

Chapter 7. OPERATING COST BENEFIT

This Strategic Master Plan proposes various airfield improvements within the 20 year planning horizon (1998-2018) to increase capacity of the runway system, when and if the forecast activity occurs. This increase in airfield capacity offers benefits to the airlines (and their customers) in the form of reduced delay. In addition, the increased capacity will allow the hub cargo carrier, Emery Worldwide, to serve its flights within its required operating time windows and stay competitive within the global cargo market. The calculation of the annual operating cost savings to the airlines is discussed in the following sections:

- Aircraft Performance
- Operating Costs
- Annual Savings

1. AIRCRAFT PERFORMANCE

Airspace delay, ground delay, taxi time, and operating outside the specified cargo operating window were used to quantify the cost of operating at DAY. Airspace delay is delay incurred in the air within 25 nautical miles of the airport. Ground delay is delay incurred between the runway and the gate (or cargo parking position) as a result of taxiway congestion, runway crossings, pushback delay, taxi speed variation, or waiting in the departure queue. Taxi time is defined as unrestricted travel time between the runway and the gate. The fourth measure of performance is the number of Emery flights operating outside the defined sort window.

These performance measures were determined through the use of the FAA's airfield and airspace simulation model, SIMMOD Version 2.2. This model determines performance results based upon aircraft operations levels, weather conditions, FAA procedures, and runway and taxiway layout.

The existing airfield, with and without the recommended improvements, was simulated against the 1998, 2003, 2008, and 2018 demand. The performance results are shown in **Table 7-1**. If no runway improvements are made, hourly nighttime cargo demand will exceed the capacity of the existing runway system by 2003, leading to an unacceptable number of flights falling outside the Emery operating window.

Table 7-1

Dayton International Airport

Strategic Master Plan Update Study
All Weather Average Performance Summary

	1998		200	2003		2008		18		6R	6R&18
	Emery	Average	Emery	Average	Emery	Average	Emery	Average	2008	0	0
	# Flights	Taxi Time	2009	1	0						
	Outside	& Delay	2010	1	1						
Actual Performance	Window	(min./op.)	Window	(min./op.)	Window	(min./op.)	Window	(min./op.)	2011	2	1
									2012	2	1
Existing Airfield	0	6.24	4	7.30	31	15.35	82	27.19	2013	3	2
6R Extension	0	6.29	0	6.87	0	8.08	6	11.57	2014	4	2
6R & 18 Extension	0	6.29	0	6.87	0	8.08	3	9.92	2015	4	2
6R & 18 Extension, Third Parallel	0	6.29	0	6.85	0	7.86	0	9.18	2016	5	2
									2017	5	3
									2018	6	3

Note: 1/ Average time and delay includes all airport operations.

2/ Flights outside of operating window represents only Emery Worldwide flights.

Source: Simulation model output Prepared by: Landrum & Brown Draft, 01/13/00

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2. OPERATING COSTS

Two types of costs were used to assess the operating benefits from airfield expansion: aircraft operating cost and the cost of delayed cargo materials. The aircraft operating cost was calculated based on direct operating costs filed by the carriers. The cost of delayed cargo materials was calculated based on past Emery Worldwide shipments. Both types of costs are discussed in this section.

(1) Aircraft Operating Cost

Direct operating costs filed by the carriers for 1997 and 1998 were obtained for the types of aircraft that operate at DAY for each forecast demand level. A weighted average of these costs was computed based on the fleet mix in the design day schedules. The resulting weighted average cost per minute of operation is \$47.81 in 1998, increasing to \$59.25 in 2003, decreasing to \$58.78 in 2008, and increasing to \$64.51 in 2018. The slight drop of cost per minute from \$59.25 in 2003 to \$58.78 in 2008 can be attributed to the phase out of the costly DC-8 aircraft currently being used by Emery.

Based on previous analyses, it was assumed that airborne operations are 90 percent of block hour operations and ground costs are 70 percent of airborne costs. Based on this assumption and the cost per operation, the weighted average airborne and ground costs per operation were determined. These costs are summarized in **Table 7-2**. **Tables 7-3** through **7-6** show the calculation of these costs.

Table 7-2 – Ai	Table 7-2 – Aircraft Operating Costs									
<u>Year</u>	Airborne Cost (per minute of operation)	Ground Cost (per minute of operation)								
1998	\$49.29	\$34.50								
2003	\$61.08	\$42.76								
2008	\$60.60	\$42.42								
2018	\$66.51	\$46.55								

Note: All costs are in 1998 dollars.

Source: Aviation Daily (First Quarter, 1998), World Aviation Directory (Jan-June, 1994) and Cargo Facts (January, 1999).

