

## ***DENVER INTERNATIONAL AIRPORT (DIA)***

### **Background**

How does one convert a \$1.2 billion project into a \$5.0 billion project? It's easy. Just build a new airport in Denver. The decision to replace Denver's Stapleton Airport with Denver International Airport (DIA) was made by well-intentioned city officials. The city of Denver would need a new airport eventually, and it seemed like the right time to build an airport that would satisfy Denver's needs for at least 50–60 years. DIA could become the benchmark for other airports to follow.

A summary of the critical events is listed below:

1985: Denver Mayor Federico Pena and Adams County officials agree to build a replacement for Stapleton International Airport.

Project estimate: \$1.2 billion

1986: Peat Marwick, a consulting firm, is hired to perform a feasibility study including projected traffic. Their results indicate that, depending on the season, as many as 50 percent of the passengers would change planes. The new airport would have to handle this smoothly. United and Continental object to the idea of building a new airport, fearing the added cost burden.

May, 1989: Denver voters pass an airport referendum.

Project estimate: \$1.7 billion

March, 1993: Denver Mayor Wellington Webb announces the first delay. Opening day would be postponed from October, 1993 to December, 1993. (Federico Pena becomes Secretary of Transportation under Clinton).

Project estimate: \$2.7 billion

October, 1993: Opening day is to be delayed to March, 1994. The problems were the fire and security systems in addition to the inoperable baggage handling system.

Project estimate: \$3.1 billion

December, 1993: The airport is ready to open, but without an operational baggage handling system. Another delay is announced.

February, 1994: Opening day is to be delayed to May 15, 1994 because of baggage handling system.

May, 1994: Airport misses the fourth deadline.

August, 1994: DIA finances a backup baggage handling system. Opening day is delayed indefinitely.

Project estimate: \$4 billion plus.

December, 1994: Denver announces that DIA was built on top of an old Native-American burial ground. An agreement is reached to lift the curse.

## Airports and Airline Deregulation

Prior to the Airline Deregulation Act of 1978, airline routes and airfare were established by the Civil Aeronautics Board (CAB). Airlines were allowed to charge whatever they wanted for airfare, based upon CAB approval. The cost of additional aircraft was eventually passed on to the consumer. Initially, the high cost for airfare restricted travel to the businessperson and the elite who could afford it.

Increases in passenger travel were moderate. Most airports were already underutilized and growth was achieved by adding terminals or runways on existing airport sites. The need for new airports was not deemed critical for the near term.

Following deregulation, the airline industry had to prepare for open market competition. This meant that airfares were expected to decrease dramatically. Airlines began purchasing hoards of planes, and most routes were “free game.” Airlines had to purchase more planes and fly more routes in order to remain profitable. The increase in passenger traffic was expected to come from the average person who could finally afford air travel.

Deregulation made it clear that airport expansion would be necessary. While airport management conducted feasibility studies, the recession of 1979–1983 occurred. Several airlines such as Braniff filed for bankruptcy protection under Chapter 11 and the airline industry headed for consolidation through mergers and leveraged buyouts.

Cities took a wait-and-see attitude rather than risk billions in new airport development. Noise abatement policies, environmental protection acts, and land acquisition were viewed as headaches. The only major airport built in the last 20 years was Dallas-Ft. Worth, which was completed in 1974.

## Does Denver Need a New Airport?

In 1974, even prior to deregulation, Denver’s Stapleton Airport was experiencing such rapid growth that Denver’s Regional Council of Governments concluded that Stapleton would not be able to handle the necessary traffic expected by the year 2000. Modernization of Stapleton could have extended the inevitable problem to 2005. But were the headaches with Stapleton better cured through modernization or by building a new airport? There was no question that insufficient airport capacity would cause Denver to lose valuable business. Being 500 miles from other major cities placed enormous pressure upon the need for air travel in and out of Denver.

In 1988, Denver’s Stapleton International Airport ranked as the fifth busiest with 30 million passengers. The busiest airports were Chicago, Atlanta, Los Angeles, and Dallas-Ft. Worth. By the year 2000, Denver anticipated 66 million passengers, just below Dallas-Ft. Worth’s 70 million and Chicago’s 83 million estimates.

Delays at Denver’s Stapleton Airport caused major delays at all other airports. By one estimate, bad weather in Denver caused up to \$100 million in lost income to the airlines each year because of delays, rerouting, canceled flights, putting travelers into hotels overnight, employee overtime pay, and passengers switching to other airlines. Denver’s United Airlines and Continental comprise 80% of all flights in and out of Denver. Exhibit 11–1 shows the current service characteristics of United and Continental between December, 1993 and April, 1994. Exhibit 11–2 shows all of the airlines serving Denver as of June, 1994. Exhibit 11–3 shows the cities that are serviced from Denver. It should be obvious that delays in Denver could cause delays in each of these cities. Exhibit 11–4 shows the top ten domestic passenger origin-destination markets from Denver Stapleton.

Stapleton was ranked as one of the 10 worst air traffic bottlenecks in the United States. Even low clouds at Denver Stapleton could bring delays of 30 to 60 minutes.

**Exhibit 11-1. Current Service Characteristics: United Airlines and Continental Airlines, December 1993 and April 1994**

	Enplaned passengers (a)	Scheduled seats (b)	Boarding load factor	Scheduled departures (b)	Average seats per departure
<b>December 1993</b>					
United Airlines	641,209	1,080,210	59%	7,734	140
United Express	57,867	108,554	53%	3,582	30
Continental Airlines	355,667	624,325	57%	4,376	143
Continental Express	52,680	105,800	50%	3,190	33
Other	<u>236,751</u>	<u>357,214</u>	66%	<u>2,851</u>	125
<b>Total</b>	<b>1,344,174</b>	<b>2,276,103</b>	<b>59%</b>	<b>21,733</b>	<b>105</b>
<b>April 1994</b>					
United Airlines	717,093	1,049,613	68%	7,743	136
United Express	44,451	92,880	48%	3,395	27
Continental Airlines	275,948	461,168	60%	3,127	147
Continental Express	24,809	92,733	27%	2,838	33
Other	<u>234,091</u>	<u>354,950</u>	66%	<u>2,833</u>	125
<b>Total</b>	<b>1,296,392</b>	<b>2,051,344</b>	<b>63%</b>	<b>19,936</b>	<b>103</b>

(a) Airport management records.

(b) Official Airline Guides, Inc. (online data base); for periods noted.

Stapleton has two parallel north-south runways that are close together. During bad weather where instrument landing conditions exist, the two runways are considered as only one. This drastically reduces the takeoffs and landings each hour.

The new airport would have three north-south runways initially with a master plan calling for eight eventually. This would triple or quadruple instrument flights occurring at the same time to 104 aircraft per hour. Currently, Stapleton can handle only 30 landings per hour under instrument conditions with a *maximum* of 80 aircraft per hour during clear weather.

The runway master plan called for ten 12,000 foot and two 16,000 foot runways. By opening day, three north-south and one east-west 12,000 foot runways would be in operation and one of the 16,000 foot north-south runways would be operational shortly thereafter.

The airfield facilities also included a 327 foot FAA air traffic control tower (the nation's tallest) and base building structures. The tower's height allowed controllers to visually monitor runway thresholds as much as three miles away. The runway/taxiway lighting system, with lights imbedded in the concrete pavement to form centerlines and stopbars at intersections, would allow air traffic controllers to signal pilots to wait on taxiways and cross active runways, and to lead them through the airfield in poor visibility.

Due to shifting winds, runway operations were shifted from one direction to another. At the new airport, the changeover would require four minutes as opposed to the 45 minutes at Stapleton.

Sufficient spacing was provided for in the concourse design such that two FAA Class 6 aircraft (i.e. 747-XX) could operate back-to-back without impeding each other.

**Exhibit 11–2. Airlines Serving Denver June 1994***Major/national airlines*

America West Airlines  
 American Airlines  
 Continental Airlines  
 Delta Air Lines  
 Markair  
 Midway Airlines  
 Morris Air (a)  
 Northwest Airlines  
 Trans World Airlines  
 United Airlines  
 USAir

*Charter airlines*

Aero Mexico  
 American Trans Air  
 Casino Express  
 Express One  
 Great American  
 Private Jet  
 Sun Country Airlines

*Foreign flag airlines (scheduled)*

Martinair Holland  
 Mexicana de Aviacion

*Regional/commuter airlines*

Air Wisconsin (United Express) (b)  
 Continental Express  
 GP Express Airlines  
 Great Lakes Aviation (United Express)  
 Mesa Airlines (United Express)  
 Midwest Express (b)

*Cargo airlines*

Airborne Express  
 Air Vantage  
 Alpine Air  
 American International Airways  
 Ameriflight  
 Bighorn Airways  
 Burlington Air Express  
 Casper Air  
 Corporate Air  
 DHL Worldwide Express  
 Emery Worldwide  
 Evergreen International Airlines  
 EWW Airline/Air Train  
 Federal Express  
 Kitty Hawk  
 Majestic Airlines  
 Reliant Airlines  
 United Parcel Service  
 Western Aviators

(a) Morris Air was purchased by Southwest Airlines in December 1993. The airline has announced that it will no longer serve Denver as of October 3, 1994.

(b) Air Wisconsin and Midwest Express have both achieved the level of operating revenues needed to qualify as a national airline as defined by the FAA. However, for purposes of this report, these airlines are referred to as regional airlines.

Source: Airport management, June 1994.

Even when two aircraft (one from each concourse) have pushed back at the same time, there could still exist room for a third FAA Class 6 aircraft to pass between them.

