

A large, glowing blue clock face is the central visual element. The clock has a white face with black numbers and hands. It is overlaid with a network of blue lines and nodes, suggesting a digital or communication theme. The background is a dark blue gradient with abstract shapes.

A TIME SYNCHRONIZATION PROTOCOL FOR UAS

RESEARCH FELLOWSHIP FALL 2021

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Aerospace Sciences Ph.D.

SUCCINT PROFILE



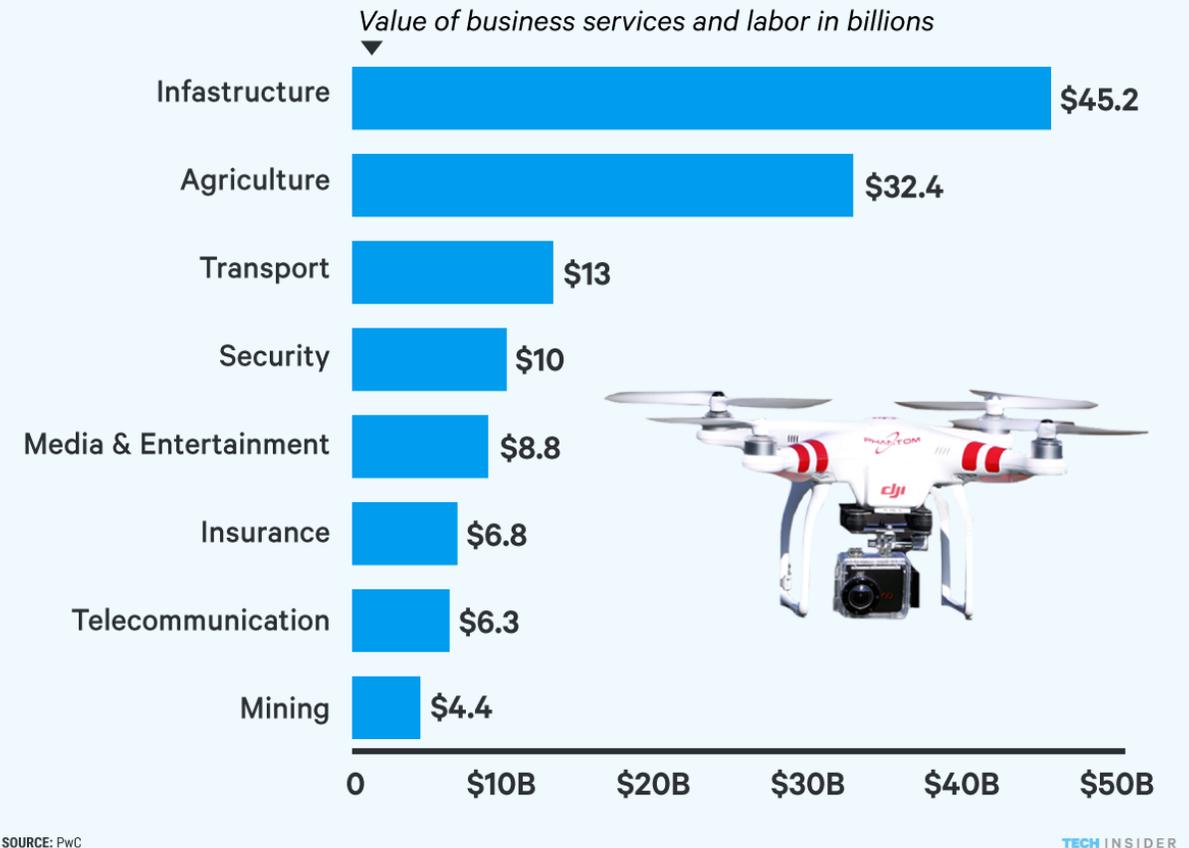
- Ms.C. Aeronautical Engineering (Polytechnic University Madrid).
- 20 years of experience in aviation.
- Ph.D. Aerospace Sciences (UND).
- Research Fellowship Fall 2021.



FUTURE UAS TRENDS

- 850,000 UAS registered in the U.S.
 - 37% commercial purposes.

