

TORONTO PEARSON FLIGHT PATHS

CONCEPTS FOR NOISE MITIGATION



Concepts for Study
Summer 2015

MITIGATION INITIATIVES



Airspace Change Communications and Consultation Protocol

A voluntary protocol of the aviation industry
June 2015

- NAV CANADA and the Canadian Airports Council have published an Airspace Change Consultation and Communication Protocol
- This document outlines how public consultation will occur when specific airspace changes are proposed
- This process will be followed when firm proposals for specific change exist

NAV CANADA

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NEXT STEPS





NOISE MITIGATION IDEAS







- ✈️ GTAA & NAV CANADA responsible for safe and orderly flow of air traffic
- ✈️ Factors affecting flight path options:
 - Geography – Runway location, residential & industrial Areas
 - Airspace Constraints – Other Airports, FAA airspace
 - Regulatory Framework – Noise Abatement Procedures, procedure design, aircraft ops limits
 - ATC Rules & Standards – wake turbulence, separation
 - Traffic Volume
 - 15th busiest airport by movements
 - 13th busiest airport by passengers
 - Traffic Mix – 18 seat Turboprops to 500 seat Jets



OTHER CONSIDERATIONS

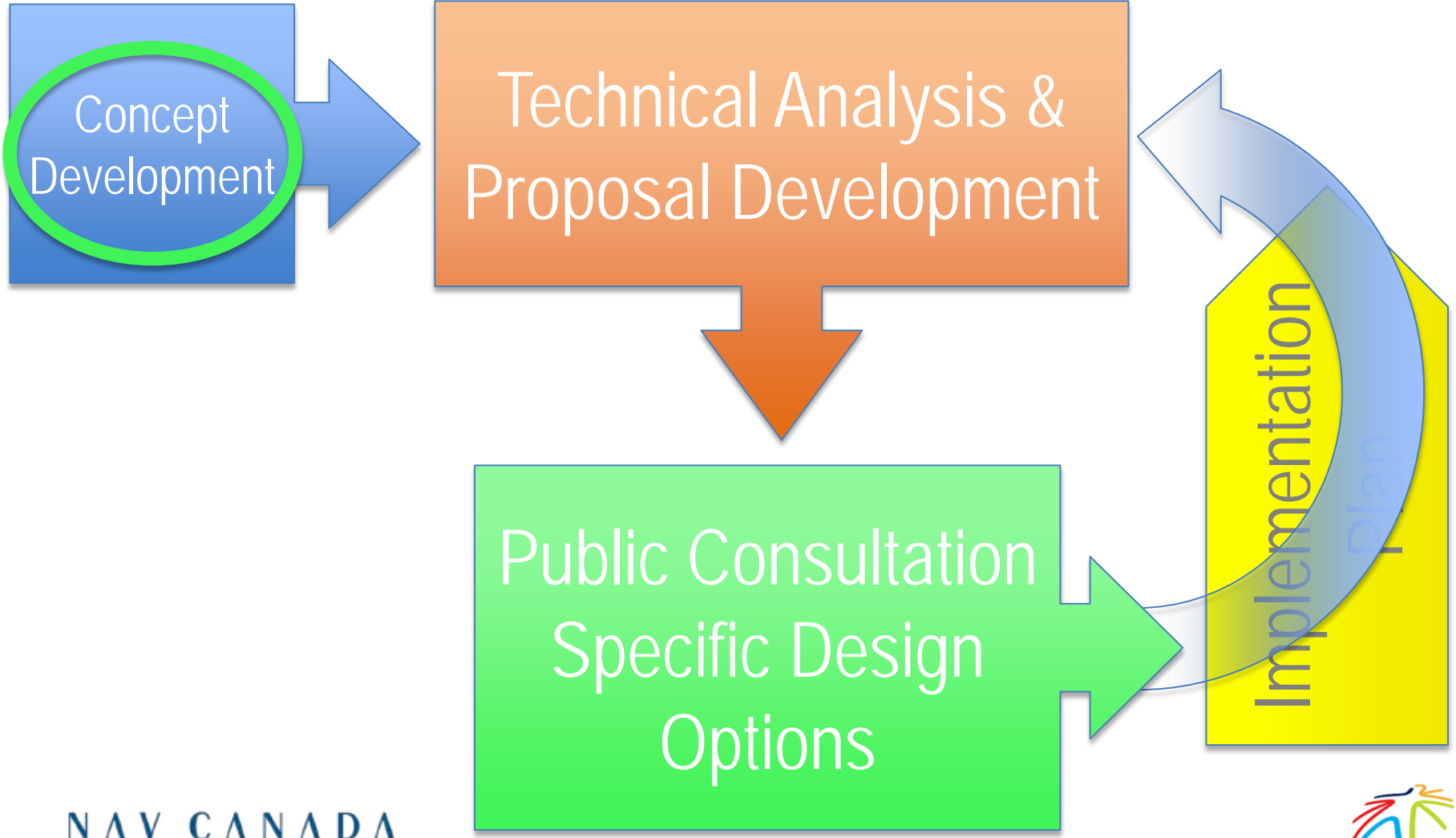
Our objective in developing these concepts is to reduce the generation of noise in proximity to residential areas

Ideas must also

-  Maintain an equivalent level of safety
-  Not reduce capacity below demand, and enable the airport to accommodate growth
-  Be manageable with current fleet mix
-  Use technology that is currently available and surface infrastructure that is currently in existence
-  Not materially increase operating costs
-  Take a systems approach - discretionary aeronautical changes can't prioritize one residential area over another, or adversely impact operations at other airports





PRE-PROPOSAL STAGE








PRE-PROPOSAL STAGE

Our objective in developing these concepts is to reduce the generation of noise in proximity to residential areas

-  We don't have firm proposals
-  Ideas being presented today are the outcome of suggestion analysis

-  Share these ideas
-  Collect your thoughts & input
-  Determine what warrants further study



Status & System Overview

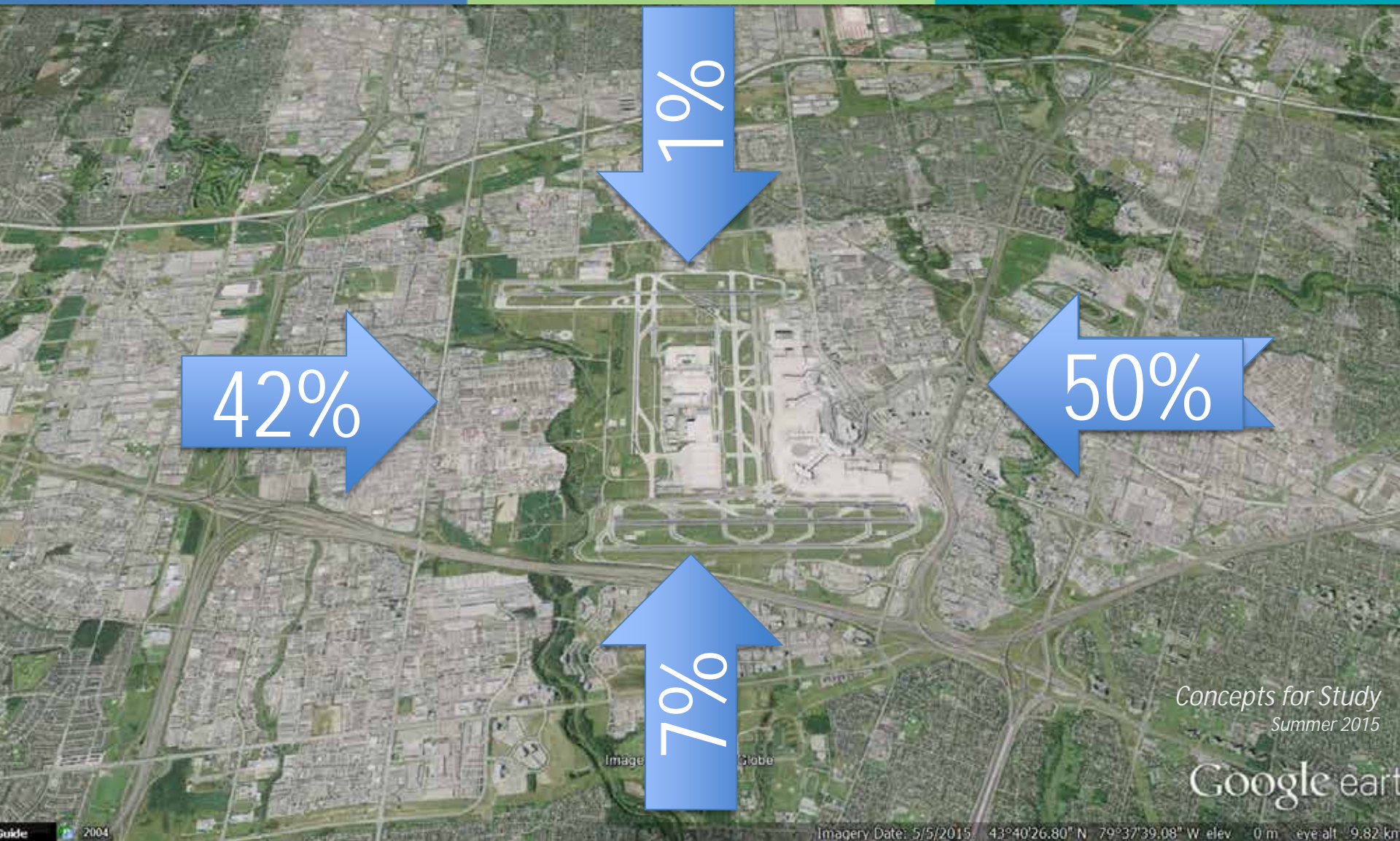
Ideas for Discussion

1. Night-time RNAV Approaches
2. Night-time SID Procedures
3. Coded Speed Restrictions
4. RNP Deployment
5. Weekend Runway Selection
6. Night-time Preferential Runways



PEARSON AIRPORT OPS

2014 DAYTIME OPERATIONS



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Google earth



PEARSON AIRPORT OPS



Traffic Flow Diagram (Landing West)

Standard Terminal Arrival Routes

Jet - Standard Instrument Departures (RNAV Portion)

Turboprop - Standard Instrument Departures (RNAV Portion)