(2) <u>Cost of Delayed Cargo Materials</u>

Due to the nature of DAY as a cargo hub for Emery Worldwide, all Emery flights must operate within specified time windows. Flights that occur outside these time windows due to delay can have a severe financial impact on the airline. The nighttime and daytime arrival window lasts approximately three hours. The nighttime departure window lasts

Table 7-3

Dayton International Airport

Strategic Master Plan Update Study

Aircraft Direct Operating Costs - 1998 Design Day Schedule

			1998		
	Number o	f Operations	Average	Percent of	Cost
Aircraft Group	Cargo	Non Cargo	Cost 1/	Operations	Weight
DC-10-10	0	0	\$0.00	0.00%	\$0.00
DC-8-50F	16	0	\$97.01	3.35%	\$3.25
DC-8-60F	50	0	\$86.76	10.46%	\$9.08
DC-8-71F	24	0	\$132.22	5.02%	\$6.64
DC-8-73F	28	0	\$80.78	5.86%	\$4.73
A300-600F	0	0	\$0.00	0.00%	\$0.00
B767-300	0	0	\$0.00	0.00%	\$0.00
B727-200	45	2	\$88.10	9.83%	\$8.66
B727-100	18	0	\$111.61	3.77%	\$4.20
MD-11F	0	0	\$0.00	0.00%	\$0.00
B747-100	0	0	\$0.00	0.00%	\$0.00
F100	0	10	\$36.76	2.09%	\$0.77
B737-300	0	2	\$30.46	0.42%	\$0.13
B737-500	0	2	\$24.77	0.42%	\$0.10
B737-200	0	14	\$25.12	2.93%	\$0.74
DC9-30	0	24	\$29.67	5.02%	\$1.49
DC9-10	0	2	\$23.48	0.42%	\$0.10
MD80	0	12	\$32.39	2.51%	\$0.81
Regional Jet	0	22	\$8.90	4.60%	\$0.41
Turboprop	0	86	\$23.75	17.99%	\$4.27
GA	0	121	\$9.61	25.31%	\$2.43
	181	297			
Total Operations		478		100.00%	\$47.81
Airspace Delay Cost F	Per Minute 2/	/			\$49.29
Ground Delay Cost Pe	er Minute 2/				\$34.50

Note: 1/ Average cost is based on Aviation Daily (First Quarter, 1998), World Aviation Directory (Jan.-June, 1994), and Cargo Facts (January 1999) and is expressed in 1998 dollars.

Prepared by: Landrum & Brown

Draft, 1/13/00

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^{2/} Airspace and ground cost is based on the assumption that airborne operations are 90% of block hour operations and ground costs are 70 percent of airborne costs.

Table 7-4
Dayton International Airport
Strategic Master Plan Update Study

Aircraft Direct Operating Costs - 2003 Design Day Schedule

			2003		
	Number of	Operations	Average	Percent of	Cost
Aircraft Group	Cargo	Non Cargo	Cost 1/	Operations	Weight
DC-10-10	34	0	\$104.04	7.11%	\$7.40
DC-8-50F	15	0	\$97.01	3.14%	\$3.04
DC-8-60F	48	0	\$86.76	10.04%	\$8.71
DC-8-71F	23	0	\$132.22	4.81%	\$6.36
DC-8-73F	28	0	\$80.78	5.86%	\$4.73
A300-600F	12	0	\$110.73	2.51%	\$2.78
B767-300	12	0	\$58.74	2.51%	\$1.47
B727-200	46	2	\$88.14	10.04%	\$8.85
B727-100	21	0	\$111.61	4.39%	\$4.90
MD-11F	2	0	\$98.23	0.42%	\$0.41
B747-100	0	0	\$0.00	0.00%	\$0.00
F100	0	10	\$36.76	2.09%	\$0.77
B737-300	0	2	\$30.46	0.42%	\$0.13
B737-500	0	2	\$24.77	0.42%	\$0.10
B737-200	0	15	\$25.12	3.14%	\$0.79
DC9-30	0	24	\$29.67	5.02%	\$1.49
DC9-10	0	2	\$23.48	0.42%	\$0.10
MD80	0	13	\$32.39	2.72%	\$0.88
Regional Jet	0	22	\$8.90	4.60%	\$0.41
Turboprop	0	70	\$23.75	14.64%	\$3.48
GA	0	121	\$9.61	25.31%	\$2.43
	241	283		· <u> </u>	
Total Operations		524		109.62%	\$59.25
Airspace Delay Cost P	er Minute 2/				\$61.08
Ground Delay Cost Per	r Minute 2/				\$42.76

Note: 1/ Average cost is based on Aviation Daily (First Quarter, 1998), World Aviation Directory (Jan.-June, 1994), and Cargo Facts (January 1999) and is expressed in 1998 dollars.

