Conklin & de Decker
A JSSI Company

Aircraft Cost Summary
V 19.2

ESTIMATED VARIABLE COSTS - Per Hour

Aircraft	Citation Ultra
Type of Operation	Corporate
Fuel[1]	$1,039.18
Fuel Additives	11.15
Lubricants	0.00
Maintenance Labor[2]	295.12
Parts Airframe/Engine/Avionics[3]	331.72
Engine Restoration[4]	487.66
Thrust Reverser Allowance	0.00
Propeller Allowance	0.00
APU Allowance	0.00
Major Periodic Maintenance	88.45
Miscellaneous Expenses – Landing/Parking	20.97
• Crew Expenses	84.78
• Supplies/Catering	38.88
• Carbon Offset[5]	0.00
• Other	0.00
Total Variable Cost per Hour	**$2,397.91**
Total Variable Cost per Nautical Mile	**$6.20**
Average Speed-Kts. 600-NM trip[6]	387.00

Footnotes: **Currency:** $ **Size of Operation:** 1 – 2 Aircraft

1. Fuel Cost	4.66
Gallons per hour. Block fuel divided by flight time + 15%	223
2. Maintenance Labor Cost per Hour	136
Maintenance Hours per Flight Hour	2.17
3. Includes Engine Parts Cost	No
Engine Model	JT15D-5D
Aircraft Model Year	1999
4. Overhaul Cost Source	JSSIEssen19
5. CO^2 Cost per Tonne	0
6. Block Speed Source	Mftr Data

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ANNUAL FIXED COSTS

Aircraft	Citation Ultra
Type of Operation	Corporate
Crew Salaries – Captain[7]	$115,000
• Co Pilot	99,000
• Flight Attendant	0
• Flight Engineer/Other	0
• Benefits	64,200
Hangar – Typical	31,000
Insurance – Hull[8]	6,300
• Single Limit Liability	8,500
Recurrent Training	24,888
Aircraft Modernization[9]	45,900
Navigation Chart Service	4,638
Refurbishing[10]	28,560
Computer Maintenance Program[11]	4,000
Weather Service[12]	700
Other Fixed Costs	0
Total Fixed Cost per Year	**$432,686**

Footnotes: **Currency:** $ **Size of Operation:** 1 – 2 Aircraft

7. Crew Salary Source	18 NBAA
Number of Crew	2
8. Insured Hull Value	1,400,000
Hull Insurance Rate (%)	0.45
9. Modernization	10 Yr Avg
10. Refurbishment Labor Hrs per Seat	30
11. Computerized Maintenance Program Source	Typical
12. Weather Service Source	Typical

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A JSSI Company

Aircraft Cost Summary
V 19.2

ANNUAL BUDGET

Aircraft	Citation Ultra
Type of Operation	Corporate
Utilization - Nautical Miles	175,000
• Hours	452
Variable Cost per Year	1,083,855
Fixed Cost per Year	432,686
Total Cost (No Depreciation)	**$1,516,541**
• Per Hour	3,355
• Per NM	8.67
• Per Seat NM	1.24
Total Cost (No Depreciation)	1,516,541
Book Depreciation[13]	140,000
Total Cost (Book Depreciation)	**$1,656,541**
• Per Hour	3,665
• Per NM	9.47
• Per Seat NM	1.35
Total Cost (No Depreciation)	1,516,541
Market Depreciation[14]	95,200
Total Cost (Market Depreciation)	**$1,611,741**
• Per Hour	3,566
• Per NM	9.21
• Per Seat NM	1.32

Footnotes: **Currency:** $ **Size of Operation:** 1 - 2 Aircraft

13. Book Depreciation Rate	10
14. Market Depreciation Rate	7

GENERAL COMPARISON

Aircraft	Citation Ultra
Type of Operation	Corporate
Cabin-Height (FT)	4.80
• Width	4.83
• Length	17.33
Cabin Volume (CU-FT)	310
Cabin Door Height (FT)	4.25
• Width	2.00
Baggage -Internal (CU-FT)	26
• External	41
Typical Crew/Passenger Seating	2 / 7
Weight-Max Take-Off (LBS)	16,300
• Maximum Landing	15,200
• Basic Operating	9,950
• Usable Fuel	5,771
Payload-Full Fuel (LBS)	779
• Maximum	2,250
Certified/IFR	Yes/Yes
Price - New (Corporate) / 1,000	7,395
• Pre Owned Range / 1,000	900/1,400
• Years Produced	1994 - 1999

PERFORMANCE COMPARISON

Aircraft	Citation Ultra
Type of Operation	Corporate
Range-NBAA IFR Reserve (NM)	
Seats Full	1,259
Ferry Range	1,651
Range-30 Minute Reserve (NM)	
Seats Full	0
Ferry Range	0
Balanced Field Length (FT)	3,500
Landing Field Length - FAR 91	2,300
Landing Field Length - FAR 121	3,833
Landing Field Length - FAR 135	2,875
Rate of Climb (FT/MIN)	4,230
• One Engine Out	728
Cruise Speed-Maximum (KTAS)	430
• Normal	430
• Long Range	372
Stall Speed (IAS)	73
Ceiling - Certified MTOW (FT)	45,000
• Service	45,000
• Service OEI	26,000
• Hover IGE (Helicopter Only)	0
• Hover OGE (Helicopter Only)	0

CONKLIN & DE DECKER REPORT
EXPLANATION OF TERMS & ASSUMPTIONS
EVALUATOR EXPLANATION OF TERMS

Introduction

The data for aircraft not yet certificated will be marked "Preliminary Data" to indicate that the data shown for this aircraft has not yet been independently verified. Occasionally, data for aircraft recently certificated will also be marked as "Preliminary Data" for the same reason.

Methodology and Disclaimer

It is the opinion of Conklin & de Decker that the data presented in this publication is based on reasonable methodologies, assumptions and reliable sources. Manufacturers' data may be based on different assumptions, sales price adjustments, individually negotiated fleet contracts, differing warranties, or specialty maintenance programs peculiar to a manufacturer or year of production, and is therefore, in the opinion of Conklin & de Decker, not suitable for comparison with other aircraft. Conklin & de Decker has made adjustments based on research, which in its opinion are reasonable and necessary in order to provide a database that is suitable for comparative purposes. Actual experience will vary, and the data does not reflect specialized maintenance contracts, separately negotiated fleet deals, or other items unique to particular sales transactions.

The Conklin & de Decker Report is not intended as a budgeting tool. It makes generalized assumptions that may not apply to your aircraft and operating conditions. For an in depth, budgetary costing tool we recommend use of our *Life Cycle Cost Analysis* software and data program. Due to fluctuations in market costs, operating conditions and other factors, we make no warranties or representations regarding the future costs of maintenance or operation of any aircraft.

Measures and Currency

The measures for weights, volumes, distances and speed may be shown in the English system (Lbs, Gallons, Feet, Miles, Knots, etc.) or the Metric system (Kilos, Liters, Meters, Kilometers Kilometers/Hour, etc.), depending on the selection made by the user when the program is opened. The English system is the default selection.

The default currency selection for showing the cost data is the US Dollar ($). Other currencies may be selected by the user when the program is opened.

