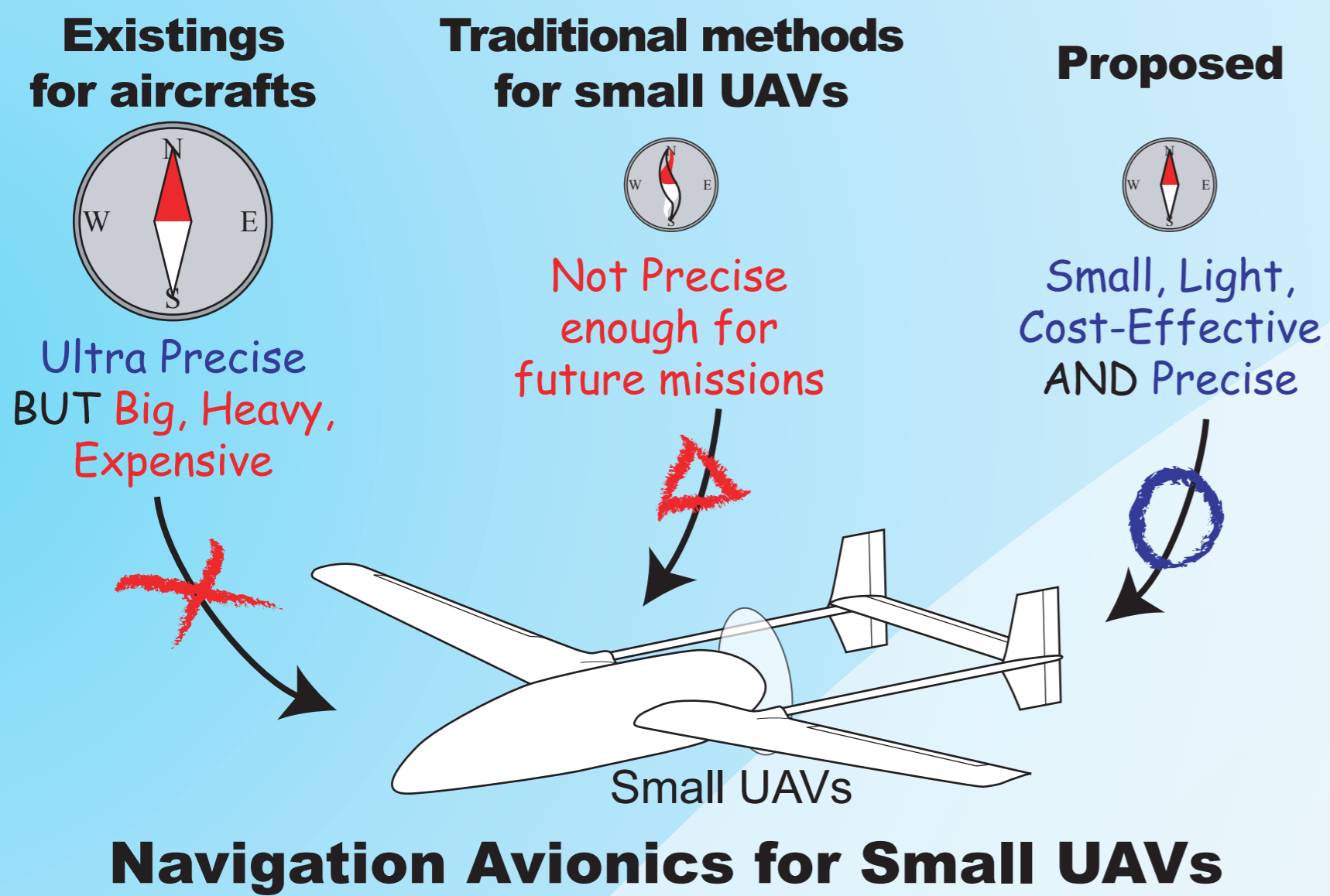


# A Navigation Avionics for Small UAVs

○Masaru Naruoka and Takeshi Tsuchiya  
(Department of Aeronautics and Astronautics, The University of Tokyo)

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## INTRODUCTION



Small UAVs need precise navigation information to fly more intelligently for extending its application to utilize guidance and control routine subsequent to navigation

Existing navigation devices for aircraft  
Ultra precise but big, heavy, and expensive  
Not capable of installing on small UAVs

Therefore, we propose a new navigation avionics for small UAVs  
Small, light and cost-effective  
And, higher precision than the traditional methods for UAVs that employs an only GPS receiver

