted on the front of the stowage bins to increase passengers' awareness that carry-on items may have shifted during flight (fig. 5).

The availability and recommended installation locations for the warning placard (part number BAC29PPS32327) are described in a Boeing service letter dated March 26, 1999 (707-SL-25-023-B, 727-SL-25-034-B, 737-SL-25-073-B, 747-SL-25-158-B, 757-SL-25-059-B, 767-SL-25-076-B, 777-SL-25-009-B). The placard features the standard Boeing white background color with a dark gray lettering color and a warning symbol background color of international orange.

Secondary restraint devices. Another design enhancement is the installation of secondary restraint devices on shelf bins such as secondary doors or visors, nets, and deflector panels and thresholds.

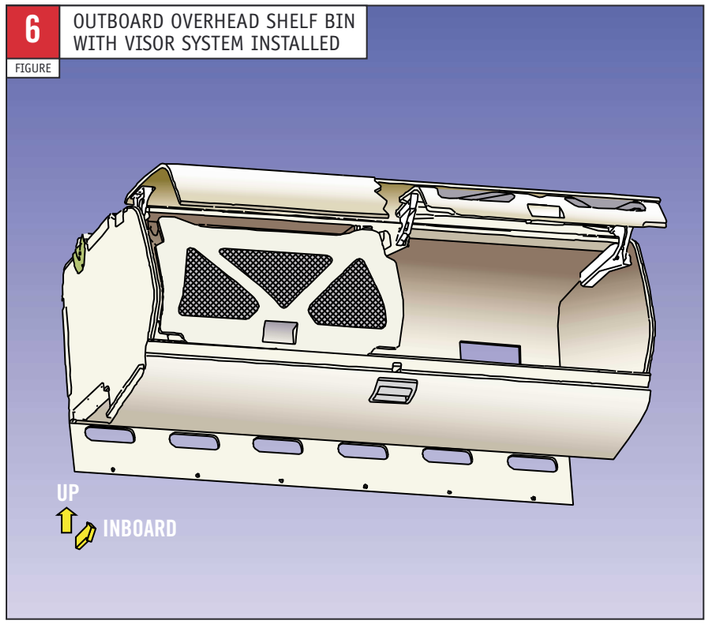
The secondary door or visor system consists of a set of two secondary doors or visors per bin, which remains in the closed position when the primary bin door is opened (fig. 6). The visors have open viewing ports with flexible nets installed over the ports. After opening the primary bin door, the visor allows a person to observe the bin contents and take necessary action if an item has the potential for falling when the visor is opened. The system, developed by Bridport Aviation Products, Bridport, England, is designed for shelf bins approximately 50 to 60 in long. Parts are currently available for many 737, 747, and 757 applications.

Another type of secondary restraint system is a net system for use on 727 and 767 airplanes. This system, developed by Ansett Australia, Melbourne, consists of a weave of elastic straps sewn together to form a net. The net mechanically fastens to the inside of the stowage bin and covers approximately the lower half of the stowage bin opening (fig. 7). With the primary stowage bin door in the open position, baggage items may be loaded and unloaded by displacing the elastic netting.