Regional Cost Data

The Conklin & de Decker Report default database is focused on US/North American cost factors. Regional databases are available for several regions with substantial business aviation activity, such as Europe and China. These databases use cost factors that are obtained from operators and Maintenance and Repair Organizations (MROs) in that region and focus on regional costs, such as fuel, salaries, Air Traffic Control (ATC) charges, etc., many of which are significantly different than these costs in the US. The Regional databases may be selected when the program is opened.

General Assumptions - Fixed Wing

The cost data shown in the *Conklin & de Decker Report* is based on extensive research using a variety of sources of information such as industry surveys, manufacturer supplied technical data and maintenance schedules and average actual cost data supplied by Jet Support Services, Inc, major Maintenance and Repair Organizations (MROs), manufacturers, etc. We also use our knowledge of similar aircraft models utilizing similar maintenance philosophies in conjunction with operator cost data to calculate the estimated costs for aircraft that have recently entered production or have gone out of production.
All jet, helicopter and piston aircraft maintenance costs are estimated using our FulLife ™ cost approach. Maintenance costs for turboprop aircraft will transition from the current 10-year cost basis to the FulLife ™ approach in 2020. Under the FulLifeTM approach we estimate the funds that should be set aside in order to pay for all scheduled and unscheduled, near-term and eventual maintenance of the aircraft over one operational life cycle of each inspection, component overhaul, engine overhaul and replacement of life limited items. For example, if the aircraft (fixed wing or helicopter) has a major inspection due at 5,000 hours, the maintenance cost accrued per hour is equal to the cost of the inspection divided by its interval of 5,000 hours. Similarly, if an aircraft has a gear overhaul that is due at 6,000 landings, the cost of the overhaul equals the cost of the overhaul divided by the overhaul interval of 6,000 cycles. For more detailed information, please refer to the maintenance cost categories below.

During the warranty period new jets and turboprops, which can extend to 5 years, the operator may see labor costs 15% less and parts costs 30% less than aircraft not under warranty. For helicopters and piston aircraft, which generally have much shorter warranty periods, the impact of warranty of the cost of maintenance is minor.

The costs shown are list prices for the goods and services offered and do not take into account discounts that operators may be able to obtain through negotiation. Cost shown for each country or region are average costs for that country or region and do not reflect the sometimes much higher costs that may be encountered in particular cities.

General Assumptions - Helicopter

The cost data shown in the *Conklin & de Decker Report* is based on extensive research using a variety of sources of information such as industry surveys, manufacturer supplied technical data and maintenance schedules and average actual cost data supplied by Jet Support Services, Inc, major Maintenance and Repair Organizations (MROs), manufacturers, etc. We also use our knowledge of similar aircraft models utilizing similar maintenance philosophies in conjunction with operator cost data to calculate the estimated costs for aircraft that have recently entered production or have gone out of production.
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Sales Tax

No sales or value added taxes (VAT) are included in these costs.

Annual Utilization

Almost all aircraft are used to fly trips from A to B – in other words their true annual utilization should be expressed as a function of distance. Aircraft variable costs on the other hand are usually expressed as hourly costs. Therefore, we have established an annual utilization in nautical miles (NM) based on NBAA survey data for each group of aircraft (jets, turboprops, piston aircraft and helicopters). The assumed annual utilization expressed in terms of distance is:

- Jets: 175,000 NM (325,000 KM),
- Turboprops: 115,000 NM (210,000 KM).
- Corporate (professionally flown) Pistons: 45,000 NM (83,000 KM)
- Business Pistons: 22,500 NM (41,500 KM).
- Helicopters: 45,000 NM (83,000 KM).

Hourly annual utilization used in the Conklin & de Decker Report for each aircraft is then calculated by dividing the annual utilization in NM or KM by the average speed of that aircraft.

Average Speed

The average speed is the recommended cruise speed if this is defined by the manufacturer in the performance manual for the aircraft. If the manufacturer does not provide a recommended cruise speed, we use the average speed between the long range cruise speed and the high speed/maximum cruise speed.

Maintenance Assumption

Our cost numbers assume that aircraft maintenance is performed at a qualified service facility for routine maintenance and a factory authorized MRO facility for major/heavy maintenance and overhauls unless indicated otherwise in the aircraft categories' explanations.

Maintenance Assumption

Our cost numbers assume that aircraft maintenance is performed at a qualified service facility for routine maintenance and a factory authorized MRO facility for major/heavy maintenance and overhauls unless indicated otherwise in the aircraft categories' explanations.

Aircraft Categories

Corporate - Jets, Turboprops, Helicopters and Pistons **-** Corporate costs assume the aircraft is owned and operated by a company solely for company use. These aircraft are flown by one or two professional pilots, depending on the class of aircraft. Super mid-size and larger jet aircraft also carry a professional flight attendant. These aircraft are required to maintain a very high reliability rate and are kept in excellent condition. Equipment levels for all models are assumed to be appropriate for the transportation of executives in instrument meteorological conditions (IMC). In addition, the long-range jets are equipped for extended over-water, trans-continental flights. When appropriate corporate aircraft are also suitably equipped for internet and mobile phone connectivity for both the crew and the passengers.

Business - Turboprops **-** Business costs assume the aircraft is owner flown in support of a small business. If single pilot operations are approved for a particular make/model, the owner is assumed to be the pilot. If two pilots are required, the owner is assumed to be one of the two pilots and the other pilot is a professional pilot. Maintenance reflects the same safety standards as Corporate but is not as labor-intensive as Corporate. Insurance costs for single pilot turbine operations are higher than if flown with two pilots. Equipment levels are suitable for flight in IMC. In addition, these aircraft are suitably equipped for internet and telephone connectivity

Business - Pistons **-** Business costs assume the aircraft is owner flown by a businessperson who is also a rated pilot. No crew salaries are included. Insurance costs for owner-flown aircraft tend to be higher than if flown by a professional pilot. Business hangar costs are assumed to be at a smaller airport with fewer amenities versus corporate hangar costs (T-hanger vs. heated, executive-style hangar). Annual utilization is also assumed to be half that of Corporate. Maintenance reflects the same safety standards as corporate. Equipment levels are suitable for flight in IMC.

Commercial and Offshore (Helicopter only) - These costs assume the aircraft is part of a fleet owned and operated for commercial/offshore purposes. Relative cost per hour is lower than a corporate aircraft. The aircraft is flown by one or two professional pilots and aircraft utilization is higher than corporate. Pilot salaries are generally 20-30% lower than corporate pilots and Insurance is generally 25 - 50% higher than corporate. Aircraft maintenance and component overhauls are usually done in-house as opposed to sending the aircraft to a certified maintenance facility. These aircraft generally have fewer optional equipment items.

EMS (Helicopter only) **-** EMS costs assume the aircraft is owned and operated by a company solely for emergency transport of patients from an accident scene to a medical facility and/or for inter-hospital transfers. The aircraft is flown by a professional pilot. These aircraft are required to maintain a very high reliability rate and are kept in excellent condition. Equipment levels are assumed to be appropriate for the transportation of people experiencing a life-threatening medical emergency in instrument meteorological

Data Sources For Maintenance Costs

***Newly-Fielded and Newly-Developed Aircraft* -** Manufacturer supplied cost data and our knowledge of similar aircraft models utilizing similar maintenance philosophies are used to estimate costs for aircraft not yet certificated. These aircraft will be noted as having "Preliminary Data" to indicate that the data shown for this aircraft has not yet been independently verified. Occasionally, data for aircraft recently certificated will also be marked as "Preliminary Data" for the same reason.