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Google earth

Image © 2015 DigitalGlobe
Image Landsat
Image NOAA
Image © 2015 First Base Solutions

Imagery Date: 4/9/2013 43°35'18.72" N 79°35'43.44" W elev 0 m eye alt 69.79 km

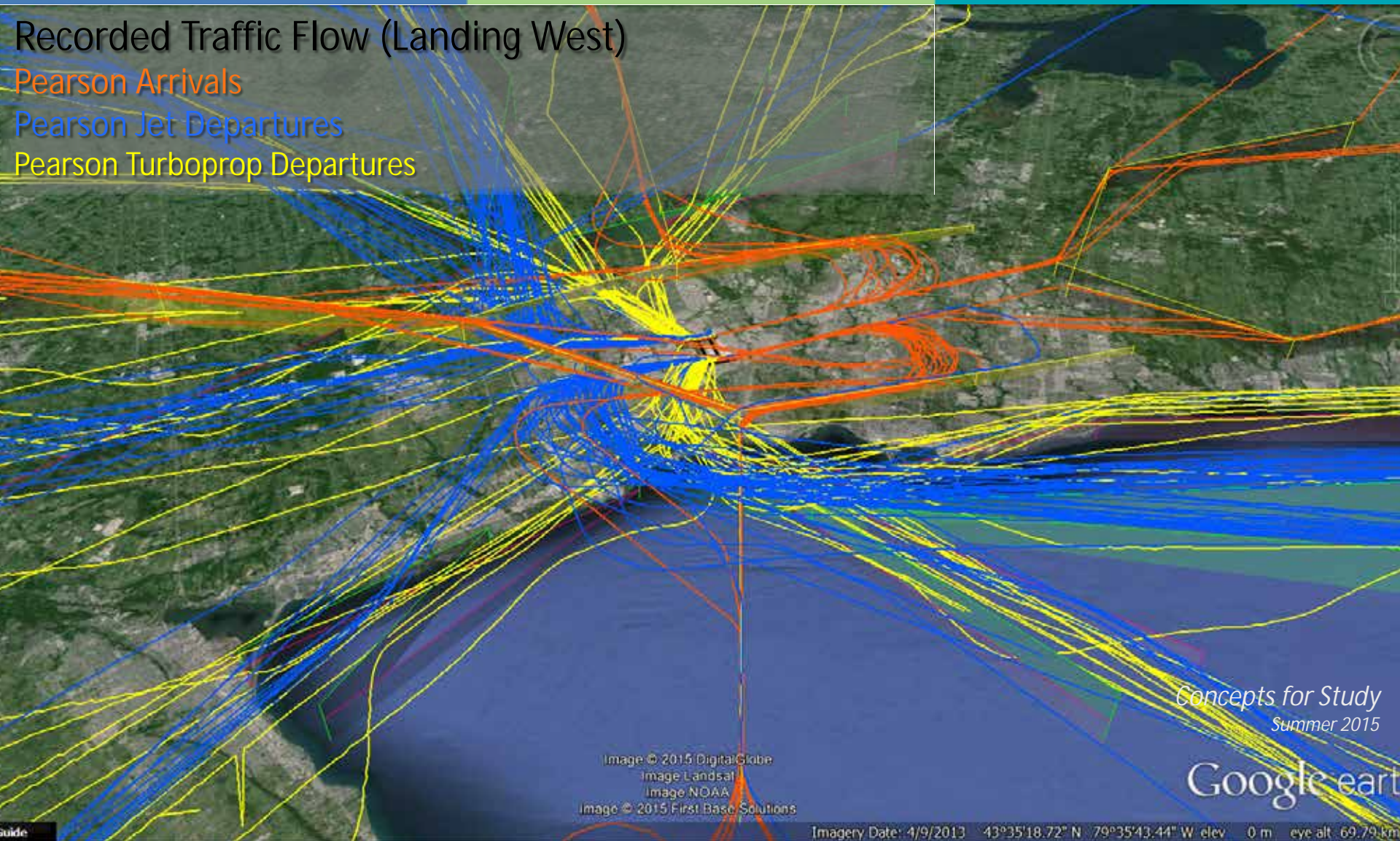


PEARSON AIRPORT OPS



Recorded Traffic Flow (Landing West)

- Pearson Arrivals
- Pearson Jet Departures
- Pearson Turboprop Departures



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Google earth

Image © 2015 DigitalGlobe
Image Landsat
Image NOAA
Image © 2015 First Base Solutions

Imagery Date: 4/9/2013 43°35'18.72" N 79°35'43.44" W elev 0 m eye alt 69.79 km



PEARSON AIRPORT OPS

TYPICAL MEDIUM CATEGORY ARRIVAL

TORONTO PEARSON INTERNATIONAL AIRPORT MODELED LMAX (dBA) NOISE CONTOUR

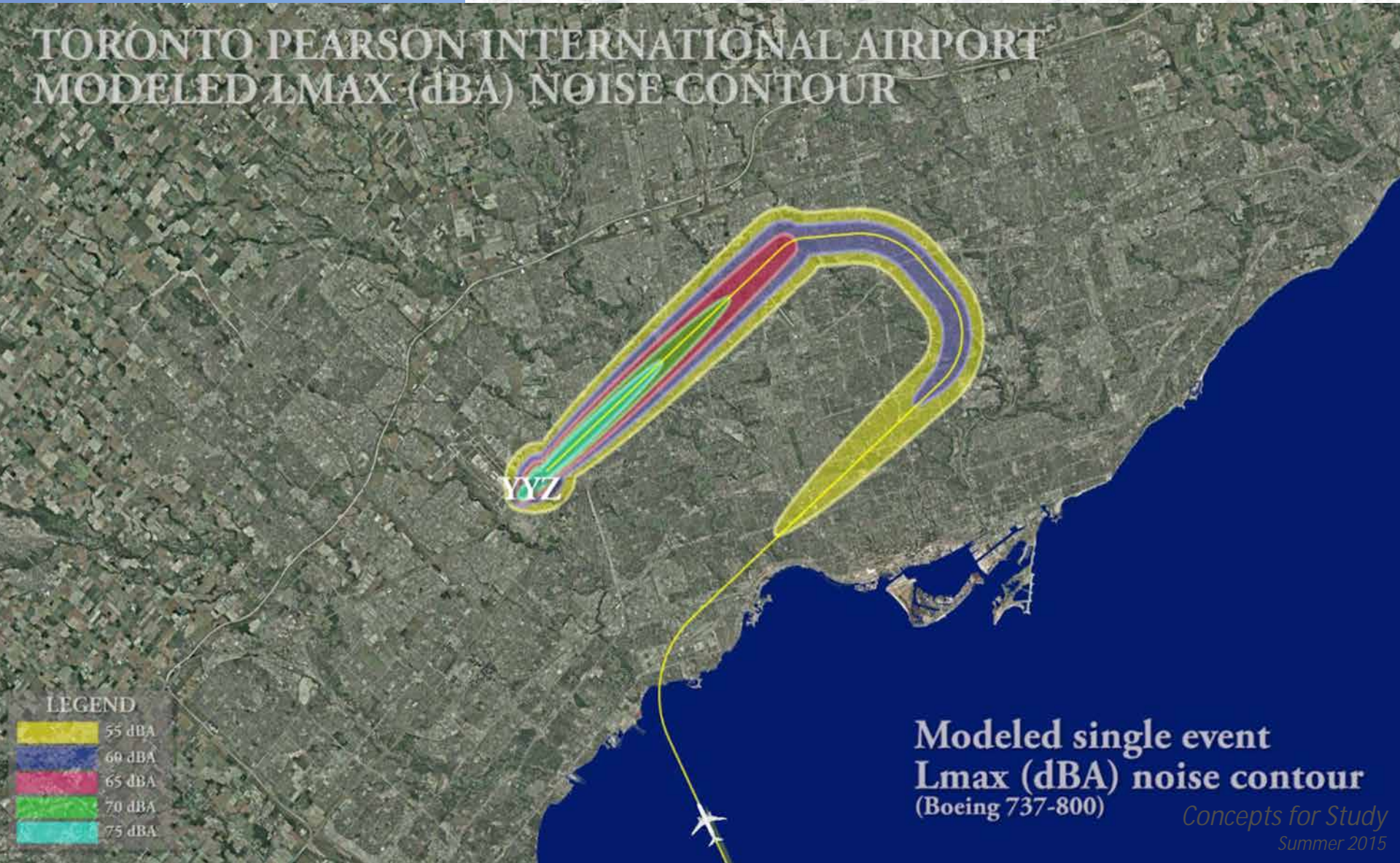
YYZ

LEGEND

Yellow	55 dBA
Blue	60 dBA
Pink	65 dBA
Green	70 dBA
Cyan	75 dBA

**Modeled single event
Lmax (dBA) noise contour
(Boeing 737-800)**

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PEARSON AIRPORT OPS



Traffic Flow Diagram (Landing East)
 Standard Terminal Arrival Routes
 Jet - Standard Instrument Departures (RNAV Portion)
 Turboprop - Standard Instrument Departures (RNAV Portion)



Concepts for Study
Summer 2015

Google earth

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Image NOAA
Image © 2015 First Base Solutions

