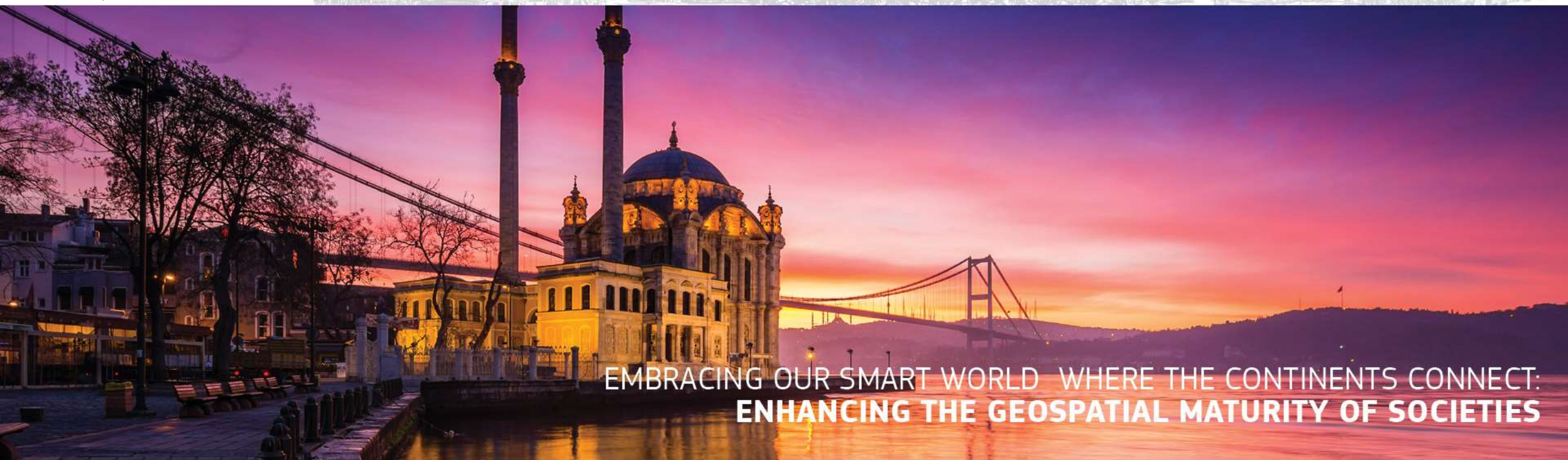
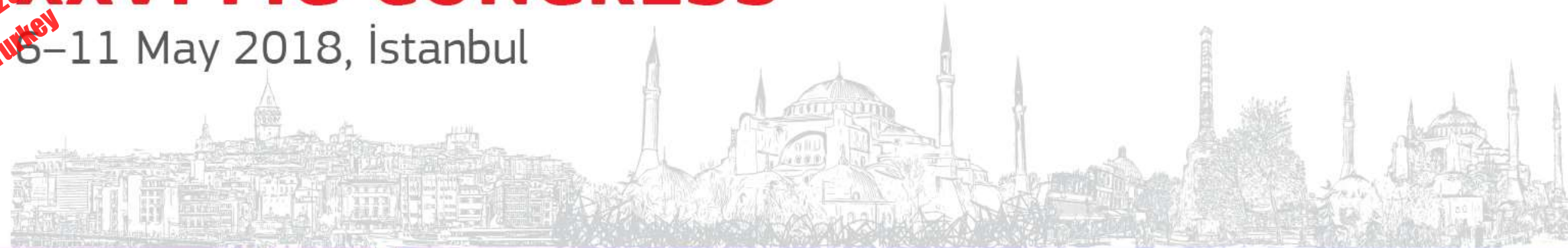


**FIG**  
2018  
ISTANBUL

Presented at the FIG Congress 2018  
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# Towards UAV-based Land Tenure Data Acquisition in Rwanda: Needs Assessment and Technology Response

*Claudia STÖCKER; Serene HO; Mila KOEVA; Placide NKERABIGWI;  
Cornelia SCHMIDT; Jaap ZEVENBERGEN; Rohan BENNETT*



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## Introduction – its4land

Program: EU granted H2020-ICT-2015



Horizon 2020  
European Union funding  
for Research & Innovation

Time period: 2016 - 2020

Consortium: 8 partners from Rwanda, Kenya, Ethiopia, Belgium, Germany and The Netherlands

Objective: Development of an innovative suite of land tenure recording tools

More information: TS09G 11:00-12:30 or [www.its4land.com](http://www.its4land.com) or



