Drone Delivery: Deal or No Deal

Assessing Feasibility of the Delivery Drone

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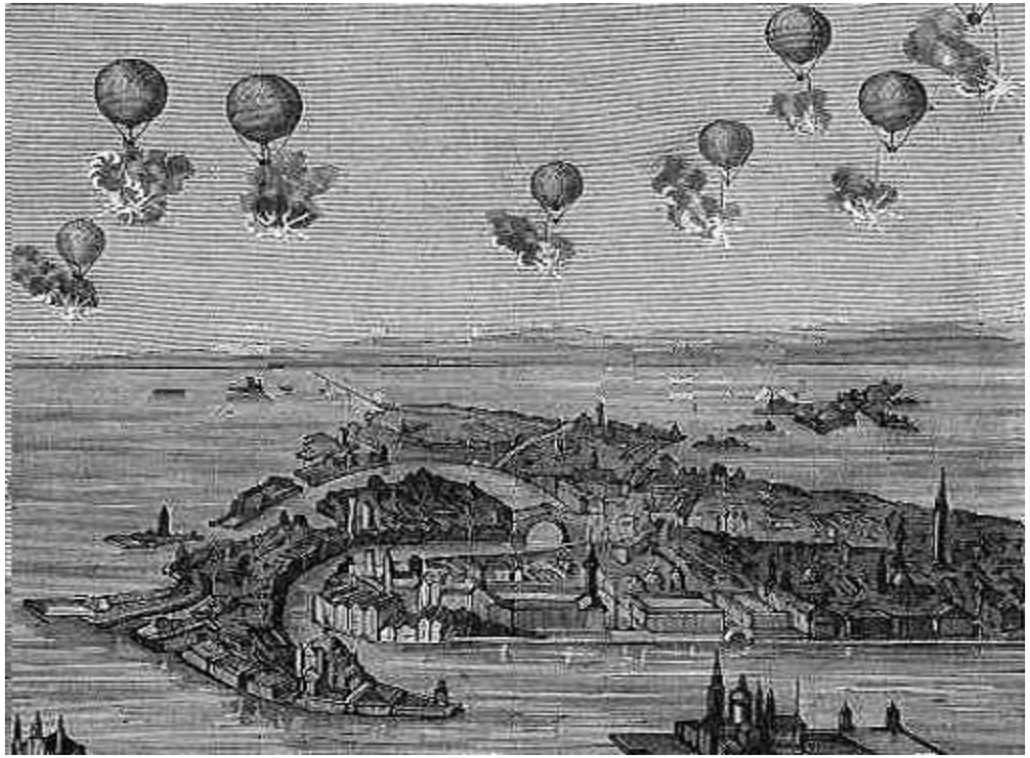
Supply Chain MANAGEMENT

Overview

- Background
- Methodology
- Result
    - Operational feasibility
    - Financial feasibility
- Discussion & conclusion

A history that started with a bang



- **July 1849 – Austrians sent incendiary balloons to besiege Venice**

and continued

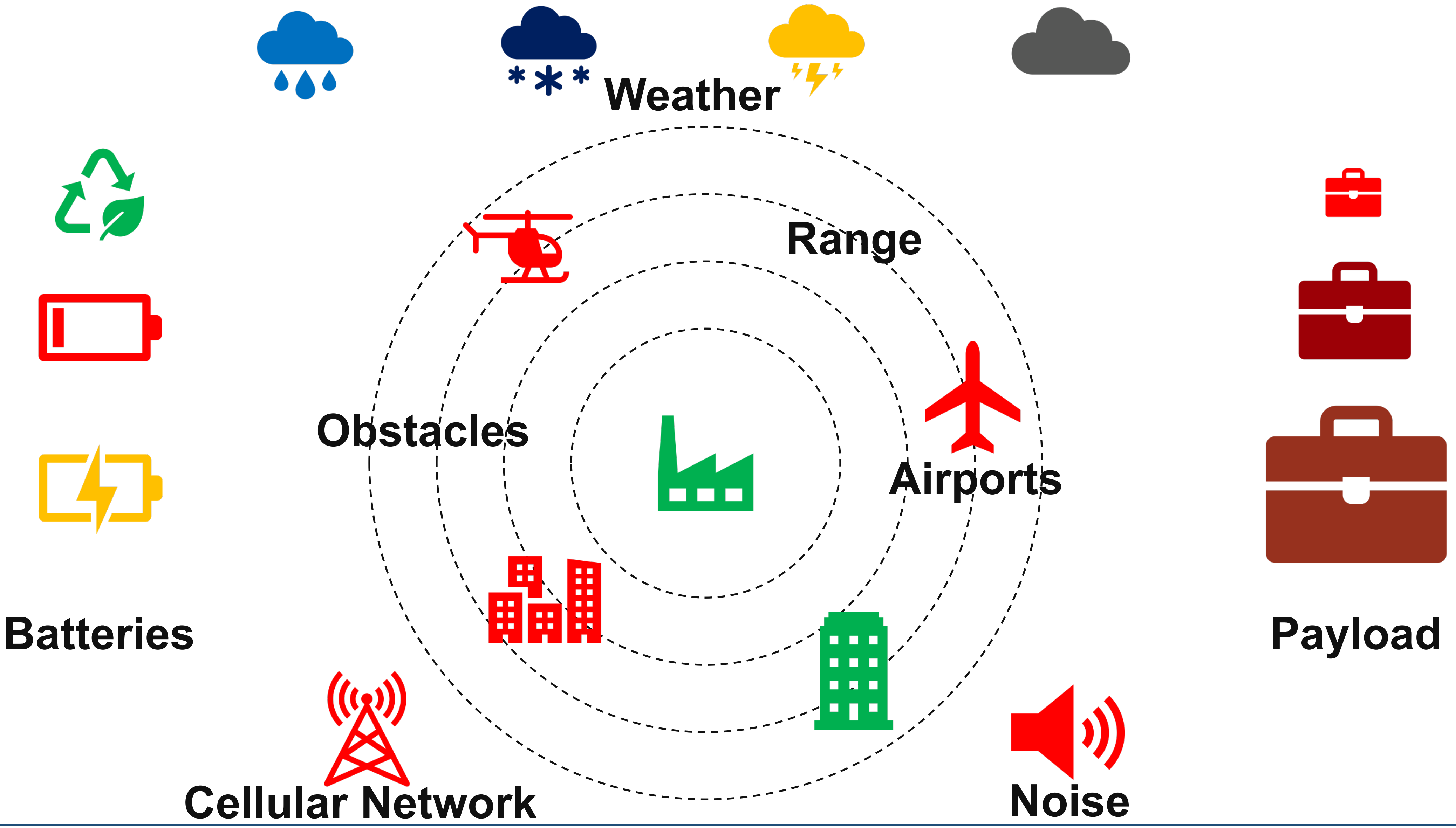
- **June 1941 – Winston Churchill and others waiting to watch the launch of a de Havilland Queen Bee target drone**

