The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRANSPORTATION RESEARCH BOARD

Assessing Community Annoyance with Helicopter Noise

Thursday, March 8, 2018
2:00pm to 3:30pm ET

Purpose

Discuss research from the Airport Cooperative Research Program (ACRP)'s Synthesis 76: Helicopter Noise Information for Airports and Communities and Research Report 181: Assessing Community Annoyance of Helicopter Noise.

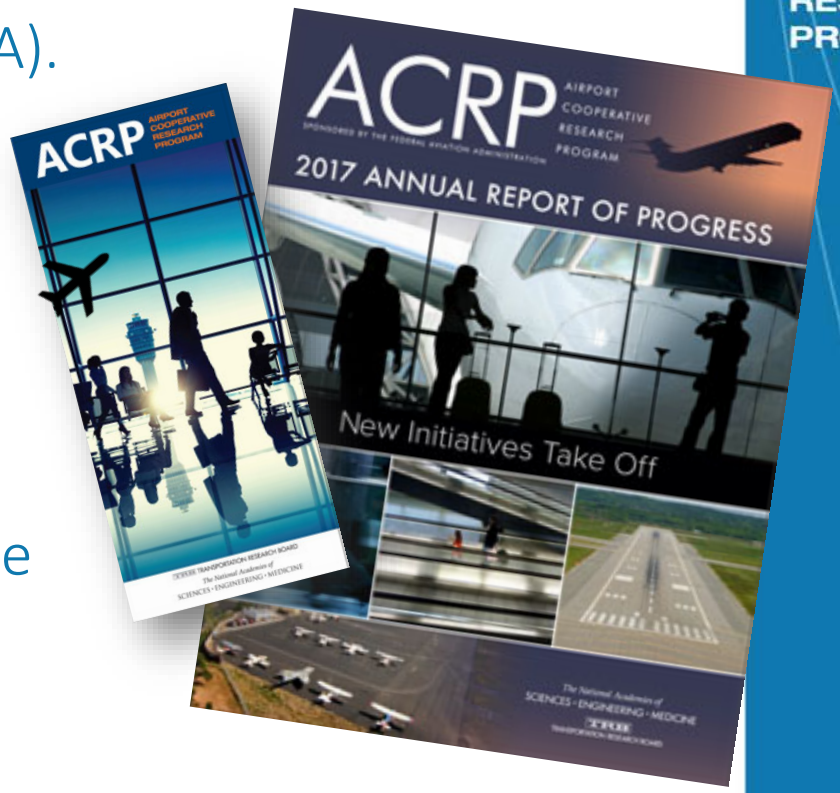
Learning Objectives

At the end of this webinar, you will be able to:

- Understand best practices for airport or heliports in managing helicopter noise
- Understand how responses differ for helicopter noise and fixed-wing noise, along with the role of non-acoustic factors

ACRP is an Industry-Driven Program

- Managed by TRB and sponsored by the Federal Aviation Administration (FAA).
- Seeks out the latest issues facing the airport industry.
- Conducts research to find solutions.
- Publishes and disseminates research results through free publications and webinars.



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Opportunities to Get Involved!

- ACRP's Champion program is designed to help early- to mid-career, young professionals grow and excel within the airport industry.
- Airport industry executives sponsor promising young professionals within their organizations to become ACRP Champions.
- Visit ACRP's website to learn more.

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Challenges to Implementing Successful Land Use Strategies at Airports

April 10-11, 2018 | Washington, D.C.

FREE Registration: tinyurl.com/land-use-insight-event

Featuring interactive breakout sessions, networking opportunities, and keynote addresses. Speakers include:

- **Thella Bowens,** (retired) President/CEO, San Diego County Regional Airport Authority
- **Dr. Stephen Van Beek,** Director & Head of North American Aviation, Steer Davies Gleave
- **John Terrell,** Vice President Commercial Development, DFW International Airport

ACRP | INSIGHT EVENT

Economic and Social Sustainability at Airports

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With interactive breakouts, networking opportunities, and plenary presentations, this engaging and groundbreaking forum will help airports and their stakeholders frame, plan, communicate, implement, and report social and economic initiatives to fully realize triple bottom line sustainability benefits.

Featuring…

- Dr. Davina Durgana – *anti-human trafficking expert*
- Dr. Steve Nakana – *airport social equity expert*
- Ted Howard – *community wealth building expert*

FREE Registration: tinyurl.com/sustainability-insight-event

Upcoming ACRP Webinars

March 21

Interpreting the Results of Airport Water Monitoring

April 5

Addressing Significant Weather Impacts on Airports

April 26

Generating Revenue from Commercial Development On or Adjacent to Airports

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Additional ACRP Publications Available on Today's Topic

Research Results Digest 24: Recommended Community Noise Model Enhancements to Improve Prediction of Helicopter Activity Impacts

Web-Only Document 16: Assessing Aircraft Noise Conditions Affecting Student Learning

Web-Only Document 17: Research Methods for Understanding Aircraft Noise Annoyances and Sleep Disturbance

Synthesis 9: Effects of Aircraft Noise

Visit: www.trb.org/ACRP

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Today's Speaker

Vincent Mestre
Landrum & Brown

Presenting

Synthesis 76: Helicopter Noise Information for Airports and Communities

and

Report 181: Assessing Community Annoyance of Helicopter Noise

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ACRP SYNTHESIS 76

Helicopter Noise Information for Airports and Communities

Vincent Mestre, P.E.
Associate Vice President, Landrum & Brown

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Vincent Mestre, P.E.
Principal Investigator

- Associate Vice President, Landrum & Brown
- Founder Mestre Greve Associates, Now a Division of L&B
- Chair SAE A-21 Committee on Aviation Noise & Emissions
- Recent Publications in JASA and NCEJ On Annoyance, Sleep Disturbance and Noise Complaint Patterns

Major Contributor:
Paul Schomer, PhD, P.E.

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ACRP Synthesis 76: Oversight Panel

ROBERT GROTELL, *PlaneNoise Inc., Port Jefferson, NY*

RHEA GUNDRY, *Harris Miller Miller & Hanson Inc.*

JEFFREY JACQUART, *Clark County (NV) Department of Aviation, Las Vegas, NV*

RONALD E. REEVES, *Long Beach Airport, CA*

FREDRIC SCHMITZ, *University of Maryland*

JASON L. SCHWARTZ, *Port of Portland, Portland, OR*

DON SCIMONELLI, *South Capitol Street Heliport, LLC, Washington, DC*

KATHERINE ANDRUS, *Federal Aviation Administration* (Liaison)

Christine Gerencher, *Transportation Research Board*

TRB Staff: Gail R. Staba

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Table of Contents

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Additional Materials

- REFERENCES
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- APPENDIX A2- CORRELATIONAL ANALYSIS OF HELICOPTER NOISE METRICS
- APPENDIX A3- COMMUNITY TOLERANCE LEVEL, ACCOUNTING FOR NON-ACOUSTIC EFFECTS ON ANNOYANCE
- APPENDIX B ANNOTATED BIBLIOGRAPHY
- APPENDIX C HAI FLY NEIGHBORLY GUIDE
- APPENDIX D AIRPORT SURVEY QUESTIONS
- APPENDIX E SAMPLE AIRPORT HELICOPTER BROCHURES
- APPENDIX F EXAMPLE LETER OF AGREEMENT

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Helicopter Noise

Helicopter Noise Sources

increasing importance

Main Rotor Impulsive
- *High-Speed Impulsive (HSI)*
- *Blade-Vortex Interaction (BVI)*

Tail Rotor
- *Thickness/Loading*

Main Rotor
- *Loading*

Engine/Transmission

MR/TR Interaction

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Community Response

Annoyance of noise from helicopters (direct)

- **Is DNL adequate or do low frequency and impulsive noise result in higher annoyance?**
- **Should helicopters have a correction factor?**
- **Are non-acoustic factors dominating noise levels?**

Secondary Noise Emissions – Rattle

- **Low frequency induced rattle of windows, bric-a –brac, etc. ?**
- **Is there an 'adjustment' for sound level that accounts for rattle?**
  - No consensus on that factor, aircraft dependent?