***Mature Aircraft* –** We use actual cost data supplied by Jet Support Services, Inc, major MROs and manufacturers for aircraft that have been in production for at least 5 years. We also use our knowledge of similar aircraft models utilizing similar maintenance philosophies in conjunction with operator cost data to calculate the estimated costs for aircraft for which only limited data is available.

Fleet Size

At the beginning of the program, the user can select the fleet size to be used for the cost analysis, because substantial savings can be gained from Economies of Scale. A larger operator is able to negotiate discounts in parts costs, fuel prices and other cost drivers. The larger the operator's fleet, the more negotiating power they are likely to have. A larger operation also gains experience in performing inspections and other maintenance more economically and efficiently, resulting in more savings. Another area a larger operator can find savings is having an avionics or engine expert on staff. A smaller operator would have to go to an outside expert at a much increased cost.

VARIABLE COSTS

Fuel Cost

Conklin & de Decker's fuel cost is obtained from a third-party survey of numerous Fixed Base Operators (FBOs) for the US database and from knowledgeable operators and FBO's for other regions. The fuel cost shown is the list price for private, non-commercial operators. The prices shown do not contain any discounts, but do include applicable taxes as well as airport and FBO uplift fees. The cost of fuel is updated regularly (currently twice annually). No additives are included in the fuel cost. The cost of fuel may be shown as cost-per-gallon or cost-per-liter, depending on whether the user of the program has selected the English or the Metric system of measures. In addition, the cost of fuel will be shown in the currency selected by the user when the program was opened.

Fuel Burn - Fixed Wing

The average fuel burn is shown in gallons per hour or liters per hour for each make/model aircraft using data that is generally derived from flight manuals, is calculated at the recommended cruise speeds and includes start, taxi and take-off fuel. Cruise altitude assumed for unpressurized aircraft is 8,000 feet (2,500 meters). For pressurized aircraft a flight altitude for optimum cruise fuel consumption is used. However, the cruise altitude cannot exceed the maximum certificated altitude. In addition, the cabin altitude cannot exceed 8,000 Ft (2,500 M). If it does, the cruise altitude is decreased to achieve an 8,000 Ft (2,500 M) cabin altitude.

The fuel burn calculation includes engine start, taxi, take-off and climb, cruise, descent, and landing for a standard trip length for each class of aircraft so that fuel burns for the aircraft in each class of aircraft are directly comparable:

Standard Trip Length

- Jets 600 NM (1,100 KM)
- Turboprops 300 NM (550 KM)
- Pistons 200 NM (370 KM)

The flight crew and passenger complement is assumed to be as follows, unless otherwise noted:

Pilots Passengers

- Jets (all except VLJ) 2 4
- Jets (VLJ) 1 3
- Turboprops (twin engine) 2 4
- Turboprops (single engine) 1 4
- Pistons 1 2

The flight profile used for the fixed-wing fuel burn calculation is as follows:

- Start, taxi and take-off (include fuel for 10 minutes ground time).
- ISA, Standard Day (sea – level, 59F/15C)
- Normal climb at ISA Standard conditions, no wind.
- Climb direct to altitude (no step climb), at minimum rate of climb of 500 feet/minute (150 meters/minute).
  - Altitude for jets to be an optimum flight level between FL 290 – FL 450
  - Altitude for turboprops and pistons is the optimum altitude consistent with the need to keep cabin altitude at or below 8,000 Ft (2,500 Meters)
- Cruise at altitude for at least 50% of the total flight time.
- Cruise speed to be at a recommended constant cruise speed or Mach number
- Normal descent at ISA Standard conditions (no winds, 59F/15C at sea – level). A high speed/maximum descent schedule will not be used if a slower descent schedule is available.
- Trip time is measured from take – off to touchdown.

The average fuel burn rate is then calculated as trip fuel/trip time.

To that amount we add 15% to account for real world conditions to include:

- Pilot flying techniques.
- Using high speed/maximum power settings.
- Air Traffic Control Restrictions - restricting the aircraft to less than optimum altitudes. Lower altitudes usually increase fuel burn.
- Ground delays - Running engines while spending extra time on the ground.
- Auxiliary Power Unit (APU) operation (many jets and some turboprops)
- Tankering Fuel - Carrying more fuel than is required for a single flight (common on many larger aircraft to take advantage of discounted fuel at home base)

Fuel Burn - Helicopter

The average fuel burn is shown in gallons per hour or liters per hour for each make/model helicopter using data that is generally derived from flight manuals and is calculated at recommended cruise speeds. Cruise altitude and temperature for helicopters are assumed to be 2,000 Ft (600 Meters) and ISA temperatures.

The fuel burn calculation includes engine start, taxi, take-off and climb, cruise, decent and landing for a standard trip length so that fuel burn rates among different helicopters are directly comparable:

- Helicopters 50 NM (90 KM)

The flight crew and passenger complement is assumed to be as follows, unless otherwise noted:

Pilots Passengers
- Helicopters (twin engine or over 12,500 Lbs/5,700 Kilo) 2 4
- Helicopters (single engine) 1 4 *

** Or maximum seating capacity if less than 4 passenger seats are available*

The flight profile used for helicopter fuel burn calculations is as follows:

- Start, taxi and take–off (include fuel for 10 minutes ground time).
- ISA, Standard Day)sea–level, 59F/15C)
- Normal climb at ISA Standard conditions, no wind to 2,000 Feet (600 Meters) cruise altitude with ISA temperature
- Cruise speed to be at a recommended constant speed
- Normal descent at ISA Standard conditions (no winds, 59F/15C at sea-level).
- Trip time is measured from take – off to touchdown.

No additional fuel allowance to account for real-world conditions is added to the helicopter fuel burn because most of the factors experienced in fixed wing flight operations do not occur in helicopter operations. This is supported by extensive operator data collected by our company over many years.

Fuel Additives

This is the cost per gallon or liter of fuel additives used for anti-icing or as a fungicide.

Lubricants (Piston and Helicopter Aircraft Only)

Cost of all lubricants such as engine oil, transmission oil and hydraulic fluid is used for all helicopters (at a standard 1%) and all piston aircraft (at 2%). Surveys have confirmed these to be realistic estimates. This cost is not calculated for jets and turboprops, since the cost for these items is included in the parts cost.

Maintenance - Labor

Maintenance labor costs assume one full operational life cycle of the aircraft. An aging factor is applied to the aircraft costs during the aircraft's operational life cycle.

Maintenance labor cost is composed of two parts: the cost per labor hour and the number of labor hours.

Cost per Labor Hour

The cost per labor hour is an average of the cost per hour experienced by operators at various manufacturers' authorized maintenance facilities in the US for the different types of aircraft (jets, turboprops, pistons and helicopters). This cost is surveyed and adjusted annually. A similar approach is used for the other regions around the world.

