Mass-Scale Regional Sky Transit

May 3, 2022 by Brien A. Seeley M.D.
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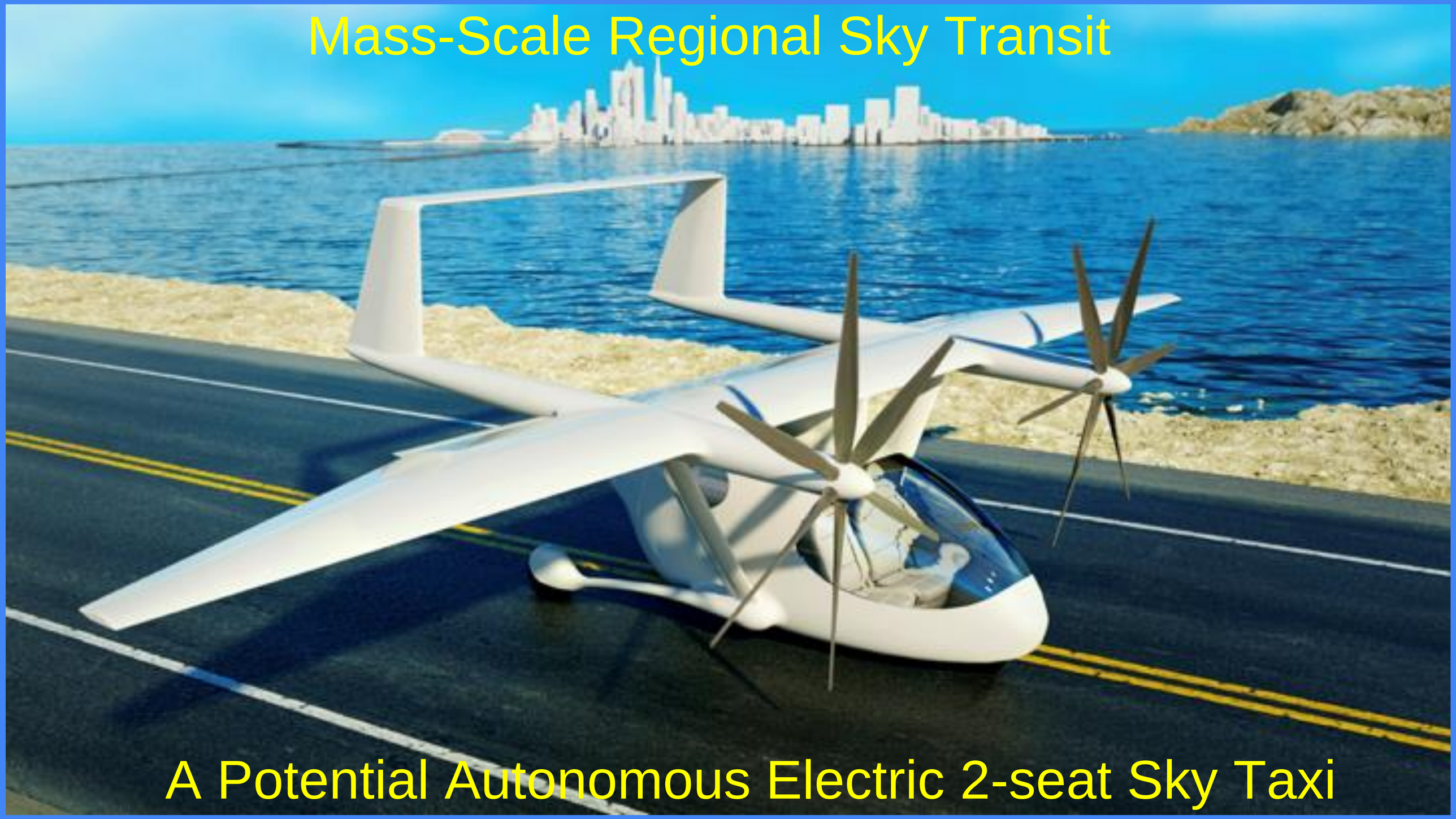
Mass-Scale Regional Sky Transit



A Potential Autonomous Electric 2-seat Sky Taxi

“If you want to understand something, examine its *extremes*.”

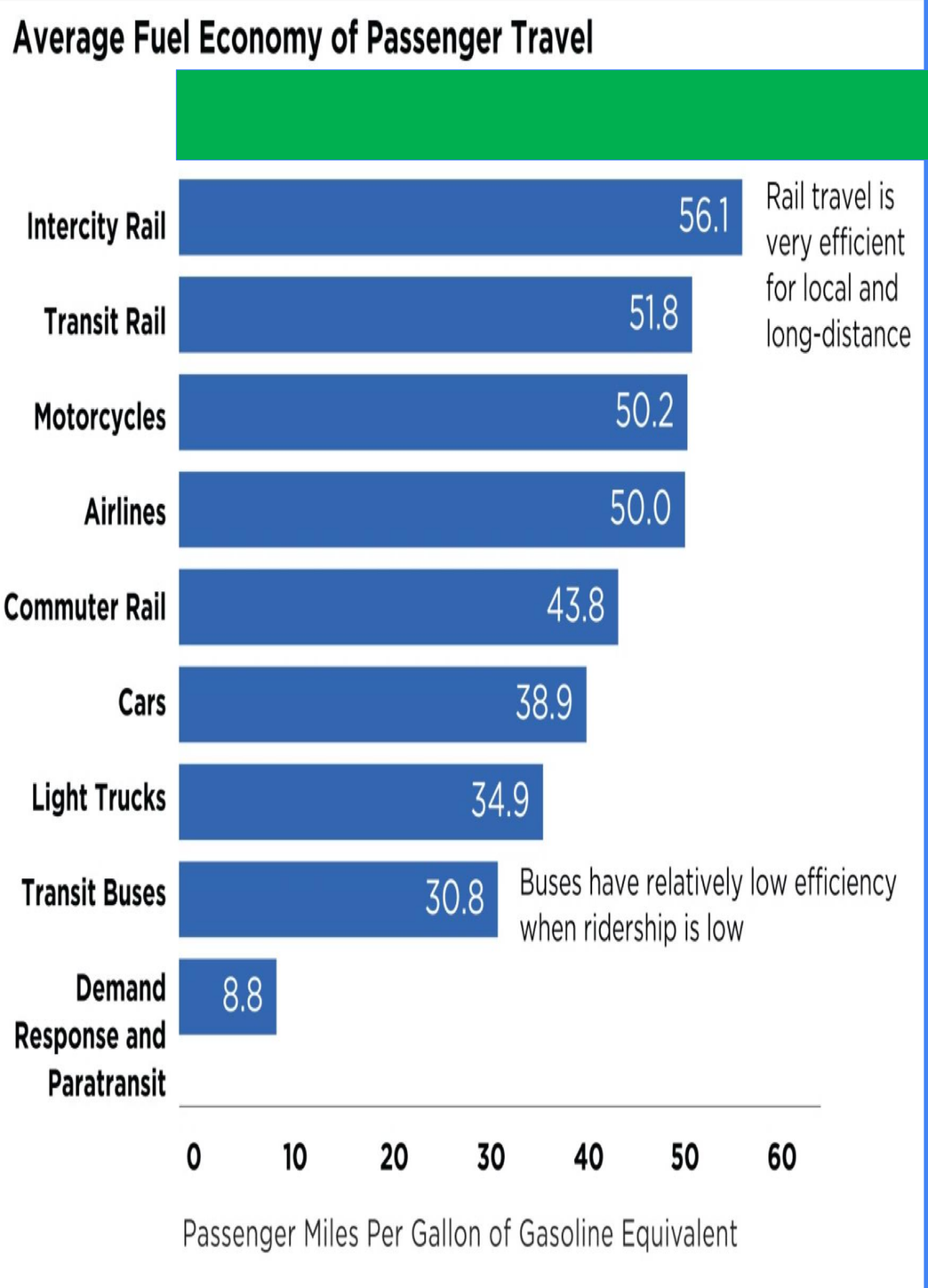
— Lyle S. Powell Jr. M.D.

Extreme what?
Extreme autonomy (with ‘airline safety’)
Extreme efficiency
Extreme capacity
Extreme ubiquity
Extreme cost savings
Extreme CO_2 reductions
Extreme noise reduction
Extreme fire suppression

Extreme autonomy: clockwise from left: Driverless pinpoint landings at 245 fps on a carrier deck pitching in 10-foot seas. Driverless copter on Mars. Driverless air-to-air refueling. Driverless formation flight.

Extreme efficiency:

The 2011 NASA Green Flight Challenge (GFC)



Extreme capacity: fast turnaround times need fast boarding

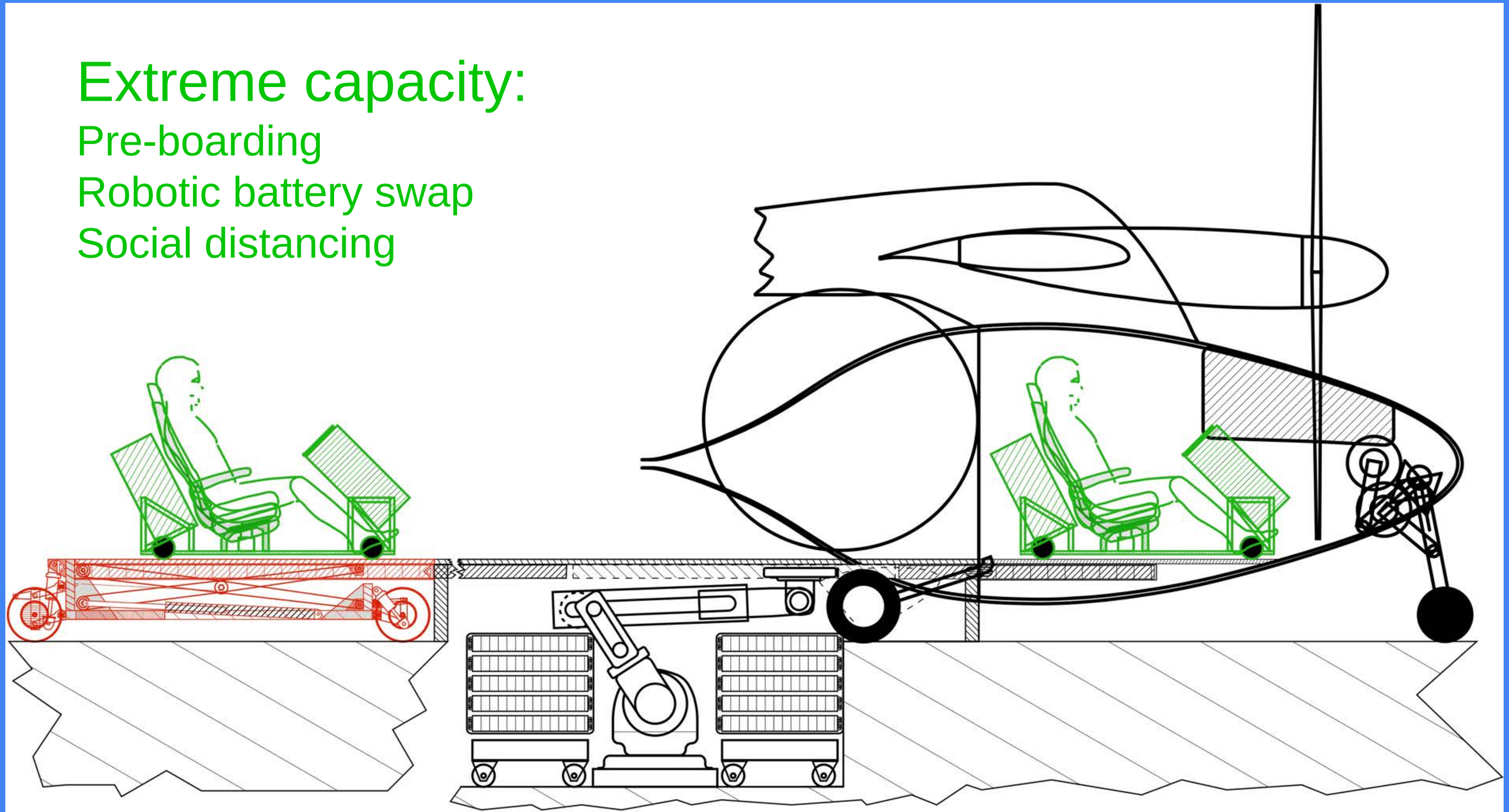
Extreme capacity: no TSA delays
Must have walk-up service & take-off in just 30 seconds.

Extreme capacity:

Pre-boarding

Robotic battery swap

Social distancing



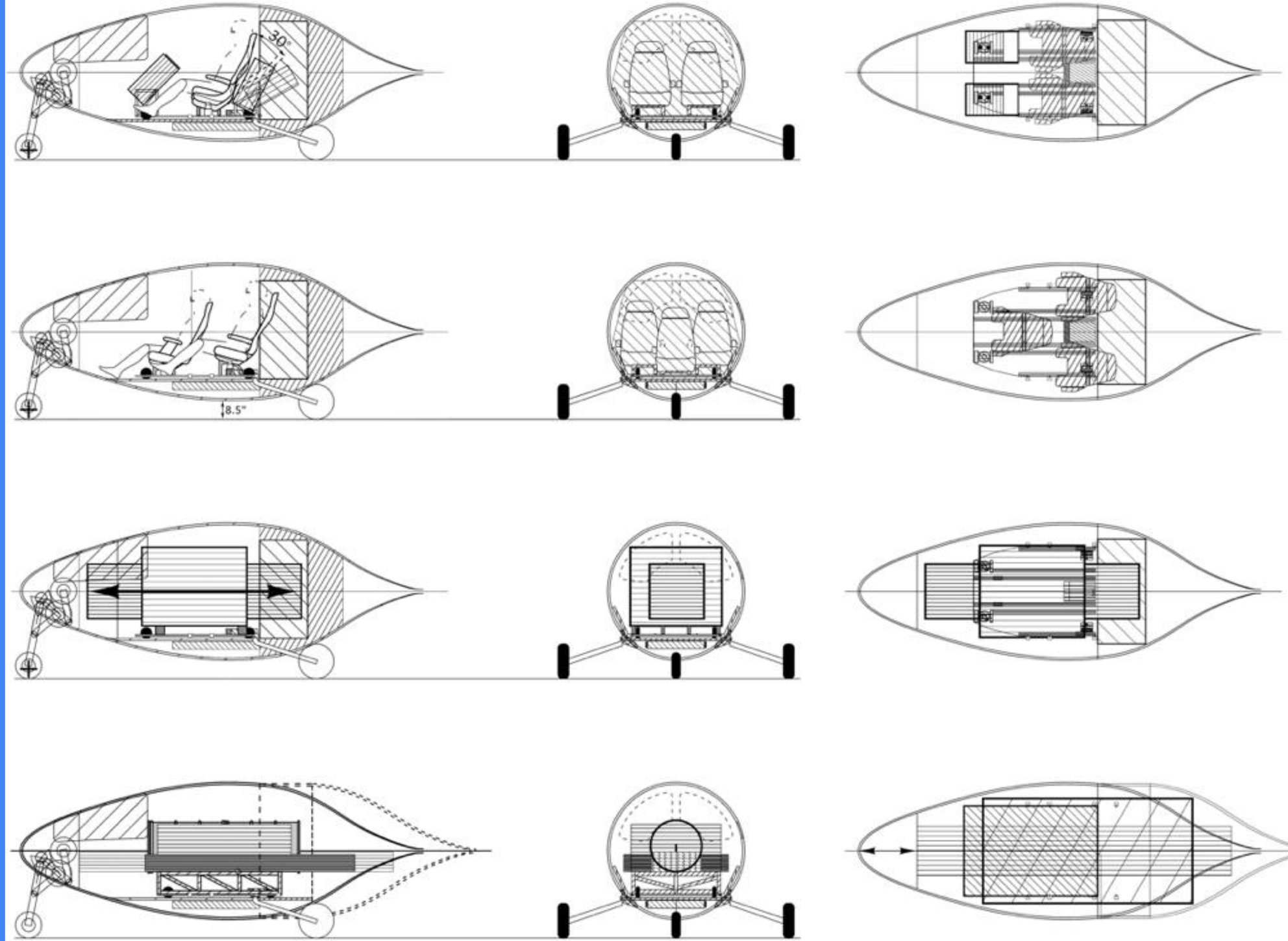
Extreme Capacity:

Payload versatility:

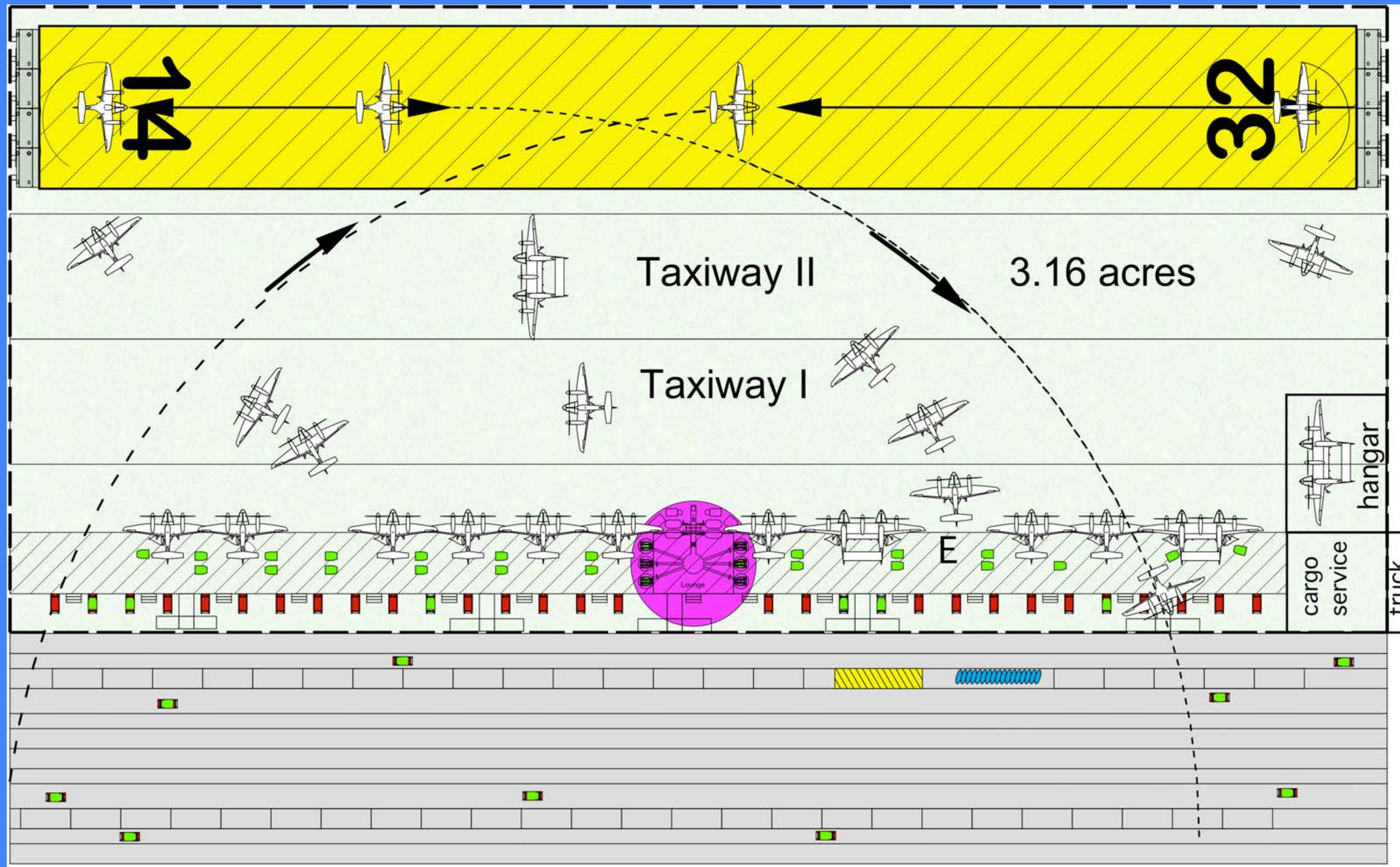
Passengers

Cargo

Building materials

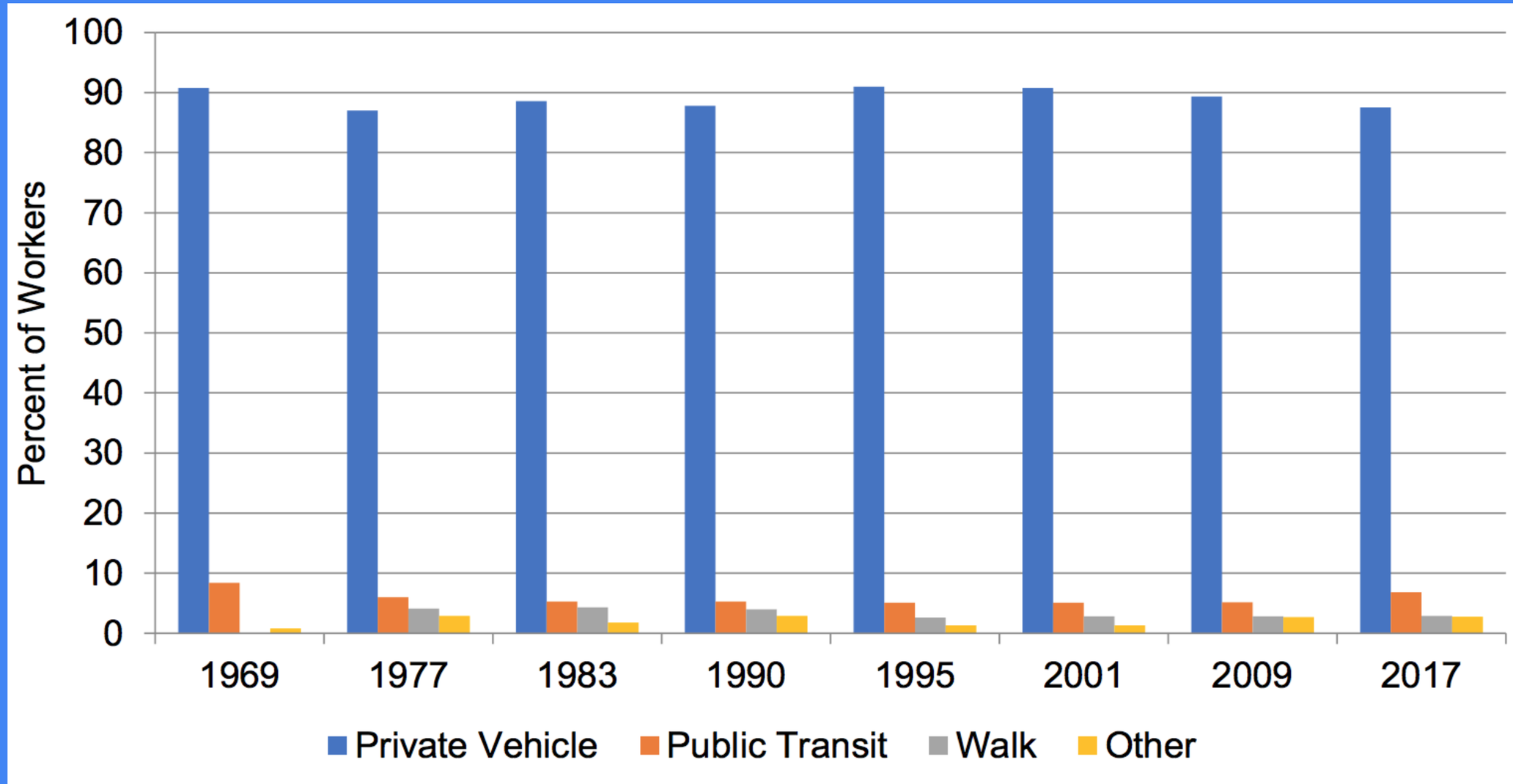


Extreme capacity: 2-6 seat ESTOL electric sky taxis

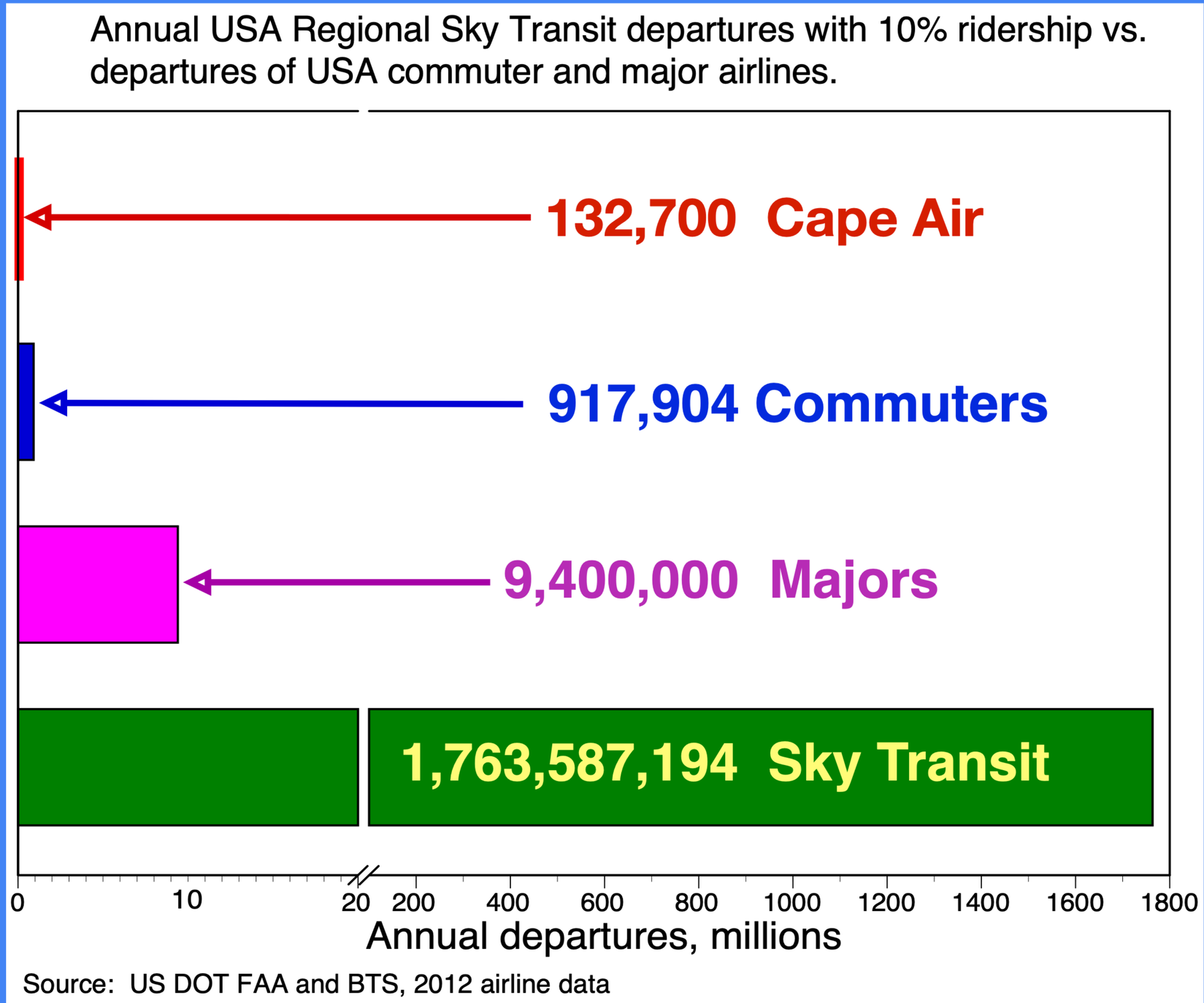


Extreme capacity:

Over 5 decades, public surface transit ridership averages just 6.9% of inter-county commuters.

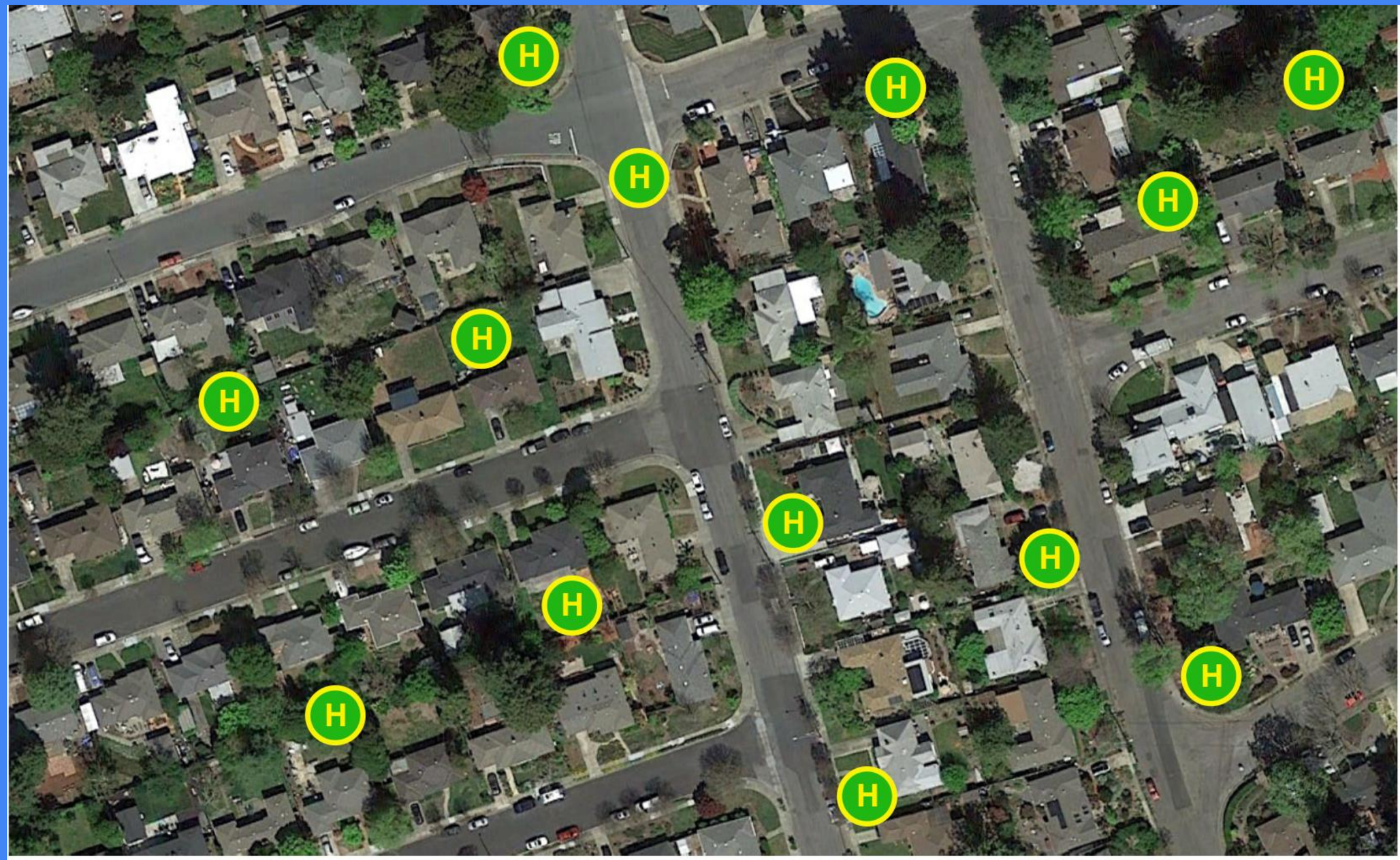


Extreme capacity:



Source: US DOT FAA and BTS, 2012 airline data

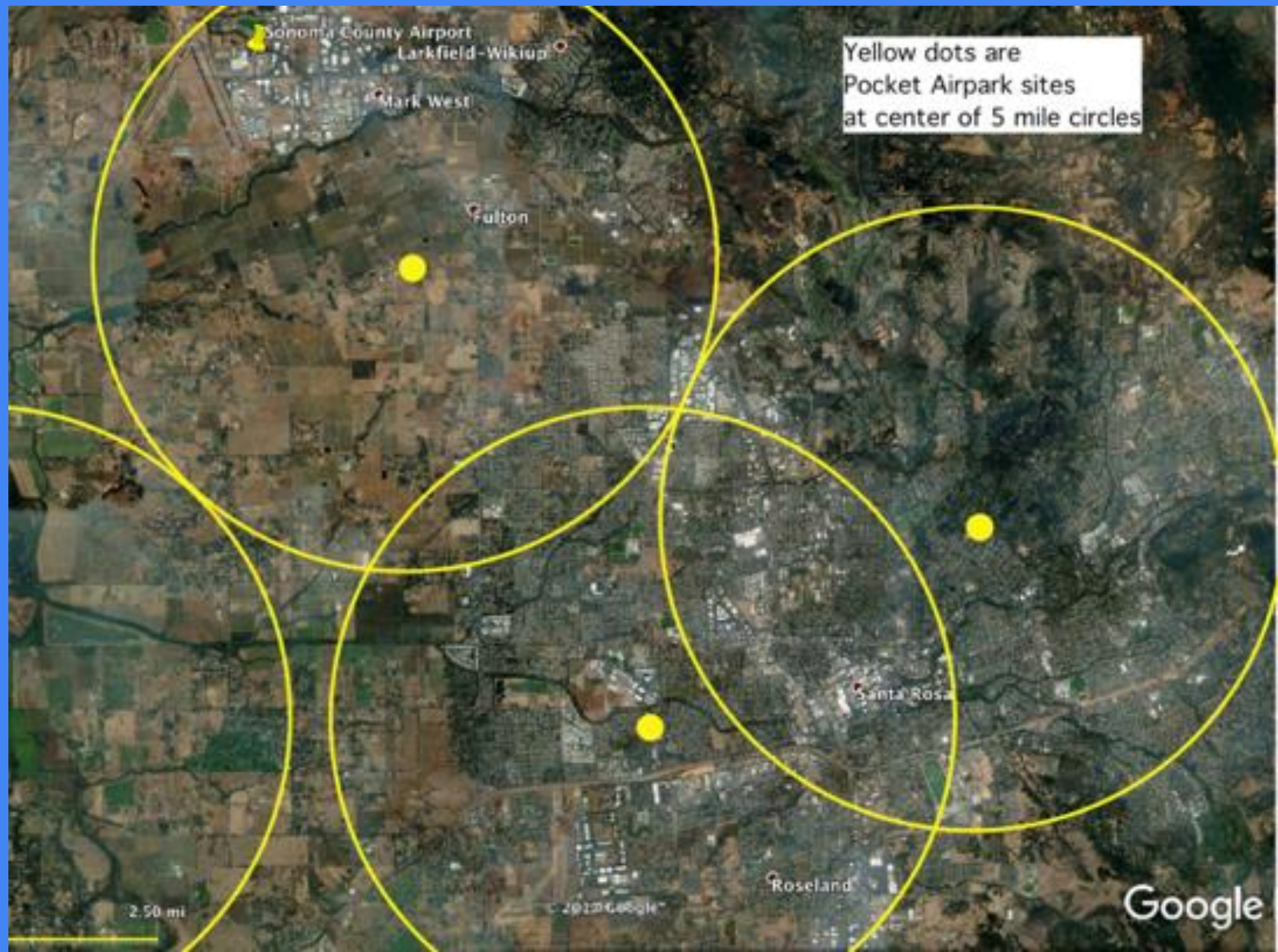
Extreme ubiquity:



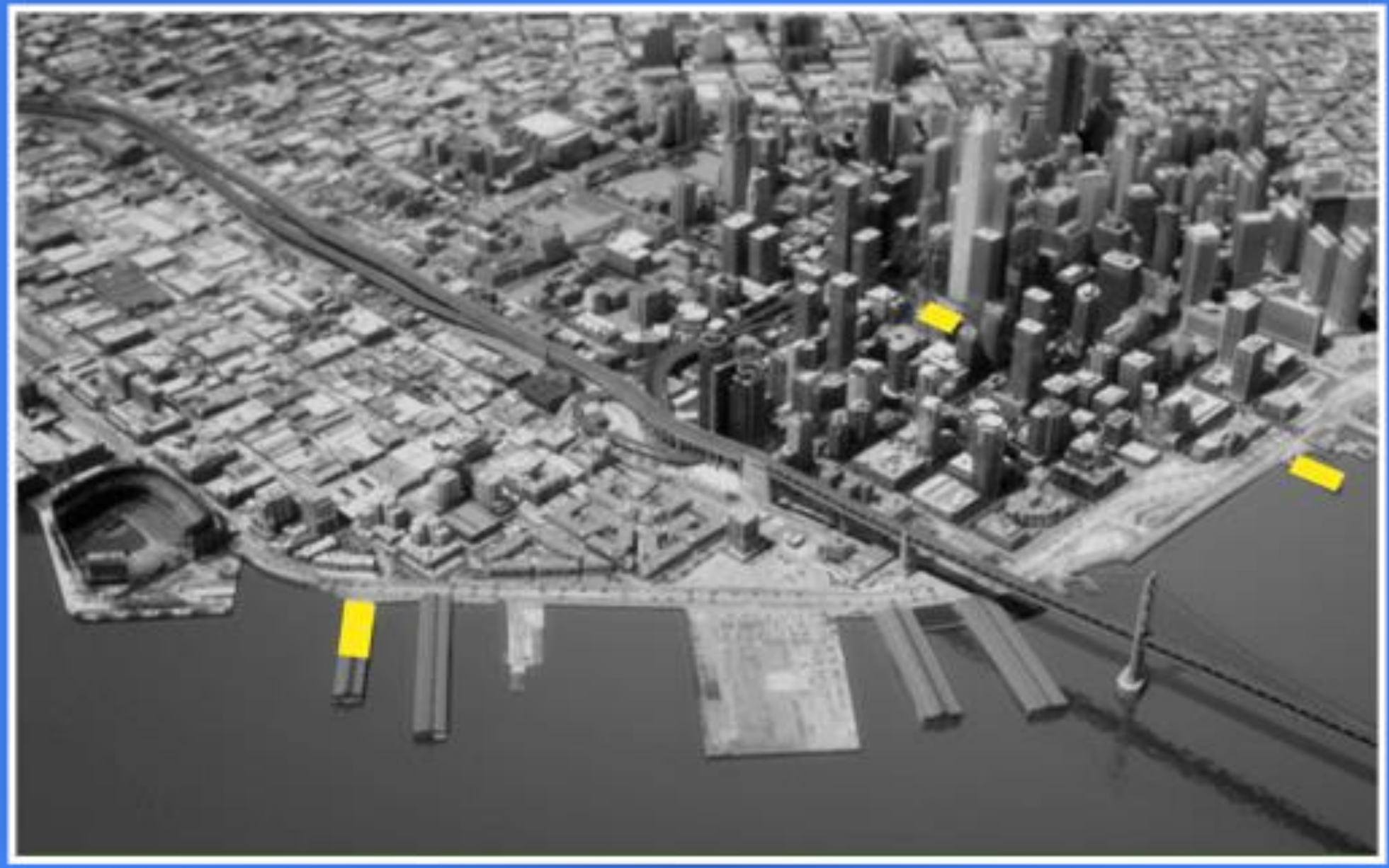
Extreme ubiquity:

4 airparks give a 6-minute GTT for a region with 8 High Schools

Note: with no need to use freeways

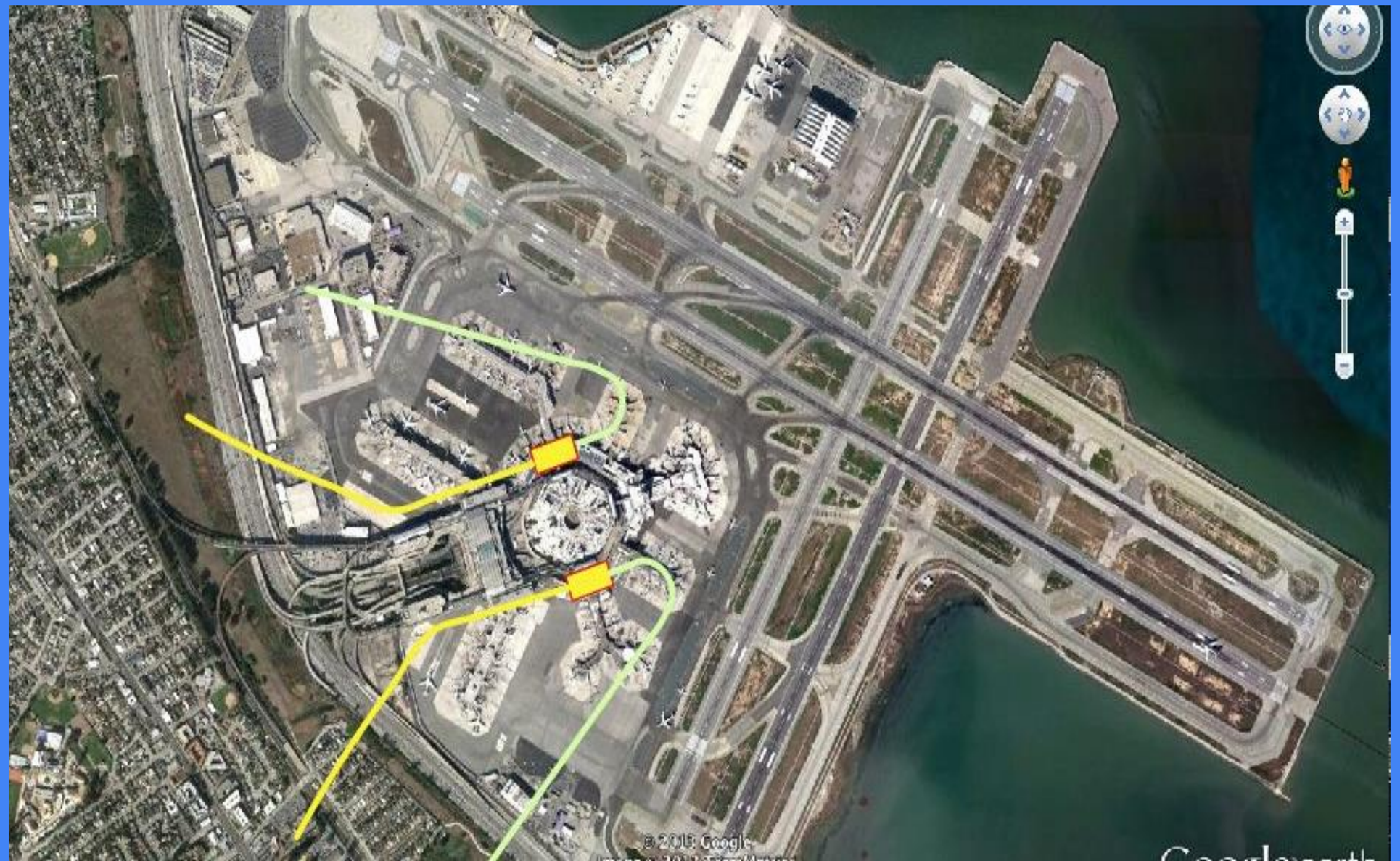


Extreme ubiquity: UAM in downtown San Francisco



Extreme ubiquity:

2 Pocket airparks atop SFO terminal: 1000+ pax/hr, 3 hours saved per trip



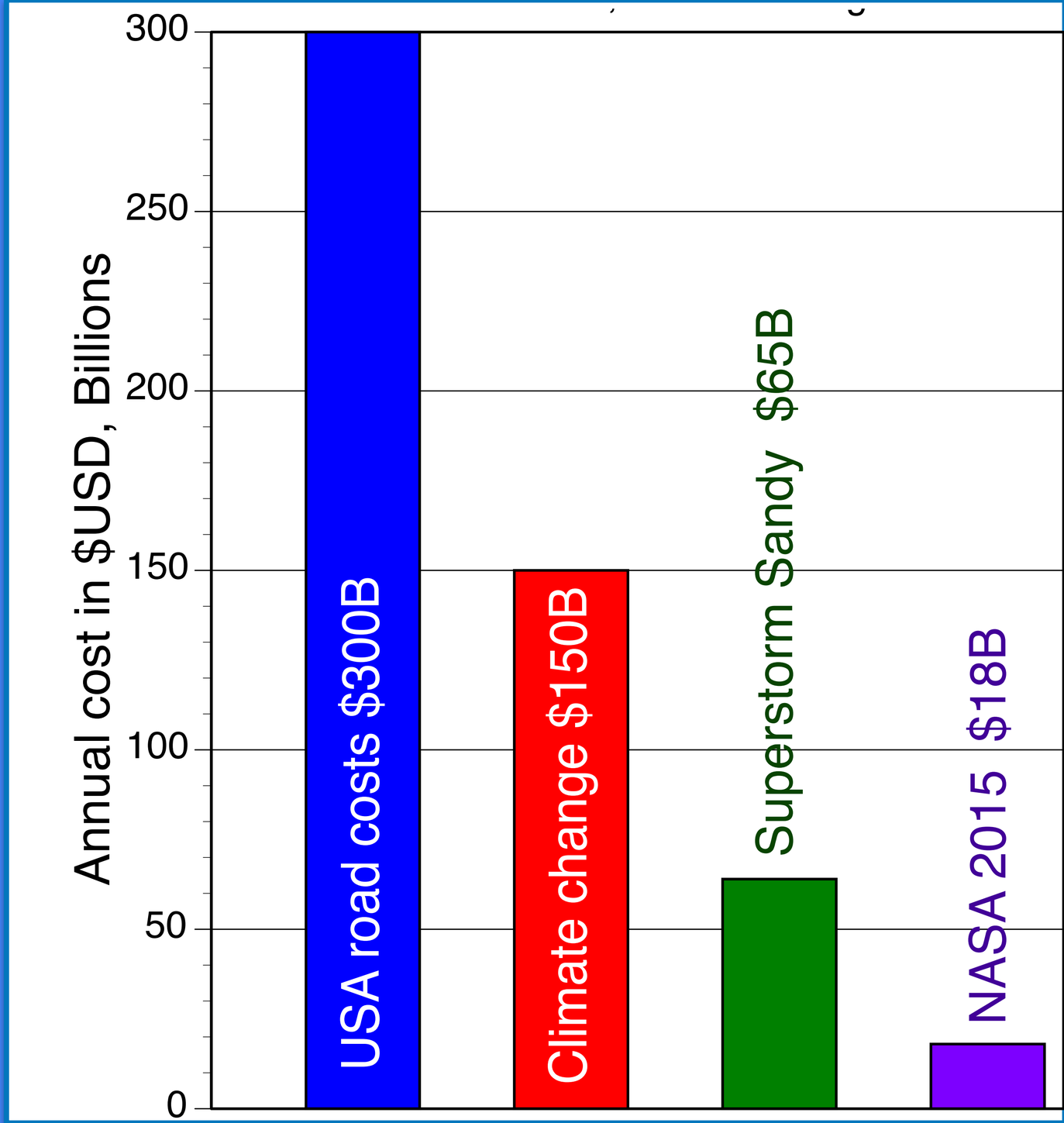
Extreme cost savings:

Annual costs of surface gridlock
5.5 M hours of lost productivity
2.9 B gallons of wasted fossil fuel
$121 B in wasted fuel

-----source AIAA/NASA
mailto:http://livestream.com/AIAAvideo/Aviation2014

Extreme cost savings:

Comparative costs in transportation and climate change. A remedy that could substantially cut those costs is urgently needed.