The Delivery Drone

- **2012 / 2013 – the delivery drone craze begins (medical, surveillance, inspection, small parcel, food delivery)**

The Delivery Drone

Delivery drone challenges



Methodology

Operational Feasibility

- Understand regulatory landscape for drone delivery
- Define feasible metrics for drone delivery
- Operational sensitivity analysis

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Financial Feasibility

- Baseline financial model
- Cost sensitivity analysis
- Scenario analysis

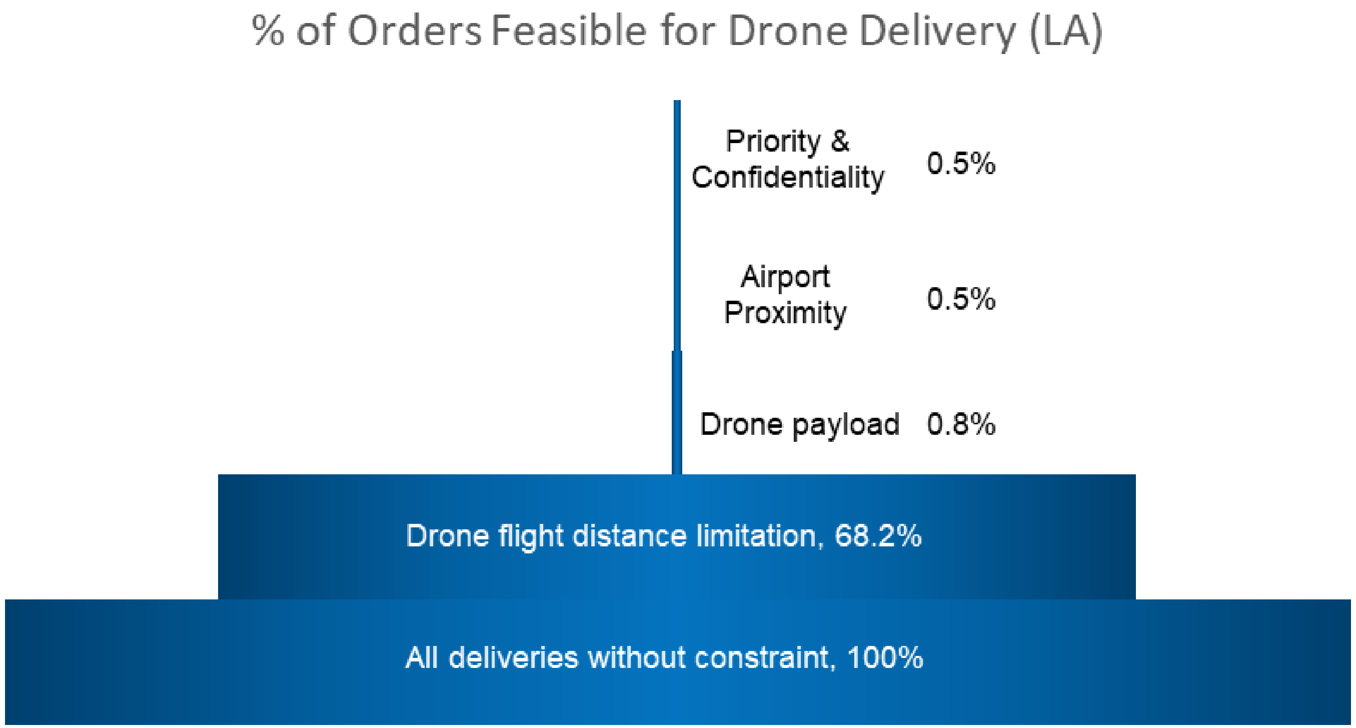
Target Locations & Key Operational Metrics

Key Metrics selected for analysis:

- **Maximum flying range**
- **Airport Proximity**
- **Payload**
- **Priority level**

Operational Feasibility – Current Scenario

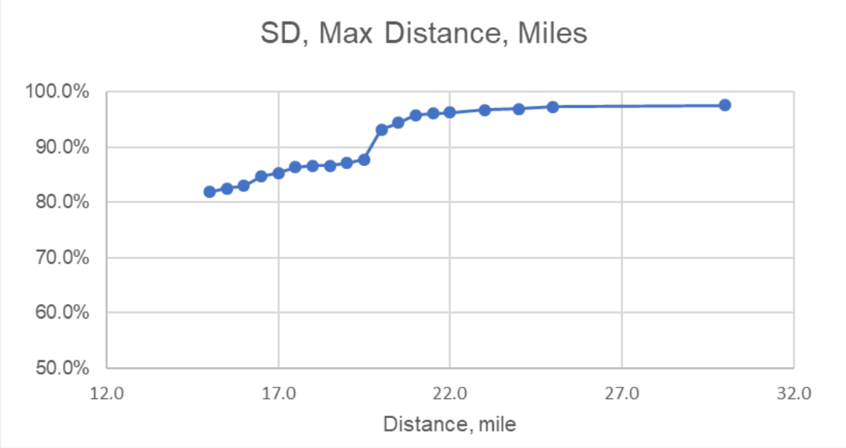
With the current capabilities and scenario, all of the cities analyzed had less than 1% of their current deliveries feasible for drone delivery.

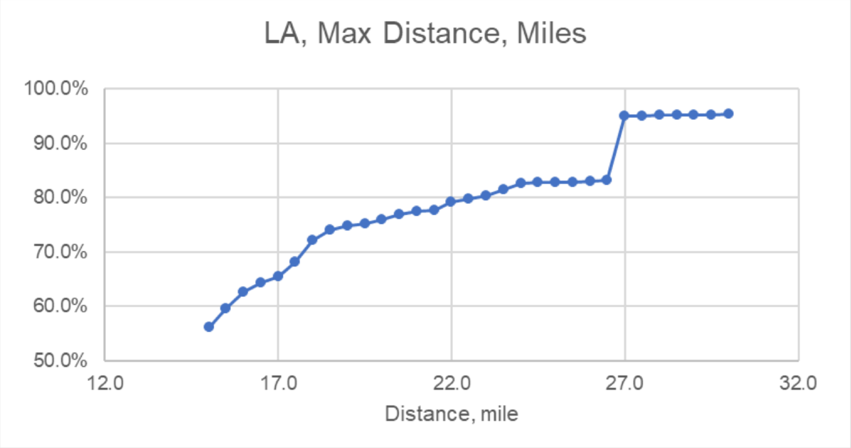


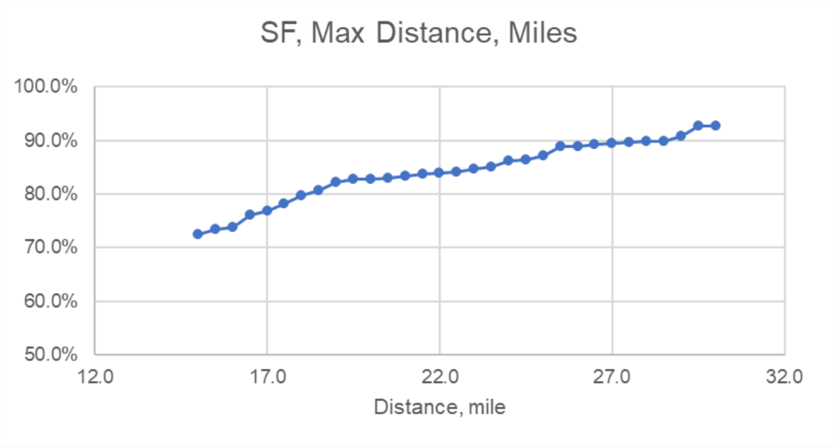
- **< 1% of current deliveries are feasible for drone delivery.**
- **Payload is the primary constraint followed by airport proximity constraint.**

