# Appendix E-2

## Cabrillo Business Park Aircraft Impact Analysis (ACTA, Inc.)

Report No. 453-01 (Rev 1a)

# CABRILLO BUSINESS PARK
# AIRCRAFT IMPACT ANALYSIS

Prepared for
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## SUMMARY

This impact probability study was conducted to determine aircraft impact probabilities associated with eleven proposed buildings on Cabrillo Business Park near the Santa Barbara Municipal Airport. The site, approximately 92.25 acres, is located approximately 2,250 feet west of the end of the Airport runway 7-25. This study is revision to the original draft study dated Feb 2001 that considered twelve buildings, which was changed to eleven buildings for this study. The Building #3 on the original site plan has been deleted and Building #12 on the original site plan has been relocated to where the Building #3 was located, reduced in size to 73,500 square feet and made into a two-story building.

Property impact probabilities are presented as the annual probability of impacting each specified location. Return periods, another way of presenting the results, are the expected time between accidents and are a useful way of comparing the risks for different locations. The higher the return period, the lower the risk.

The probability of impact per annum was computed for each proposed building using the following equation:

$$P(I) = P(A) * P(D|A) * P(C|A) * N$$

where,

- $P(A)$ = probability of an accident per operation
- $P(D|A)$ = probability of a downrange impact given an accident
- $P(C|A)$ = probability of a crossrange impact given an accident
- $N$ = number of operations per year

The National Transportation Safety Board (NTSB) provided over 30 years of accident data for the airport, which was used to estimate aircraft accident rates specific to the airport. The Santa Barbara Municipal Airport and Aviation Systems Associates provided aircraft operations data, including the details of the airport's flight tracks and the number of annual operations of each type of aircraft on each flight track.

The potential for an aircraft accident was computed for general aviation, commuter and air carrier categories of aircraft operations. An impact area of 1 acre was used as the size of the possible impact footprint for general aviation aircraft. These impact footprints are considered relevant for the smaller aircraft that use the Santa Barbara Airport. The impact footprints for commuter aircraft, with weights ranging from 10,000 lbs to 25,000 lbs are assumed to be 2 acres. An impact area of 6 acres was used for larger transport aircraft such as Boeing 737, 757 and the BAC146. This assumption is considered relevant because the forward momentum on impact will tend to cause aircraft debris to be scattered over a wide area. An impact area of

about 10 acres was used to develop the Boeing 747 and DC10 aircraft impact footprints, which presumed similar to the expected debris footprint for a large military transport aircraft.

The computed impact probability range of all aircraft operating in Santa Barbara Airport region ranges from 4.14E-5 to 4.62E-4for the "no-runway extension" case. The impact probability range for the 800 feet extended runway case is 4.33E-5 to 4.83E-4. In other words, the potential for impacting one of the eleven proposed buildings on Cabrillo Business Park ranges from 4 chances in one hundred thousand per annum to about 5 chances in ten thousand per annum.

There is little difference in the results whether the runway is left as is, or whether it is extended 800 feet west. The maximum increase in impact probability from the no extension case is about 5%.

The annual impact probabilities for the proposed Development plan and Comparison Sites are shown in the following table.

| SITE NAME | No Runway Extension | | 800 feet Runway Extension | |
|---|---|---|---|---|
| | Maximum Annual Impact Probability | Return Period (Year) | Maximum Annual Impact Probability | Return Period (Year) |
| Cabrillo Business Park (1) | 4.62E-4 | 2,160 | 4.83E-4 | 2,070 |
| Santa Barbara Business Park (SBBC) (1) | 4.87E-4 | 2,053 | 4.98E-4 | 2,008 |
| SB County Post Office | 1.01E-3 | 990 | 1.04E-3 | 960 |
| UCSB Extension | 3.84E-4 | 2,600 | 4.02E-4 | 2,587 |
| Spectrum Microsystems | 3.88E-4 | 2,580 | 4.06E-4 | 2,463 |

(1) Based on the maximum value for the site

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## 1. INTRODUCTION

This study was conducted to calculate the probability of impact to proposed buildings on the Cabrillo Business Park from potential aircraft accidents. The site is located approximately 2,250 feet west of the end of the Santa Barbara Municipal Airport runway 7-25. This study is a revision to the original draft study dated Feb 2001 that considered twelve buildings, which was changed to eleven buildings for this study. The Building #3 on the original site plan has been deleted and Building #12 on the original site plan has been relocated to where the Building #3 was located, reduced in size to 73,500 square feet and made into a two-story building.

This analysis predicts the potential for impact on eleven proposed buildings, from aircraft operations to and from Santa Barbara Municipal Airport. All westerly arrivals, departures and touch-and-go operations, of fixed-wing aircraft were considered in this analysis. In addition, impact probabilities to the project site with an 800 foot extension of the runway westbound were also computed. The risk to building occupants was not predicted. This later risk would require analysis using building damage and casualty models. Casualty probabilities will be lower than the impact probabilities presented here.

Data provided by the National Transportation Safety Board (NTSB), References 1-3, was used to estimate aircraft accident rates. Aircraft operations data for each of flight track was provided by Aviation Systems Associates and the Santa Barbara Municipal Airport [Reference 5].

## 2. SITE LOCATION

Figure 2-1 shows the location of the Cabrillo Business Park in relation to US Highway 101 and Los Carnerios/Hollister Ave/Storke Road as well as the orientation of the site with respect to the Santa Barbara Municipal Airport. The total site is approximately 92.25 acres and is bounded by Hollister Avenue to the north, a California Fish and Game Parcel to the south, the K-Mart Shopping Center to the west, and Los Carneros to the east.

The plan proposes a maximum of 530,000 square feet of R&D building floor area and 174,600 square feet of self-storage building area, which includes a parking area for up to 2,138 vehicles parking areas.

Figures 2-2 shows the original proposed site plan that was evaluated in the original report dated February 2001. Figure 2-3 shows the revised site plan that proposes eleven new buildings.


