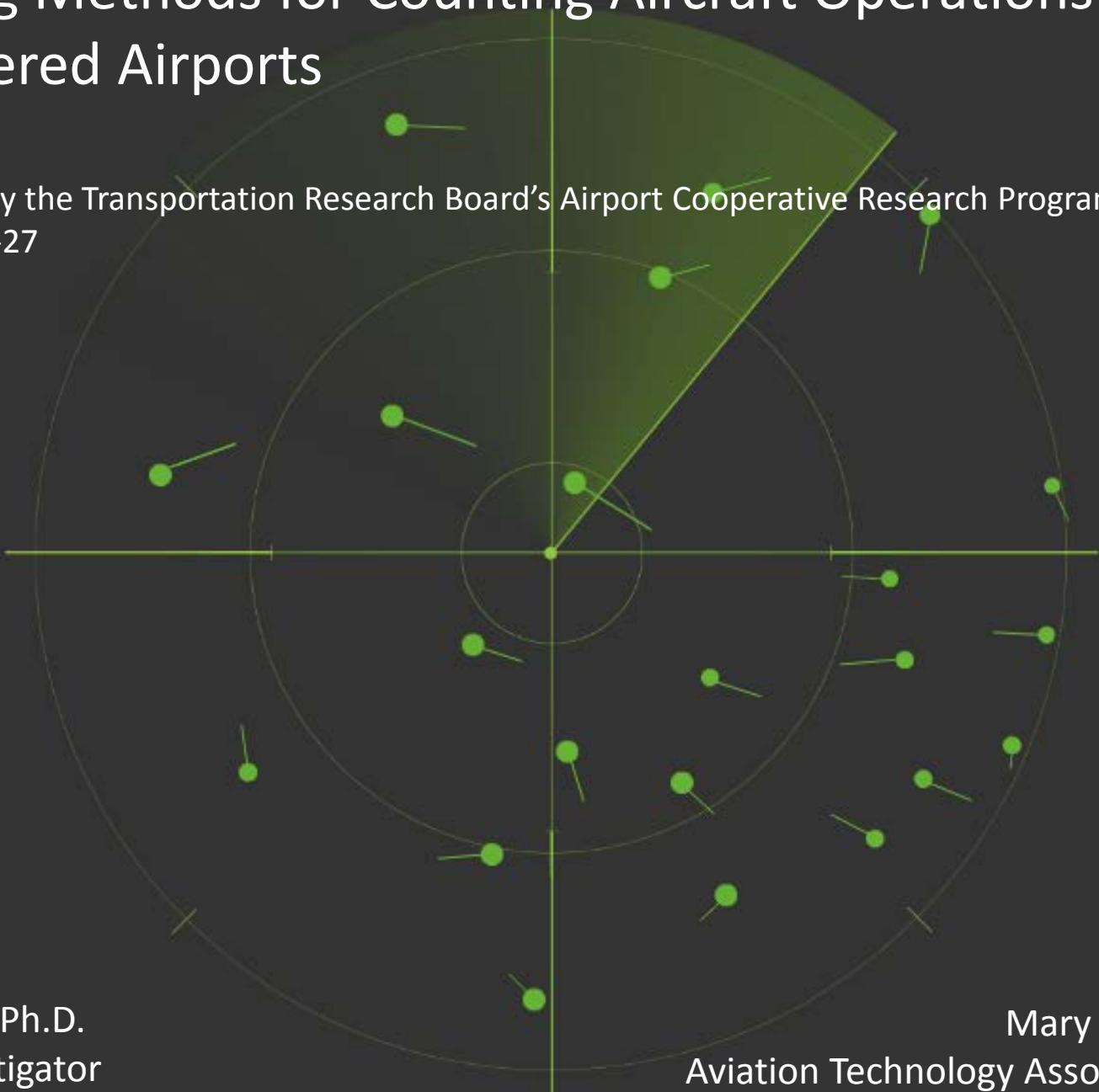# Evaluating Methods for Counting Aircraft Operations at Non-Towered Airports

Project funded by the Transportation Research Board's Airport Cooperative Research Program
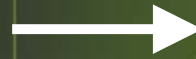Project ACRP 03-27

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Does Anyone Care about Airport Operations Estimates?

- Airports, States, FAA
- Why?

Fun Facts

- Approximately 3300 public airports in FAA system plan

- Only about 500 public airports have an air traffic control tower that tracks airport takeoffs and landings (operations)

- How much traffic occurs at those airports without towers?