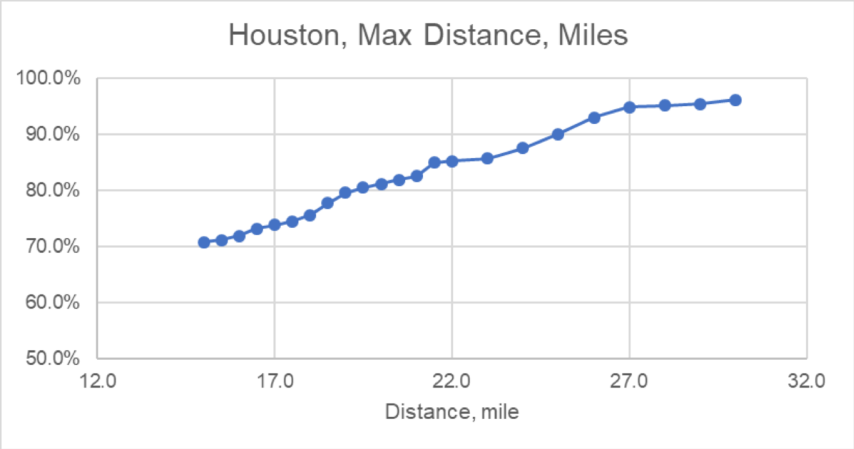
Operational Sensitivity Analysis – Maximum Distance

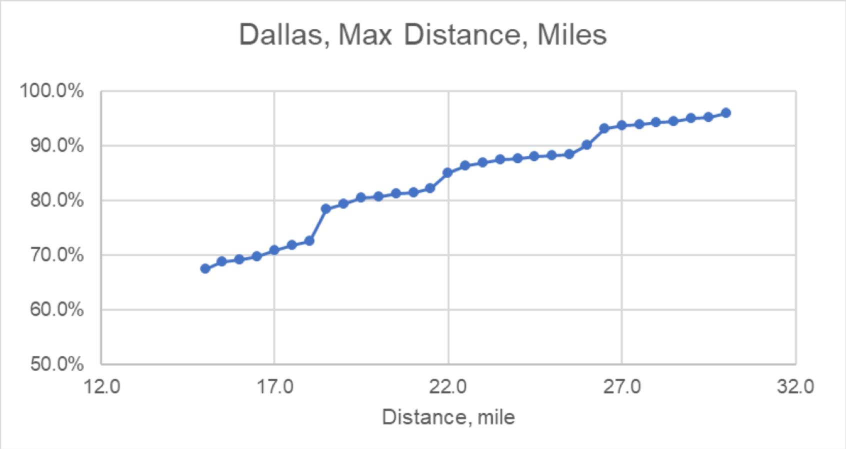
>90% of customers (by number of orders) can be reached by drone when it can fly up to 55 miles round trip.