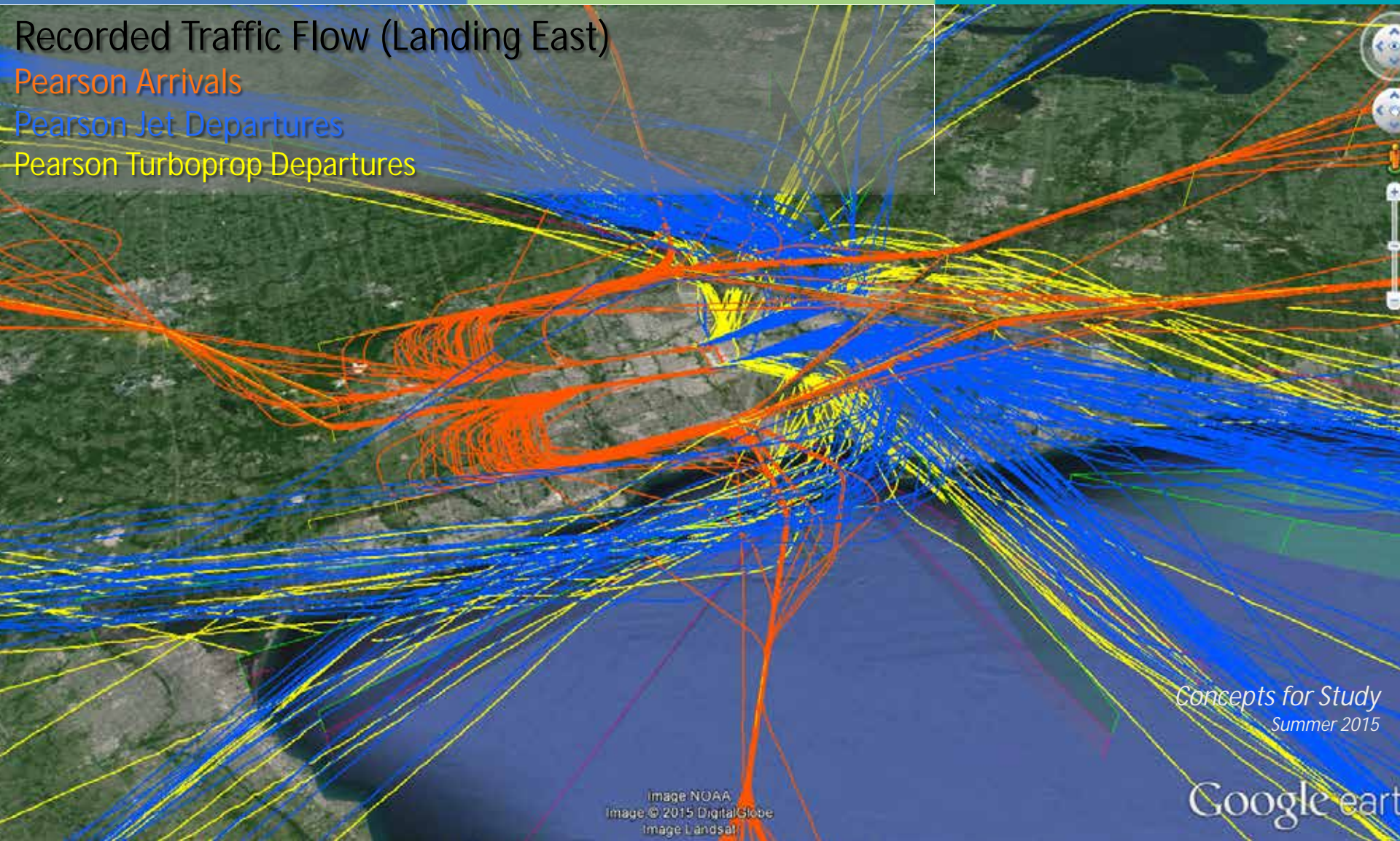
Imagery Date: 4/9/2013 43°35'18.72" N 79°35'43.44" W elev 0 m eye alt 69.79 km



PEARSON AIRPORT OPS

Recorded Traffic Flow (Landing East)

- Pearson Arrivals
- Pearson Jet Departures
- Pearson Turboprop Departures



*Concepts for Study
Summer 2015*

Google earth



PEARSON AIRPORT OPS

TYPICAL MEDIUM CATEGORY ARRIVAL

TORONTO PEARSON INTERNATIONAL AIRPORT MODELED LMAX (dBA) NOISE CONTOUR



LEGEND

Yellow	55 dBA
Blue	60 dBA
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**Modeled single event
Lmax (dBA) noise contour
(Boeing 737-800)**

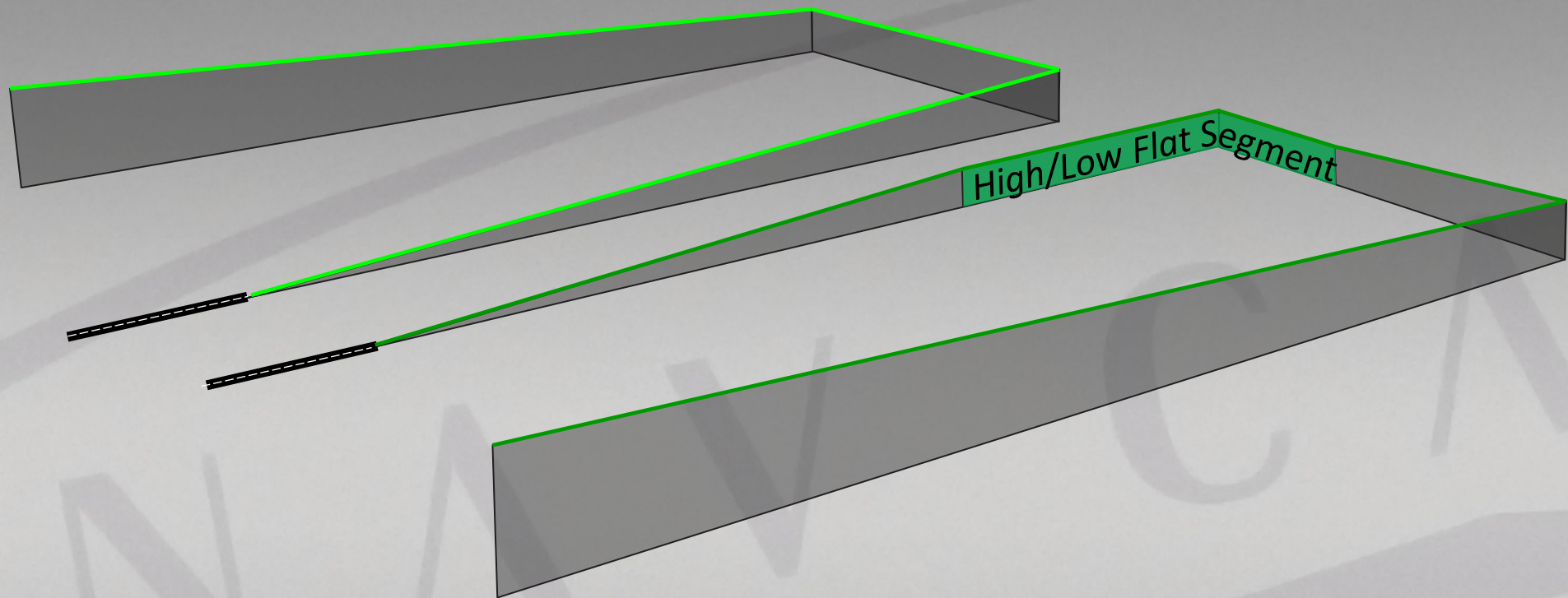
High/Low Operations

Dual, Parallel, Independent Operations *MANOPS 581*

At a controlled airport where simultaneous independent parallel ILS approaches have been approved, you may clear aircraft for straight-in ILS approaches provided the Arrival Controller provides a minimum of 1,000 feet vertical, or 3 miles radar separation until both aircraft are within their normal operating zones and established on their respective localizers.



High/Low Operations



In a Parallel Environment at CYYZ

- Use the Global practice of High/Low operations
- Aircraft are vectored to the ILS approach
 - Traffic demand warrants precise ATC management to maintain separation between subsequent arrivals; and
 - To comply with the High/Low requirements



IDEA #1

NEW APPROACHES FOR NIGHT TIME OPERATIONS

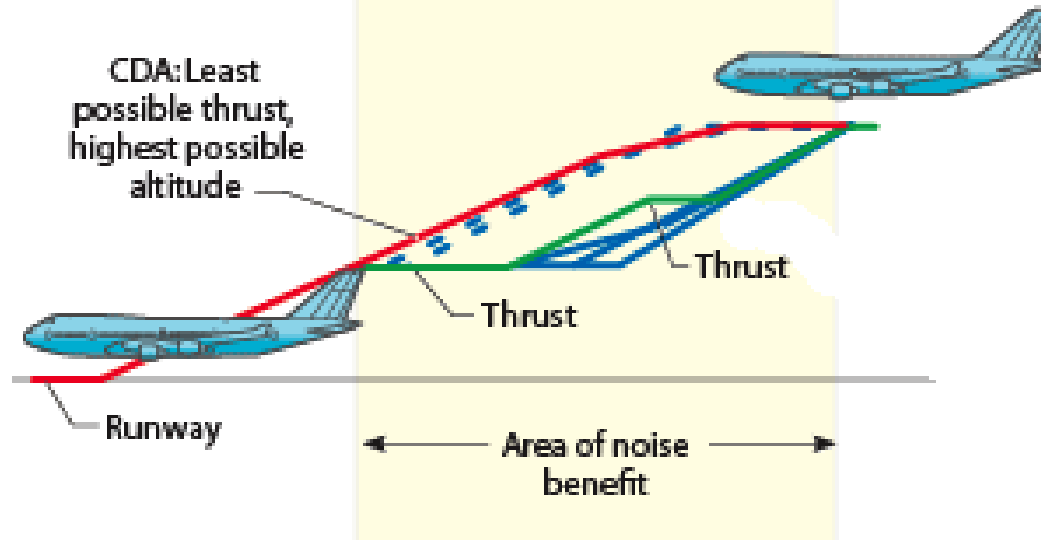
- During busy daytime periods, the safe management of air traffic necessitates certain procedures. However, when traffic volumes are lighter at night, and single runway operations are being used, there are options to improve descent profiles that could reduce noise impacts.
- *Proposed Approach:* Design new approaches for use during designated night-time operations.