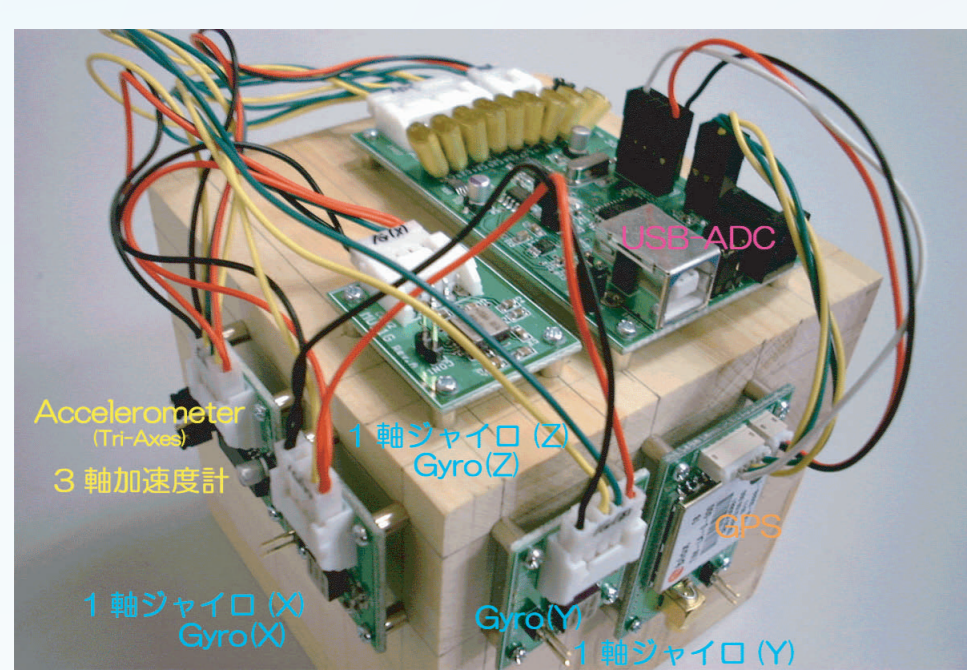
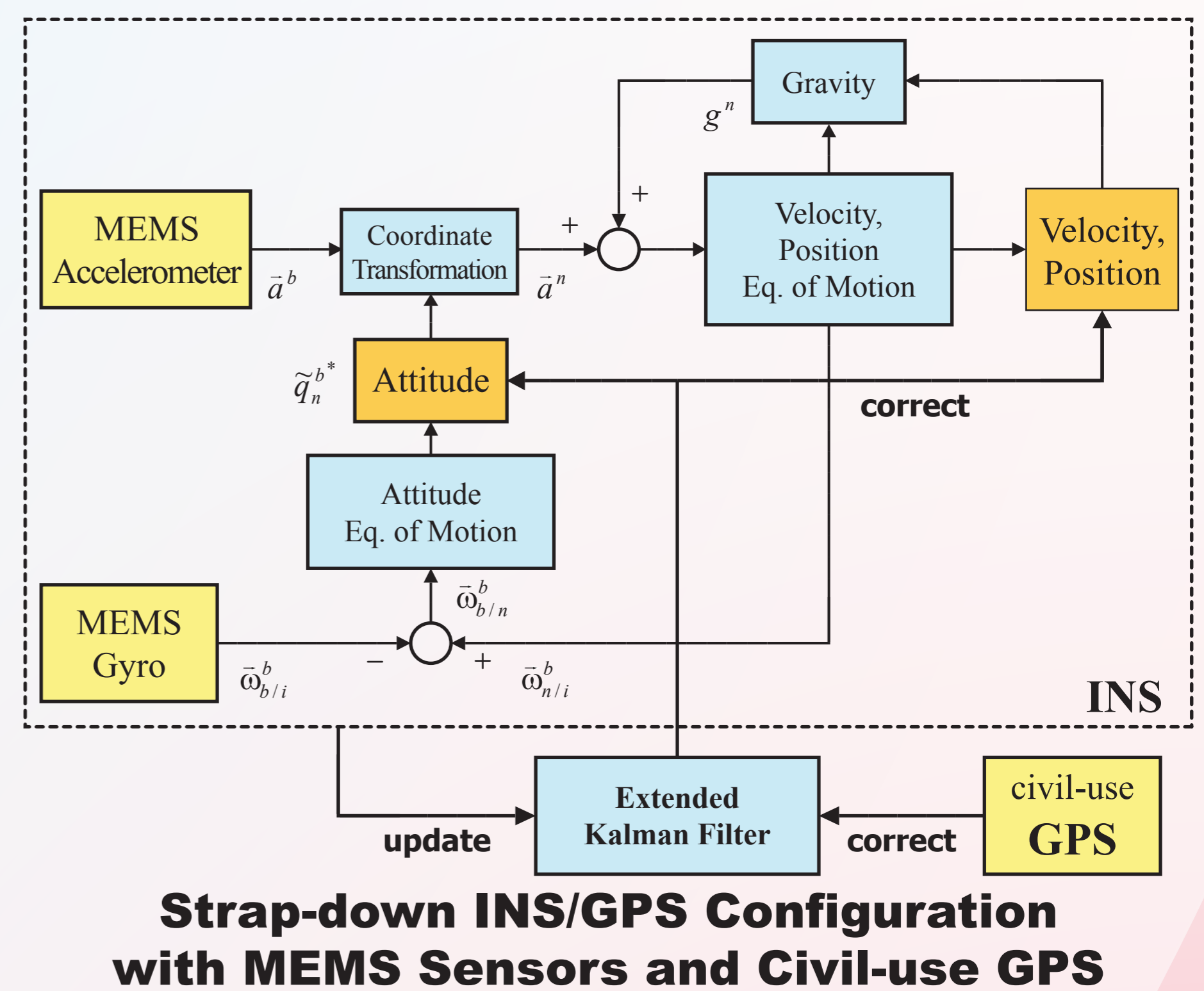
## PROPOSED SYSTEM