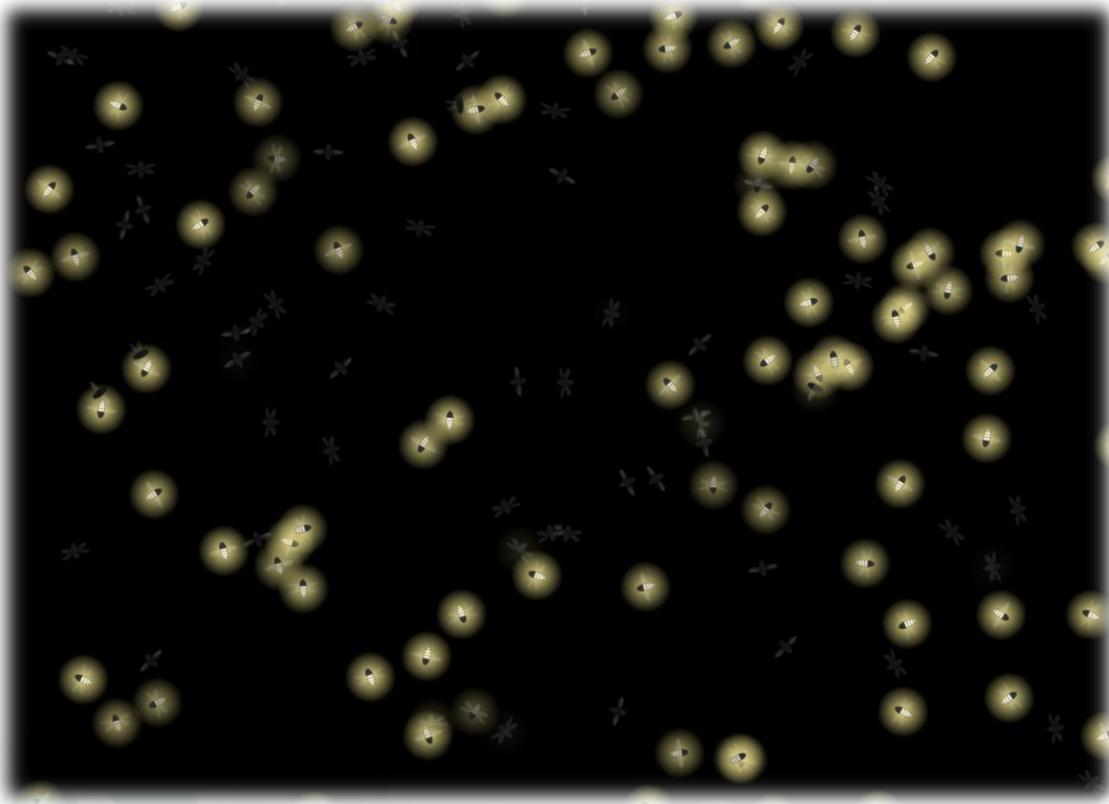
Predicted value of drones by industry



Source: PwC, as cited in Insider Intelligence, Feb. 10, 2020



TIME SYNCHRONIZATION



Time Division Multiple Access.
Slots allocation



GPS TIME

A world time reference.

Cs and Rb clocks (accuracy: 100 nsec).

