

Aerial or Satellite Imagery? The Keys for Making Right Decisions.

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The Group

- PASCO, World's leading Geospatial Group
- Geospatial Information Acquisition Capability
- Market Segments

Aerial or Satellite Imagery? The Keys for Making Right Decisions.

- Context of this Presentation
- Operations & Repeatability
- Weather Conditions
- Data Acquisition
- Mapping Accuracy
- Budget & Licensing

Case Study on North Tunisia

- Project Steps
- Flight Plan
- Deliverables Specifications
- Estimated Figures

Any Questions?



History

- Founded in 1953

Mission

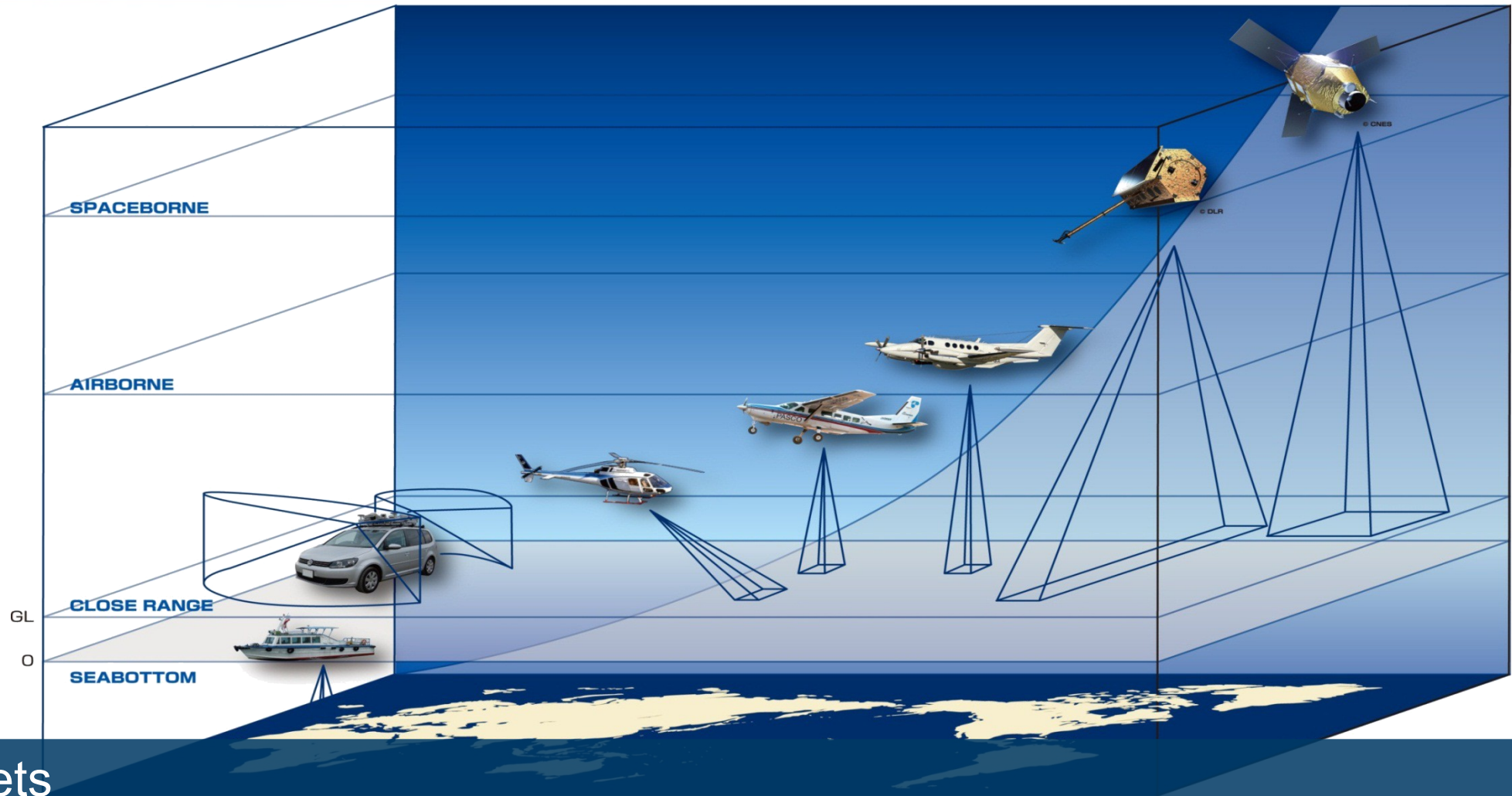
- Committed to be recognized as the worldwide leader in geospatial information services
- Collecting geospatial information from the space, the air, the ground and the sea
- Process and analyze information
- Serve geospatial data and value added products



Consolidated figures

- 2,500 people
- 350M€ revenue

Spatial Information Acquisition Capability



Assets

- 15 x Satellite data distributorship
- 45 x Aircrafts
- 23 x Mobile systems
- 37 x Vessels

Market Segments

Energy, Telecom & Utilities



- Network infrastructure planning
- Network maintenance
- Powerplant construction

Agriculture & Natural Resources



- Agriculture land planning
- Biomass calculation
- Forestry management

Land & Water Management



- Cadastral & parcel mapping
- Dredging & marine works
- Urban planning & monitoring

Transportation



- Airport & obstacle mapping
- Road & railway planning and maintenance
- Road network maps & navigation

Risk & Insurance



- Disaster management
- Real estate value estimation

Environment



- Urban heat islands monitoring
- Light pollution
- Heat loss mapping
- Sustainable energy resource mapping



Aerial or Satellite Imagery?