Our navigation system for small UAVs  
Strap-down INS/GPS configuration  
Using MEMS sensors and a civil-use GPS receiver  
A small, light and low-cost navigation device  
Providing data more frequently and correctly than GPS alone

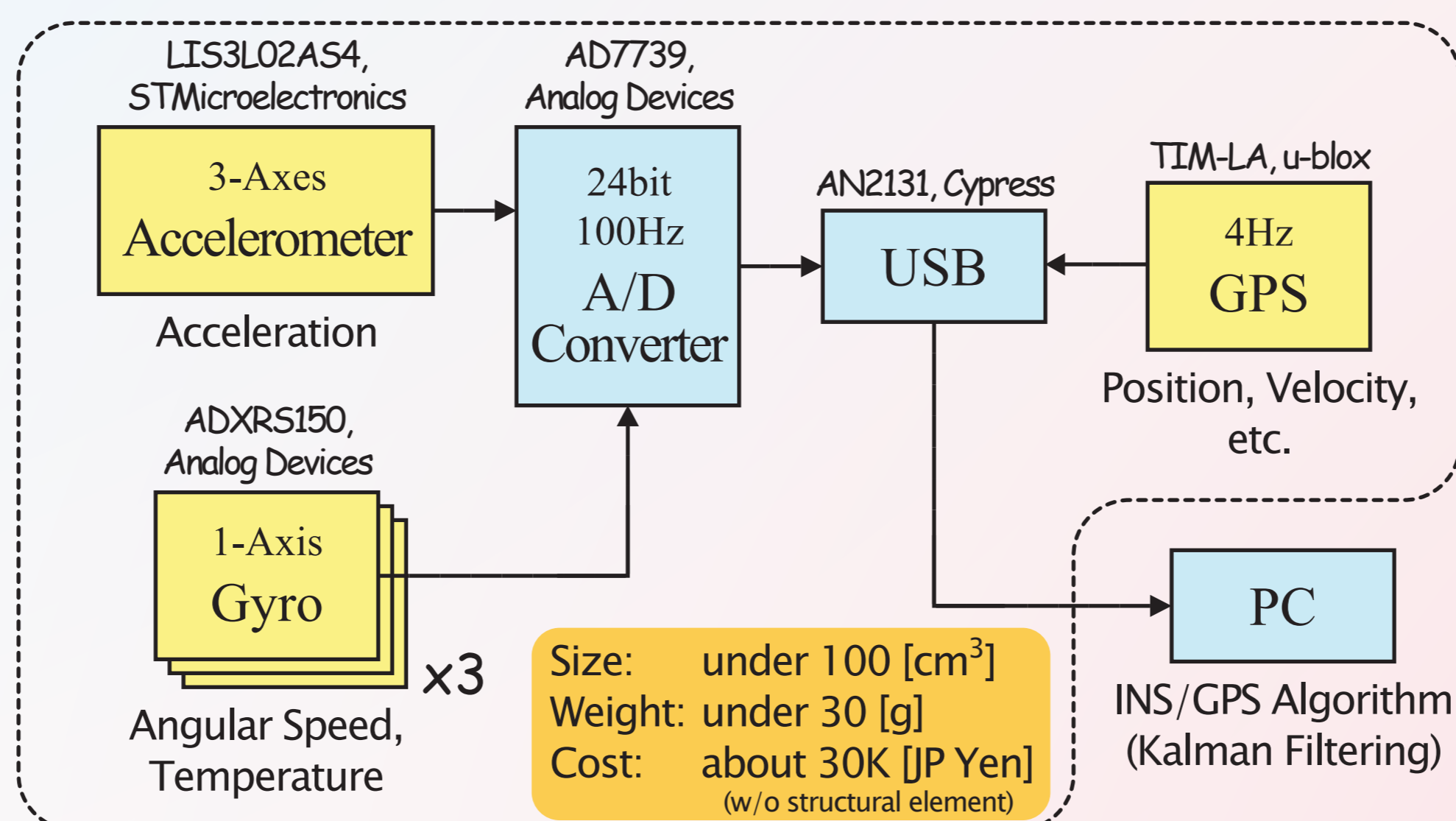
### Evaluation

Prototyping  
Making based on our proposed configuration  
Experiment to compare the prototype with GAIA  
Carried out in flight of an experimental aircraft, MuPAL- $\alpha$  of JAXA  
GAIA : a high-precision INS/GPS device of JAXA

Our System has precision equal to the high-precision INS/GPS device



A Look of the Prototype