Labor Hours per Flight Hour

Labor included in our aircraft labor calculation is all labor required for:

- Scheduled maintenance to include all inspections for a FulLife ™ period, including the labor required for major periodic inspections due on many jets at 96 months or on one manufacturer's helicopters at 12 years.
- Discrepancies found during scheduled maintenance inspections/events for the airframe and avionics (on condition).
- Routine engine maintenance not covered during engine overhaul.
- Labor for the removal/replacement of components requiring overhaul/inspection/servicing as well as life limited components.
- Unscheduled maintenance discrepancies.
- Troubleshooting unscheduled maintenance discrepancies.
- Minor airworthiness directives and service bulletins.

Labor not included in our labor calculation is labor required for:

- Major engine maintenance covered by our estimated engine restoration costs.
- Off aircraft overhaul and repair of major components, such as landing gear, propellers and main rotor gearboxes

Maintenance labor required for optional equipment, aircraft completion items (interior), aircraft cleaning and washing, any administrative labor, stocking of aircraft supplies or travel to repair aircraft.

Maintenance - Parts

Parts included in our aircraft parts cost calculation**:**

- All airframe, avionics and minor engine consumable parts required for routine scheduled maintenance including for major inspections
- Unscheduled maintenance, including for standard avionics and cockpit displays.
- On-condition maintenance.
- An average of 20% of the total component overhaul and life limited parts cost has been added to account for premature removal of these parts due to failure (Helicopters only).
- Parts associated with airworthiness directives and mandatory service bulletins.

Not included in our parts cost calculation:

- Parts used in the normal overhaul of components, life-limited parts and engines.
- Parts required for inventory costs, optional equipment, and aircraft completion items (interior).
- Shipping, import duties and taxes/VAT.

Engine Restoration Cost - Fixed Wing

The engines used on all aircraft require major periodic maintenance to maintain and/or restore their integrity and performance. For most turbine and all piston powered aircraft (fixed-wing and helicopter), these major engine maintenance events occur on a fixed interval inspection schedule. However, for some large and long range corporate fixed-wing aircraft and almost all airliner aircraft the major engine maintenance occurs on an “on-condition” basis. To obtain a clear understanding of the long-term cost of engine maintenance we show the cost per hour that should be set aside to cover the estimated cost of the major maintenance when it is due -- i.e. the total estimated cost of the engine major maintenance divided by the major inspection interval in hours or the average number of hours between on-condition removals. The source for these estimated costs per flight hour are as follows:

Turbine Powered Fixed-wing Aircraft -- Engine allowances for turbine powered fixed-wing aircraft use the Jet Support Services Essential+ LLC plan to cover the cost of scheduled and unscheduled maintenance, all required inspections and overhauls and replacement of any LLC (Life Limited Components such as the turbine disks or impeller). Aircraft for which no JSSI plan rate is available are estimated using our engine cost database.

Piston Powered Fixed-wing Aircraft -- All piston powered fixed-wing aircraft use a set aside estimate to cover the cost of an overhaul of the engine. The cost per flight hour estimate for the overhaul is based on the recommended Time between Overhaul (TBO).

Engine Restoration Cost - Helicopter

The engines used on all aircraft require major periodic maintenance to maintain and/or restore their integrity and performance. For most turbine and all piston powered aircraft (fixed-wing and helicopter), these major engine maintenance events occur on a fixed interval inspection schedule. However, for some large and long range corporate fixed-wing aircraft and almost all airliner aircraft the major engine maintenance occurs on an "on-condition" basis. To obtain a clear understanding of the long-term cost of engine maintenance we show the cost per hour that should be set aside to cover the estimated cost of the major maintenance when it is due -- i.e. the total estimated cost of the engine major maintenance divided by the major inspection interval in hours or the average number of hours between on-condition removals. The source for these estimated costs per flight hour are as follows:

Turbine Powered Helicopters -- The engine costs for turbine powered helicopters are estimated using our engine overhaul cost database for an "average" engine. This cost includes the labor and parts for all scheduled and unscheduled maintenance, repair, overhaul or replacement of accessories and replacement of LLC (Life Limited Components) if required. The cost per flight hour estimate for the overhaul is based on two cycles per hour and the recommended Time between Overhaul (TBO).

Piston Powered Helicopters -- All piston helicopters use a set aside estimate to cover the cost of an overhaul of the engine. The cost per flight hour estimate for the overhaul is based on the recommended Time between Overhaul (TBO).

Major Periodic Maintenance

In addition to the engines, many fixed and rotary wing aircraft require major periodic inspections and/or overhauls of major components. Examples include the landing gear overhaul at a specified number of landings on almost all fixed-wing aircraft and the main rotor gearbox after a certain number of hours on almost all helicopters. As with the engines, it is important to have a clear understanding of the long-term cost of this type of major maintenance. For this reason, we show the cost per hour that should be set aside to cover the estimated cost of these major inspections and overhauls when they are due -- i.e. the total estimated cost of the inspection or component overhaul divided by the major inspection/overhaul interval in hours.

The costs per flight hour shown are estimated using our major inspection and component overhaul costs included in our FulLife ™ cost database. Included in the cost per hour for this element are:

Major Component Overhauls – This includes the inspection labor plus the maintenance labor and parts, as well as the required testing for the major component overhaul.
Life Limited Parts – Only the cost of the parts is included here since the cost of labor is included in the airframe maintenance labor cost. For example, an item with a life of 20,000 cycles and a cost of $20,000 would have a cost of $1 per hour.

Thrust Reverser Allowance (Jets Only)

This is the cost of parts and labor required to overhaul the thrust reversers that have a fixed overhaul interval. Routine costs for on-condition thrust reversers are included in the maintenance-parts and labor. On some aircraft this cost is included with the engine restoral cost.

Propeller Allowance (Turboprop and Piston Aircraft)

This is an estimate of the maintenance labor and parts costs required to overhaul the propeller(s), including the cost of any life-limited parts. This cost is divided by the overhaul interval to arrive at a cost per hour.

APU Maintenance Allowance

This cost element includes all costs associated with the maintenance and overhaul of the Auxiliary Power Unit (APU) except routine maintenance and minor servicing which is included with the general maintenance labor and parts cost. For Honeywell units, if covered by a *JSSI* APU maintenance plan, it is the annual fee divided by the aircraft's annual flight hours; otherwise it is the *Honeywell MSP* hourly rate. For units manufactured by other than Honeywell, we use JSSI's hourly rates. If the unit is not covered by JSSI we estimate the hourly cost.

Landing And Parking Fees

This cost element represents typical charges associated with landing and parking the aircraft away from home base. These charges vary widely from airport to airport. In general, landing charges are based on the maximum take-off gross weight of the aircraft and parking charges are based on the weight of the aircraft and the duration of the stay. However, every airport and FBO uses its own formula. For that reason we use an average of a variety of airports to calculate the average hourly cost. Costs for airports outside the US tend to be higher, sometimes by a very significant margin. Our approach has been to obtain the basic formula for various representative airports in a particular region from data published on the internet by these airports or from operators familiar with these airports/countries. The resulting data is then averaged to obtain an average cost per hour for Landing and Parking fees for the US and other regions/countries.

Crew Expenses

If shown, this is the cost incurred by the flight crew (Pilots and Flight Attendant), when away from home base, for accommodations, transportation and meals. The costs for the US are typical of a major metropolitan area and use a formula that includes $250 per person per night (Hotel $150, Meals $50, Misc. $50). For other regions we adjust these costs by means of the US State Department allowances in the different countries or regions for these expenses. This information is then cross checked with local operators and adjusted if appropriate.

