State Passenger Aircraft Fleet Replacement Plan - UPDATE

February 2019

The Texas Department of Transportation's (TxDOT) Flight Services Section (FSS) provides air transportation and pilot services to state officials, employees, and sponsored contractors traveling on official state business.

FSS's mission calls for the provision of ***"... safe, cost-effective, and efficient aerial transportation of state employees ..."***

While FSS's daily focus on its mission helps state officials and agencies fulfil their mission to meet the needs of the state; that mission becomes critical when Texas is faced with a major emergency such as Hurricane Harvey, infectious disease outbreaks, and national crises such as the September 11th terrorist attack.

BACKGROUND

In 2005, the Texas Legislature abolished the State Aircraft Pooling Board and transferred the state's aircraft assets and responsibilities to the Texas Department of Transportation (TxDOT). Use of the state aircraft fleet is governed by Subchapter B, Chapter 2205, Texas Government Code. Statute requires each agency to use state-owned aircraft to the extent feasible and TxDOT provide aircraft transportation to state officers and employees travelling on official business.

The TxDOT Flight Services Section (FSS) provides air transportation and pilot/co-pilot services to state officials, employees, and sponsored contractors traveling on official state business. FSS provides maintenance services for aircraft owned by other state agencies, including the Texas Department of Public Safety, Texas Parks and Wildlife Department, Texas Department of Criminal Justice, Texas A&M University, and University of Texas at Austin. It also sells fuel to those agencies and higher education institutions for their flights.

Pursuant to recommendations adopted by the Texas Sunset Commission, language was included in TxDOT's Sunset Bill (SB 312, 85R, 2017) calling for the department to adopt a fleet replacement plan by September 1, 2018. The Legislature also authorized a total of $20 million in funding for aviation fleet replacement via Rider 48, Article VII of the General Appropriations Act 2018-19 Biennium.

Chapter 2056 of the Texas Government Code requires all state agencies to develop strategic plans. Texas Government Code §2205.032 further directs TxDOT to develop a long-range plan for its fleet of aircraft. This plan provides the basis for analysis and action to enable TxDOT to meet its mission to provide "...safe, cost-effective, and efficient aerial transportation of state employees ..." in both the near- and long-term.

CURRENT FLEET FACTS

SAFETY

Safety and efficiency are primary concerns for the state's aircraft fleet. While the fleet is in satisfactory condition for current operations; the longer an aircraft is in service, the greater the chance an age-related issue may arise. Issues include major system failure --- including flight control, electrical, and pneumatic systems; as well as high maintenance costs, and technologically obsolete flight display/monitoring system capabilities.

COMPOSITION AND AGE

TxDOT's FSS currently operates and maintains a fleet of six aircraft which consists of four King Air 6- to 8-seat passenger planes (transport), and two Cessna 2- to 3-seat planes (utility). Five of the six aircraft are more than 33 years old (Figure 1).

Figure 1: Aircraft Composition, Age and Total Life Use

Aircraft (Age, Type, #)	Age of Plane	Total # Hours/Cycles Flown	Total # Nautical Miles* Flown
1981 King Air 200 / 1TX	37 yr.	7,957	2,094,099
1982 King Air B200 / 173TX	36 yr.	7,563	1,982,911
1985 King Air B200 / 184TX	33 yr.	5,103	1,335,170
2000 King Air B200 / 116TX	18 yr.	3,152	822,323
1979 Cessna 206 / 147TX	39 yr.	6,311	903,478
1980 Cessna 182 / 148TX	38 yr.	8,971	1,210,431

*Nautical Mile = 6,076'

AIRCRAFT USE

During the last five fiscal years, the current passenger fleet transported nearly 12,000 passengers --- representing 35 different agencies and universities --- with over 3,100 take-offs (Figure 2). While utilization rates vary from year to year; in Fiscal Year (FY) 2018, TxDOT accounted for 6.6% of the total passenger flights taken.