RNAV APPROACH

OPPORTUNITY FOR CONSTANT DESCENT

Continuous descent approaches

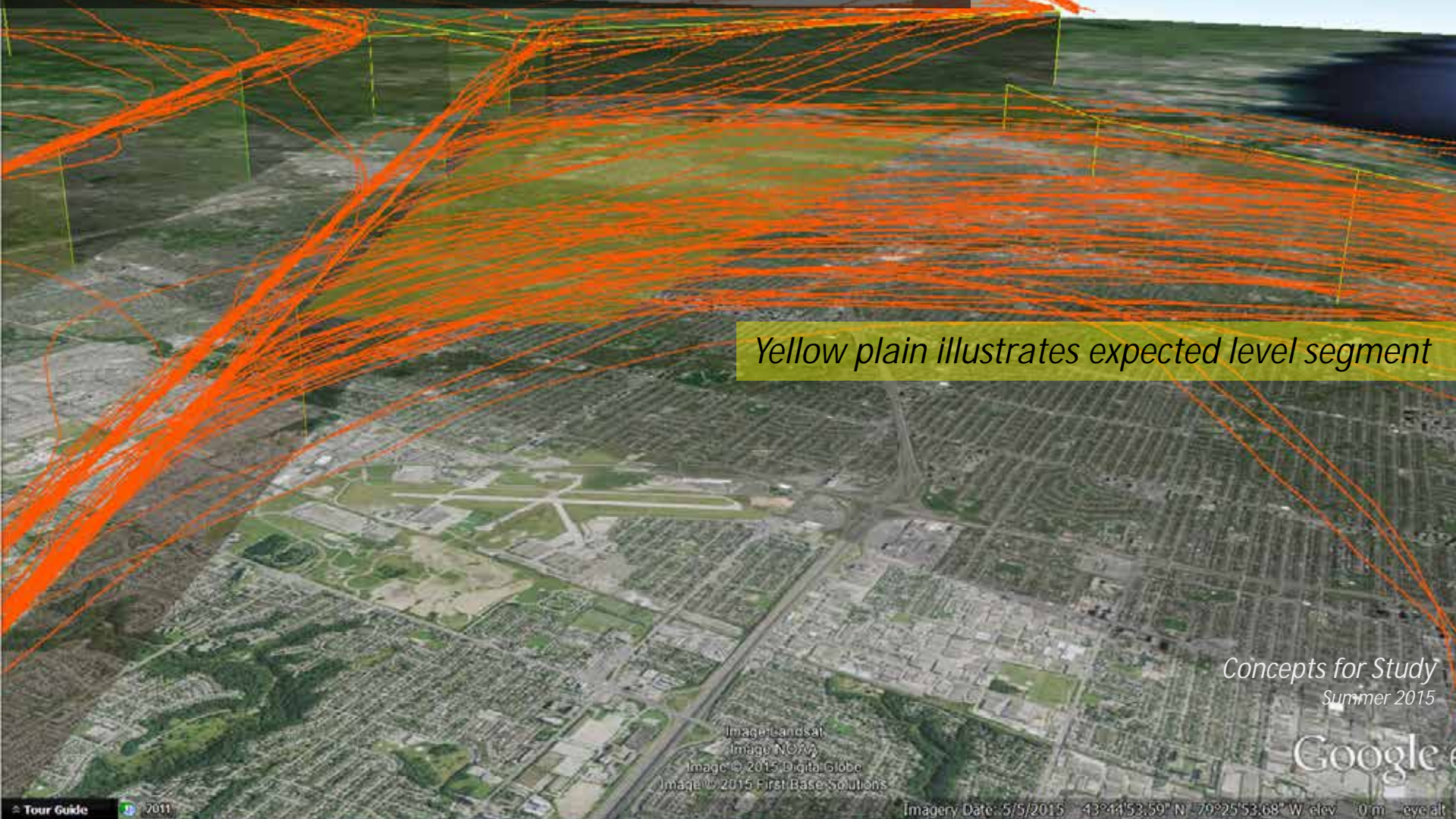




RNAV APPROACHES

OPPORTUNITY FOR CONSTANT DESCENT

Snapshot of actual arrival flight paths landing west at Pearson



Yellow plain illustrates expected level segment

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Image Landsat
Image NOAA
Image © 2015 DigitalGlobe
Image © 2015 First Base Solutions

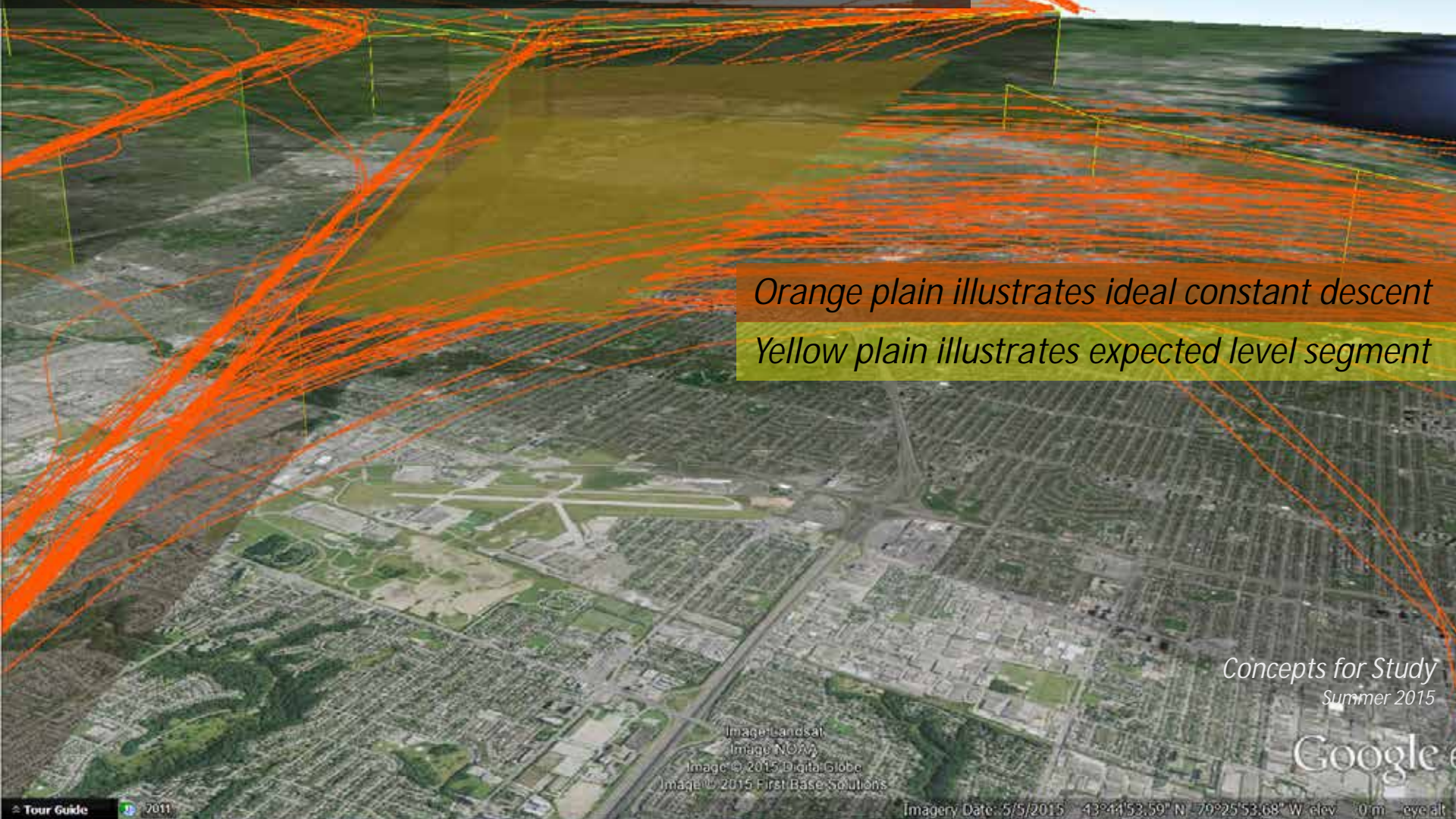
Imagery Date: 5/5/2015 43°44'53.59" N 79°25'53.68" W elev: 10 m level alt



RNAV APPROACHES

OPPORTUNITY FOR CONSTANT DESCENT

Snapshot of actual arrival flight paths landing west at Pearson



Orange plain illustrates ideal constant descent

Yellow plain illustrates expected level segment

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Google

Image Landsat
Image NOAA
Image © 2015 DigitalGlobe
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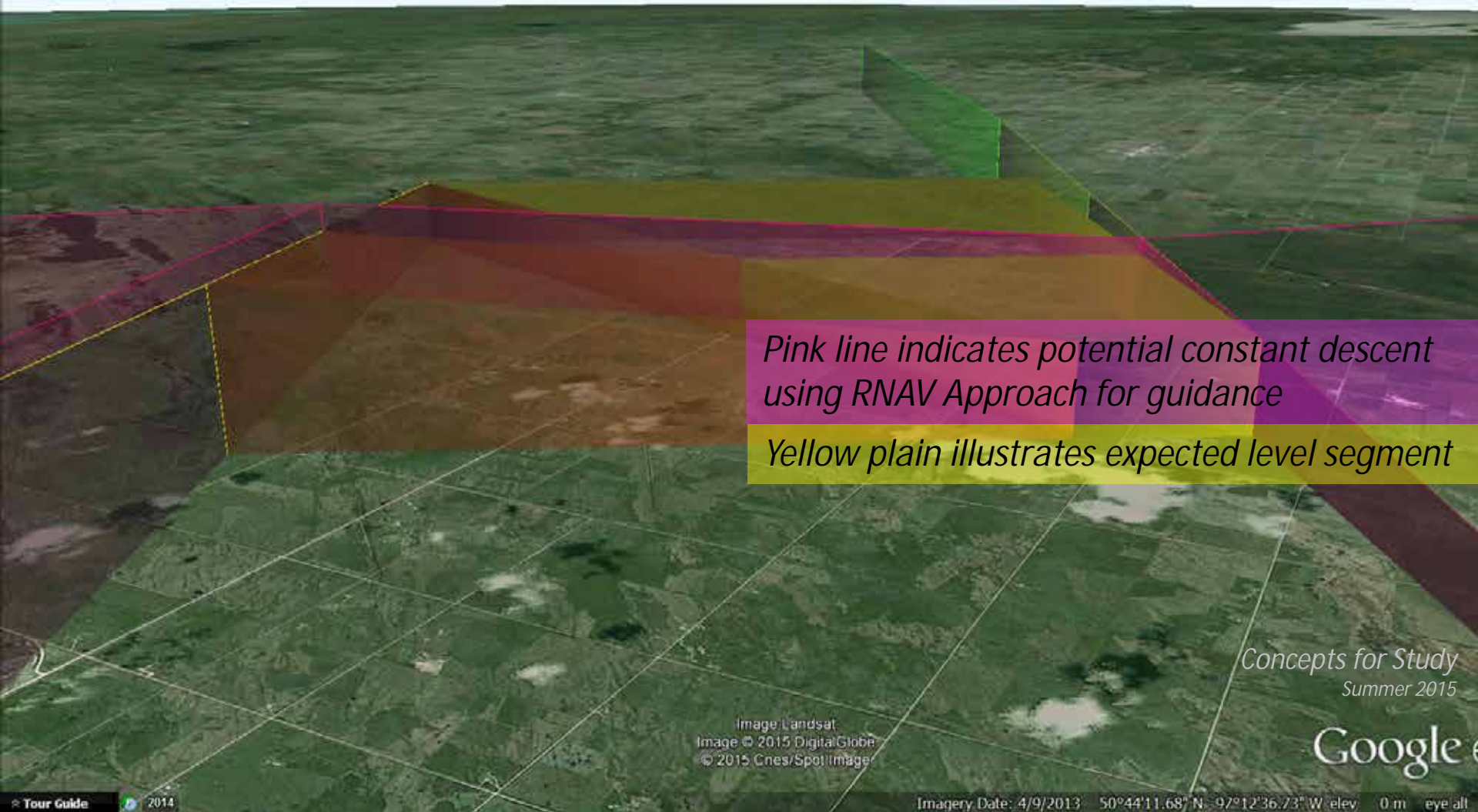
Imagery Date: 5/5/2015 43°41'53.59" N 79°25'53.68" W elev: 10 m - eye alt