Cabrillo
Job#: 01-453

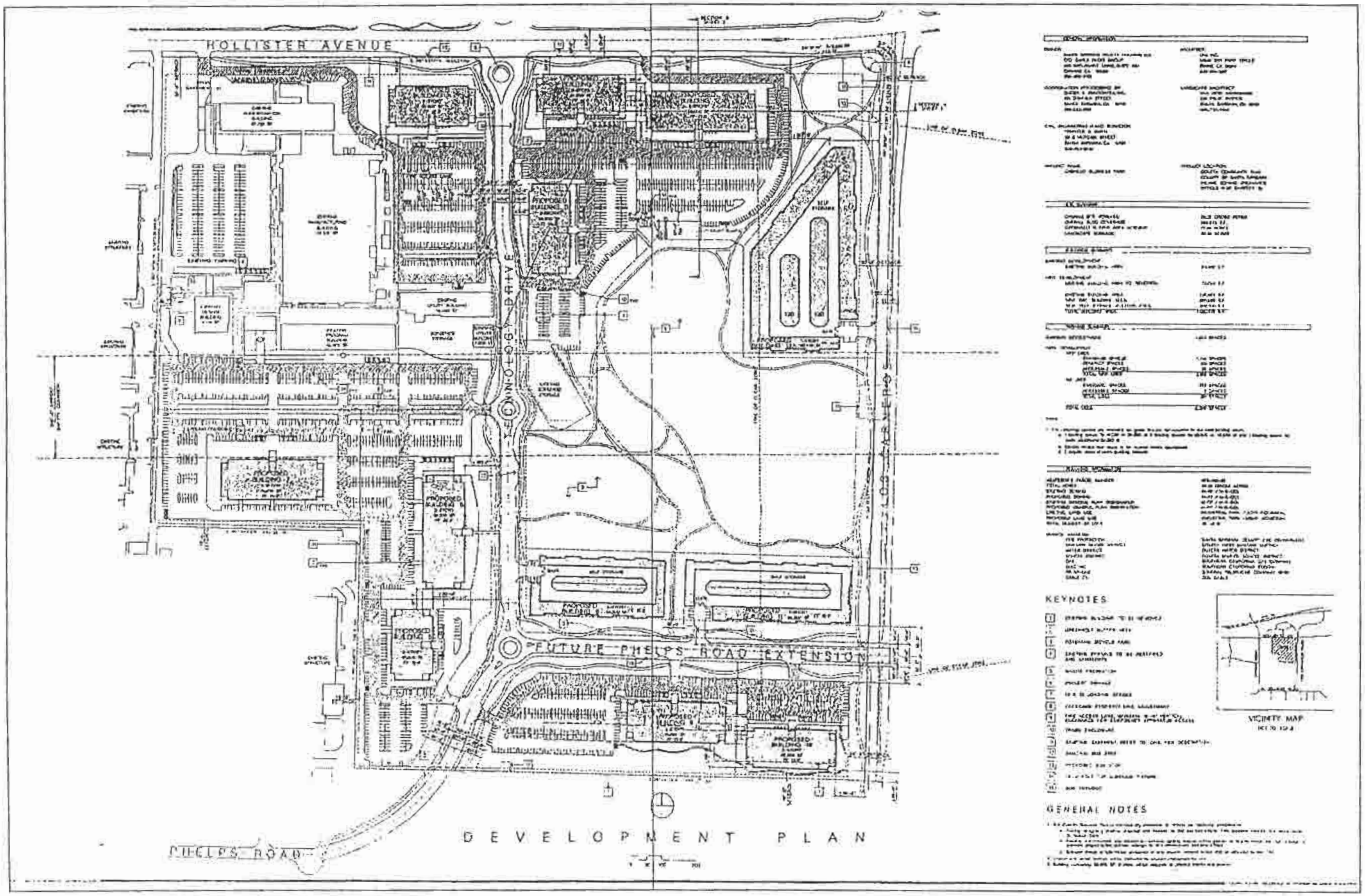



Figure 2-2. Original Cabrillo Business park Development Plan

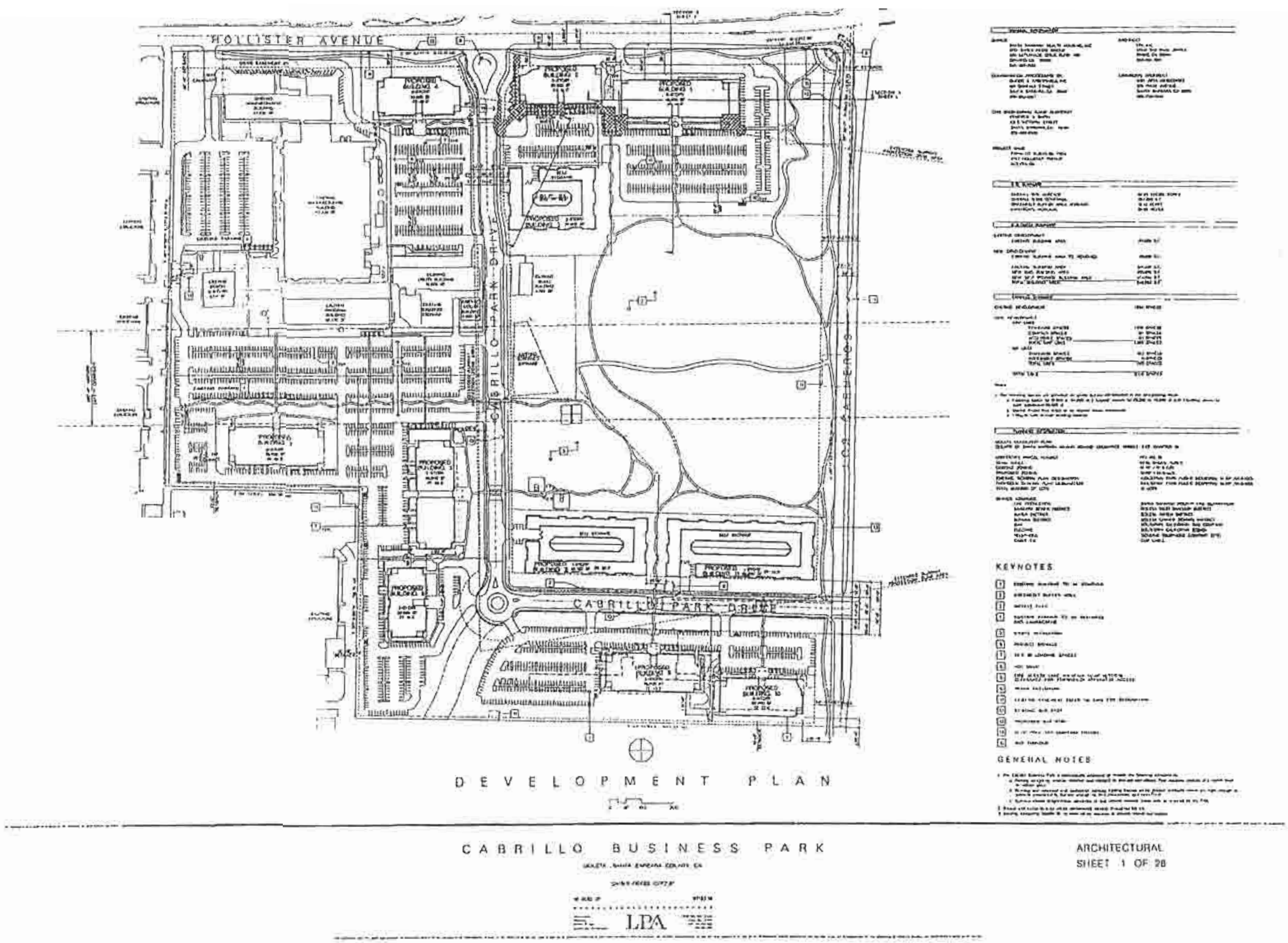



Figure 2-3. Revised Cabrillo Business Park Development Plan

## 3 SANTA BARBARA MUNICIPAL AIRPORT FLIGHT PATTERNS AND OPERATIONS

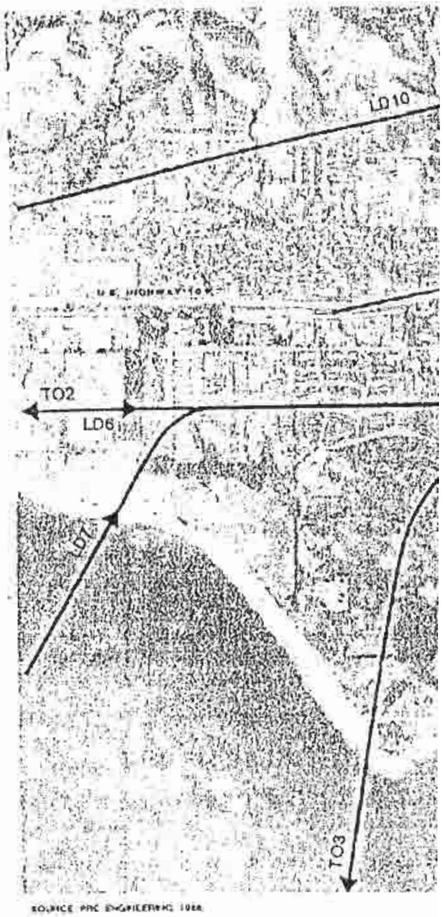
Figure 3-1 shows the flight tracks at Santa Barbara Municipal Airport. The figure also indicates the location of the proposed site in relation to these flight tracks.

Table 3-1 contains the estimated total number of annual aircraft operations for the period 1975 through 1999. These data were gathered from a draft report on Santa Barbara Airport Aviation Facilities Plan prepared by P&D Technologies, Reference 4. Operations data for the period of 1995 to 1999 were provided by Santa Barbara Airport Authority, Reference 5. Operations data for the calendar years marked with an asterisk were not available. These numbers were calculated from a linear regression of the estimated actual operations for the period covered.

Table 3-1. Santa Barbara Airport Total Operations Data of General Aviation

| CALENDAR YEAR | NUMBER OF OPERATIONS |
|---|---|
| 1975 | 159,500 |
| 1976 | 168,000 |
| 1977 | 171,000 |
| 1978 | 201,100 |
| 1979 | 194,032 |
| 1980 | 193,407 |
| 1981 | 170,948 |
| 1982 | 149,865 |
| 1983 | 167,209 |
| 1984 | 183,634 |
| 1985 | 155,177 |
| 1986* | 136,556 |
| 1987 | 134,509 |
| 1988 | 132,857 |
| 1989 | 131,355 |
| 1990 | 127,000 |
| 1991* | 132,080 |
| 1992* | 137,363 |
| 1993* | 142,858 |
| 1994* | 148,572 |
| *1995* | *167,817* |
| *1996* | *165,647* |
| *1997* | *175164* |
| *1998* | *158,922* |
| *1999* | *168,457* |
| **Total:** | **3,973,029** |

* Number of operations estimated by linear regression




Figure

Cabrillo
Job#: 01-453

Table 3-2 is the distribution of aircraft operations on the flight tracks relevant to this study for 1999. These data include the operations that would be conducted 24 hours a day.