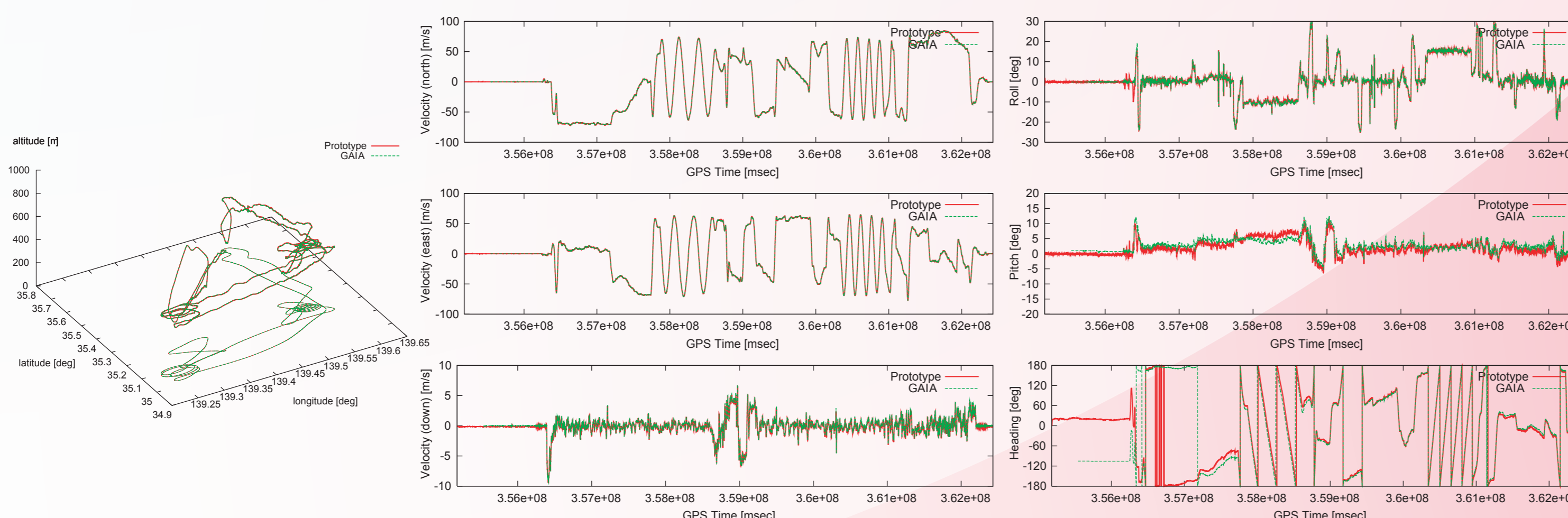
Block Diagram of the prototype

### Differences between the prototype and GAIA in the experiment

	Mean	STD	Worst
Horizontal distance [m]	6.44	2.97	17.0
Altitude [m]	0.85	2.10	6.90
North Speed [m]	0.00	0.12	1.25
East Speed [m]	0.00	0.12	-1.13
Down Speed [m]	-0.08	0.10	-0.69
Roll [deg]	0.00	1.21	-1.19
Pitch [deg]	-0.67	0.26	-3.90
Heading [deg]	4.17	9.68	23.9

## CONCLUSION

Proposed navigation system is  
INS/GPS using MEMS sensors and civil-use GPS  
Small, light and low cost  
Precise enough for navigation of small UAVs



Detailed Result of the Experiment  
(Position, Velocity and Attitude History)