Small Supplies And Catering

This is the costs incurred for minor supplies for the cabin and cockpit (flashlight batteries, napkins, toilet paper, etc.) and all in-flight catering for the crew and passengers. We use a formula based on the number of crew, number of passenger seats and class of aircraft.

CO2

This cost reflects a Carbon Offset Fee. At present Carbon Offset fees for business class aircraft are largely voluntary. Some business aircraft operators or owners voluntarily pay a Carbon Offset fee. The cost is shown as $/Metric Tonne of CO2 produced. This amount is calculated based upon the default aircraft hourly fuel burn. The calculation is as follows: (tonnes of fuel per hour)*(3.15 tonnes of CO2 per tonne of fuel)*(cost per tonne). At present, the voluntary offset cost is between $5 and $20 per tonne of CO2.

FIXED COSTS

Crew Salaries

This shows the annual base salary of a full-time Captain, Copilot and, for super midsize and larger aircraft, Flight Attendant for each category of aircraft.

Crew salaries for US-based aircraft are obtained from the National Business Aviation Association survey (90th percentile), Professional Pilot magazine salary survey and other surveys. Crew salaries for aircraft based in other countries/regions are generally obtained from the local business aviation community and operators familiar with the region or country.

Crew Salaries - Benefits

This cost covers expenses that are paid by the employer in behalf of the employee in the form of:

- Payroll taxes (such as the employer's portion of a government run retirement plan (Social Security in the US), medical care program (Medicare in the US), unemployment insurance, etc.
- Benefits that are typically offered by the organization, such as life insurance, loss of license insurance, medical insurance (if not provided through a government program), uniform allowances, retirement plan contributions, cell phone plans, etc.

In the US this cost is typically 30% of the salary. The percentage in other countries/regions is based on internet research and discussions with operators familiar with the region or country.

Hangar - Typical

Hangar space rental costs vary by aircraft size and location. The square footage size for fixed-wing aircraft is calculated by multiplying aircraft length by wingspan. For helicopters with three or more rotor blades, the square footage is calculated by multiplying the rotor diameter and the overall length. For two-bladed helicopters, the square footage is calculated by multiplying the maximum width of the fuselage and the overall length of the helicopter. For a given aircraft, the hangar cost will be highest at busy airports with limited real estate space in major metropolitan areas.

For the US, yearly hangar rental costs per square foot is the average of an annual survey of a number of major business aviation airports in large metropolitan areas. Hangar costs for other regions/countries are based on operator data.

Insurance - Hull

All-risk hull insurance cost in the *Conklin & de Decker Report* is calculated by applying a percentage to the hull value of the aircraft. The percentage rates we use are valid for operators who have a good safety record, use professional, simulator-based pilot training programs at least annually and are audited by outside auditors on a regular schedule. Operators who do not meet these standards are likely to have higher insurance costs.

All-risk hull insurance covers the aircraft while in flight, as well as on the ground while parked or in the hangar, taxiing and/or during engine run-ups by the pilot(s) or qualified maintenance personnel.

The hull insurance rates we use are averages obtained from major insurance underwriters for coverage of US-based aircraft as well as for aircraft based in other regions/countries.
Operators can buy hull insurance at three different levels:

- ***Ground only - (not in motion)*** - Ground only (not in motion) covers your aircraft for all risk exposures while the aircraft is on the ground (i.e. in the hangar or on the ramp) and not in motion. This includes vandalism, theft, windstorm, flood, fire, etc.
- ***Ground including taxi and Ground only (not in motion)*** - covers your aircraft for all risk exposures while the aircraft is on the ground and not in motion, as discussed above. It also covers the aircraft while taxiing including hitting a parked aircraft, hitting a hangar, running into taxi-way lights and signs, etc.
- ***All Risk*** – This covers the aircraft while it is on the ground (not in motion) as well as while taxiing as described above and it adds risks during flight.

We use the “all-risk” category for our hull insurance cost.

The hull value includes instruments, radios, autopilots, wings, engines, and other equipment attached to or carried on the plane as described in the policy.

Insurance - Combined Single Limit Liability

Aircraft liability insurance protects you if your aircraft injures other people or damages other peoples’ property. The most comprehensive version of this insurance is Combined Single Limit Liability Insurance. The cost for this liability insurance is shown in the *Conklin & de Decker Report*.

The Combined Single Limit Liability insurance we use combines coverage for both property damage and bodily injury per occurrence into a single limit with no further limitation. In other words, regardless of whether the claim against you arises from injuries or death to persons or from damage to another's property, the amount of protection you have is the Combined Single Limit. It is usually expressed as a single number, for example $50 Million for each occurrence.

The liability limits used for the *Conklin & de Decker Report* are:

- Jets (12 seats or more) $200 Million
- Jets (11 seats or less) $100 Million
- VLJ's $25 Million
- Turboprops $50 Million
- Turbine Helicopter $25 Million
- Piston Helicopter $1 Million
- Piston aircraft $1 Million

The liability insurance rates we use are averages obtained from major insurance underwriters for coverage of US-based aircraft as well as for aircraft based in other regions/countries.

Note: *Your insurance cost may be different from ours as these costs are based on aircraft mission as well as pilot training and flight department safety records. Our insurance premium costs assume professional pilots who attend regular, simulator-based professional refresher training at least annually and who have an accident free record. Consult with your aviation insurance broker to determine your risks and recommended coverage.*

The legal definition of aircraft liability insurance is that the insurance company will pay on the behalf of the insured all sums which the Insured shall become legally obligated to pay as damages because of Bodily Injury sustained by any person and any Property Damage caused by an occurrence and arising out of the ownership, maintenance or use of the aircraft. In addition, the insuring company shall have the right and duty to defend any suit against the Insured seeking damages on account of Bodily Injury or Property Damage even if any of the allegations of the suit are groundless, false or fraudulent and may make such investigation and settlement of any claim or suit as it deems expedient. The insurance company shall not be obligated to pay any claim or judgment or to defend any suit after the applicable limit of the Company's liability has been exhausted by payment of judgments or settlements.

Condensed down into layman's terms aircraft liability insurance protects you if your aircraft injures other people or damages property. There are two ways aircraft insurance liability is structured;

- Combined Single Limit Liability Insurance (smooth limit or level limit)

Combined Single Limit "Smooth Limits" combines coverage for both property damage and bodily injury per occurrence into a single limit with no further limitation. In other words, regardless of whether the claim against you arises from injuries or death to persons or from damage to another's property, the amount of protection you have is the Combined Single Limit. It is usually expressed as a single number, for example $50 Million each occurrence. In general, this type of coverage provides more protection when compared to sub limited coverage and is also more expensive.

- Combined Single Limit Liability Insurance (sub-limit).

The most common and least expensive liability coverage is a sub-limited coverage. Sub-limited coverage is also Combined Single Limited coverage but it places a limitation on your coverage for a specific loss in the form of a lower amount than each occurrence amount. These limits apply to all or a type of bodily injury. For example, such a $1 Million liability policy may be limited to $100,000 per person, which places a maximum amount of coverage for death of or injuries to any person at $100,000. This amount is part of, and not in addition to, the $1 Million for each occurrence limit. Be aware of policy wording that states the sub-limit is per person. This means all persons, passengers and non-passengers alike are limited to the $100,000. The only acceptable sub-limit is per passenger.