Table 3-2. Santa Barbara Airport 1999 Annual Aircraft Operations by Selected Flight Track

| AIRCRAFT TYPE | NUMBER OF OPERATIONS ON EACH FLIGHT TRACK | | | | | | |
|---|---|---|---|---|---|---|---|
| | TO2 | LD6 | LD7 | TO3 | TG1 | TG3 | LD8 |
| B727 | | | | | | | |
| B737 | 587 | 1175 | 587 | 1175 | | | 1175 |
| DC-9 | | | | | | | |
| BAC146 | 392 | 783 | 392 | 783 | | | 783 |
| B747 | 21 | 21 | | | | | 21 |
| DC10 | 11 | 11 | | | | | 11 |
| | | | | | | | |
| J31 | 1767 | 1325 | 1325 | 1767 | | | |
| BE1 | 1767 | 1325 | 1325 | 1767 | | | |
| SWM | 1767 | 1325 | 1325 | 1767 | | | |
| EM2 | 1767 | 1325 | 1325 | 1767 | | | |
| | | | | | | | |
| SE 1-3 seats | 3600 | 900 | 900 | 3600 | 5143 | 18367 | 3600 |
| SE 4+ seats | 4886 | 1222 | 1222 | 4886 | 6980 | 27093 | 4886 |
| ME <12,000 lbs | 1799 | 482 | 482 | 1799 | 2755 | 11755 | 1928 |
| ME >12,500 lbs | | | | | | | |
| TP <12,500 lbs | 1799 | 482 | 482 | 1799 | 2755 | 12492 | 1928 |
| TP >12,500 lbs | | | | | | | |
| Tjet | 414 | 64 | 64 | 414 | | | 258 |

## 4. SANTA BARBARA MUNICIPAL AIRPORT ACCIDENT RATES

The accident history for Santa Barbara Municipal Airport, from 1975 through 1999, is presented in Table 4-1. This data was obtained from the NTSB, Reference 1. The data presented was pre-screened from the raw accident history reports to obtain the relevant accidents appropriate to this risk assessment. All the relevant accidents were in the general aviation category. There were no relevant accidents in the commuter air carrier or air taxi categories. For these later operations, US wide accident data was used.

Table 4-1. Relevant Aircraft Accidents that Occurred at Santa Barbara Airport, 1975-1999

| DATE | AIRCRAFT TYPE | DESCRIPTION | ACCIDENT TYPE/CAUSE |
|---|---|---|---|
| 10-Jul-77 | Spezio 1 | Ferry; General Aviation | Engine failure or malfunction, gear collapsed; forced landing off airport on land |
| 7-Jan-78 | Cessna 140 | 1,450 lbs | Forced landing on airport/seaplane base/heliport; engine failure or malfunction |
| 24-Sep-78 | Cessna 182M | 2,950 lbs | Collision with ground/water: uncontrolled; cause undetermined; aircraft not recovered |
| 3-Nov-78 | Cessna 170I | 2,300 lbs | Forced landing on airport/seaplane base/heliport; power plant failure for undetermined reason. |
| 13-Dec-78 | Cessna 182 | 2,950 lbs | Nose over/down; delayed action in aborting takeoff |
| 21-Jun-79 | Beech 19 | Small General Aviation | Stall; failed to obtain/maintain flying speed; |
| 13-Jan-80 | Cessna T207A | 3,800 lbs | Collided with ground/water: uncontrolled; attempted operation with known deficiencies in equipment; spatial disorientation |
| 10-Dec-80 | Beech 65-88 | 7,700 lbs; 6 seater; GA | Fire or explosion on impact to ground; lock nut on 3/8 inch adjustable 45 degree fuel line elbow loose |
| 7-May-82 | Bellanca 17-30 | 3,000 lbs | Missed approach; in flight collision with terrain; improper use of procedure, over confidence in personal ability, flight into known adverse weather |
| 8-Apr-85 | Cessna P210N | 3,800 lbs | Collision with water, loss of control; performed VFR flight into IMC, spatial disorientation |
| 23-Jul-85 | Cessna 150L | 1,600 lbs | Loss of control; in flight collision with terrain/water; poor judgment, proper airspeed not maintained |
| 5-Jun-87 | Piper PA-32-300 | 3,400 lbs | Forced landing, loss of engine power; reason for occurrence undetermined |
| 29-Dec-89 | Piper PA-28-181 | 2,400 lbs | Pilot failed to maintain adequate terrain clearance during a night visual approach and collided with a hill |
| 17-May-90 | Cessna 150H | 1,600 lbs | Presumed to have crashed into the ocean; pilot failed to maintain control of the aircraft; darkness contributed to the accident |
| 21-Oct-90 | Cessna 172M | 2,300 lbs | Pilot failed to maintain proper glidepath while on final approach and collided with an object on ground/water sun glare was a contributing factor |
| 28-Jun-91 | Mitsubishi-MN-2B-36A | 10,800 lbs; 7 seater; GA | Crashed in ocean; pilot failed to maintain directional control of the airplane after becoming spatial disorientated; darkness and low overcast conditions contributed to the accident |
| 21-Apr-91 | Beech V35B | | Aircraft landed short of the runway; loss of engine power, ran out of fuel. |
| 7-Jun-96 | Piper PA-32R-300 | | Impacted the water at a high speed and steep descent; pilot did not meet the FAA instrument flight currency requirements. |
| 20-Nov-96 | Beech 95-B55 | | Impacted trees on the west side of sloping terrain at 440' msl; no pre-impact mechanical anomaly was found that would have resulted in the accident. Pilot became spatially disoriented |
| 15-Mar-97 | Piper PA-28-140 | 2,400 lbs | Crashed 3 miles east of the airport. Pilot requested in-flight refueling; no fuel was found onboard; aircraft entered Santa Barbara's Class C airspace without authorization |
| 3-Jan-99 | Cessna 140 | 1,450 lbs | Airplane nosed over and came to rest in a marsh located near the runway; airplane was performing touch-and-go landings; engine abruptly lost power at 150 feet above ground |

The relevant accidents can be used along with the operations data of Section 3 to compute accident rates per operation for general aviation. Because it isn't possible to distiquish, in all cases, whether an accident occurred on take-off or landing, single general aviation accident rate was computed using all available data. The general aviation takeoff and landing accident rates were assumed to be the same. For a total of 3,973,029 aircraft operations in Santa Barbara Airport for the period of 1975 to 1999, there were 21 relevant accidents. Therefore, the relevant landing and take-off accident rate for general aviation yielded the following:

$$P(A)_D = P(A)_L = 5.29E\text{-}06$$

where,

$P(A)_D$ = Departure accident rate
$P(A)_L$ = Landing accident rate

There have been no commuter air carrier accidents at Santa Barbara Airport in the period covered. The following NTSB US commuter wide accident rates for 1999 (Reference 3), were used in this study:

| | |
|---|---|
| Commuter: | P(A) = 4.30E-06 |
| Large Air carrier: | P(A) = 6.50E-07 |