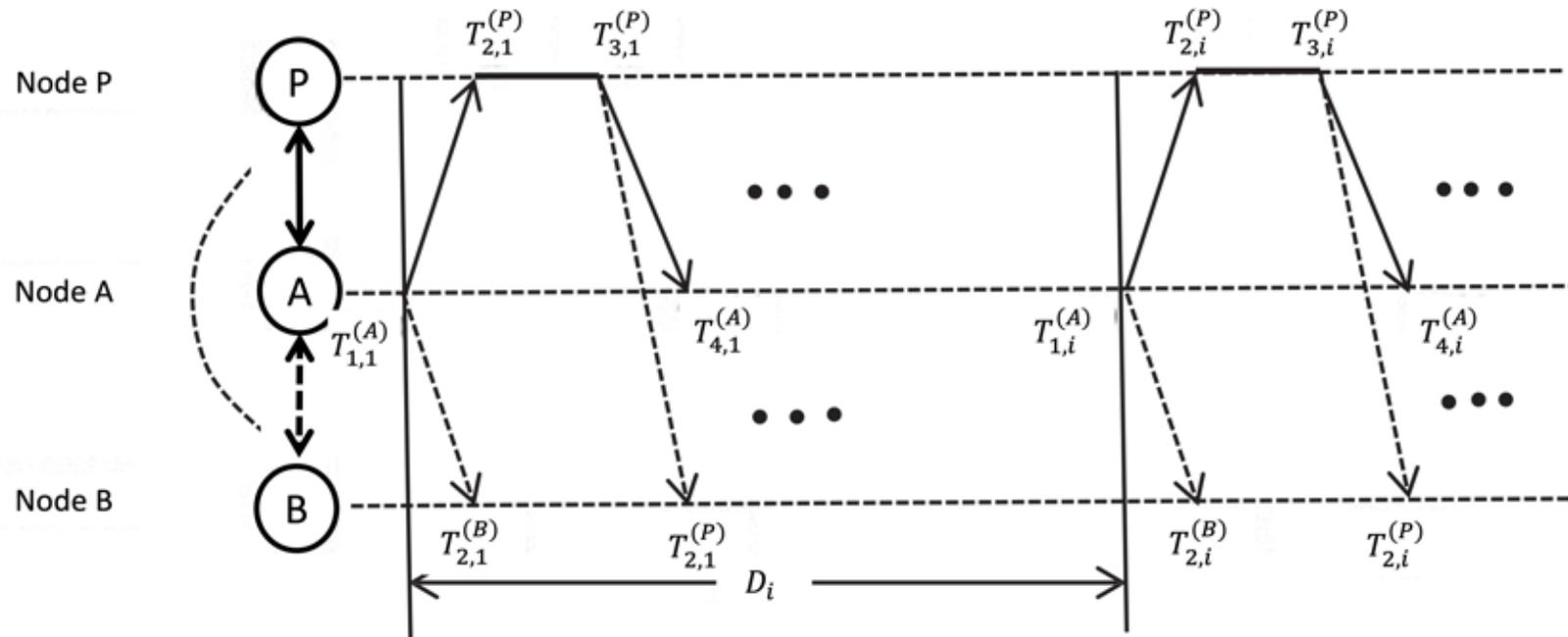


Limitations:

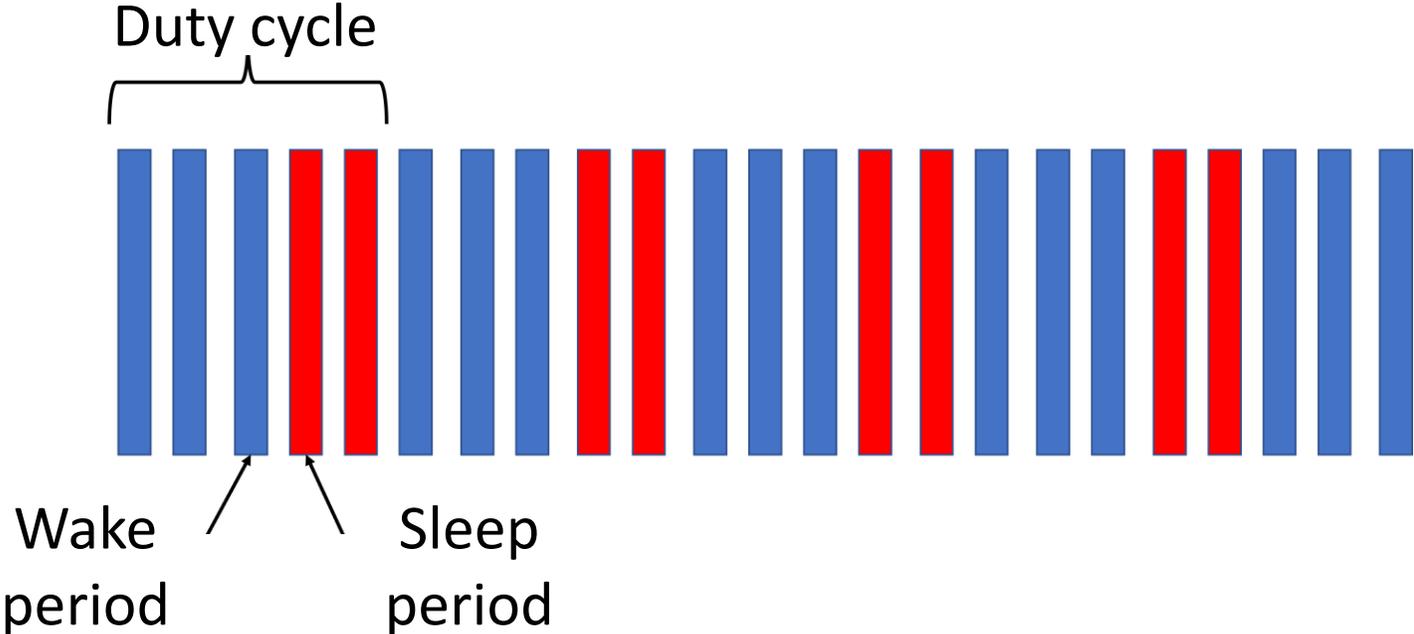
DoD ownership.