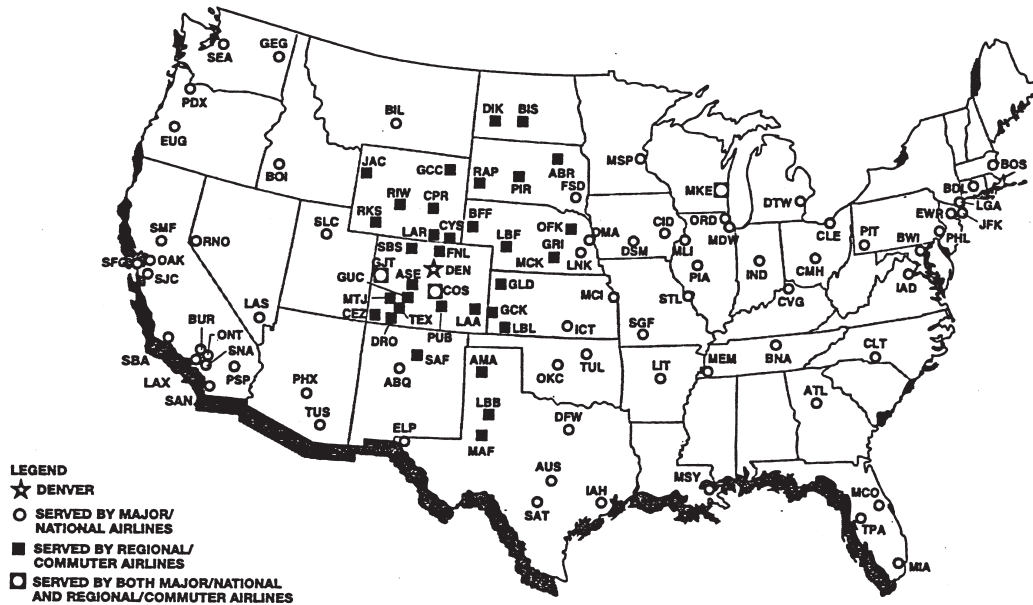
City officials believed that Denver's location, being equidistant from Japan and Germany, would allow twin-engine, extended range transports to reach both countries nonstop. The international opportunities were there. Between late 1990 and early 1991, Denver was entertaining four groups of leaders per month from Pacific Rim countries to look at DIA's planned capabilities.

In the long term, Denver saw the new airport as a potential hub for Northwest or USAir. This would certainly bring more business to Denver. Very few airports in the world can boast of multiple hubs.

**The Enplaned  
 Passenger Market**

Perhaps the most critical parameter that illustrates the necessity for a new airport is the enplaned passenger market. (An enplaned passenger is one who gets on a flight, either an origination flight or connecting flight.)

Exhibit 11–3. U.S. Airports Served Nonstop from Denver



SOURCE: OFFICIAL AIRLINE GUIDES, INC. (ONLINE DATA BASE), JUNE 1994.

Exhibit 11–5, shown below, identifies the enplaned passengers for individual airlines servicing Denver Stapleton for 1992 and 1993.

Connecting passengers were forecast to decrease about 1,000,000 between 1993 and 1995 before returning to a steady 3.0% per year growth, totaling 8,285,500 in 2000. As a result, the number of connecting passengers is forecast to represent a smaller share (46%) of total enplaned passengers at the Airport in 2000 than in 1993 (50%). Total enplaned passengers at Denver are forecast to increase from 16,320,472 in 1993 to 18,161,000 in 2000—an average increase of 1.5% per year (decreasing slightly from 1993 through 1995, then increasing 2.7% per year after 1995).

The increase in enplaned passengers will necessitate an increase in the number of aircraft departures. Since landing fees are based upon aircraft landed weight, more arrivals and departures will generate more landing fee revenue. Since airport revenue is derived from cargo operations as well as passenger activities, it is important to recognize that enplaned cargo is also expected to increase.

## Land Selection<sup>16</sup>

The site selected was a 53-square-mile area 18 miles northeast of Denver's business district. The site would be larger than the Chicago O'Hare and Dallas Ft. Worth air-

16. Adapted from David A. Brown, "Denver Aims for Global Hub Status with New Airport Under Construction," *Aviation Week and Space Technology*, March 11, 1991; p. 44

**Exhibit 11–4. Top 10 Domestic Passenger Origin-Destination Markets and Airline Service, Stapleton International Airport (for the 12 months ended September 30, 1993)**

City of origin or destination (a)	Air miles from Denver	Percentage of certified airline passengers	Average daily nonstop departures (b)
1. Los Angeles (c)	849	6.8	34
2. New York (d)	1,630	6.2	19
3. Chicago (e)	908	5.6	26
4. San Francisco (f)	957	5.6	29
5. Washington, D.C. (g)	1,476	4.9	12
6. Dallas/Forth Worth	644	3.5	26
7. Houston (h)	864	3.2	15
8. Phoenix	589	3.1	19
9. Seattle	1,019	2.6	14
10. Minneapolis	693	2.3	16
Cities listed		43.8	210
All others		56.2	241
Total		100.0	451

(a) Top 10 cities based on total inbound and outbound passengers (on large certificated airlines) at Stapleton International Airport in 10% sample for the 12 months ended September 30, 1993.

(b) Official Airline Guides, Inc. (online data base), April 1994. Includes domestic flights operated at least four days per week by major/national airlines and excludes the activity of foreign-flag and commuter/regional airlines.

(c) Los Angeles International, Burbank-Glendale-Pasadena, John Wayne (Orange County), Ontario International, and Long Beach Municipal Airports.

(d) John F. Kennedy International, LaGuardia, and Newark International Airports.

(e) Chicago-O'Hare International and Midway Airports.

(f) San Francisco, Metropolitan Oakland, and San Jose International Airports.

(g) Washington Dulles International, Washington National, and Baltimore/Washington International Airports.

(h) Houston Intercontinental and William P. Hobby Airports.

Sources: U.S. Department of Transportation/Air Transport Association of America, "Origin-Destination Survey of Airline Passenger Traffic, Domestic," third quarter 1993, except as noted.

ports combined. Unfortunately, a state law took effect prohibiting political entities from annexing land without the consent of its residents. The land was in Adams County. Before the vote was taken, Adams County and Denver negotiated an agreement limiting noise and requiring the creation of a buffer zone to protect surrounding residents. The agreement also included continuous noise monitoring, as well as limits on such businesses as airport hotels that could be in direct competition with existing services provided in Adams County. The final part of the agreement limited DIA to such businesses as airline maintenance, cargo, small package delivery, and other such airport-related activities.

With those agreements in place, Denver annexed 45 square miles and purchased an additional 8 square miles for noise buffer zones. Denver rezoned the buffer area to prohibit residential development within a 65 LDN (Level Day/Night) noise level. LDN is a weighted noise measurement intended to determine perceived noise in both day and night conditions. Adams County enacted even stiffer zoning regulations calling for no residential development with an LDN noise level of 60.

**Exhibit 11–5. Enplaned Passengers by Airline 1992–1993, Stapleton International Airport**

Enplaned passengers	1992	1993
United	6,887,936	7,793,246
United Express(1)	470,841	578,619
	<u>7,358,777</u>	<u>8,371,865</u>
Continental	5,162,812	4,870,861
Continental Express	514,293	532,046
	<u>5,677,105</u>	<u>5,402,907</u>
American Airlines	599,705	563,119
America West Airlines	176,963	156,032
Delta Air Lines	643,644	634,341
MarkAir	2,739	93,648
Northwest Airlines	317,507	320,527
Trans World Airlines	203,096	182,502
US Air	201,949	197,095
Other	256,226	398,436
	<u>2,401,829</u>	<u>2,545,700</u>
Total	<u>15,437,711</u>	<u>16,320,472</u>

(1) Includes Mesa Airlines, Air Wisconsin, Great Lakes Aviation and Westair Airlines.  
(Source: Department of Aviation management records.)

Most of the airport land embodied two ranches. About 550 people were relocated. The site had overhead power lines and gas wells, which were relocated or abandoned. The site lacked infrastructure development and there were no facilities for providing water, power, sewage disposal, or other such services.

### Front Range Airport

Located 2.5 miles southeast of DIA is Front Range Airport, which had been developed to relieve Denver's Stapleton Airport of most nonairline traffic operations. As a satellite airport to DIA, Front Range Airport had been offering six aviation business services by 1991.

- Air cargo and air freight, including small package services. (This is direct competition for DIA.)
- Aircraft manufacturing.
- Aircraft repair. (This is direct competition for DIA.)
- Fixed base operators to service general (and corporate) aviation.
- Flight training.
- Military maintenance and training.

The airport was located on a 4800-acre site and was surrounded by a 12,000-acre industrial park. The airport was owned and operated by Adams County, which had completely different ownership than DIA. By 1991, Front Range Airport had two east-west runways: a 700-foot runway for general aviation use and an 8000-foot run-

way to be extended to 10,000 feet. By 1992, the general plans called for two more runways to be built, both north-south. The first runway would be 10,000 feet initially with expansion capability to 16,000 feet to support wide body aircraft. The second runway would be 7000 feet to service general aviation.

Oponents of DIA contended that Front Range Airport could be enlarged significantly, thus reducing pressure on Denver's Stapleton Airport, and that DIA would not be necessary at that time. Proponents of DIA argued that Front Range should be used to relieve pressure on DIA if and when DIA became a major international airport as all expected. Both sides were in agreement that initially, Front Range Airport would be a competitor to DIA.

## Airport Design

The Denver International Airport was based upon a "Home-on-the-Range" design. The city wanted a wide open entry point for visitors. In spring of 1991, the city began soliciting bids.

To maintain a distinctive look that would be easily identified by travelers, a translucent tent-like roof was selected. The roof was made of two thicknesses of translucent, Teflon-coated glass fiber material suspended from steel cables hanging from the structural supports. The original plans for the roof called for a conventional design using 800,000 tons of structural steel. The glass fiber roof would require only 30,000 tons of structural steel, thus providing substantial savings on construction costs. The entire roof would permit about 10% of the sunlight to shine through, thus providing an open, outdoors-like atmosphere.

The master plan for the airport called for four concourses, each with a maximum of 60 gates. However, only three concourses would be built initially, and none would be full size. The first, Concourse A, would have 32 airline gates and six commuter gates. This concourse would be shared by Continental and any future international carriers. Continental had agreed to give up certain gate positions if requested to do so in order to accommodate future international operations. Continental was the only long-haul international carrier with one daily flight to London. Shorter international flights were to Canada and Mexico.