We use pricing based on the Combined Single Limit "Smooth Limits" in *The Conklin & de Decker Report*.

Exclusions

Any insurance policy, whether for hull or liability insurance, will have a number of exclusions that if applicable will allow the insurance company to refuse to pay any claims. These exclusions include:

- Illegal use of an aircraft;
- Using an aircraft for purposes other than that described in the policy;
- Wear and tear;
- Piloting the aircraft by someone not named in the policy;
- Operating an aircraft outside stipulated geographical boundaries;
- Damage or destruction of an aircraft resulting from war, riots, strikes, and civil commotions, unless the specific coverage for these events has been obtained.
- Mechanical breakdown loss,
- Structural failure loss.

Recurrent Training

We use the cost for one-time recurrent flight crew training using a professional, full-motion simulator-based training program, such as provided by FlightSafety, CAE/Simuflite, Textron or SimCom, or the equivalent for aircraft that do not have a full-motion simulator-based training program available. This cost includes a $1,000 allowance for travel and lodging per pilot to the location of a simulator training program appropriate for the aircraft for which training is needed.

Aircraft Modernization & Uninsured Damage

This accrual covers the cost of installing desired optional service bulletins, avionics and cockpit instrumentation and displays, avionics upgrades required by the FAA or other aviation authorities, as well as the cost of repairing damage to the aircraft that is not covered by the insurance (i.e. the cost of the hull insurance deductible or small claims not submitted to the insurance company). These costs are not necessarily expended every year but usually will accrue for several years.

The cost shown is an annual cost based on the aircraft type and group (large jet, medium jet, single engine turboprop, medium twin helicopter, etc.) and is an average over the life of the aircraft. Note that buyers of older aircraft may well encounter higher costs in this area.

Costs are estimated for US-based aircraft and adjusted for non-US regions/countries using adjustment factors that take into account the cost and productivity of labor.

Navigation Chart Service

This is the cost for an annual subscription to an enroute and approach chart service tailored to the aircraft's operation. This cost will differ depending on aircraft mission. For example, helicopters and piston fixed-wing get regional subscriptions; long-range jets get a worldwide subscription. Subscription costs are essentially the same for all countries.

Refurbishing

This an accrual cost for maintaining the appearance of the interior and exterior of the aircraft in excellent condition. Included is routine cleaning and the repairs of the cockpit and cabin furnishings. Periodic minor interior refurbishment is included. This includes touch-ups, plus repairs of upholstery and other fabrics. One major interior refurbishment to include replacement of fabrics and seat reupholstering is assumed to be done in conjunction with an exterior repainting every 7 to 10 years.
We use a formula to calculate this cost based on aircraft type, size and mission. Large cabin, long-range aircraft assume a higher level of materials and furnishings, plus a more extensive galley than do smaller aircraft, such as small jets, turboprops and helicopters used for regional or local flights.
Costs are estimated for US-based aircraft and adjusted for non-US regions/countries using adjustment factors that take into account the cost and productivity of labor.

Computerized Maintenance Program

This is the cost for an annual subscription cost of a typical computerized tracking and record keeping service for scheduled aircraft maintenance and components. Subscription costs are essentially the same for all countries.

Weather Service

This is the cost of an annual subscription for a typical computerized weather forecasting service. Again, subscription costs are essentially the same for all countries.

Book Depreciation

The book depreciation expense is the amount recorded on the “books” of the corporation and reported on the financial statements. For example, if an aircraft costs $5,000,000, is expected to be used for 10 years and to have no salvage value at the end of the 10 years, the annual “book” depreciation expense would be $500,000 each year. (This assumes the straight-line method and the aircraft was acquired on the first day of an accounting year.) In the Conklin & de Decker Report we assume book depreciation of 10% per year for 10 years using the straight-line method of depreciation with no salvage (residual) value.

Market Depreciation

Market Depreciation is a widely changing variable based on the residual value of the aircraft in the marketplace. Until the aircraft is sold no one really knows the exact market value of the aircraft. Once an aircraft is sold the difference between what the aircraft was purchased for and the eventual selling price (Residual Value) is referred to as Market Depreciation. Aircraft tend to retain more of their value for a longer period of time than trucks or machinery. However, until the aircraft is sold, market depreciation is an estimate.

In the Conklin & de Decker Report, we assume market depreciation of 7% per year for Jets, 6% per year for Turboprops and Piston and 8% per year for Helicopters. Market depreciation percentages are based on our historical residual value data for these aircraft types and are reviewed on a regular basis.


GENERAL SPECIFICATIONS

Cabin Dimensions

The dimensions, volumes, weights, etc. shown in the General Specification section of the *Conklin & de Decker Report* and discussed in the following paragraphs may be shown in the English system (Feet, Inches, Lbs, Gallons, Feet, Miles, Knots, etc.) or the Metric system (Meters, Centimeters, Kilos, Liters, Kilometers Kilometers/Hour, etc.), depending on the selection made by the user when the program is opened. The English system is the default selection.

Similarly, the purchase price shown in the *Conklin & de Decker Report may be shown* in a number of different currencies, as selected by the user when the program is opened. The default currency selection is the US Dollar ($).

Cabin Height, Width, and Length – These dimensions are based on a completed interior. On "cabin-class" aircraft, the length is measured from the cockpit divider to the aft pressure bulkhead (or aft cabin bulkhead if unpressurized). For small cabin aircraft, the distance is from the cockpit firewall to the aft bulkhead. Height and width are the maximum available within that cabin space.

Cabin Volume – The total passenger cabin volume = (empty volume from cockpit divider/back of pilot seat to aft-most point of rear seating) + (front passenger area [if single pilot]. It is measured with headliner in place with no chairs or other furnishings. We calculate this based on CAD drawings of the interior and not manufacturer provided data.

Internal Baggage Storage: If there is an area in the cabin that is clearly defined as baggage space and readily accessible by the passengers in flight, then it is calculated and displayed as a separate value from the cabin volume.

In the case of helicopters with rear clamshell doors we assume the cabin/baggage space ends at the rear perimeter of the flat floor.

We assume a standard 20 cubic feet for the front passenger area of all single pilot aircraft.

Cabin Door Height and Width

These are the measurements of the main passenger cabin entry door.

Baggage

Internal Baggage Volume **-** is accessible in flight by the passenger. This amount may vary with the interior layout.

External Baggage Volume **-** is not available in flight (nacelle lockers, etc.).

Typical Crew/Pass Seating

This is the crew and passenger seating commonly used on the aircraft. Since the focus of the aircraft is usually passenger comfort, the seating capacity shown may be less than the maximum certificated seating capacity of the aircraft. These numbers may vary for different operations (Corporate, Commercial, EMS, Utility, etc.).

Weights

Maximum Take-off Weight – The maximum permissible weight of the aircraft at take-off as determined during the aircraft certification.