RNAV APPROACH

OPPORTUNITY FOR CONSTANT DESCENT

Example Airport



Pink line indicates potential constant descent using RNAV Approach for guidance

Yellow plain illustrates expected level segment

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Image Landsat
Image © 2015 DigitalGlobe
© 2015 Cnes/Spot Image

Imagery Date: 4/9/2013 50°44'11.68" N 97°12'36.73" W elev 0 m eye alt



RNAV APPROACH

OPPORTUNITY FOR CONSTANT DESCENT

Example Airport



RNAV approaches can have multiple transitions linking aircraft to final approach

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Image Landsat
Image © 2015 DigitalGlobe
© 2015 Cnes/Spot Image



RNAV APPROACH SUMMARY

- Would require new procedure to be designed and published with specified hours of use
- Study points
 - Noise benefit / impact
 - RNAV equipage rates for night operations
 - What hours/traffic volume is this viable



IDEA #2

NEW DEPARTURE PROCEDURES FOR NIGHT OPERATIONS

- There are opportunities to alter night-time departure procedures during lower traffic volume periods when only one runway is in use for departures. Increasing the altitude achieved before aircraft turns are permitted may deliver noise benefits for those under the departure flight path.
- *Proposed Approach:* Design new departures for use during designated night-time periods.



SID PROCEDURES

PEARSON DEPARTURES



Standard Instrument Departure

Final approach course

Final approach course

Standard Instrument Departure

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- Final approach courses are defined by radio beams, and are aligned with the extended runway centerline
- Standard Instrument departures from parallel runways must diverge so that no matter the weather and operational conditions, aircraft are never separated by less than the distance between the departure runways



NIGHTTIME OPS

PEARSON DEPARTURES



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Amended – fly Runway Heading on departure, with no turns below 5,000' ASL

Currently - following the Standard Instrument Departure, and turning at 3,600' ASL

Image NOAA
 Image © 2013 TerraMetrics
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Google earth



NIGHTTIME OPS

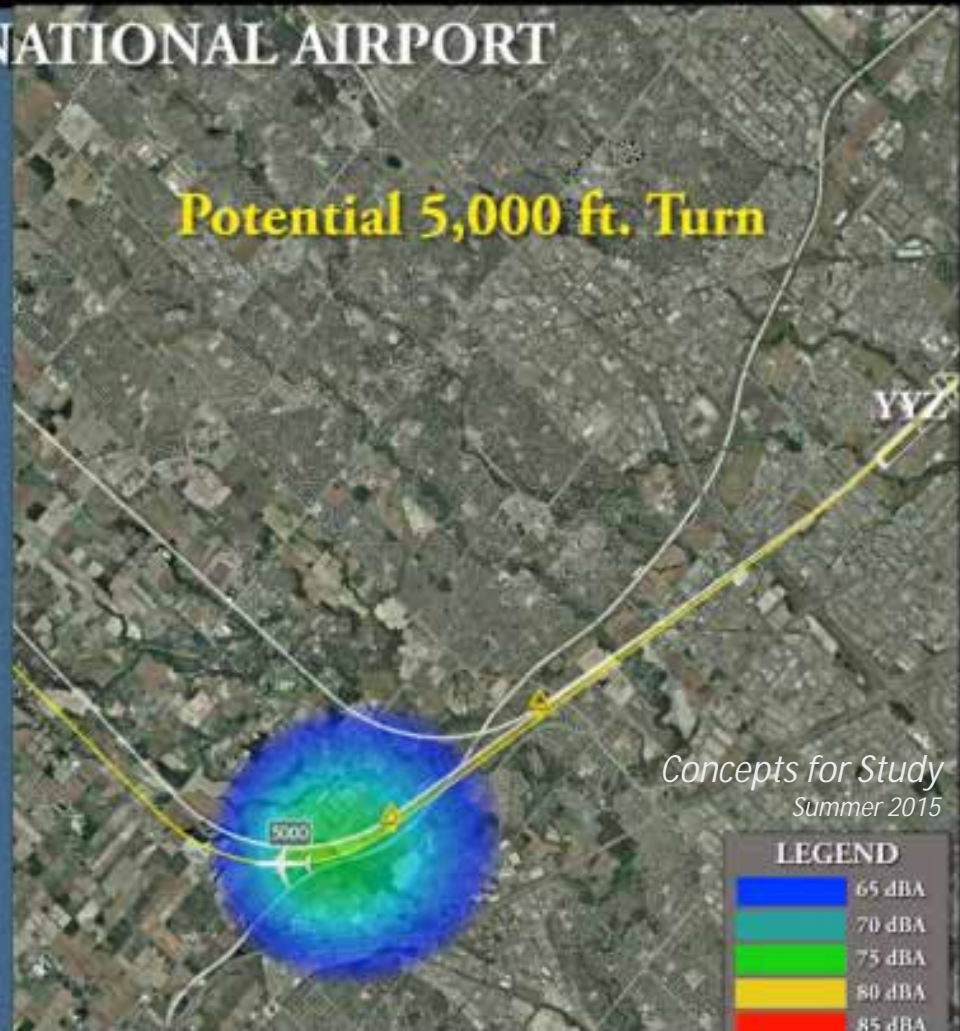
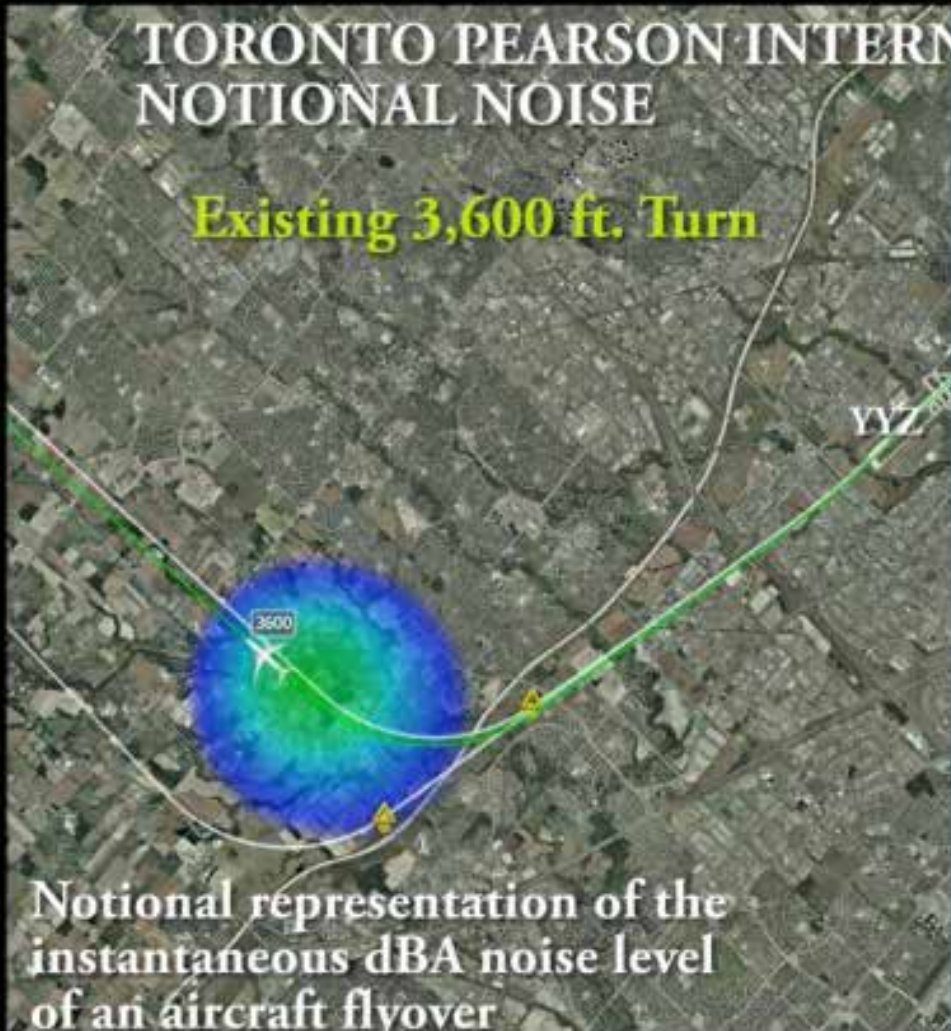
PEARSON DEPARTURES



TORONTO PEARSON INTERNATIONAL AIRPORT NOTIONAL NOISE

Existing 3,600 ft. Turn

Potential 5,000 ft. Turn



Notional representation of the instantaneous dBA noise level of an aircraft flyover