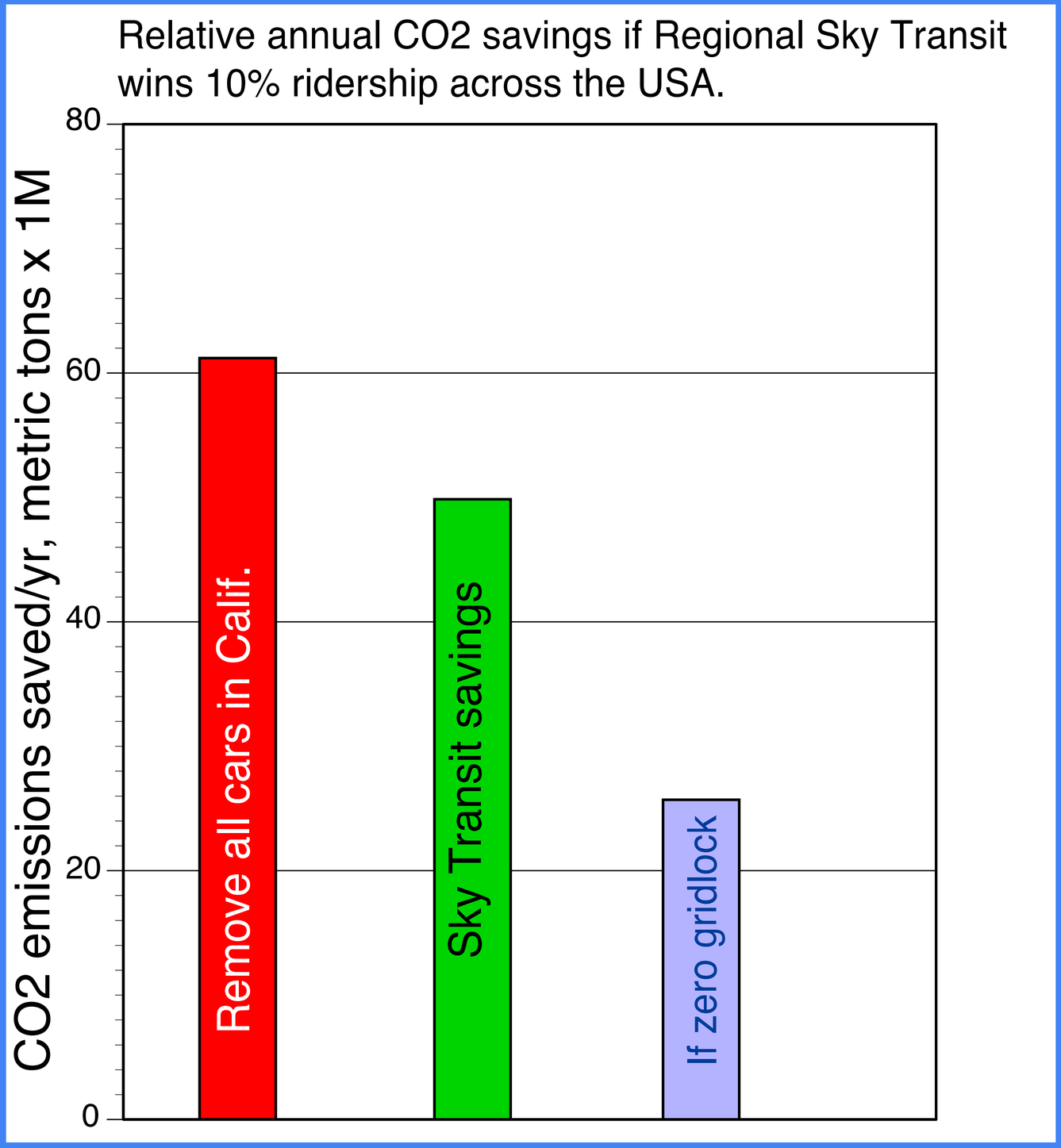


Extreme cost savings

Mass-scale demands mass production
to cut unit cost and provide affordability

Extreme CO2 reductions:

10% ridership would bring meaningful cuts in CO2 emissions, but ridership will depend upon ubiquity, safety and cost



Extreme quiet:

The biggest challenge for mass-scale Sky Transit

Extreme quiet: METRICS PRIMER

DNL = “day-night level” has 10 dBA added from 10PM to 7AM

Leq = the equivalent sound level in dBA averaged over a finite time

44 DNL = 44 Ldn = 37.6 Leq, 1 hour measured in dBA

Leq, 5s is the equivalent sound averaged over 5 seconds

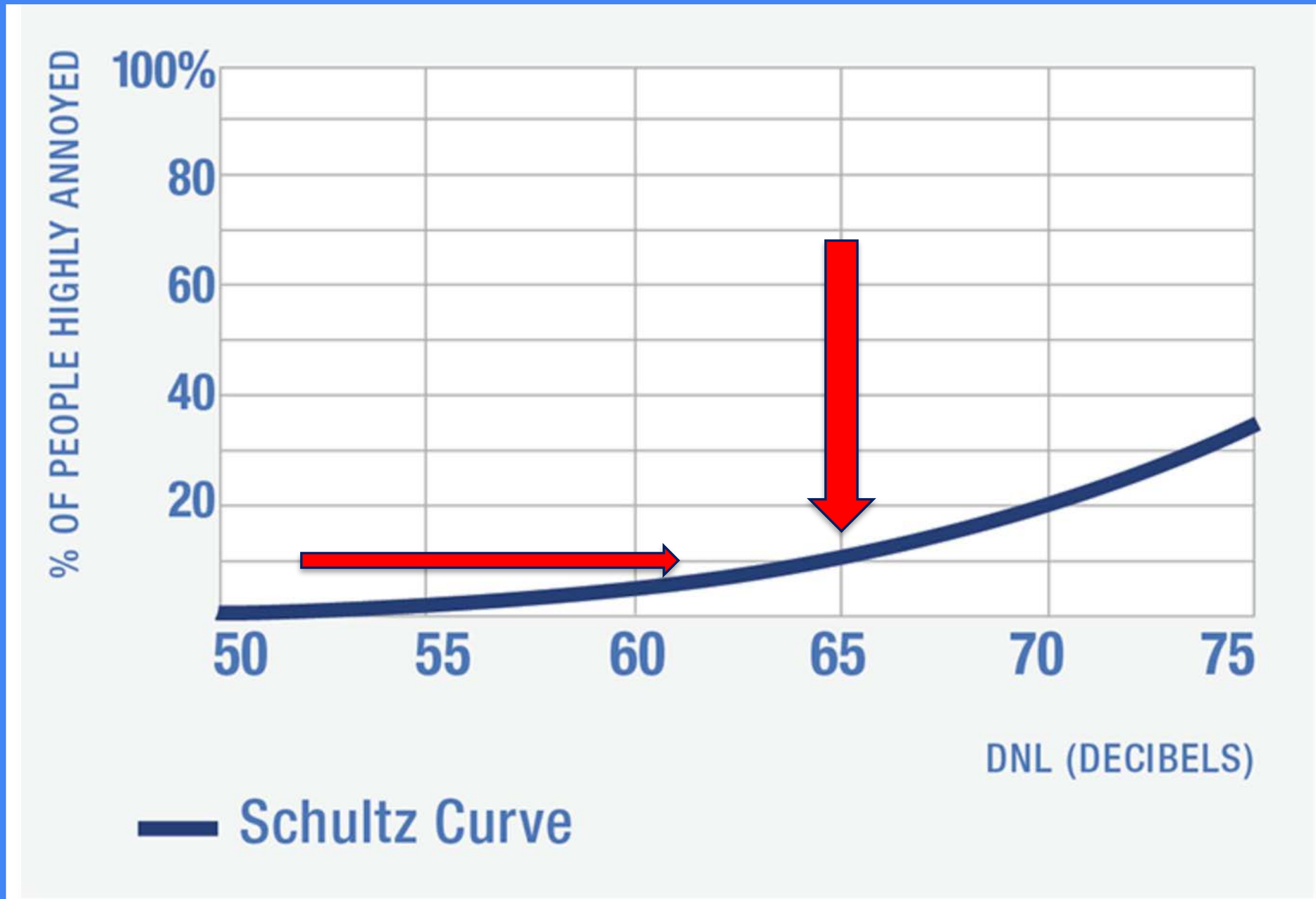
dBA levels must specify at what distance they are measured

dBA levels drop about 6 dBA for every doubling of distance

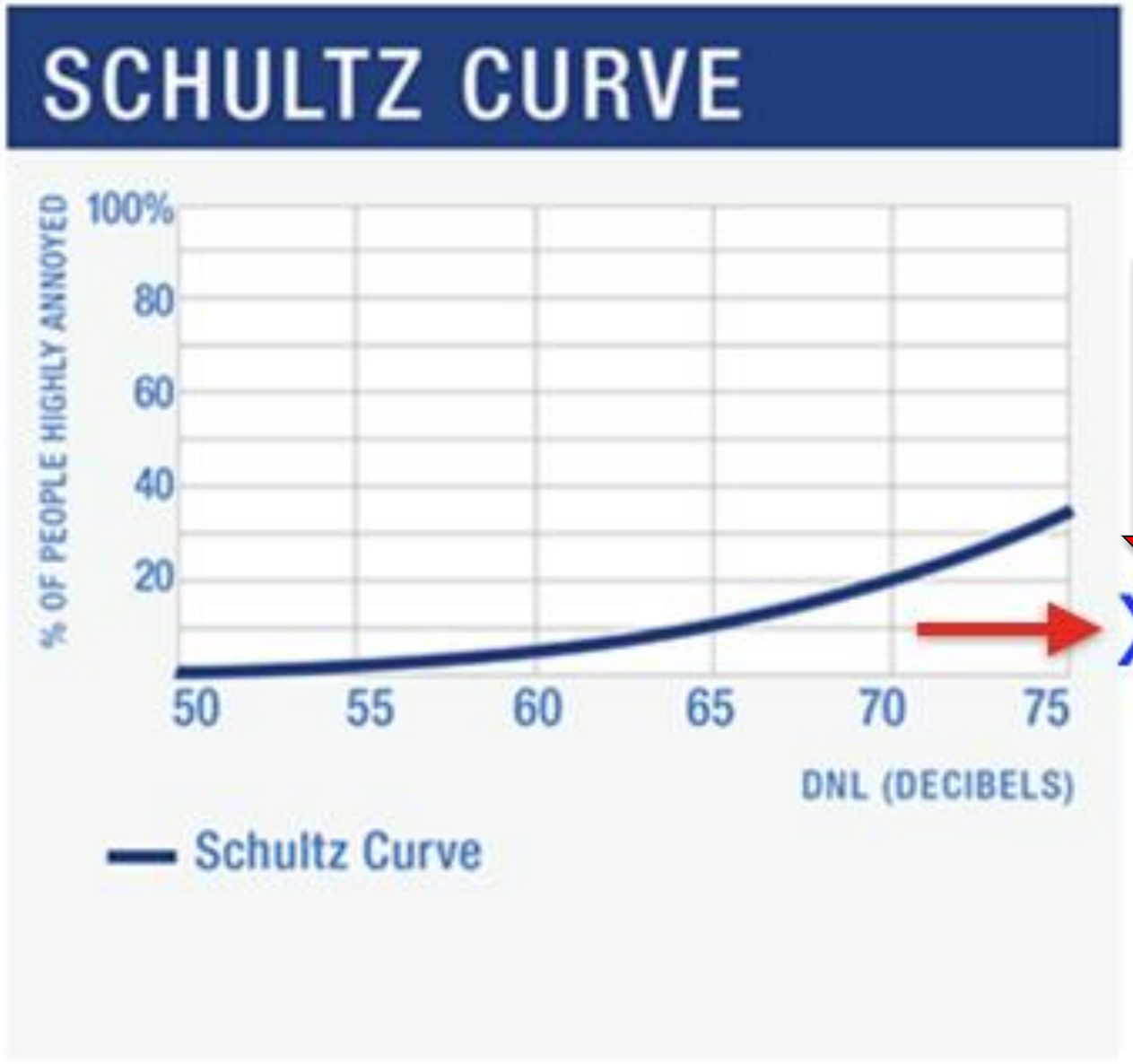
Extreme quiet:

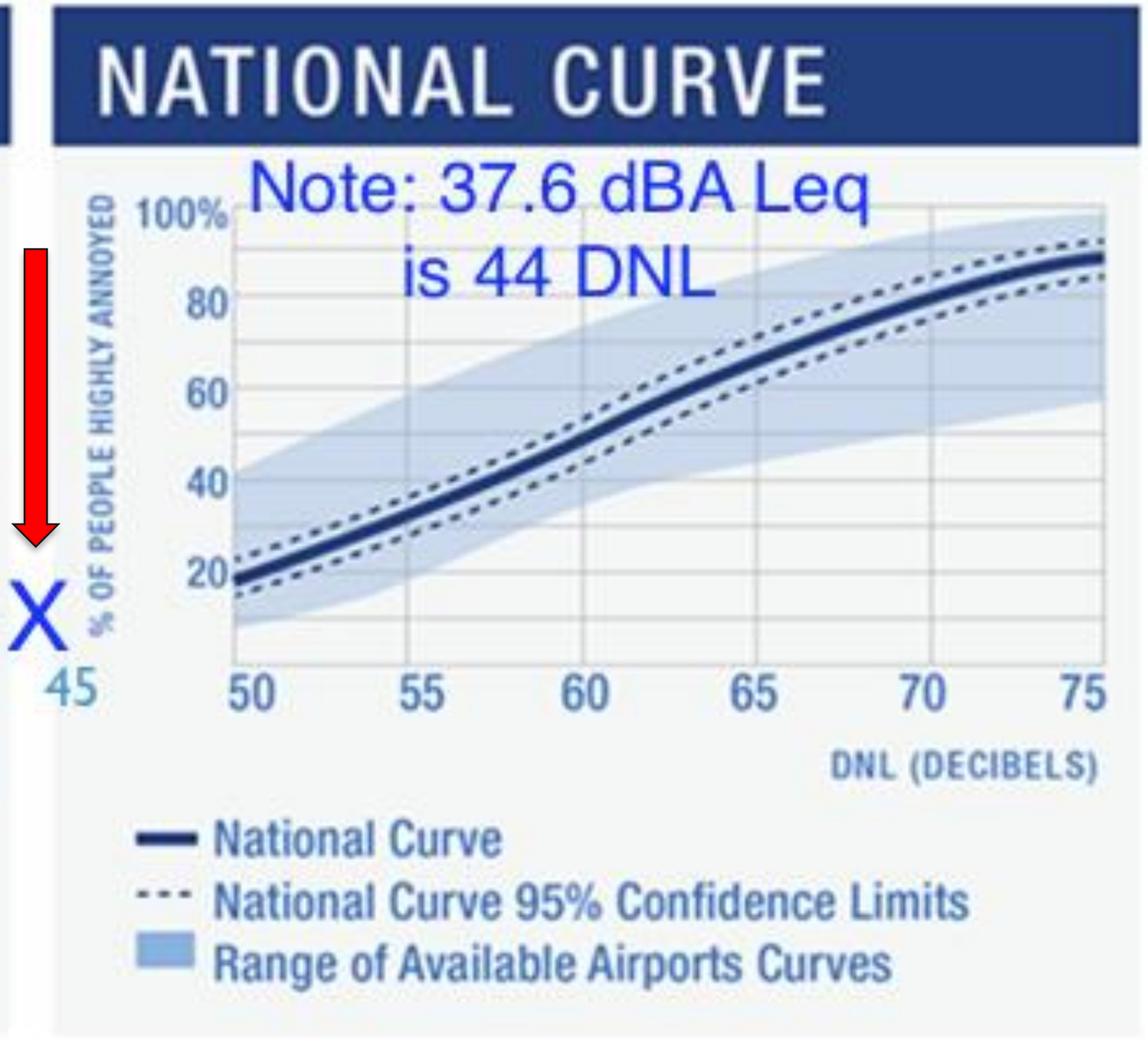
FAA adopted 65 dBA DNL as the noise limit for residential land use compatibility.

https://www.faa.gov/regulations_policies/policy_guidance/noise/history - current



Extreme quiet: FAA's new National Curve demands more





X 45

Extreme quiet:

Night noise:

Annoyance worsens over 3-fold with frequent night flights

24 dBA Leq indoors at night

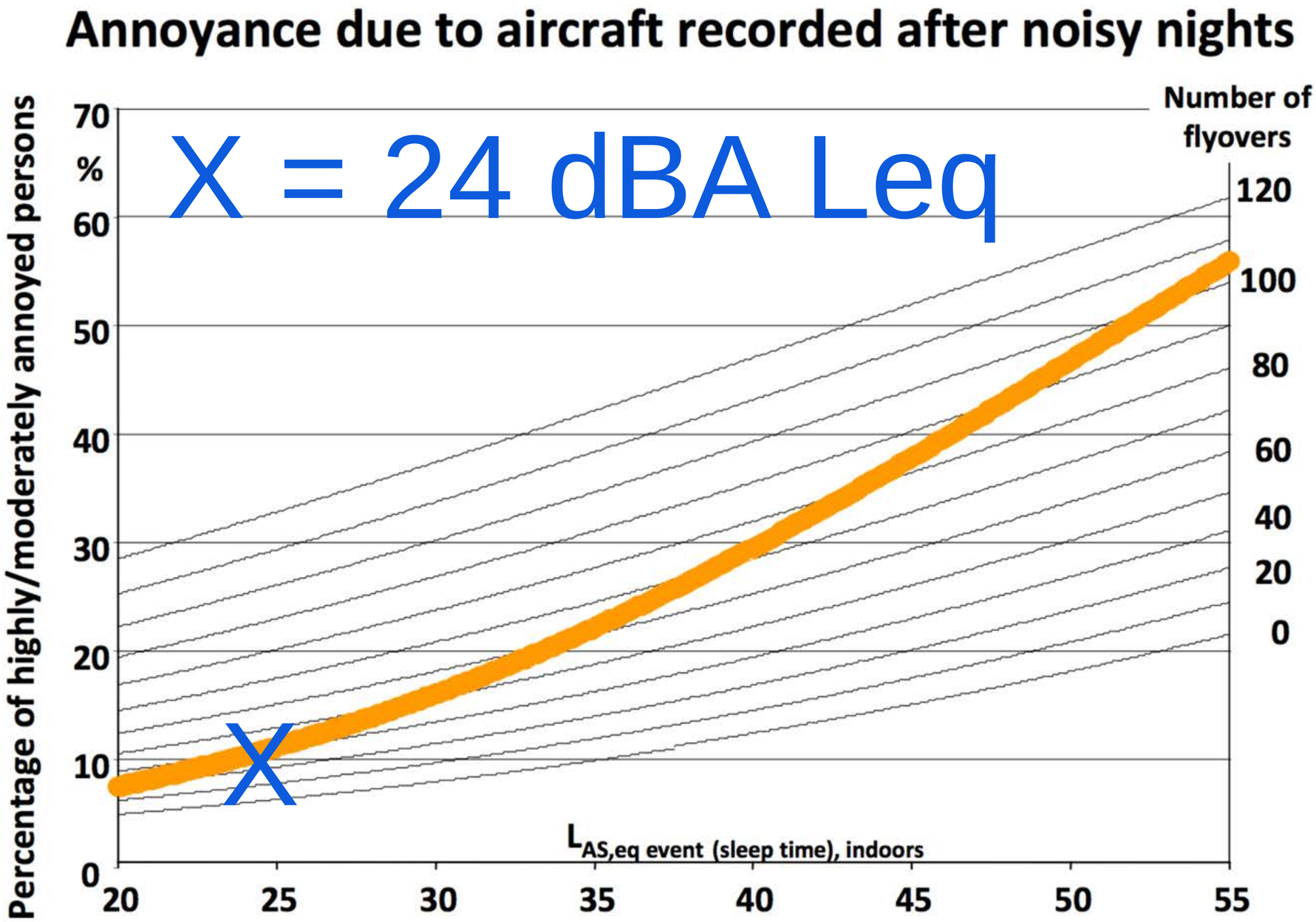


Figure 5: Annoyance related to the equivalent noise level.