Jamming/spoofing exposure.

RECEIVER ONLY SYNCHRONIZATION PROTOCOL

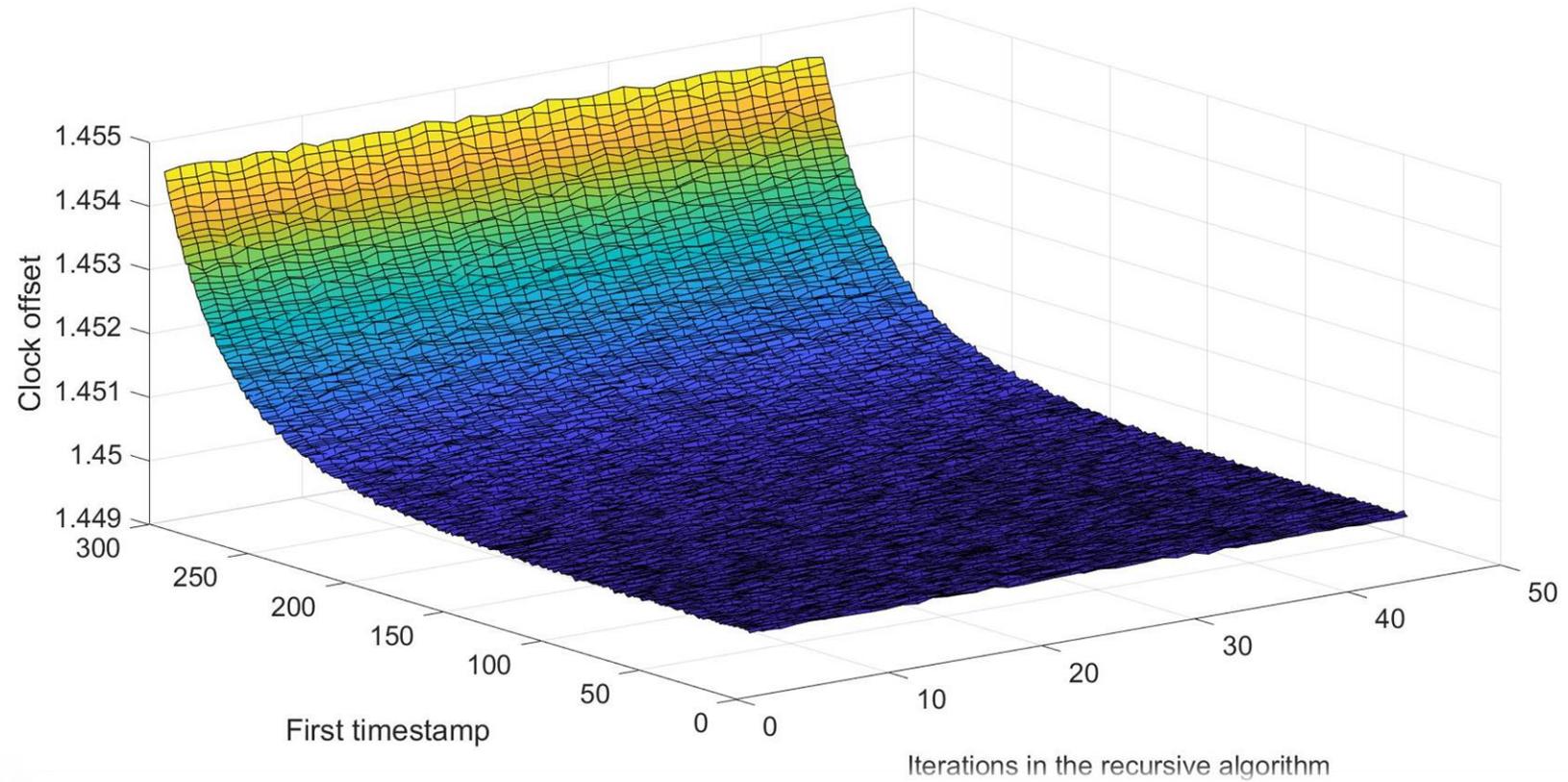


DUTY CYCLE

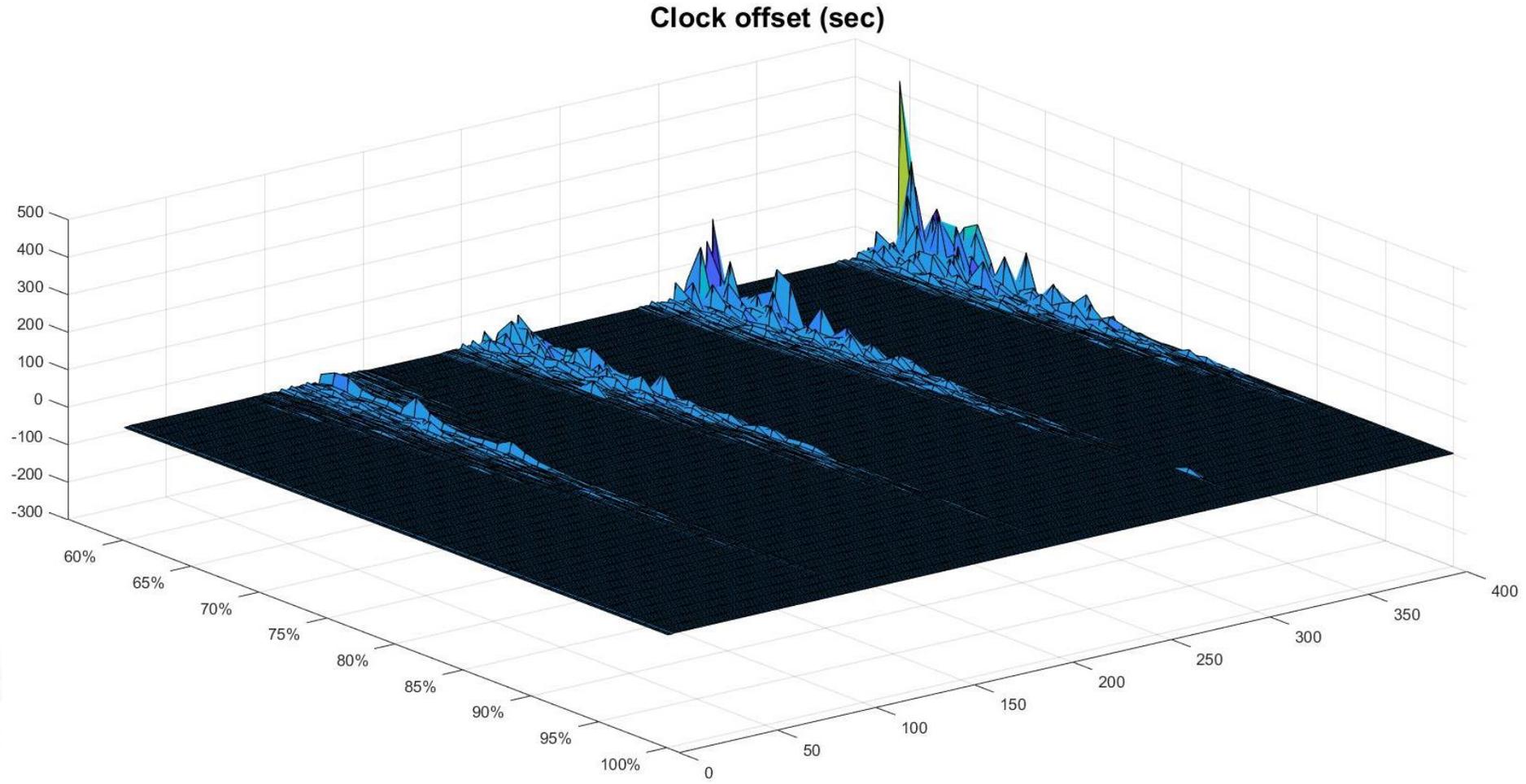


RESULTS: OBSERVATIONS AND ITERATIONS

$$T_{1,N}^{(P)} = 450$$



RESULTS: DUTY CYCLE- ACCURACY



Duty cycle scheme, active modes

Last point in the regression



CONCLUSIONS: GENERAL SUMMARY

- A time synchronization protocol analyzed under UAS perspective.
- Fully efficient.
 - Accurate (with a sufficient number of observations).
 - Small variation of results.



NASA STRATEGIC GOAL 3

“Address National Challenges and Catalyze Economic Growth.”

- Expanded use of drones for economic and societal benefit.