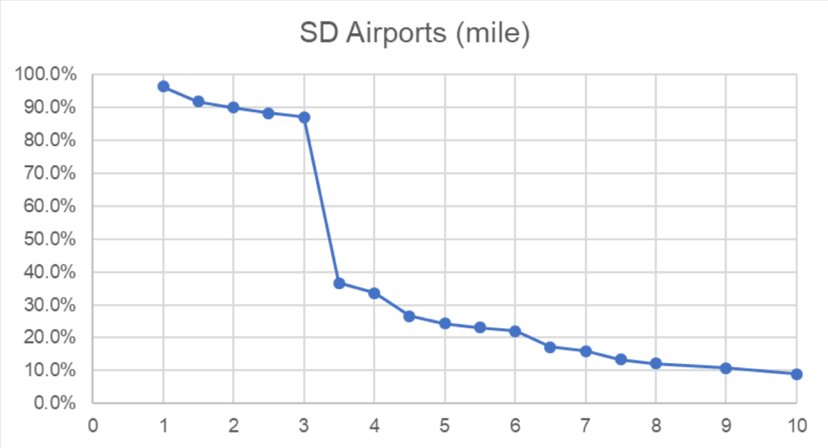


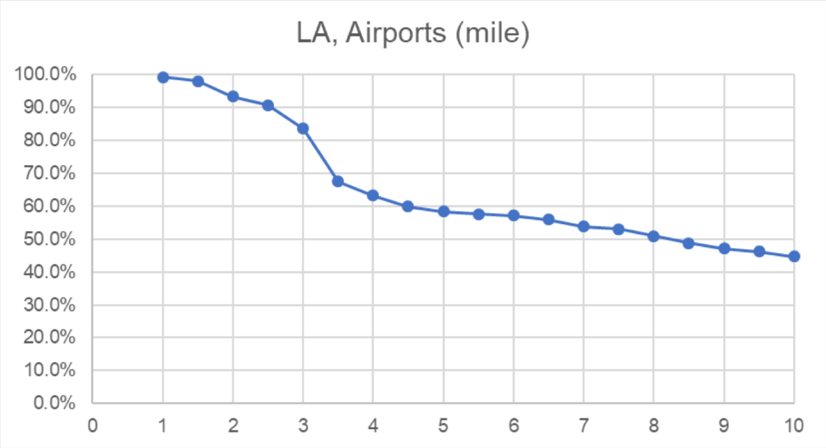


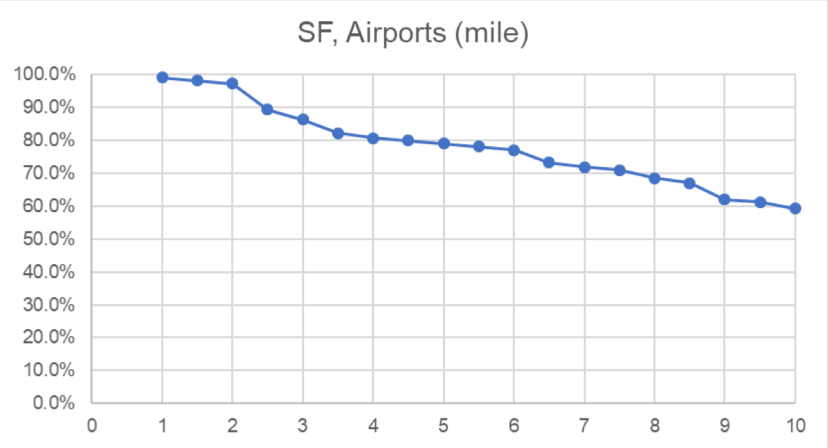


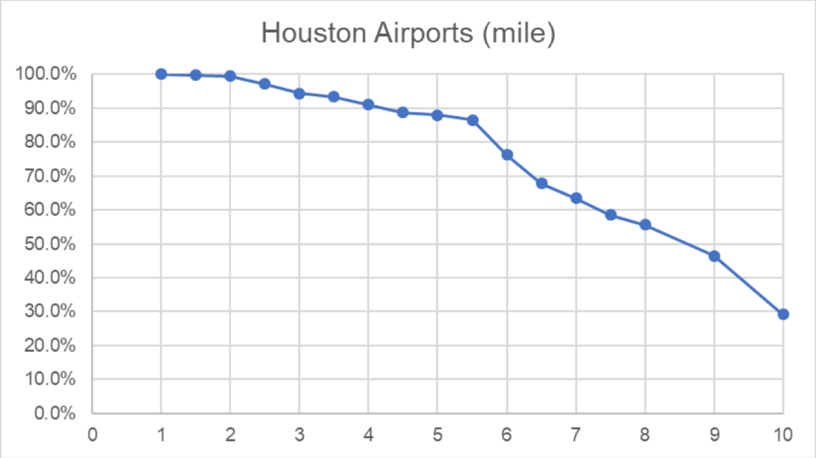
Operational Sensitivity Analysis – Airport Proximity

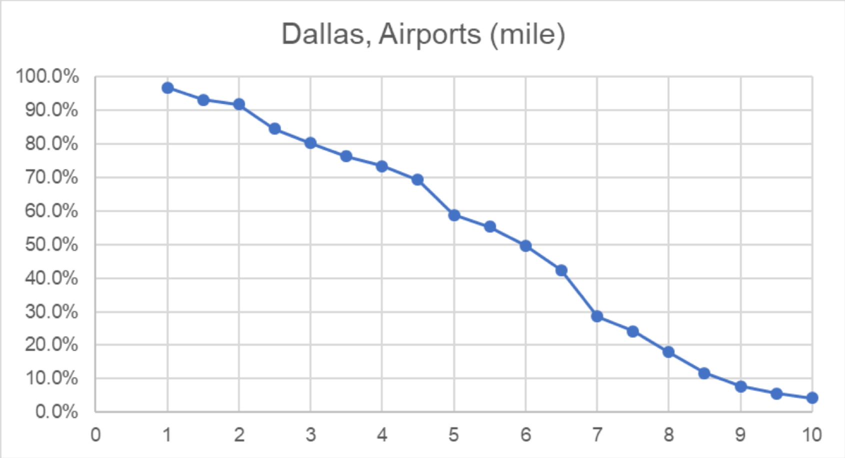
>80% of customers (by number of orders) can be reached by drone when it is allowed to fly 3 miles from airports.





