Appendix B

ILS Upgrade Feasibility Study

CAT-II ILS Feasibility Analysis

Akron-Canton Airport (CAK)

North Canton, Ohio

Airport Master Plan Update

CHA Project Number: 26152

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1 Introduction

As part the Akron-Canton Airport's (CAK or the Airport) Master Plan Update project, an evaluation was performed to determine the feasibility of implementing a Category II (CAT-II) Instrument Landing System (ILS) approach to one of the four runway ends at CAK. This would be an upgrade from the current CAT-I capabilities and would lower the approach minimums for appropriately trained and equipped aircrews. Throughout the process, coordination and consultation was made with the airport staff, the Federal Aviation Administration (FAA), the airlines, the Airline Pilot Association (ALPA), and other airport tenants and aircraft operators. Additionally, the following resources were referenced for guidance in this evaluation:

- FAA AC 150/5300-13A, *Airport Design*
- FAA AC 120-29A, *Criteria for Approval of Category I and Category II Weather Minima for Approach*
- FAA Order 6750.16D, *Siting Criteria for Instrument Landing Systems*
- FAA Order 8400.13D, *Procedures for the Evaluation and Approval of Facilities for Special Authorization Category I Operations and All Category II and III Operations*
- FAA Order 6750.24E, *Instrument Landing System and Ancillary Electronic Component Configuration and Performance Requirements*
- FAA Order JO 6850.2B, *Visual Guidance Lighting Systems*
- FAA Order 6950.2D, *Electrical Power Policy Implementation at National Airspace System Facilities*
- AC 150/5340-30G, *Design and Installation Details for Airport Visual Aids*
- AC 150/5340-1K, *Standards for Airport Markings*

The findings in this report detail the Airport's current navaid facilities and approach capability, the need for an approach system upgrade and benefits thereof, system requirements and options for achieving CAT-II minimums, preliminary cost estimates and potential funding sources.

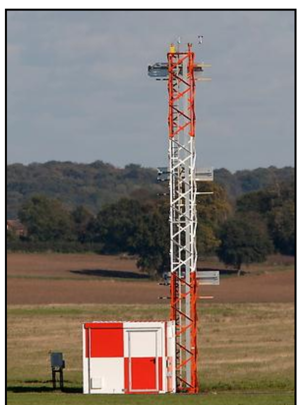
2 Precision Instrument Landing System (ILS)

Instrument navigation systems are intended to support flight operations when weather and visibility conditions are less than that needed to safely and efficiently operate using only visual guidance queues. Systems that provide pilots electronic guidance during an approach to landing can be either “precision” or “non-precision”. Non-precision systems provide horizontal guidance while precision systems provide both vertical and horizontal guidance. Achieving full capability of an ILS is dependent on the equipment installed at the airport, the approach procedures developed by the FAA, the equipment on the aircraft, and the training of the pilot.

2.1 Primary System Components

For well over 50 years, the ILS has been backbone of instrument landing navigation aids within the United States National Airspace System. The traditional ILS is comprised of ground-based transmitters that provide directional guidance to approaching aircraft that are equipped with the appropriate receivers. The two main transmitter subsystems are the localizer and the glide slope. The localizer generates and radiates signals to provide final approach azimuth navigation information to landing aircraft. Similar to localizer signal (except turned 90 degrees on axis), the glide slope sends a UHF carrier signal with the same two 90-Hz and 150-Hz sideband frequencies that aircraft instruments determine as above or below the desired glide path. These are often paired with an approach lighting system that provides additional visual guidance to the landing threshold and can support lower landing visibility minimums.

Localizer



Glideslope

Approach Lighting

2.2 Categories and Minimums

ILS systems are categorized by the approach minimums (ceiling and visibility) they are designed to support. Ceiling can also be referred to as decision height (DH), and visibility can also be expressed in terms of runway visual range (RVR). The DH is the altitude above ground level (AGL) at which the pilot must establish adequate visual reference to the landing environment (e.g. runway or approach lighting) to decide whether or not to land. RVR is measured by a ground-based transmissometer and is

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expressed in feet. It represents the horizontal distance measured at points along the runway. RVR is horizontal visual range, not slant visual range, and is used in lieu of prevailing visibility in determining minimums for a particular runway. The general correlation between RVR and visibility minimums is presented in the following table.

RVR (feet)	Visibility (statute miles)
1200	1/4 [1]
1600	1/4
1800	3/8
2400	1/2
3200	5/8
4000	3/4
4500	7/8
5000	1
6000	1 1/4

[1] applicable to helicopters
Sources: FAA Aeronautical Information Manual, FAA Order 8260.3B TERPS

Generally speaking, the higher the equipment performance (both on the ground and airborne), the lower the approach minimums can be. That is of course assuming all the other airport regulatory requirements are met (i.e. FAA design standards and airspace protection) and the pilots are adequately trained. FAA Order 8400.13D identifies the specific ground equipment requirements for each category of ILS. Under certain conditions however, the FAA Flight Technologies & Procedures Division (AFS-400) can issue "Special Authorization" (SA) Category I or II operations. The special authorization allows the same minimums as the standard approach category but identifies specific ground equipment exemptions such as alternative airfield lighting configurations and minimum sensor and equipment monitoring requirements. Additionally, special authorization approach operations with lower than standard minimums can be established for aircraft with enhanced airborne equipment and operator certifications. For example, aircraft that are equipped with "autoland" or Heads-Up Display (HUD) may be afforded lower RVR minimums than those without. The ILS categories and corresponding minimums they could support are presented in the following table.

Category (CAT)	Ceiling/DH (feet)	RVR (feet)	Notes
I	200	2400	
I	200	1800	w/ touchdown zone and centerline lighting or with autopilot, Flight Director or HUD
SA I	150	1400	w/ HUD to DH
II	100	1200	
II	100	1000	w/ autoland or HUD to touchdown
SA II	100	1200	w/ autoland or HUD to touchdown no touchdown zone, centerline or ALSF-2 lighting are required
III a	<100	700	
III b	<50	150-700	
III c	0	0	

Source: FAA Aeronautical Information Manual, FAA Order 8260.3B TERPS

2.3 Area Navigation (RNAV) versus Traditional ILS

According to the FAA, "Area Navigation" (RNAV) is a method of navigation that permits aircraft operation on any desired flight path within the coverage of ground- or space-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these."[1] In other words, RNAV essentially utilizes Global Positioning System (GPS) technology and does not rely on ground-based transmitters. Until recently, precision instrument approach capability was provided by airport-based ILS equipment. Advances in GPS technology have allowed "vertically-guided instrument approach procedures" and "ILS-like" approach capability without the need for traditional ILS installations. RNAV approach procedures that provide precision ILS performance are titled Localizer Performance with Vertical Guidance (LPV) and may have a DH as low as 200 feet with visibility minimums as low as ½ mile. These minimums are equivalent to that of a standard CAT-I ILS.

3 Instrument Approach Capability at CAK

The following describes the existing instrument approach capability and ILS facilities in operation at CAK.

3.1 Existing Approach Procedures and Minimums

Each of the four runway ends are equipped with a CAT-I ILS, which provides precision approach capabilities with a 200-foot ceiling and ½-statute mile visibility minimum – the best possible for CAT-I approaches. Aircraft and flight crews that are authorized to use advanced on-board guidance systems such as Flight Director or Autopilot or HUD to Decision Altitude have RVR minimums of 1800 (3/8 mile visibility). Precision RNAV/LPV approaches are also available to each runway end with a 200-foot

[1] FAA Aeronautical Information Manual, 7/26/12

ceiling and ½-statute mile visibility minimum – the best possible for LPV approaches. Non-precision VOR approaches are also available to Runways 5 and 23. The following table summarizes the available instrument approach procedures at CAK.