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LABORATORY VERSUS FIELD STUDIES OF HELICOPTER ANNOYANCE

- **Mostly studies are heavy military helicopters**
- **Laboratory studies fail to capture non-acoustic affects**
- **Helicopters 'noticed' far more readily that fixed wing aircraft**
  - Low frequency? Impulsive noise? Lack of habituation

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NON-ACOUSTIC CONTRIBUTIONS TO COMMUNITY REACTION TO HELICOPTER NOISE

- **Low flight altitude**
  - **Privacy?**
- **Long hover durations**
- **Times, numbers, and frequencies of operations**
- **Flight track location**
  - Why here, why not there?
- **Fear of crashes**
- **Necessity?**
- **Attitudes of misfeasance and malfeasance**

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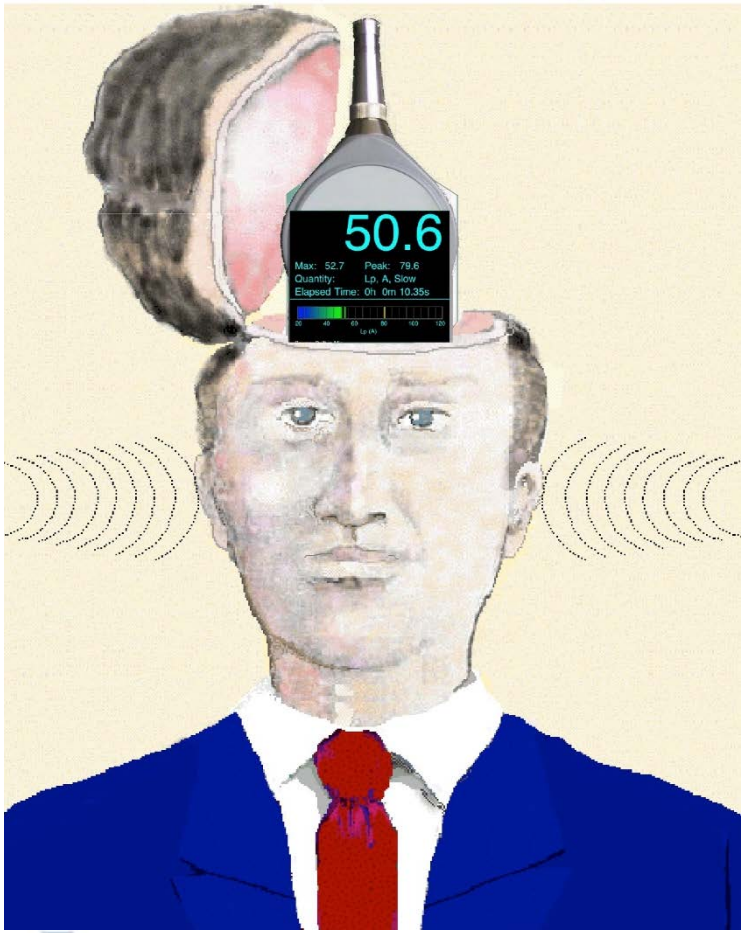
SUMMARY OF ACOUSTIC AND NON-ACOUSTIC THEORY



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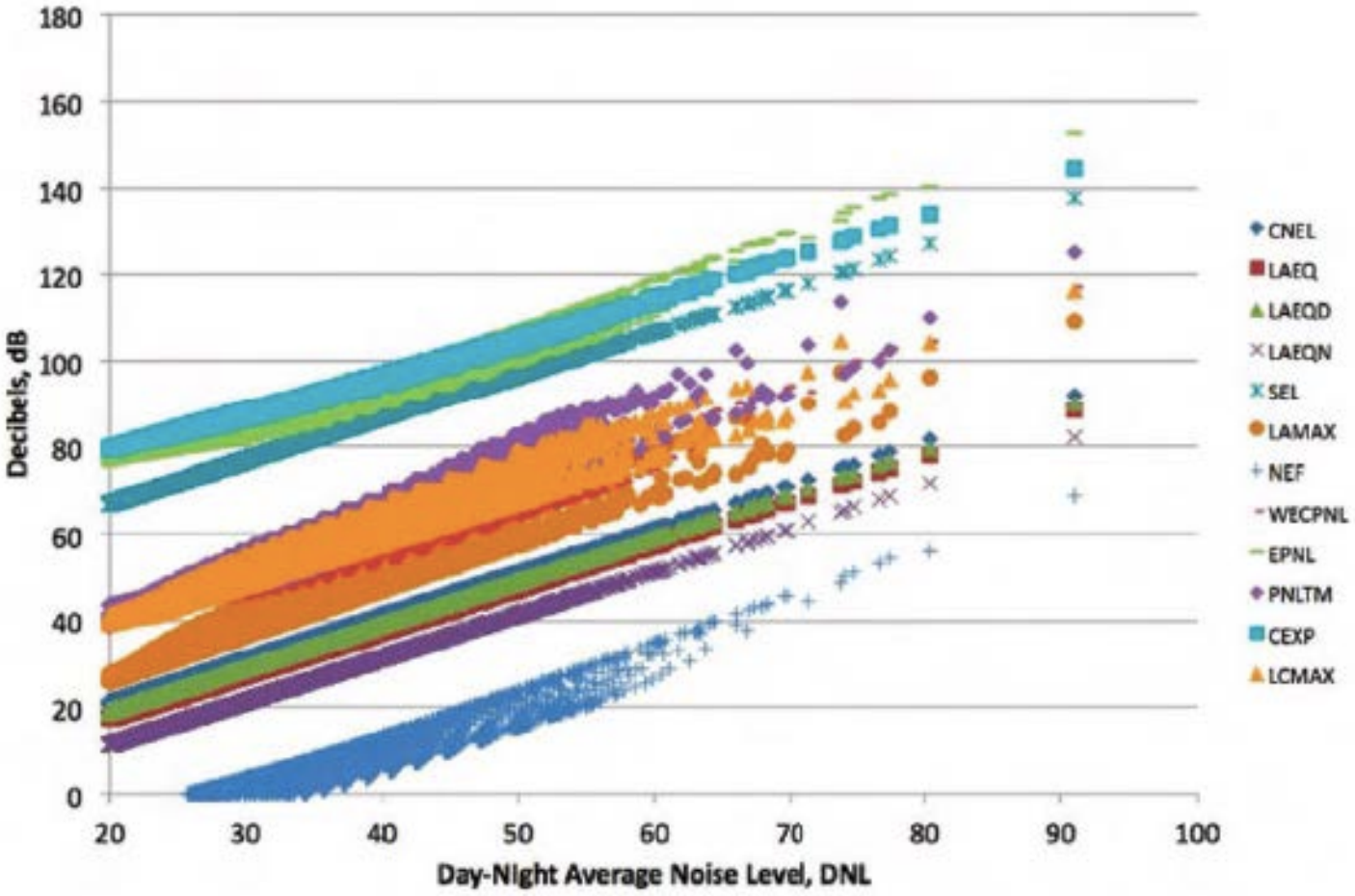
NOISE METRICS FOR QUANTIFYING HELICOPTER NOISE



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EFFECTIVE PRACTICES AND MITIGATION OF HELICOPTER NOISE

- Outreach
  - To both community and operators
  - Flight track monitoring maps to aid discussion with community and operators
  - Establish local or regional forum to address helicopter noise.
- Helicopter noise management program
  - Collect and analyze complaints
  - Flight track monitoring
    - Report helicopter compliance
- Published guides or brochures.

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- **Technology**
  - Quieter aircraft
  - Pilot aides; that is, Global Positioning System-based routes and use of visual landmarks.
- **Noise abatement procedures**
  - Noise abatement routes
  - Minimum altitudes
  - Reducing high-speed impulse and blade slap
  - Limit hovering.
- **Media pooling**
- **Fees based on quiet technology**
- **Voluntary operational limits and curfews.**