Concourses B and C would each have 20 gates initially for airline use plus six commuter gates. Concourse B would be the United Concourse. Concourse C would be for all carriers other than Continental or United.

All three concourses would provide a total of 72 airline gates and 18 commuter gates. This would be substantially less than what the original master plan called for.

Although the master plan identified 60 departure gates for each concourse, cost became an issue. The first set of plans identified 106 departure gates (not counting commuter gates) and was then scaled down to 72 gates. United Airlines originally wanted 45 departure gates, but settled for 20. The recession was having its effect.

The original plans called for a train running through a tunnel beneath the terminal building and the concourses. The train would carry 6000 passengers per hour. Road construction on and adjacent to the airport was planned to take one year. Runway construction was planned to take one year but was deliberately scheduled for two years in order to save on construction costs.

The principal benefits of the new airport compared to Stapleton were:

- A significantly *improved airfield configuration* that allowed for triple simultaneous instrument landings in all weather conditions, improved the efficiency and safety of airfield operations, and reduced taxiway congestion



- *Improved efficiency in the operation of the regional airspace*, which, coupled with the increased capacity of the airfield, was supposed to significantly reduce aircraft delays and airline operating costs both at Denver and system-wide
- *Reduced noise impacts* resulting from a large site that was situated in a relatively unpopulated area
- *A more efficient terminal/concourse/apron layout* that minimized passenger walking distance, maximized the exposure of concessions to passenger flows, provided significantly greater curbside capacity, and allowed for the efficient maneuvering of aircraft in and out of gates
- *Improved international facilities* including longer runway lengths for improved stage length capability for international flights and larger Federal Inspection Services (FIS) facilities for greater passenger processing capability
- *Significant expansion capability* of each major functional element of the airport
- *Enhanced efficiency of airline operations* as a result of new baggage handling, communications, de-icing, fueling, mail sorting, and other specialty systems

One of the problems with the airport design related to the high wind shears that would exist where the runways were placed. This could eventually become a serious issue.

## Project Management

The city of Denver selected two companies to assist in the project management process. The first was Greiner Engineering, an engineering, architecture, and airport planning firm. The second company was Morrison-Knudsen Engineering (MKE) which is a design-construct firm. The city of Denver and Greiner/MKE would function as the Project Management Team (PMT) responsible for schedule coordination, cost control, information management, and administration of approximately 100 design contracts, 160 general contractors, and more than 2000 subcontractors.

In the selection of architects, it became obvious that there would be a split between those who would operate the airport and the city's aspirations. Airport personnel were more interested in an "easy-to-clean" airport and convinced the city to hire a New Orleans-based architectural firm with whom Stapleton personnel had worked previously. The city wanted a "thing of beauty" rather than an easy-to-clean venture.

In an unusual split of responsibilities, the New Orleans firm was contracted to create standards that would unify the entire airport and to take the design of the main terminal only through schematics and design development, at which point it would be handed off to another firm. This sharing of the wealth with several firms would later prove more detrimental than beneficial.

The New Orleans architectural firm complained that the direction given by airport personnel focused on operational issues rather than aesthetic values. Furthermore, almost all decisions seemed to be made in reaction to maintenance or technical issues. This created a problem for the design team because the project's requirements specified that the design reflect a signature image for the airport, one that would capture the uniqueness of Denver and Colorado.

The New Orleans team designed a stepped-roof profile supported by an exposed truss system over a large central atrium, thus resembling the structure of train sheds. The intent was to bring the image of railroading, which was responsible for Denver's early growth, into the jet age.

The mayor, city council, and others were concerned that the design did not express a \$2 billion project. A blue-ribbon commission was formed to study the matter. The city council eventually approved the design.

Financial analysis of the terminal indicated that the roof design would increase the cost of the project by \$48 million and would push the project off schedule. A second architectural firm was hired. The final design was a peaked roof with Teflon-coated fabric designed to bring out the image of the Rocky Mountains. The second architectural firm had the additional responsibility to take the project from design development through to construction. The cost savings from the new design was so substantial that the city upgraded the floor finish in the terminal and doubled the size of the parking structure to 12,000 spaces.

The effectiveness of the project management team was being questioned. The PMT failed to sort out the differences between the city's aspirations and the maintenance orientation of the operators. It failed to detect the cost and constructability issues with the first design even though both PMT partners had vast in-house expertise. The burden of responsibility was falling on the shoulders of the architects. The PMT also did not appear to be aware that the first design may not have met the project's standards.

Throughout the design battle, no one heard from the airlines. Continental and United controlled 80% of the flights at Stapleton. Yet the airlines refused to participate in the design effort, hoping the project would be canceled. The city ordered the design teams to proceed for bids without any formal input from the users.

With a recession looming in the wings and Continental fighting for survival, the city needed the airlines to sign on. To entice the airlines to participate, the city agreed to a stunning range of design changes while assuring the bond rating agencies that the 1993 opening date would be kept. Continental convinced Denver to move the international gates away from the north side of the main terminal to terminal A, and to build a bridge from the main terminal to terminal A. This duplicated the function of a below-ground people-mover system. A basement was added the full length of the concourses. Service cores, located between gates, received a second level.

United's changes were more significant. It widened concourse B by 8 feet to accommodate two moving walkways in each direction. It added a second level of service cores, and had the roof redesigned to provide a clerestory of natural light. Most important, United wanted a destination-coded vehicle (DCV) baggage handling system where bags could be transferred between gates in less than 10 minutes, thus supporting short turnaround times. The DCV was to be on Concourse B (United) only. Within a few weeks thereafter, DIA proposed that the baggage handling system be extended to the entire airport. Yet even with these changes in place, United and Continental *still* did not sign a firm agreement with DIA, thus keeping bond interest expense at a higher than anticipated level. Some people contended that United and Continental were holding DIA hostage.

From a project management perspective, there was no question that disaster was on the horizon. Nobody knew what to do about the DCV system. The risks were unknown. Nobody realized the complexity of the system, especially the software requirements. By one account, the launch date should have been delayed by at least two years. The contract for DCV hadn't been awarded yet, and terminal construction was already under way. Everyone wanted to know why the design (and construction) was not delayed until after the airlines had signed on. How could DIA install and maintain the terminal's baseline design without having a design for the baggage handling system? Everyone felt that what they were now building would have to be ripped apart.

There were going to be massive scope changes. DIA persisted in its belief that the airport would open on time. Work in process was now \$130 million per month. Acceleration costs, because of the scope changes, would be \$30–\$40 million. Three shifts were running at DIA with massive overtime. People were getting burned out to the point where they couldn't continue.

To reduce paperwork and maintain the schedule, architects became heavily involved during the construction phase, which was highly unusual. The PMT seemed to be abdicating control to the architects who would be responsible for coordination. The trust that had developed during the early phases began evaporating.

Even the car rental companies got into the act. They balked at the fees for their inter-terminal location and said that servicing within the parking structures was inconvenient. They demanded and finally received a separate campus. Passengers would now be forced to take shuttle buses out of the terminal complex to rent or return vehicles.

### The Baggage Handling System

DIA's \$200 million baggage handling system was designed to be state-of-the-art. Conventional baggage handling systems are manual. Each airline operates its own system. DIA opted to buy a single system and lease it back to the airlines. In effect, it would be a one-baggage-system-fits-all configuration.

The system would contain 100 computers, 56 laser scanners, conveyor belts, and thousands of motors. As designed, the system would contain 400 fiberglass carts, each carrying a single suitcase through 22 miles of steel tracks. Operating at 20 miles per hour, the system could deliver 60,000 bags per hour from dozens of gates. United was worried that passengers would have to wait for luggage since several of their gates were more than a mile from the main terminal. The system design was for the luggage to go from the plane to the carousel in 8–10 minutes. The luggage would reach the carousel before the passengers.

The baggage handling system would be centered on track-mounted cars propelled by linear induction motors. The cars slow down, but don't stop, as a conveyor ejects bags onto their platform. During the induction process, a scanner reads the bar-coded label and transmits the data through a programmable logic controller to a radio frequency identification tag on a passing car. At this point, the car knows the destination of the bag it is carrying, as does the computer software that routes the car to its destination. To illustrate the complexity of the situation, consider 4000 taxicabs in a major city, all without drivers, being controlled by a computer through the streets of a city.

### 1989

Construction began without a signed agreement from Continental and United.

### Early Risk Analysis

By March of 1991, the bidding process was in full swing for the main terminal, concourses, and tunnel. Preliminary risk analysis involved three areas: cost, human resources, and weather.

- *Cost:* The grading of the terminal area was completed at about \$5 million under budget and the grading of the first runway was completed at about \$1.8 million under budget. This led management to believe that the original construction cost estimates were accurate. Also, many of the construction bids being received were below the city's own estimates.

- *Human Resources:* The economic recession hit Denver a lot harder than the rest of the nation. DIA was at that time employing about 500 construction workers. By late 1992, it was anticipated that 6000 construction workers would be needed. Although more than 3000 applications were on file, there remained the question of available, qualified labor. If the recession were to be prolonged, then the lack of qualified suppliers could be an issue as well.
- *Bad Weather:* Bad weather, particularly in the winter, was considered as the greatest risk to the schedule. Fortunately, the winters of 1989–1990 and 1990–1991 were relatively mild, which gave promise to future mild winters. Actually, more time was lost due to bad weather in the summer of 1990, than in either of the two previous winters.

### March 1991

By early March, 1991, Denver had already issued more than \$900 million in bonds to begin construction of the new airport. Denver planned to issue another \$500 million in bonds the following month. Standard & Poor's Corporation lowered the rating on the DIA bonds from BBB to BBB–, just a notch above the junk grade rating. This could prove to be extremely costly to DIA because any downgrading in bond quality ratings would force DIA to offer higher yields on their new bond offerings, thus increasing their yearly interest expense.

Denver was in the midst of an upcoming mayoral race. Candidates were calling for the postponement of the construction, not only because of the lower ratings, but also because Denver *still* did not have a firm agreement with either Continental or United Airlines that they would use the new airport. The situation became more intense because three months earlier, in December of 1990, Continental had filed for bankruptcy protection under Chapter 11. Fears existed that Continental might drastically reduce the size of its hub at DIA or even pull out altogether.