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LEGEND

Blue	65 dBA
Teal	70 dBA
Green	75 dBA
Yellow	80 dBA
Red	85 dBA

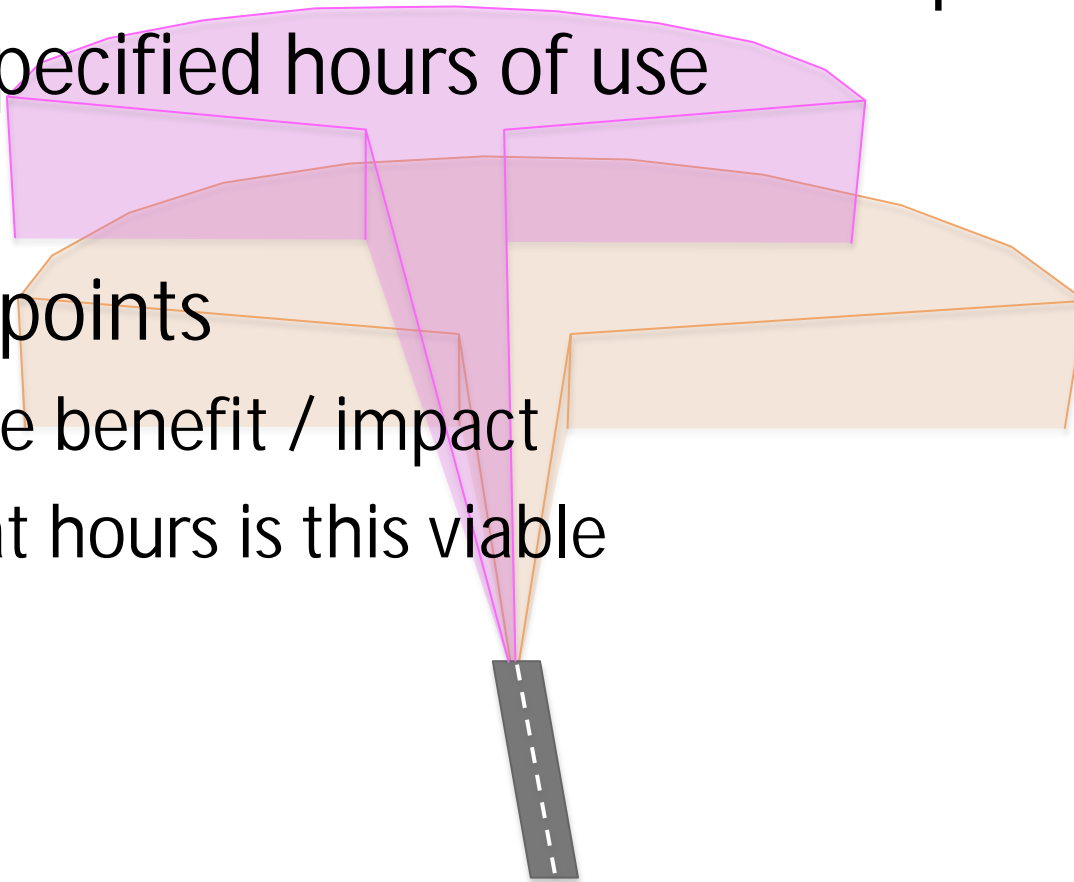
Actual 737 departure path - noise modelling



NIGHT TIME DEPARTURES

SUMMARY

- Amendment to noise abatement procedures with specified hours of use
- Study points
 - Noise benefit / impact
 - What hours is this viable





IDEA #3

INCREASE DOWNWIND ARRIVAL SPEEDS

- Changing the published speeds on the “downwind” portion of the arrival flight path from 200 knots to 210 knots may reduce noise in some areas of the city.
- *Proposed Approach:* Study the noise benefits of increasing speeds.



Performance Categories

Toronto Pearson Arrivals, by category:

<i>Category</i>	<i>Weight</i>	<i>Annual Count</i>	
 Heavy Jets	≥ 300,000 lbs	22,391	10%
 Medium Jets	>15.5 to <300	155,579	72%
 Light Jets	≤15,500 lbs	1,159	<1%
 Medium Prop	>15,500 lbs	35,907	17%
 Light Prop	≤15,500 lbs	2,211	1%



TRAFFIC MIX

SOUTH DOWNWIND FOR 05/06

2014 breakdown of traffic that flew in the South Downwind to land to the East at Pearson.

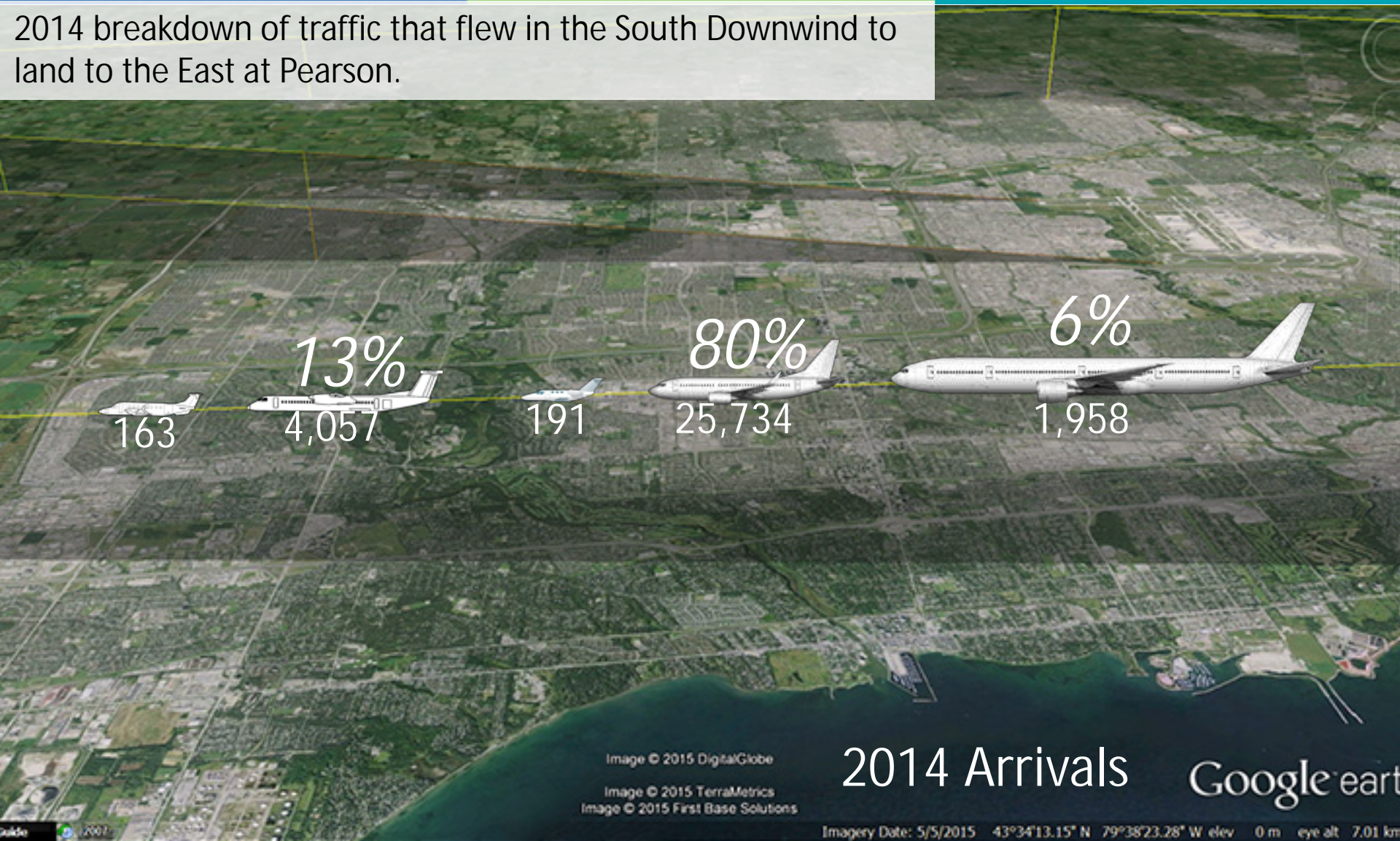


Image © 2015 DigitalGlobe

Image © 2015 TerraMetrics
Image © 2015 First Base Solutions

2014 Arrivals

Google earth

Imagery Date: 5/5/2015 43°34'13.15" N 79°38'23.28" W elev 0 m eye alt 7.01 km



TRAFFIC MIX

NORTH DOWNWIND FOR 05/06



2014 breakdown of traffic that flew in the North Downwind to land to the East at Pearson.

2014 Arrivals

Google earth

Image © 2015 TerraMetrics
Image © 2015 First Base Solutions

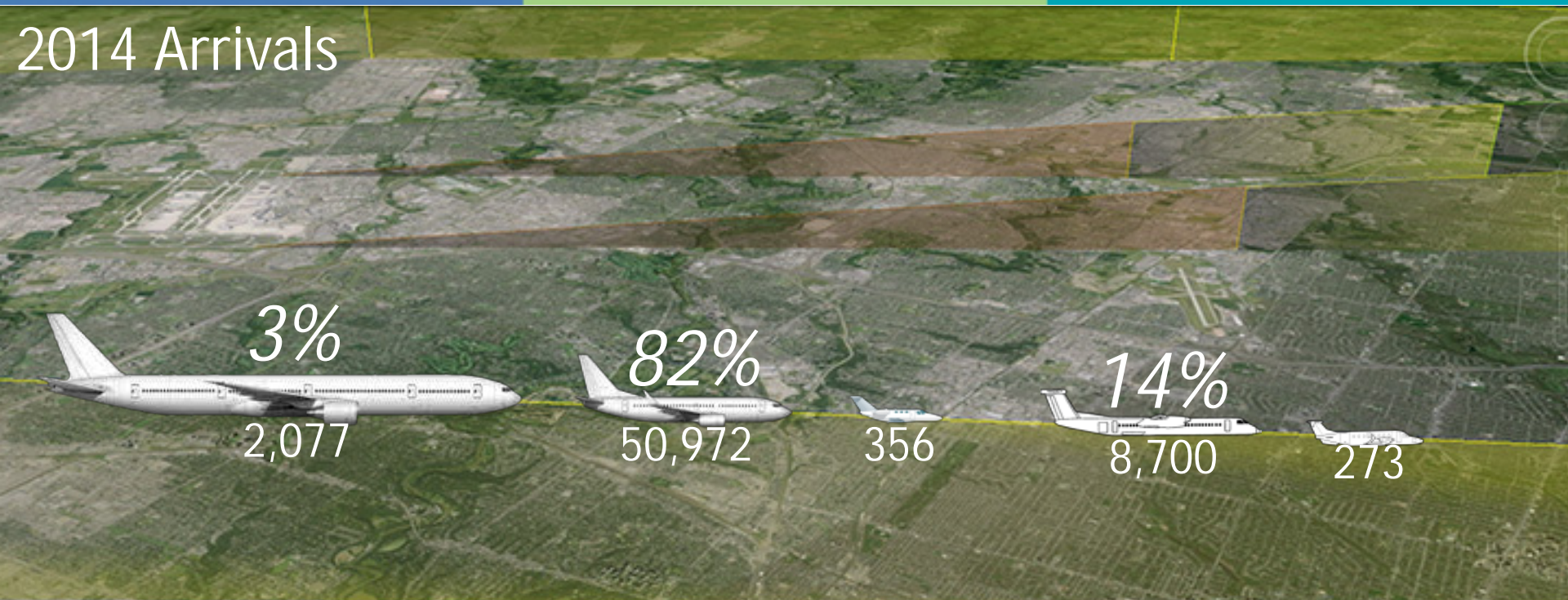
Imagery Date: 5/1/2015 43°34'13.15" N 79°38'23.28" W elev 0 m eye alt 7.01 km



TRAFFIC MIX

SOUTH DOWNWIND FOR 23/24

2014 Arrivals



2014 breakdown of traffic that flew in the South Downwind to land to the West at Pearson.