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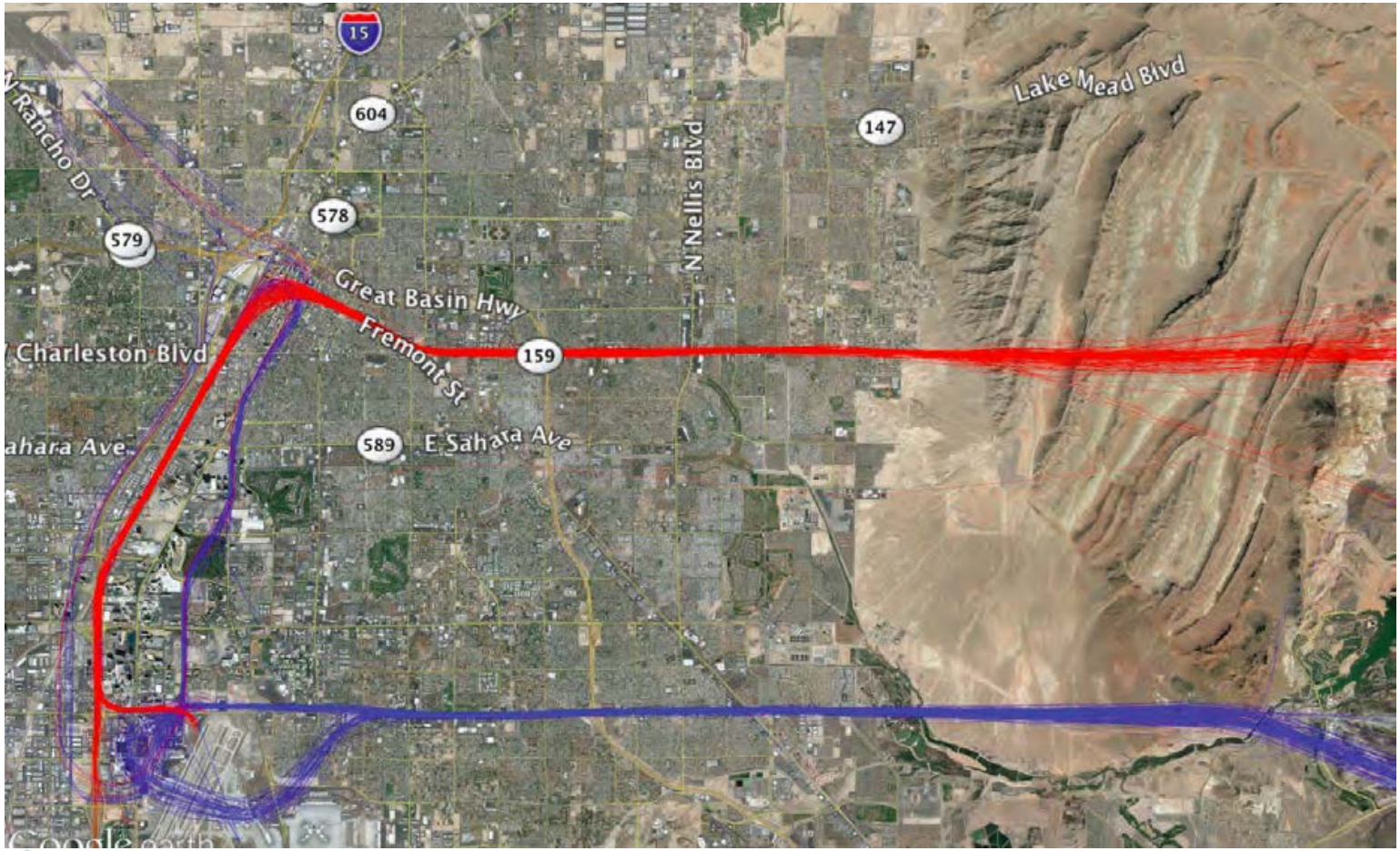
LAS VEGAS SUCCESS



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OTHER MATERIALS INCLUDED:

- Annotated Bibliography
- HIA Fly Neighborly Guide
- Sample Brochures
- Sample LOA, Airport and Air Traffic Control

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ACRP Research Report 181

Assessing Community Annoyance of Helicopter Noise

Vincent Mestre, P.E.

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Vincent Mestre, P.E.
Principal Investigator

- Former Associate Vice President, Landrum & Brown
- Chair SAE A-21 Committee on Aviation Noise & Emissions
- Recent Publications in JASA and NCEJ On Annoyance, Sleep Disturbance and Noise Complaint Patterns
- Co-Authors: Sanford Fidell, PhD, Richard Horonjeff, Paul Schomer, PhD, Aaron Hastings (Volpe), PhD, Barbara Tabachnick, Phd, Fredric Schmitz, PhD.

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ACRP Report 181: Oversight Panel

Heath Allen, *Lake Charles Regional Airport*
Ambrose Clay, *City of College Park, Georgia*
Eric Dinges, *ATAC*
Jeffrey Jacquart, *McCarron International Airport*
Don Scimonelli, *South Capitol Street Heliport*
Kevin Shepherd, *NASA*
Natalia Sizov, *FAA Liaison*
Christine Gerencher, *TRB Liaison*
TRB Staff: Joseph Navarrette

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Primary Purpose

1. “Improve understanding of the roles of acoustic and non-acoustic factors that influence community annoyance to civil helicopter noise.”
2. Focus was entirely on light civil helicopters, and did not include military or heavy-lift helicopters.
3. **Is there a difference in annoyance response to light civil helicopters than to fixed wing aircraft?**

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3 Community Surveys

(proof of concept)

Long Beach, CA, Redondo Corridor

Las Vegas, NV, Tropicana Blvd Corridor

Washington DC, Potomac River Corridor

Number Operations:

Long Beach	~ 18 per day
DC	~ 18 per day
Las Vegas	~ 150 per day

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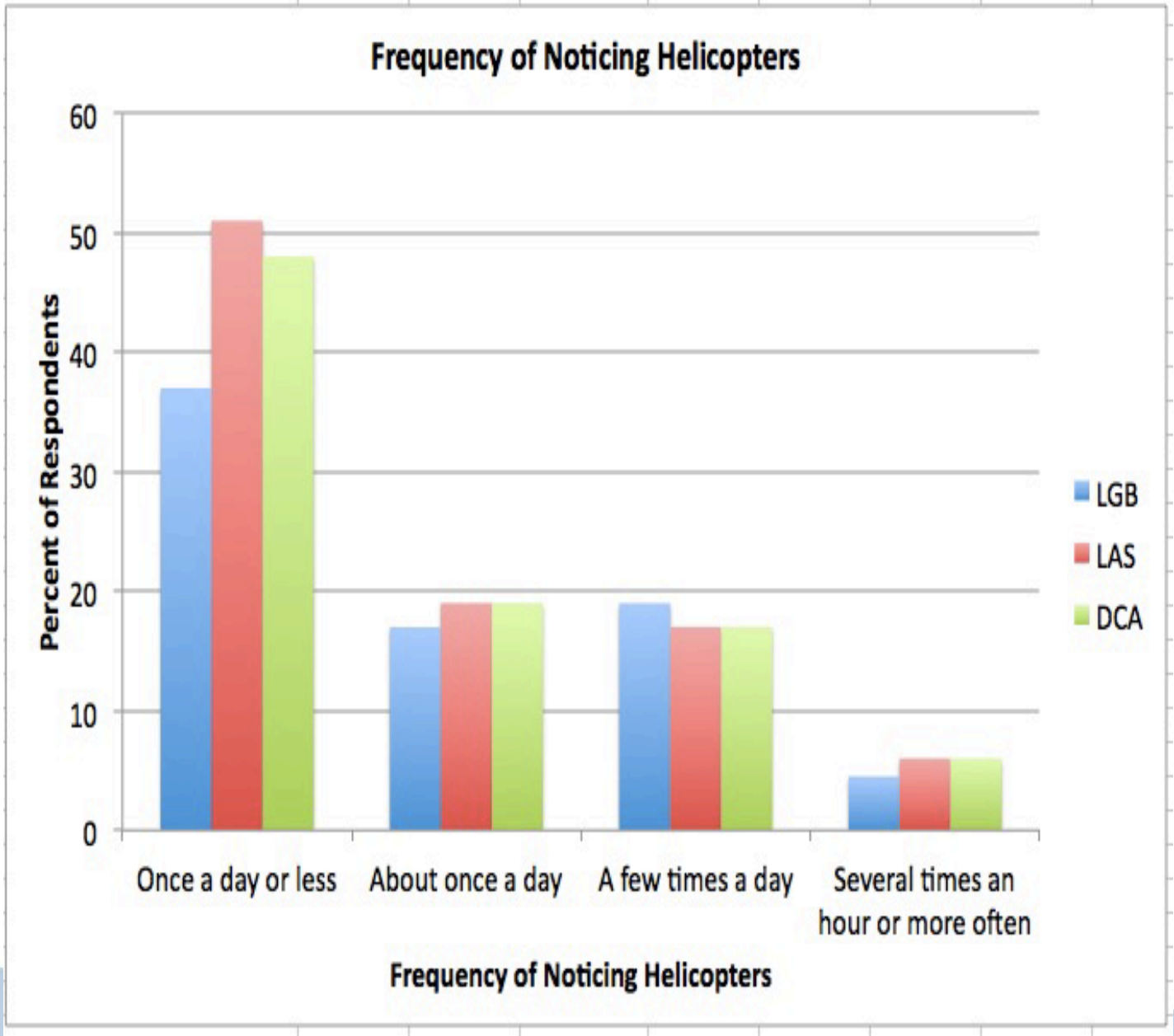