Figure 2: Passenger Aircraft Use – FY 2014 through 2018 *(Over Five Fiscal Years)*

Aircraft (Age, Type, #)	# Flights	# Passengers	# Hours Flown	Nautical Miles Flown
1981 King Air 200 / 1TX	724	2,873	758	159,806
1982 King Air B200 / 173TX	816	3,330	857	178,069
1985 King Air B200 / 184TX	844	3,194	871	182,138
2000 King Air B200 / 116TX	754	2,380	799	170,522
TOTAL	3,138	11,777	3,285	690,535

To meet requirements in Senate Bill 312 (85R), TxDOT implemented procedures whereby the administrative head of the requesting agency must certify that their employee's transportation on state-owned aircraft complies with all applicable laws, regulations, and rules. In addition, TxDOT has developed a "Travel Mode Cost Comparison" form for use by its staff to analyze the potential cost-benefit of using state aircraft versus commercial air travel or ground transportation.

FLEET MAINTENANCE AND AGING AIRCRAFT ISSUES

MAINTENANCE COST

Proper and continuous maintenance is vital to the safety of the state's aircraft fleet. As illustrated in Figure 3, maintenance expenditures can vary widely from year-to-year and are difficult to assess in the long-term. Unanticipated costs, such as major engine and navigation/communication systems repair, can greatly increase annual expenditures.

Figure 3: Aircraft Maintenance – FY 2014 through 2018 *(Over Five Fiscal Years)*

Aircraft (Age, Type, #)	Maintenance Hours	Maintenance Costs
1981 King Air 200 / 1TX	3,256	$ 429,601
1982 King Air B200 / 173TX	3,104	$ 374,034
1985 King Air B200 / 184TX	2,695	$ 331,325
2000 King Air B200 / 116TX	2,557	$ 286,283
1979 Cessna 206 / 147TX	976	$ 55,703
1980 Cessna 182 / 148TX	705	$ 44,911
TOTAL	13,292	$ 1,521,856

AGING ISSUES

As aircraft age, they require more frequent and complex maintenance and specialized inspections. The deteriorating condition of these aircraft and the increasing challenge of maintaining them is documented in the Texas Sunset Commission's recent review of TxDOT.[1] FSS projects that maintenance costs will increase on the current fleet as it continues to age. Issues adding to increased maintenance costs include:

- **Metal Fatigue** – Even with the best of maintenance, metal fatigue will become an issue with age and use.
- **Outdated Avionics** – The current fleet's avionics are analog and must use "work arounds" to be compatible with present-day digital technology.
- **Specialized Inspections** – The Federal Aviation Administration (FAA) requires all aircraft with more than 5,000 flight hours to undergo more extensive specialized inspections (Aging Airplane Safety Rule).
- **NexGen Compliance** – In January 2020, FAA's NexGen regulations will take effect requiring all aircraft to have Automatic Dependent Surveillance Broadcast (ADSB) equipment. This equipment is based on digital technology. FSS estimates the upgrade would cost approximately $300,000 per plane.
- **Engine Overhaul** – The current fleet of King Airs will require engine overhauls within next 5-7 years. FSS estimates a cost of approximately $750,000, per plane.
- **Additional Maintenance Expenses** – The current fleet of King Airs will require hot section, prop overhauls, and landing gear inspections in the next 2-7 years. FSS estimates $183,000, per plane.

Over the next five to seven years, additional maintenance, inspection, and technology costs may actually reach, or exceed, the estimated value of the current aircraft.

MISSION AND PURPOSE FOR FLEET USE

Pursuant to Texas Government Code §2205.039, TxDOT FSS maintains a travel log for gathering information on the use of state-operated aircraft. The travel log requests the following information from each passenger:

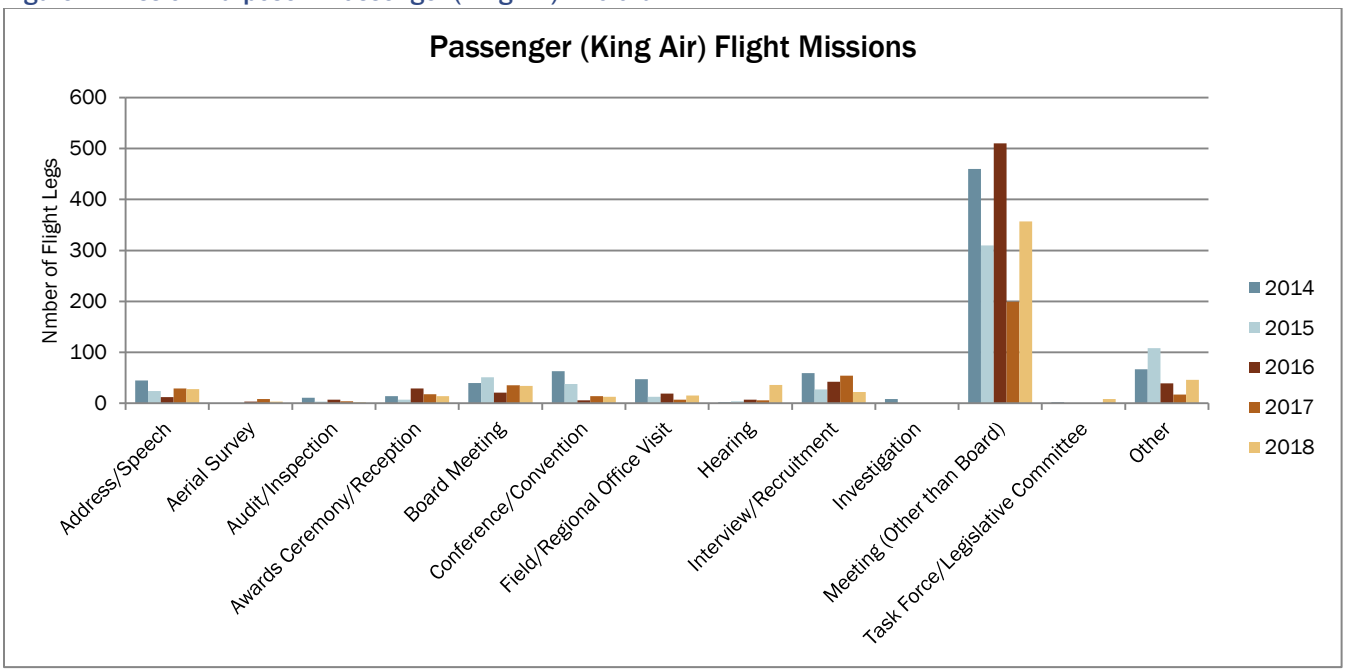
- Mission statement (selected from general categories);
- Passenger's name;
- State agency represented;
- Destination;
- Passenger's signature;
- Date of flight; and
- Detailed/specific description of official business purpose.

[1] Texas Sunset Advisory Commission Report, Texas Department of Transportation, 85th Legislature, Issue 7, pg. 87.

All passengers taking a FSS flight are required to sign an affidavit certifying that the use of Flight Services is consistent with statutory requirements. Specifically, that either: a) the destination is not served by a commercial carrier; b) the time required to use a commercial carrier interferes with passenger obligations; or c) the number of passengers traveling makes the use of state aircraft cost-effective.

Based on information obtained via the travel log, the state aircraft fleet was used for the following purposes (Figure 4) over the course of the last five years (FY 2014 – FY 2018).

Figure 4: Mission Purpose – Passenger (King Air) Aircraft



ALTERNATIVE TRANSPORTATION METHODS

FSS has assessed the costs and benefits of alternative methods for meeting air transportation needs, including using commercial air carrier and third-party charter service. Figure 5 provides the average FSS invoice cost for some of the top destinations in FY 2017 (19 cities constituted 71% of total destinations), as compared to commercial and third-party charter costs to those cities. The table illustrates that as the number of passengers increase, and the advance reservation time decreases, FSS can become more cost-effective than flying commercial. For the top 19 cities visited, FSS was always less expensive than flying via third-party charter.