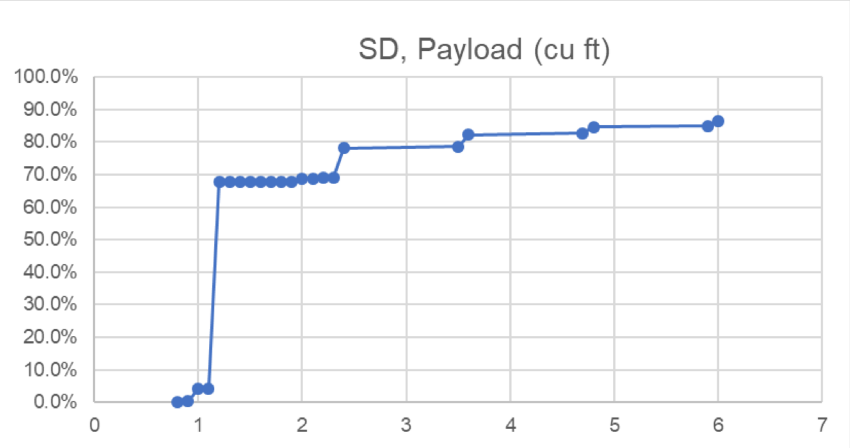


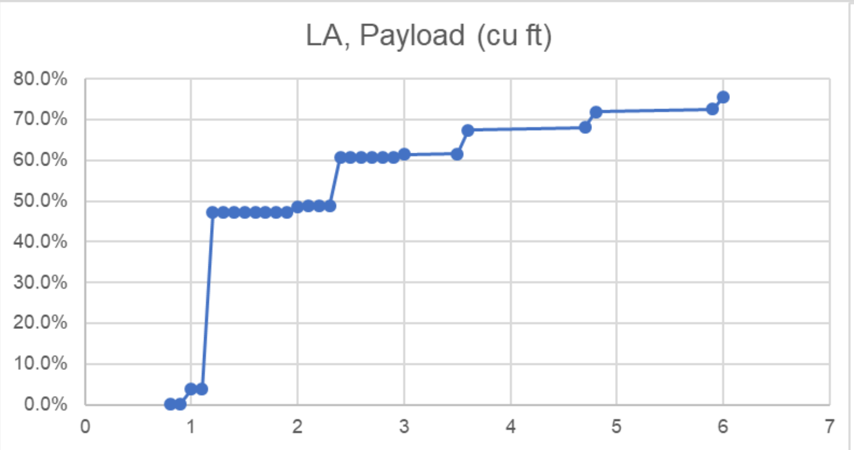


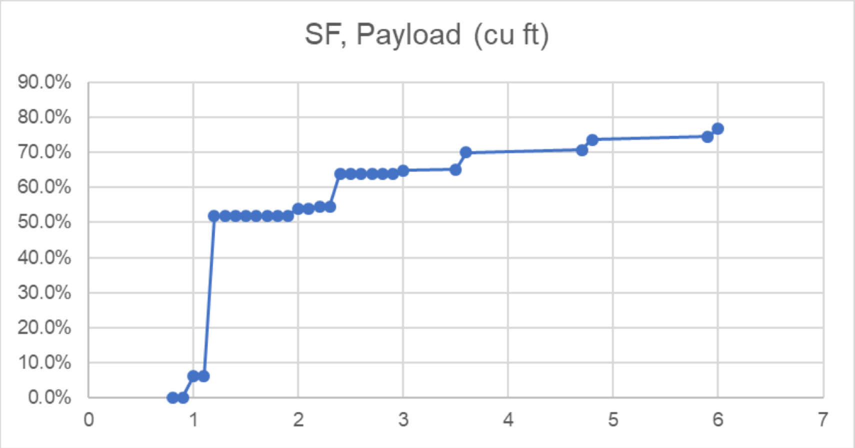


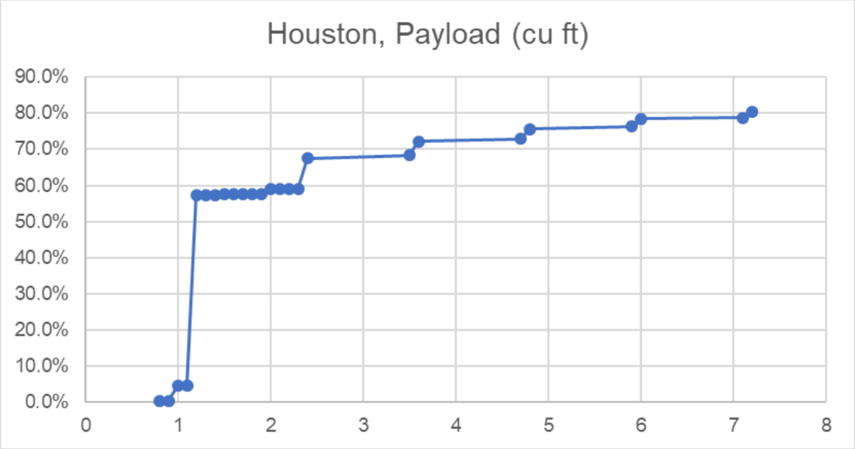
Operational Sensitivity Analysis – Package Size

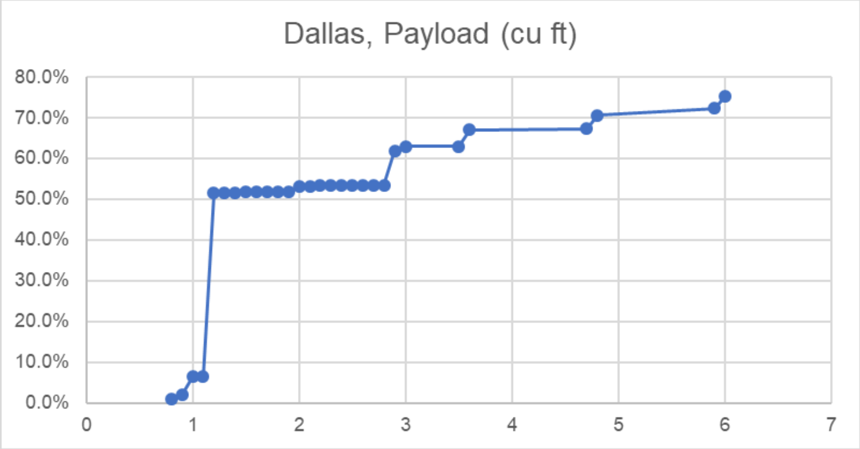
In terms of delivery package size, 50 - 60% of orders are 1.2 cu. ft. in volume.









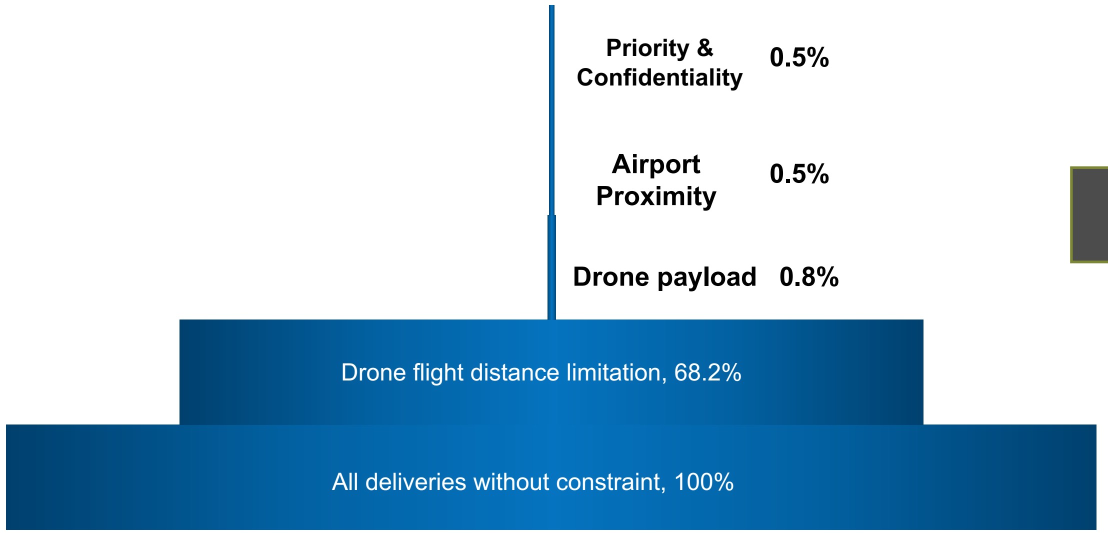


Operational Feasibility – Future Scenario

With favorable improvement in technology and relaxation in regulations in the next 5 years, 8% - 18% of deliveries would be feasible for drone delivery.

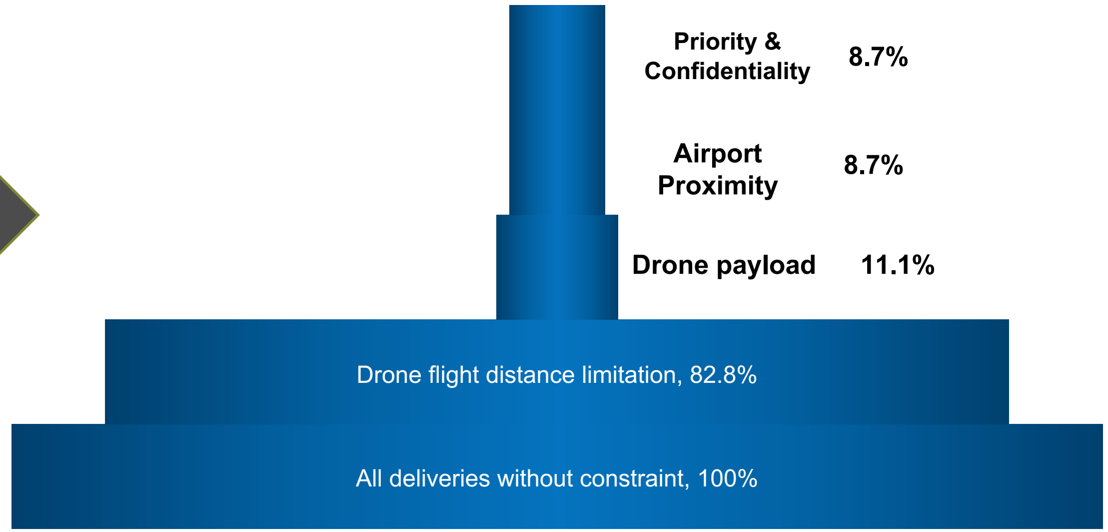
Current scenario

% of Orders Feasible for Drone Delivery (LA)



Likely scenario in 5 years

% of Orders Feasible for Drone Delivery (LA)



City/Region	Current	Next 5 years
Los Angeles	0.50%	8.74%
San Diego	0.24%	18.08%
San Francisco	0.61%	8.77%
Dallas	0.51%	10.30%
Houston	0.64%	9.39%

