

# Planning Implications of Regional Airport Closures

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Trends in the Philadelphia region of closing critical general aviation airports since 1980 are described in this paper. The continuation of this trend is projected to the year 2000. Diversion of based aircraft and operations are assigned to remaining airports through the study period. Normal growth of general aviation demand is also estimated and assigned to remaining airports. System capacity is compared with demand in 1988 and 2000 and deficiencies are identified. Modifications to public and private capital investment plans are proposed to counteract the loss of system capacity and to minimize the negative economic impacts and longer ground access trips resulting from airport closures. Alterations to annual federal and state funding programs and amounts, especially regarding privately owned airports in the National Plan of Integrated Airport Systems, are required. Airspace conflicts near remaining airports are also anticipated and will necessitate further study.

The Delaware Valley Regional Planning Commission (DVRPC), acting as the regional planning agency for the 12-county, four-state area surrounding Philadelphia, adopted the Regional Airport System Plan (RASP) in 1982. RASP identifies critical public use airports and heliports necessary to serve the region's mobility and economic development to the year 2000 (1). The region is a 6,000-mi<sup>2</sup> area including Philadelphia; Bucks, Chester, Delaware, and Montgomery counties in Pennsylvania; Mercer, Burlington, Camden, Gloucester, and Salem counties in New Jersey; New Castle County, Delaware; and Cecil County, Maryland. The plan provides the direct local system input to FAA for its annual funding decisions concerning federal Airport Improvement Program grants to improve safety and capacity at all public use aviation facilities. In fiscal year 1988 FAA grants to regional airports totaled more than \$25 million.

In 1982 RASP contained 42 facilities distributed geographically throughout the region to ensure reasonable travel time access from ground origins and to ground destinations. These facilities included 3 commercial airports (all publicly owned), 13 reliever airports (3 publicly owned and 10 privately owned), 14 general aviation airports (2 publicly owned and 12 privately owned), 3 seaplane bases, and 9 heliports or sites.

Between 1982 and 1988 many private factors and market forces changed the regional airport system as well as the expected demand for aviation facilities to the year 2000. Certain airports had been closed or sold for nonaviation development by their private owners. Markets for heliports and seaplane bases had not materialized. Drastic increases in commercial airline traffic at the Philadelphia International Airport

(PHL) had caused the suburban reliever and general aviation airports to take a more significant role in maintaining safety through air traffic control and airspace separation. Private and public investment in some airports enhanced their capacity, but lack of capital facilities investment in critical local markets caused other airports to languish. In response to these events, DVRPC, in fall 1988, amended RASP to include only 35 facilities, reflecting a 25 percent reduction in the number of noncommercial airports originally in the system.

DVRPC and the regional aviation community believe that without modification of funding levels and recipient eligibility procedures, the trend of closing private airports will continue to the year 2000. Additional strain on those airports remaining open will be created; a negative impact on regional economic development, mobility, and airspace related delays and safety will result as well. As development extends outward from Philadelphia to distant suburbs, land prices rise and the resulting increased value of airport real estate pushes private owners to liquidate. Between 1982 and 1988 the RASP system had experienced a significant loss of general aviation capacity resulting in shifts of storage and operations demand to other available airports. These shifts have yet to result in demand exceeding capacity at any system facility. However, many airports now approach full usage. Further closures, which are probable between now and 2000, will have more deleterious effects on the overall system capability to provide mobility and support economic development in the region.

## STUDY OBJECTIVE

Shifts in demand for airport facilities will be evaluated in two stages; first, storage and tangential operation demand shifts resulting from airport closures between 1982 and 1988, the time of RASP amendment, will be examined. A "worst-case" scenario of additional airport closures from 1988 to 2000 will then be projected, on the basis of assumptions to be defined, and the cumulative shift of demand will be calculated to 2000. With this year 2000 restructured demand scenario, storage and operating capacity deficiencies at remaining facilities will be identified. Potential airspace conflicts of concentrated demand may become apparent among groupings of airports in the suburbs. The possibility of major shifts of demand back to commercial airports can be determined. This information will allow regional officials to better determine the direction of multiyear airport capital programming and provide corroboration for developmental decisions at individual RASP airports.