Figure 5: Cost Comparison: FSS Cost Versus Charter and Commercial Cost

				COMMERCIAL FLIGHT COST								
				One Passenger			Average Load (3.02 Passengers)			Six Passengers		
Destination	Flight Services Invoiced Flight Cost (Avg)	Charter Flight Cost*	$ Increase with Charter	2 week prior reservation	1 week prior reservation	Same day reservation	2 week prior reservation	1 week prior reservation	Same day reservation	2 week prior reservation	1 week prior reservation	Same day reservation
Houston	$ 2,973	$ 4,513	$ 1,540	$ 350	$ 442	$ 456	$ 1,056	$ 1,334	$ 1,369	$ 2,098	$ 2,650	$ 2,738
College Station	$ 1,879	$ 4,002	$ 2,123	$ 538	$ 708	$ 910	$ 1,624	$ 2,137	$ 2,719	$ 3,226	$ 4,246	$ 5,458
Dallas	$ 3,500	$ 3,954	$ 454	$ 190	$ 310	$ 444	$ 575	$ 937	$ 1,333	$ 1,142	$ 1,862	$ 2,666
McAllen	$ 4,183	$ 5,351	$ 1,168	$ 588	$ 696	$ 801	$ 1,775	$ 2,101	$ 2,417	$ 3,526	$ 4,174	$ 5,668
Tyler	$ 3,205	$ 4,002	$ 797	$ 511	$ 557	$ 657	$ 1,544	$ 1,683	$ 1,972	$ 3,068	$ 3,344	$ 5,907
Corpus Christi	$ 3,397	$ 4,002	$ 605	$ 366	$ 420	$ 476	$ 1,104	$ 1,267	$ 1,491	$ 2,194	$ 2,518	$ 2,983
Beaumont	$ 3,336	$ 4,002	$ 666	$ 557	$ 557	$ 995	$ 1,683	$ 1,683	$ 2,984	$ 3,344	$ 3,344	$ 6,087
Fort Worth	$ 2,996	$ 4,002	$ 1,007	$ 190	$ 310	$ 444	$ 575	$ 937	$ 1,333	$ 1,142	$ 1,862	$ 2,666
El Paso	$ 6,285	$ 8,630	$ 2,345	$ 378	$ 502	$ 671	$ 1,140	$ 1,515	$ 1,986	$ 2,266	$ 3,010	$ 3,972
Lubbock	$ 4,540	$ 5,340	$ 801	$ 533	$ 533	$ 520	$ 1,608	$ 1,608	$ 1,559	$ 3,195	$ 3,195	$ 3,118
Laredo	$ 3,090	$ 4,013	$ 922	$ 662	$ 696	$ 801	$ 1,998	$ 2,101	$ 2,417	$ 3,970	$ 4,174	$ 4,834
Amarillo	$ 5,154	$ 5,727	$ 573	$ 388	$ 548	$ 642	$ 1,171	$ 1,654	$ 1,925	$ 2,326	$ 3,286	$ 3,850
Galveston	$ 3,355	$ 3,922	$ 567	no commercial flights available								
Brownsville	$ 4,220	$ 5,652	$ 1,432	$ 360	$ 376	$ 659	$ 1,086	$ 1,134	$ 2,309	$ 2,158	$ 2,254	$ 3,962
Harlingen	$ 4,821	$ 5,443	$ 622	$ 406	$ 424	$ 528	$ 1,225	$ 1,279	$ 1,622	$ 2,434	$ 2,542	$ 3,243
Huntsville	$ 2,249	$ 4,002	$ 1,753	no commercial flights available								
Arlington	$ 3,239	$ 4,002	$ 763	no commercial flights available								
Canadian	$ 5,440	$ 5,969	$ 529	no commercial flights available								
Paris	$ 3,477	$ 4,002	$ 525	no commercial flights available								

*Based on Rates from Tower Aviaton of Austin, TX

NOTE: Green highlights indicate instances in which the charter/commercial flight cost is more expensive than Flight Services invoiced cost

FLEET REPLACEMENT ANALYSIS

AGE OF AIRCRAFT

There is no prescribed method for determining or defining when an aircraft is too old; however, an aircraft's age is important to consider when analyzing fleet replacement needs. The age of an aircraft depends on a number of factors including flight hours and flight cycles (Figure 1). As previously noted, the longer an aircraft is in service, the greater the chance an age-related issue may arise.