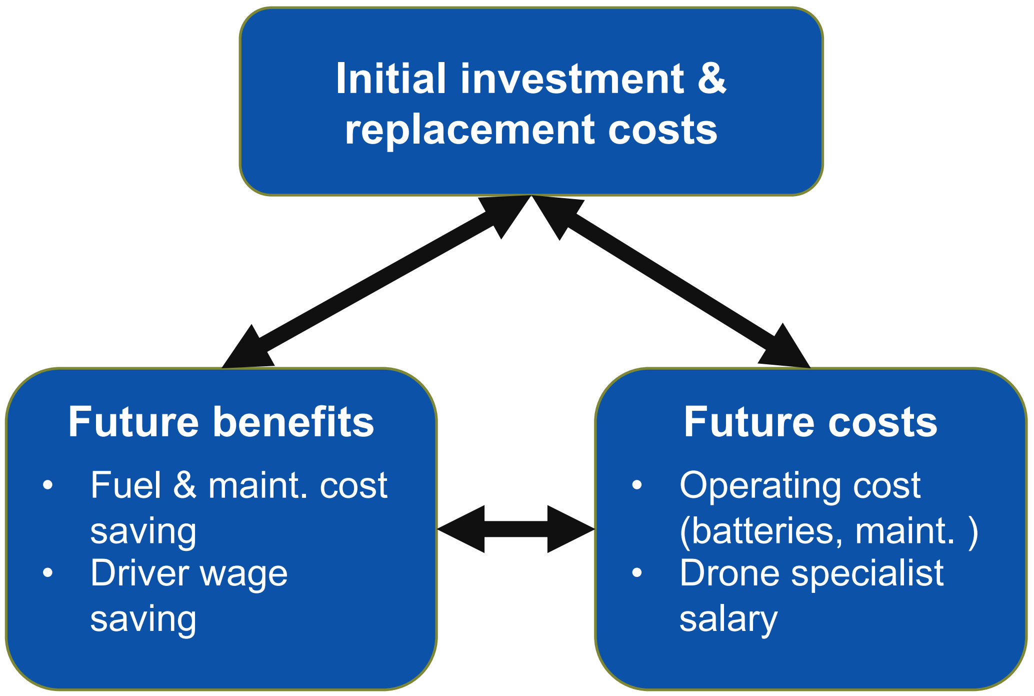
Financial Feasibility – Current vs Future

Drone delivery is only feasible under optimistic scenario as a cost saver.

NPV without premium charge *(cost saver)*

City/Region	Current scenario	Future scenarios in 5 years		
		Pessimistic	Most likely	Optimistic
▪ Los Angeles	(2,745)	(2,627)	(919)	560
▪ San Diego	(1,377)	(1,355)	(558)	590
▪ San Francisco	(1,439)	(1,427)	(428)	339
▪ Houston	(1,371)	(1,361)	(481)	(11)
▪ Dallas	(1,421)	(1,464)	(734)	(669)

Cost metrics to be considered in all scenarios:



Financial Feasibility – Cost Saver vs Profit Driver

Pairing some fees with most likely and optimistic scenarios show some potential for delivery drone investment.

NPV without premium charge *(cost saver)*

	Current scenario	Future scenarios in 5 years		
		Pessimistic	Most likely	Optimistic
City/Region				
▪ Los Angeles	(2,745)	(2,627)	(919)	560
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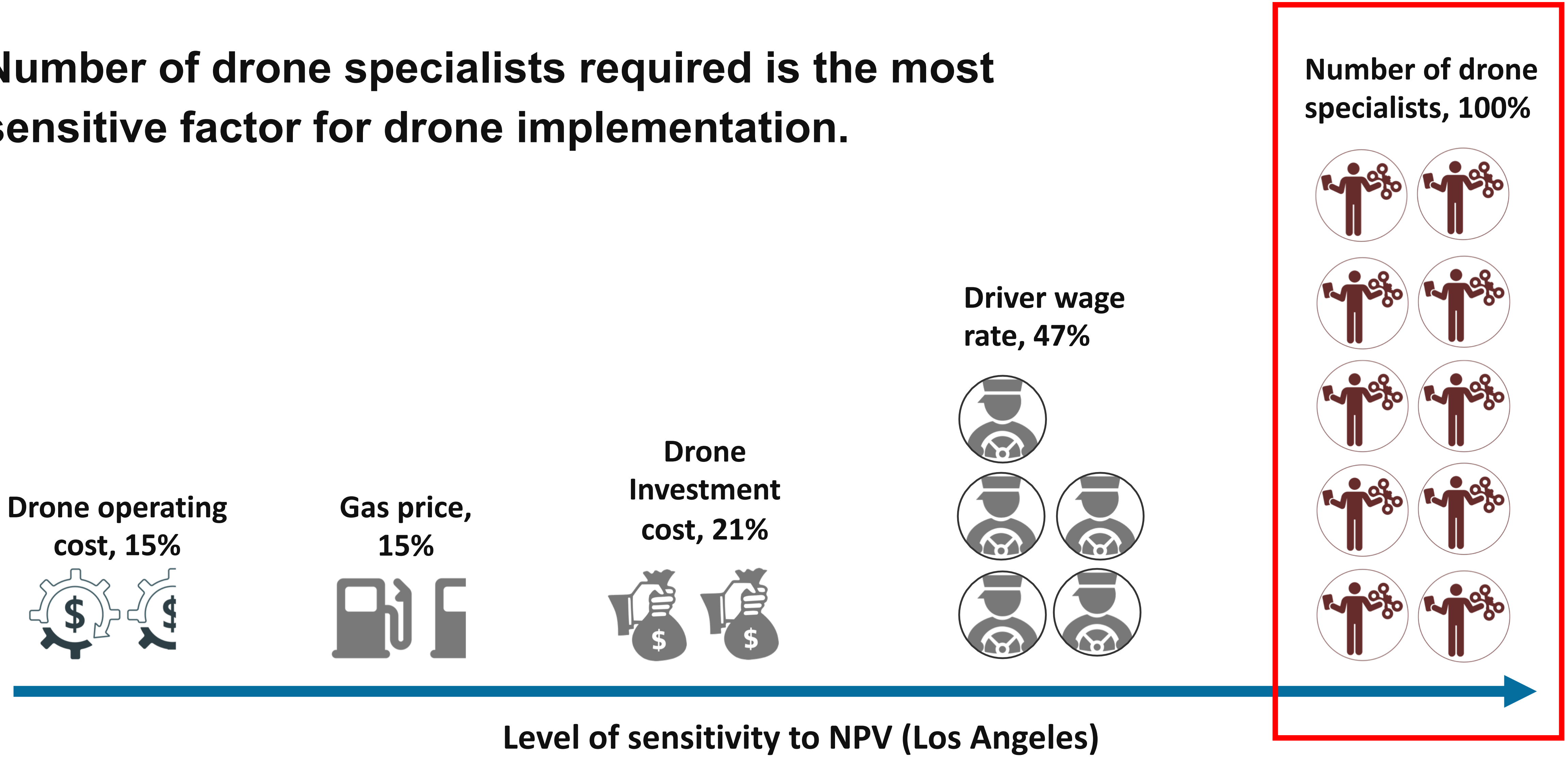
NPV with $20 premium per order *(profit driver)*

	Current scenario	Future scenarios in 5 years		
		Pessimistic	Most likely	Optimistic
City/Region				
▪ Los Angeles	(2,623)	(2,022)	1,220	6,037
▪ San Diego	(1,361)	(1,238)	582	2,808
▪ San Francisco	(1,405)	(1,263)	53	1,494
▪ Houston	(1,338)	(1,184)	(1)	1,072
▪ Dallas	(1,411)	(1,402)	(565)	(298)

Cost Sensitivity Analysis

Number of drone specialists required is the most sensitive factor for drone implementation.