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## BACKGROUND DATA AND ASSUMPTIONS

### Base System

Table 1 lists the noncommercial airports contained in the 1982 adopted RASP. Data describing demand at these facilities include the number of based aircraft, which was estimated by site visits during 1985 and 1986 or from the RASP plan document. Annual operations levels at each airport are listed. These data were estimated by the DVRPC counting program or from the RASP document for those airports that closed before 1988. Also estimated is the available additional storage capacity at each airport (2). Airports closed by 1988, the first phase of demand shift, have zero additional capacity. Current general aviation system storage capacity is estimated as the sum of the existing regional fleet—2,285 aircraft plus 1,313 extra storage spots at airports open in 1988, or 3,598.

### Sequence of System Reduction

Table 2 summarizes the stages of reduction of the airport system, from its original capacity before the RASP amendments of 1988 to the amended post-1988 system (which has lost several airports) to the worst-case system of airports remaining in 2000. Over six years, from 1982 to 1988, the number of system general aviation airports decreased from 30 to 23. This total further reduces to 12 in the 12 years to 2000, amounting to more than a 50 percent reduction in the number of airports from the original RASP number.

The post-1988 system reflects actual changes to the airport facilities but the 2000 worst-case system is an extrapolation of trends that have formed since 1982. Only publicly owned airports and those privately owned airports that receive public funds are retained in the year 2000 system, because they are the only airports with a high degree of certainty of continued operation.

This study excludes heliports because no capacity crisis exists or is anticipated because of the low level of regional helicopter operations. Also, given the small area required for a heliport, compared with fixed wing aircraft, maintaining existing or locating new sites is much less difficult for heliports than for airports.

### Other Factors Influencing Diversion

Several other factors affect diversion of general aviation demand in the region. Although closing of airports is the most dramatic and quantifiable factor, other factors include diversion of general aviation traffic from PHL as commercial operations increase and diversion of general aviation traffic from the terminal control area (TCA) resulting from revised operating rules, Mode C-transponder equipment requirements, and extension of the radius and floor of the TCA.

Since deregulation of the airline industry in 1978, line haul and commuter and commercial operations at PHL have grown to approximately 420,000 per year, a 50 percent increase over prederegulation levels. Some nonitinerant general aviation traffic may have shifted from PHL to suburban airports to avoid commercial traffic or TCA regulation around PHL.

Because the based aircraft numbers used in this study represent field observations at general aviation airports from 1985 to 1987, it is assumed that any diversion of based aircraft is represented in the based aircraft numbers for the system noncommercial airports.

Likewise, the effect of the TCA equipment and dimension changes on aircraft owners' choice of basing location cannot be measured at this time. These rule changes are not completely enforced yet, but when fully implemented, certain air traffic control exceptions or corridors for general aviation airports in the TCA are being contemplated by PHL ATC. If airport-specific exemptions occur, pressure on aircraft owners to move to less restrictive operating locations may not be significant, so no predictable diversion will be estimated for this analysis.

### Airport Storage Versus Operations Capacity

The Federal Aviation Administration establishes annual operations capacities for general aviation airports on the basis of runway configuration, existence of crosswind runway, mix of aircraft, and taxiway configurations (3). Airports in this study have annual capacities in the range of 150,000 to 230,000 operations. Only Northeast Philadelphia, Wilmington, and Mercer County airports, which are considered later in the study, have current operation volumes in this range. Consequently, only storage capacity, which is based on available hangars and tie down storage space, will be considered when assigning diversions to remaining airports. However, by the year 2000, additional operating capacity improvements and storage improvements may be needed to accommodate regional aggregate operating demand.

### Potential Airspace Conflicts

As demand concentrates at fewer airports through the three phases of the study, volumes of operations at these airports will go up as potential conflicts from neighboring airports in some locations go down. Those airports continuing to operate will probably be fully equipped with visual NAVAIDS and precision instrument approach systems for visual flight rules and instrument flight rules operations. Currently, it does not appear that airspace conflicts will deter the diversion of aircraft to study airports.