## 5. DISTRIBUTION OF ACCIDENTS

Accident Distributions can be described according to a downrange impact distribution and a cross-range impact distribution. These conditional distributions, and their use in the computation of impact probabilities, are defined in subsequent Section 6 of this report. The uncertainty of an aircraft's impact location relative to the runway is shown graphically in Figure 5-1. This figure indicates that the distribution of accidents is highest at locations near to the end of the runway; this is depicted by the exponential curve of Figure 5-1. In addition cross-range impact uncertainty, with respect to the runway centerline, is depicted in Figure 5-1 by the series of normal distributional curves, which indicate that uncertainty in cross-range impact location is reduced the closer an aircraft is to the end of the runway.

### 5.1 Downrange Impact Distribution

The National Transportation Safety Board (NTSB) has documented the downrange location of general aviation accidents. This data is shown in Table 5-1 for general aviation. Table 5-1 can be used to defined the distribution of downrange accidents for fixed-wing general aviation aircraft of the type operating at Santa Barbara Airport.

Figure 5-2 is a plot of the "Serious & Fatal Accidents" data of Table 5-1 ("All Accidents"). The data, plotted on exponential distribution paper, is shown as the black dots. (On-airport and traffic pattern accidents have been excluded). Several exponential probability density models of the form of equation (5-1) were used to bound the actual data.

$$f(x) = \left(\frac{1}{\lambda}\right)e^{\left(-\frac{x}{\lambda}\right)} \qquad (5\text{-}1)$$

The exponential model (which shows decreasing impact probability with increasing distance from the end of the runway) has been shown to provide a good fit to other available aircraft accident data. The most likely model for Santa Barbara Airport fixed-wing aircraft is that labeled (2) on Figure 5-2.

The probability of a downrange impact for fixed wing aircraft, given an accident, can now be computed by the following:

$$P(D|A)[a < x < b] = \int_a^b f(x)d(x) \qquad (5\text{-}2)$$

where,

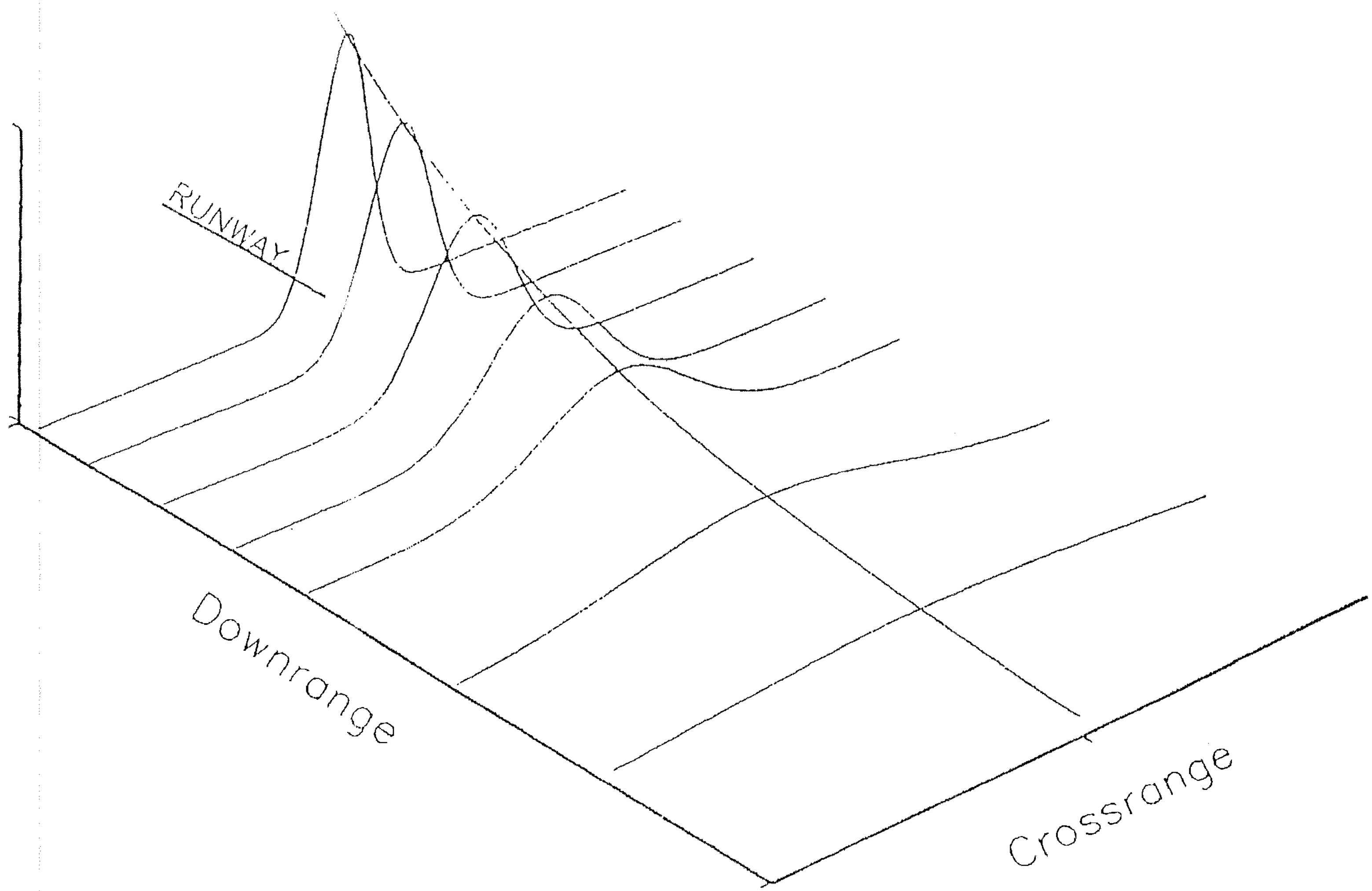



Figure 5-1. Impact Location Uncertainty

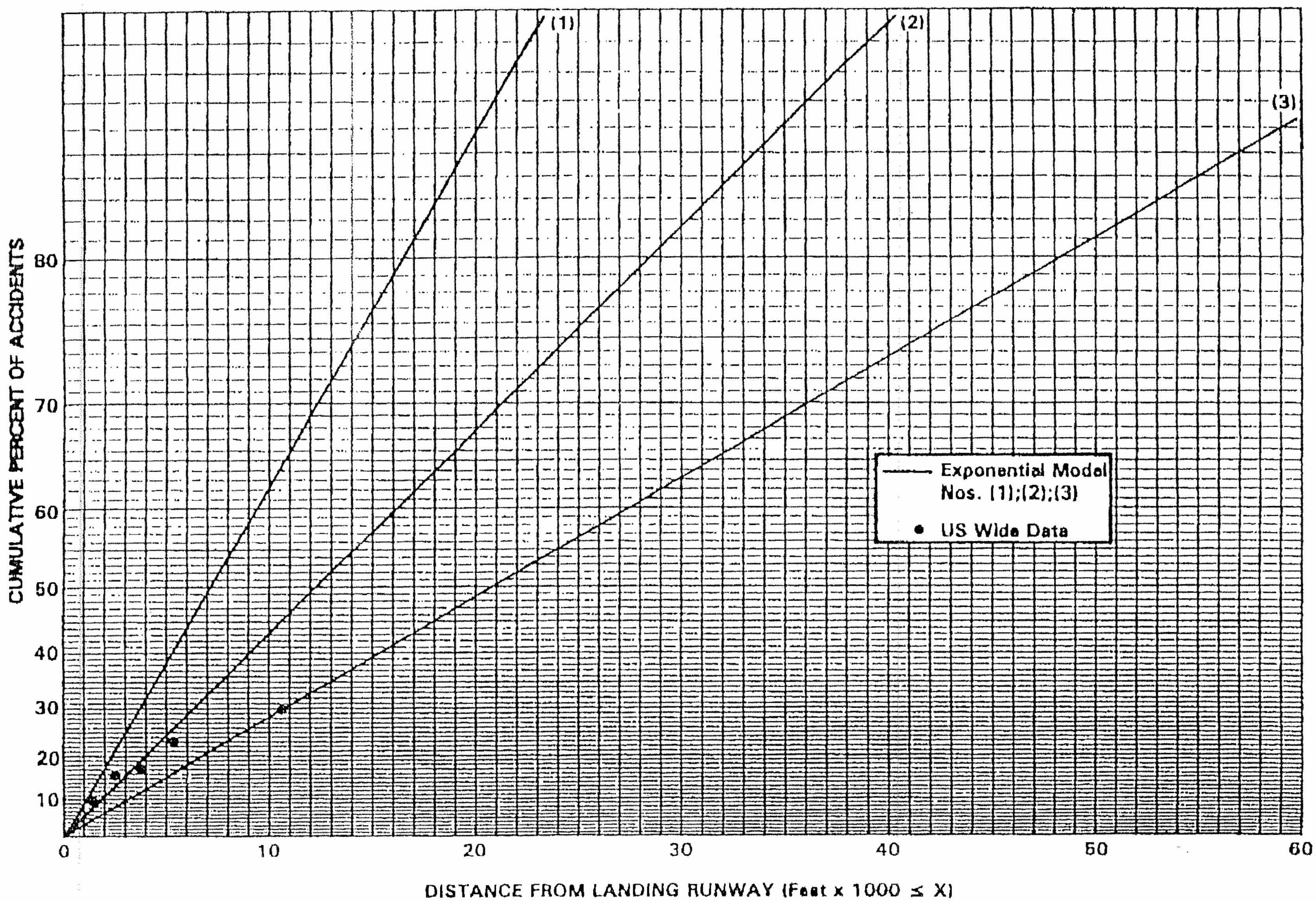



Figure 5-2. Downrange Distribution of Accidents from End of Runway (General Aviation)

$$f(x) = \left(\frac{1}{17735}\right) e^{\left(-\frac{x}{17735}\right)} \quad (5\text{-}3)$$

equation (5-3) corresponds to model (2) of Figure 5-2.

Table 5-1. Location of General Aviation Accidents (1974-1979)*
(percentage of Accidents)

| LOCATION | ACCIDENTS | | SERIOUS AND FATAL ACCIDENTS | | COLLISIONS BETWEEN AIRCRAFT | |
|---|---|---|---|---|---|---|
| | ALL ACCIDENTS | NEAR AIRPORT ACCIDENTS | ALL ACCIDENTS | NEAR AIRPORT ACCIDENTS | ALL ACCIDENTS | NEAR AIRPORT ACCIDENTS |
| On Airport | 44.8% | -- | 16.6% | -- | 54.4% | -- |
| Near Airport | | | | | | |
| - in traffic pattern | 4.2% | 28.6% | 5.8% | 26.4% | 7.8% | 56.9% |
| - within 1/4 mile | 4.9% | 33.8% | 7.2% | 32.7% | 1.9% | 13.6% |
| - within 1/2 mile | 2.7% | 18.3% | 4.4% | 19.9% | 2.2% | 15.9% |
| - within 3/4 mile | .7% | 4.5% | 1.3% | 6.1% | .9% | 6.8% |
| - within 1 mile | 2.1% | 14.8% | 3.3% | 14.9% | .9% | 6.8% |
| NEAR AIRPORT SUBTOTAL | 14.6% | 100.0% | 22.0% | 100.0% | 13.7% | 100.0% |
| Within 2 miles | 2.8% | -- | 4.9% | -- | 3.1% | -- |
| Greater than 2 miles | 32.2% | -- | 50.4% | -- | 26.2% | -- |
| Unknown | 5.6% | -- | 6.1% | -- | 2.5% | -- |
| TOTAL | 100.0% | | 100.0% | | 100.0% | |

*Source: National Transportation Safety Board, Reference 3

Note: The NTSB defines an accident as an occurrence incident to flight in which, "as a result of the operation of an aircraft, any person (occupant or non-occupant) receives fatal or serious injury or any aircraft receives substantial damage." Substantial damage means damage or structural failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Accident reports are filed for all accidents, both on and off airports.