Discussion & Conclusion

- Changes in regulations
  - Line of sight to autonomous
  - Flight over populated areas

- Technology
  - Advancement in batteries
  - Increase in payload
  - Increase in range
  - All weather capability

- Watch for momentum in drone medical deliveries

- Wait for the best means of drone delivery service to emerge

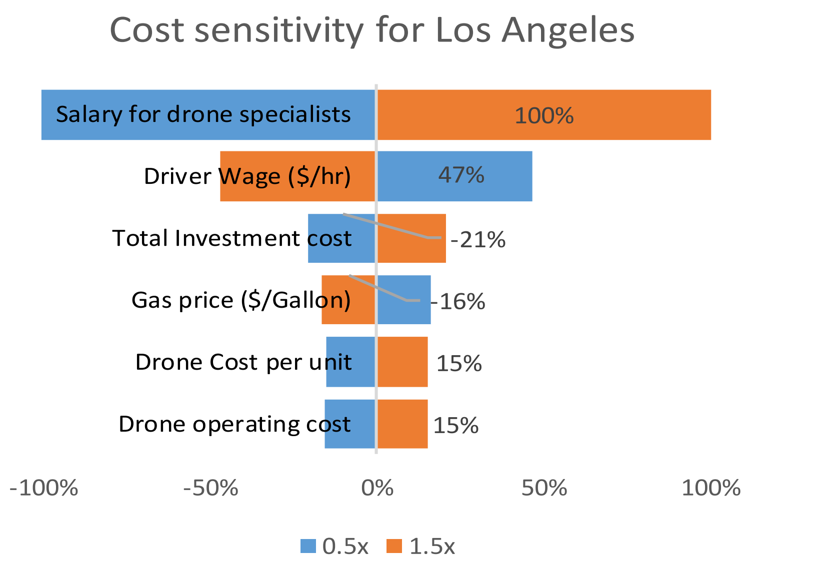
Discussion & Conclusion

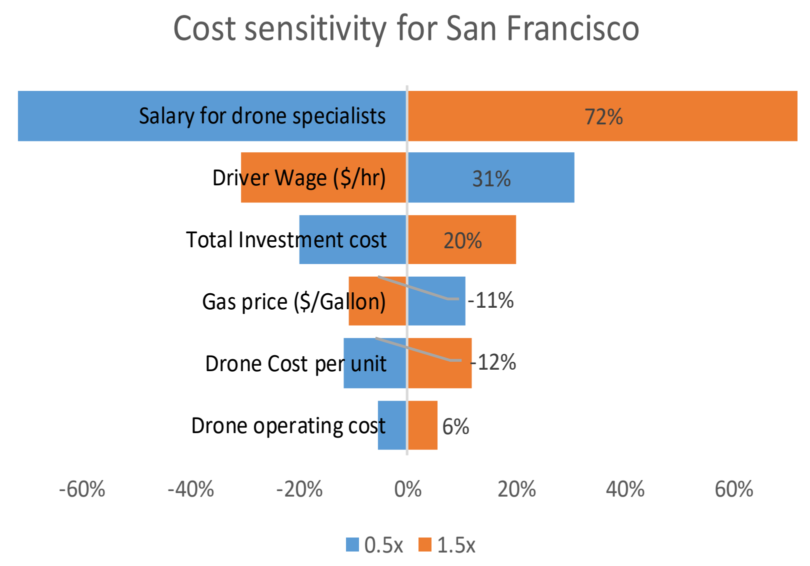
- **Understanding the complex nature of delivery drone operations**
- **Cost savings versus profit driving**