REPLACEMENT AIRCRAFT

In analyzing options for replacement of existing passenger planes, a variety of turbo-fan and turbo-prop planes were reviewed; including aircraft comparable to the fleet's current King Air B200s. Figure 6 provides information regarding cost of the aircraft, passenger capacity, flight speed, range; as well as fuel economy and average cost of operation per nautical mile during the first 10 years of operation.

Figure 6: Replacement Aircraft Comparison

Cost/Features	Embraer Phenom 100EV	Cessna Citation M2	Cessna Citation CJ3+	Cessna Citation CJ4	King Air C90 GTx	King Air 250	King Air 350
Acquisition Cost (BCA)*	$4,495,000	$4,700,000	$8,295,000	$9,195,00	$3,795,000	$6,295,000	$7,345,000
Type	Turbo-fan	Turbo-fan	Turbo-fan	Turbo-fan	Turbo-prop	Turbo-prop	Turbo-prop
Standard Passenger Capacity**	5	7	8	8	7	8	9
Maximum Passenger Capacity**	7	7	9	9	8	10	11
Maximum Flight Speed (KTAS = True Airspeed in Knots)***	405 ktas	404 ktas	416 ktas	451 ktas	270 ktas	310 ktas	312 ktas
Maximum Range***	1,178 nm	1,550 nm	2,040 nm	2,165 nm	1,260 nm	1,720 nm	1,806 nm
Fuel Economy Time/Fuel Burn in Pounds (300 nm leg)*	0:53 / 753 lbs	0:52 / 804 lbs	0:49 / 969 lbs	0:46 1,087 lbs	1:13 748 lbs	1:05 848 lbs	1:05 919 lbs
Direct Cost per Nautical Mile (300nm flight). Average for First 10 yrs. of Operation*	$1.11	$1.42	$1.48	$1.64	$1.46	$1.54	$1.57

*Data acquired from Business & Commercial Aviation – May 2018
**Data acquired from individual aircraft manufacturers
***Data acquired from Business & Commercial Aviation – May 2017

SAFETY AND TECHNOLOGY

Safety and technology features of a variety of turbo-fan and turbo-prop (current King Air fleet) planes were reviewed; as well as accident and fatality data for both plane types. Some key factors supporting the safety of turbo-fan versus turbo-prop planes include:

- Turbo-fan aircraft are over four times safer (IBAC safety data per 100,000 flight hours).
- Turbo-fan aircraft can perform operations at higher altitudes that avoid most (if not all) hazardous convective weather (thunderstorms) and icing.
- There is increasing technological obsolescence of turbo-prop powered aircraft.
- Technological avionics enhancements incorporated in turbo-fan cockpits provide increased situational awareness for flight crews. In addition, in 2020, new Federal Aviation Administration safety standards will require the use of modern avionics which the current fleet does not have.
- The combination these technological advancements greatly enhances overall safety and operational awareness.

Figure 7 provides aircraft accident and fatal aircraft accident rates for turbo-fan and turbo-prop aircraft from 2013 through 2017; while Figure 8 provides a comparison of a number of technological, safety and performance features on the planes reviewed

Figure 7: Accident Rate* Comparison – 2013 through 2017

Aircraft Type	Aircraft Accidents	Fatal Aircraft Accidents
Turbo-Fan (Jet)	1.25	0.08
Turbo-Prop	4.11	0.90

* Number of accidents per 1 million flights
** Data extracted from *IATA – Safety Report 2017, issued April 2018.*