INDIANA

❖ **115** Public Airports

❖ **12** with ATC Towers

❖ **3037** based single engine GA aircraft

❖ **>1.2M** GA operations each year

We Reviewed 3 Estimating Methods

1 - Multiplying the number of based aircraft by an estimated number of operations per based aircraft (OPBA)
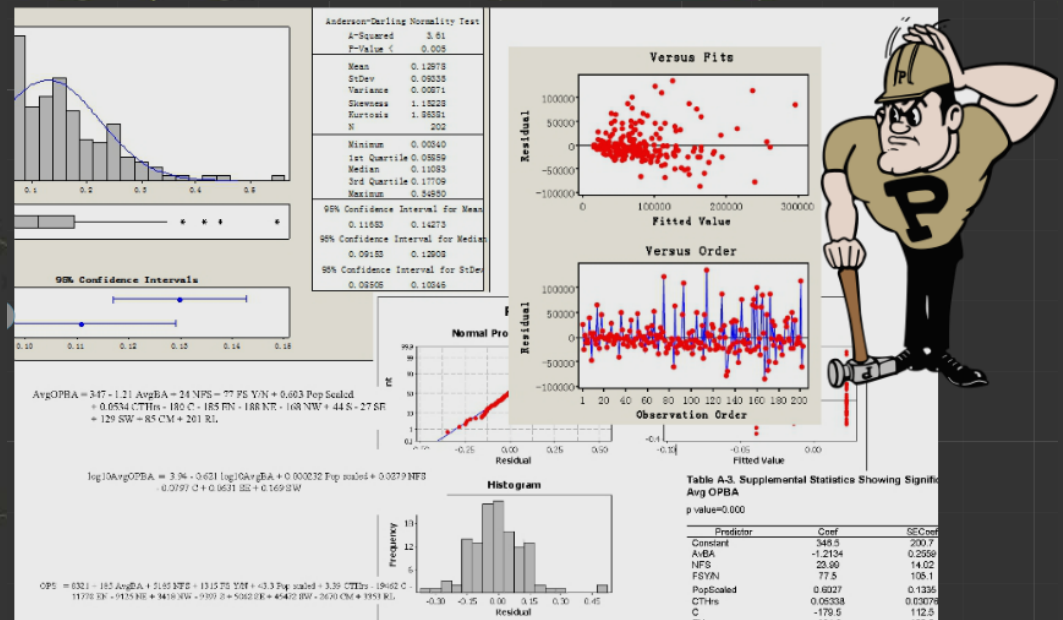
2 - Applying a ratio of FAA instrument flight plans to total operations (IFPTO)

3 - Expanding a sample count into an annual estimate through statistical extrapolation.

OPBA

- Is there a consistent number(s) of OPBA that occur at small, towered airports that can then be applied to non-towered airports? (taking into account climate, population, and flight schools)

Summary of OPBA by Region

Table A-2 Summary of Small Towered Airport Data by Region Used in this Study

NOAA Climate region	Number of airports	AvgBA per region	Avg Ops per region	AvgPop	OPBA mean	median	OPBA 95% Confidence Interval for the median	OPBA range Low	OPBA range High
Alaska	1	965.8	152,018	283,382	157.40	157.40	NA	NA	NA
Central	33	141.01	49,187	162,441	429.54	360.13	(298.02, 426.85)	201.75	1,015.54
E. N. Central	13	188.52	67,823	260,933	473.92	462.29	(266.65, 550.52)	177.42	798.85
Hawaii	1	22.80	104,224	13,689	4,771.68	4771.6	NA	NA	NA
Northeast	28	187.06	72,081	353,687	432.95	408.37	(351.95, 504.20)	225.91	828.52
Northwest	8	202.90	80,577	224,704	382.95	779.38	(264.80, 453.03)	219.87	779.38
South	41	154.19	65,312	352,947	597.89	338.00	(302.52, 522.53)	132.17	2,481.89
Southeast	38	212.66	95,457	171,804	561.74	439.42	(338.62, 572.66)	190.89	2,491.54
Southwest	15	394.01	16,802	391,318	487.23	396.66	(336.31, 646.39)	192.52	819.86
West	27	381.98	124,391	388,546	370.13	326.30	(282.28, 362.85)	139.69	875.89
W.N. Central	0	NA	NA	NA	NA	NA	NA	NA	NA
Overall	205	222.35	85,890	394,118	501.68	377.78	(350.30, 412.86)	132.17	4,471.68

Legend:
Avg = Average
BA = Based Aircraft
Ops = Operations
OPBA = Operations per Based Aircraft
NA = Not Applicable

Prepared by: Purdue University

Based on the study objectives and data -

- There were no practical and consistent OPBAs found or modeled at small, towered airports nationally or by climate region, even when considering the number of flight schools based at the airport.