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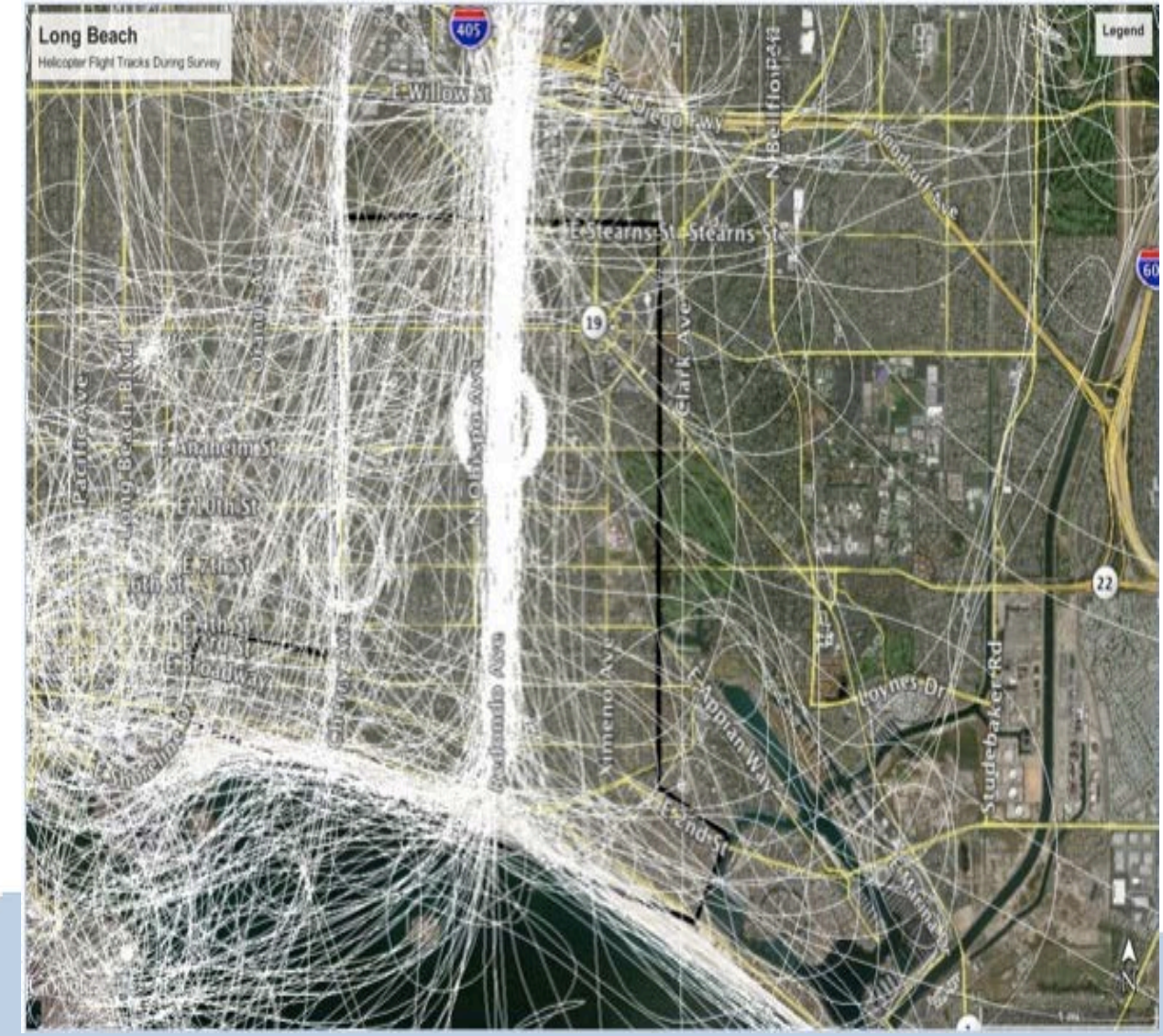
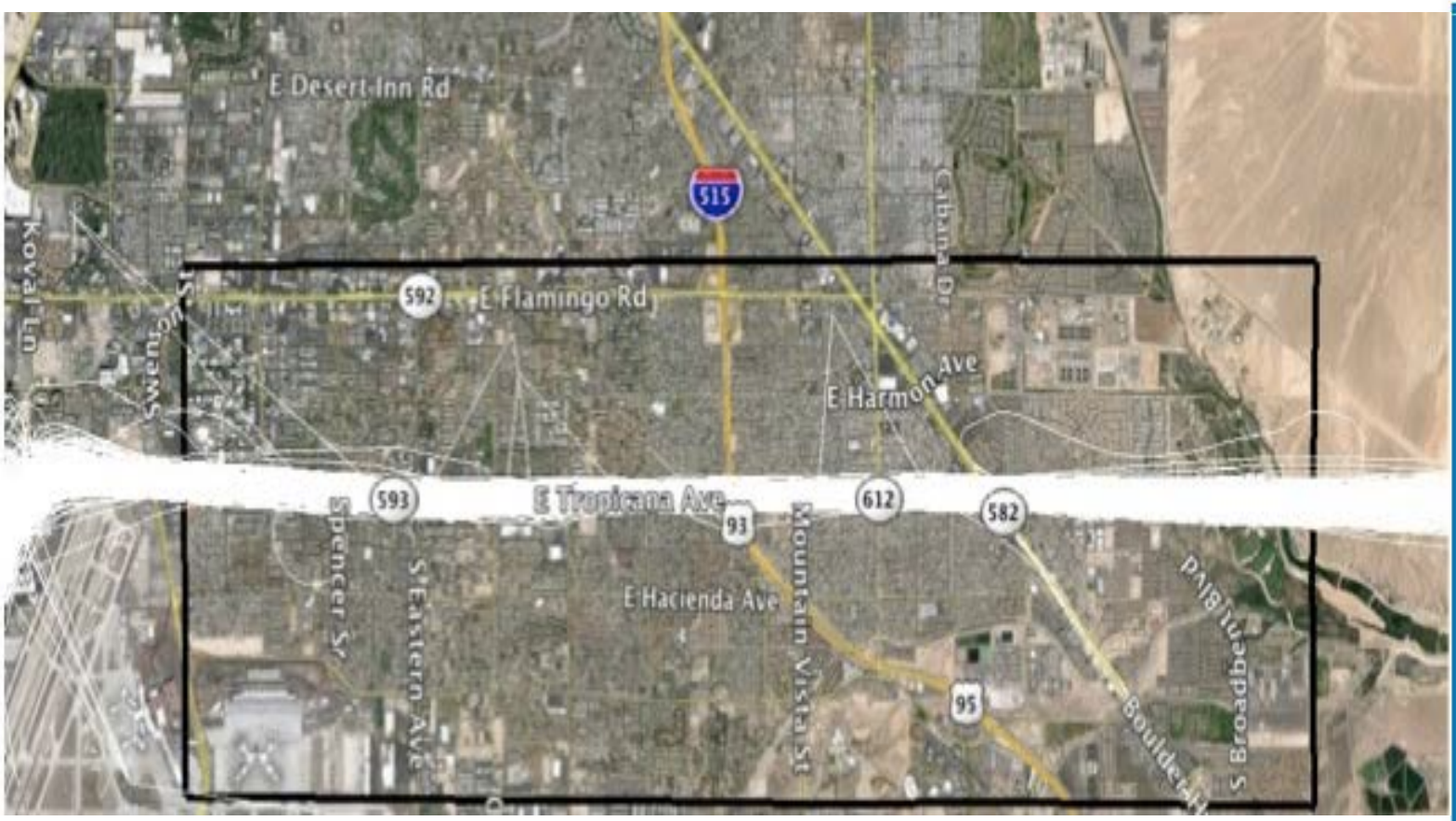
Long Beach Radar Tracks