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^{2/} Airspace and ground cost is based on the assumption that airborne operations are 90% of block hour operations and ground costs are 70 percent of airborne costs.

Table 7-5

Dayton International Airport
Strategic Master Plan Update Study

Aircraft Direct Operating Costs - 2008 Design Day Schedule

			2008		
	Number o	f Operations	Average	Percent of	Cost
Aircraft Group	Cargo	Non Cargo	Cost 1/	Operations	Weight
DC-10-10	44	1	\$103.28	6.96%	\$7.18
DC-8-50F	0	0	\$0.00	0.00%	\$0.00
DC-8-60F	0	0	\$0.00	0.00%	\$0.00
DC-8-71F	0	0	\$0.00	0.00%	\$0.00
DC-8-73F	0	0	\$0.00	0.00%	\$0.00
A300-600F	120	0	\$110.73	18.55%	\$20.54
B767-300	123	1	\$58.72	19.17%	\$11.25
B727-200	48	7	\$83.71	8.50%	\$7.12
B727-100	19	0	\$111.61	2.94%	\$3.28
MD-11F	12	0	\$98.23	1.85%	\$1.82
B747-100	0	0	\$0.00	0.00%	\$0.00
F100	0	10	\$36.76	1.55%	\$0.57
B737-300	0	2	\$30.46	0.31%	\$0.09
B737-500	0	3	\$24.77	0.46%	\$0.11
B737-200	0	15	\$25.12	2.32%	\$0.58
DC9-30	0	24	\$29.67	3.71%	\$1.10
DC9-10	0	2	\$23.48	0.31%	\$0.07
MD80	0	16	\$32.39	2.47%	\$0.80
Regional Jet	0	19	\$8.90	2.94%	\$0.26
Turboprop	0	60	\$23.75	9.27%	\$2.20
GA	0	121	\$9.61	18.70%	\$1.80
	366	281			
Total Operations		647		100.00%	\$58.78
Airspace Delay Cost P	Per Minute 2/	′			\$60.60
Ground Delay Cost Pe	er Minute 2/				\$42.42

Note: 1/ Average cost is based on Aviation Daily (First Quarter, 1998), World Aviation Directory (Jan.-June, 1994), and Cargo Facts (January 1999) and is expressed in 1998 dollars.

Prepared by: Landrum & Brown

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^{2/} Airspace and ground cost is based on the assumption that airborne operations are 90% of block hour operations and ground costs are 70 percent of airborne costs.

Table 7-6
Dayton International Airport
Strategic Master Plan Update Study

Aircraft Direct Operating Costs - 2018 Design Day Schedule

			2018		
	Number of	Operations	Average	Percent of	Cost
Aircraft Group	Cargo	Non Cargo	Cost 1/	Operations	Weight
DC-10-10	68	0	\$104.04	8.61%	\$8.96
DC-8-50F	0	0	\$0.00	0.00%	\$0.00
DC-8-60F	0	0	\$0.00	0.00%	\$0.00
DC-8-71F	0	0	\$0.00	0.00%	\$0.00
DC-8-73F	0	0	\$0.00	0.00%	\$0.00
A300-600F	139	0	\$110.73	17.59%	\$19.48
B767-300	139	2	\$58.70	17.85%	\$10.48
B727-200	96	24	\$79.95	15.19%	\$12.14
B727-100	39	0	\$111.61	4.94%	\$5.51
MD-11F	12	0	\$98.23	1.52%	\$1.49
B747-100	0	2	\$0.00	0.25%	\$0.00
F100	0	12	\$36.76	1.52%	\$0.56
B737-300	0	2	\$30.46	0.25%	\$0.08
B737-500	0	3	\$24.77	0.38%	\$0.09
B737-200	0	19	\$25.12	2.41%	\$0.60
DC9-30	0	24	\$29.67	3.04%	\$0.90
DC9-10	0	2	\$23.48	0.25%	\$0.06
MD80	0	33	\$32.39	4.18%	\$1.35
Regional Jet	0	14	\$8.90	1.77%	\$0.16
Turboprop	0	39	\$23.75	4.94%	\$1.17
GA	0	121	\$9.61	15.32%	\$1.47
	493	297		· <u> </u>	
Total Operations		790		100.00%	\$64.51
Airspace Delay Cost	Per Minute 2/				\$66.51
Ground Delay Cost P	er Minute 2/				\$46.55

Note: 1/ Average cost is based on Aviation Daily (First Quarter, 1998), World Aviation Directory (Jan.-June, 1994), and Cargo Facts (January 1999) and is expressed in 1998 dollars.