Denver estimated that cancellation or postponement of the new airport would be costly. The city had \$521 million in contracts that could not be canceled. Approximately \$22 million had been spent in debt service for the land, and \$38 million in interest on the \$470 million in bond money was already spent. The city would have to default on more than \$900 million in bonds if it could not collect landing fees from the new airport. The study also showed that a two year delay would increase the total cost by \$2 billion to \$3 billion and increase debt service to \$340 million per year. It now appeared that the point of no return was at hand.

Fortunately for DIA, Moody's Investors Service, Inc. did *not* lower their rating on the \$1 billion outstanding of airport bonds. Moody's confirmed their conditional Baa1 rating, which was slightly higher than the S & P rating of BBB–. Moody's believed that the DIA effort was a strong one and that even at depressed airline traffic levels, DIA would be able to service its debt for the scaled-back airport. Had both Moody's and S & P lowered their ratings together, DIA's future might have been in jeopardy.

### April 1991

Denver issued \$500 million in serial revenue bonds with a maximum yield of 9.185% for bonds maturing in 2023. A report by Fitch Investors Service estimated that the airport was ahead of schedule and 7% below budget. The concerns of the investor community seemed to have been tempered despite the bankruptcy filing of Continental Airlines. However, there was still concern that no formal agreement existed between DIA and either United Airlines or Continental Airlines.

**May 1991**

The city of Denver and United Airlines finally reached a tentative agreement. United would use 45 of the potential 90–100 gates at Concourse B. This would be a substantial increase from the 26 gates DIA had originally thought that United would require. The 50% increase in gates would also add 2000 reservations jobs. United also expressed an interest in building a \$1 billion maintenance facility at DIA employing 6000 people.

United stated later that the agreement did not constitute a firm commitment but was contingent upon legislative approval of a tax incentive package of \$360 million over 30 years plus \$185 million in financing and \$23 million in tax exemptions. United would decide by the summer in which city the maintenance facility would be located. United reserved the right to renegotiate the hub agreement if DIA was not chosen as the site for the maintenance facility.

Some people believed that United had delayed signing a formal agreement until it was in a strong bargaining position. With Continental in bankruptcy and DIA beyond the point of no return, United was in a favorable position to demand tax incentives of \$200 million in order to keep their hub in Denver and build a maintenance facility. The state legislature would have to be involved in approving the incentives. United Airlines ultimately located the \$1 billion maintenance facility at the Indianapolis Airport.

**August 1991**

Hotel developers expressed concern about building at DIA, which is 26 miles from downtown compared to 8 miles from Stapleton to downtown Denver. DIA officials initially planned for a 1000-room hotel attached to the airport terminal, with another 300–500 rooms adjacent to the terminal. The 1000-room hotel had been scaled back to 500–700 rooms and was not likely to be ready when the airport would open in October, 1993. Developers had expressed resistance to build close to DIA unless industrial and office parks were also built near the airport. Even though ample land existed, developers were putting hotel development on the back burner until after 1993.

**November 1991**

Federal Express and United Parcel Service (UPS) planned to move cargo operations to the smaller Front Range Airport rather than to DIA. The master plan for DIA called for cargo operations to be at the northern edge of DIA, thus increasing the time and cost for deliveries to Denver. Shifting operations to Front Range Airport would certainly have been closer to Denver but would have alienated northern Adams County cities that counted on an economic boost in their areas. Moving cargo operations would have been in violation of the original agreement between Adams County and Denver for the annexation of the land for DIA.

The cost of renting at DIA was estimated at \$0.75 per square foot compared to \$0.25 per square foot at Front Range. DIA would have higher landing fees of \$2.68 per 1000 pounds compared to \$2.15 for Front Range. UPS demanded a cap on landing fees at DIA if another carrier were to go out of business. Under the UPS proposal, area landholders and businesses would set up a fund to compensate DIA if landing fees were to exceed the cap. Cargo carriers at Stapleton were currently paying \$2 million in landing fees and rental of facilities per year.

As the “dog fight” over cargo operations continued, the Federal Aviation Administration (FAA) issued a report calling for cargo operations to be collocated

with passenger operations at the busier metropolitan airports. This included both full cargo carriers as well as passenger cargo (i.e., “belly cargo”) carriers. Proponents of Front Range argued that the report didn’t preclude the use of Front Range because of its proximity to DIA.

### December 1991

United Airlines formally agreed to a 30-year lease for 45 gates at Concourse B. With the firm agreement in place, the DIA revenue bonds shot up in price almost \$30 per \$1000 bond. Earlier in the year, Continental signed a five-year lease agreement.

Other airlines also agreed to service DIA. Exhibit 11–6, shown below, sets forth the airlines that either executed use and lease agreements for, or indicated an interest in leasing, the 20 gates on Concourse C on a first-preferential-use basis.

### January 1992

BAE was selected to design and build the baggage handling system. The airport had been under construction for three years before BAE was brought on board. BAE agreed to do eight years of work in two years to meet the October, 1993 opening date.

### June 1992

DIA officials awarded a \$24.4 million contract for the new airport’s telephone services to U.S. West Communication Services. The officials of DIA had considered controlling its own operations through shared tenant service, which would allow the airport to act as its own telephone company. All calls would be routed through an airport-owned computer switch. By grouping tenants together into a single shared entity, the airport would be in a position to negotiate discounts with long distance providers, thus enabling cost savings to be passed on to the tenants.

By one estimate, the city would generate \$3 million to \$8 million annually in new, nontax net revenue by owning and operating its own telecommunication network. Unfortunately, DIA officials did not feel that sufficient time existed for them to operate their own system. The city of Denver was unhappy over this lost income.

#### **Exhibit 11–6. Airline Agreements**

<b>Airline</b>	<b>Term (Years)</b>	<b>No. of Gates</b>
American Airlines	5	3
Delta Air Lines(1)	5	4
Frontier Airlines	10	2
MarkAir	10	5
Northwest Airlines	10	2
Trans World Airlines	10	2
USAir(1)	5	<u>2</u>
<b>TOTAL</b>		<b>20</b>

(1) The City has entered into Use and Lease Agreements with these airlines. the USAir lease is for one gate on Concourse C and USAir has indicated its interest in leasing a second gate on Concourse C.

**September 1992**

By September, 1992, the city had received \$501 million in Federal Aviation Administration grants and \$2.3 billion in bonds with interest rates of 9.0%–9.5% in the first issue to 6% in the latest issue. The decrease in interest rates due to the recession was helpful to DIA. The rating agencies also increased the city's bond rating one notch.

The FAA permitted Denver to charge a \$3 departure tax at Stapleton with the income earmarked for construction of DIA. Denver officials estimated that over 34 years, the tax would generate \$2.3 billion.

The cities bordering the northern edge of DIA (where the cargo operations were to be located) teamed up with Adams County to file lawsuits against DIA in its attempt to relocate cargo operations to the southern perimeter of DIA. This relocation would appease the cargo carriers and hopefully end the year-long battle with Front Range Airport. The Adams County Commissioner contended that relocation would violate the Clean Air Act and the National Environmental Policy Act and would be a major deviation from the original airport plan approved by the FAA.

**October 1992**

The city issued \$261 million of Airport Revenue Bonds for the construction of facilities for United Airlines. (See Exhibit A at the end of this case study).

**March 1993**

The city of Denver announced that the launch date for DIA would be pushed back to December 18 rather than the original October 30 date in order to install and test all of the new equipment. The city wanted to delay the opening until late in the first quarter of 1994 but deemed it too costly because the airport's debt would have to be paid without an adequate stream of revenue. The interest on the bond debt was now at \$500,000 per day.

The delay to December 18 angered the cargo carriers. This would be their busiest time of the year, usually twice their normal cargo levels, and a complete revamping of their delivery service would be needed. The Washington-based Air Freight Association urged the city to allow the cargo carriers to fly out of Stapleton through the holiday period.

By March 1993, Federal Express, Airborne Express, and UPS (reluctantly) had agreed to house operations at DIA after the city pledged to build facilities for them at the south end of the airport. Negotiations were also underway with Emery Worldwide and Burlington Air Express. The "belly" carriers, Continental and United, had already signed on.

UPS had wanted to create a hub at Front Range Airport. If Front Range Airport were a cargo-only facility, it would free up UPS from competing with passenger traffic for runway access even though both Front Range and DIA were in the same air traffic control pattern. UPS stated that it would not locate a regional hub at DIA. This would mean the loss of a major development project that would have attracted other businesses that relied on UPS delivery.

For UPS to build a regional hub at Front Range would have required the construction of a control tower and enlargement of the runways, both requiring federal funds. The FAA refused to free up funds for Front Range largely due to a lawsuit by United Airlines and environmental groups.

United's lawsuit had an ulterior motive. Adams County officials repeatedly stated that they had no intention of building passenger terminals at Front Range. However,

once federal funds were given to Front Range, a commercial passenger plane could not be prevented from setting up shop in Front Range. The threat to United was the low-cost carriers such as Southwest Airlines. Because costs were fixed, fewer passengers traveling through DIA meant less profits for the airlines. United simply did not want any airline activities removed from DIA!

**August 1993**

Plans for a train to connect downtown Denver to DIA were underway. A \$450,000 feasibility study and federal environmental assessment were being conducted, with the results due November 30, 1993. Union Pacific had spent \$350,000 preparing a design for the new track, which could be constructed in 13 to 16 months.

The major hurdle would be the financing, which was estimated between \$70 million and \$120 million, based upon hourly trips or 20-minute trips. The more frequent the trips, the higher the cost.

The feasibility study also considered the possibility of baggage check-in at each of the stops. This would require financial support and management assistance from the airlines.

**September 1993**

Denver officials disclosed plans for transferring airport facilities and personnel from Stapleton to DIA. The move would be stage-managed by Larry Sweat, a retired military officer who coordinated troop movements for Operation Desert Shield. Bechtel Corporation would be responsible for directing the transport and setup of machinery, computer systems, furniture, and service equipment, all of which had to be accomplished overnight since the airport had to be operational again in the morning.

