

National Transportation Safety Board



Aircraft Structures

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MRAPs (Special Cargo Load)



12-ton M-ATV



18-ton Cougar



Special Cargo Loads

- Nonstandard, odd-sized cargo
 No unit load devices (ULD) used
 Free-floating pallets loaded along centerline of cargo deck
- Pallets did not lock into cargo handling system restraint devices



Typical ULD Loading





Example Strapping





Limitations

Airplane structural limitations: Type certificate (TC) holder (Boeing)
Cargo handling system limitations: Supplemental type certificate (STC) holder (Telair International)



Limitations

- Location of cargo in airplane
- Floor structural limitations
- Allowable strap load
- Strap angles
- Number of straps
- Strap attachment locations on airplane and on cargo



Documentation

- Weight and balance manual and loading control documents
 - Produced by TC and STC holders
 - FAA-approved documents
 - Instructions for securing cargo
 - Technical details
 - Safety-critical



NAL Documentation

- Weight and balance manual (approved by FAA)
- Cargo operations manual (accepted by FAA)
 - Technical content was not reviewed and approved
- Guidance had numerous errors
- Safety-critical information was omitted



NAL Tie-Down Assumptions

- All strap angles at maximum of 30°
- All attachment points
 - Capable of 3,750 lbs
 - Equal capability
 - Can react load in all three directions
- Infinite number of MRAP tie-down points





Forward



Strap Calculations

| | M-ATV | Cougar |
|----------|-------|--------|
| Accident | 24 | 26 |
| NAL | 32 | 44/46 |
| Boeing | 60 | * |
| Telair | ** | ** |

*Boeing: Due to TRC requirements, one M-ATV (and no Cougars) could be transported **Telair: Due to TRC requirements, no MRAPs could be transported



M-ATV Tie-Down Scheme







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