Runway End	Approach Type	Approach Method	Minimums – Ceiling (AGL) / Visibility	Notes
5	Precision	ILS	200' / ½ mile	RVR 1,800 authorized with use of Flight Director or Autopilot or HUD to Decision Altitude
		RNAV/LPV	200' / ½ mile	
	Non-Precision	VOR	500' / ½ mile	For A and B aircraft. Visibility increases for C and D aircraft.
23	Precision	ILS	200' / ½ mile	RVR 1,800 authorized with use of Flight Director or Autopilot or HUD to Decision Altitude
		RNAV/LPV	200' / ½ mile	
	Non-Precision	VOR	500' / ½ mile	For A and B aircraft. Visibility increases for C and D aircraft.
1	Precision	ILS	200' / ½ mile	RVR 1,800 authorized with use of Flight Director or Autopilot or HUD to Decision Altitude
		RNAV/LPV	200' / ½ mile	
19	Precision	ILS	200' / ½ mile	RVR 1,800 authorized with use of Flight Director or Autopilot or HUD to Decision Altitude
		RNAV/LPV	200' / ½ mile	

Source: Akron-Canton Airport Instrument Approach Procedure Charts, valid 19Sep2013 to 17Oct2013

3.2 Existing Facilities and ILS Equipment

The Airport has two runways. Runway 1-19 is 7,601 feet long and 150 feet wide with a 600-foot displaced threshold on the north end, and Runway 5-23 is 8,204 feet long and 150 feet wide. Both runways are marked as precision instrument runways and are equipped with High Intensity Runway Lighting (HIRL) along the edges. The Airport also has an FAA staffed Air Traffic Control Tower (ATCT) that is in operation from 6:00am to midnight daily.

All four runway ends are equipped with a Medium Intensity Approach Light Systems with Runway Alignment Indicator Lights (MALSR). A MALSR is a full-length approach lighting system beginning at the threshold of the runway and extending into the approach approximately 2,400 feet. The length of this lighting provides up to a ¼ mile visibility credit over ILS systems with lesser approach light configurations. All lights are located symmetrically about the extended runway centerline and consist of a threshold bar with 18 individual green lights, seven steady burning light bars each with five clear lights and five sequenced flashers located at the last five stations.

3.2.1 Runway 1

The Runway 1 ILS uses an 8-element, single-frequency Log Periodic Dipole (LPD) Localizer Antenna with Wilcox Mark 1f equipment. The localizer antenna array is installed on the extended runway centerline, approximately 1,701 feet north of the end of Runway 19 (2301 feet north of the Runway 19 displaced threshold) and is located outside of the extended Runway Safety Area. This location meets the current requirements of FAA Order 6750.16D – *Siting Criteria for Instrument Landing Systems*. The existing localizer shelter is located approximately 375 feet east of the localizer antenna site.

The Runway 1 ILS Glide Slope is also Wilcox Mark 1f equipment in a capture effect antenna configuration. The Glide Slope is located 420 feet west of the runway centerline and backset 1,060 feet north of the Runway 1 threshold. The published Threshold Crossing Height (TCH) for this facility is 53.4 feet with a glide slope angle of 3.00 degrees. The glide slope electronic equipment is housed in an equipment shelter located directly behind the antenna tower.

There is an existing Outer Marker located approximately 3.5 miles south of the threshold of Runway 1 that is used as the Final Approach Fix (FAF) for this approach.

3.2.2 Runway 19

The Runway 19 ILS uses an 8-element, single-frequency Log Periodic Dipole (LPD) Localizer Antenna with Wilcox Mark 1f equipment. The localizer antenna array is installed on the extended runway centerline, approximately 1,744 feet south of the Runway 1 threshold and is located outside of the extended Runway Safety Area. This location meets the current requirements of FAA Order 6750.16D – *Siting Criteria for Instrument Landing Systems*. The existing localizer shelter is located approximately 280 feet east of the localizer antenna site.

The Runway 19 ILS Glide Slope is also Wilcox Mark 1f equipment in a capture effect antenna configuration. The Glide Slope is located 404 feet west of the runway centerline and backset 975 feet south of the Runway 19 threshold. The published Threshold Crossing Height (TCH) for this facility is 52.9 feet with a glide slope angle of 3.00 degrees. The glide slope electronic equipment is housed in an equipment shelter located directly behind the antenna tower. There are currently two active taxiways (“H” and “J”) that cross through the Glide Slope Critical Area. Both taxiways are marked with ILS hold lines to help prevent potential signal interference during aircraft operations but in its current state is not a desirable situation for possible upgrade to CAT-II.

There is an existing Outer Marker located approximately 4.2 miles north of the threshold of Runway 19 that is used as the Final Approach Fix (FAF) for this approach.

3.2.3 Runway 5

The Runway 5 ILS uses a 14-element, dual-frequency Log Periodic Dipole (LPD) Localizer Antenna with Thales Mark 20A equipment. The localizer antenna array is installed on the extended runway centerline, approximately 1,010 feet northeast of the Runway 5 threshold and is located outside of the extended Runway Safety Area. This location meets the current requirements of FAA Order

6750.16D – *Siting Criteria for Instrument Landing Systems*. The existing localizer shelter is located approximately 425 feet west of the localizer antenna site.

The Runway 5 ILS Glide Slope is also dual-frequency Thales Mark 20A equipment in a capture effect antenna configuration. The Glide Slope is located 260 feet northwest of the runway centerline and backset 830 feet northeast of the Runway 5 threshold. This location meets the current requirements of FAA Order 6750.16D for Category I operations; however, it does not meet the required minimum offset distance for Category II and III approaches. That distance is at least 400 feet from runway centerline.

The published Threshold Crossing Height (TCH) for the ILS is 49.4 feet with a glide slope angle of 3.00 degrees. The glide slope electronic equipment is housed in an equipment shelter located directly behind the antenna tower.

There is existing Distance Measuring Equipment (DME) collocated with the Runway 5 Localizer shelter that is used to develop the Final Approach Fix (FAF) for this approach.

3.2.4 Runway 23

The Runway 23 ILS consists of a 14-element, dual-frequency Log Periodic Dipole (LPD) Localizer Antenna with Thales Mark 20A equipment. The localizer antenna array is installed on the extended runway centerline, approximately 1,010 feet southwest of the Runway 23 threshold and is located outside of the extended Runway Safety Area. This location meets the current requirements of FAA Order 6750.16D – *Siting Criteria for Instrument Landing Systems*. The existing localizer shelter is located approximately 410 feet east of the localizer antenna site.

The Runway 23 ILS Glide Slope is also dual-frequency Thales Mark 20A equipment in a capture effect antenna configuration. The Glide Slope is located 410 feet northwest of the runway centerline and backset 1029 feet southwest of the Runway 23 threshold. This location meets the current requirements of FAA Order 6750.16D for Category I, II and III operations; however, there an existing taxiway (“B”) crossing directly in front of the antenna within the Glide Slope Critical Area. In addition, there is a large portion of Taxiway “D” located within the Glide Slope Critical Area forward of the antenna. Both of these taxiways are marked with ILS hold lines to help prevent potential signal interference from vehicles or aircraft that pass through this area when there are approaching aircraft, however, this is also not a desirable situation for possible upgrade to CAT II because of potential signal interference.

The published Threshold Crossing Height (TCH) for this facility is 45.7 feet with a glide slope angle of 3.00 degrees. The glide slope electronic equipment is housed in an equipment shelter located directly behind the antenna tower.

There is existing Distance Measuring Equipment (DME) collocated with the Runway 5 Localizer shelter that is used to develop the Final Approach Fix (FAF) for this approach.

4 Purpose of an ILS Upgrade

In an effort to provide the highest level of airfield utility and customer service to both the airlines and traveling public, through improved airfield access during periods of inclement weather (i.e. fewer delays and diversions), the need and anticipated benefits of upgrading the instrument approach capability of CAK was evaluated.