Extreme quiet:

The 10% who are highly annoyed will demand that airparks be closed

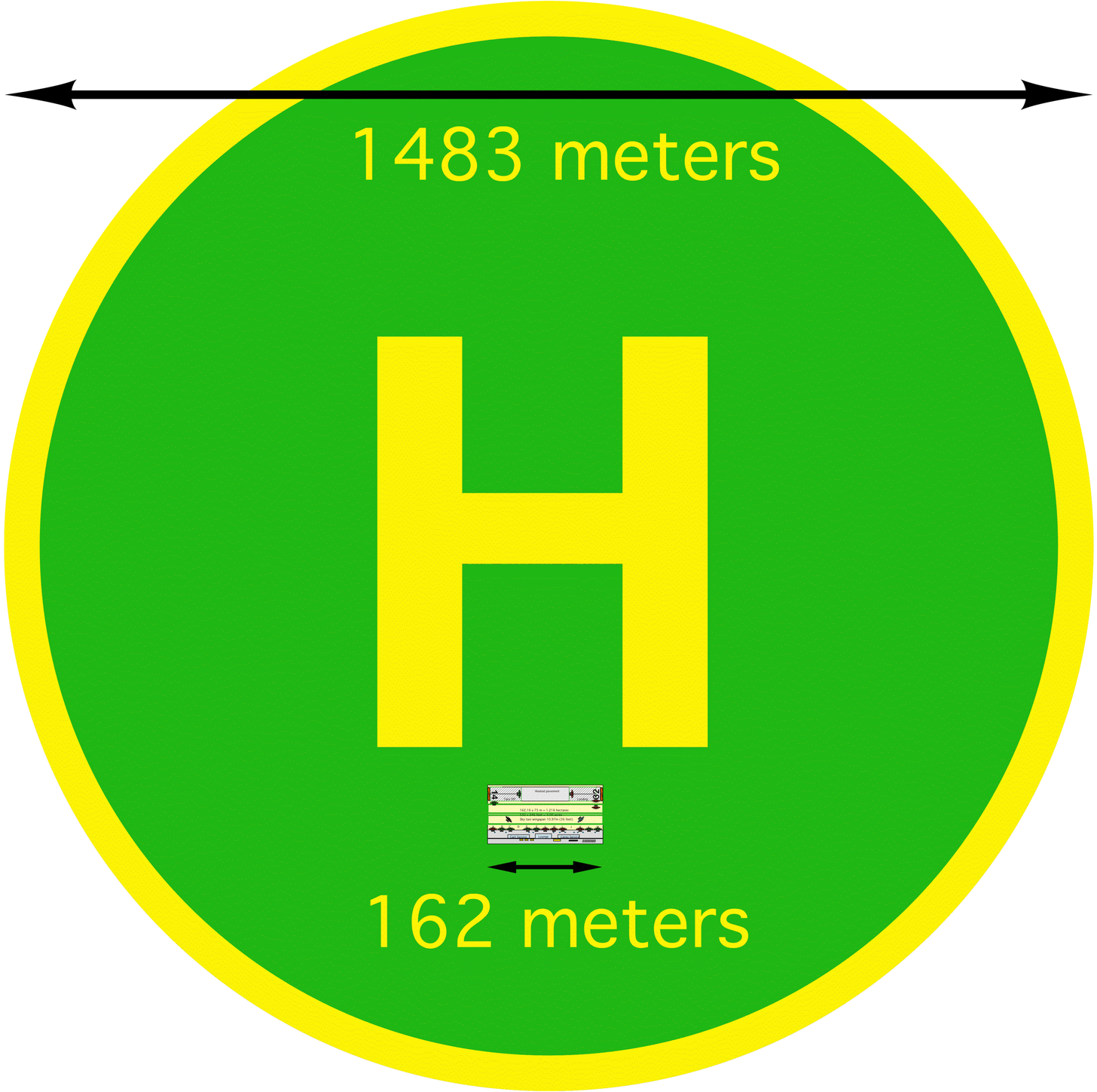
Extreme quiet: How are we doing so far?

Aircraft	dBA, Leq	@ distance, m	dBA @ 40m, Leq	37.6 dBA Leq @ distance, m	airpark size, hectares
Joby eVTOL	**55**	100	**62.96**	**741**	**220**
Lilium eVTOL	60	100	67.96	1318	695
Heavyside	65	305	82.64	7150	20448
Volocopter	65	75	70.46	1758	1236
Future eVTOL	**30**	100	37.96	**42**	**0.7**
Quiet ESTOL	**29**	40	**29.00**	**15**	0.09

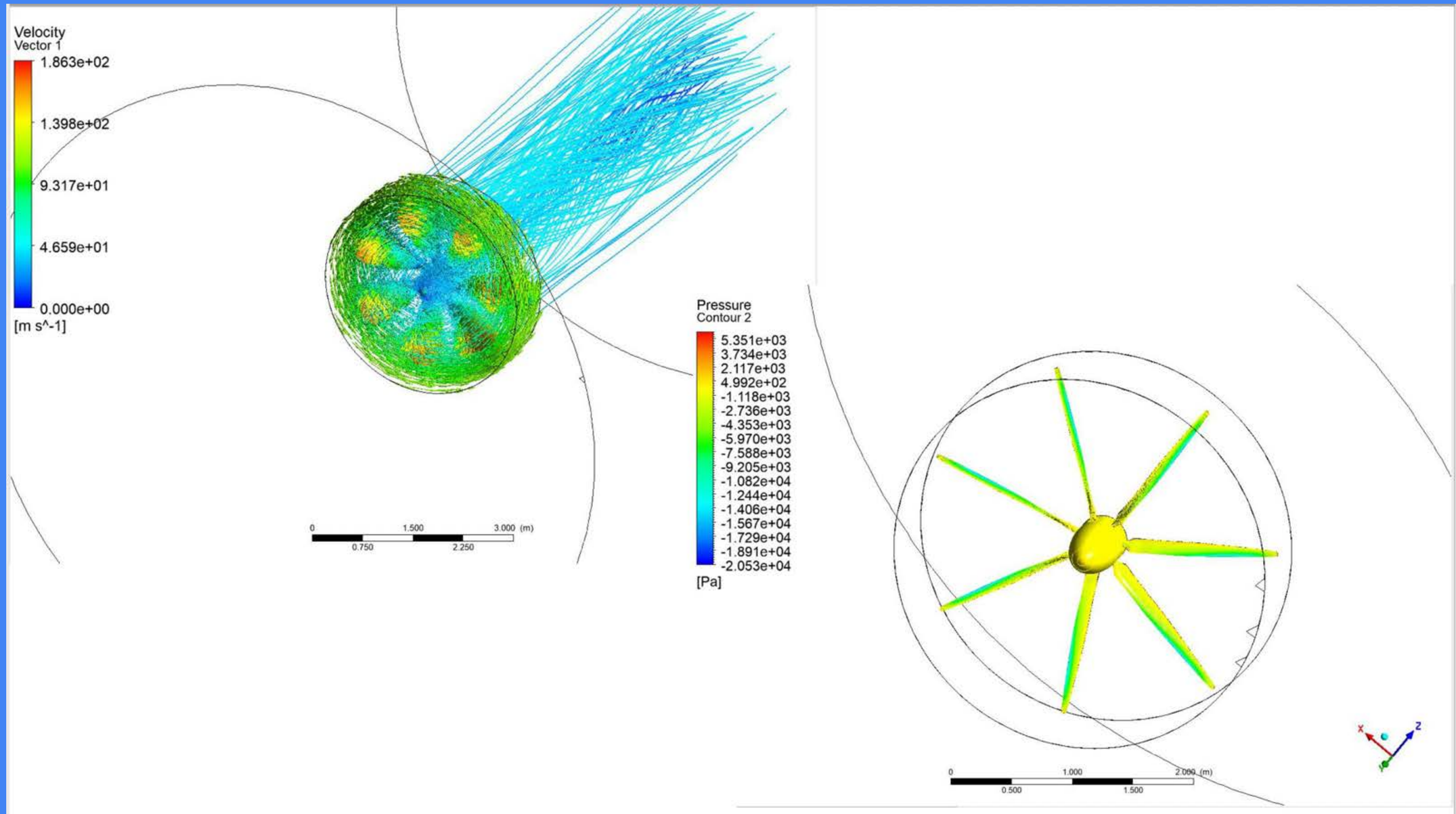
Extreme Quiet:

Land parcel size comparison with equivalent noise:

Noise will be the crucial enabler of Regional Sky Transit



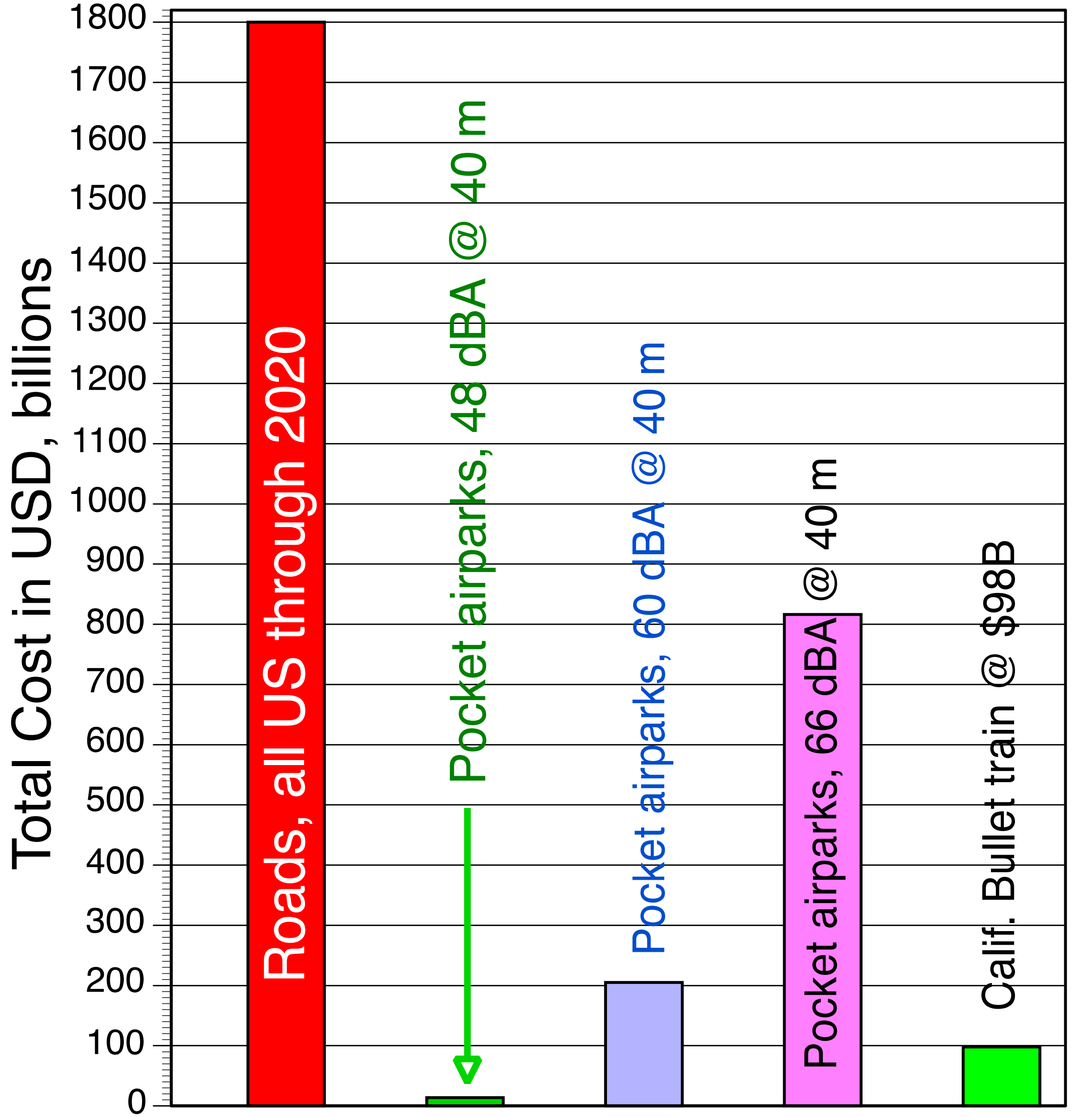
Extreme quiet: 600 lb thrust @ 26 dBA Leq @ 40 m



Extreme quiet:

The nationwide cost of 5,000 airparks for Sky Taxis will depend upon the aircraft noise level because noise determines airpark size.

US system-wide costs in USD for roads vs. 5,000 new pocket airparks versus California bullet train's 15 stations



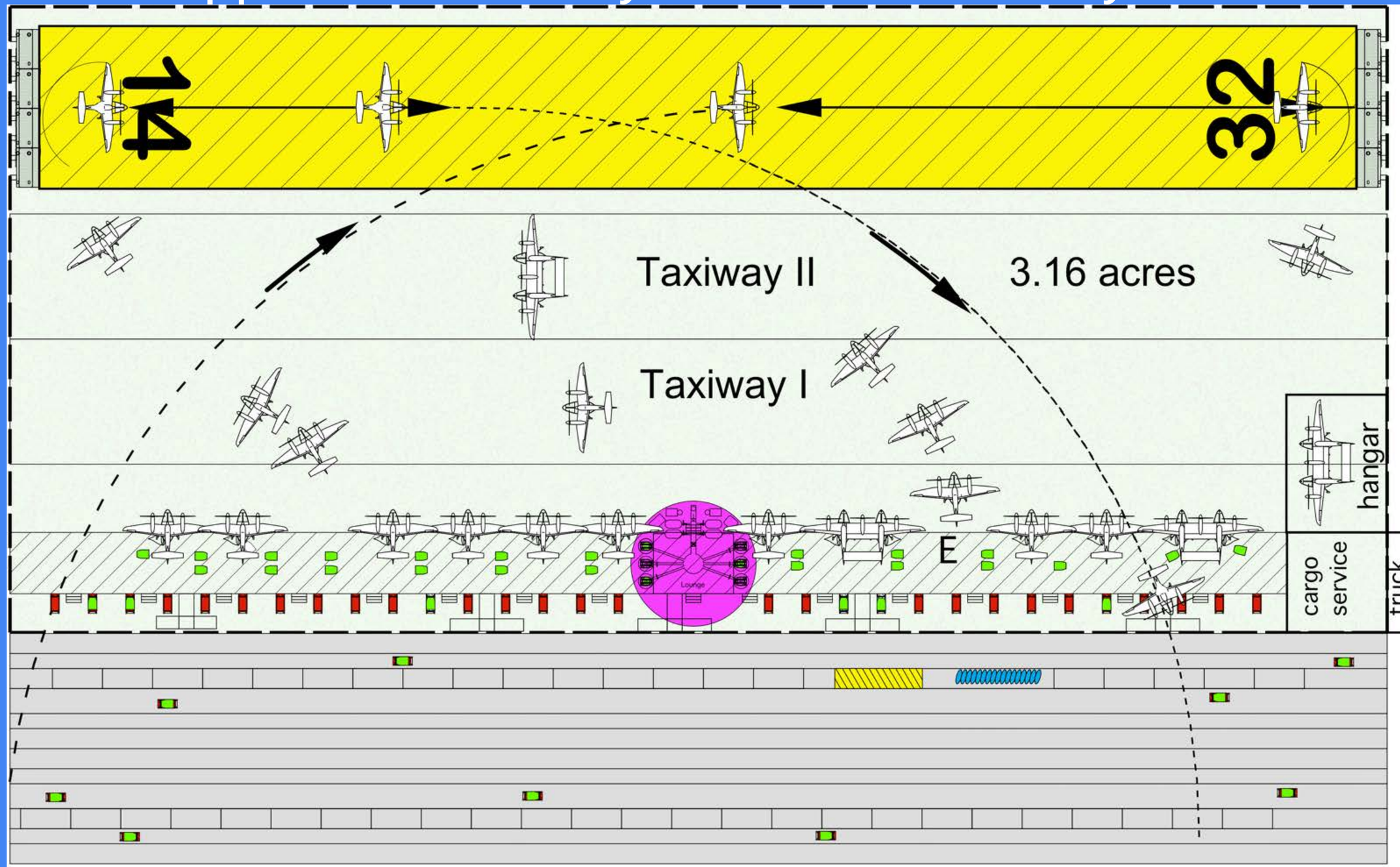
Airpark cost includes $500K/acre, $30/ft fencing, $7/sq ft paving, 2000 sq ft passenger lounge at $67/sq ft.