@its4land1

@drone4land

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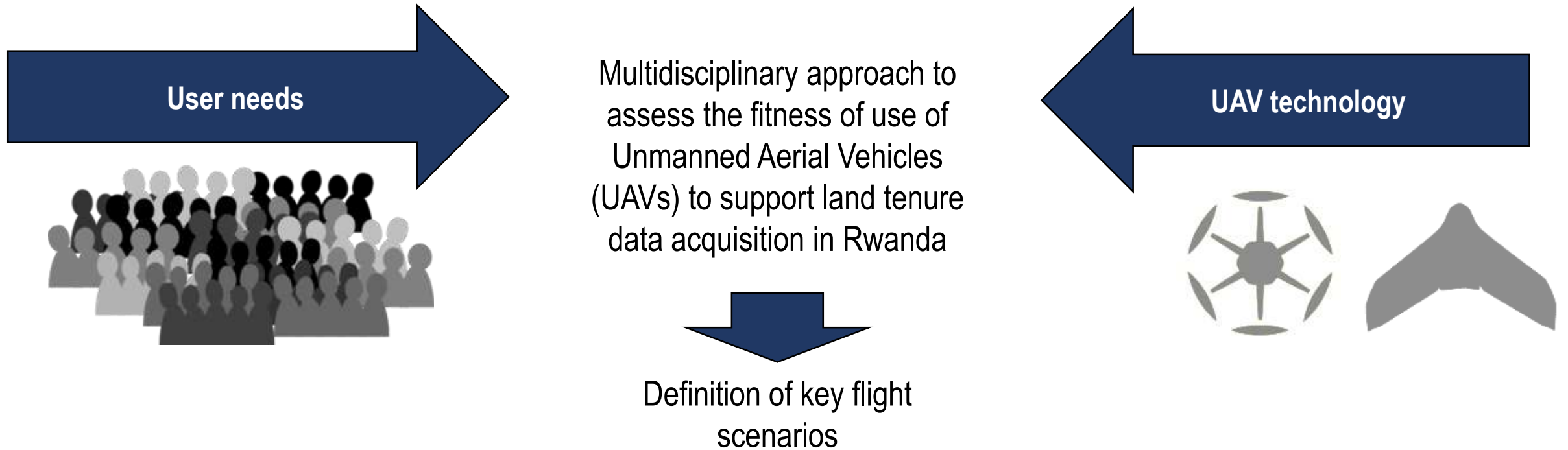


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## Introduction – aim and motivation



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## Study area – Rwanda

- More than 24.000km<sup>2</sup> and a population of 12.5m people → one of the most densely populated countries in Africa
- Land is of vital importance to Rwanda
  - ↓
  - ↓
  - Agriculture as a form of employment and subsistence
  - Growing demand for housing and infrastructure
- Land tenure regularization program (LTPR) completed
- Problem: almost absent ability to collect relevant land and property information at a certain frequency and scale



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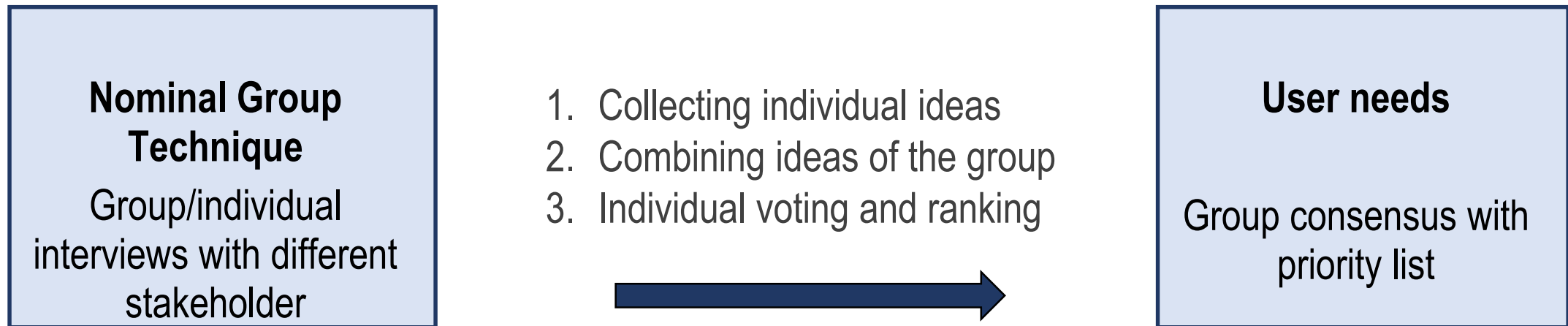


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## Needs assessment – NGT method



*What land and land-related information is still needed?*

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## Needs assessment – results

Land tenure or land info need	P1	P2	P3	P4	P5	P6	P7	P8	P9	SoC	Rel. Impt.	Popl.	Priority
Highly accurate data - image and GIS data	1	5	4	5	5	5	5	5	5	40	29.63	1.00	#1

National government

Land tenure and/or land info need	P1	P2	P3	P4	P5	SoC	Rel. Impt.	Popl.	Priority
High accuracy satellite/aerial imagery	5	2		5	2	14	18.7	0.8	#1

Sub-national government

Stakeholder group	Smart Sketchmaps	UAV	Automated Feature Extraction	Geocloud Services
Nat_Gov	2	7	1	6
Nat_NonGov	4	5	2	2
Dist_Gov		✓		✓
<b>Total no. of 'yes' votes</b>	<b>6</b>	<b>12</b>	<b>3</b>	<b>8</b>

Which its4land technologies are best suited to meet identified land information needs?