### Growth Trends in Regional General Aviation Fleet, 1982 to 2000

RASP's 1982 growth projections of based aircraft, from which operations projections follow, varied by airport from 1.5 to 5 percent per year for the 18-year period. Typically, New Jersey airports averaged higher growth rates while Pennsylvania airports averaged slightly lower rates, reflecting the more mature nature of development on the Pennsylvania side of the region.

Actual growth in general aviation activity has not been as significant as assumed in 1980. Although business-related operations are increasing in the suburbs with the influx of

TABLE 1 STUDY INVENTORY RASP AIRPORTS (1982)

1982 Airport/County	Based Aircraft	Available Storage Capacity (Aircraft)	Operations Per Year
<b>BUCKS</b>			
Buehl	65	50	12,500
Quakertown	40	40	22,600
Doylestown	105	60	32,700
Pennridge	55	105	34,600
3-M	60	0	18,000
Warrington	65	0	20,000
Vasant	<u>30</u>	<u>0</u>	<u>10,000</u>
	420	255	150,400
<b>MONTGOMERY</b>			
Turner	120	0	43,900
Willow Grove	-	-	-
Wings	80	65	40,100
Pottstown-Limerick	70	40	28,500
Pottstown Municipal	70	0	35,000
Perkiomen Valley	<u>90</u>	<u>60</u>	<u>26,100</u>
	430	165	173,600
<b>CHESTER</b>			
Shannon	50	30	37,000
Brandywine	80	40	18,100
Chester County	100	100	30,500
Oxford	20	0	8,000
New Garden	<u>95</u>	<u>65</u>	<u>26,600</u>
	345	235	120,200
PHILADELPHIA/NE Philadelphia	250	50	190,000
MERCER/Trenton-Robbinsville	150	75	68,900
<b>BURLINGTON</b>			
Red Lion	70	57	35,800
Burlington County	60	150	16,900
Flying W	<u>100</u>	<u>49</u>	<u>50,000</u>
	230	247	102,700
CAMDEN/Camden/Burlington	70	0	35,000
<b>GLOUCESTER</b>			
Bridgeport	60	0	23,000
Cross Keys	<u>120</u>	<u>80</u>	<u>68,200</u>
	180	80	91,200
<b>SALEM</b>			
Oldmans	45	85	20,000
Salem County	<u>25</u>	<u>50</u>	<u>10,000</u>
	70	135	30,000
NEW CASTLE/Summit	120	25	40,400
CECIL/Cecil County	<u>20</u>	<u>47</u>	<u>7,500</u>
	2,285	1,313	1,009,900

TABLE 2 PHASES OF SYSTEM CAPACITY REDUCTION

<b>Pre-1988 Regional Airport System</b>	<b>Post 1988 System</b>	<b>Year 2000 Worst Case System</b>
<b>BUCKS COUNTY</b>		
Buehl Doylestown Pennridge 3-M Warrington Vansant	Buehl Quakertown Doylestown Pennridge Vansant	Quakertown Doylestown Pennridge
<b>MONTGOMERY COUNTY</b>		
Turner Willow Grove NAS Wings Pottstown Limerick Pottstown Municipal Perkiomen Valley	Wings Pottstown-Limerick Pottstown Municipal Perkiomen Valley	Wings Pottstown Municipal Pottstown Limerick
<b>CHESTER COUNTY</b>		
Shannon Brandywine Chester County Oxford New Garden	Shannon Brandywine Chester County New Garden	Brandywine Chester County New Garden
<b>PHILADELPHIA</b>		
NE Philadelphia	NE Philadelphia	NE Philadelphia
<b>MERCER COUNTY</b>		
Trenton-Robbinsville	Trenton-Robbinsville	
<b>BURLINGTON COUNTY</b>		
Burlington County Red Lion Flying W	So. Jersey Regional Red Lion Flying W	So. Jersey Regional
<b>CAMDEN COUNTY</b>		
Camden-Burlington		
<b>GLOUCESTER COUNTY</b>		
Bridgeport Cross Keys	Cross Keys	
<b>NEW CASTLE</b>		
Summitt	Summitt	Summitt
<b>CECIL COUNTY</b>		
Cecil County	Cecil County	