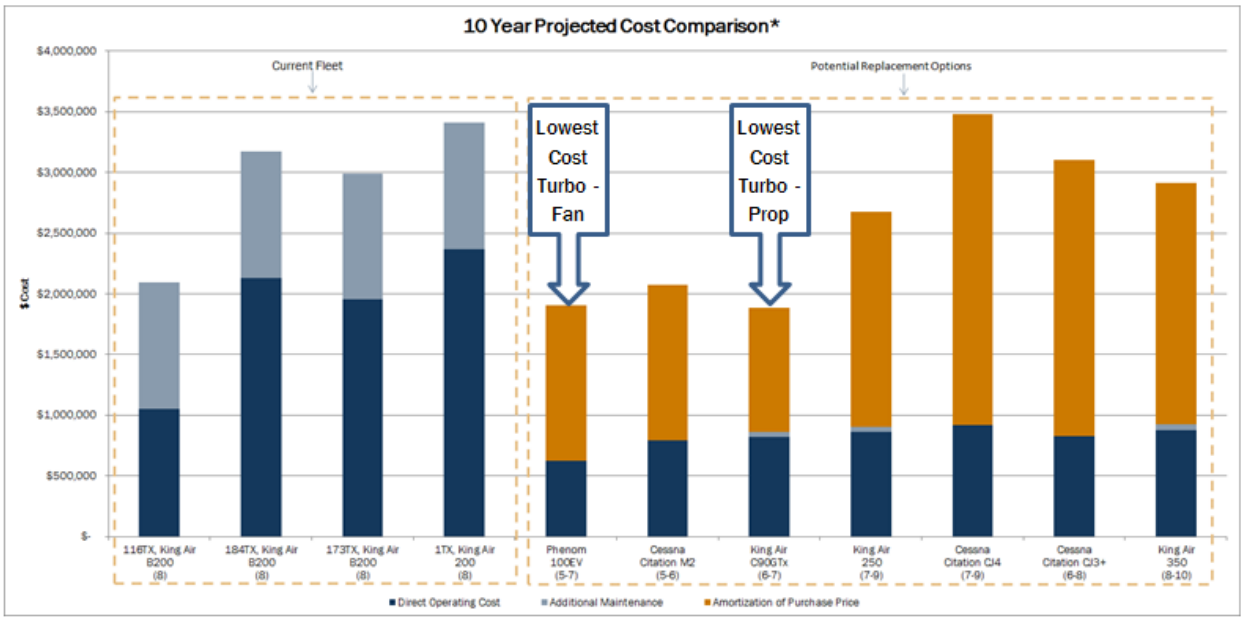
Figure 8: Aircraft Technology and Safety Feature Comparison

Technology/Safety Features	Current King Air Turbo-Prop Plane	New Turbo-Prop Plane	New Turbo-Fan Plane
Synthetic Vision	No	Yes	Yes
Engine Indication/Crew Alert System	No	No	Yes
Electronic Checklist	No	Yes	Yes
Electronic Charts and Maps	Yes	Yes	Yes
Terminal Collision Avoidance	Yes	Yes	Yes
Terrain Awareness and Avoidance	No	Yes	Yes
Oral Warning Messages	No	Yes	Yes
Performance Comparison			
Singe Engine Service Ceiling	21,000 ft.	19,000 ft.	24 – 30,000 ft.

OPERATIONAL COST

Review of potential replacement aircraft included an analysis of 10-year operating costs for the planes. These costs included the cost of fuel and maintenance, and application of the initial purchase warranty. The 10-year cost comparison demonstrates that replacement aircraft options could yield a significant savings over the cost of operating and maintaining the current fleet. A comparison of the most cost-effective versions of new turbo-fan and turbo-prop aircraft were roughly equivalent (Figure 9); however, significantly below the collective cost of the current fleet.

Figure 9: 10-Year Operational Cost Projection - Current Fleet vs Potential Replacement Options



* Based on TxDOT analysis and data from *Business & Commercial Aviation 2016 and 2017 Operations Planning Guides*. Projection assumes each plane flies 66,250 nautical miles/year (about 250 hours/year in current King Air aircraft). The 10-year cost is discounted to net present value. Amortization of purchase price for new aircraft assumes useful life of 30 years. The analysis assumes single plane purchase prices and does not include potential volume purchase discounts.

** While the above figure compares specific aircraft as part of the purchasing process; TxDOT will consider all aircraft that meet criteria defined within bid specifications.

