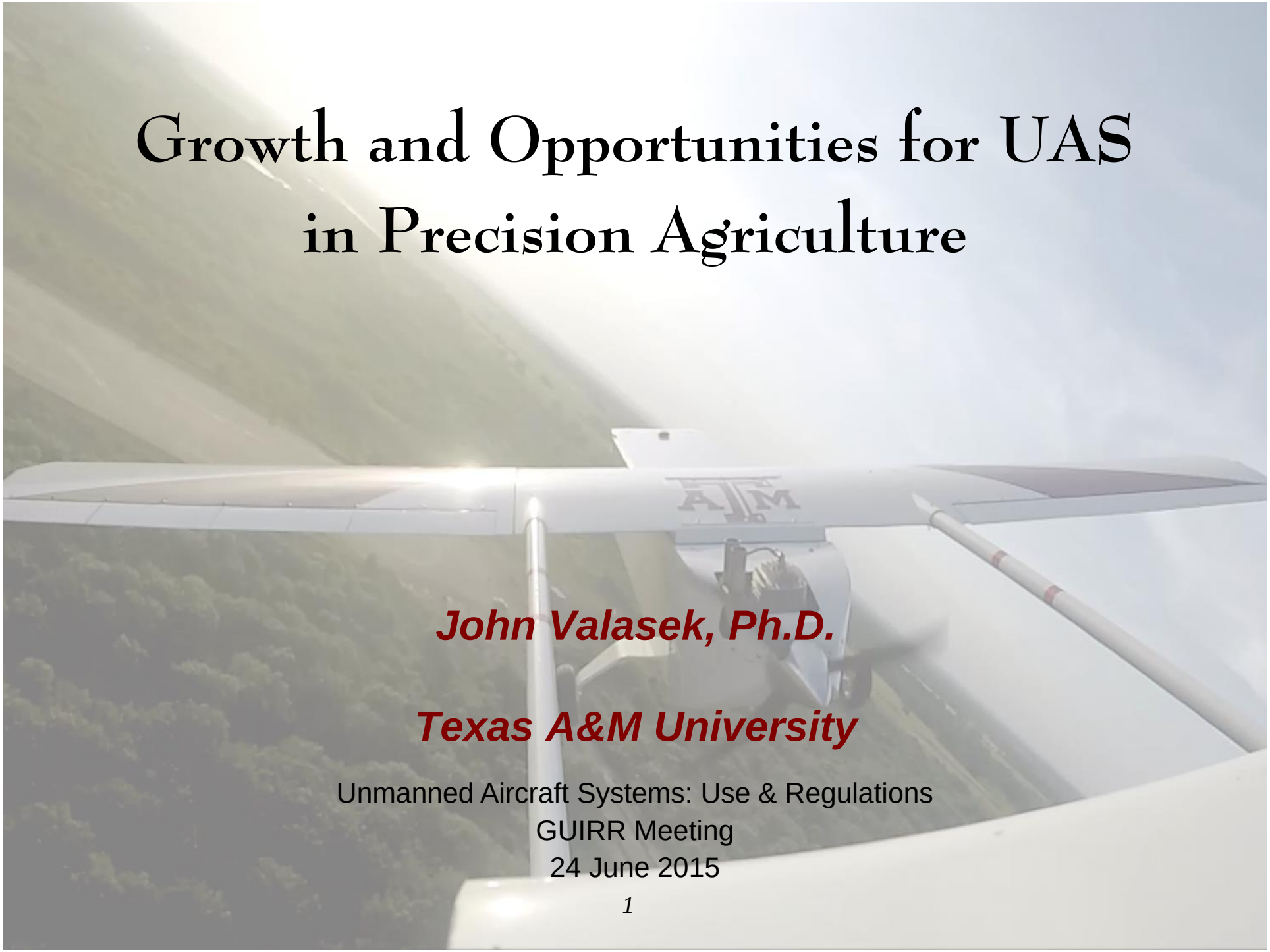
Growth and Opportunities for UAS in Precision Agriculture



John Valasek, Ph.D.