TABLE 2 (continued)

<b>Pre 1988 Regional Airport System</b>	<b>Post 1988 System</b>	<b>Year 2000 Worst Case System</b>
<b>SALEM COUNTY</b>		
<b>Oldmans Salem</b>	<b>Oldmans Salem</b>	
<b>Total Facilities: 30</b>	<b>Total Facilities: 23</b>	<b>Total Facilities: 12</b>

new regional employment, recreational flying has not increased, partially because of the effects of insurance cost increases on aircraft cost and flight school operations. Because based aircraft and operations data are current and based on field observations, not original RASP estimates, this study will use a conservative 2 percent growth rate from 1989 to 2000 to reflect the regional growth of demand and any diversion from commercial airports (4,5). Assuming a level of annual operations per based aircraft equal to the average at each airport now, this rate of increase, even with significant diversion, would not exceed the operating capacity of the general aviation airports.

#### AVIATION DEMAND ASSIGNMENT PROCESS

In this section of the analysis the 1988 amended RASP system and the 2000 worst-case system are assigned aircraft storage demand shifted from airports that have closed. Total airport demand assignments are cumulative to 2000, when projected regional demand is assigned to remaining airports without regard to existing capacity to establish capacity deficits.

Table 3 lists the operating airports according to the RASP as amended in 1988. Current levels of based aircraft and available storage capacity are presented. Demand in based aircraft from airports that have left the system from 1982 to 1988 is then assigned to the amended system. Airports that have closed include Warrington, Turner, 3M, Oxford, Bridgeport, and Camden-Burlington. Demand was shifted by assigning aircraft to the nearest operating airports within concentric rings around the closed facilities. This assumes that the airplane owners are distributed randomly around the airport. In one case, Bridgeport, demand was assigned to the only two nearby airports, 6 and 14 mi away. In the case of Turner, demand was shifted to the five closest airports within a 6- to 18-mi band around the airport. In all cases, new demand at the remaining airports did not exceed available storage capacity. Assignment of demand is identified in the third column of Table 3 by its placement in the row of the recipient airport. The letter next to the assigned aircraft represents the airport of origin of that demand. The revised 1988 demand for based aircraft at the recipient airport is in the fourth column.

Table 4 describes the year 2000 worst-case system and the demand diversion from airports closing from 1989 to 2000 under the study assumptions. Airports assumed to close include Vansant, Buehl, Trenton-Robbinsville, Perkiomen Valley, Shannon, Cecil County, Flying W, Red Lion, Oldmans, Salem,

and Cross Keys. Wings and Pennridge, private airports that have not to date received federal grants, have been retained in the year 2000 system because of the significant private investment in Pennridge and the growing scheduled commercial service at Wings. These airports ultimately might be sold to nonaviation interests, further eroding the system.

Mercer County and Wilmington airports have been added, although they are commercial service facilities, because the commercial traffic is light enough to permit general aviation use if their locations warrant general aviation assignment (Table 4). The first three columns identify year 2000 based aircraft and available aircraft storage capacity. These levels were derived by increasing the based aircraft levels of the amended plan as presented in the last column of Table 3 by 2 percent per year. Available capacity is adjusted downward as a result. The "1989-2000 shift" column indicates reassigned demand from closed airports (identified with initials after the reassigned volume). Based aircraft growth at airports proposed to close (and therefore the total aircraft per airport reassigned) was inflated at the same rate but only for 6 instead of 12 years to reflect the average end date of operation, which was 1994. "Total Demand" indicates total year 2000 general aviation demand at the remaining airports. The last column lists the aircraft storage deficit by airport, which could also be interpreted as a measure of additional capacity needed.

#### FINDINGS AND CONCLUSIONS

After review of the 1988 and 2000 demand scenarios, several findings can be cited that have ramifications on the direction of airport system development in the Delaware Valley for the next 12 years.