Basic Operating Weight – This is the empty weight, typically equipped, including the interior, the flight crew @ 200 pounds (90 Kg) each and their supplies, unusable fuel and liquids and galley supplies. The flight crew includes the pilot (s) and the flight attendant on super-midsize and larger aircraft. Generally speaking, no dedicated mission equipment is included in the Basic Operating Weight shown.

Useable fuel - Useable fuel is the fuel available for consumption by the power plants and/or APU. It does not include the trapped fuel that may exist in the fuel tanks that cannot be collected by the fuel system. Fuel is measured in gallons or liters when dispensed into the aircraft and measured in pounds or kilos when used for performance calculations. The conversions we use are:

- Jet fuel 6.7 Lbs/Gallon 0.80 Kg/Liter
- AvGas 6.0 Lbs/Gallon 0.72 Kg/Liter

Payload - Full Fuel – This is the useful load minus the useable fuel. The useful load is based on the maximum ramp weight minus the basic operating weight. The maximum ramp weight is the maximum take-off gross weight plus an allowance for engine start and taxi out fuel. This weight is determined during aircraft certification. For many aircraft (particularly piston and rotary wing aircraft), the maximum ramp weight is the same as the maximum take-off gross weight.

Payload - Maximum – This is the maximum zero fuel weight minus the basic operating weight. The maximum zero fuel weight is the maximum certificated total weight of the aircraft without any usable fuel on board. For almost all jet aircraft it is less than the maximum take-off weight, while for almost all other aircraft it is the same as the maximum take-off weight.

Certified/IFR Certified

"Certified" indicates whether the aircraft is certificated or not. New models in flight test are not certificated. "IFR Certified" refers to whether the aircraft is certificated for flight in IMC (Instrument Meteorological Conditions).

Price

***Price - New (Typical)* –** This is the selling price of a typically equipped new aircraft. For current production aircraft this is the price of the current year's model. For out of production aircraft, this refers to the selling price from the last year the model was produced. For aircraft not yet in production, it reflects the proposed price for an early delivery. This figure is in thousands of US Dollars or other currency if that has been selected. New aircraft prices do not reflect escalation factors for future delivery dates.

***Price - Pre-owned Range* –** This shows the low and high current selling prices of used aircraft. The prices shown for fixed-wing aircraft and most helicopters are based on the latest available edition of The *Aircraft Bluebook Price Digest* and other price guides.

PERFORMANCE SPECIFICATIONS

Range

***Range - NBAA IFR Res - Seats Full* -** This is used for jet and turboprop aircraft and is the maximum IFR range of the aircraft with all passenger seats occupied. This uses the NBAA IFR alternate fuel reserve calculation for a 200 NM (365 Km) alternate.

Range - NBAA IFR Res - Tanks Full - This is used for jet and turboprop aircraft and is the maximum IFR ferry range of the aircraft with the maximum fuel on board and no passengers. This uses the NBAA IFR alternate fuel reserve calculation for a 200 NM (365 Km) alternate.

Range - 30 Min Res - Seats Full – This is used for all piston fixed-wing aircraft and helicopters. It is the maximum VFR (Visual Flight Rules) range of the aircraft with all passenger seats occupied. This uses a fuel reserve of 30 minutes at cruise speed and altitude.

Range - 30 Min Res - Tanks Full - This is used for all piston fixed-wing aircraft and helicopters. It is the maximum VFR range of the aircraft with the maximum fuel on board and no passenger seats occupied. This uses a fuel reserve of 30 minutes at cruise speed and altitude.

Balanced Field Length (BFL)

The ***Balanced Field Length*** *(BFL)* is the length of runway required to permit two takeoff scenarios. In scenario 1, the aircraft accelerates with all engines operating to a speed just less than a speed called V1. At this point one engine fails, the pilot initiates a rejected takeoff and stops the aircraft on the remaining runway. In scenario 2, the aircraft again accelerates with all engines to the speed called V1, where the engine fails but then the pilot continues the takeoff and achieves a height above the runway of 35 (10.7 Meters) feet at a certain point over the runway. When the distance required for scenario 1 is the same as for scenario 2, that distance is called the Balanced Field Length. From a practical point of view this means that if the runway length available is the same as or greater than the BFL, the pilot can either come to a complete stop if one engine fails at or below V1 or continue the take-off if one of its engines fails at or above the critical speed (V1). For our analysis, this is based on four passengers and maximum fuel on board, as well as a Dry Level Runway, No Wind, NBAA IFR Reserves and 86 degrees F (30 degrees C). No thrust reversers or propeller reversal may be used to establish this distance. The BFL is used for all multi-engine jet aircraft as well as multi-engine turboprop aircraft over

12,500 Lbs (5,670 Kg) or certificated to FAR Part 25 (transport category) standards.

The ***Take-off Distance*** is applicable to turboprop aircraft with a take-off gross weight less than 12,500 Lbs (5,670 Kg), all piston fixed-wing aircraft and all single engine aircraft. This distance represents the take-off field length required to achieve a 35 Ft (10.7 meters) height above the runway at Maximum Take-off Weight (MTOW). Again, this distance assumes a Dry Level Runway, No Wind and 86 degrees F (30 deg C). No propeller reversal or thrust reverser may be used to establish this distance.

The Balanced Field Length (BFL) performance of aircraft can be very confusing. Most often the confusion arises from the basic differences in operating regulations governing the types of aircraft. There are two regulations that govern runway distance requirements for jets and turboprops. These regulations are FAR 23 (aircraft with a gross weight of 12,500 pounds and under) and FAR 25 (Air Transport Category aircraft with a gross weight over 12,500 pounds). These two regulations vary significantly. The more stringent rules of FAR 25 provide the passenger with greater safety margins than those used for FAR 23 private aircraft.

For example, FAR 23 makes no allowance for loss of power or an engine or propeller failure. Additionally, the published distance requires no allowance for either being able to stop on the remaining runway or to continue the take-off on one engine after an engine failure.

By contrast, FAR 25 regulations intended for Air Transport Aircraft such as business jets and large turboprops assures their passengers and crew that in the unlikely event of a loss of engine power during take-off the aircraft can either:

- Stop within the remaining runway length
- Take-off and climb on the remaining good engine.

This distance is known as Balanced Field Length. BFL is the distance obtained by determining the decision speed (V1) at which the take-off distance and the accelerate-stop distance are equal. Decision speed is the point where the pilot decides to either continue with the take-off or slam on the brakes and stop the aircraft.

To illustrate how these regulations work let’s look at a typical situation involving a small turboprop (FAR 23) and a small business jet (FAR 25), both seating six passengers. We’ll assume maximum gross weight, sea level, International Standard Atmospheric (ISA) conditions and a dry, level, hard surface runway.

The small turboprop can legally take-off from a 2,600-ft runway operating under FAR 23. Although it has no requirement to consider an engine failure let’s assume an engine fails at its published rotation speed (Vr) of 94 knots. Rotation speed is the point when the aircraft starts to lift off the ground. Its distance to accelerate to Vr and stop is 3,400 ft, 800 ft longer than the take-off distance. If the take-off is continued after engine failure at Vr, then the runway required jumps to 4,750 ft, 82% longer than the take-off distance of 2,600 ft. Although 4,750 ft is the BFL for the turboprop it is not a legal requirement under Part 23 for runway length decision.