Texas A&M University

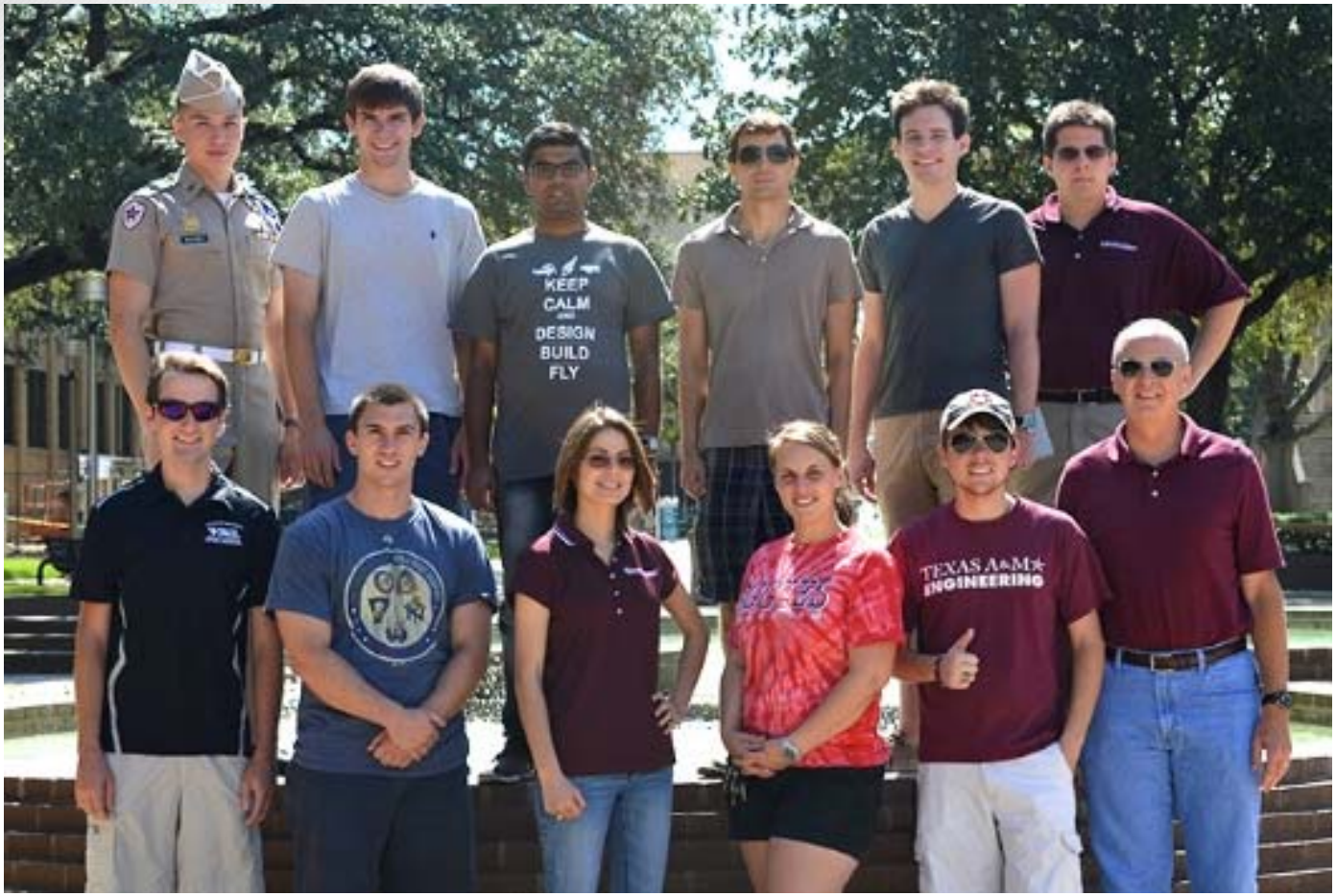
Unmanned Aircraft Systems: Use & Regulations
GUIRR Meeting
24 June 2015

Briefing Objective

By the end of this briefing you should have introductory knowledge of the role, utility, and players of UAS for Precision Agriculture, and where to get additional information/materials.