Source: US DOT and Am. Soc. Civil Engineers.
File: Sky.Transit.Noise.Acreage.xlsx

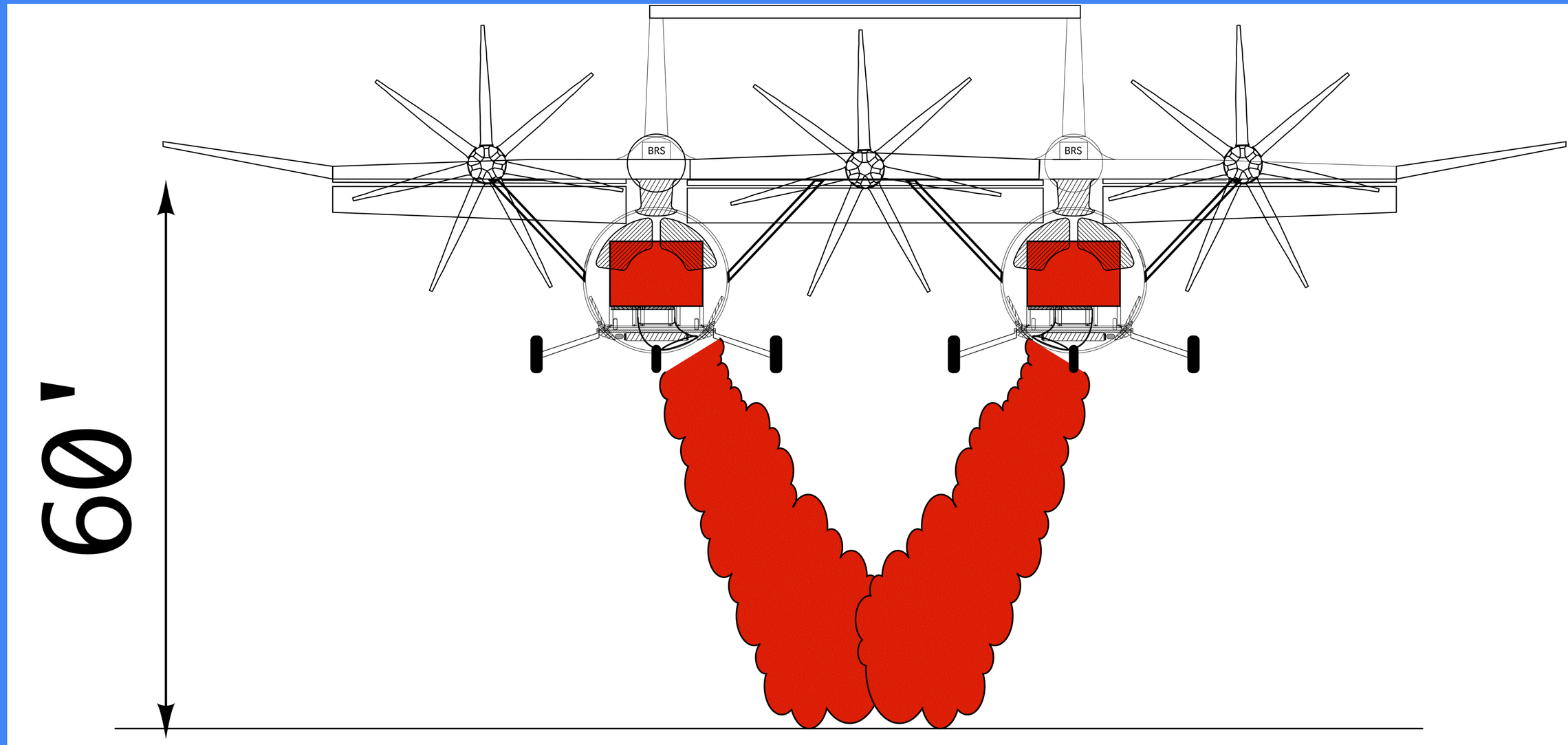
Extreme fire suppression:

Cal-Fire’s Air Attack chiefs say fire suppression by air is handicapped by not enough pilots, aircraft that each cost $24M, and inability to fly in smoke and darkness.

Extreme fire suppression: Is Sky Transit the remedy?

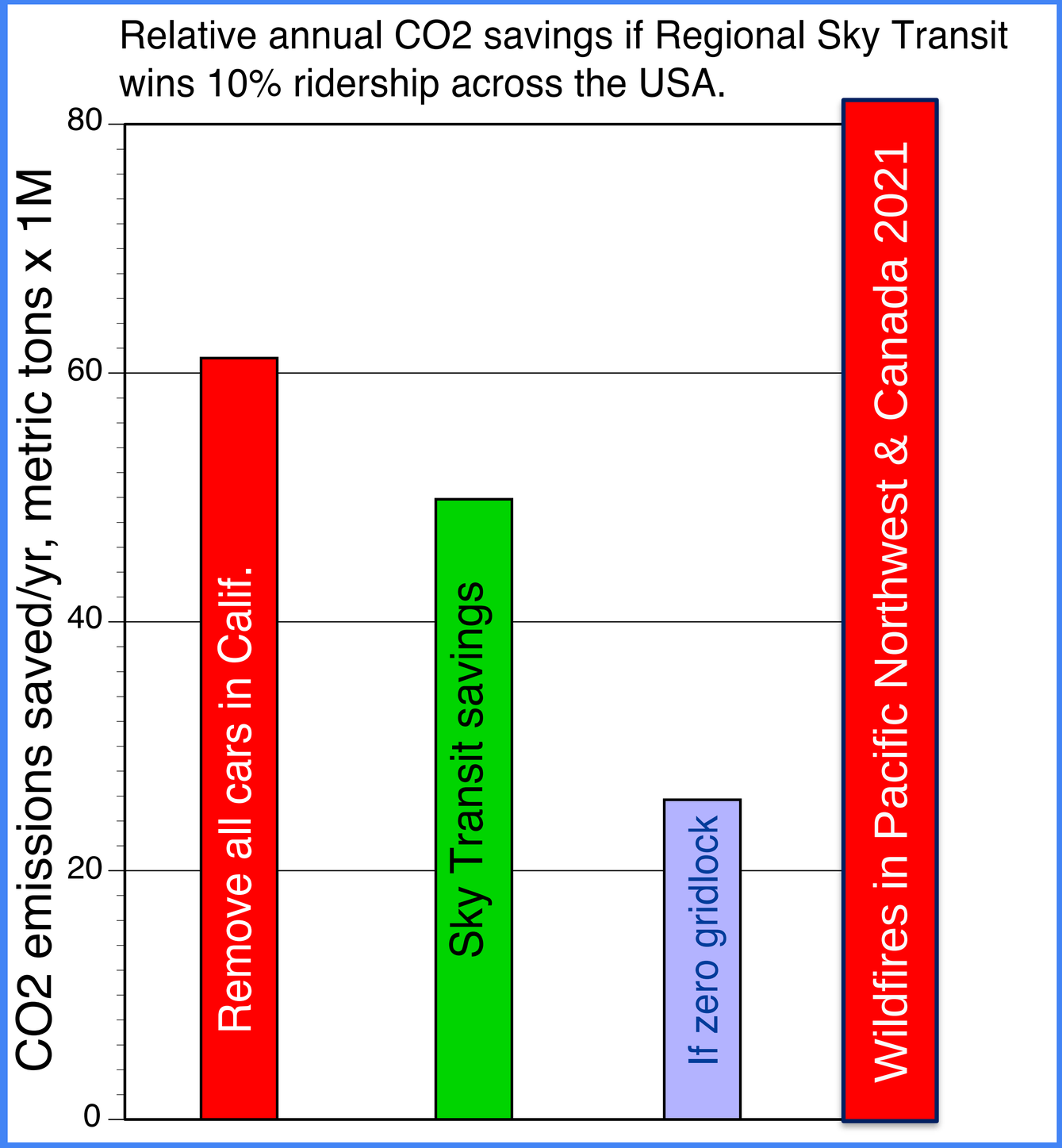


BONUS: Extreme fire suppression: 20X more gallons/hour, 100X less cost, driverless swarms of re-purposed Sky Taxis get on-scene 3X faster, in darkness and in smoke



Extreme CO2 reductions:

Wildfire emissions?
https://www.weforum.org/agenda/2021/12/siberia-america-wildfires-emissions-records-2021/
Wildfires in Canada, California and the U.S. Pacific Northwest emitted around 83 million tonnes of CO2.



The End

A presentation regarding the advancements, current standing and future implementation of electric aircraft, with particular emphasis on the prospects and benefits of mass-scale use of ultra-quiet autonomous electric flight. A concept of operations, impacts on potential aggregate emissions reductions of both pollutants and noise, land use planning, mission requirements, compliant vehicle types, as well as secondary benefits to surface transportation and infrastructure, the presentation will include the system's potential benefits for dramatically reducing the smoke and damage from wildfires.

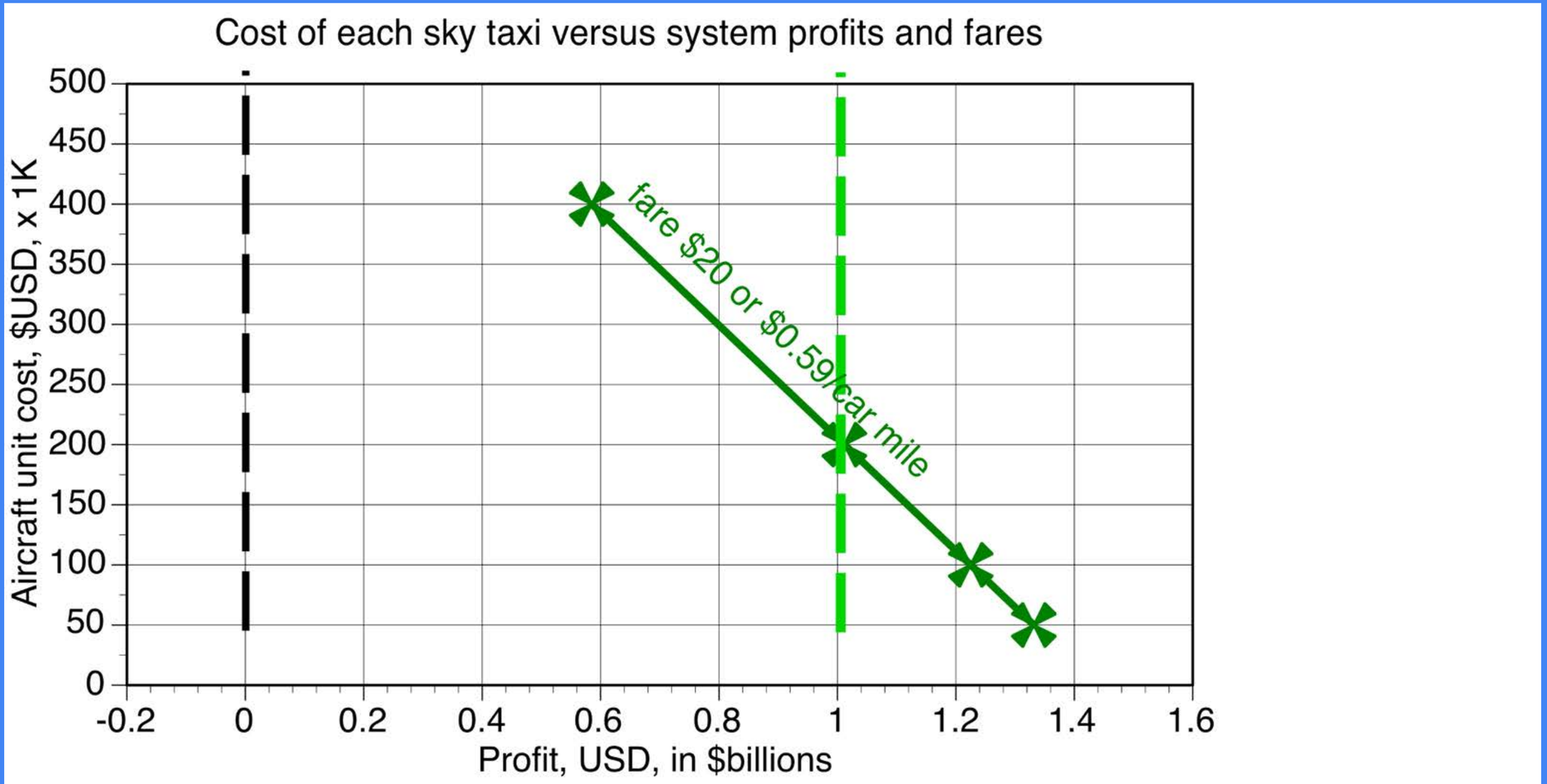
Spare slides

Why should we care ??