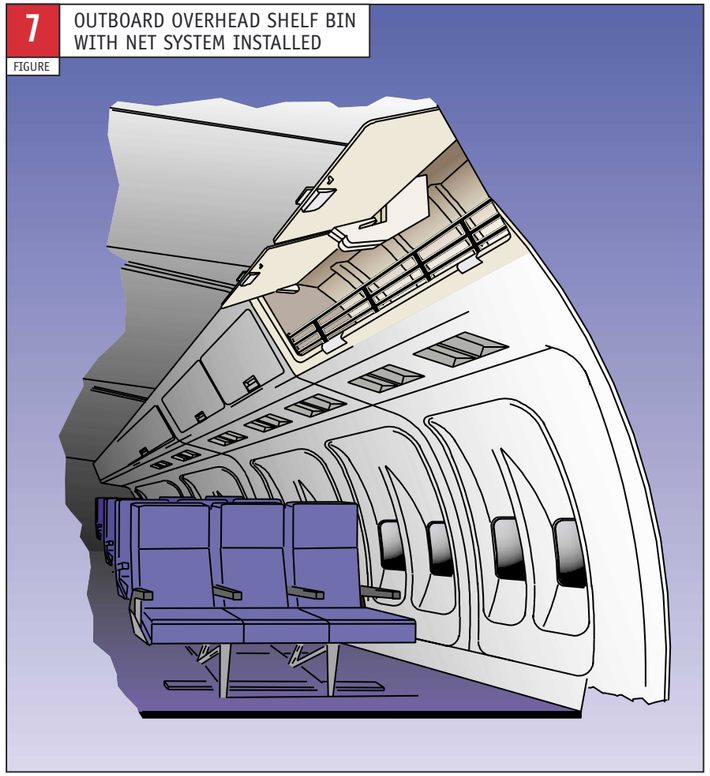
A third secondary restraint system involves deflector panels of flat honeycomb, which are mechanically attached to the inside of shelf bins whose doors protrude beyond the stowage bin door threshold. The deflector panels form a vertical wall within the shelf bin door cavities and are designed to restrict baggage from encroaching into the door cavity (figs. 8a and 8b). Items forced deeper into the stowage bin are less likely to fall upon opening the door. The deflector panels are offered as production or retrofit options for the 737, 747, and 757 models.

5 FIGURE OVERHEAD STOWAGE BIN WARNING PLACARD

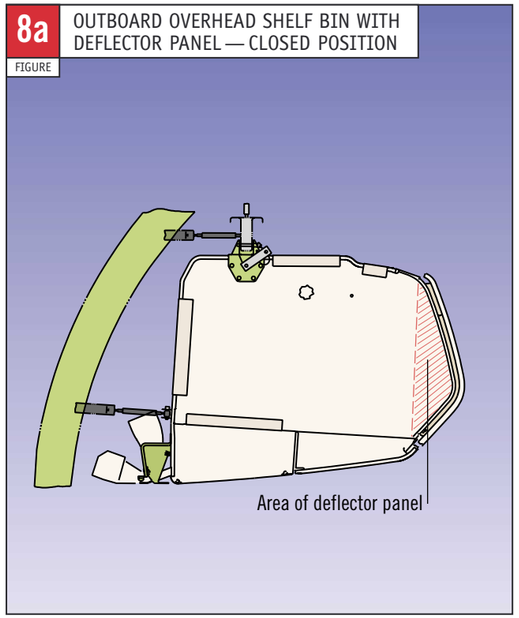
6 FIGURE OUTBOARD OVERHEAD SHELF BIN WITH VISOR SYSTEM INSTALLED



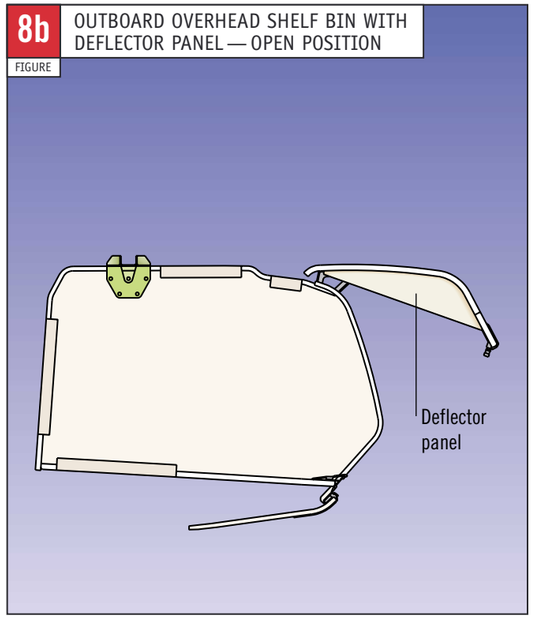
7 FIGURE OUTBOARD OVERHEAD SHELF BIN WITH NET SYSTEM INSTALLED



8a FIGURE OUTBOARD OVERHEAD SHELF BIN WITH DEFLECTOR PANEL — CLOSED POSITION



8b FIGURE OUTBOARD OVERHEAD SHELF BIN WITH DEFLECTOR PANEL — OPEN POSITION



SUMMARY

Proper loading of the overhead stowage bin is critical to improve article retention. Attention to article characteristics and stacking sequence can reduce the risk of article-retention-related injuries. Stowage bin design enhancements are available to further improve overhead stowage bin article retention.