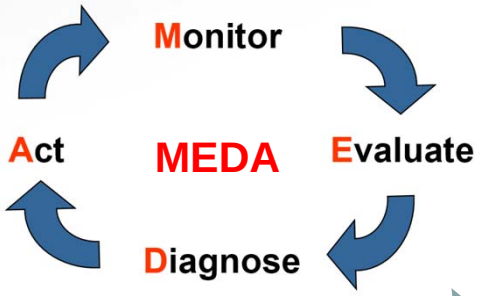
- Precision Agriculture
- Precision Agriculture economic impact
- What can UAS contribute to Precision Agriculture?
- How hard is it?
- Who will do this?
- Sample Mission (video)
- The Way Forward

Valasek Student Research Team
2014- 2015



Precision Agriculture essential for life

Application of technology that seeks to understand a situation (site specific management) and assist in implementing decisions (1985 - present)



continuously monitored crops

irrigation management

animal inventory / assessment

Precision Agriculture essential for life

Application of technology that seeks to understand a situation (site specific management) and assist in implementing decisions (1985 - present)

Value is ***timely, actionable*** information for better management decisions and improved efficiencies. Not more data.

continuously monitored crops

irrigation management

animal inventory / assessment

Precision Agriculture Economic Impact

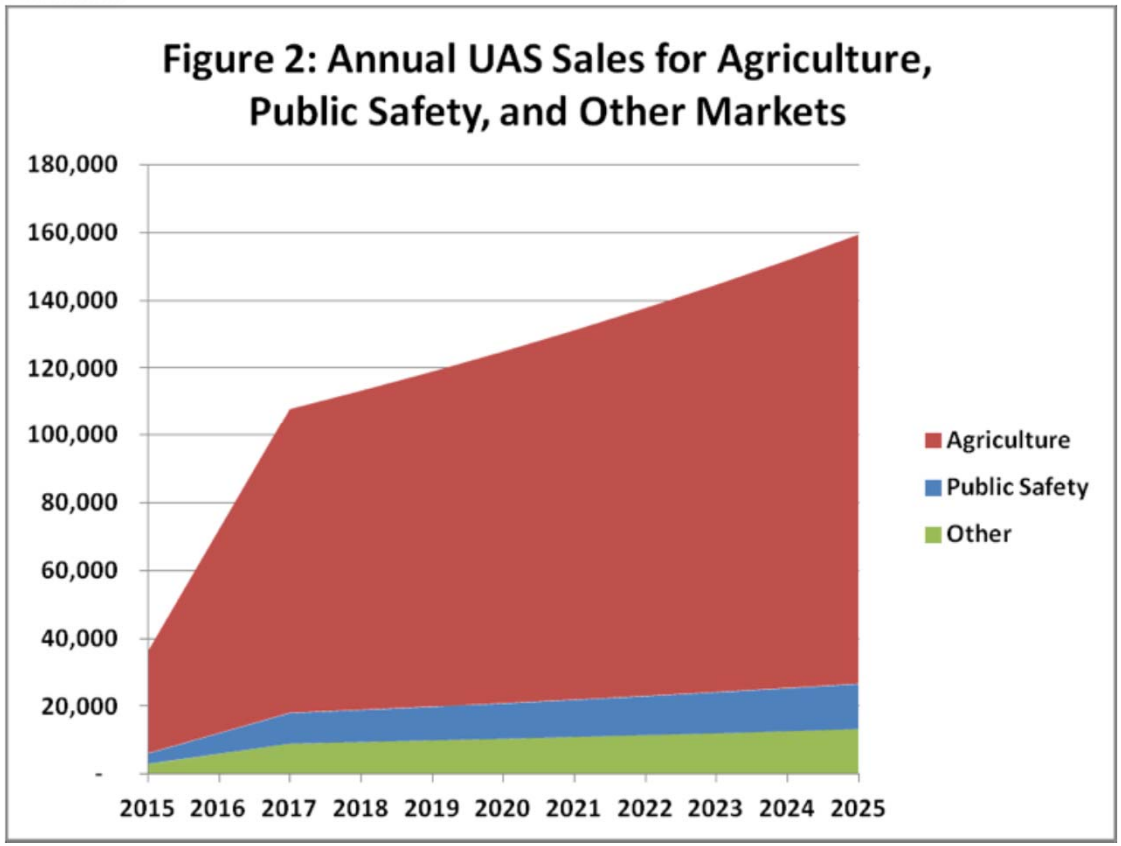
Association for Unmanned Vehicle Systems International (AUVSI) Report