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## UAV technology – equipment

Name	Inspire 2 (DJI)	FireFLY6 (BIRDSEYEVUE)	DT18 PPK (Delair Tech)
			
Type	Rotary wing UAV	Hybrid UAV	Fixed-wing UAV
Sensor	Zenmuse X5S	SONY A6000	DT18 3Bands PPK
Area	Busogo (50 ha) – 2 flights	Muhoza (94 ha) – 2 flights	Gahanga (14 ha) – 1 flight

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# UAV technology – data acquisition

UAV flights



GNSS measurements



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# UAV flights – results

Data capture of 3 study areas



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Aerial image 2009



UAV image 2018

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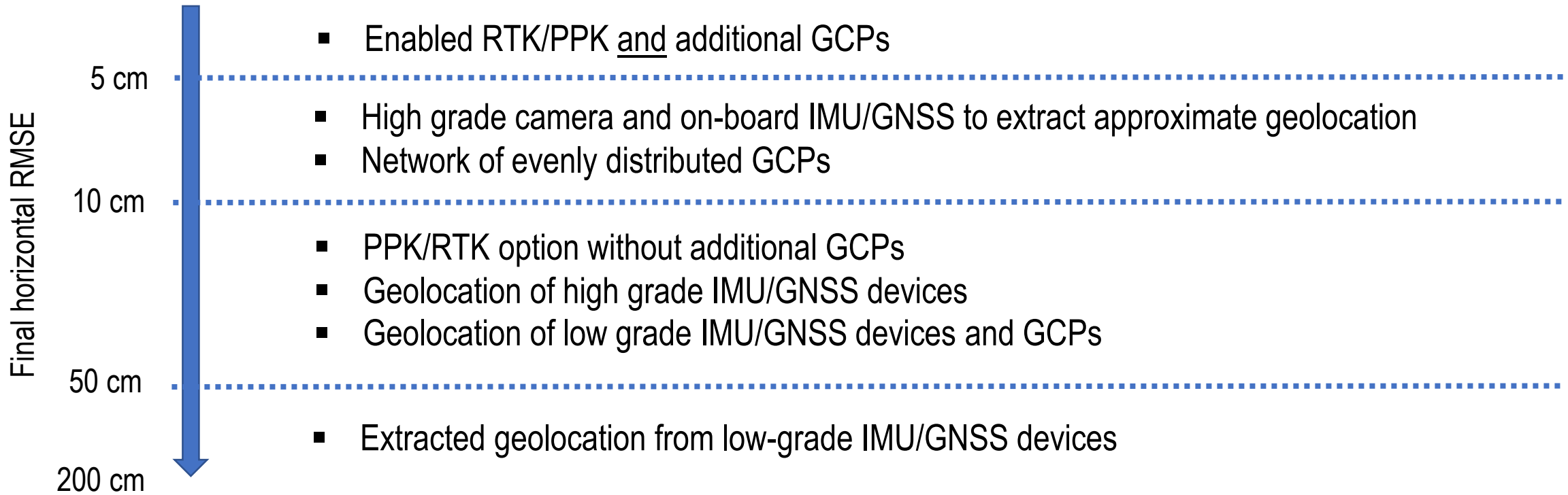


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## UAV flights – geometric accuracy (2D)



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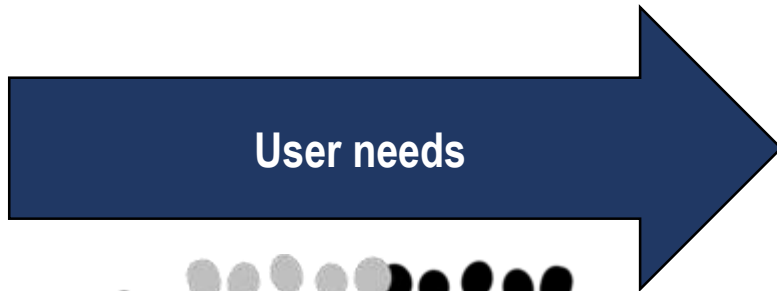
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## Conclusion



Up-to-date land information  
Highly accurate data/images



### Current challenges:

- Regulatory frameworks (Stöcker et al. 2017)
- Meteorological conditions
- Ground measurements

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Thank you for your attention



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