

Quantifying the Carbon Footprint of UCLA Related Air Travel

UC/CSU/CCC Sustainability Conference 2008

Prepared for: UCLA Transportation

Prepared by:

Calvin Lee Kwan, MPH

Environmental Science & Engineering Program

University of California, Los Angeles

Introduction

- AB32: CA Global Warming Solutions Act 2006
- ACUPCC
- UCOP Policy on Sustainable Practices
 - Reduce 2014 emissions down to 2000 levels
 - Reduce 2020 emissions down to 1990 levels

About UCLA

- College of Letters and Science
 - 11 Professional schools
 - Largest UC campus
 - 5,040 Academic Staff
 - 20,880 Staff Personnel
 - 38,476 students (Undergraduate & Graduate)
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Objectives

- Estimate the total annual air miles traveled on UCLA related business
 - Develop a *transparent* carbon calculator to determine carbon dioxide emissions from air travel
 - Quantify the associated carbon dioxide emissions
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UCLA Air Travel

- Definition of UCLA related air travel?
- Population
 - Faculty
 - Staff
 - Other representatives
 - Athletic teams
- Purpose of Travel
 - Government Panels
 - Conference
 - Expert testimony

UCLA Air Travel: Records

- Three Categories
 - Travel booked via UCLA Travel
 - Annual records available electronically
 - Athletics Department travel
 - Typically very similar each year
 - Made through a third-party travel agency
 - Travel paid for via grants or third-parties
 - Typically faculty members
 - Extent unknown

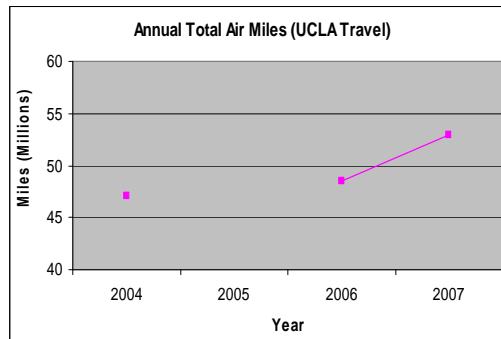
UCLA Air Travel: UCLA Travel

- In-house travel service for UCLA
- Used by administrative staff
- Records available, requested from UCLA Travel
- All unique Origin and Destination pairs with count

Ori.	Dest	Names	Ct	Distance	Total
SBA	LAX	Santa Barbara/Los Angeles	1	88.4	88.4
PHL	LGA	Philadelphia/New York	1	95.4	95.4
SAN	JFK	San Diego/New York	2	2,439.2	4,878.4
LAX	HNL	Los Angeles/Honolulu	104	2,551.1	26,5314.4
LAX	EZE	Los Angeles/Buenos Aires	24	6,123.8	14,6971.2
LAX	CPT	Los Angeles/Cape Town	6	9,985.3	59,911.8

UCLA Air Travel: UCLA Travel

- 2004
 - 24208 trips made
 - 43.3 million miles
- 2006
 - 29130 trips made
 - 44.7 million miles
- 2007
 - 28305 trips made
 - 49.1 million miles



UCLA Air Travel: Athletics

- Book travel on their own
- Travel plans, destinations and count rarely change
- Origin, Destination and Count received
- Total of 3.7 million miles by UCLA Athletics
- Total UCLA related air travel
 - 2004 ~ 43.2 million miles
 - 2006 ~ 48.0 million miles
 - 2007 ~ 52.3 million miles

Source: Personal communication with Mike Dowling, Director of Event Management, UCLA

UCLA Air Travel: Faculty

- Perhaps the group that travels the most
- Many trips paid for through grants or third-party organizations
- UCLA Travel does not have records of trips booked outside of UCLA Travel
- Extent of such travel was unknown
- Implemented a survey to estimate faculty air travel

UCLA Air Travel: Faculty Survey

- Department
- Rank
- Years of Employment
- Administrative Positions
- Number of Round Trips taken in the last 12 months
- Percentage made through UCLA Travel
- Three most recent destinations and dates of travel

Faculty Air Travel Survey

1) With what department or unit at UCLA are you personally affiliated? *Ex: History*

2) What is your rank at UCLA? *check only ONE*

Distinguished Professor Professor Associate Professor
 Assistant Professor Lecturer

The above checked appointment(s) is/are checked all that apply

Acting Adjunct Clinical

3) Approximately how many years have you been employed at UCLA?

And approximately how long is your current profession?