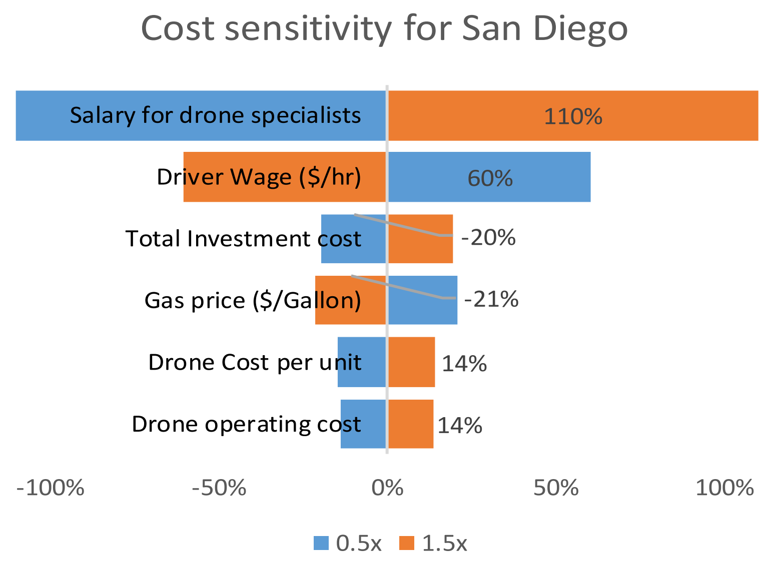
Q & A

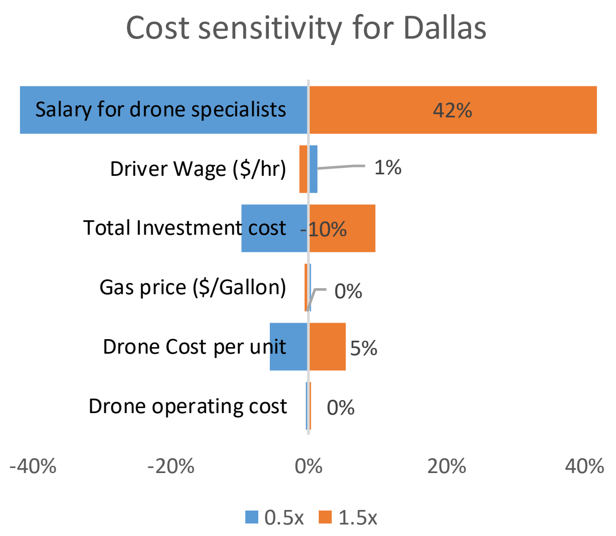
Appendices

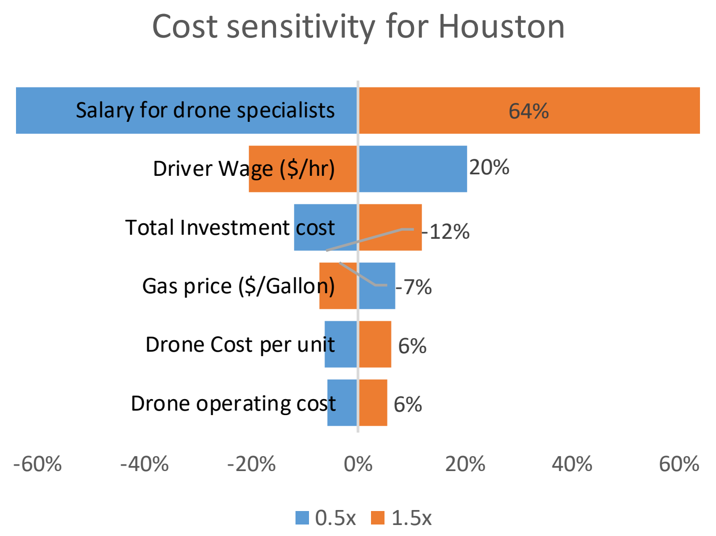
Cost Sensitivity Analysis











Key Assumptions

Drone capability assumptions:

- Speed: 35 mph
- Flight time: 1 hour

Initial investment cost assumptions:

- Drone price = $10,000 per unit
- Container price = $100 per unit, 3 cargo containers per drone
- Drone station price = $10,000 per location (one location per depot)
- Implementation, system integration, and other administration cost = $40,000
- The useful life of drones and containers is 5 years

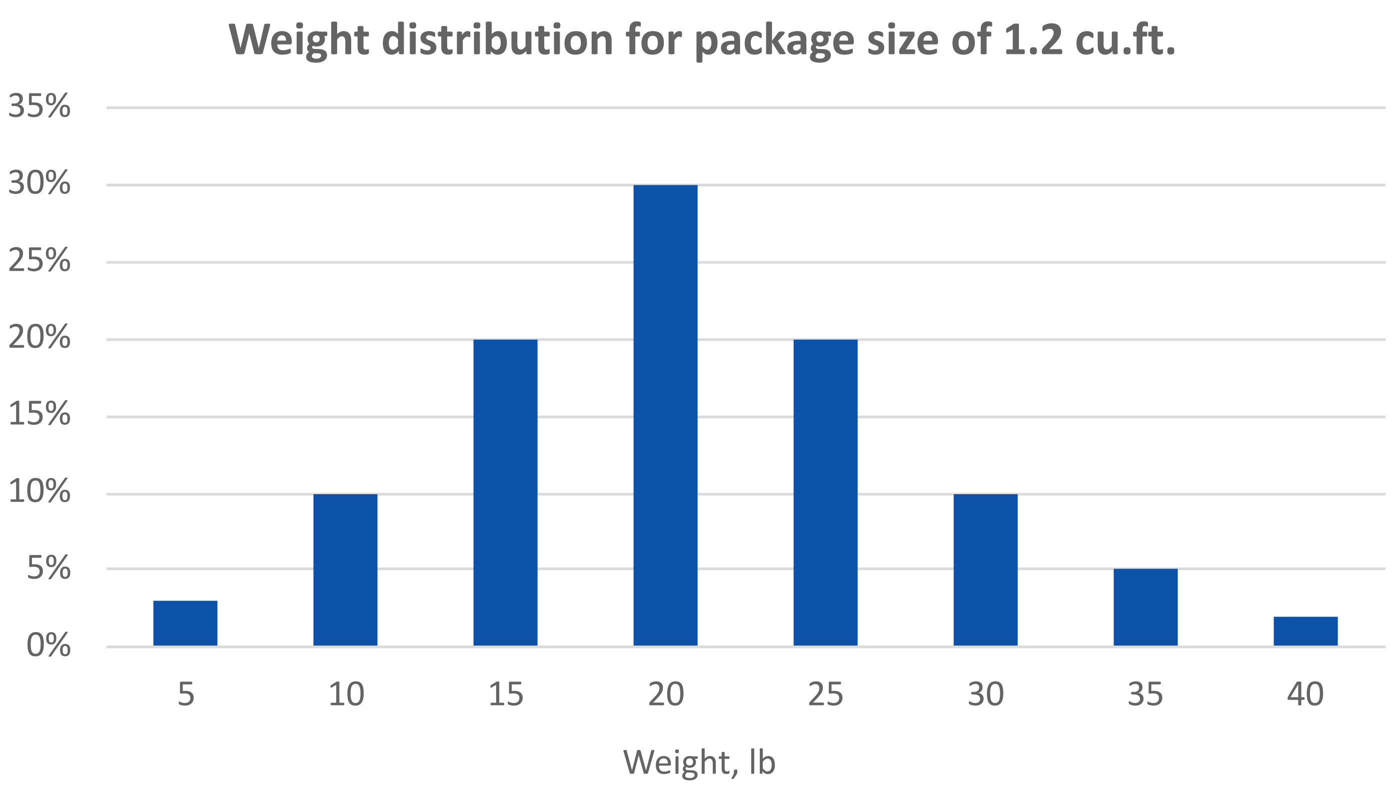
Drone operating cost assumptions:

- Annual salary for drone specialist = $60,000 per person.
- Drone maintenance cost (including battery, repairs, etc.) = $0.10 per mile

Vehicle cost saving assumptions:

- Gas price = $3.50 per gallon
- Energy consumption = 10 mile per gallon
- Average distance traveled per hour = 25 miles per hour

Weight Distribution for Package Size of 1.2 cu.ft.



Scenario Analysis – 3 possible future scenarios to be considered for financial analysis

Parameters	Current	In 5 years		
	Base case	Future Scenario 1 Pessimistics Scenario	Future Scenario 2 Most likely Scenario	Future Scenario 3 Optimistics Scenario
Max Flying distance	17.5 miles	20 miles	25 miles	30 miles
Payload	5 lb	10 lb	15 lb	20 lb
Distance from airports	6 miles	4 miles	3 miles	2 miles
No. of drone specialists required	1 person handles 2 drones	1 person handles 2 drones	1 person handles 5 drones	1 person handles 10 drones
Total Investment cost	base case estimates based on regions	25% increase	25% reduction	25% reduction
Drone operating cost	base case estimates based on regions	25% increase	Same as base case	25% reduction
Gas price ($/Gallon)	3.5	25% reduction	Same as base case	25% increase
Driver Wage ($/hr)	20	Base case	25% increase	50% increase

References

Image credit for Slide 3:
https://www.robinradar.com/press/blog/evolution-of-the-drone-threat-part-1/
Historical references for Slide 3:
The Future of Drone Use: Opportunities and Threats from Ethical and Legal Perspectives, Asser Press – Springer, chapter by Alan McKenna, page 355

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