63% of all human-caused carbon emissions have occurred in the last 25 years

http://www.climateaccountability.org/pdf/MRR%208.3%207Nov13.pdf

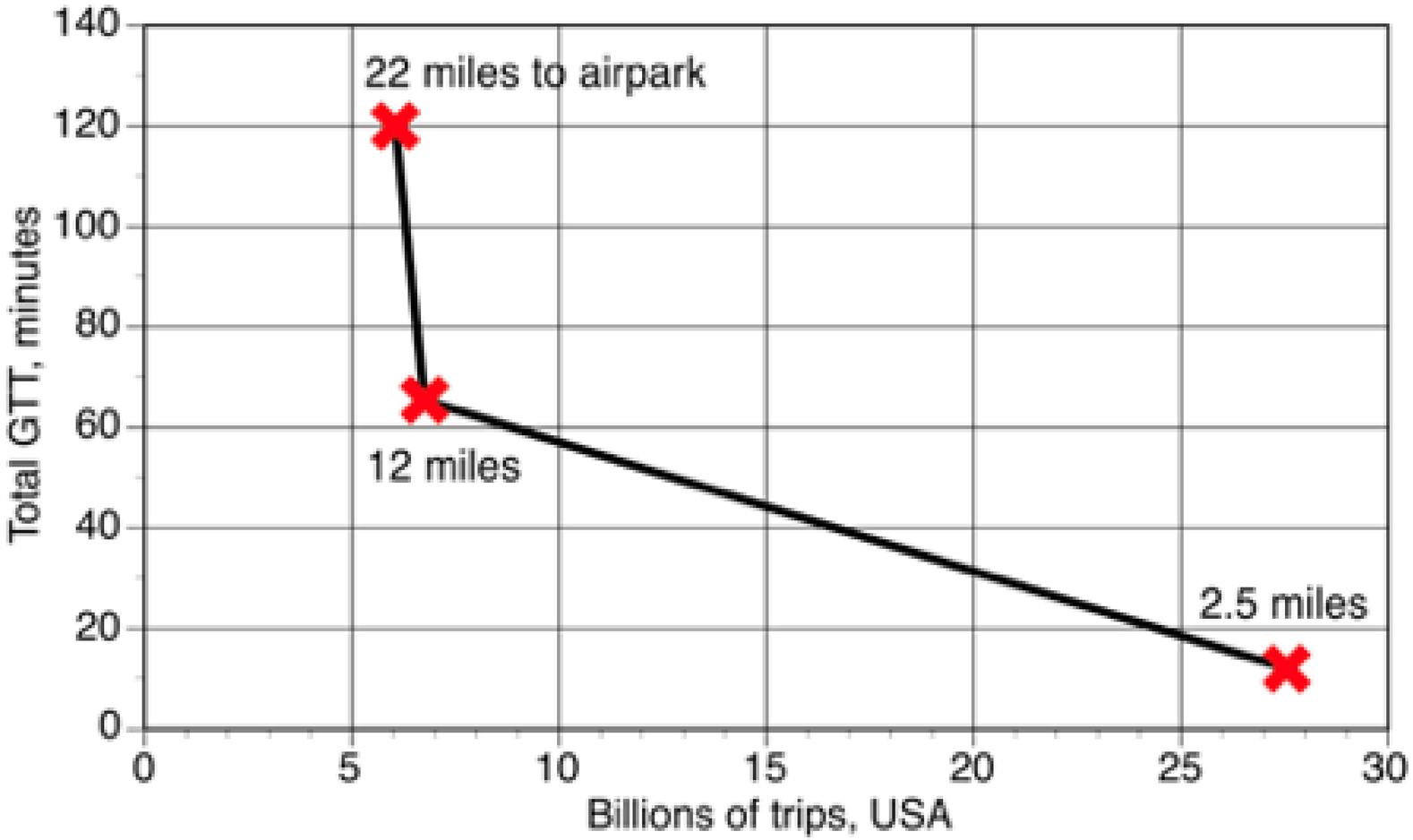
Extreme cost savings: mass production is key



Base case metrics: 22 mph cars, TAT = 2 minutes, GTT is total in and out
50 km average air trip distance, $200,000 sky taxi, $20 shared fare, L/D = 12,
MTC data for SF Bay Area, includes climb and 10% distance penalty to cars.
NOTE: 10% ridership used for all cases
UCB.graphs.profits.2019.xlsx

Airpark proximity and GTT are crucial to the number of trips on which 30 minutes can be saved

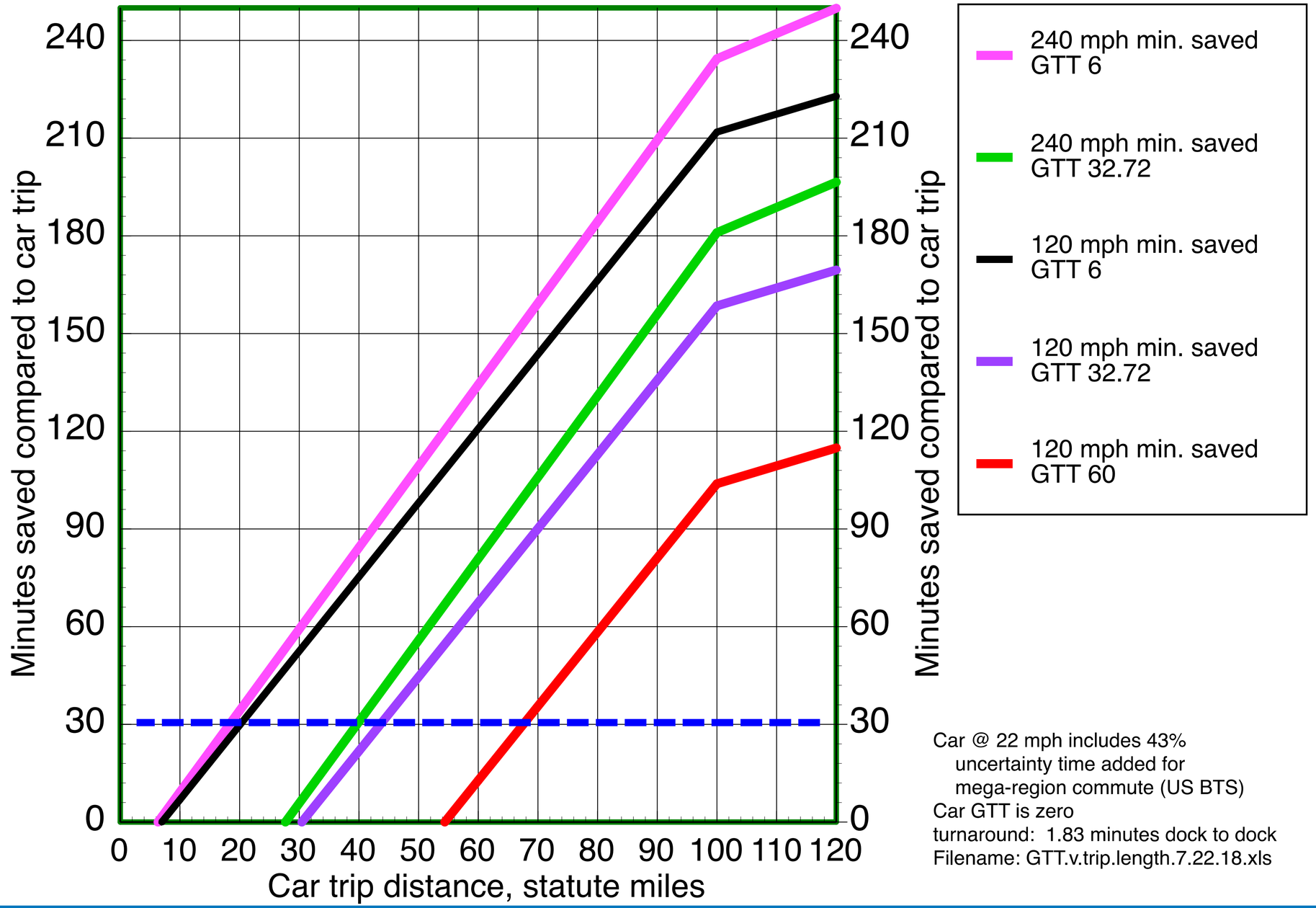
Ground travel time (GTT) in minutes, versus total number of trips in USA if must save 30 minutes per trip. Establishes a slope of reduction in trips per GTT.



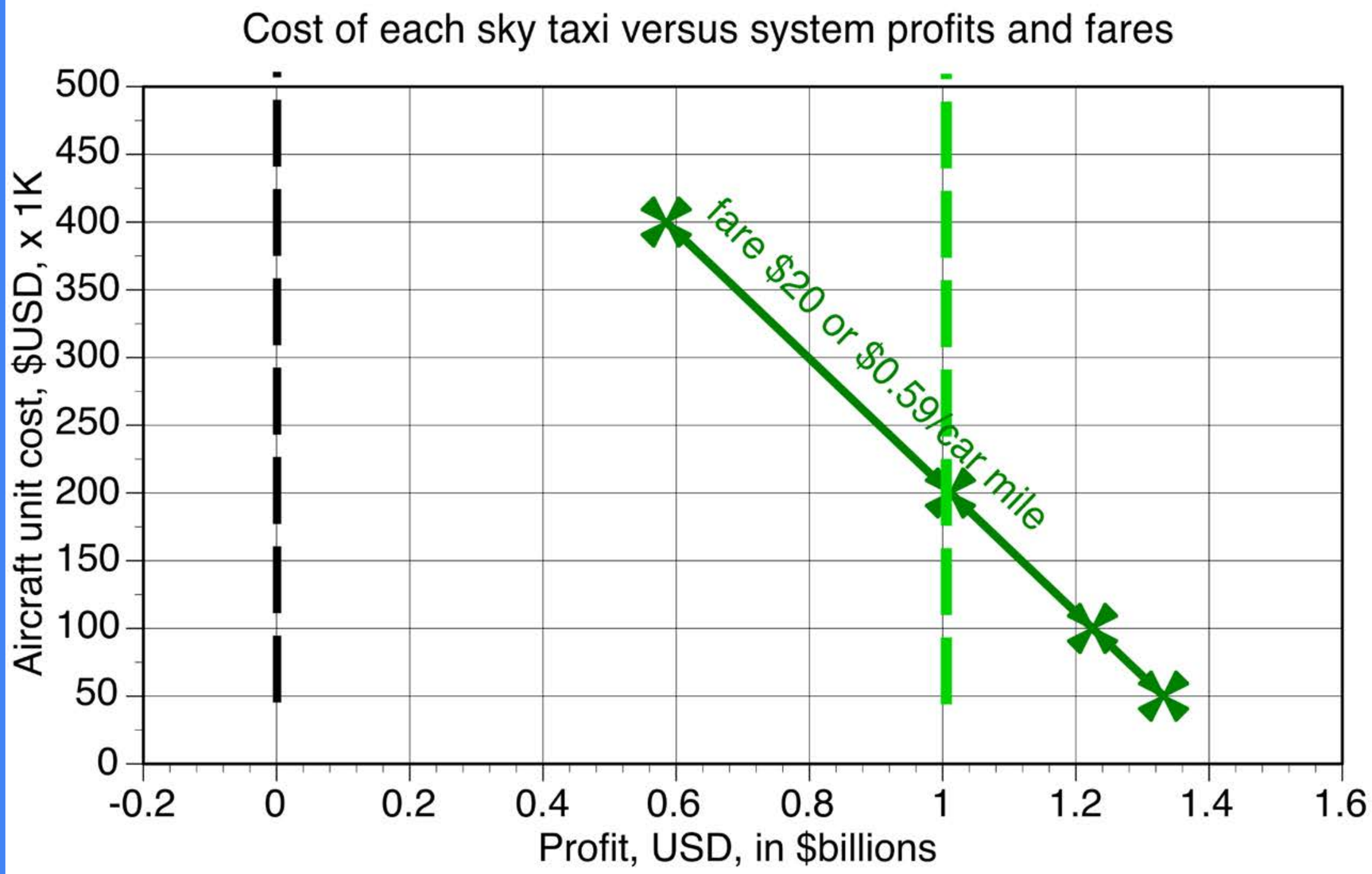
For 22 mph cars and 120 mph Sky Taxis, with 2 minute turnaround time. GTT = 6 minutes to airparks 2.5 miles distant. GTT = 32.72 minutes to airparks 12 miles distant. GTT = 60 minutes to airparks 22 miles distant.
Includes climb and 10% distance penalty to cars. 2009 NHTS data.
filename: UCB.Graphs.Brien.trip.length.v.trips.xlsx

Extreme GTT

Regional Sky Transit: Ground travel time (GTT) effect on time saved
Distance to airpark: 1.8, 12 and 22 miles give GTTs of 6, 32.72 and 60 minutes



Car @ 22 mph includes 43% uncertainty time added for mega-region commute (US BTS)
Car GTT is zero
turnaround: 1.83 minutes dock to dock
Filename: GTT.v.trip.length.7.22.18.xls



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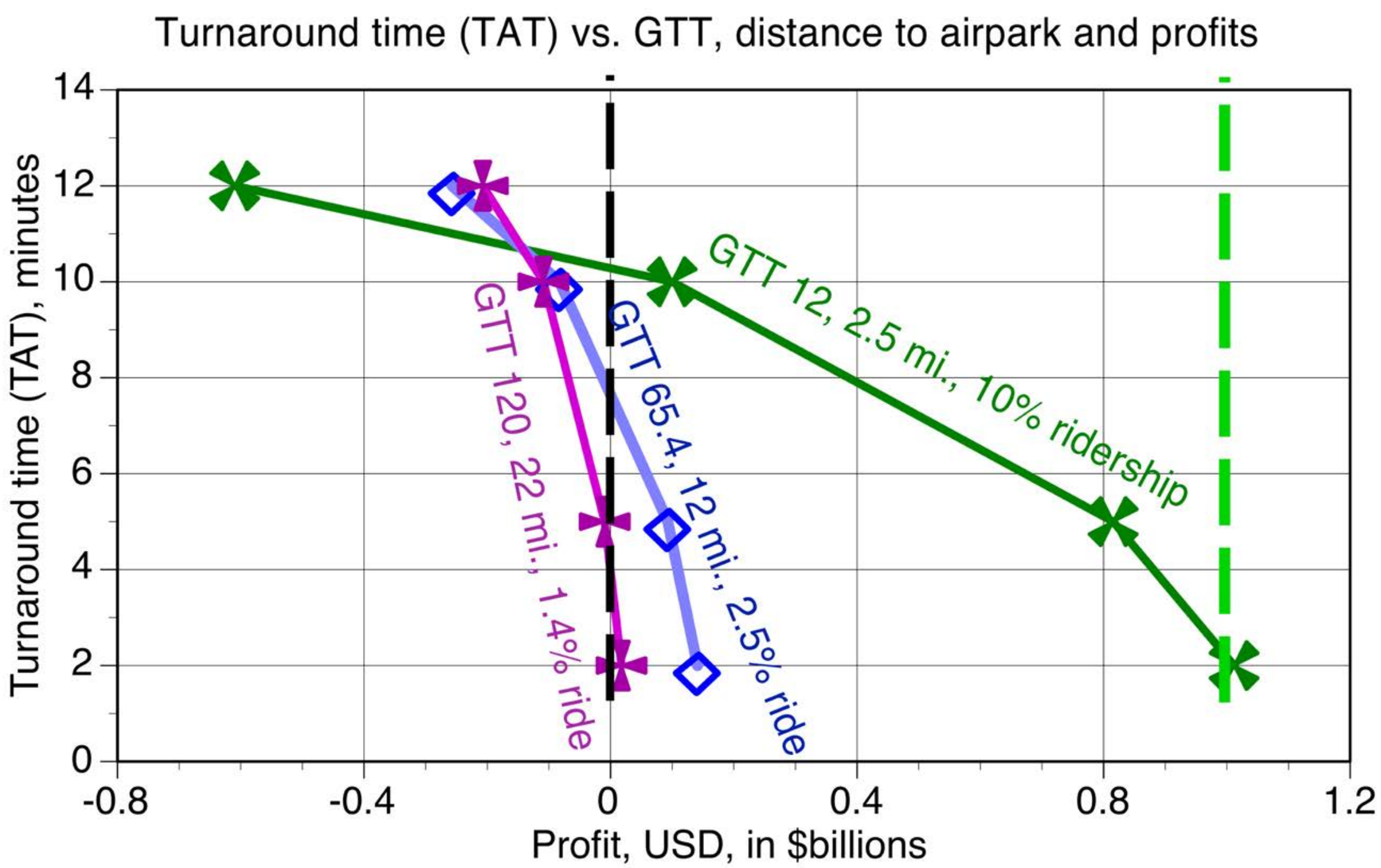
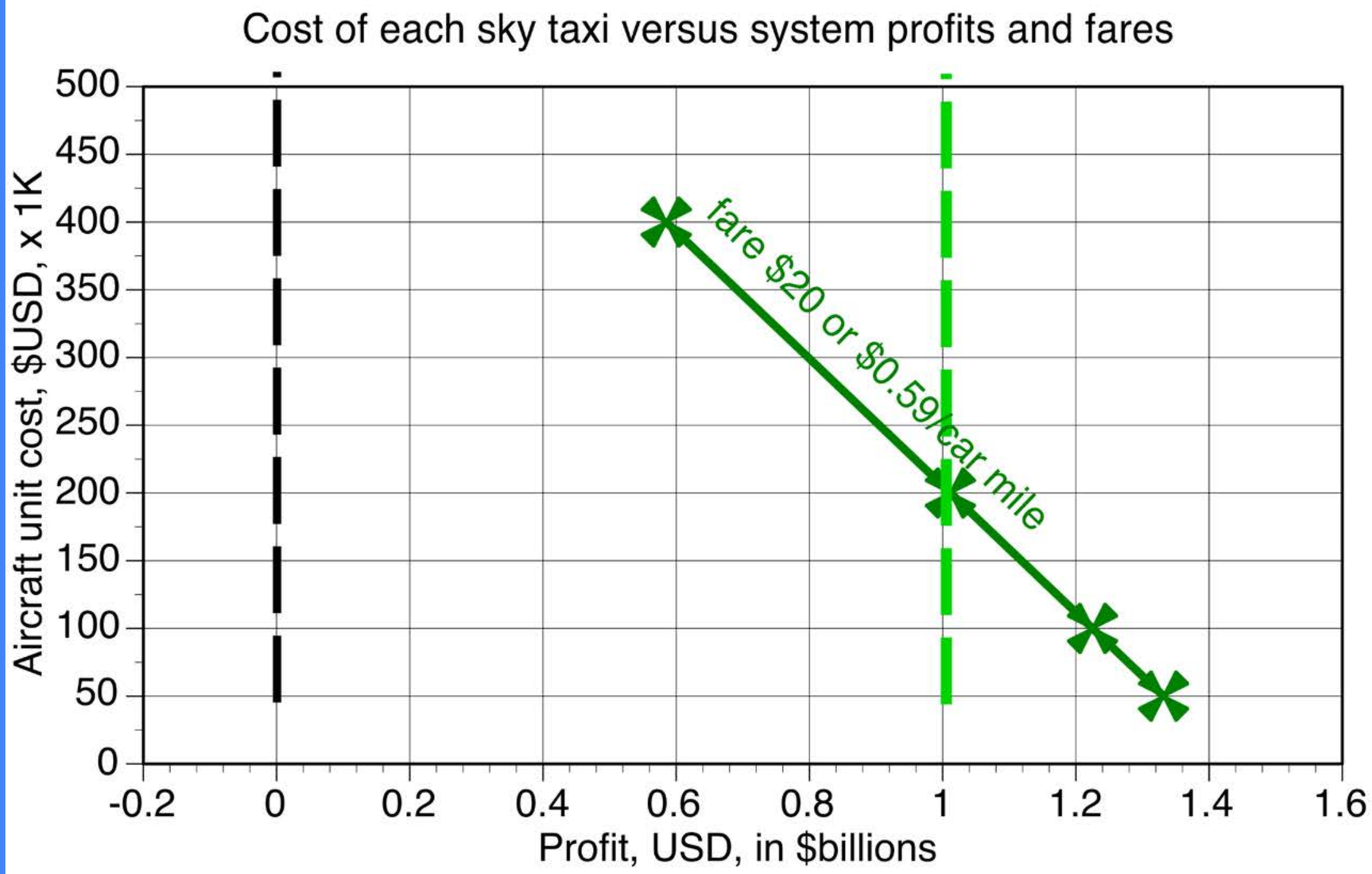


