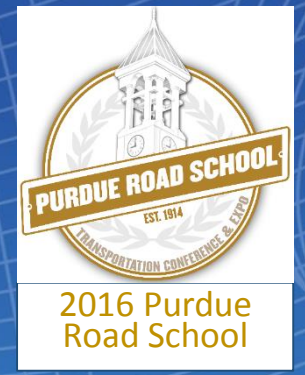
Estimating Operations and Airport-Specific Landing & Take-off Cycles at GA Airports



2016 Purdue Road School

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Facts

- The 117 public-use airports, seaplane bases and heliports in Indiana contribute over $14 billion in annual economic output.
- As of May 29, 2015, FAA policy requires the use of the new integrated model for noise, fuel burn and emissions and air quality impact analysis (AEDT 2b).
- AEDT 2b needs airport-specific information: layout, based aircraft, operations counts and LTO cycle information.
- GA airports and other non-towered airports may have limited resources to develop estimates of operations counts and LTO cycle.

Purpose

- Discuss methods for airports to use to develop more accurate estimates for use in models of exhaust and noise emissions

- The Aviation Emissions Design Tool (AEDT) uses airport information, operations counts and LTO cycle durations in its models. AEDT is the exhaust and noise emissions modeling software for FAA projects.

Overview

- Review ***operations*** estimation and sample counting methods for non-towered airports
- Discuss a method for estimating airport-specific ***LTO cycles***

Both of these inputs are needed to estimate emissions!

Evaluating Methods for Counting Aircraft Operations at Non-Towered Airports – ACRP Report 129 (2015)

by Dr. Maria J. Muia & Dr. Mary E. Johnson

- Developed estimates of annual operations based on easy to measure factors such as number of based aircraft and the ratio of instrument flight plans.
- Studied mechanisms (camera and acoustic) to get sample counts.
- Compared four different statistical methods to extrapolate sample counts to annual counts.

What are the number of total operations for this airport?

=

X **OPBA**

=

Instrument flight plans / Total Operations

Others factors such as region, population, and number of flight schools were considered

Operations counting methods for non-towered airports

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.

Operations counting methods for non-towered airports

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

Previous Work Review

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%

ACRP Report 129, 2015.

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

Estimating Methods Rely on Sample Counts of Operations

- Methods studied in ACRP Report 129.
  - Automated acoustical counter
  - Sound-level meter
  - Security/trail cameras
  - Video image detection with a transponder receiver

- These methods require post-processing of the counts to get an accurate count.

- Selection of the technology depends on air field layout, fleet mix, budget and other factors.

Overview

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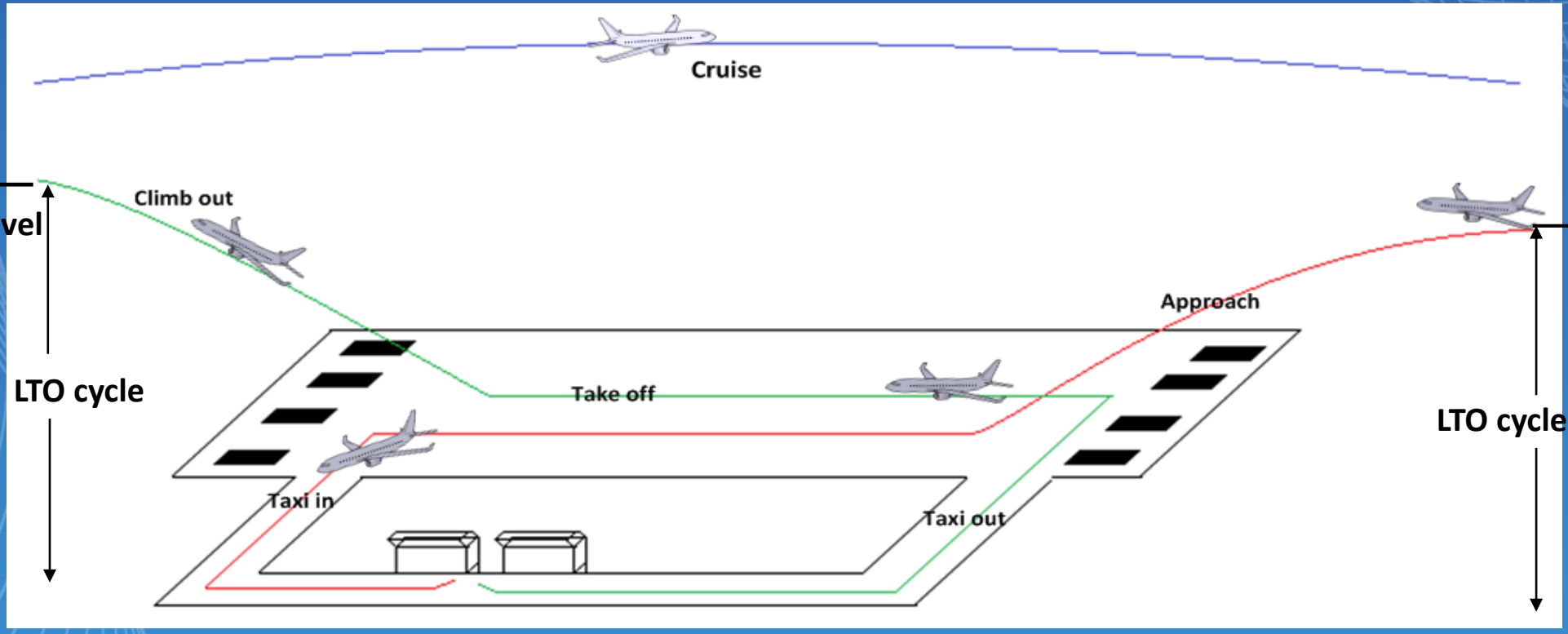
Landing and Take-off Cycles at GA Airports