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^{2/} Airspace and ground cost is based on the assumption that airborne operations are 90% of block hour operations and ground costs are 70 percent of airborne costs.

approximately two hours, while the daytime departure window lasts almost four hours. Nighttime is assumed to be the time period between 10:00 PM and 07:00 AM.

While the exact value of delay to air cargo materials is difficult to measure accurately, it has been estimated that each average package that is unable to be sorted within the operating window costs \$30 in refund of shipping charges and tracking expense. Each box of U.S. mail (which contains hundreds of letters or numerous small packages) costs, on average, \$32. If an aircraft full of packages is delayed and misses the sort window, the average cost is estimated at \$8,470. This cost is increased by two percent to account for the long-term potential loss of customers to Emery. Therefore, the cost of a flight operating outside the window is \$8,670.

3. <u>ANNUAL SAVINGS</u>

The following three major airfield improvements are recommended in order to serve forecast demand at an acceptable level of service:

- Extend Runway 6R/24L to 11,400 feet to provide sufficient length to serve all cargo operations.
- Extend and relocate Runway 18/36 to the north
- Provide a new third parallel Runway 6/24

The savings with each of the three runway projects is shown in **Table 7-7**. The annual quantified benefits include the annual aircraft operating cost savings as well as the annual delayed cargo cost savings. Annual aircraft operating costs are calculated by multiplying the delay and taxi times from SIMMOD by the average operating cost times the number of annual operations. The annual cost of delayed cargo was calculated by multiplying the number of flights outside the window by 312 days, which assumes the flights operate six days per week.

The annual benefit of the Runway 6R/24L extension as compared to the existing airfield is \$25.8 million in 2003, increasing to a savings of \$538 million in 2018. The Runway 18/36 extension results in a \$40.3 million savings in 2018, assuming the Runway 6R/24L extension is in place. The combination of the third parallel runway and the Runway 18/36 extension results in \$3 million dollar savings in 2008, increasing to a savings of \$66.5 million by 2018, assuming the Runway 6R/24L extension is in place.

Table 7-7

Dayton International Airport
Strategic Master Plan Update Study
All Weather Average Annual Savings

		2003			2008			2018	
<u> </u>	Emery			Emery			Emery		
	# Flights	Average		# Flights	Average		# Flights	Average	
	Outside	Taxi Time		Outside	Taxi Time		Outside	Taxi Time	
Actual Performance	Window	& Delay	Total	Window	& Delay	Total	Window	& Delay	Total
Benefit Over Existing Airfield 6R Extension 6R & 18 Extension Third Parallel	\$21,563,942 \$21,563,942 \$21,563,942	\$4,263,517 \$4,263,517 \$4,327,505	\$25,827,459 \$25,827,459 \$25,891,448	\$167,120,554 \$167,120,554 \$167,120,554	\$59,863,274 \$59,863,274 \$62,823,532	\$226,983,827 \$226,983,827 \$229,944,086	\$409,714,906 \$425,887,862 \$442,060,819	\$128,050,350 \$152,138,080 \$162,169,602	\$537,765,255 \$578,025,942 \$604,230,421
Benefit Over 6R Extension									
6R & 18 Extension	\$0	\$0	\$0	\$0	\$0	\$0	\$16,172,957	\$24,087,730	\$40,260,687
Third Parallel	\$0	\$63,989	\$63,989	\$0	\$2,960,259	\$2,960,259	\$32,345,914	\$34,119,253	\$66,465,166

	2003	2008	2018
Cost per Minute of Air Delay 1/	\$61.08	\$60.60	\$66.51
Cost per Minute of Ground Delay 2/	\$42.76	\$42.42	\$46.55
Cost per Flight Outside Window 3/	\$8,639	\$8,639	\$8,639
Design Day Operations	524	647	790
Design Day to Annual Ratio	333	326	321

Note: 1/ Air delay cost is based on the assumption that airborne operations are 90% of block hour operations.

- 2/ Ground delay cost is based on the assumption that ground operations are 70% of block hour operations.
- 3/ Assumes cost of flight outside the window is applied to the arrival and the departure portion of a flight.
- 4/ Average time and delay includes all airport operations excluding the Emery Worldwide flights outside of operating time window.
- 5/ The number of flights outside of operating window represents only Emery Worldwide flights.
- 6/ The design day to annual ratio is based on the Aviation Activity Forecast presented in Master Plan Charpter II.
- 7/ Cost is expressed in 1998 dollars.

Source: Simulation model output

Prepared by: Landrum & Brown

Draft, 01/13/00

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Exhibit 7-1 shows a comparison of annual project benefits to one time project construction costs. The Runway 6R extension has a two-year payback period in year 2003 and a one-year payback in year 2005. All of the projects achieve a one-year payback period by year 2008.

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