**October 1993**

DIA, which was already \$1.1 billion over budget, was to be delayed again. The new opening date would be March 1994. The city blamed the airlines for the delays, citing the numerous scope changes required. Even the fire safety system hadn't been completed.

Financial estimates became troublesome. Airlines would have to charge a \$15 per person tax, the largest in the nation. Fees and rent charged the airlines would triple from \$74 million at Stapleton to \$247 million at DIA.

**January 1994**

Front Range Airport and DIA were considering the idea of being designated as one system by the FAA. Front Range could legally be limited to cargo only. This would also prevent low cost carriers from paying lower landing fees and rental space at Front Range.

**February 1994**

Southwest Airlines, being a low cost-no frills carrier, said that it would not service DIA. Southwest wanted to keep its airport fees below \$3 a passenger. Current projections indicated that DIA would have to charge between \$15 and \$20 per passenger in order to service its debt. This was based upon a March 9 opening day.

Continental announced that it would provide a limited number of low-frill service flights in and out of Denver. Furthermore, Continental said that because of the



high landing fees, it would cancel 23% of its flights through Denver and relocate some of its maintenance facilities.

United Airlines expected its operating cost to be \$100 million more per year at DIA than at Stapleton. With the low-cost carriers either pulling out or reducing service to Denver, United was under less pressure to lower airfares.

### March 1994

The city of Denver announced the fourth delay in opening DIA, from March 9 to May 15. The cost of the delay, \$100 million, would be paid mostly by United and Continental. As of March, only Concourse C, which housed the carriers other than United and Continental, was granted a temporary certificate of occupancy (TCO) by the city.

As the fingerpointing began, blame for this delay was given to the baggage handling system, which was experiencing late changes, restricted access flow, and a slow-down in installation and testing. A test by Continental Airlines indicated that only 39% of baggage was delivered to the correct location. Other problems also existed. As of December 31 1993, there were 2100 design changes. The city of Denver had taken out insurance for construction errors and omissions. The city's insurance claims cited failure to coordinate design of the ductwork with ceiling and structure, failure to properly design the storm draining systems for the terminal to prevent freezing, failure to coordinate mechanical and structural designs of the terminal, and failure to design an adequate subfloor support system.

Consultants began identifying potential estimating errors in DIA's operations. The runways at DIA were six times longer than the runways at Stapleton, but DIA had purchased only 25% more equipment. DIA's cost projections would be \$280 million for debt service and \$130 million for operating costs, for a total of \$410 million per year. The total cost at Stapleton was \$120 million per year.

### April 1994

Denver International Airport began having personnel problems. According to DIA's personnel officer, Linda Rubin Royer, moving 17 miles away from its present site was creating serious problems. One of the biggest issues was the additional 20-minute drive that employees had to bear. To resolve this problem, she proposed a car/van pooling scheme and tried to get the city bus company to transport people to and from the new airport. There was also the problem of transferring employees to similar jobs elsewhere if they truly disliked working at DIA. The scarcity of applicants wanting to work at DIA was creating a problem as well.

### May 1994

Standard and Poor's Corporation lowered the rating on DIA's outstanding debt to the noninvestment grade of BB, citing the problems with the baggage handling system and no immediate cure in sight. Denver was currently paying \$33.3 million per month to service debt. Stapleton was generating \$17 million per month and United Airlines had agreed to pay \$8.8 million in cash for the next three months only. That left a current shortfall of \$7.5 million each month that the city would have to fund. Beginning in August 1994, the city would be burdened with \$16.3 million each month.

BAE Automated Systems personnel began to complain that they were pressured into doing the impossible. The only other system of this type in the world was in Frankfurt, Germany. That system required six years to install and two years to debug. BAE was asked to do it all in two years.

BAE underestimated the complexity of the routing problems. During trials, cars crashed into one another, luggage was dropped at the wrong location, cars that were needed to carry luggage were routed to empty waiting pens, and some cars traveled in the wrong direction. Sensors became coated with dirt, throwing the system out of alignment, and luggage was dumped prematurely because of faulty latches, jamming cars against the side of a tunnel. By the end of May, BAE was conducting a worldwide search for consultants who could determine what was going wrong and how long it would take to repair the system.

BAE conducted an end-of-month test with 600 bags. Outbound (terminal to plane), the sort accuracy was 94% and inbound the accuracy was 98%. The system had a zero down-time for both inbound and outbound testing. The specification requirements called for 99.5% accuracy.

BAE hired three technicians from Germany's Logplan, which helped solve similar problems with the automated system at Frankfurt, Germany. With no opening date set, DIA contemplated opening the east side of the airport for general aviation and air cargo flights. That would begin generating at least some revenue.

## June 1994

The cost for DIA was now approaching \$3.7 billion and the jokes about DIA appeared everywhere. One common joke was that when you fly to Denver, you will have to stop in Chicago to pick up your luggage. Other common jokes included the abbreviation, DIA. Exhibit B at the end of this case study provides a listing of some of the jokes.

The people who did not appear to be laughing at these jokes were the concessionaires, including about 50 food service operators, who had been forced to rehire, retrain, and reequip at considerable expense. Several small businesses were forced to call it quits because of the eight-month delay. Red ink was flowing despite the fact that the \$45-a-square foot rent would not have to be paid until DIA officially opened. Several of the concessionaires had requested that the rent be cut by \$10 a square foot for the first six months or so, after the airport opened. A merchant's association was formed at DIA to fight for financial compensation.

## The Project's Work Breakdown Structure (WBS)

The city had managed the design and construction of the project by grouping design and construction activities into seven categories or "areas":

- Area #0 Program management/preliminary design
- Area #1 Site development
- Area #2 Roadways and on-grade parking
- Area #3 Airfield
- Area #4 Terminal complex
- Area #5 Utilites and specialty systems
- Area #6 Other

Since the fall of 1992, the project budget had increased by \$224 million (from \$2,700 million to \$2,924 million) principally as a result of scope changes.

- Structural modifications to the terminal buildings (primarily in the Landside Terminal and Concourse B) to accommodate the automated baggage system
- Changes in the interior configuration of Concourse B

- Increases in the scope of various airline tenant finished, equipment, and systems, particularly in Concourse B
- Grading, drainage, utilities, and access costs associated with the relocation of air cargo facilities to the south side of the airport
- Increases in the scope and costs of communication and control systems, particularly premises wiring
- Increases in the costs of runway, taxiway, and apron paving and change orders as a result of changing specifications for the runway lighting system
- Increased program management costs because of schedule delays

Yet even with all of these design changes, the airport was ready to open except for the baggage handling system.

### July 1994

The Securities and Exchange Commission (SEC) disclosed that DIA was one of 30 municipal bond issuers that were under investigation for improper contributions to the political campaigns of Pena and his successor, Mayor Wellington Webb. Citing public records, Pena was said to have received \$13,900 and Webb's campaign fund increased by \$96,000. The SEC said that the contributions may have been in exchange for the right to underwrite DIA's municipal bond offerings. Those under investigation included Merrill Lynch, Goldman Sachs & Co., and Lehman Brothers, Inc.

### August 1994

Continental confirmed that as of November 1, 1994, it would reduce its flights out of Denver from 80 to 23. At one time, Continental had 200 flights out of Denver.

Denver announced that it expected to sell \$200 million in new bonds. Approximately \$150 million would be used to cover future interest payments on existing DIA debt and to replenish interest and other money paid due to the delayed opening.

Approximately \$50 million would be used to fund the construction of an interim baggage handling system of the more conventional tug-and-conveyor type. The interim system would require 500–600 people rather than the 150–160 people needed for the computerized system. Early estimates said that the conveyor belt/tug-and-cart system would be at least as fast as the system at Stapleton and would be using proven technology and off-the-shelf parts. However, modifications would have to be made to both the terminal and the concourses.

United Airlines asked for a 30-day delay in approving the interim system for fear that it would not be able to satisfy their requirements. The original lease agreement with DIA and United stipulated that on opening day there would be a fully operational automated baggage handling system in place. United had 284 flights a day out of Denver and had to be certain that the interim system would support a 25-minute turn-around time for passenger aircraft.

The city's District Attorney's Office said it was investigating accusations of falsified test data and shoddy workmanship at DIA. Reports had come in regarding fraudulent construction and contracting practices. No charges were filed at that time.

DIA began repairing cracks, holes, and fissures that had emerged in the runways, ramps, and taxiways. Officials said that the cracks were part of the normal settling problems and might require maintenance for years to come.

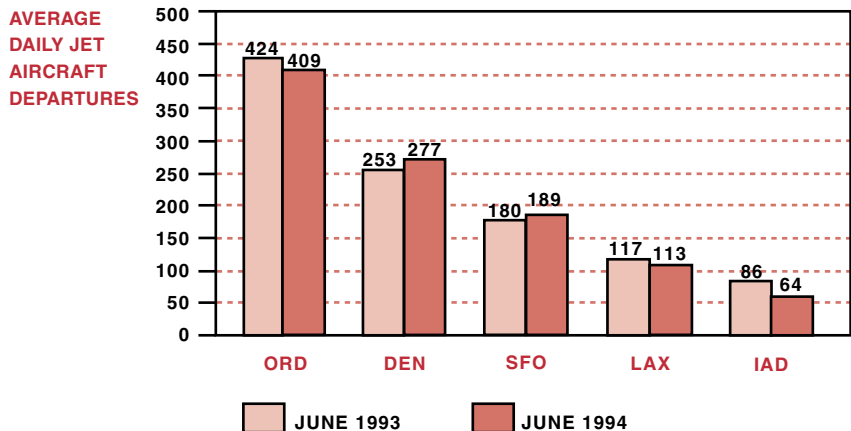
United Airlines agreed to invest \$20 million and act as the project manager to the baggage handling system at Concourse B. DIA picked February 28, 1995 as the new opening date as long as either the primary or secondary baggage handling systems were operational.