What is an LTO?



Each LTO = Taxi out + Take-off + Climb-out + Approach + Taxi in

One operation is either a take-off or a landing.

AEDT uses the LTO and cruise in emissions estimates.

Landing and Take-off Cycles at GA Airports

Why is LTO important?

Add a runway?

Runway expansion?

Needed to develop emissions estimates for airports
Used to allocate resources and projects to airports

To tower or not to tower?

Is my exhaust too loud?

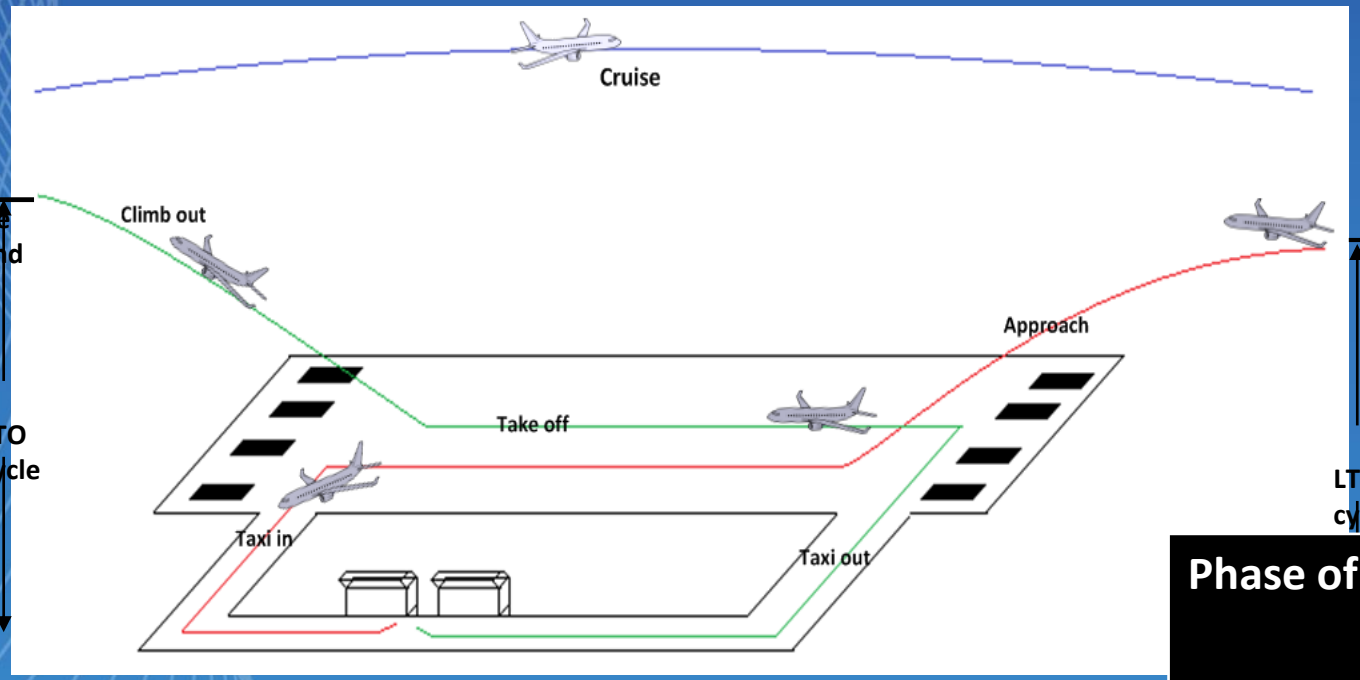
Upgrade terminal or hangars?

Taxiway expansion?

Landing and take-off procedure ok?

Landing and Take-off Cycles at GA Airports

Is LTO for GA airports the same as for commercial airports?