4.1 Potential Need for ILS Upgrade

As previously described, a CAT-II ILS could support aircraft approaches with a DH as low as 100 feet and a visibility minima as low as RVR 1200 (or ¼ mile). That is 100 feet lower and 1/8 mile better than current minimums. Historical weather data recorded by the Automated Surface Observation System (ASOS) at CAK was evaluated to determine how often weather conditions occur at the Airport within the various ILS category thresholds. As summarized in the following table, out of 82,953 recorded weather observations between 2000 and 2009, there were 773 observations during conditions below the existing CAT-I minimums at CAK. This indicates that the existing ILS systems can facilitate landings approximately 99% of the time at CAK. However, during weather conditions that occur approximately 1.0% of the year, the Airport is essentially closed to aviation traffic. A CAT-II ILS could keep the Airport open, to appropriately trained flight crews and certified aircraft, for an additional 0.7% of the year (or approximately 61 hours). The months of February, March, November and December had the most IFR observations which are most likely due to snow or early spring fog. During these periods, the weather data also indicates that wind speed is not a major factor during IFR conditions as most observations were made with wind speeds less than 10 knots.

Weather Condition	Criteria	Number of Recorded Observations	Percentage of Occurrence
All Weather *(Total Observations)*	All ceiling and visibility weather conditions	82,953	100%
Visual Meteorological Conditions (VMC)	Ceiling ≥ 1,000’ and visibility ≥ 3 miles	72,678	87.6%
Instrument Meteorological Conditions (IMC) *Non-Precision and ILS Category I*	Ceiling ≥ 200’ and < 1,000’ and Visibility ≥ ½ mile and < 3 miles	9,502	11.5%
IMC *ILS Category II*	Ceiling ≥ 100’ and < 200’ and Visibility ≥ ¼ mile and < ½ mile	558	0.7%
IMC *ILS Category III*	Ceiling < 100’ and Visibility < ¼ mile	215	0.3%

Source: NOAA, National Climate Center, Station 72521 (2000-2009)
VMC: Visual Meteorological Conditions, Visual Flight Rules (VFR) apply
IMC: Instrument Meteorological Conditions, Instrument Flight Rules (IFR) apply

4.2 Benefits of an ILS Upgrade

A CAT-II ILS could lower the approach visibility minimums and accommodate a greater percentage of landings in poor weather conditions. As of July 2013, the FAA has published 181 CAT II approach procedures. According to the FAA, some of the airports with these procedures have reported upwards of 150 arrival operations saved per year. These operational “saves” can result in numerous benefits extended to the aviation community and its users.

4.2.1 Airlines

Though vital to air transportation as a whole, safety and efficiency are two main factors that airlines constantly strive to improve. They are challenged to adhere to an extremely rigid schedule of operations that can be disrupted by the slightest setback. Their customer base is comprised of thousands of passengers that expect the air carrier network to achieve perpetual on-time performance. All of this must be accomplished while observing the strict but necessary safety policies and regulations established by the FAA.

With lowered CAT II weather minimums, airlines could conduct operations with fewer delays and diversions, thus improving safety, efficiency and on-time performance. This in turn would reduce operational costs incurred by the airlines. While there are many factors to measure airline performance, generally speaking, passengers are most satisfied when they arrive at their destination securely and on time. A satisfied passenger is more likely to utilize that airline again which in turn can increase demand on those airports that can effectively support safe and efficient operations on a year-round basis.

Based on discussions with airline personnel, there are differing opinions on the need and potential benefits of upgrading the ILS at CAK. The variance is dependent on the airline’s equipment, connecting route structure and overall business model. Some believe it could support expanded route development and reduce diversions and others would prefer to see capital investment in other features of the Airport like ticketing lobby and covered automobile parking. It is understood the CRJs and A319/320s within Delta Airline’s fleet are equipped for CAT-II operations but the DC9s are not. All of Southwest Airline’s fleet and crew are capable of CAT-II operations. The CRJs within US Airways’ fleet are currently not equipped for CAT-II operations.

4.2.2 General Aviation and Corporate Operators

General aviation (GA) includes a variety of aircraft and operator types including personal and business flyers, flight training, corporate flight departments, and charter and air-taxi operations. All of which much still maintain high levels of operational safety. While not as rigorously monitored as the airlines, the business and corporate operators also tend to have demanding flight schedules and their business success relies on accessibility and on-time arrivals. Many GA operators are equipped to fly CAT I approaches, but due to the requirements for sophisticated avionics equipment and extra pilot training, it has historically been less common for GA operators to have authorization to fly CAT II approaches. However, advances in avionics technology have made it easier to obtain the necessary CAT II equipment which increases the likelihood of more corporate operators flying CAT II approaches in the future. As the Airport, and nation as a whole, are anticipated to experience growth in corporate type traffic, thus increasing the potential of operations in poor weather conditions, a CAT II approach could prove advantageous.

4.2.3 Air Traffic Control

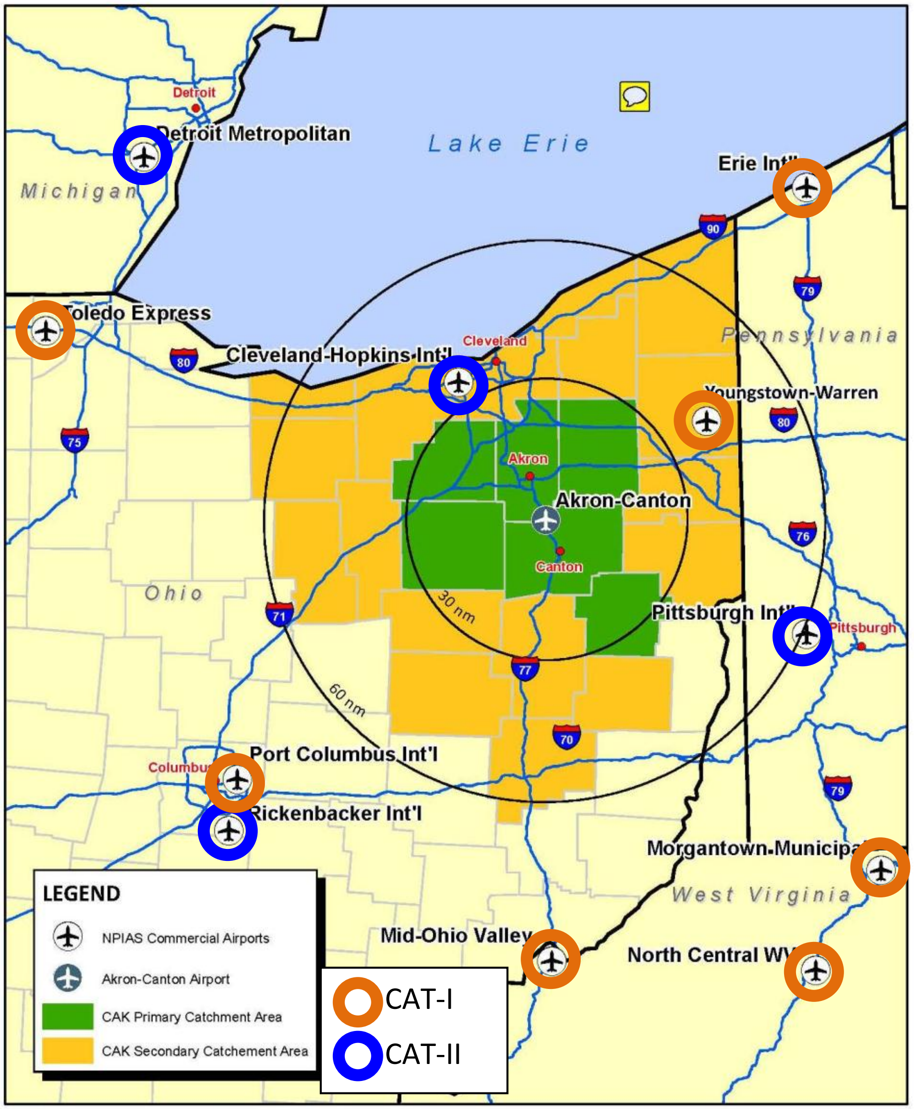
Based on discussions with air traffic control (ATC) personnel at CAK, increasing the level of safety for any flight operations is favorable. While lowering the approach minimums with a CAT-II ILS could enable a broader mix of aircraft flying into CAK, it would also increase workload and training requirements for the ATC staff. Overall, improved approach capability would be welcomed, but considering the current approach capability and weather conditions described previously, there does not appear to an overwhelming demand for a CAT-II upgrade from ATC's perspective.