**United Benefits from Continental's Downsizing**

United had been building up its Denver hub since 1991, increasing its total departures 9% in 1992, 22% in 1993, and 9% in the first six months of 1994. Stapleton is United's second largest connecting hub after Chicago O'Hare (ORD) ahead of San Francisco (SFO), Los Angeles (LAX), and Washington Dulles (IAD) International Airports, as shown in Exhibit 11-7.

In response to the downsizing by Continental, United is expected to absorb a significant portion of Continental's Denver traffic by means of increased load factors and increased service (i.e. capacity), particularly in larger markets where significant voids in service might be left by Continental. United served 24 of the 28 cities served by Continental from Stapleton in June, 1994, with about 79% more total available seats to those cities—23,937 seats provided by United compared with 13,400 seats provided by Continental. During 1993, United's average load factor from Denver was 63%, indicating that, with its existing service and available capacity, United had the ability to absorb many of the passengers abandoned by Continental. In addition, United had announced plans to increase service at Denver to 300 daily flights by the end of the calendar year.

**Exhibit 11-7. Comparative United Airlines Service at Hub Airports, June 1993 and June 1994**



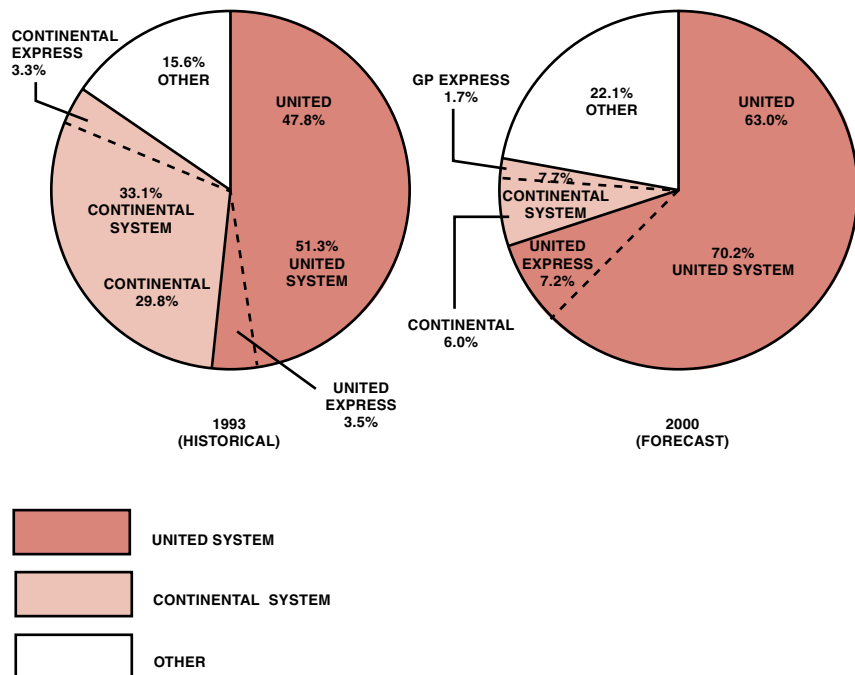
NOTE: DOES NOT INCLUDE ACTIVITY BY UNITED EXPRESS.

SOURCE: OFFICIAL AIRLINE GUIDES, INC. (ONLINE DATA BASE), FOR PERIODS SHOWN.

As a result of its downsizing in Denver, Continental was forecasted to lose more than 3.9 million enplaned passengers from 1993 to 1995—a total decrease of 80%. However, this decrease was expected to be largely offset by the forecasted 2.2 million increase in enplaned passengers by United and 1.0 million by the other airlines, resulting in a total of 15,877,000 enplaned passengers at Denver in 1995. As discussed earlier, it was assumed that, in addition to a continuation of historical growth, United and the other airlines would pick up much of the traffic abandoned by Continental through a combination of added service, larger average aircraft size, and increased load factors.

From 1995 to 2000, the increase in total enplaned passengers is based on growth rates of 2.5% per year in originating passengers and 3.0% per year in connecting passengers. Between 1995 and 2000, United's emerging dominance at the airport (with almost twice the number of passengers of all other airlines combined) should result in somewhat higher fare levels in the Denver markets, and therefore may dampen traffic growth. As shown in Exhibit 11-8, of the 18.2 million forecasted enplaned passengers in 2000, United and United Express together are forecasted to account for 70% of total passengers at the airport—up from about 51% in 1993—while Continental's share, including GP Express, is forecasted to be less than 8%—down from about 33% in 1993.

**Exhibit 11-8. Enplaned Passenger Market Shares  
Denver Airport**



SOURCES: 1993: AIRPORT MANAGEMENT RECORDS.

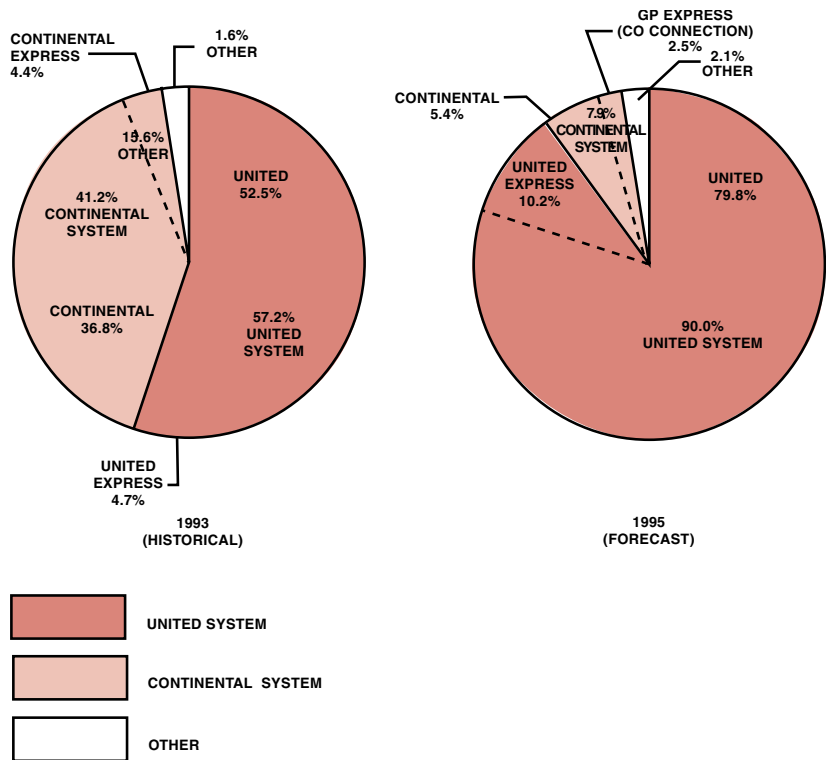
Total connecting passengers at Stapleton increased from about 6.1 million in 1990 to about 8.2 million in 1993—an average increase of about 10% per year. The number of connecting passengers was forecast to decrease in 1994 and 1995, as a result of the downsizing by Continental, and then return to steady growth of 3.0% per year through 2000, reflecting expected growth in passenger traffic nationally and a stable market share by United in Denver. Airline market share of connecting passengers in 1993 and 1995 are shown in Exhibit 11–9.

**September 1994**

Denver began discussions with cash-strapped MarkAir of Alaska to begin service at DIA. For an undercapitalized carrier, the prospects of tax breaks, favorable rents, and a \$30 million guaranteed city loan were enticing.

DIA officials estimated an \$18 per person charge on opening day. Plans to allow only cargo carriers and general aviation to begin operations at DIA were canceled.

**Exhibit 11–9. Connecting Passenger Market Shares  
Denver Airport**



SOURCES: 1993: AIRPORT MANAGEMENT RECORDS AND U.S. DEPARTMENT OF TRANSPORTATION

Total construction cost for the main terminal exceeded \$455 million (including the parking structure and the airport office building).

General site expenses, commission	\$38,667,967
Sitework, building excavations	15,064,817
Concrete	89,238,296
Masonry	5,501,608
Metals	40,889,411
Carpentry	3,727,408
Thermal, moisture protection	8,120,907
Doors and windows	13,829,336
Finishes	37,025,019
Specialties	2,312,691
Building equipment	227,720
Furnishings	3,283,852
Special construction	39,370,072
Conveying systems	23,741,336
Mechanical	60,836,566
Electrical	73,436,575
TOTAL	\$455,273,581

#### October 1994

A federal grand jury convened to investigate faulty workmanship and falsified records at DIA. The faulty workmanship had resulted in falling ceilings, buckling walls, and collapsing floors.

#### November 1994

The baggage handling system was working, but only in segments. Frustration still existed in not being able to get the whole system to work at the same time. The problem appeared to be with the software required to get computers to talk to computers. The fact that a mere software failure could hold up Denver's new airport for more than a year put in question the project's risk management program.

Jerry Waddles was the risk manager for Denver. He left that post to become risk manager for the State of Colorado. Eventually the city found an acting risk manager, Molly Austin Flaherty, to replace Mr. Waddles, but for the most part, DIA construction over the past several months had continued without a full-time risk manager.

The failure of the baggage handling system had propelled DIA into newspaper headlines around the country. The U.S. Securities and Exchange Commission had launched a probe into whether Denver officials had deliberately deceived bondholders about how equipment malfunctions would affect the December 19 1993 opening. The allegations were made by Denver's KCNC-TV. Internal memos indicated that in the summer of 1993 city engineers believed it would take at least until March 1994 to get the system working. However, Mayor Wellington Webb did not announce the delayed opening until October 1993. The SEC was investigating whether the last postponement misled investors holding \$3 billion in airport bonds.

Under a new agreement, the city agreed to pay BAE an additional \$35 million for modifications *if* the system was working for United Airlines by February 28, 1995. BAE would then have until August, 1995 to complete the rest of the system for the other tenants. If the system was not operational by February 28, the city could withhold payment of the \$35 million.

BAE lodged a \$40 million claim against the city, alleging that the city caused the delay by changing the system’s baseline configuration after the April 1, 1992 deadline. The city filed a \$90 million counterclaim blaming BAE for the delays.