USED vs. NEW

In assessing aircraft cost and options, staff also weighed the advantages and disadvantages of purchasing used versus new aircraft. While the initial purchase price weighs in favor of used aircraft; a number of other factors weigh in favor of purchase of new aircraft, including warranty, reduced maintenance costs, availability, and rationalization of the fleet. Rationalization comes from having standardized and consistent aircraft that are as close to identical as possible in their manufacture, operations, equipment, and maintenance standards. Having a consistent and rationalized fleet of aircraft is expected to offer long-term safety, efficiency, and cost advantages.

CAPITAL COST RECOVERY ANALYSIS

Texas Government Code §2205.032(c)(7) *"… requires the long-range plan to include an analysis of the impact of including capital recovery costs in the rates the department charges under Section 2205.040 that, at a minimum, includes the impact of those included costs on customer utilization and the department's schedule for replacing aircraft in the pool."* Pursuant to this requirement, TxDOT staff conducted a capital cost recovery analysis. The analysis included running a variety of scenarios with the following base assumptions:

- 30 year use of four new aircraft;
- 2.3% rate of inflation on current aircraft value;
- 56% resale value of 30-yr. old aircraft;
- 1.0% investment return rate;
- Historical flight use; and
- Projected direct costs per hour.

The analysis then varied the following assumptions:

- # of planes to be purchased in the future (3 versus 4);
- Inclusion of 50% of historical passenger flights taken on utility aircraft (Cessnas);
- Base rate (year 1) for capital recovery; and
- Annual escalation rate for capital recovery.

Texas Government Code §2205.040 provides that *"If the department's most recent long-term plan contains an analysis under Section 2205.032(c)(7) that finds that including capital recovery costs in the rates the department charges under this section is a practicable fleet replacement strategy, the department may adopt rates for interagency aircraft services provided by the department that are sufficient to recover, in the aggregate and to the extent possible: (1) all direct costs for service provided, as provided by Subsection (a); and (2) the capital costs of replacing aircraft in the pool."*

The above assumptions provide a range for the total cost per hour for use of the aircraft from $869 to $1,061. Hourly rates for aircraft use will be established within this range by TxDOT Flight Services. Because the assumptions are based on historical use of an over 30-year old fleet, once new aircraft have been put into service, TxDOT will re-assess the matter using newer flight-use and direct cost data. The reassessment will provide a better indication of the impact of including capital recovery costs in the rates the department charges for use of the aircraft.

STAFF RECOMMENDATION

As part of its long-range plan for the aviation fleet, TxDOT recommended replacement of the current passenger fleet with the purchase of up to four new aircraft. The recommendation included the following minimum provisions:

SAFETY: Technological and performance features that maximize the overall safety of the aircraft.

SEATING: Seating for five to seven passengers, based on historical passenger loads.

OPERATIONS: Travel efficiencies through increased flight speed, fuel efficiency, and travel distance capability.

RATIONALIZATION: Efficient and safe service delivery through acquisition and maintenance of like aircraft.

COST EFFECTIVENESS: Lower operating and maintenance costs.

FLEET REPLACEMENT PLAN AND TIMELINE

As outlined in this document, TxDOT staff determined retirement and rationalization of the current passenger fleet is necessary. Following consultation with the Texas Transportation Commission, the Governor and Lt. Governor's offices, and key legislative members, staff developed and issued a Request for Proposal (RFP) for the purchase of three, possibly four, replacement aircraft. Based on the analysis provided in this report, and responses to the RFP, TxDOT has negotiated for the purchase of four Embraer Phenom 100EV aircraft. The purchase price of each aircraft is $4.3 million, for a total price of $17.2 million. The trade-in value for sale of the four existing King Airs is $3.9 million, making the final cost of acquisition of the four new planes $13.3 million.

TxDOT staff anticipates delivery of all four aircraft by end of FY 2019. Following training of pilots and mechanics, the new aircraft will be put into service and the old aircraft removed and sold.

FUTURE ANALYSIS

As previously noted TxDOT will analyze use of the new aircraft and then determine the potential impact and viability of adding a capital recovery fee to the hourly cost of service. This plan will be updated on the TxDOT.gov website as further information is available and the department determines an appropriate plan for future capital cost recovery.