Base case metrics: 22 mph cars, GTT is total in and out, 50 km average air trip distance, $200,000 sky taxi, $20 shared fare, L/D = 12, MTC data for SF Bay Area, includes climb and 10% distance penalty to cars.
NOTE: includes decreased number of trips with longer GTT.
UCB.graphs.profits.2019.xlsx



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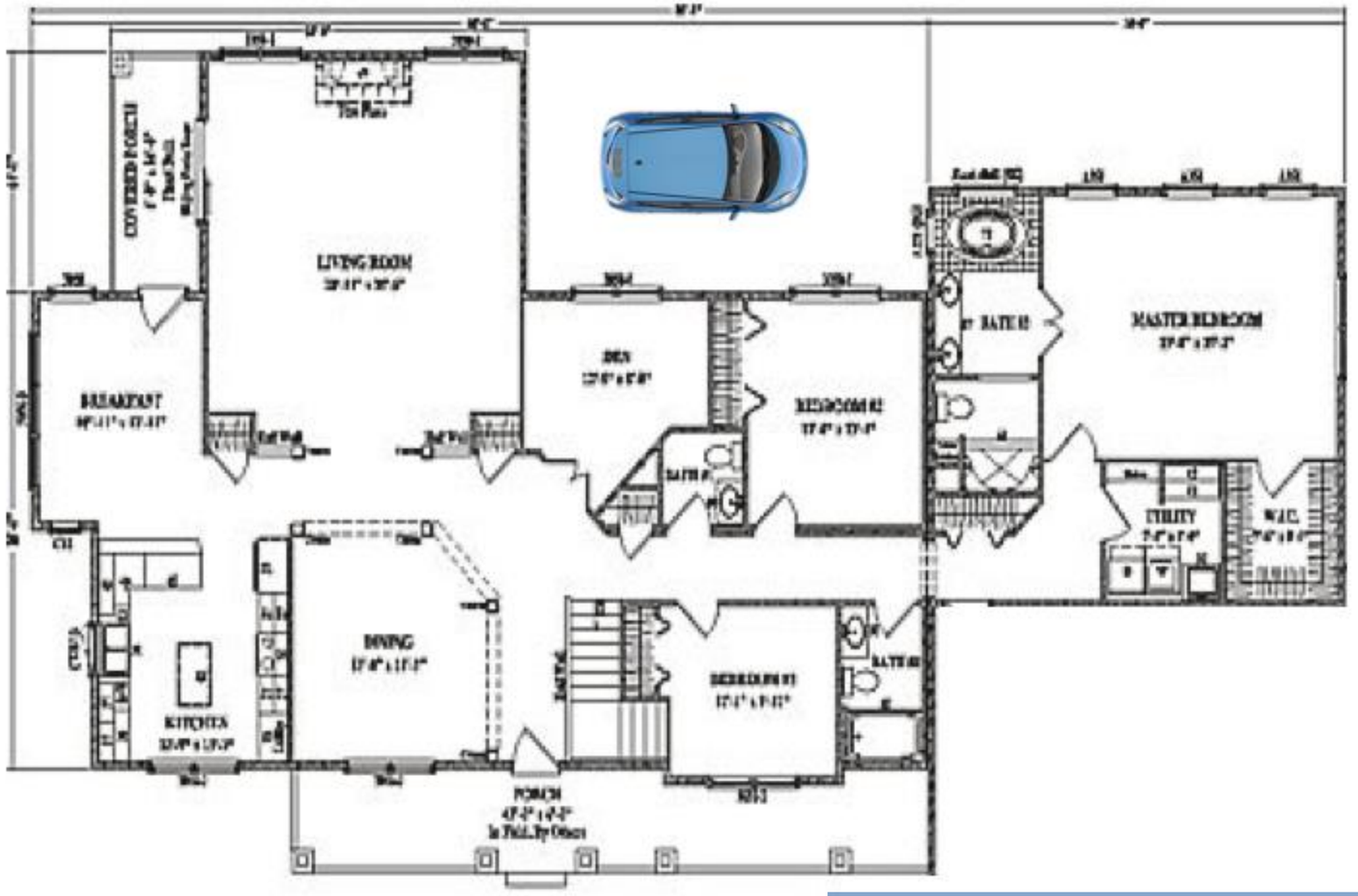
MTC data for SF Bay Area, includes climb and 10% distance penalty to cars.
NOTE: 10% ridership used for all cases

UCB.graphs.profits.2019.xlsx

Compare BART with SF Sky Transit

Category	BART	Sky Transit
Ave. speed, incl waits	21 mph	100 mph
Headway	20 minutes	1 minute
Cost of tracks	$1B / mile	$0 / mile
Fares as % of overhead	68%	200% est.
Destinations	44 stations	354 airparks
Capacity, seated/hr 5 cars per train	900/hr 60 pass./car	720/hr/airpark in 2-seat Taxis

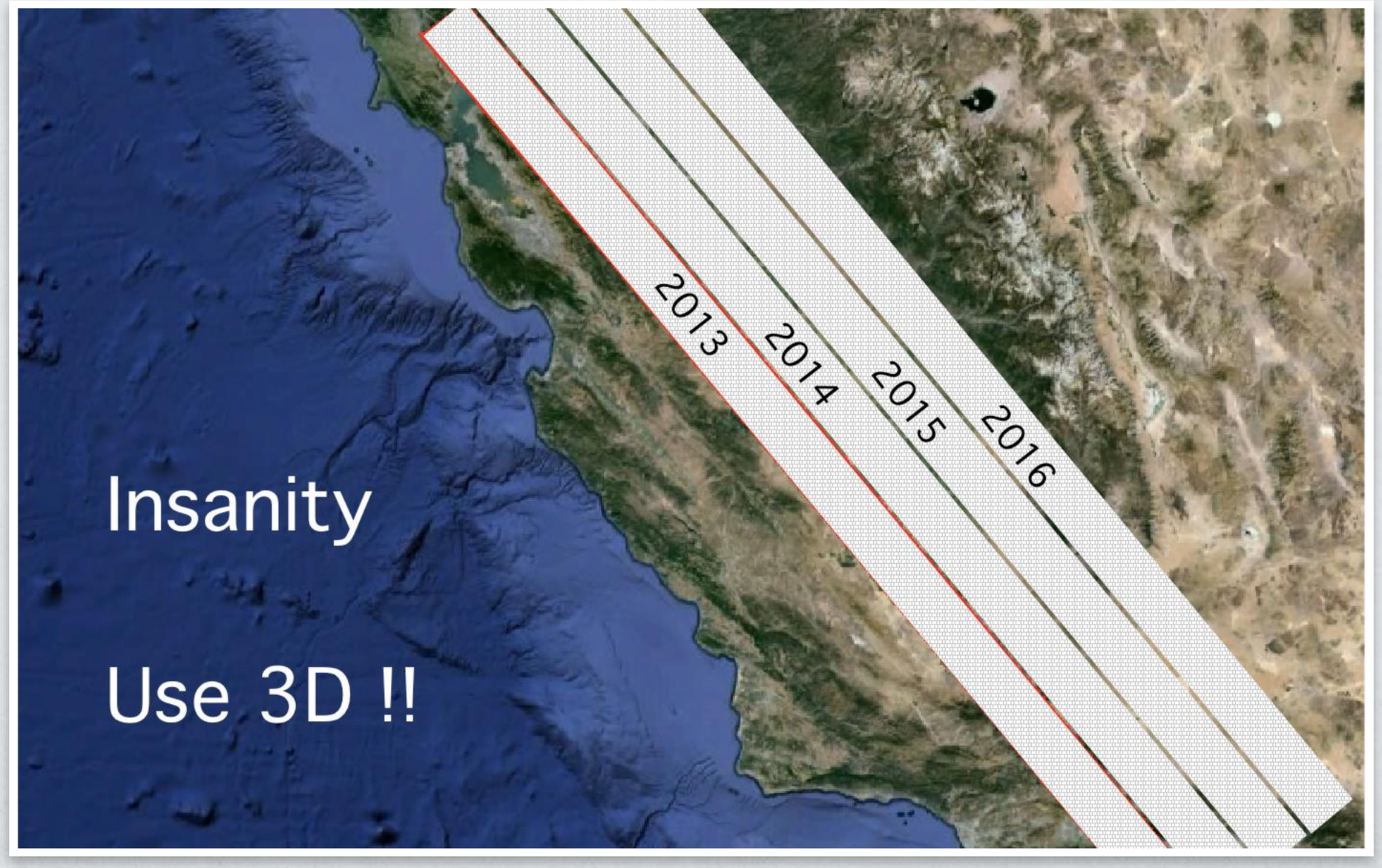
PAVEMENT demand: US Averages 2700 sq ft of pavement for every car – Todd Litman, Planetizen 11/21/14



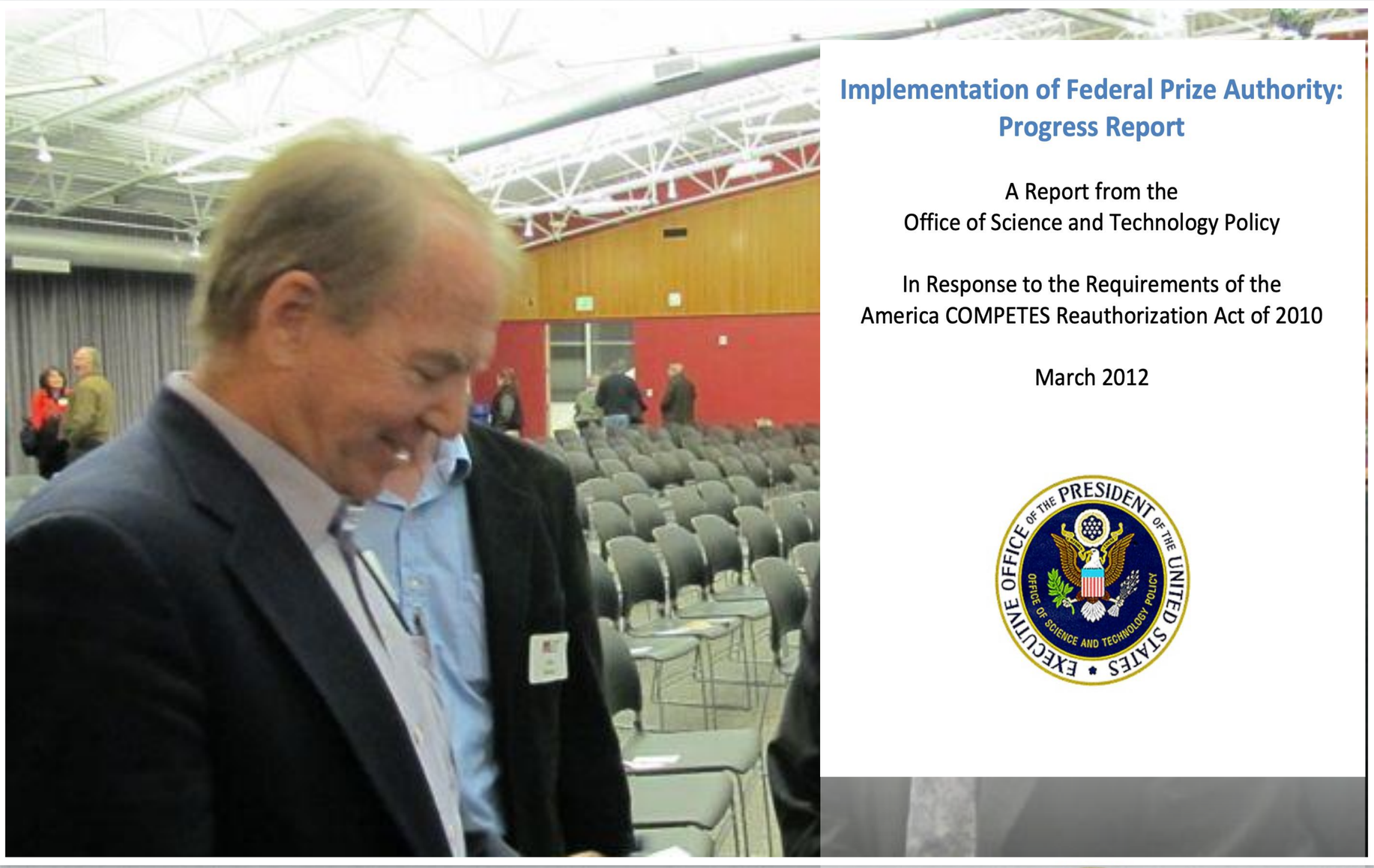
Must we pave precious earth ??

When 87M vehicles are born each year, the new hardscape requirements are astounding!

20 x 423 mi.


2013
2014
2015
2016
Insanity
Use 3D !!

Obama White House OSTP lauds GFC: John Holdren



At NASA HQ, NASA Administrator Charles Bolden recognizes Brien Seeley for the Green Flight Challenge

2011 Green Flight Challenge in Santa Rosa

Resolution No. 12-0318
Dated: June 19, 2012

Resolution

OF THE

BOARD OF SUPERVISORS

OF THE

COUNTY OF SONOMA, STATE OF CALIFORNIA

HONORING AND CELEBRATING CHAPTER 124 OF THE EXPERIMENTAL AIRCRAFT ASSOCIATION (EAA) FOR 50 SUCCESSFUL YEARS OF ACTING AS A PROMINENT "GATEWAY" TO GENERAL AVIATION IN SONOMA COUNTY

WHEREAS, in 1962 a group of dedicated volunteers formed EAA Chapter 124 to organize and foster the building and flying of aircraft in Sonoma County; and

WHEREAS, EAA Chapter 124 has been in continuous operation as a non-profit, community-based organization open to all who have an interest in aviation; and

WHEREAS, since 1962, thousands of Sonoma County residents have been exposed to all aspects of general aviation through air shows, Young Eagles Flight events, wherein youth may experience flying cost-free, public celebrations and monthly meetings hosted by the members of Chapter 124; and

WHEREAS, EAA Chapter 124 shares membership and volunteer efforts with other prominent aviation organizations in Sonoma County that express a shared passion for the advancement of aviation, including the Comparative Aircraft Flight Efficiency Foundation (CAFE), and the Pacific Coast Air Museum; and

WHEREAS, more than 100 active members of EAA Chapter 124 continue to volunteer their time and financial support to public outreach events and aircraft design and building projects, stimulating educational, vocational, hobby and retirement opportunities for Sonoma County residents of all ages; and

WHEREAS, EAA Chapter 124 has for 50 consecutive years proven itself as a fiscally responsible organization that places a high value on maintaining a working relationship with the County of Sonoma while carrying out its mission.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of the County of Sonoma hereby commemorates the 50th anniversary of Chapter 124 of the Experimental Aircraft Association of Santa Rosa, California and congratulates the many volunteers who, since 1962, have been dedicated to the growth and advancement of general aviation in Sonoma County.