- Therefore, the research team cannot recommend an OPBA or OPBA equation for estimating annual operations at non-towered airports.

IFPTO

- Is there a consistent ratio of IFR flight plans to total operations (IFPTO) that can be used to estimate operations at non-towered airports? (taking into account climate)

Sectional screenshot from www.SkyVector.com

Based on the study objectives and data -

- No practical and consistent IFPTOs found in the dataset of small towered airports nationally or by climate region.

- Cannot recommend an IFPTO for estimating annual operations at non-towered airports.

- Recommendation: take sample of actual operations and extrapolating into annual operations from the sample.

Statistical Extrapolation

Tested sample sizes and time frames of
A. One week in each season
B. Two weeks in each season
C. One month in spring, summer, or fall
D. One month in winter

Table 3A-9: Summary of the Percent Difference Between Estimates Using Monthly/Seasonal Factors and OPSNET Annual Operations

% Difference from OPSNET Annual Operations	1 Week each Season	2 Weeks each Season	1 Month Spring, Summer, or Fall	1 Month Winter
Average of real values	4%	2%	9%	2%
Average of absolute values	9%	8%	12%	13%
Highest	13%	13%	13%	53%
Lowest	-32%	-26%	-25%	-20%
Range	45%	39%	38%	73%

The two weeks in each season scenario has a combination of statistics reported that indicate preference over the others.

How to take samples?

Aircraft Traffic Counters

Different aircraft counting technologies included

1 - automated acoustical counter.

2 - sound-level meter acoustical counter,
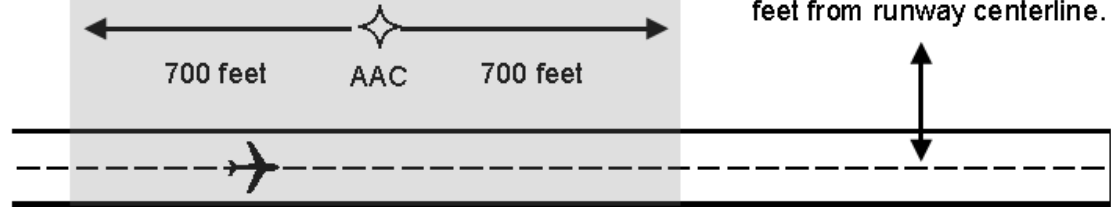
3 - security/trail cameras, and

4 - video image detection with a transponder receiver.

Tested at TYQ, I42, EYE, and LAF

AAC

Aircraft lift-off (rotation point) should be within approximately 700 feet of a point perpendicular of the counter, which may require multiple counters.
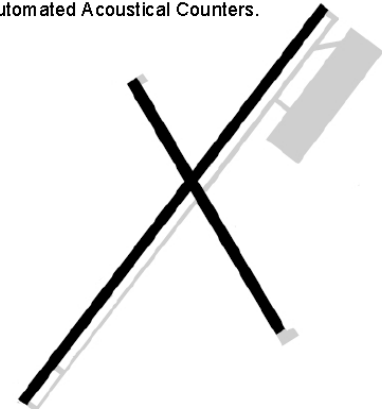
700 feet   AAC   700 feet

Counter can be as far as 250 feet from runway centerline.

Example of configuration conducive for Automated Acoustical Counters.

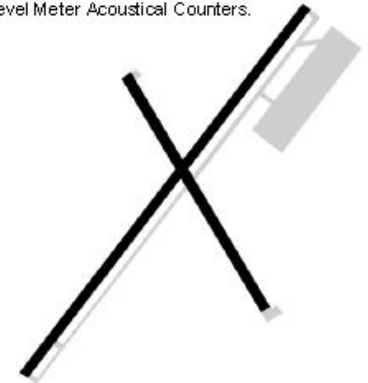Example of difficult configuration for Automated Acoustical Counters.

SMAC

Example of configuration conducive for Sound-Level Meter Acoustical Counters.

Example of difficult configuration for Sound-Level Meter Acoustical Counters.