Estimated nationwide total economic impact of agricultural spending on UAS in 2015 is **$550,584,654** and **5,770** jobs

Estimated **$5B** / year industry in South Texas alone by 2020*

Japanese model for UAS Precision Ag practices not accurate for forecasting U.S. market and practices.

* http://lsuasc.tamucc.edu/



What Can UAS Contribute to PA?

- **SHORT TERM: Research**
  - Optimized sensor packages
  - **Automated data processing**
  - Presentation for expert use
  - Cost reduction

fixed-wing: crop stress, irrigation

- **LONG TERM: Commercial**
  - Variable rate application of products
    - Seed
    - plant protection chemicals
    - Irrigation
    - fertilizer
  - **Risk management/Insurance claims**
  - Detect errors and prevent in future

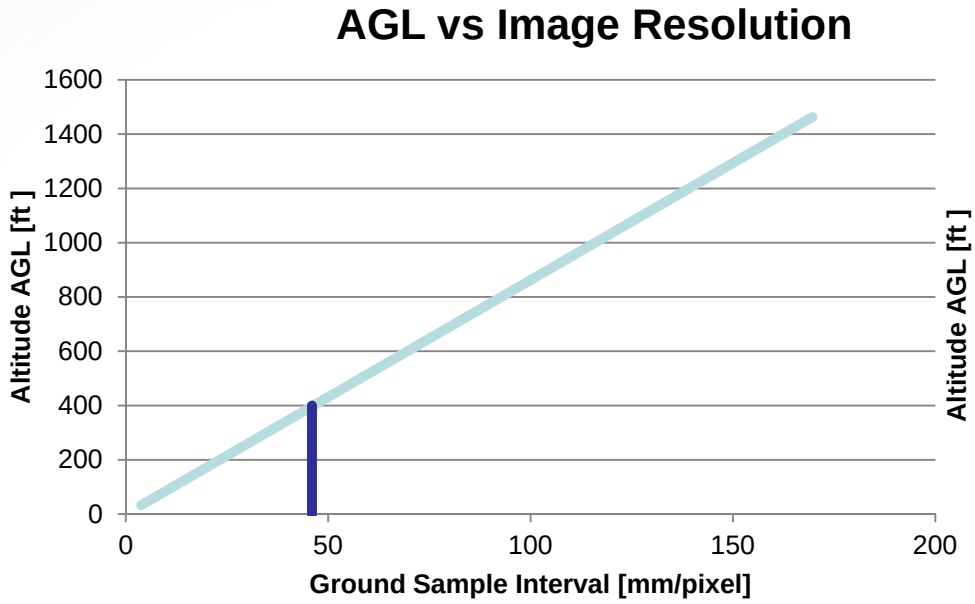
rotorcraft: plant height, canopy, infestation