4.2.4 Airport

CAT-II approach capability has the potential to increase the Airport's value and attract a variety of aviation users. This includes international operators, who would otherwise be reluctant to fly long hauls to an airport that has a greater chance of diversion. It could also provide increased operational flexibility to existing and prospective commercial airlines and could ultimately result in expanded route structures at CAK. A CAT-II approach would likely increase the appeal of the Airport to corporate flight departments which could in turn lead to new tenants and based aircraft. This increased market appeal could therefore contribute to increased operational revenues to the Authority and increased economic impact to the local and regional business communities.

4.2.5 Regional CAT-II Capability

While upgrading CAK to CAT-II capability would prevent diversions from CAK to other airports in the region during periods of poor weather, it would also provide a haven for aircraft being diverted from those airports with only CAT-I ILS capability. There are 11 commercial service airports within approximately 100 nautical miles of CAK. Of those, the busy Cleveland, Pittsburgh, and Detroit provide CAT-II approaches as does Rickenbacker. Commercial and corporate aircraft operating to the south of Akron would have to utilize Pittsburgh or fly past CAK to the North to find an acceptable diversion airport during CAT-II conditions. Upgrading CAK would provide operational flexibility to the air traffic controllers and all aircraft operators in the region. The following graphic depicts the regional commercial service airports and their approach capabilities.



5 Upgrading to a CAT-II ILS at CAK

As described previously, a CAT-II ILS could support aircraft approaches with a DH as low as 100 feet and a visibility minima as low as RVR 1200. These approach minimums can be achieved through one of two system variants: the Standard CAT-II ILS or the Special Authorization (SA) CAT-II ILS.

The criteria for approval of Standard and SA CAT-II approaches are found in the FAA's AC 120-29A and Order 8400.13. These policies include not only the operational and airborne system requirements but also the runway length, NAVAID equipment and airfield lighting requirements to achieve the lowest CAT II minimums for air carriers operating under Title 14 of the Code of Federal Regulations (14 CFR) part 121 or 135. These minima must be authorized through FAA-developed Operations Specifications (OpSpecs) for each individual air carrier, and may also apply to commercial operators operating under 14 CFR Part 125.

According to FAA AC 120-29A, to be eligible for CAT-II procedures, the runway must have, or be qualified for, a Part 97 CAT-I SIAP with a DH of 200 feet and a visibility minimum not more than RVR 1800. Both runways at CAK meet this requirement. The following describes the requirements for both Standard and SA CAT-II systems and evaluates the ability of CAK to meet those requirements.

5.1 Preferred Runway

Runway 5/23 has a northeast/southwest orientation, Runway 1/19 has a north/south orientation and all four runway ends are utilized for takeoff and landing (arrival and departure) operations. To identify predominate runway usage, flight operations ("radar") data was collected from the commercial operations monitoring installation that Passur Aerospace operates at Cleveland-Hopkins International Airport and that covered the CAK airspace[2]. The data sample included the months of January, April, July, and October 2012 to provide a reasonable representation of seasonal variation in activity and operating conditions. As summarized in the following table, the data indicates that Runway 23 is utilized the vast majority of time for arrivals by both turbo-prop and jet aircraft. Piston aircraft tend to utilize Runway 19 more often.

Air Carrier Jets (≥ 90 seats) and All Military Fixed-Wing	Arrivals (%)		
	Day	Night	Total
Runway 1	11	15	12
Runway 5	15	32	19
Runway 19	26	21	25
Runway 23	**48**	**32**	**44**
Total	100	100	100
Regional Jets (< 90 seats)	**Day**	**Night**	**Total**
Runway 1	16	24	17
Runway 5	12	23	14
Runway 19	29	17	27
Runway 23	**42**	**36**	**41**
Total	100	100	100
General Aviation Jets	**Day**	**Night**	**Total**
Runway 1	14	14	14
Runway 5	16	17	16
Runway 19	26	28	26
Runway 23	**45**	**41**	**44**
Total	100	100	100

[2] This data was collected as part of the concurrent Airport Master Plan Update and Part 150 Update projects and reviewed and concurred upon by Airport and ATC staff.

Turbo-Propeller Aircraft	Day	Night	Total
Runway 1	11	4	8
Runway 5	14	2	8
Runway 19	28	22	25
Runway 23	**47**	**72**	**59**
Total	100	100	100
Piston-Propeller Aircraft	**Day**	**Night**	**Total**
Runway 1	7	8	7
Runway 5	15	38	18
Runway 19	**49**	**29**	**47**
Runway 23	29	25	28
Total	100	100	100

While both runways at CAK could be developed to meet the requirements for CAT-II operations, Runway 5/23 has a longer landing length (8204 feet) and the newest ILS equipment. Runway 23 also has the highest overall utilization, as well as the highest crosswind coverage during CAT-II IFR conditions, and is therefore the most likely candidate for an enhanced approach procedure and upgrade to Category II operations.

5.2 Standard CAT-II System Requirements

Per AC 120-29A, the following are the system requirements for developing a CAT-II ILS at CAK.

5.2.1 ATCT

CAT II operations require an operational ATCT to ensure separation of airborne and ground traffic in low visibility conditions, to ensure proper protection of the localizer and glideslope critical areas, and to accomplish the required monitoring of ground equipment. CAK meets this requirement.

5.2.2 Localizer and Glide Slope

The localizer and glideslope must be dual transmitter and dual monitor systems to provide the required redundancy and integrity to support CAT-II approach and landing operations.

Runway 1/19

The current Wilcox Mark 1f ILS equipment on Runway 1/19 will not meet the appropriate integrity, continuity and reliability performance standards for a CAT-II procedure. This electronic equipment would need to be replaced with more current versions of the localizer and glide slope hardware, either Thales Mark 20A or Thales 420 ILS.

In addition, there are currently two active taxiways (“H” and “J”) that cross through the Runway 19 Glide Slope Critical Area. Although both taxiways are marked with ILS hold lines, aircraft operations crossing directly in front of the antennas would likely produce signal interference during CAT-II operations. Additional evaluation of current flight inspection recordings to confirm continuous electronic guidance to the ILS reference datum for a CAT-II approach would need to be analyzed.

Runway 5/23

The existing Thales Mark 20A ILS systems on Runway 5/23 will meet the appropriate integrity, continuity and reliability performance standards for a CAT-II procedure. Additional evaluation of current flight inspection recordings to confirm continuous electronic guidance to the ILS reference datum for a CAT-II approach would need to be analyzed to confirm that the signal performs to category tolerances.

The glide slope serving Runway 5 is located closer than 400 feet to the runway centerline. In order to move the glide slope outboard the additional 140 feet necessary to meet the siting criteria, extensive fill and grading would be required forward of the proposed antenna location and throughout the Glide Slope Critical Area.

The Runway 23 glide slope also presents several challenges for a possible CAT-II approach. Although the antenna is located more than 400 feet from runway centerline, taxiways “B” and “D” are both located in the Glide Slope Critical Area. The possibility of inadvertent operations in these areas by either vehicles or taxiing aircraft could cause significant signal degradation during CAT-II approaches.

5.2.3 Localizer Far Field Monitor (FFM)

Per FAA Order 6750.24 *Instrument Landing System and Ancillary Electronic Component Configuration and Performance Requirements*, this equipment is needed to provide remote status monitoring of the localizer signal in the runway approach area. The FFM is a useful indicator of critical area incursions and localizer antenna array problems not detected by the localizer integral monitors. A FFM is an antennae mounted sensor/ receiver located on the extended runway centerline, between 3,000 and 4,800 feet (0.5-0.8 nautical miles) prior to the threshold. None of the runways at CAK are equipped with a FFM. It appears that an FFM could be installed within the limits of airport property for any of the four runway ends. For Runway 23 this could be installed on the site of the previous ILS middle marker, northeast of I-77 and adjacent to Mayfair Road. This site is already developed and power would be readily available.