## 5.2 Cross-range Impact Distribution

The cross-range impact distribution describes the uncertainty, in a cross-range direction, of an aircraft's flight path. The normal distribution was assumed to describe this uncertainties of actual flight paths around the idealized path. This probability distribution is illustrated in Figure 5-3. For the purpose of analysis, it was assumed that fixed-wing aircraft would impact within one quarter-of-a-mile of the nominal runway centerline as depicted for the flight tracks shown in Figure 3-1. Assuming 80% of all unsuccessful landings will impact within these limits, a normal distribution can be selected, the tails of which have an area of 10% on either side of the cross-range distribution of impacts.

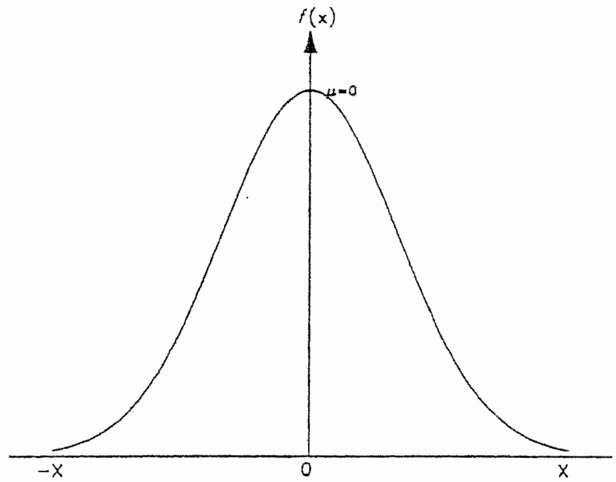



Figure 5-3. Cross-range Impact Distribution

Based on the above assumptions, the standard deviation of the cross-range distance from the nominal flight track is computed to be 515. This standard deviation will be used to compute probabilities of cross-range impact, given an accident. This is considered to be realistic for the location of the site in relation to the Santa Barbara Municipal Airport runways.

# 6. PROPERTY IMPACT PROBABILITIES

Impact probabilities can be computed based on several variables, e.g. per operation, unit of time, etc. Here, they will be computed as the probability of impact per year, the reciprocal of which is the return period. The return period is the number of years expected, on average, between impacts.

The probability of impact per year is computed for each site using the following relation:

$$P(I) = P(A) * P(D|A) * P(C|A) * N \tag{6-1}$$

where,

$P(A)$ = probability of an accident per operation
$P(D|A)$ = probability of a downrange impact given an accident
$P(C|A)$ = probability of a crossrange impact given an accident
$N$ = number of operations per year

P(D|A) is computed using equation 5-2. P(C|A) is computed using the normal distribution assumptions as outlined in Section 5.2.

## 6.1 Impact Probabilities For Each Flight Path

The proposed development plan was analyzed for impact potential from aircraft using the flight tracks described in Section 3.

Because different types of aircraft will result in varying debris footprints on impact, it was necessary to compute impact probabilities for categories of equipment. For example, debris will generally be scattered over a larger area for heavier aircraft and so the potential for building impact will be greater. In determining the impact footprint area around each building, therefore, the potential for impact from non-direct hits was included. The size of the impact footprint for different aircraft types was determined on the basis on US Air Force wide data, Reference 6, for fixed-wing aircraft.

An impact area of 1 acre was used as the size of the possible impact footprint for general aviation aircraft. These impact footprints are considered relevant for the smaller aircraft that use the Santa Barbara Airport. The impact footprints for commuter aircraft, with weight ranging from 10,000 lbs to 25,000 lbs are assumed to be 2 acres. An impact area of 6 acres was used for larger transport aircraft such as Boeing 737, 757 and the BAC146. This assumption is considered relevant by evaluating the forward momentum on impact that will tend to cause the aircraft and debris to be scattered in a wider area. An impact area of about 10 acres was used to develop the Boeing 747 and DC10 aircraft impact footprints, which is the expected debris footprint for a large military transport aircraft.

The results of the analysis, in terms of annual impact probabilities, for the project, are shown in Tables 6-1 and 6-2.

Table 6-1. Revised Annual Impact Probabilities – Proposed Cabrillo Business Park (No Runway Extension)