4) What, if any, administrative appointment do you hold at UCLA?

Dean Associate Dean Department Chair
 Provost Assistant Provost *Other please specify*

The following questions are in regards to UCLA related air travel

"UCLA related air travel" is defined as any travel made by faculty or staff as representatives of UCLA. This includes, but is not limited to, serving on government panels, attending conferences or providing expert testimony. Air travel for personal consulting services, leisure, personal interest, or activities that require Chancellor approval are NOT considered UCLA related.

5) Based on the definition of UCLA-related air travel given above, have you completed any UCLA related air travel in the last 12 months?

Yes >>> About how many round-trips? _____

No

Not sure, explain _____

6) When traveling on UCLA-related flights, about what share (%) of the trips are typically arranged through UCLA Travel (the official campus travel agent)? *Ex: 15%*

_____%

7) For your three most recent UCLA-related business trips, please list the destinations and approximate dates of the travel below. Please note whether the trips were booked through UCLA Travel.

Destination	Date	Booked through UCLA Travel?
<i>Ex: Beijing</i>	<i>March 07</i>	<i>No</i>
<i>Sacramento</i>	<i>Feb 07</i>	<i>Yes</i>
<i>Chicago</i>	<i>Jan 07</i>	<i>No</i>
_____	_____	_____
_____	_____	_____
_____	_____	_____

Please add any clarifications to your above answers here:

UCLA Air Travel: Faculty

- 2,158 people invited to participate
 - 1,275 Professors
 - 304 Associate Professors
 - 266 Assistant Professors
 - 313 Lecturers
- 107 different departments
- Survey online for two weeks

Source: UCLA Diversity Committee

UCLA Air Travel: Faculty

- 465 unique responses (22%)
- 80% completed UCLA related air travel
- Even distribution ratios across departments
- 87 different departments represented

Rank	Population	Frac. of Pop	Survey	Frac. of Survey
Professor	1,275	0.59	293	0.63
Associate Professor	304	0.14	59	0.13
Assistant Professor	266	0.12	57	0.12
Lecturer	313	0.15	56	0.12
Total	2,158	1	465	1

UCLA Air Travel: Faculty

- 74% of faculty do not use UCLA Travel
- ~ 1500 trips, 3.9 million miles reported from survey
- When projected to UCLA population, 18 million additional air miles are traveled by faculty
- Total air miles in 2007: ~ 70 million miles

Objective 2

- Estimate the total annual air miles traveled on UCLA related business
- Develop a *transparent* carbon calculator to determine carbon dioxide emissions from air travel
- Quantify the associated carbon dioxide emissions

Carbon Calculator: Online Discrepancies

- Many available online
 - Terrapass, CarbonFund.org, EPA, CA/CP
- Lack of transparency
 - “Proprietary” formula
- Inconsistencies
 - Unknown assumptions
 - Different methodologies

Carbon Calculator: Comparisons

	Flight conversion (lbs CO ₂ /mile)	CO ₂ emitted for 830 miles flown (lbs/year)
American Forests	0.44	365
Be Green	0.42	352
BEF	1.36 ^a	1,129
CarbonCounter.org	0.87 ^a	720
Chuck Wright	0.51	426
Clear Water	0.62	517
Conservation Fund	0.43	360
SafeClimate	0.64	528
TerraPass	0.45	373
<i>Mean</i>	<i>0.64</i>	<i>530</i>
<i>Median</i>	<i>0.51</i>	<i>426</i>

^a includes radiative forcing factor

Source: Padgett et al. 2008

Carbon Calculator: Factors

Factor	B737-700	B777-400	B747-400
Passenger Capacity	126	350	400
Load Factor	85%	85%	85%
Fuel Type	Jet Fuel A	Jet Fuel A	Jet Fuel A
Fuel Efficiency	1.9 GPM ¹	4.38 GPM ¹	6.48 GPM ¹
CO2 emitted/LTO	3,150 kg ²	5,200 kg ²	7,900 kg ²
CO2 emissions	3,150 kg/T ²	3,150 kg/MT ²	3,150 kg/MT ²

¹ from BTS,
² from IPCC

Other Factors:

Weight of Jet Fuel: 3.06 kg/gallon

Carbon Calculator: Radiative Forcing

- Change in the difference between incoming and outgoing solar radiation
- Emissions in the atmosphere do not have the same effect as emissions on the ground
- NO_x, PM, water vapor from aircraft
- Generally 2.7 times the CO₂ radiative forcing