5.2.4 Backup Power

Per FAA Order 8400.13D, the localizer, glideslope, and inner marker (if operationally required) must have an FAA approved backup power source which provides an uninterrupted power supply in the event of a primary power source outage. Additionally, the backup power for the runway lighting systems must also initiate with no less than a one second delay. Per FAA Order 6950.2D, *Electrical Power Policy Implementation at National Airspace System Facilities*, the power equipment used for support of CAT-II and III operations must be capable of transferring to an alternate source within one second. The one-second transfer time can be obtained by powering the facility with the engine generator during the CAT-II conditions and using commercial power as the standby source. Should the engine generator fail, the facility load will automatically transfer back to commercial power within the required one-second transfer time. Once the CAT-II conditions have subsided, the facility would be returned to the commercial (primary) power source.

According to FAA personnel at CAK, the existing MALSRs do not have backup power and the ILS equipment has battery backup. The primary power source for these systems are direct feeds from the utility provider which are not routed through the airfield electrical vault. Typically, the battery on the Mark 20A ILS equipment is accepted by the FAA as a satisfactory backup power source. A backup engine generator would have to be installed for the upgraded runway end to power the approach lighting or two redundant primary power sources (i.e. utility providers) would need to be provided with switching through the airfield electrical vault.

According to airport personnel, backup power for the runway lighting (HIRLS, REILS) is provided from the terminal building's backup generator. To meet the one-second transfer time requirement, modifications to the existing equipment would be needed to allow the generator to function as the primary power source during IFR conditions with the ability to switch to commercial power as the backup source.

5.2.5 Approach Lighting System

All four runway ends are equipped with a Medium Intensity Approach Lighting System with Rails (MALSR). The lighting standards outlined in FAA Order JO 6850.2B, *Visual Guidance Lighting Systems* for CAT II approaches require high-intensity, 5-step systems – either ALSF-1 or ALSF-2. Since the ALSF-1 is not currently being manufactured, the ALSF-2 is the accepted high-intensity approach light system currently accepted by the FAA, and would need to replace the existing MALSR.

Additionally, runway and approach lighting systems must have standby power with a one second transfer and must be remotely monitored so that aircraft can be notified immediately if they become inoperative.

5.2.6 Touchdown Zone Lighting System

An in-pavement lighting system defining the runway touchdown zone and conforming to AC 150/5340-30G, *Design and Installation Details for Airport Visual Aids* is required for Standard CAT II operations. Neither Runway 1/19 nor Runway 5/23 currently have these lights so they would need to be installed on the proposed CAT II approach end of the runway.

5.2.7 Centerline Lighting System

AC 150/5340-30G requires an in-pavement centerline lighting system to support Standard CAT-II operations. Neither Runway 1/19 nor Runway 5/23 currently have centerline lights so they would need to be installed for the entire length of the CAT-II runway.

5.2.8 Runway Edge Lighting

AC 150/5340-30G and AC 150/5300-13A, *Airport Design* require a High-Intensity Runway Lighting System (HIRLS) that defines the lateral and longitudinal limits of the runway for Standard CAT-II operations. Both Runway 1/19 and Runway 5/23 are equipped with HIRLS.

5.2.9 Taxiway Lighting Systems

Per AC 120-29A, an FAA-approved Surface Movement Guidance and Control System (SMGCS) plan is recommended for operations below CAT-I and required for CAT-II operations below 1200 RVR. SMGCS operations facilitate low visibility takeoffs and landings and surface traffic movement by providing procedures and visual aids for taxiing aircraft between the runways and apron areas. Specific low visibility taxi routes are published on a separate SMGCS airport chart. SMGCS operations also facilitate the safety of vehicle movements that directly support aircraft operations such as aircraft rescue and fire fighting (ARFF), follow-me services, towing, and marshaling. A SMGCS system includes taxiway turnoff, stop bar, and runway guard lighting, and critical area taxiway lighting designations (as necessary) in accordance with AC 120-57, *Surface Movement Guidance and Control System* and the AC 150/5340 series defining the type and style of fixtures required. With typical CAT-II minimums of 1200 RVR, and considering the weather data previously described, a SMGCS plan and associated facility improvements for CAK would likely not be needed.

5.2.10 Runway Markings

AC 150/5300-13A and AC 150/5340-1K *Standards for Airport Markings* require all-weather precision runway markings for CAT II approach procedures. Both Runway 1/19 and Runway 5/23 meet these requirements.

5.2.11 Runway Visual Range (RVR)

Per AC 120-29A, an RVR system is required to support CAT-II instrument procedures. For Standard CAT-II procedures on runways greater than 8000 feet in length, three RVR units (touchdown, midpoint, and rollout) are required. The touchdown zone RVR report is controlling for all approach operations and the rollout RVR report provides advisory information to pilots. The midpoint RVR report, if available, provides advisory information to pilots and may be substituted for the rollout RVR report if the rollout RVR report is not available. The RVRs may also be used for determining visibility conditions for instrument departure procedures, which is particularly useful when the ATC tower cab is above a low-lying fog layer and the controllers cannot visually determine if runway visibility conditions meet the established departure minimums.

Both Runway 1/19 and Runway 5/23 are equipped with two RVRs located at each glide slope. Runway 5/23 is 8204 feet long so an additional midpoint RVR would need to be added for CAT-II operations on this runway.

It should be noted that most US airports still have in place RVR systems which utilize transmissometers located adjacent to applicable runway to report minimum visibility in units of feet. These systems are being replaced by the newer scatter-effect RVR systems, which use infrared projectors and receivers, have low maintenance costs, eliminate the use of steel and concrete structures on the airport surface, and provide RVR readings as low as zero feet. Additionally, the touchdown RVR system must have standby power with a one second transfer in the event of a primary power source outage.

Timely reports of touchdown, midpoint, and rollout RVR values should be provided to the air traffic system (e.g., Tower, TRACON, ARTCC, as applicable) for transmission to the pilots of arriving aircraft, and to other pilots and operators for pre-flight and en-route flight planning.

5.2.12 Radar (Radio) Altimeter Height

For CAT II procedures, radar (radio) altimeter (RA) heights above the approach terrain will need to be established during the FAA's procedure design process. When a RA value above approach terrain is specified, it typically corresponds to a particular desired DH value for the intended height above the TDZ (HAT). RA heights will be provided on the FAA Form 8260.3 indicating the vertical distance at the 100/150 ft. DA(H), assuming a 19 ft. wheel to navigation reference point height (e.g., glide slope antenna height) and the terrain on runway extended centerline beneath this aircraft reference point. This is a procedural action and there are no associated facility or equipment installations required at the Airport.

5.2.13 Facility Status Remote Monitoring

Remote facility status monitoring should be provided for the following NAVAIDs or visual aids in accordance with FAA Order 6750.24 *Instrument Landing System and Ancillary Electronic Component Configuration and Performance Requirements*:

a) Glide Slope, Localizer, Localizer Far Field Monitor
b) Approach lighting system
c) Relevant electrical power sources or systems
d) Runway edge, centerline and TDZ lights
e) Critical taxiway lighting, runway guard lights, and stop bars (as applicable for SMGCS and RVR below 1200)

According to FAA personnel at CAK, the ILS systems for Runway 1/19 provide only an on/off status indication in the tower. The ILS systems for Runway 5/23 provide full status indications in the tower.

5.2.14 Facility Status Monitoring by Periodic Inspection or After Reported Failures

As per AC 120-29A, the following systems will require inspection by airport management or FAA personnel or pilot reports to determine if they are operating in accordance with the specified criteria:

a) Touchdown zone and centerline lights.
b) Runway edge lights.
c) Runway markings.
d) Runway guard lights.
e) Taxiway centerline lights.
f) Taxiway clearance bar lights.
g) Taxiway signs.

h) Taxiway markings.

Monitoring procedures should be capable of detecting when more than 10 percent of the lights are inoperative. The lighting system/configuration should be considered inoperative when more than 10 percent of the lights are not functioning. Taxiway lights and individual airport/runway lights do not have to be remotely monitored. However, when visual aid lighting systems which support CAT-II procedures are monitored by observation, the inspection interval should ensure that undetected failures of more than 10 percent of the lights, or more than two adjacent lights would be unlikely, taking into consideration lamp expected life, environmental conditions, etc. The procedure to visually verify operation of runway edge, centerline, and TDZ lights should specify that a visual inspection take place within one day prior to commencement of anticipated CAT-II operations, or at least daily for continued CAT-II operations.