Aircraft lift-off (rotation point) should be within approximately 700 feet of a point perpendicular of the counter, which may require multiple counters.
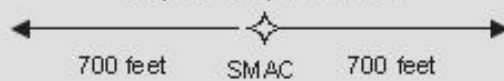
Counter can be as far as 75 feet from runway centerline.

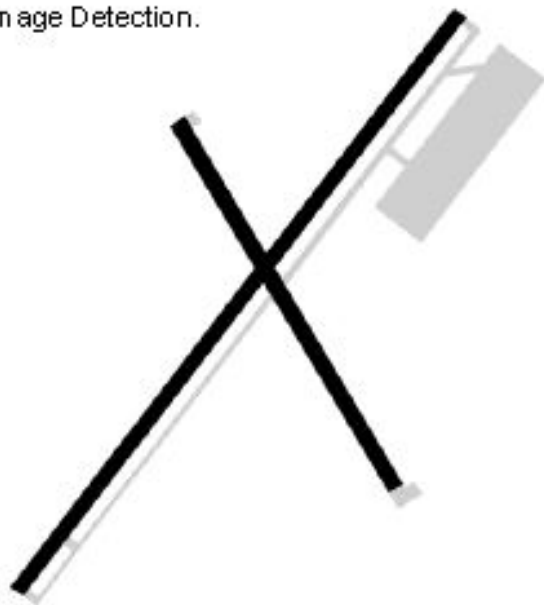700 feet   SMAC   700 feet

VID

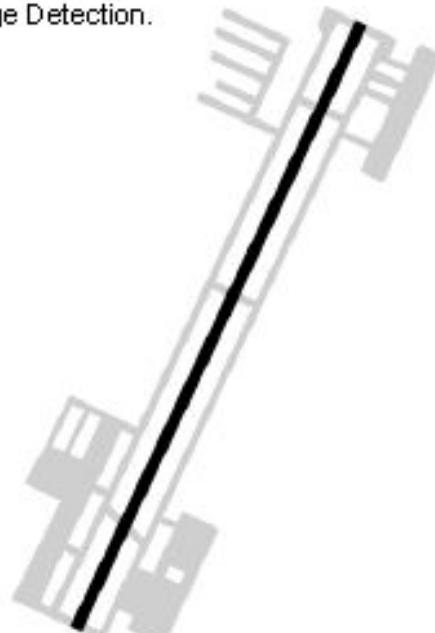## Video Image Detection and ADS-B Transponder Receiver Highlights

Best used at airports with centralized terminal and hangar area with limited access points and little touch-and-go activity.

- Accuracy levels as high as 90% were achieved for recording aircraft entering or exiting the runway environment.
- Unable to count touch-and-goes.
- ADS-B transponder receiver option adds little to no value considering the low equipage rate of the U.S. general aviation fleet with ADS-B out.
- Most expensive option.
- Least labor intensive option.
- Requires service contract.
- Can also be used for automated billing of landing fees.

Example of configuration conducive for Video Image Detection.

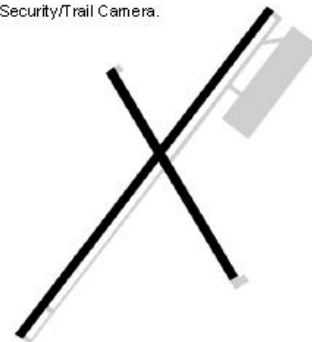Example of difficult configuration for Video Image Detection.

S/TC

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**Security/Trail Camera Highlights**

Best used at airports with centralized terminal and hangar area with limited access points and little touch-and-go activity.

- Accuracy levels approaching 100% can be achieved for recording aircraft entering or exiting the runway environment.
- Unable to count touch-and-goes.
- Exceptionally slow moving aircraft may be missed.
- As ambient temperature approaches temperature of target aircraft, target may be missed.
- Labor intensive because manual tally of images is required.
- Information on aircraft type, make, and model can be obtained from aircraft registration number.
- Low cost for airports with simple airfield configurations.
- Can also be used for detecting wildlife.

Example of configuration conducive for Security/Trail Camera.

Example of difficult configuration for Security/Trail Camera.

Prepared by: Woolpert, Inc.
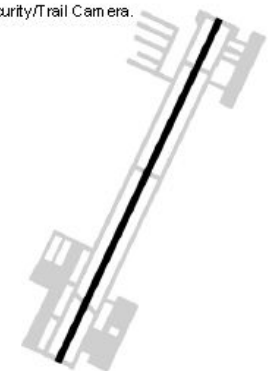
Not all images are planes

Not all birds are planes

Wildlife and planes don't mix

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