The small business jet has a BFL of 4,500 ft runway in the same conditions, 250 ft shorter than the turboprop under the same contingencies and with the same margin of safety.

Although the small business jet could take-off or accelerate/stop like the turboprop from a shorter runway the pilot is not permitted to base the runway length decision on anything other than the BFL data while operating under FAR 25.

Landing Runway Length

The landing distance, as required by the regulations, is the distance needed to land and come to a complete stop from a point 50 feet (22.5 meters) above the threshold end of the runway. It includes the air distance required to travel from the 50 foot (15.24 m) height to touchdown plus the stopping distance and assumes a dry, level runway, maximum brakes and no use of thrust reversers. The assumed landing weight consists of the basic operating weight (BOW) plus 4 passengers and reserve fuel for a 200 NM (365 Km) alternate for turbine powered aircraft and 2 passengers and fuel for a 100 NM (185 KM) alternate for piston aircraft.

Note: *Our analysis of runway length requirements is based on the US Federal Aviation Regulations (FARs) requirements for private, not-for-hire operators (FAR Part 91) and for scheduled and unscheduled, commercial, for-hire operators (FAR Part 121, 91-subpart K and 135), as indicated. Other national aviation authorities may use different safety margins for private operators, air carriers and commercial operations.*

Private, not for hire operators who operate under FAR Part 91 do not require any additional safety margin in addition to the calculated landing distance. Therefore, the required landing field length is the same as the calculated landing distance.

Commercial, for-hire operators, such as air carriers and commercial operators operating under FAR Parts 121, 91 subpart K or 135, operate with a different set of requirements. For these operators, the required landing distance at the destination from the 50 foot height cannot exceed 60% of the actual runway length available. For these operators the landing field length at the destination airport is computed by multiplying the FAR Part 91 un-factored landing distance by 1.667.

Under FAR Part 121, 91 Subpart K or 135 the required landing field length at an optional airport runway (normally the planned divert airport runway) is calculated differently. For these operations, the required landing field length cannot exceed 80% of the available runway length. This means the landing field length at the optional airport runway is obtained by multiplying the FAR Part 91 un-factored landing distance by 1.25.

Under FAR Part 135, “Eligible on-demand” operators (those issued authorization by their Operations Specifications for pilots meeting certain crew experience and pairing requirements), when conducting a destination airport analysis, must meet the requirement that the required landing field length equals or exceeds 80% of the available runway length. This means that for these “eligible on-demand” operators, the landing field length at the destination airport runway is obtained by multiplying the FAR Part 91 un-factored landing distance by 1.25.

Note: *All landing distances are calculated assuming optimum landing conditions. No allowances are made for a variety of real-world factors such as rain or snow, worn tires and brakes, non-optimum runway conditions, one engine inoperative, etc. However, the FAA has published various factors that must be used when landing on wet or snow- covered runways.*

Rate of Climb (Ft/Min)

The rate of climb, given in feet per minute or meters per minute, assumes all engines are operating with the aircraft at its maximum take-off gross weight (MTOW) in ISA conditions.

One Engine Out rate of climb is for a one engine inoperative rate of climb at MTOW and ISA conditions.

All climb rates assume retractable equipment (such as landing gear and flaps) are retracted, and any anti-ice systems (engine, wing or rotor, etc.) are turned off.

Cruise Speed

Max - is the maximum cruise speed at maximum continuous power. This may also be commonly referred to as High Speed Cruise.
Normal – is the manufacturer's recommended cruise speed. Sometimes, this speed is the same as Maximum Cruise Speed.
Long Range Cruise - is the manufacturer's recommended cruise speed for maximum range.

Stall Speed (IAS)

The stall speed shown is for the aircraft in the landing configuration with four passengers and NBAA IFR Fuel Reserves (turbine) or VSO stall speed (piston). Helicopters do not have a stall speed.

Ceiling

Certified Ceiling **–** This is the maximum altitude a particular aircraft is certified to operate at. This does not mean the aircraft can reach this altitude at all weights. It also does not mean that the aircraft cannot exceed this altitude under certain weight conditions.

Service Ceiling – This is the lesser of the highest altitude at which a 100 fpm (45 meters/minute) rate of climb is possible at MTOW with all engines running OR the maximum certificated altitude for operation of this fixed or rotary wing aircraft.

Service OEI **-** is the service ceiling with one engine inoperative.

Hover In Ground Effect (HIGE – Helicopters only) - HIGE is a condition where the downwash of air from the main rotor is able to react with a hard surface (the ground), and give a useful reaction to the helicopter in the form of more lift force available with less engine power required. It is a condition of improved performance encountered when hovering within up to one rotor diameter of the ground.

Hover OGE (Helicopter) - HOGE occurs when the helicopter rotor downwash is not affected by the proximity of the landing surface. In other words, OGE normally occurs when the helicopter is more than one rotor diameter above the ground.

Comparative Field Lengths - Jets and Turboprops

The Balanced Field Length (BFL) performance of aircraft can be very confusing. Most often the confusion arises from the basic differences in operating regulations governing the types of aircraft. There are two regulations that govern runway distance requirements for jets and turboprops. These regulations are FAR 23 (aircraft with a gross weight of 12,500 pounds and under) and FAR 25 (Air Transport Category aircraft with a gross weight over 12,500 pounds). These two regulations vary significantly. The more stringent rules of FAR 25 provide the passenger with greater safety margins than those used for FAR 23 private aircraft.

For example, FAR 23 makes no allowance for loss of power or an engine or propeller failure. Additionally, the published distance requires no allowance for either being able to stop on the remaining runway or to continue the take-off on one engine after an engine failure.

By contrast, FAR 25 regulations intended for Air Transport Aircraft such as business jets and large turboprops assures their passengers and crew that in the unlikely event of a loss of engine power during take-off the aircraft can either:

- Stop within the remaining runway length
- Take-off and climb on the remaining good engine.

This distance is known as Balanced Field Length. BFL is the distance obtained by determining the decision speed (V1) at which the take-off distance and the accelerate-stop distance are equal. Decision speed is the point where the pilot decides to either continue with the take-off or slam on the brakes and stop the aircraft.

To illustrate how these regulations work let’s look at a typical situation involving a small turboprop (FAR 23) and a small business jet (FAR 25), both seating six passengers. We’ll assume maximum gross weight, sea level, International Standard Atmospheric (ISA) conditions and a dry, level, hard surface runway.

The small turboprop can legally take-off from a 2,600-ft runway operating under FAR 23. Although it has no requirement to consider an engine failure let’s assume an engine fails at its published rotation speed (Vr) of 94 knots. Rotation speed is the point when the aircraft starts to lift off the ground. Its distance to accelerate to Vr and stop is 3,400 ft, 800 ft longer than the take-off distance. If the take-off is continued after engine failure at Vr, then the runway required jumps to 4,750 ft, 82% longer than the take-off distance of 2,600 ft. Although 4,750 ft is the BFL for the turboprop it is not a legal requirement under Part 23 for runway length decision.

The small business jet has a BFL of 4,500 ft runway in the same conditions, 250 ft shorter than the turboprop under the same contingencies and with the same margin of safety.

Although the small business jet could take-off or accelerate/stop like the turboprop from a shorter runway the pilot is not permitted to base the runway length decision on anything other than the BFL data while operating under FAR 25.