The lawsuits were settled out of court when BAE agreed to pay \$12,000 a day in liquidated damages dating from December 19 1993 to February 28, 1995, or approximately \$5 million. The city agreed to pay BAE \$6.5 million to cover some invoices submitted by BAE for work already done to repair the system.

Under its DIA construction contract, BAE’s risks were limited. BAE’s liability for consequential damages resulting from its failure to complete the baggage handling system on time was capped at \$5 million. BAE had no intention of being held liable for changes to the system. The system as it was at the time was not the system that BAE was hired to install.

Additional insurance policies also existed. Builder’s risk policies generally pay damages caused by defective parts or materials, but so far none of the parts used to construct the system had been defective. BAE was also covered for design errors or omissions. The unknown risk at that point was who would be responsible if the system worked for Concourse B (i.e., United) but then failed when it was expanded to cover all concourses.

A study was underway to determine the source of respiratory problems suffered by workers at the construction site. The biggest culprit appeared to be the use of concrete in a confined space.

The city and DIA were also protected from claims filed by vendors whose businesses were put on hold because of the delays under a hold-harmless agreement in the contracts. However, the city had offered to permit the concessionaires to charge higher fees and also to extend their leases for no charge to make up for lost income due to the delays.

**December 1994**

The designer of the baggage handling system was asked to reexamine the number of bags per minute that the BAE system was required to accommodate as per the specifications. The contract called for departing luggage to Concourse A to be delivered at a peak rate of 90 bags per minute. The designer estimated peak demand at 25 bags per minute. Luggage from Concourse A was contracted for at 223 bags per minute but again, the designer calculated peak demand at a lower rate of 44 bags per minute.

**Airport Debt**

By December 1994, DIA was more than \$3.4 billion in debt, as shown below.

Series 1984 Bonds . . . . .	\$103,875,000
Series 1985 Bonds . . . . .	175,930,000
Series 1990A Bonds . . . . .	700,003,843
Series 1991A Bonds . . . . .	500,003,523
Series 1991D Bonds . . . . .	600,001,391
Series 1992A Bonds . . . . .	253,180,000
Series 1992B Bonds . . . . .	315,000,000
Series 1992C Bonds . . . . .	392,160,000
Series 1992D–G Bonds . . . . .	135,000,000
Series 1994A Bonds . . . . .	257,000,000
	<hr/>
	\$3,432,153,757



### Airport Revenue

Airports generally have two types of contracts with their tenants. The first type is the residual contract where the carriers guarantee that the airport will remain solvent. Under this contract, the carriers absorb the majority of the risk. The airport maintains the right to increase rents and landing fees to cover operating expenses and debt coverage. The second type of contract is the compensatory contract where the airport is at risk. DIA has a residual contract with its carriers.

Airports generate revenue from several sources. The most common breakdown includes landing fees and rent from the following entities: airline carriers, passenger facilities rental car agencies, concessionary stores, food and beverage services, retail shops, and parking garages. Retail shops and other concessionary stores also pay a percent of sales.

### Airline Costs per Enplaned Passenger

Revenues derived from the airlines are often expressed on a per enplaned passenger basis. The average airline cost per enplaned passenger at Stapleton in 1993 was \$5.02. However, this amount excludes costs related to major investments in terminal facilities made by United Airlines in the mid-1980s and, therefore, understates the true historical airline cost per passenger.

Average airline costs per enplaned passenger at the airport in 1995 and 2000 are forecast to be as follows:

<b>Total average airline costs per enplaned passenger</b>		
<b>Year</b>	<b>Current dollars</b>	<b>1990 dollars</b>
1995	\$18.15	\$14.92
2000	17.20	11.62

The forecasted airline costs per enplaned passenger at the airport are considerably higher than costs at Stapleton today and the highest of any major airport in the United States. (The cost per enplaned passenger at Cleveland Hopkins is \$7.50). The relatively high airline cost per passenger is attributable, in part, to (1) the unusually large amount of tenant finishes, equipment, and systems costs being financed as part of the project relative to other airport projects and (2) delayed costs incurred since the original opening date for purposes of the Plan of Financing (January 1, 1994).

The City estimates that, as a result of the increased capacity and efficiency of the airfield, operation of the airport will result in annual delay savings to the airlines of \$50 million to \$100 million per year (equivalent to about \$3 to \$6 per enplaned passenger), and that other advanced technology and systems incorporated into the design of the airport will result in further operational savings. In the final analysis, the cost effectiveness of operating at the airport is a judgment that must be made by the individual airlines in deciding to serve the Denver market.

It is assumed for the purposes of this analysis that the city and the airlines will resolve the current disputes regarding cost allocation procedures and responsibility for delay costs, and that the airlines will pay rates generally in accordance with the procedures of the use and lease agreements as followed by the city and as summarized in the accompanying exhibits.

### February 28, 1995

The airport opened as planned on February 28, 1995. However, several problems became apparent. First, the baggage handling system did have "bad days." Passengers

traveling to and from Denver felt more comfortable carrying bags than having them transferred by the computerized baggage handling system. Large queues began to form at the end of the escalators in the main terminal going down to the concourse trains. The trains were not running frequently enough, and the number of cars in each train did not appear to be sufficient to handle the necessary passenger traffic.

The author flew from Dallas-Ft. Worth to Denver in one hour and 45 minutes. It then took one hour and 40 minutes to catch the airport shuttles (which stop at all the hotels) and arrive at the appropriate hotel in downtown Denver. Passengers began to balk at the discomfort of the remote rental car facilities, the additional three dollar tax per day for each rental car, and the fact that the nearest gas station was 15 miles away. How does one return a rental car with a full tank of gas?

Departing passengers estimated it would take two hours to drive to the airport from downtown Denver, unload luggage, park their automobile, check in, and take the train to the concourse.

Faults in the concourse construction were becoming apparent. Tiles that were supposed to be 5/8 inches thick were found to be 1/2 inch thick. Tiles began to crack. During rainy weather, rain began seeping in through the ceiling.

**EXHIBIT A<sup>17</sup>**  
**MUNICIPAL BOND PROSPECTUS**  
**\$261,415,000**  
**CITY AND COUNTY OF DENVER, COLORADO**  
**6.875% SPECIAL FACILITIES AIRPORT REVENUE BONDS**  
**(UNITED AIRLINES PROJECT)**  
**Series 1992A**  
**Date: October 1, 1992**  
**Due: October 1, 2032**  
**Rating: Standard & Poor's BBB-**  
**Moody's Baa2**

## Introduction

This official statement is provided to furnish information in connection with the sale by the City and County of Denver, Colorado (the "City") of 6.875% Special Facilities Airport Revenue Bonds (United Airlines Project) series 1992A in the aggregate principle amount of \$261,415,000 (the "Bonds"). The bonds will be dated, mature, bear interest, and be subject to redemption prior to maturity as described herein.

The Bonds will be issued pursuant to an Ordinance of the City and County of Denver, Colorado (the "Ordinance").

The proceeds received by the City from the sale of the Bonds will be used to acquire, construct, equip, or improve (or a reimbursement of payments for the acquisition, construction, equipping, or improvement of) certain terminals, Concourse B, aircraft maintenance, ground equipment maintenance, flight kitchen, and air freight facilities (the "Facilities") at the new Denver International Airport (the "New Airport").

The City will cause such proceeds to be deposited, distributed, and applied in accordance with the terms of a Special Facilities and Ground Lease, dated as of October

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17. Only excerpts from the prospectus are included here.

1, 1992 (the “Lease”) between United Airlines and the City. Under the Lease, United has agreed to make payments sufficient to pay the principal, premium, if any, and interest on the Bonds. Neither the Facilities nor the ground rental payments under the Lease are pledged as security for the payment of principal, premium, if any, and interest on the bonds.

### **Agreement between United and the City**

On June 26, 1991, United and the City entered into an agreement followed by a second agreement on December 12, 1991, which, among other things, collectively provide for the use and lease by United of certain premises and facilities at the New Airport. In the United Agreement, United agrees among other things, to (1) support the construction of the New Airport, (2) relocate its present air carrier operations from Stapleton to the New Airport, (3) occupy and lease certain facilities at the New Airport, including no less than 45 gates on Concourse B within two years of the date of beneficial occupancy as described in the United Agreement, and (4) construct prior to the date of beneficial occupancy, a regional reservation center at a site at Stapleton.

In conjunction with the execution of the United Agreement, United also executes a 30-year use and lease agreement. United has agreed to lease, on a preferential use basis, Concourse B, which is expected to support 42 jet aircraft with up to 24 commuter aircraft parking positions at the date of beneficial occupancy, and, on an exclusive use basis, certain ticket counters and other areas in the terminal complex of the New Airport.

### **The Facilities**

The proceeds of the bonds will be used to finance the acquisition, construction, and equipping of the Facilities, as provided under the Lease. The Facilities will be located on approximately 100 acres of improved land located within the New Airport, which United will lease from the City. The Facilities will include an aircraft maintenance facility capable of housing ten jet aircraft, a ground equipment support facility with 26 maintenance bays, an approximately 55,500-square-foot air freight facility, and an approximately 155,000-square-foot flight kitchen. Additionally, the proceeds of the Bonds will be used to furnish, equip, and install certain facilities to be used by United in Concourse B and in the terminal of the New Airport.

### **Redemption of Bonds**

The Bonds will be subject to optional and mandatory redemption prior to maturity in the amounts, at the times, at the prices, and in the manner as provided in the Ordinance. If less than all of the Bonds are to be redeemed, the particular Bonds to be called for redemption will be selected by lot by the Paying Agent in any manner deemed fair and reasonable by the Paying Agent.