Las Vegas Radar Tracks



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DC Helicopter Radar Tracks

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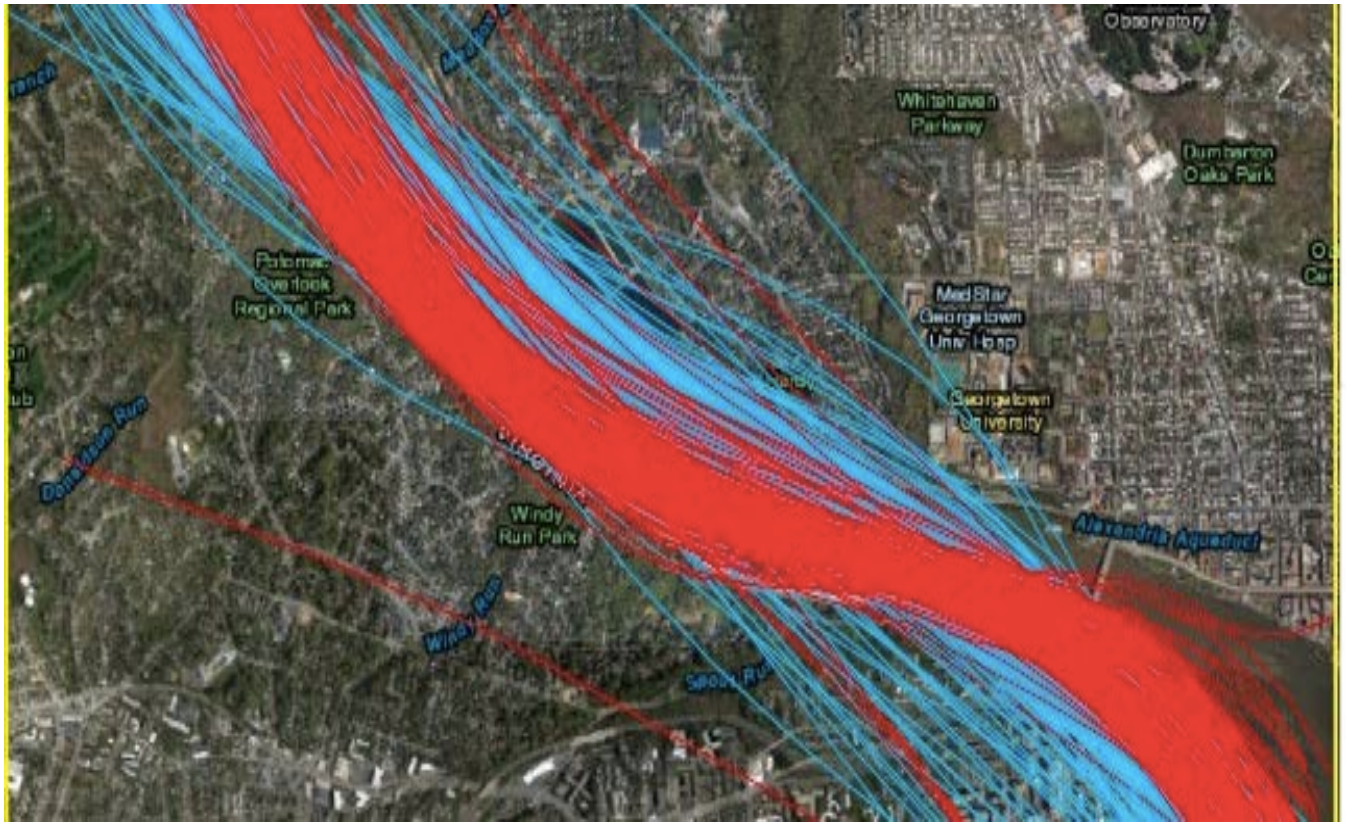
DC Fixed Wing Radar Tracks



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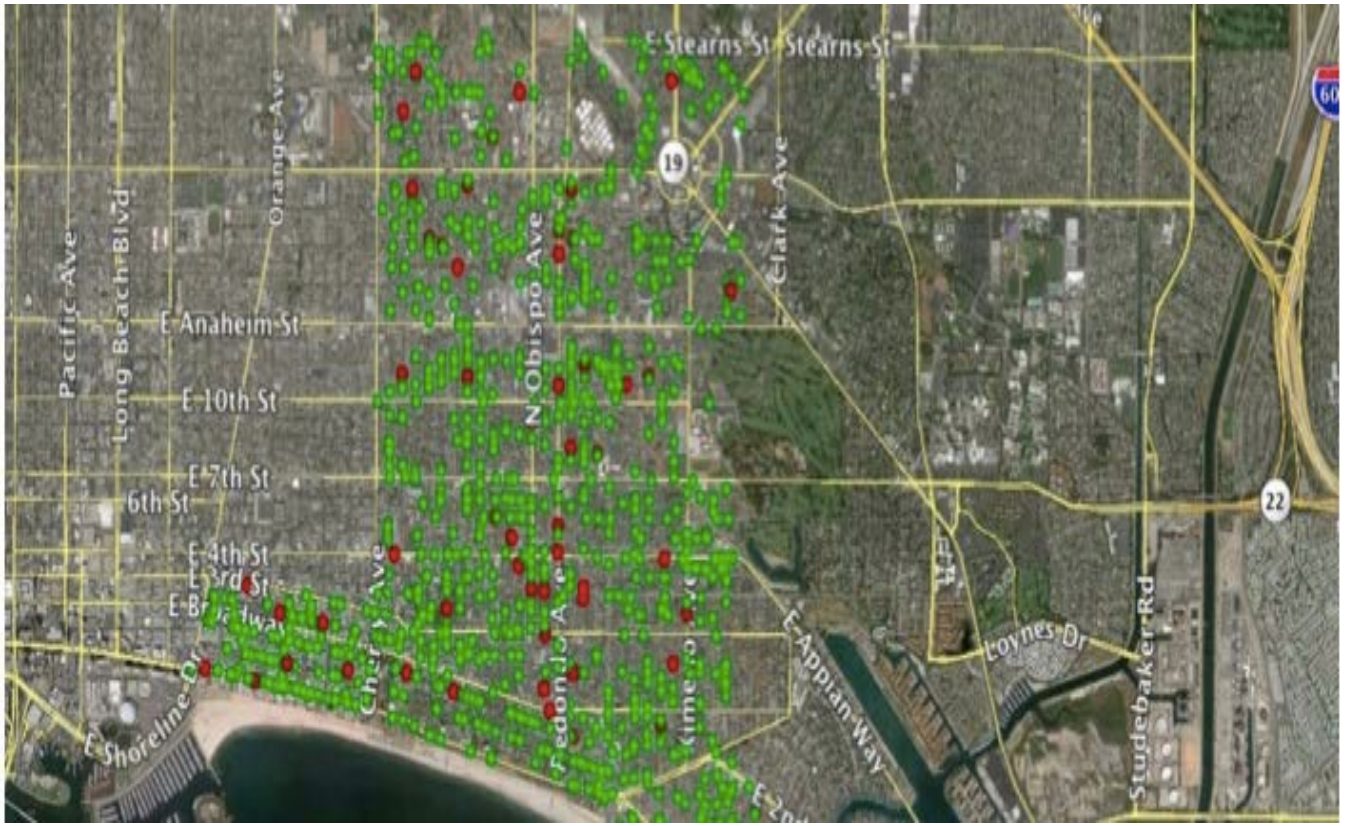
Long Beach Respondents and Highly Annoyed



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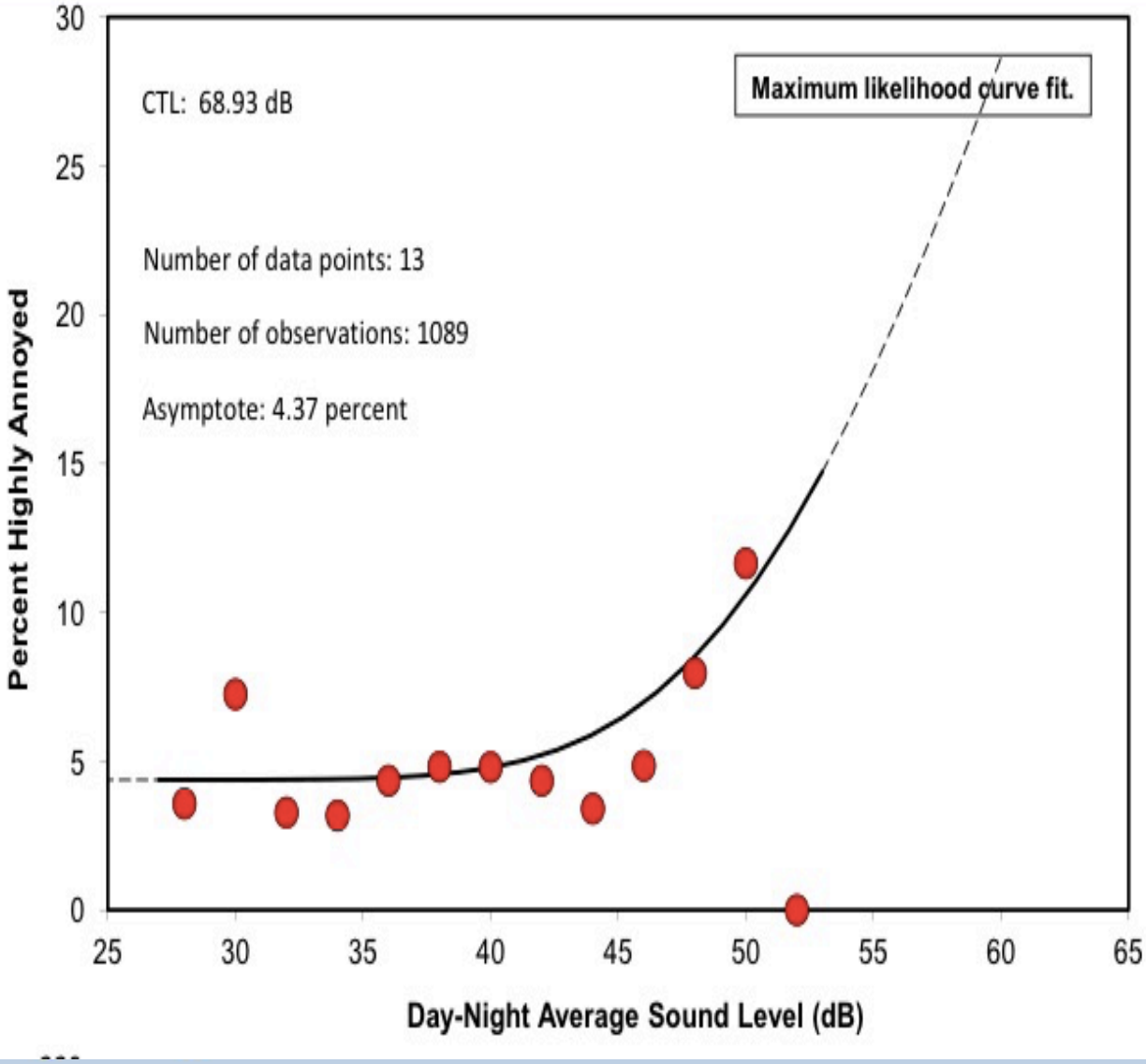
Survey 1: Long Beach Dose-Response