##### 1988 Amended RASP

Shifts of storage demand between 1982 and 1988 have increased based aircraft at 16 of 23 operating airports (Table 3). However, none of these airports has exceeded its storage capacity. Enough airports remain in the system so that owners or pilots do not have to travel far from their original base to find an alternative location for their aircraft. Consequently, no significant travel time loss or negative economic impact to users has resulted from the closure of the six airports between 1982 and 1988. Also, operating capacity at each of the amended system airports, conservatively estimated at 150,000 opera-

TABLE 3 1988 DEMAND MODIFICATIONS AT OPERATING SYSTEM AIRPORTS

	Based Aircraft	Available Space	1982-1988 Shift	Total Demand
<b>BUCKS</b>				
Buehl	65	50	+20 W+10 M	95
Quakertown	40	40	+20 T	60
Doylestown	105	60	+20 W+30 T	155
Pennridge	55	105	+15 W+20 T	90
VanSant	30	0		30
	295	255		430
<b>MONTGOMERY</b>				
Perkiomen Valley	90	60	+10 W+20 T	120
Wings	80	65	+30 T	110
Pottstown-Limerick	70	40		70
Pottstown Municipal	70	0		70
	310	165		370
<b>CHESTER</b>				
Chester County	100	100		100
Brandywine	80	40	+5 O	85
Shannon	50	30		50
New Garden	95	65	+10 O	105
	325	235		340
<b>PHILADELPHIA/NE</b>	250	50	+30 M	280
<b>BURLINGTON</b>				
Burlington County	60	150	+20 B/C	80
Red Lion	70	57	+20 B/C	90
Flying W	100	40	+15 B/C	115
	230	247		285
<b>GLOUCESTER/Cross Keys</b>	120	80	+20 B + 15 B/C	155
<b>SALEM COUNTY</b>				
Oldmans	45	85	+40 B	85
Salem County	25	50		25
	70	135		110
<b>MERCER/ Trenton Robbinsville</b>	150	75	+20 M	170
<b>NEW CASTLE/Summitt</b>	120	25		120
<b>CECIL/Cecil County</b>	20	46	+55 O	25
				2285

tions per year, has not been exceeded as of 1989. (At the airports of greatest increase of based craft, previous operating volumes were well below 50 percent of operating capacity.) Because per vehicle usage per year has generally remained constant and the number of aircraft has increased, at most by 45 percent, no operating capacity problems are expected.

#### Year 2000 Worst-Case RASP Storage Capacity

Demand for storage of aircraft is based on 1988 based aircraft at each site, and has increased by 2000 (Table 4). These non-shift related increases have taken 4 of 12 airports to or beyond their storage capacity limits. When shifted storage demand

from the 11 airports that are suggested to close is reassigned to the remaining facilities, severe storage capacity deficiencies appear in 9 of 12 general aviation airports. In this scenario, Mercer County and Wilmington, both underutilized commercial airports, have been used to absorb diverted general aviation demand because of their critical locations and public ownership stability. Specifically by area, Chester County airport storage capacity is predicted to be adequate to 2000, although Montgomery County airports may experience modest storage capacity shortages. In Bucks, County, Doylestown Airport will have a severe capacity shortfall and Northeast Philadelphia Airport, which was assigned diverted traffic from Bucks and Burlington counties, will also experience a serious general aviation storage deficiency. Over 200 based aircraft

TABLE 4 YEAR 2000 DEMAND MODIFICATIONS AT OPERATING SYSTEM AIRPORTS

	Year 2000 Based -	Available Capacity	1989-2000 Shift	Total Demand	Yr. 2000 Deficit
<b>BUCKS COUNTY</b>					
Quakertown	76	4	+10 V	86	6
Doylestown	195	-30	+35 B+14 V+25 TR	269	104
Pennridge	113	47	+10 V	123	-
<b>MONTGOMERY COUNTY</b>					
Pottstown Municipal	88	-18	+20 PV	88	38
Pottstown-Limerick	88	22	+58 PV	146	36
Wings	138	2	+57 PV	195	55
<b>CHESTER COUNTY</b>					
Chester County	126	74	+28 Sh	154	-
Brandywine	100	20	+27 Sh	127	7
New Garden	119	41	+14 CC	133	-
PHILADELPHIA/NE	352	-52	+35 B+51 RL+40 FW +60 CK	538	238
<b>BURLINGTON COUNTY</b>					
South Jersey Regional	100	50	+60 RL+60 FW+25 TR +65 CK	310	160
<b>NEW CASTLE COUNTY</b>					
Summit	151	- 1	+30 OM	181	31
<b>MERCER COUNTY*</b>					
Mercer			+37 B+30 FW+142 TR	209	209
<b>WILMINGTON*</b>					
Greater Wilmington			+66 OM+14 CC+28 S +50 CK	<u>158</u>	<u>158</u>
				2717	1042