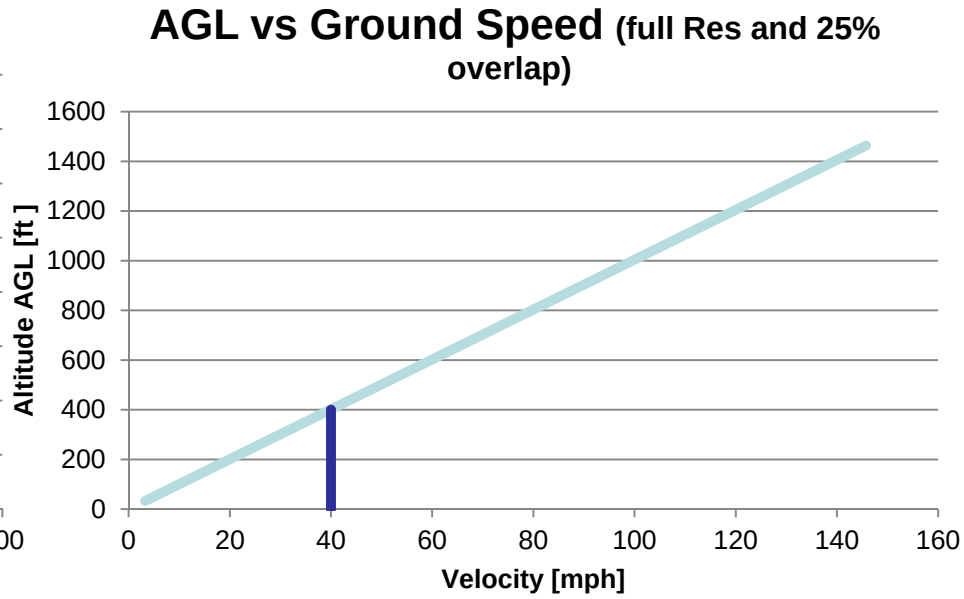
How Hard Is It?

Multi Spectral Camera

- Max frame rate 3 sec for raw, 6 sec for compressed
- Field of View angle is 37.67deg cross track; 28.75 along track
- Sensor Pixels 2048 cross track; 1536 along track
- Resolution vs Altitude (see graph)
- Ground Speed vs Altitude (see graph)
- Pre/Postflight Calibration Target imaging
- Recording time 2.2 hrs with 16Gb Memory Card

Requires precise control of airspeed, altitude, ground track





Scientific Research
enabled and enhanced by UAS

- Remote sensing of agronomic crops: foliage nutrient levels, foliage water status, ability to tolerate environmental stresses
- Plant species identification and differentiation, weed density (cover) estimation, and assessment of crop injury due to herbicides
- High capacity phenotyping
- Plant breeding to develop new varieties and improve food security
- Characterizing soil moisture status in relation to crop rooting structures
- Plant counts, morphology, pathological/entomological assessments
- Chemical/fertilizer/seed applications
- Resource inspections: maximize the efficiency of irrigation scheduling, crop water demand
- Remote sensing in rangelands
- Animal health or reproductive status, inventory/assessment in controlled or wild areas

Who Will Do This?

- **Farmers**
  - Operation
  - Limited post-processing, online/commercial tools

- **Crop Consultants**
  - Operation
  - Consultation on optimal procedures & equipment
  - Full post-processing using custom tools and data interpretation and recommendations

- **Researchers: evolving**
  - FAA permits only aeronautical research – “research and testing of the aircraft themselves, the control systems, equipment that is part of the aircraft (such as **sensors**), flight profiles, or development of **specific functions and capabilities** for them”

June 13, 2014 Memorandum – "UAS Operations by Public Universities for Aeronautical Research“

Sample Mission

CUE VIDEO

The Way Forward

1. Integrate mature/proven tools from UAS remote sensing with expert ag knowledge to generate **actionable information**

2. Develop and demonstrate **safe UAS operational policies & procedures** that encourage FAA to sanction non-Visual Line-of-Sight (VLOS) flights

3. Relationship building with traditional manned ag aviation to **address safety and competition concerns**

Acknowledgements

- **Texas A&M AgriLife Research: http://agriliferesearch.tamu.edu/**
  - Muthu Bagavathiannan, Cristine Morgan, Seth C. Murray
  - Haly Neely, Sorin Popescu, Nithya Rajan, Jackie Rudd
  - Stephen Searcy, Wayne Smith, Lee Tarpley, Alex Thomasson

- **Texas A&M Engineering Experiment Station: http://tees.tamu.edu/**
  - Gregory Huff
  - John Valasek

- **Center for Autonomous Vehicles and Sensor Systems (CANVASS):http://ci.tamu.edu/centers/indexview/centerid/277**

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