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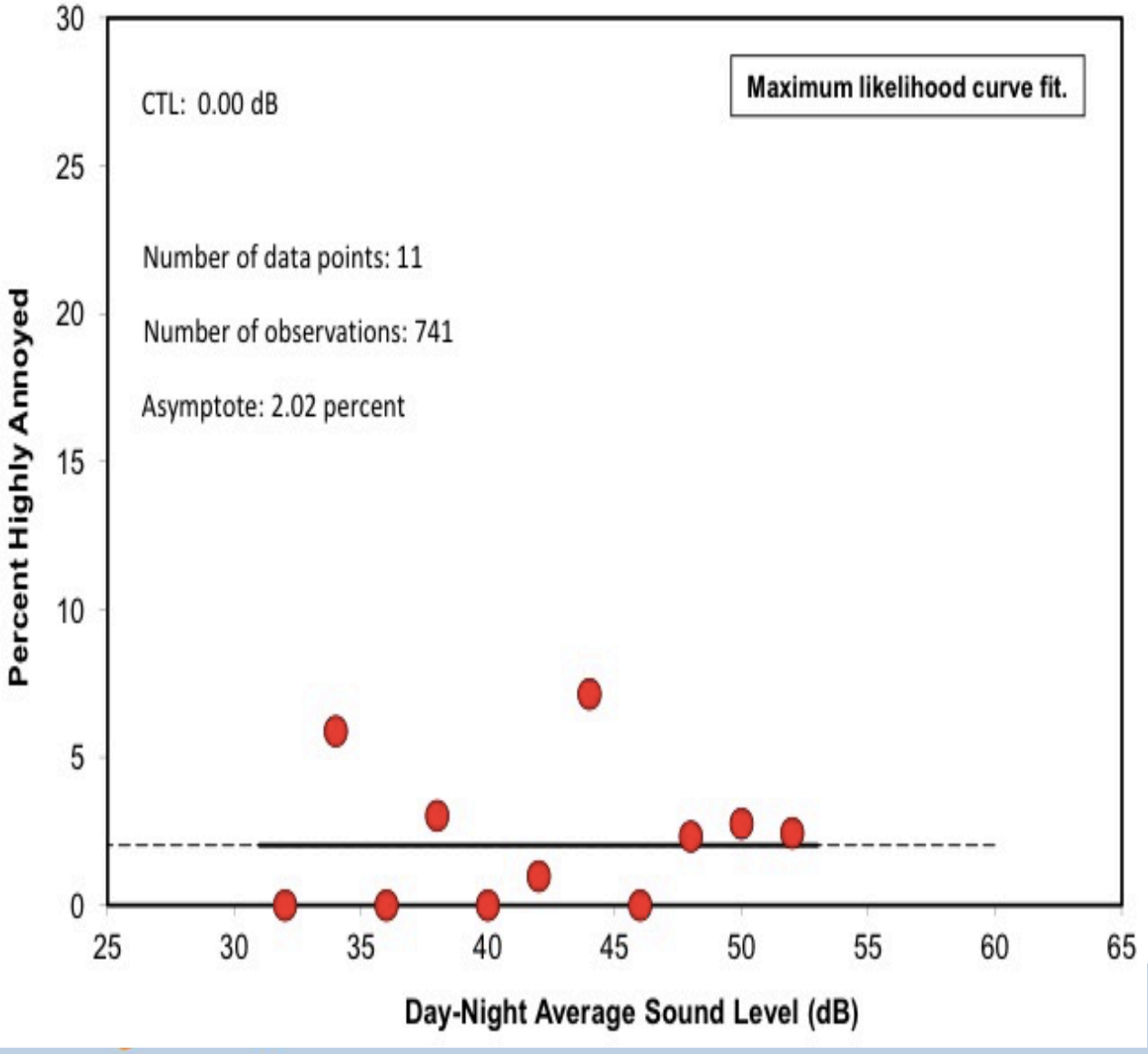
LAS Dose-Response



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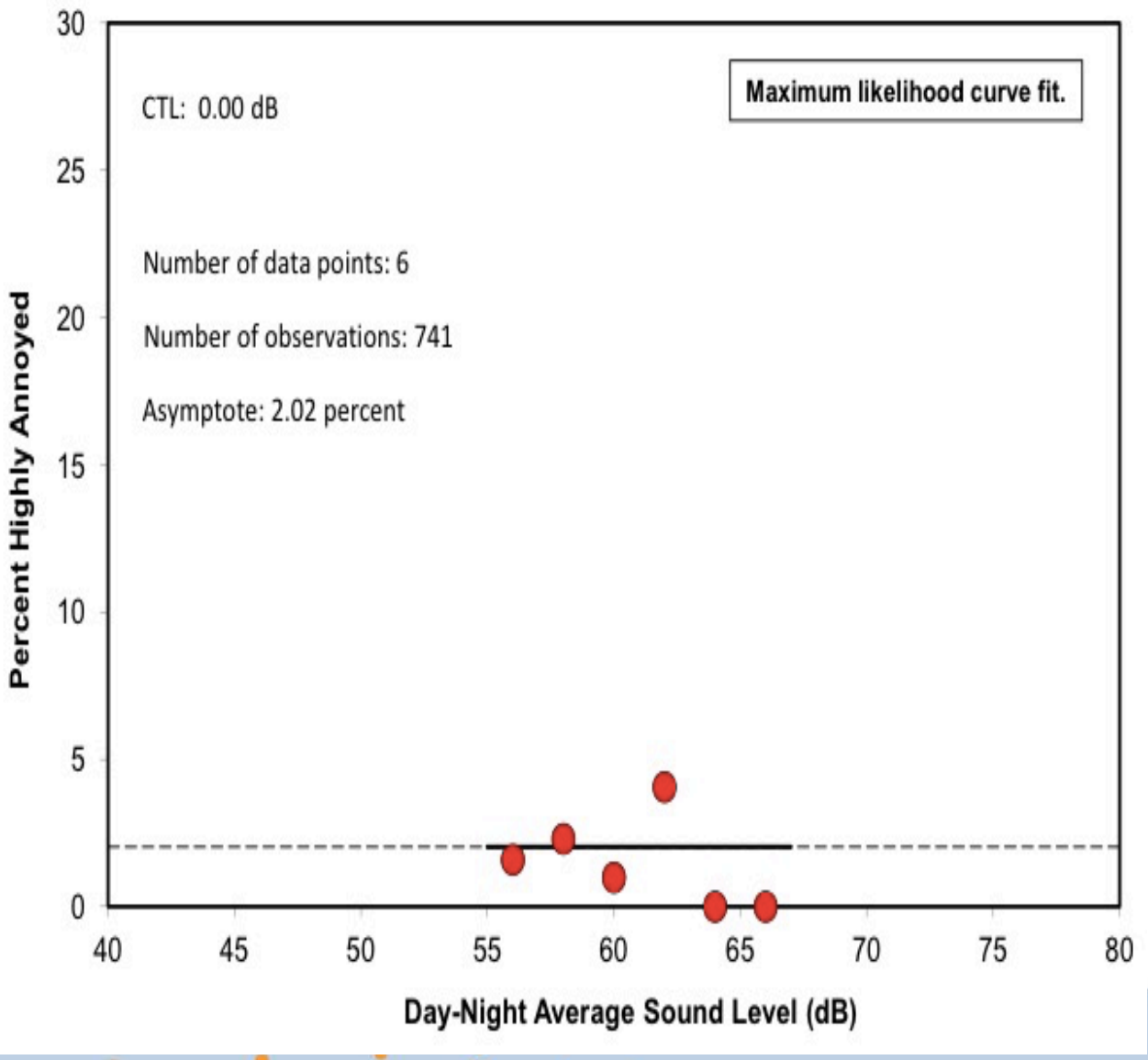
DC Helo Dose-Response