5.2.15 Critical Areas

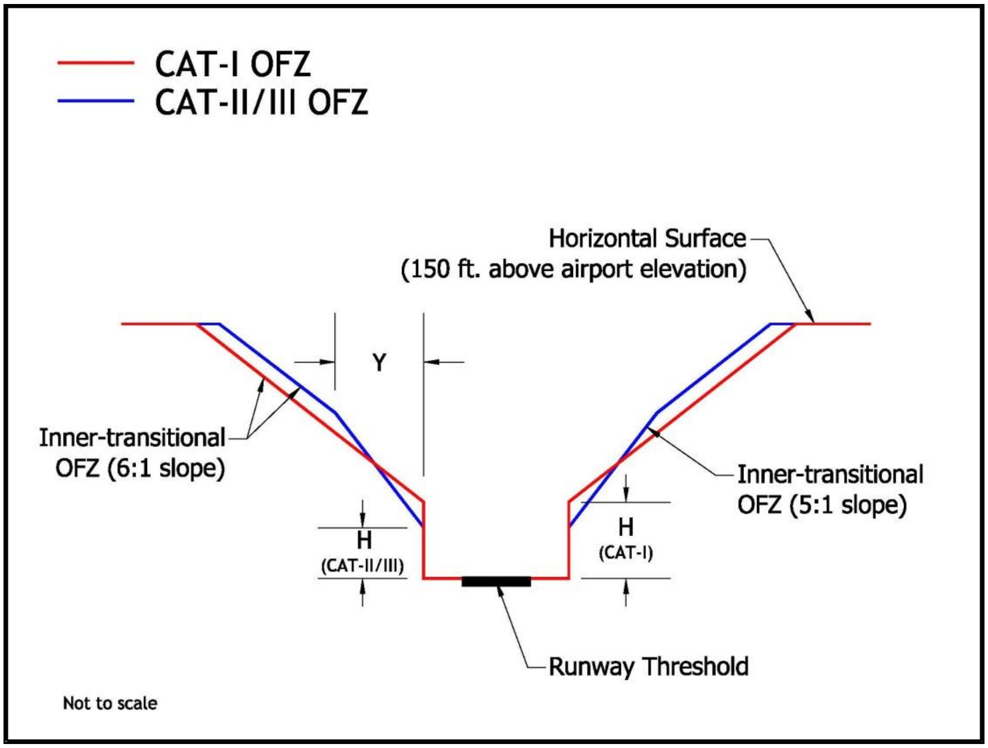
FAA Order 6750.16 specifies the localizer and glide slope critical areas that must be marked and protected from unlimited movement of vehicular and air traffic to ensure continuous integrity of the ILS signal received by approaching aircraft. AC 150/5300-13A describes that the Localizer Critical Area is essentially 400 feet wide by 2,000 feet long for a CAT-I ILS. These dimensions are the same for a CAT-II ILS as long as the size of the aircraft being served is less than 135 feet in length or 42 feet in height (i.e. A319/320, B737-800). For aircraft larger than that (i.e. B737-900, A300, B727, B747, B757, MD80), the Localizer Critical Area expands to 500 feet wide by 4,000 feet long.

NAVAID equipment critical areas for Runway 1/19 and Runway 5/23 are adequately marked for the current CAT-I and potential smaller aircraft CAT-II requirements. Cursory visual evaluation indicates that some additional marking to service roads may be required to support larger aircraft with CAT-II procedures.

5.2.16 Obstacle Clearance Criteria

Unless otherwise specified by the Director of FAA Flight Standards Service (AFS-1) the criteria found in FAA Orders 8260.3B *United States Standard for Terminal Instrument Procedures (TERPS)* and 8260.36 *Civil Utilization of Microwave Landing Systems (MLS)* should be used to establish CAT-II minimums for each new ILS, MLS, or Global Navigation Satellite System (GLS) based approach procedures. Order 8260.3B TERPS criteria may be used for previously established ILS systems. AC 120-29A contains guidance for evaluating and establishing Required Navigation Performance (RNP) procedures which are essentially similar to RNAV procedures except for the requirement of on-board navigation performance monitoring and alerting. This is an issue to be addressed by the FAA during development of the approach procedures and there are no associated facility or equipment installations required at the Airport.

Additionally, according to AC 150/5300-13A, lowering the existing approach visibility minimums to less than 200-foot ceiling and ½-mile visibility would require modification of Runway Obstacle Free Zone (OFZ) dimensions of the affected runway. The OFZ's imaginary surfaces restrict objects or structures from reaching heights that may be hazardous to aircraft utilizing the runway. The figure below illustrates the modification of OFZ dimensions to the vertical "H" and inner-transitional surfaces.



As seen above, the inner-transitional surface of the OFZ starts at the top of the vertical dimension "H". For a CAT-I OFZ, the "H" is equal *to 61 – 0.094(S) – 0.003(E)*; for a CAT-II/III OFZ, the "H" is equal to *53 - 0.13(S) – 0.0022(E)*. "S" is equal to the most demanding wingspan of the Runway Design Code (RDC) of the runway, and "E" is equal to the runway threshold elevation above sea level. Using the Boeing 737-800's wingspan (112.58 feet) and Runway 23's threshold elevation (1,225.4 feet MSL), the CAT I "H" dimension was calculated to be 46.74 feet; the CAT II/III "H" dimension was calculated to be 35.66 feet.

While a CAT-I OFZ has a single inner-transitional surface of 6:1 that extends to the horizontal surface, a CAT-II/III OFZ has two inner-transitional surfaces. The first surface has a 5:1 slope for a horizontal distance of "Y", which is equal to *440 + 1.08(S) - .024(E)*. This was calculated to be 532.18 feet. At that point, the second surface begins, extending at a 6:1 slope until it reaches the horizontal surface.

The results of this analysis indicate that a CAT-II/III ILS would place greater restrictions on object heights around Runway 5/23, so as not to penetrate the lower surfaces of the new OFZ. The heights of the existing facilities and structures at CAK are currently below these surfaces, and would not require removal or modification. Any new construction around Runway 16/34 would need to consider the greater OFZ restriction imposed by the CAT-II ILS.

5.3 Special Authorization (SA) CAT-II System Requirements

Special Authorization (SA) CAT II approaches, created and approved by the FAA Flight Technologies & Procedures Division (AFS-400) through OpSpecs, can be established only when the aircraft intended to utilize the procedure are equipped with advanced on-board navigation control systems such as autoland or Heads-Up Display (HUD). The SA CAT-II approach allows the same low minimums as Standard CAT-II (DH of 100 feet and RVR 1200), but is exempt of certain criteria or equipment required for Standard CAT-II approach operations. In order to upgrade the existing CAT-I ILS at CAK to a SA CAT-II ILS, all of the criteria for Standard CAT-II must be met with the following exceptions as contained in FAA Order 8400.13D:

a) Dual transmitter localizer and glideslope facilities are recommended, but single transmitter facilities are also acceptable. If the critical areas for single frequency systems are too large to protect, dual frequency systems are required. The Runway 5/23 ILS equipment meets the dual transmitter requirement for Standard CAT-II procedures and will satisfy the SA CAT-II requirements.

b) A Far Field Monitor (FFM) is not required.

c) MALSR (with threshold bar that is separate from runway end lights) may be used in place of the ALSF-2 infrastructure. Each of the existing MALSR lighting systems at CAK include threshold bars that are separate from the runway end lights however they are not "embedded threshold bars". The exiting MALSR systems are adequate to support SA CAT-II approaches. A backup power source (i.e. engine generator) and remote monitoring of the MALSR is not required for SA CAT-II procedures.

d) Touchdown Zone (TDZ) or Runway Centerline (RCL) lights need not necessarily be installed if the runway's lighting configuration is reviewed and approved by FAA for use by each applicable operator. The runways at CAK are currently not equipped with these systems, and though preferred, may not be required for issuance of SA CAT-II procedures. .

e) Only two RVR sensors required - Touchdown and either Midpoint or Rollout. Both runways at CAK have the necessary two RVRs and meet this requirement.

f) Remote monitoring capability is desired, but is not required. If not provided, a method to assure timely reporting of failures reported to ATS or the airport to flight crews should be established. The ILS systems for Runway 5/23 provide full status monitoring in the tower.

g) NAVAID, lighting, and marking monitoring may be authorized for each operator if a procedure is equivalent to the Standard CAT-II monitoring procedure, and is approved by FAA considering use by each applicable operator.

h) Protection of the localizer and glideslope critical areas can be provided through procedural methods, as compared to marking, as long as it can be assured that the critical areas can be suitably protected for each operator.