| Proposed Building | Description | Area | | Annual P(I) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Sq. Ft. | Acres | Aircraft < 10,000 lbs | Commuter Aircraft | 737,757, BAC146 | 747, DC10 | **Total** |
| Bldg #1 | | 80,000 | 1.82 | 5.73E-05 | 2.99E-05 | 1.30E-06 | 1.41E-08 | **8.84E-05** |
| Bldg #2 | | 60000 | 1.36 | 4.10E-05 | 2.14E-05 | 9.30E-07 | 1.01E-08 | **6.33E-05** |
| Bldg #4 | | 60000 | 1.36 | 4.17E-05 | 2.18E-05 | 9.49E-07 | 1.03E-08 | **6.45E-05** |
| Bldg #5 | | 80000 | 1.82 | 1.83E-04 | 9.53E-05 | 4.16E-06 | 4.50E-08 | **2.82E-04** |
| Bldg #6 | | 50000 | 1.14 | 5.67E-05 | 2.96E-05 | 1.29E-06 | 1.40E-08 | **8.75E-05** |
| Bldg #7 | | 70000 | 1.59 | 1.89E-04 | 9.86E-05 | 4.31E-06 | 4.66E-08 | **2.92E-04** |
| Bldg #8 | | 44300 | 1.01 | 2.50E-04 | 1.30E-04 | 5.70E-06 | 6.15E-08 | **3.86E-04** |
| Bldg #9 | | 70000 | 1.59 | 4.28E-05 | 2.23E-05 | 9.80E-07 | 1.06E-08 | **6.62E-05** |
| Bldg #10 | | 60000 | 1.36 | 2.68E-05 | 1.40E-05 | 6.13E-07 | 6.60E-09 | **4.14E-05** |
| Bldg #11 | | 55500 | 1.26 | 2.76E-04 | 1.44E-04 | 6.33E-06 | 6.81E-08 | **4.27E-04** |
| Bldg #3a | | 103000 | 2.34 | 2.99E-04 | 1.56E-04 | 6.86E-06 | 7.26E-08 | **4.62E-04** |
| Median | | | | 5.73E-05 | 2.99E-05 | 1.30E-06 | 1.41E-08 | 8.84E-05 |
| Maximum | | | | 2.99E-04 | 1.56E-04 | 6.86E-06 | 7.26E-08 | 4.62E-04 |
| Minimum | | | | 2.68E-05 | 1.40E-05 | 6.13E-07 | 6.60E-09 | 4.14E-05 |

* Based on Aircraft Accidents that Occurred at Sanata Barbara Airport, 1975 - 1999 and Associated Aircraft Operations data

Table 6-2. Revised Annual Impact Probabilities – Proposed Cabrillo Business Park (800feet Runway Extension)

| Proposed Building | Description | Area | | Annual P(I) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Sq. Ft. | Acres | Aircraft < 10,000 lbs | Commuter Aircraft | 737,757, BAC146 | 747, DC10 | **Total** |
| Bldg #1 | | 80,000 | 1.82 | 5.53E-05 | 3.12E-05 | 1.36E-06 | 1.48E-08 | **8.79E-05** |
| Bldg #2 | | 60000 | 1.36 | 4.29E-05 | 2.24E-05 | 9.73E-07 | 1.06E-08 | **6.62E-05** |
| Bldg #4 | | 60000 | 1.36 | 4.37E-05 | 2.28E-05 | 9.93E-07 | 1.08E-08 | **6.74E-05** |
| Bldg #5 | | 80000 | 1.82 | 1.91E-04 | 9.97E-05 | 4.35E-06 | 4.71E-08 | **2.95E-04** |
| Bldg #6 | | 50000 | 1.14 | 5.93E-05 | 3.09E-05 | 1.35E-06 | 1.46E-08 | **9.16E-05** |
| Bldg #7 | | 70000 | 1.59 | 1.98E-04 | 1.03E-04 | 4.51E-06 | 4.87E-08 | **3.05E-04** |
| Bldg #8 | | 44300 | 1.01 | 2.61E-04 | 1.36E-04 | 5.97E-06 | 6.44E-08 | **4.04E-04** |
| Bldg #9 | | 70000 | 1.59 | 4.48E-05 | 2.34E-05 | 1.02E-06 | 1.10E-08 | **6.92E-05** |
| Bldg #10 | | 60000 | 1.36 | 2.80E-05 | 1.46E-05 | 6.42E-07 | 6.91E-09 | **4.33E-05** |
| Bldg #11 | | 55500 | 1.26 | 2.89E-04 | 1.51E-04 | 6.62E-06 | 7.12E-08 | **4.47E-04** |
| Bldg #3a | | 103000 | 2.34 | 3.13E-04 | 1.63E-04 | 7.18E-06 | 7.59E-08 | **4.83E-04** |
| Median | | | | 5.93E-05 | 3.12E-05 | 1.36E-06 | 1.48E-08 | 9.16E-05 |
| Maximum | | | | 3.13E-04 | 1.63E-04 | 7.18E-06 | 7.59E-08 | 4.83E-04 |
| Minimum | | | | 2.80E-05 | 1.46E-05 | 6.42E-07 | 6.91E-09 | 4.33E-05 |

## 7. CONCLUSION

The computed impact probabilities for both arrivals and departures of all aircraft operating at the Santa Barbara Airport ranges from 4.14E-5 to 4.62E-4. The impact probability range for the extended runway case is 4.33E-5 to 4.83E-4. In other words, the potential for impacting one of the eleven proposed buildings on Cabrillo Business Park ranges from about 4 chances in one hundred thousand per annum to about 5 chances in ten thousand per annum. The corresponding return periods range from 2,000 to 24,000 years.

There is little difference in the results whether the runway is left as is, or whether it is extended by 800 feet west. The maximum increase in risk from the no extension case is about 5%. The reason the results vary so little is because the site is very close to the end of airport runway such that the changes in downrange and crossrange impact uncertainties for each runway length are negligible.

ACTA computed impact probabilities for other sites located close to the Santa Barbara Airport in a separate work, Reference 10. Table 7-1 shows the maximum impact probabilities and return periods for some of these sites located close to the Santa Barbara Airport. It is noteworthy that the buildings on all of these comparative sites are occupied.

Table 7.1 Maximum Impact Probabilities and Return Periods for Selected Sites Near Santa Barbara Airport

| SITE NAME | No Runway Extension | | 800 feet Runway Extension | |
|---|---|---|---|---|
| | Maximum Annual Impact Probability | Return Period (Year) | Maximum Annual Impact Probability | Return Period (Year) |
| Cabrillo Business Park (1) | 4.62-4 | 2,160 | 4.83E-4 | 2,070 |
| Santa Barbara Business Park (SBBC) (1) | 4.87E-4 | 2,053 | 4.98E-4 | 2,008 |
| SB County Post Office | 1.01E-3 | 990 | 1.04E-3 | 960 |
| UCSB Extension | 3.84E-4 | 2,600 | 4.02E-4 | 2,587 |
| Spectrum Microsystems | 3.88E-4 | 2,580 | 4.06E-4 | 2,463 |

(1) Based on maximum value for the site

## 8. REFERENCES

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