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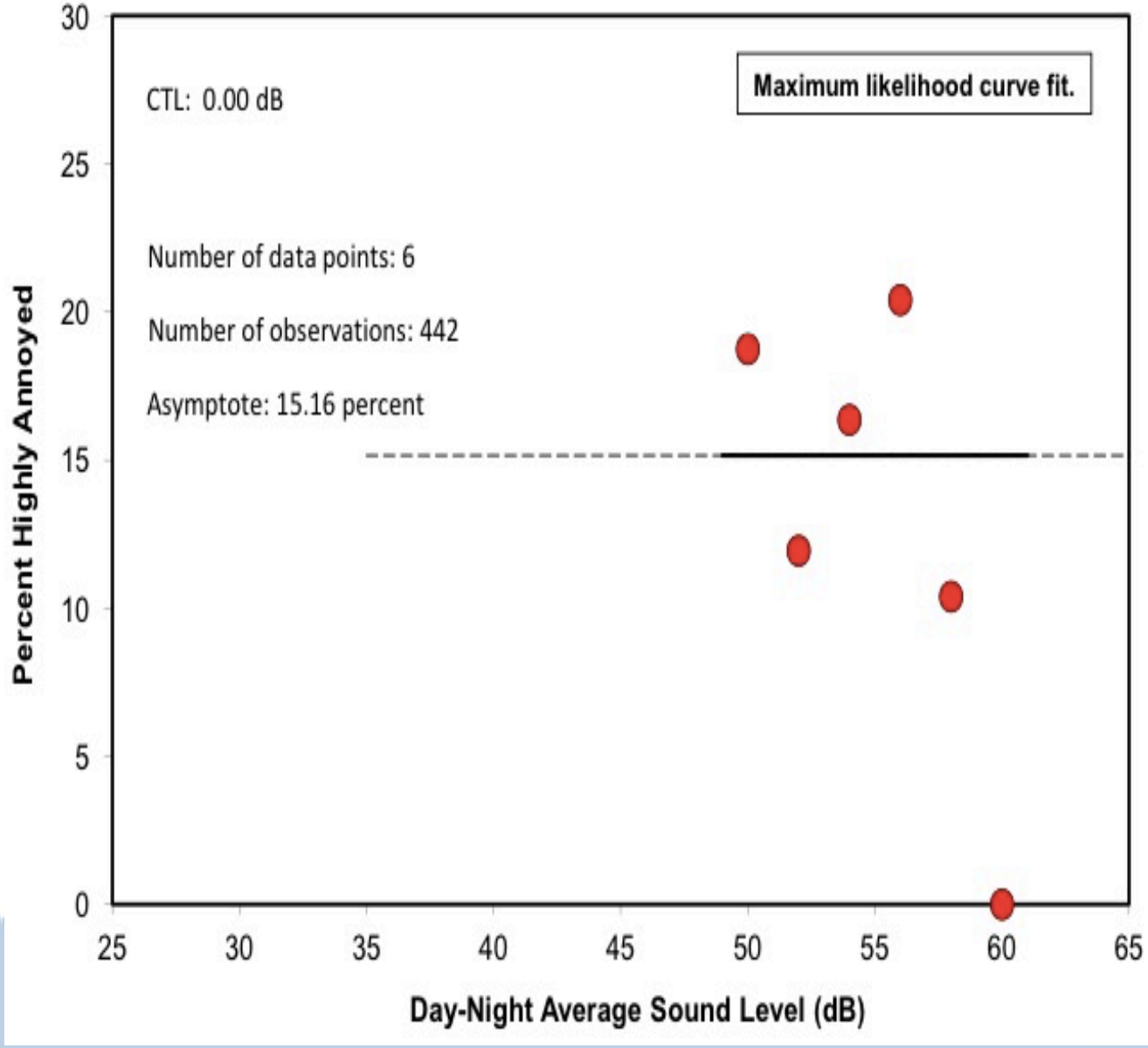
DC Fixed Wing Dose-Response



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The Big Conclusions

THE RESULTS ARE FOR LIGHT CIVIL HELICOPTERS

You can do helicopter dose-response social surveys

- Completed 3 in high use corridors
- Low use corridors would be more difficult (expensive) to survey

Three surveys are not sufficient to draw firm conclusions

What did we see from 3 surveys:

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Conclusions from 3 surveys

1. Only 1 survey showed a greater annoyance to helicopters than to fixed wing aircraft (remember this is only for light civil helicopters, and at this site there were few fixed wing overflights).
2. Annoyance due to light civil helicopters predicted in terms of A-weighted cumulative exposure only apparent in 1 of 3 surveys.
3. A-weighted non-impulsive measurements were highly correlated to C-weighted non-impulsive measurements and A and C-weighted impulsive measurements.
4. No correlation of annoyance to in-home vibration or rattling, but there was a correlation to reported 'buzzing.'

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Conclusions (2)

5. Non-acoustic factors were more salient than noise exposure in determining community response.

6. Distance to helicopters correlated with annoyance as well as helicopter noise levels.

7. No statistically significant difference in noise exposure for respondents who reported complaining and those who did not.

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Conclusions (3)

8. Only 1 site was found to have an increasing dosage-response relationship with increasing noise.

- All 3 sites had a 'background' annoyance level that was non-zero and not related to noise level.
- At 1 site this 'background' annoyance was much greater for fixed wing aircraft than for helicopters (by 10 dB).
- This site was the location of recent metroplex fixed wing route changes.

9. No compelling evidence of 'excess' annoyance of light civil aircraft as compared to fixed wing (only 3 surveys, maybe a little).

- [you could not replace the helicopters with light fixed wing aircraft and solve helicopter noise issues]

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Publication Names

ACRP Synthesis 76*:* Helicopter Noise Information for Airports and Communities

https://www.nap.edu/catalog/23609/helicopter-noise-information-for-airports-and-communities

ACRP Research Report 181: Assessing Community Annoyance of Helicopter Noise

http://www.trb.org/Publications/Blurbs/176822.aspx

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QUESTIONS?