Carbon Calculator: Formula

$$\left(\begin{array}{cccc} \text{Distance} & \text{Fuel Eff.} & \text{Wt. of Jet Fuel} & \text{Fuel Emissions} \\ \text{miles} & \text{gpm} & \text{MT/gal.} & \text{kg/MT of fuel} \end{array} \right) \times + \begin{array}{c} \text{CO2 from LTO} \\ \text{kg} \end{array}$$

$$\left(\begin{array}{c} \text{Passenger Capacity of Aircraft} \\ \text{X} \\ \text{Load Factor} \end{array} \right)$$

= kg of CO2 emitted per *PASSENGER*

Carbon Calculator: Comparison

- Los Angeles (LAX) – New York (JFK)
 - B737-700
 - 2,482 miles
 - 4,715.8 gallons of fuel consumed

Carbon Calculator	Carbon Emission/Person (kg)	% Difference
Formula	478.74 (1,388 [*])	0.00%
CCAR	447.2	-6.6%
Terrapass	326.3	-31.8%
CarbonFund	470.0	-1.8%
Safe Climate	722.0	+68.7%
Carbon Footprint	452.3	-5.5%
Bonneville Env. Found.	1,422.27 [*]	+2.5% ^a
CarbonCounter.org	1470 [*]	+5.9% ^a

^{*}Takes into account radiative forcing

^a compared to Formula result with radiative forcing factored in

Carbon Calculator: vs. CCAR

■ Boeing 737-700

Distance	Gallons	Formula (kg)	CCAR (kg)	% Diff.
500	950	117.7	90.2	23.3%
1,000	1,900	208.8	180.4	13.6%
2,000	3,800	390.9	360.8	7.7%
5,000	9,500	937.5	901.9	3.8%

■ Boeing 747-400

Distance	Gallons	Formula (kg)	CCAR (kg)	% Diff
5,000	32,400	1,003.3	969.0	3.4%
7,000	45,360	1,394.7	1,356.6	2.7%
10,000	64,800	1,981.8	1,937.9	2.2%

Objective 3

- Estimate the total annual air miles traveled on UCLA related business
- Develop a *transparent* carbon calculator to determine carbon dioxide emissions from air travel
- Quantify the associated carbon dioxide emissions

Carbon Calculator: Formula

$$\left(\frac{\text{Distance (miles)} \times \text{Fuel Eff. (gpm)} \times \text{Wt. of Jet Fuel (MT/gal.)} \times \text{Fuel Emissions (kg/MT of fuel)}}{\text{Passenger Capacity of Aircraft} \times \text{Load Factor}} \right) + \text{CO2 from LTO (kg)}$$

Passenger Capacity of Aircraft X Load Factor

Quantifying Carbon Emissions

- Distance Breakdown
 - 0-3000 miles B737-700
 - 3001-6,000 miles B777-400
 - 6,001+ B747-400
- B737-700
 - 31,730 flights, 42,323,495 miles
- B777-400
 - 2,365 flights, 14,705,949 miles
- B747-400
 - 1,571 flights, 13,762,611 miles

Quantifying Carbon Emissions

	# of Flights	Total distance	Formula Carbon Emissions	CCAR Method
B737	34,314	42,323,495	8,582	7,594
B777	2,754	14,705,949	2,274	2,202
B747	1,956	13,762,611	2,742	2,667
	Total	70,792,055		

TOTAL EMISSIONS

13,598 MT

12,463 MT

Difference

9.11%

Discussion

- Almost 71 million air miles in 2007
 - 13,598 MT of CO₂
- 42,294 MT of CO₂ from surface transportation
- Air travel is projected to increase³
- What should we do?
 - Reduce air travel?
 - Short trips (SFO-SJC, LAX-SAN, LAX-OAK?)
 - Offset these emissions?

Source: US EPA, Bureau of Transportation Statistics

Conclusion

- UCLA related air travel is a significant component of total UCLA transportation
- Air travel is necessary
- Improvements
 - Keep better track of faculty air travel
 - Increase awareness of emissions associated with air travel
 - Minimize short-haul trips and replace with lower impact modes
 - 233 flights < 150 miles

Flight	Distance (miles)
SFO/SJC	30.2
LAX/SBA	88.4
SAN/LAX	109.1
MCO/TPA	82

Questions?

This concludes the American Institute of Architects Continuing Education Systems Program.

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