ICAO reference LTO cycle

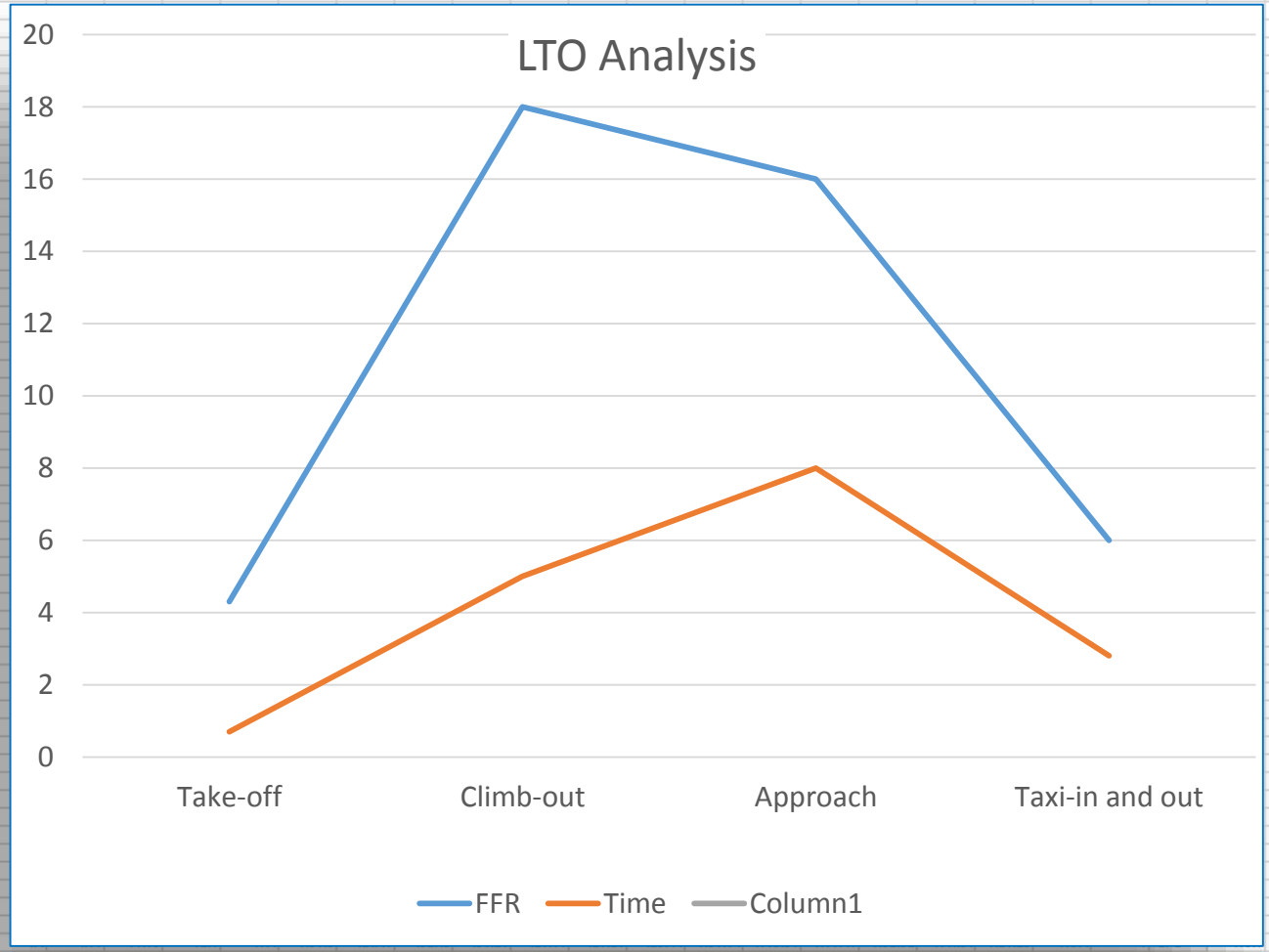
Phase of Flight	Thrust Setting (% of maximum sea level static power)	Duration (min)
Take off	100%	0.7
Climb out	85%	2.2
Approach	30%	4.0
Taxi/Idle	7%	26.0

Is this LTO accurate?

What is the LTO cycle for your airport?

Develop Better Estimates of LTO Parameters by Analyzing Flight Data

FDM System Data



Manual → Automated Phase Breaks → Automated Phase and Parameter Estimates → General Model for ANY Airport

Landing and Take-off Cycles at GA Airports

Developed and tested a software program to do automated analysis of FDM data from GA piston-engine aircraft at one Indiana airport identified

- **Duration of each phase of flight (DUR)**
- **Average fuel flow rate in each phase of flight (FFR)**

Found Statistically Significant Results

***NEXT*: Expand the number of airports and aircraft types in the study to develop a general model**

Questions?