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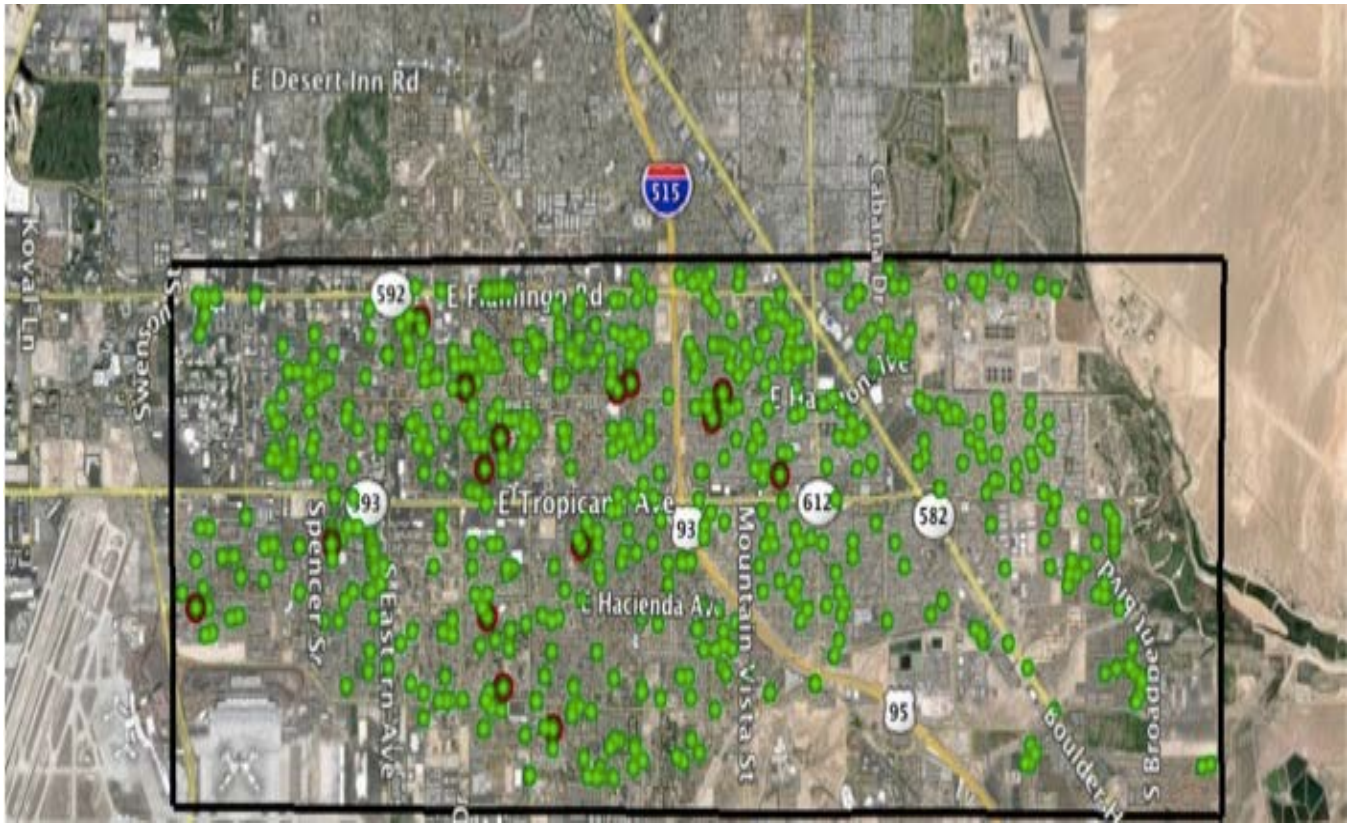
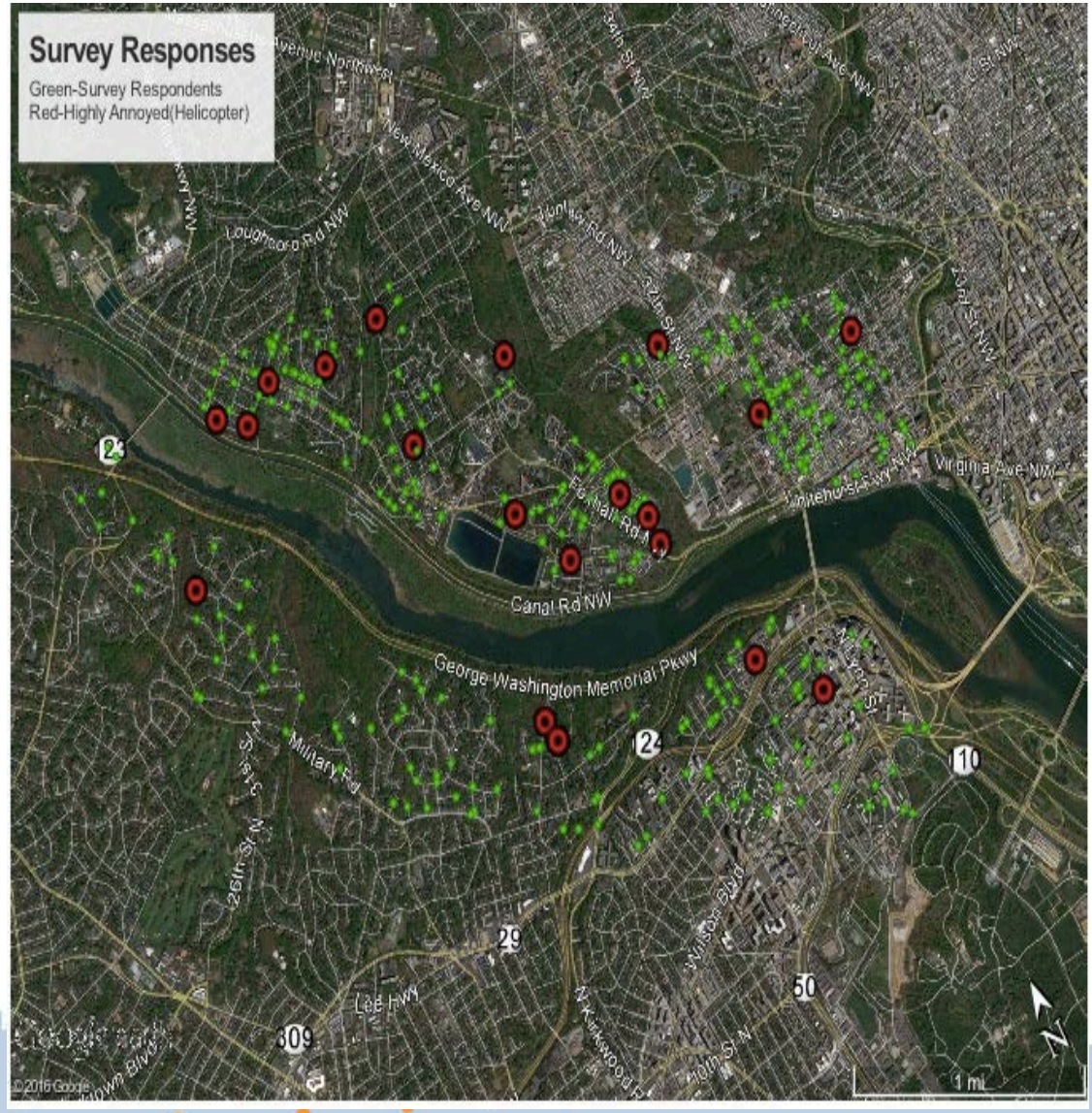
LAS Respondents and Highly Annoyed



DC Respondents and Highly Annoyed - Helo



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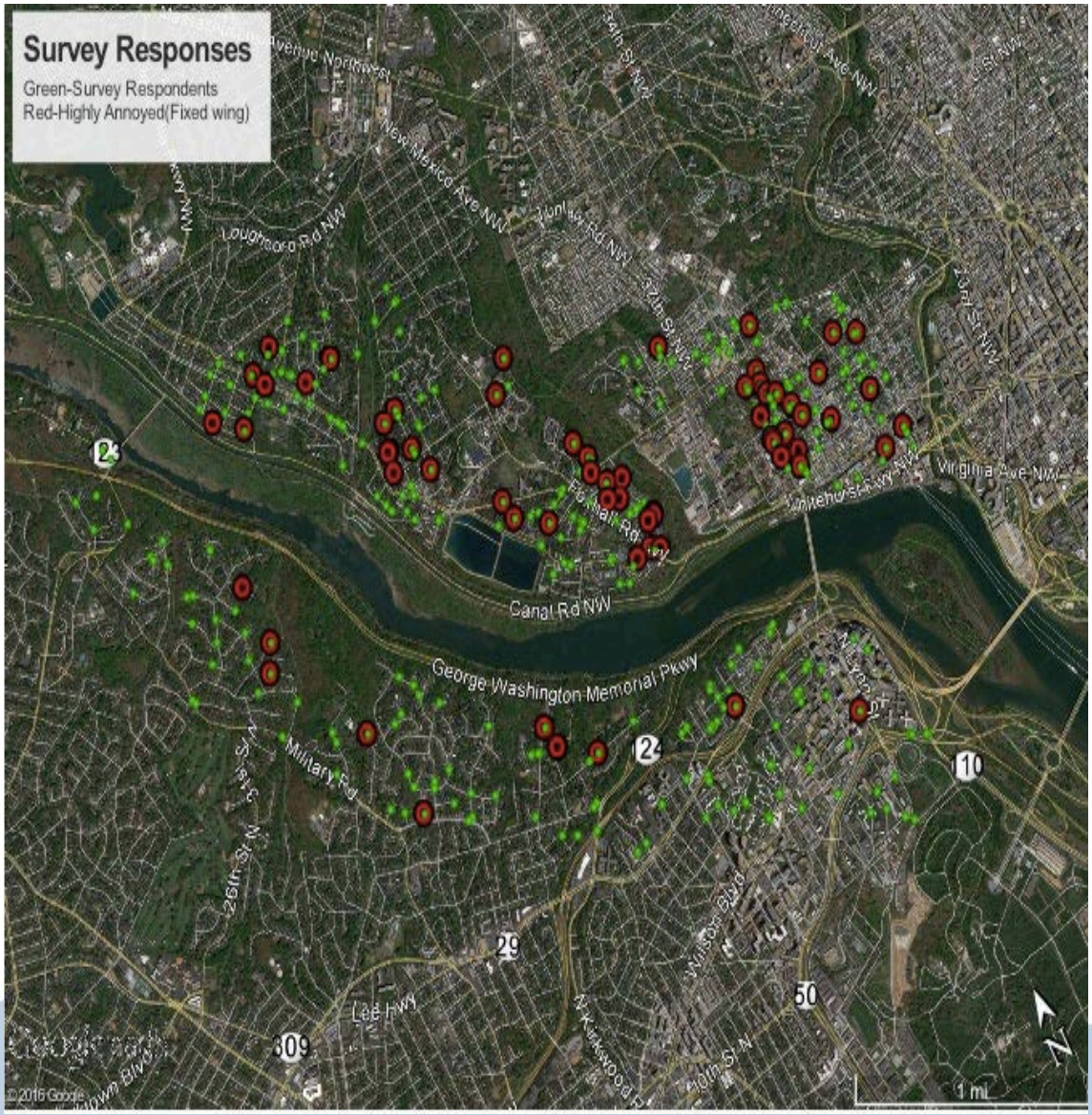
DC Respondents and Highly Annoyed – Fixed



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Today's Participants

- Ron Reeves, *Long Beach Airport*, Ron.Reeves@longbeach.gov
- Vincent Mestre, *Landrum & Brown*, vmestre@landrumbrown.com

Panelists Presentations

http://onlinepubs.trb.org/onlinepubs/webinars/180308.pdf

After the webinar, you will receive a follow-up email containing a link to the recording

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- Take part in the Champion or Ambassador Programs.

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http://www.trb.org/acrp/acrp.aspx