Google earth



PERFORMANCE

Clean Configuration – *Flying without deploying flaps*

- There is a maximum speed when flaps can be deployed, and a minimum speed where they must be deployed
- There are a number of parameters that impact when pilots select flaps. These include Type, Weather, Wind, Aircraft Weight, etc.

	200 kts	210 kts
	Unlikely	Possible?
	Likely	Likely
	Likely	Likely
	Likely	**
	Likely	**

** *Beyond normal operating speed in downwind phase of flight*



CURRENT SPEED RESTRICTIONS

SPEED
LIMIT
170

SPEED
LIMIT
200

SPEED
LIMIT
220



Image © 2015 DigitalGlobe
Image © 2013 TerraMetrics
Image NOAA

Google earth



PROPOSED SPEED RESTRICTIONS

SPEED
LIMIT
170

SPEED
LIMIT
210

SPEED
LIMIT
220

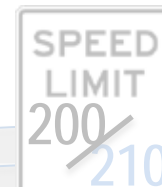
New Procedure design limits permit the speed to be increased from 200 to 210 knots – what will be the net noise change?



SPEED RESTRICTIONS

SUMMARY

- Would require published amendment to existing STARS
- STUDY POINTS
 - Safety - impact on traffic flow given traffic mix - risk of overtake
 - Noise benefit / impact





IDEA #4

USE NEW TECHNOLOGY TO REDUCE THE NEED FOR
LOW ALTITUDE LEVELLING DURING THE DAY

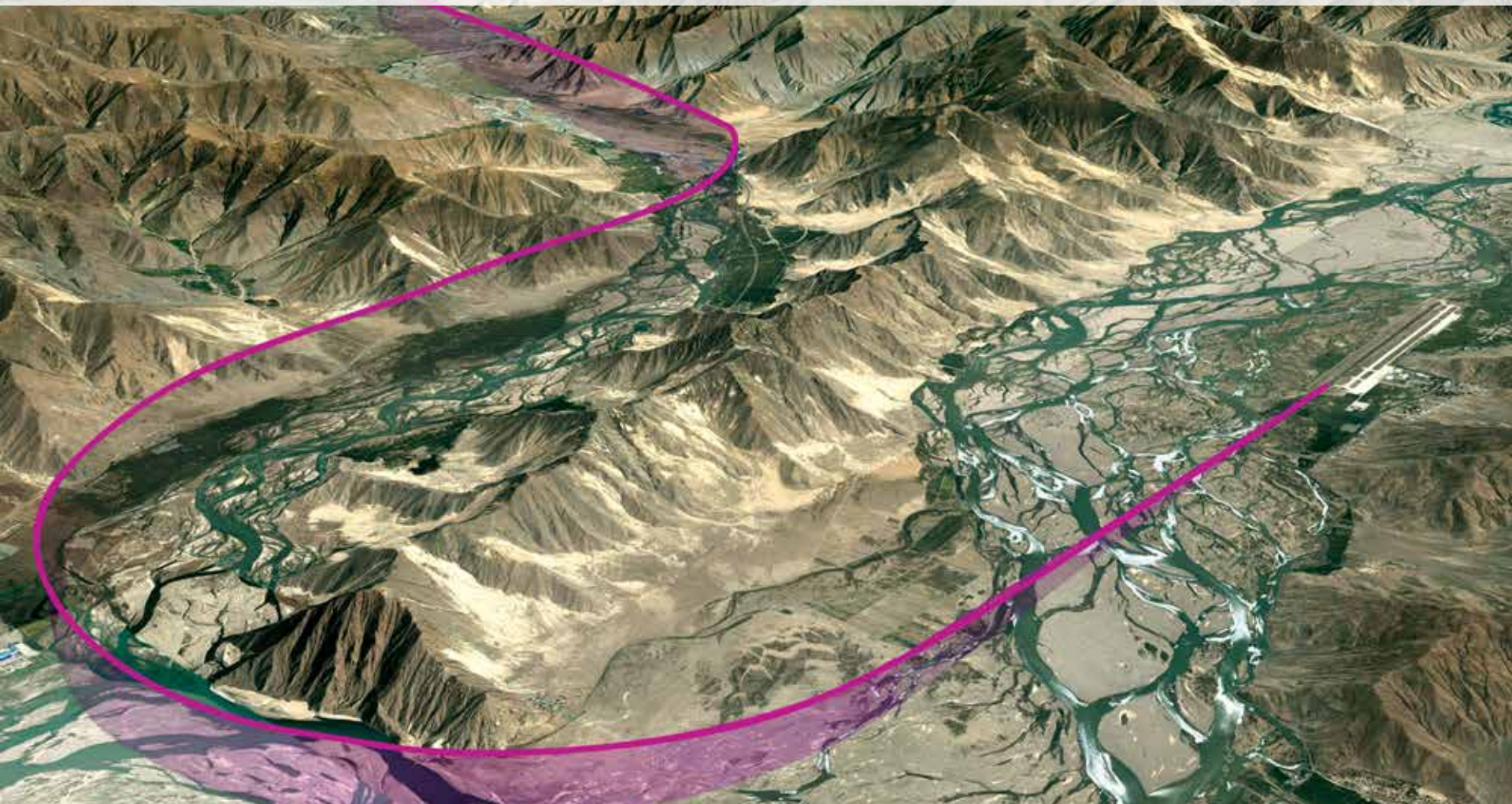
- There are noise impacts associated with power increases necessary to achieve low altitude level flight for parallel arrivals. New technologies could reduce the need for those level portions in flight profile and permit quieter, constant descent operations.
- *Proposed Approach:* Study the potential use of new technologies.



WHAT IS RNP?

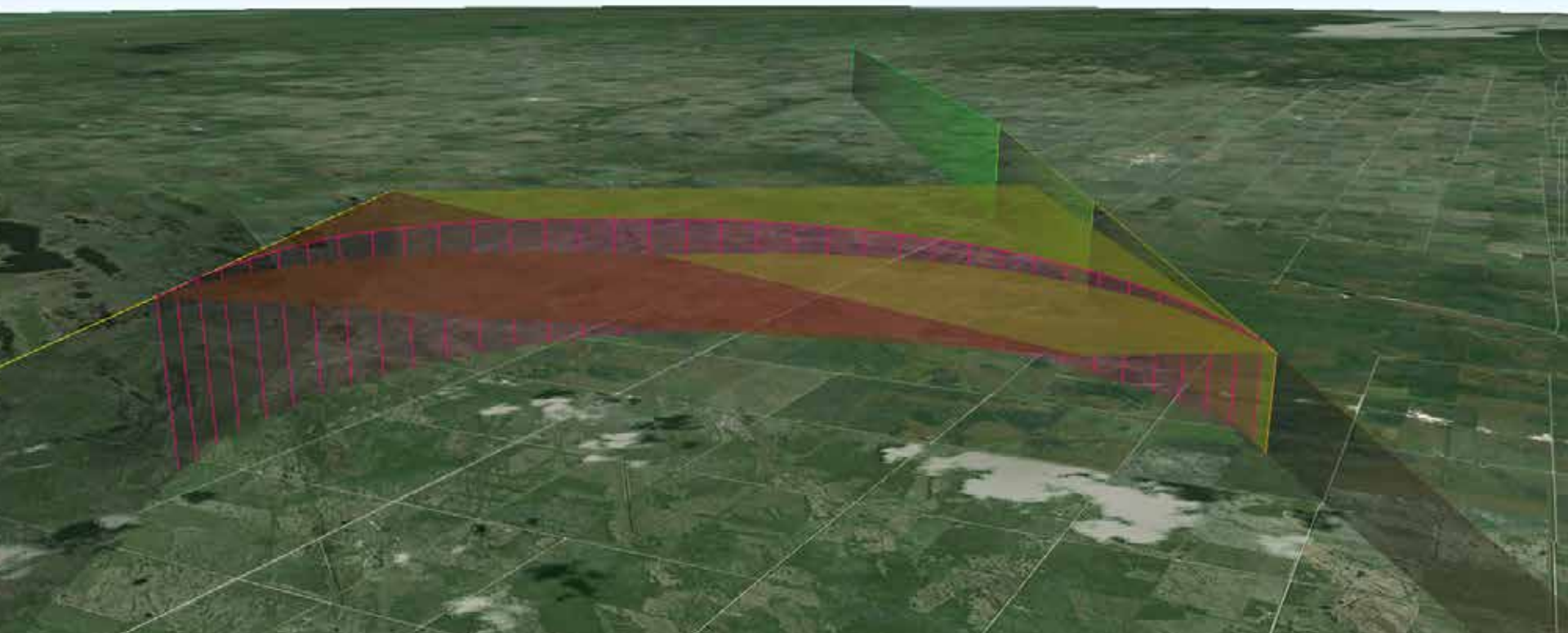
REQUIRED NAVIGATION PERFORMANCE

Augmented GPS is used by some airlines to fly accurate approach procedures in mountain valleys. We would like to explore the use of this technology in parallel runway environments





RNP DEPLOYMENT



Pink line indicates Required Navigation Performance (RNP) path to guide aircraft from a downwind to final approach. Note the constant turn radius and constant descent all the way to the final approach.