The bonds are subject to redemption prior to maturity by the City at the request of United, in whole or in part, by lot, on any date on or after October 1, 2002 from an account created pursuant to the Ordinance used to pay the principal, premium, if any, and interest on the Bonds (the “Bond Fund”) and from monies otherwise available for such purpose. Such redemptions are to be made at the applicable redemption price shown below as a percentage of the principal amount thereof, plus interest accrued to the redemption date:

Redemption Period	Optional Redemption Price
October 1, 2002 through September 30, 2003	102%
October 1, 2003 through September 30, 2004	101%
October 1, 2004 and thereafter	100%

The Bonds are subject to optional redemption prior to maturity, in whole or in part by lot, on any date, upon the exercise by United of its option to prepay Facilities Rentals under the Lease at a redemption price equal to 100% of the principal amount thereof plus interest accrued to the redemption date, if one or more of the following events occurs with respect to one or more of the units of the Leased Property:

- (a) the damage or destruction of all or substantially all of such unit or units of the Leased Property to such extent that, in the reasonable opinion of United, repair and restoration would not be economical and United elects not to restore or replace such unit or units of the Leased Property; or,
- (b) the condemnation of any part, use, or control of so much of such unit or units of the Leased Property that such unit or units cannot be reasonably used by United for carrying on, at substantially the same level or scope, the business theretofore conducted by United on such unit or units.

In the event of a partial extraordinary redemption, the amount of the Bonds to be redeemed for any unit of the Leased Property with respect to which such prepayment is made shall be determined as set forth below (expressed as a percentage of the original principal amount of the Bonds) plus accrued interest on the Bonds to be redeemed to the redemption date of such Bonds provided that the amount of Bonds to be redeemed may be reduced by the aggregate principal amount (valued at par) of any Bonds purchased by or on behalf of United and delivered to the Paying Agent for cancellation:

Terminal Concourse B Facility	Aircraft Maintenance Facility	Ground Equipment Maintenance Facility	Flight Kitchen	Air Freight Facility
20%	50%	10%	15%	5%

The Bonds shall be subject to mandatory redemption in whole prior to maturity, on October 1, 2023, at a redemption price equal to 100% of the principal amount thereof, plus accrued interest to the redemption date if the term of the Lease is not extended to October 1, 2032 in accordance with the provisions of the Lease and subject to the conditions in the Ordinance.

**Limitations**

Pursuant to the United Use and Lease Agreement, if costs at the New Airport exceed \$20 per revenue enplaned passenger, in 1990 dollars, for the preceding calendar year, calculated in accordance with such agreement, United can elect to terminate its Use and Lease Agreement. Such termination by United would not, however, be an event of default under the Lease.

If United causes an event of default under the Lease and the City exercises its remedies there under and accelerates Facilities Rentals, the City is not obligated to

relet the Facilities. If the City relets the Facilities, it is not obligated to use any of the payments received to pay principal, premium, if any, or interest on the Bonds.

**Application of the Bond Proceeds**

It is estimated that the proceeds of the sale of the Bonds will be applied as follows:

Cost of Construction . . . . .	\$226,002,433
Interest on Bonds During Construction . . . . .	22,319,740
Cost of Issuance Including Underwriters' Discount . . . . .	1,980,075
Original Issue Discount . . . . .	<u>11,112,742</u>
Principal Amount of the Bonds	261,415,000

**Tax Covenant**

Under the terms of the lease, United has agreed that it will not take or omit to take any action with respect to the Facilities or the proceeds of the bonds (including any investment earnings thereon), insurance, condemnation, or any other proceeds derived in connection with the Facilities, which would cause the interest on the Bonds to become included in the gross income of the Bondholder for federal income tax purposes.

**Other Material Covenants**

United has agreed to acquire, construct, and install the Facilities to completion pursuant to the terms of the Lease. If monies in the Construction Fund are insufficient to pay the cost of such acquisition, construction, and installation in full, then United shall pay the excess cost without reimbursement from the City, the Paying Agent, or any Bondholder.

United has agreed to indemnify the City and the Paying Agent for damages incurred in connection with the occurrence of certain events, including without limitation, the construction of the Facilities, occupancy by United of the land on which the Facilities are located, and violation by United of any of the terms of the Lease or other agreements related to the Leased Property.

During the Lease Term, United has agreed to maintain its corporate existence and its qualifications to do business in the state. United will not dissolve or otherwise dispose of its assets and will not consolidate with or merge into another corporation provided, however, that United may, without violating the Lease, consolidate or merge into another corporation.

**Additional Bonds**

At the request of United, the City may, at its option, issue additional bonds to finance the cost of special Facilities for United upon the terms and conditions in the Lease and the Ordinance.

**The Guaranty**

Under the Guaranty, United will unconditionally guarantee to the Paying Agent, for the benefit of the Bondholders, the full and prompt payment of the principal, premium, if any, and interest on the Bonds, when and as the same shall become due whether at the stated maturity, by redemption, acceleration, or otherwise. The obligations of United under the Guaranty are unsecured, but are stated to be absolute and unconditional, and the Guaranty will remain in effect until the entire principal, premium, if any, and interest on the Bonds has been paid in full or provision for the payment thereof has been made in accordance with the Ordinance.

**EXHIBIT B<sup>18</sup>**  
**JOKES ABOUT THE ABBREVIATION, DIA**

DENVER—The Denver International Airport, whose opening has been delayed indefinitely because of snafus, has borne the brunt of joke writers.

Punsters in the aviation and travel community have done their share of work on one particular genre, coming up with new variations on the theme of DIA, the star-crossed airport's new and as-yet-unused city code.

Here's what's making the rounds on electronic bulletin boards; it originated in the May 15 issue of the Boulder (Colo.) Camera newspaper:

1. Dis Is Awful
2. Doing It Again
3. Dumbest International Airport
4. Dinosaur In Action
5. Debt In Arrival
6. Denver's Intense Adventure
7. Darn It All
8. Dollar Investment Astounding
9. Delay It Again
10. Denver International Antique
11. Date Is AWOL
12. Denver Intellectuals Awry
13. Dance Is Autumn
14. Dopes In Authority
15. Don't Ice Attendance
16. Drop In Asylum
17. Don't Immediately Assume
18. Don't Ignore Aspirin
19. Dittohead Idle Again
20. Doubtful If Atall
21. Denver In Action
22. Deces, l'Inaugural Arrivage (means "dead on arrival" in French)
23. Dummies In Action
24. Dexterity In Action
25. Display In Arrogance
26. Denver Incomplete Act
27. D'luggage Is A'coming
28. Defect In Automation
29. Dysfunctional Itinerary Apparatus
30. Dis Is Absurd
31. Delays In Abundance
32. Did It Arrive?
33. Denver's Infamous Airport (sounds like "error")
34. Dopes In Action
35. Doubtful Intermittent Access
36. Don't Intend Atall
37. Damned Inconvenient Airport
38. Duped In Anticipation
39. Delay In Action
40. Delirious In Accounting
41. Date Indeterminate, Ah?
42. Denver's Indisposed Access
43. Detained Interphase Ahead
44. Denver's Interminably Aground
45. Deceit In Action
46. Delay Institute America
47. Denver's Intractable Airport
48. Delayed Indefinitely Ahead
49. Delayed Introduction Again
50. Disaster In Arrears
51. Denver International Amusementpark
52. Debacle In Action
53. Deadline (of) Incomprehensible Attainment
54. Duffel Improbable Arrival
55. Delay In America
56. Dying In Anticipation
57. Dazzling Inaccessible Absurdity
58. Damned Intractable Automation
59. Da Infamous Annoyance
60. Dare I Ask?
61. Done In Arrears
62. Done In Ancestral
63. Denver International Accident
64. Dumb Idea Anyway
65. Diversion In Accounting
66. Doesn't Include Airlines
67. Disparate Instruments in Action
68. Delay International Airport
69. Dumb Idea Askew
70. Delayed Indefinitely Airport
71. Delays In Arrival
72. Deja In Absentee
73. Done In Aminute
74. Done In August
75. Denver's Inordinate Airport
76. Denver's Imaginary Airport
77. Debentures In Arrears
78. Denver Isn't Airborne
79. Descend Into Abyss
80. Done In April 2000
81. Disaster In Aviation
82. Denver's Interminable Airport
83. Denver In Arrears
84. Dallying Is Aggravating
85. Don't In Angst
86. Distress Is Acute
87. Development Is Arrested
88. Darned Inevitable Atrocity
89. Debt In Airport
90. Devastation In Aviation
91. Debacle In Automation
92. Denver's Inconstructable Airport
93. Denver Is Awaitin'
94. DIIsAster
95. Denver's Inoperable Airport
96. Delay, Impede, Await
97. Date Isn't Available
98. Delayed International Airport
99. Denver Irrational Airport
100. Denver Irate Association
101. Denver's Ignominious Atrocity
102. Daytrippers Invitational Airport
103. Delay Is Anticipated
104. Doofis, Interruptness, Accidental
105. Denver International Arrival
106. Denver's Interminable Apparition
107. Distance Is Astronomical
108. Doubtful It's Able
109. Dreadfully Ineffective Automation
110. Do It Again
111. Did it, Installed it, Ate it
112. Drowned In Apoplexy
113. Dodo International Airport (the dodo is an extinct, flightless bird)
114. Dead In the Air
115. Denouement In Ambiguity
116. Deserted, Inactive Airport
117. Definitely Incapable of Activation
118. Democracy In Action
119. Dysfunction Imitating Art
120. Design In Alabaster
121. Desperately In Arrears
122. Dazzling, If Anything
123. Delays In Aeternum
124. Delighted If Actualized
125. Destination: Imagine Arabia
126. Dumb Idea: Abandoned?
127. Deem It Apiary
128. Dollars In Action
129. Definitely Iffy Achievement
130. Dreadfully Incompetent Architects
131. Denver International Ain't
132. Delayed In Automation
133. Dragging Its Ass
134. Driving Is Advantageous
135. Dang It All
136. Druggies Installing Automation
137. Dumb Idea Approved
138. Didn't Invite Airplanes
139. Died In April
140. Deplane In Albuquerque
141. Departure Is Agonizing
142. Denver's Infuriating Abscess
143. Denver's Ill-fated Airport
144. Domestic International Aggravation
145. Duffels In Anchorage
146. Denver's Indeterminate Abomination
147. Damn It All
148. Dam Idiotic Airport
149. Delay Is Acceptable
150. Denver's Idle Airport
151. Does It Arrive?
152. Damned Inconvenient Anyway

<sup>18</sup>Boulder (Colorado) Camera Newspaper, May 15, 1991.

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