\*Commercial Service Airport

from Bucks and Burlington counties and Trenton-Robbinsville were assigned to Mercer County Airport, greatly increasing storage demand at that airport. South Jersey and New Castle County airports will experience moderate capacity deficiencies assuming that Wilmington can accommodate 158 general aviation aircraft within its commercial operations.

Significant capital investment to the year 2000 may be needed at Doylestown, Philadelphia Northeast, South Jersey Regional, Mercer, and Wilmington to acquire land and provide storage aprons and hangars for the expected additional aircraft. Extraordinary regional allocations from the Aviation Trust Fund may be necessary annually to the year 2000 in order to accomplish the necessary expansions of remaining airports.

#### Year 2000 Operating Capacity

Based aircraft at remaining nontowered general aviation airports have increased drastically, resulting in additional operations. South Jersey Regional and Doylestown have experienced the largest increases; however, total operations at these airports based on aircraft utilization ratios from actual counts and field observations are not expected to exceed operating capacities, assuming normal runway, taxiway, and facility investments. However, in the cases of Northeast Philadelphia, Wilmington, and Mercer County, all of which are FAA towered airports with 1989 operations levels of 190,000 per year, additional assigned aircraft plus internal based airport growth



is 286,209, and 158 aircraft, respectively, above 1988 levels. This increase in traffic may exceed operations capacity at Northeast Philadelphia and Mercer County. Air traffic control impacts on commercial operations may occur. Additional capacity investment in runways, taxiways, and aprons would be necessary.

#### **Year 2000 Economic Impacts**

Of the total regional general aviation fleet estimated at 2,717 aircraft in 2000, 1,091 or 40 percent will have to relocate their bases under the assumptions in this study, sometimes at distances up to 20 mi from the original location. Given the restricted choices of general aviation base locations (14 in 2000 versus 23 in 1988) and the presumed increased travel times associated with getting to and from these airports, significant wasted time and cost will occur. This may discourage business activity in the region and have negative economic impact. The magnitude of this impact could be estimated with further study.

#### **Airspace Conflicts and Other Impacts—Year 2000 RASP**

The potential increase of general aviation operations at Northeast Philadelphia, Mercer County, and Wilmington, coupled

with commercial and military usage at these airports, could result in increased complications and responsibilities for air traffic control. The consolidation of general aviation traffic at Doylestown, South Jersey Regional, Chester County, and Wings, especially with precision instrument approaches, suggests traffic control, noise, and ground access complications. These questions must be resolved through future study at the system or master plan level as part of qualifying these airports for additional FAA and state grants to respond to future shifts in general aviation demand.

#### **REFERENCES**

1. *Delaware Valley Regional Airport System Plan*. Delaware Valley Regional Planning Commission, Philadelphia, Pa., Sept. 1982.
2. *Delaware Valley Regional Reliever System Update*. Delaware Valley Regional Planning Commission, Philadelphia, Pa., Oct. 1986.
3. *Airport Capacity and Delay*. Advisory Circular AC 150/5060-5. Federal Aviation Administration. U.S. Department of Transportation, Sept. 1983.
4. *Year 2000 Population Forecasts for the Delaware Valley Region*. Delaware Valley Regional Planning Commission, Philadelphia, Pa., Feb. 1985.
5. *Year 2000 Municipal Employment Forecasts for the Delaware Valley Region*. Delaware Valley Regional Planning Commission, Philadelphia, Pa., Sept. 1985.

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