5.4 Comparison of Airport Requirements

The following table summarizes the previously described system requirements for both Standard and Special Authorization CAT-II approach procedures and whether or not those systems are currently in place at CAK.

Requirement for CAT-II Operations	Standard	Special Authorization	CAK
Operational ATCT	R	R	YES
Dual-Transmitter and Dual-Monitor Localizer and Glide Slope	R	NR	YES - Runway 5/23 NO - Runway 1/19
Localizer Far Field Monitor (FFM)	R	NR	NO
ALSF-2	R	NR (MALSR)	MALSR
Touchdown Zone (TDZ) Lights	R	NR	NO
Runway Centerline (RCL) Lights	R	NR	NO
High-Intensity Runway Edge Lights (HIRLS)	R	R	YES
Surface Movement Guidance and Control System Taxiway Turnoff Lighting (i.e. SMGCS)	Recommended	Recommended	NO
All-Weather Runway Markings	R	R	YES
RVRs – Touchdown, Midpoint, Rollout	3 sensors	2 sensors	2 sensors
Radar Altimeter Height	R	R	Established during procedure development
Uninterrupted Backup Power Source	R (For ILS, Approach Lights and Runway Lights)	R (For ILS and Runway Lights)	Localizers and Glideslopes have backup batteries. MALSRS - none
Facility Status Remote Monitoring	R	NR	YES – Runway 5/23
Facility Status Monitoring by Periodic Inspection or After Reported Failures	R	R	YES
Critical Areas Marked	R	May use procedural methods	Marked for CAT-I, may need modification

R – Required
NR – Not required

5.5 Airborne System and Pilot Requirements

In addition to the requirements of airport characteristics, electronic navigation aids, lighting, marking, and other systems, the aircraft itself must meet the following minimum equipment requirements for CAT-II authorization:

a) Two independent navigation receivers, or equivalent, of each type intended for use

b) A suitable Automatic Flight Control System, or manual flight guidance system, or both

c) A radar altimeter display for each pilot

d) Rain removal equipment is required for each pilot (e.g., windshield wiper, bleed air)

e) Flight instruments and annunciations which can reliably depict relevant aspects of the aircraft position relative to the approach path, attitude, altitude and speed, and aid in detecting and alerting the pilots in a timely manner to failures, abnormal lateral or vertical displacements during approach, or excessive lateral deviation

f) Unless otherwise approved by the FAA based on demonstration of acceptable pilot workload, an autothrottle system

A pilot-in-command shall not conduct CAT-II operations in any airplane until that pilot has successfully completed the certificate holder's approved CAT-II training program, and has been certified as being qualified for CAT-II operations by one of the certificate holder's check airmen properly qualified for CAT-II operations or an FAA inspector. Pilots-in-command who have not met the requirements of 14 CFR Section 121.652 shall use high minimum pilot landing minima not less than RVR 1800.

Based on discussions with airline personnel, it is understood the CRJs and A319/320s within Delta Airline's fleet are equipped for CAT-II operations but the DC9s are not. All of Southwest Airline's fleet and crew are capable of CAT-II operations. The CRJs within US Airways' fleet are currently not equipped for CAT-II operations.

6 Cost and Implementation

The ILS systems (localizer, glideslope, approach lighting, backup power) at CAK are owned and maintained by the FAA. Typically, the runway lighting systems (HIRLS, REILS, touchdown zone, centerline, backup power) are owned and maintained by the airport sponsor. Various funding sources and strategies may be available for upgrading the ILS capability at CAK. These will all be dependent on further agency coordination and concurrence of need and justification within the national airspace system.

It is assumed that no significant environmental coordination or approvals, per the requirements of the National Environmental Policy Act (NEPA), will be needed for upgrading the ILS at CAK. This is based on the understanding that any required system installations will either be upgrades to existing facilities or installations on previously developed, airport owned property. Additionally, upgrading the existing ILS to CAT-II will not alter the flight paths of approaching aircraft nor will the increased airfield access during periods of inclement weather significantly increase operational activity levels or alter the current fleet mix.

6.1 Cost of Standard CAT-II System

Derived from past project information and reasonable engineering assumptions, upgrading any of the runway ends at CAK to a Standard CAT-II system would cost approximately $8 million. The following tables are preliminary, order-of-magnitude cost estimates for upgrading each of the individual runways.

Runway 1	
Item	**Estimated Cost ($)**
Runway 1 ILS Equipment Replacement	900,000
Far Field Monitor	100,000
Runway 1 Approach Lighting System (ALSF-2) (includes removal of existing MALSR)	2,800,000
Runway 1 Touchdown Zone Lights	690,000
Runway 1-19 Centerline Lighting	610,000
Taxiway Turnoff Lighting	450,000
Additional Runway Visual Range (Midpoint)	350,000
Control Cable loop for Runway 1-19 Navaids	700,000
Professional Engineering and FAA Reimbursable Services (including flight inspection)	1,000,000
Modifications to Runway Lighting Backup Generator	100,000
Total Estimated Cost	**$7,700,000**

Runway 19	
Item	**Estimated Cost ($)**
Runway 19 ILS Equipment Replacement	900,000
Far Field Monitor	100,000
Runway 19 Approach Lighting System (ALSF-2) (includes removal of existing MALSR)	3,000,000
Runway 19 Touchdown Zone Lights	690,000
Runway 1-19 Centerline Lighting	610,000
Taxiway Turnoff Lighting	450,000
Additional Runway Visual Range (Midpoint)	350,000
Control Cable loop for Runway 1-19 Navaids	700,000
Professional Engineering and FAA Reimbursable Services (including flight inspection)	1,000,000
Modifications to Runway Lighting Backup Generator	100,000
Total Estimated Cost	**$7,900,000**

Runway 5	
Item	**Estimated Cost ($)**
Runway 5 ILS Equipment Upgrade, Relocation of Glide Slope,	1,300,000
Far Field Monitor	120,000
Runway 5 Approach Lighting System (ALSF-2) (includes removal of existing MALSR)	3,200,000
Runway 5 Touchdown Zone Lights	690,000
Runway 5-23 Centerline Lighting	640,000
Taxiway Turnoff Lighting	450,000
Additional Runway Visual Range (Midpoint)	350,000
Control Cable loop for Runway 5-23 Navaids	700,000
Professional Engineering and FAA Reimbursable Services (including flight inspection)	1,000,000
Modifications to Runway Lighting Backup Generator	100,000
Total Estimated Cost	**$8,550,000**

Runway 23	
Item	**Estimated Cost ($)**
Runway 23 ILS Equipment Upgrade	$210,000
Far Field Monitor	$90,000
Runway 23 Approach Lighting System (ALSF-2) (includes removal of existing MALSR)	$3,500,000
Runway 23 Touchdown Zone Lights	$690,000
Runway 5-23 Centerline Lighting	$640,000
Taxiway Turnoff Lighting	$450,000
Additional Runway Visual Range (Midpoint)	$350,000
Control Cable loop for Runway 5-23 Navaids	$700,000
Professional Engineering and FAA Reimbursable Services (including flight inspection)	$1,000,000
Replacement Runway Lighting Backup Generator	$100,000
Total Estimated Cost	**$7,730,000**

6.2 Cost of Special Authorization CAT-II System

The following is a preliminary, order-of-magnitude cost estimate for upgrading either end of Runway 5/23 to accommodate Special Authorization CAT-II approach capability. Upgrading either end of Runway 1/19 would incur additional costs for either modification or replacement of the localizer and glideslope and to provide backup power to the MALSR.