Yellow plain illustrates expected level segment associated with parallel ILS operations

© 2015 Cnes/Spot Image
Image © 2015 DigitalGlobe

Image Landsat

Google earth

Imagery Date: 4/9/2015 50°44'11.68" N 97°12'36.73" W elev

0 m eye alt 4.22 km








WHEN CAN WE USE RNP?

RNP (Required Navigation Performance) Approaches require:

- Specialized certified equipment in the airplane
- Crew training and certification

Only a subset of aircraft are eligible:

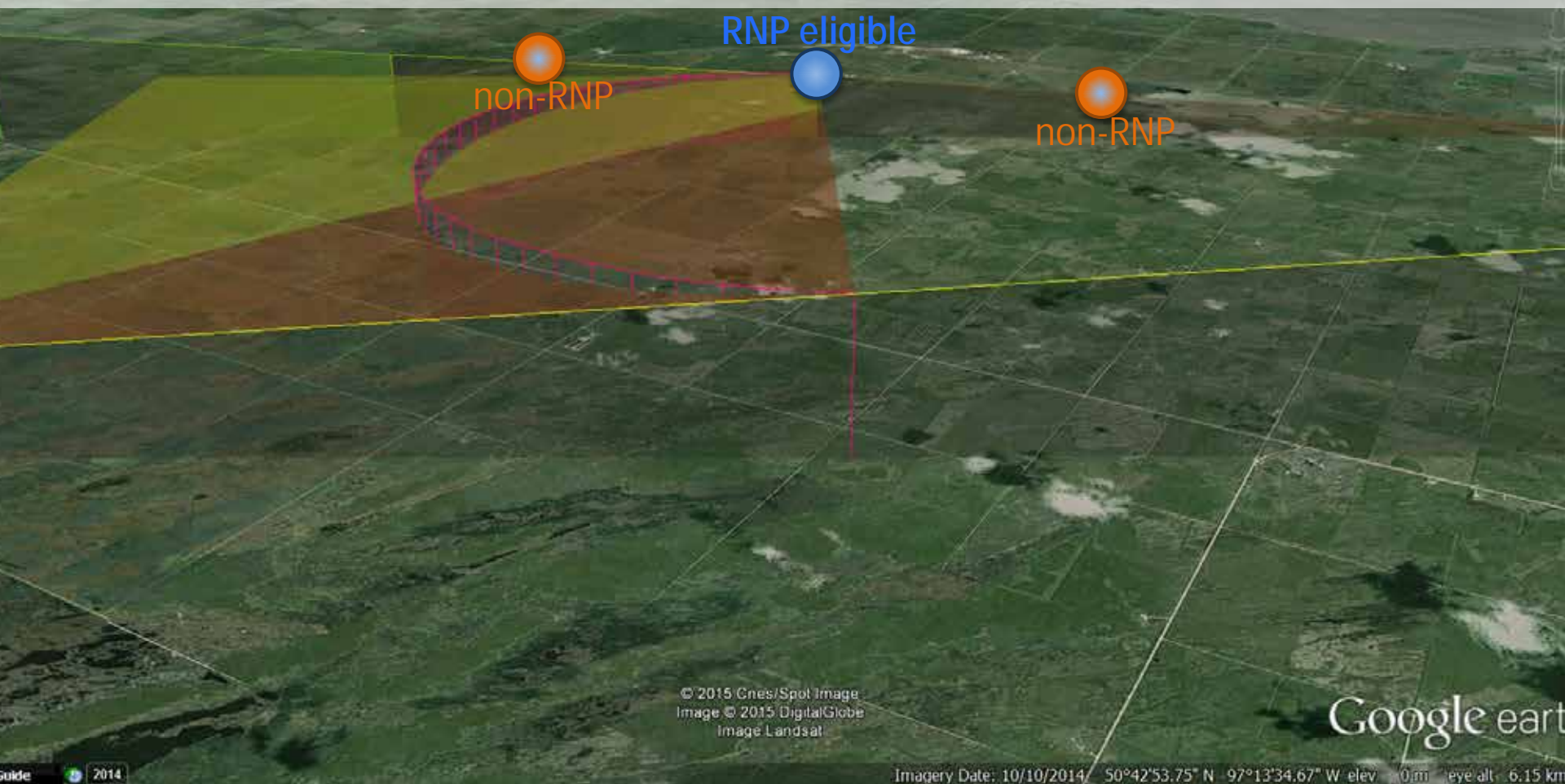
2014 arrivals/week

	145	3%
	31	1%
	761	18%
	588	14%
	210	5%
		<hr/> 41%



WHEN CAN WE USE RNP?

Not all equipped and certified RNP aircraft would be cleared to fly the RNP constant descent curved flight path to final. This flight path would only be flown when the Controller could assure separation between the eligible aircraft and both preceding and succeeding non-RNP arrivals.





RNP DEPLOYMENT SUMMARY

- Would require regulatory approval of new separation standard for RNP parallel operations
- Would require new procedures to be designed
- **STUDY POINTS**
 - Noise benefit / impact
 - Impact on traffic flow – how often



IDEA #5

ESTABLISH WEEKEND PREFERENTIAL RUNWAYS

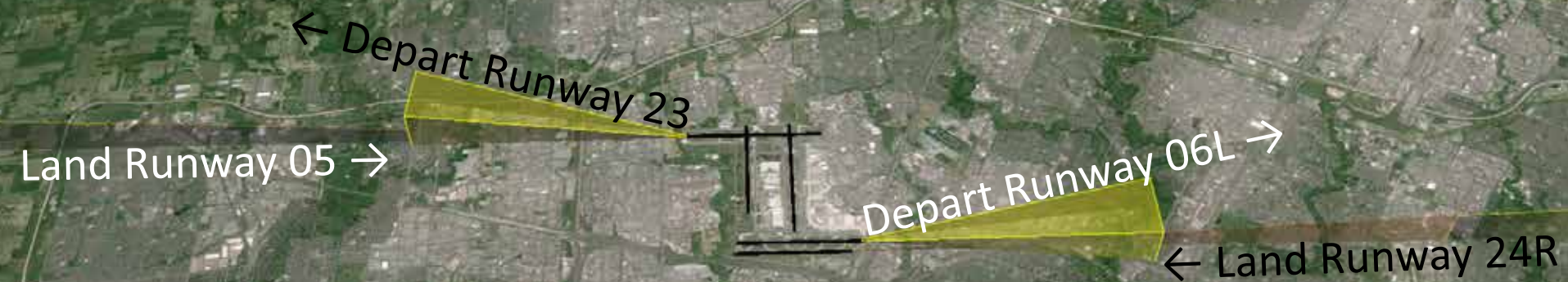
- Traffic volumes on Saturdays and Sunday mornings tend to be lower than other days of the week. Alternating runways could provide periods of weekend respite from noise for communities impacted by these operations today.
- *Proposed Approach:* Study the feasibility of establishing weekend preferential runways.



WEEKEND RUNWAY ALTERNATION

CURRENT OPERATIONS

During lower traffic periods on weekends, we often land on one runway, and depart on a parallel runway. This graphic depicts typical runway combinations.





WEEKEND RUNWAY ALTERNATION

POSSIBLE OPTION

Exploring the use of alternate runway configurations on weekends could result in changes to the communities that experience noise from aircraft flight paths.





WEEKEND RUNWAY ALTERNATION

SUMMARY

- May require amendment to published airport Noise Abatement Procedures
- Would require GTAA to design and publish a schedule
- Study points
 - Noise benefit / impact
 - Determine traffic levels at which proposal is viable



IDEA #6

ALTERNATE NIGHT-TIME PREFERENTIAL RUNWAYS

- Preferential runways exist to ensure that aircraft landing and departing overnight impact the fewest people. The possibility to alternate use of night-time preferential runways might result in sharing night-time noise impacts from aircraft operations across more communities.
- *Proposed Approach:* Review the continued appropriateness of existing night-time preferential runways to ensure they meet the stated objectives.



NIGHT TIME PREFERENTIAL RWYS

There is no longer any runway that permits aircraft to approach or depart the airport without overflying a residential area



Commercial real estate areas

Google earth



NIGHT TIME PREFERENTIAL RWYS

NIGHT TIME RUNWAY USE 2014

Pref Rwy #2 - 20%

<1%

28%

7%

Pref Rwy #1 - 39%

<1%

Pref Rwy #3 - 4%

<1%

Preferential Runway Order

	Depart	Arrive	2014
#1	23	05	39%
#2	33R	15L	20%
#3	24R	06L	4%

Image © 2015 DigitalGlobe
Image © 2015 TerraMetrics
Image Landsat
Image NOAA

Google earth

Imagery Date: 5/5/2015 43°36'25.60" N 79°38'14.53" W elev 0 m eye alt 17.75 km



NIGHT TIME PREFERENTIAL RWYS

How should night-time preferential runways be selected and the system managed?



Image © 2015 DigitalGlobe
Image © 2015 TerraMetrics
Image Landsat
Image NOAA

Google earth

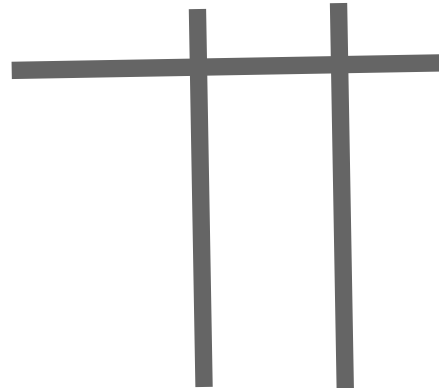
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NIGHT TIME PREFERENTIAL RWYS

SUMMARY

- Would require amendment to published airport Noise Abatement Procedures



- Study points
 - Noise benefit / impact / affected population



NEXT STEPS





FEEDBACK & QUESTIONS

<http://torontopearson.com/en/NoiseMitigationInitiativesEngagementPlan/#>

community.engagement@gtaa.com



Thank You