NASA 2022 Strategic Plan

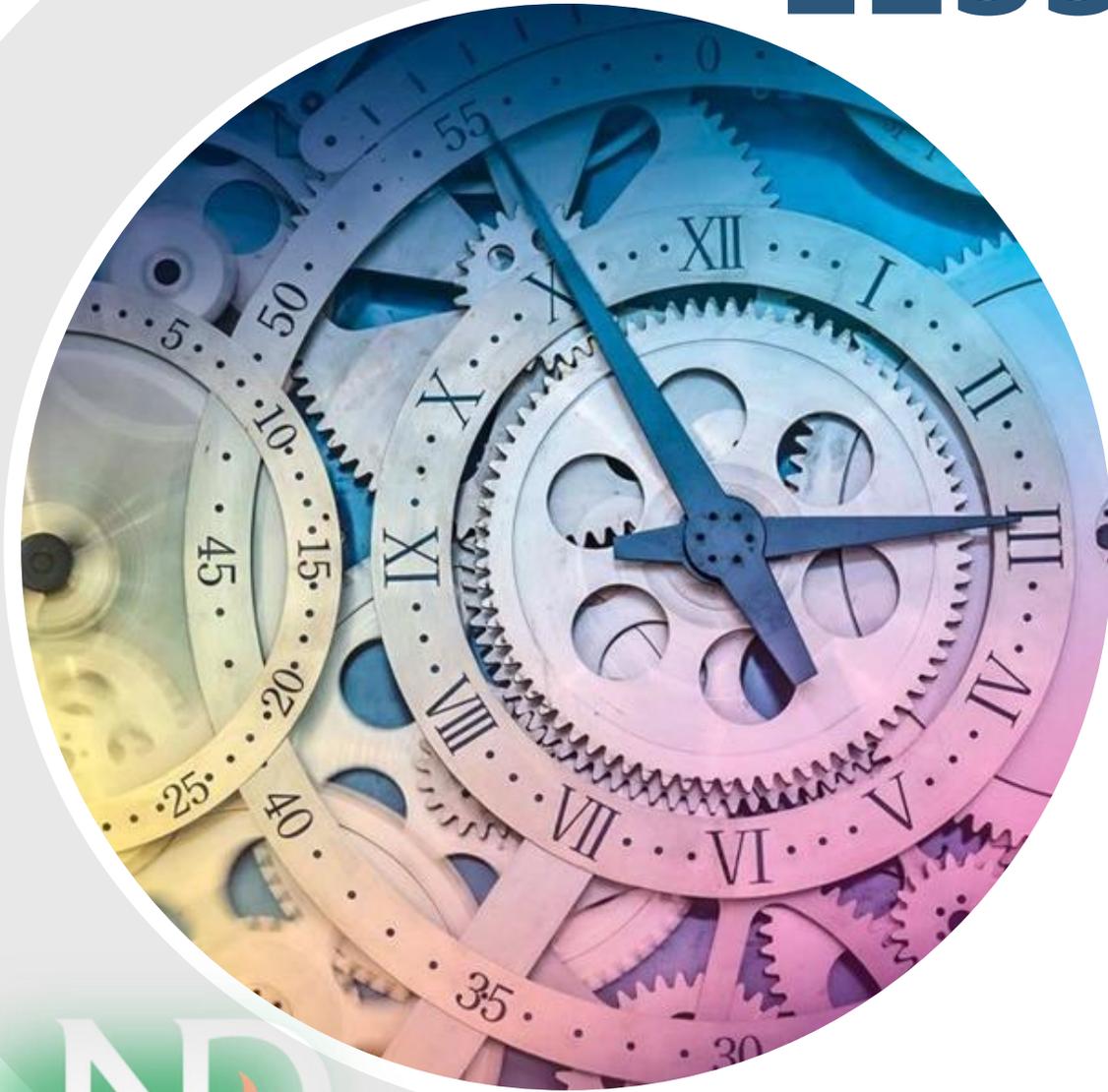


LESSONS LEARNED

Talk to experts (do something useful).

Look for funding.

Future plans.



REFERENCES (FOR THIS PRESENTATION)

Globe Newswire (2021, September 07). *Unmanned Aerial Vehicle (UAV) market size to hit US 36 \$Bn by 2030.*
<https://www.globenewswire.com/news-release/2021/09/07/2292615/0/en/Unmanned-Aerial-Vehicle-UAV-Market-Size-to-Hit-US-36-Bn-by-2030.html>

Insider Intelligence. (2020, February 10). *Commercial Unmanned Aerial Vehicle (UAV) market analysis- Industry trends, forecasts and companies.* <https://www.businessinsider.com/commercial-uav-market-analysis>