Runway 5 or Runway 23	
Item	**Cost ($)**
Miscellaneous Equipment, Software, Marking and Tower Modifications	125,000
Modifications to Runway Lighting Backup Generator	100,000
Professional Engineering and FAA Reimbursable Services (including flight inspection)	100,000
Total Estimated Cost	**$325,000**

6.3 Potential Funding

With an approximate $8 million cost, providing Standard Cat-II approach capability would be a substantial investment. The Authority and FAA would have to be confident that the benefits to the traveling public, aircraft operators, air traffic control and regional communities justify such investment. Developing Special Authorization CAT-II approach capability would require much less financial investment however the operational benefits would only be available to those operators with advanced airborne navigation systems and training (i.e. autoland or HUD to touchdown). Assuming that an ILS upgrade is supported by the stakeholders, there are three basic program funding scenarios. With Runway 23 being the most probably candidate, budget estimates for improving that runway end were used in the following funding distributions.

<u>Standard CAT-II: FAA Facilities and Equipment (F&E) Program</u>

The first scenario, and best from the Authority's perspective, is contingent on the highest level of FAA support where the agency would design, procure, install and then operate and maintain the majority of the project through their F&E program. Some components of the overall project (i.e. runway lighting equipment) would not be eligible for the F&E program and would be designed and funded by the Authority through a combination of Airport Improvement Program (AIP) funds (either entitlement or discretionary) and Authority funds (PFC, capital outlay, financing). A potential budget distribution is provided in the following table.

Runway 23				
Item	**Estimated Cost ($)**	**FAA F&E**	**FAA AIP**	**Authority**
ILS Equipment Upgrade	210,000	210,000		
Far Field Monitor	90,000	90,000		
Approach Lighting System (ALSF-2)	3,500,000	3,500,000		
Touchdown Zone Lights	690,000		621,000	69,000
Centerline Lighting	640,000		576,000	64,000
Taxiway Turnoff Lighting	450,000		405,000	45,000
Additional Runway Visual Range (Midpoint)	350,000	350,000		
Control Cable Loop	700,000	700,000		
Professional Engineering and FAA Reimbursable Services	1,000,000	800,000	180,000	20,000
Modifications to Runway Lighting Backup Generator	100,000		90,000	10,000
Total Estimated Cost	**$7,730,000**	**$5,650,000**	**$1,872,000**	**$208,000**

Standard CAT-II: FAA Reimbursable Agreement

The second scenario also relies on a high level on FAA support however the Authority would essentially front the cost of the ILS upgrade and then turn ownership and maintenance responsibility over to the FAA. FAA's F&E division would provide design overview, purchase the equipment directly, perform quality assurance and flight inspection and then pass their costs through the Authority for reimbursement through a combination of AIP grants and Authority funds. The FAA would have to agree to take over the operation and maintenance of the equipment and benefit cost analysis may also be needed for that. A potential budget distribution is provided in the following table.

Runway 23			
Item	**Estimated Cost ($)**	**FAA AIP**	**Authority**
ILS Equipment Upgrade	210,000	189,000	21,000
Far Field Monitor	90,000	81,000	9,000
Approach Lighting System (ALSF-2)	3,500,000	3,150,000	350,000
Touchdown Zone Lights	690,000	621,000	69,000
Centerline Lighting	640,000	576,000	64,000
Taxiway Turnoff Lighting	450,000	405,000	45,000
Additional Runway Visual Range (Midpoint)	350,000	315,000	35,000
Control Cable Loop	700,000	630,000	70,000
Professional Engineering and FAA Reimbursable Services	1,000,000	900,000	100,000
Modifications to Runway Lighting Backup Generator	100,000	90,000	10,000
Total Estimated Cost	**$7,730,000**	**$6,957,000**	**$773,000**

Special Authorization (SA) CAT-II: Airport Improvement Program

Due to the comparatively minimal equipment and facility improvement requirements associated with establishing a SA CAT-II approach at CAK, this scenario would likely be pursued with a combination of AIP entitlement and Authority funds. A reimbursable agreement may still be needed to reimburse the FAA's costs associated with plan review, quality assurance and flight inspection. A potential budget distribution is provided in the following table.

Runway 23			
Item	**Estimated Cost ($)**	**FAA AIP**	**Authority**
Miscellaneous Equipment, Software, Marking and Tower Modifications	125,000	112,500	12,500
Modifications to Runway Lighting Backup Generator	100,000	90,000	10,000
Professional Engineering and FAA Reimbursable Services (including flight inspection)	100,000	90,000	10,000
Total Estimated Cost	**$325,000**	**$292,500**	**$32,500**

6.4 Implementation Process

Developing instrument approach capability, even at an airport with established instrument procedures, is a complex, multi-disciplinary effort requiring the collaboration of many organizations within the FAA. The overall process can take several years before a procedure is published for use. At this point, assuming no significant issues or constraints arise, it is believed that it could take three and a half to four years to implement a Standard CAT-II approach at CAK and two and a half to three years to implement a Special Authorization CAT-II procedure. The process for both Standard and Special Authorization systems can be divided into the following three main efforts:

<u>Program Development</u>

This includes identifying the purpose, need and benefits of the proposed approach improvements through user collaboration, feasibility studies (such as this) or master planning efforts. Building consensus between the stakeholders and FAA would be essential and justification of the investment may also require a detailed Benefit-Cost Analysis (especially for the level of costs associated with a Standard CAT-II system). Revisions to the Airport Layout Plan (ALP) would likely be needed and funds would need to be programmed in the Authority's budget and Airport Capital Improvement Program (ACIP). Programming of FAA grant funds within the AIP program, and any FAA Reimbursable Agreements would also need to be established. It's difficult to quantify how long these coordination efforts could take, but assuming a reasonable level of existing stakeholder and agency desire for the ILS upgrade, it could take one to two years before the system and procedure could begin.

<u>System/Site Design and Construction</u>

With the agency agreements and funding vehicles in place, design of the physical navaid systems and needed site improvements could begin. Depending on which strategy in Section 6.3 is pursued, the design would either be managed by the Authority with FAA participation, or the Authority and FAA F&E divisions would each manage their component of the program and coordinate the two design projects (i.e. F&E for the navaids and Authority for the runway lighting). Solicitation, bidding and procurement of the equipment and contractors would then commence, followed by site construction and installation. Design and installation of a Standard system would likely take one to one and a half years. Design and installation of the SA CAT-II equipment (particularly the backup generators), would likely take eight months to one year.

<u>Procedure Design</u> – includes flight testing and controller training

Based on current FAA workload and recent similar projects, the FAA design and publication of the actual approach procedures could take 18 months to two years. This effort however, can run somewhat concurrent with the system and site design. This is a complex process that involves several offices within the FAA organization. The FAA Central Procedures Team in Texas would take the lead on evaluating, coordinating and designing the specific approach procedures. Field or obstruction survey work may be needed, by the Authority, to confirm that site conditions are adequate for the desired approach. A final FAA flight inspection to confirm system integrity and accuracy would be needed before the procedure becomes available for public use.

7 Summary of Findings

Based on this evaluation, upgrading CAK to CAT-II ILS capability would provide benefit to many of the airport's users and stakeholders. While both runways at CAK could be developed to support CAT-II operations, Runway 5/23 has the longer landing length and newest ILS equipment and is therefore the most likely candidate for upgrade. Due to its predominate utilization for approaches by all turbine aircraft, Runway 23 would be the priority end to upgrade. It appears that the existing facilities and ILS equipment associated with Runway 23 could support SA CAT-II approach procedures with modest navaid equipment upgrades, modifications to the runway lighting backup generator and power source feeds, and minor airfield marking improvements. Development of a Standard CAT-II ILS system at CAK would also require a new approach lighting system (ALSF-2), installation of runway centerline and touchdown zone lighting, and installation of a Far Field Monitor and midpoint RVR. Either scenario would also require changes to the system monitoring procedures performed by maintenance and air traffic control personnel. Air traffic control staff would also require additional training to manage the new approach procedures.