Context

- New acquisition
- Natural color with near infrared images
- Stereo mapping capability

Discussion

- Operations & Repeatability
- Weather Conditions
- Data Acquisition
- Mapping Accuracy
- Budget & Licensing

Operations & Repeatability

Aerial	Satellite
ATC, military and all other permits needed for flying	No need for permits
Need to mobilize on site	Better deployment reactivity
Once in the field, the aircraft is dedicated to the mission and can take the most of any flight window	Acquisition time within the day depends on the satellite orbit
Because of its operational flexibility, the cost on repeatability ratio switches to the advantage of the aircraft if a greater repeatability is necessary, i.e. several times a day	With a systematic revisit period depending of its orbit, the satellite offers a good cost on repeatability ratio mostly on limited surfaces

Operations & Repeatability

- Satellite easier to deploy with a good cost on repeatability ratio on limited surfaces, but the acquisition time within the day depends on the orbit
- Aircraft needs permit and mobilization, but dedicated to the mission once in the field resulting in a higher operational flexibility

Weather Conditions

Aerial	Satellite
Being on the field and flying on demand, aircraft can best use each weather window at any time of the day	Weather conditions can be tough on cloudy latitudes, i.e. equator
Possibility to fly below clouds	Possibility to get images between clouds based on spaceship's agility
Flexible enough to acquire between clouds when possible	Acquisition time within the day depends on the satellite orbit
Less than 1% of cloud is a standard in aerial images	Less than 5% of cloud is generally the best satellite offer

Weather Conditions

- Aircrafts generally bring more flexibility to deal with tough weather conditions
- Some agile satellites can offer flexibility to get images between clouds
- Standard aerial images are almost free of clouds or less than 1%

Data Acquisition

Aerial	Satellite
From 50cm up to 1cm GSD	From few meters up to 30cm
Can adapt the flying height for smaller GSD	Fixed GSD per sensor and spaceship
Possibility to combine GSD and acquire more details within the AOI, i.e. urban areas	
Possibility to simultaneously operate other sensors during the same flight, i.e. image and LiDAR	

Data Acquisition

- Satellites provide color images from low to very high resolution
- Aircrafts offer color pixels from very to ultra high resolution with ability to combine different GSD and different sensors



Mapping Accuracy

Aerial	Satellite
Possibility to adapt the sensor, i.e. focal length, to reach the requested accuracy	The sensor specifications are fixed in the spaceship
Generally good base on height (B/H) ratio due to low flying height	Possibility to multiply the stereo pairs (ie. tristereo) to reach a better accuracy

Mapping Accuracy

- For a fixed GSD, mapping accuracy mainly depends on the stereo base and acquisition height
- Then aerial images can map with a better accuracy due to lower flying height
- By going even in very high resolution, aerial images can provide very accurate mapping data



Budget & Licensing

Aerial	Satellite
No fixed price per km ² due to a fixed cost to set up the operations (mobilization) independent to the AOI size	Fixed price per km ² whatever the AOI size
But a unit price per km ² which decreases inversely to the AOI size due to scale savings	Property rights always remain to the satellite provider
Base prices generally include full property rights for the end-user	Base prices include limited user license

Budget & Licensing

- Clear satellite offer as per fixed price per km² with basic limited user license
- No fixed price in aerial imagery, but a price per km² which quickly decreases including basically a full transfer of property rights to the end-user

Case Study on North Tunisia

AOI located in North Tunisia (TN)

- Total surface of 500km² and 10,000km²
- At 50cm GSD, 80% forward overlap, 40% side overlap



Stereo Imagery

- Prepare mission
- Land survey all GCPs needed
- Image data acquisition
- Image extraction
- AT processing

Ortho Imagery

- DSM processing and DTM filtering
- Orthomosaic processing
- Image quality control and correction

Deliverables Specifications

Stereo Imagery	Aerial	Satellite
GSD	50cm	50cm
Forward Overlap	60%	-
B/H Ratio	0.34	0.3 – 0.6
Cloud Coverage	<1%	<5%
XY 1-sigma*	35cm	70cm
Z 1-sigma*	50cm	100cm
Ortho Imagery	Aerial	Satellite
GSD	50cm	50cm
Minimal Solar Angle	30deg	-
Maximal Building Lean	43%	-
XY 1-sigma**	50cm	70cm

* The given accuracies are based on full AT processing including a standard number of GCPs

** These are a priori accuracies which depend from both AT results and DTM quality



Estimated Figures for 500km²

Tunisia (500km²)	Aerial	Satellite
Operating Time	2h	-
Number of Sorties	1	-
Number of GCP	5	10
Acquisition Time	1 week	1 week
Stereo Imagery	Aerial	Satellite
Production Planning	+ 2 weeks	+ 2 weeks
Budget Estimation	29.5k€	21.5k€
Price per km ²	59€	43€
Licensing	End-user full property rights	Limited user license
Ortho Imagery	Aerial	Satellite
Production Planning	+ 3 months	+ 7 months
Budget Estimation	+6.7k€	+3k€
Price per km ²	+13€	+4€
Licensing	End-user full property rights	Limited user license

Estimated Figures for 10,000km²

Tunisia (10,000km²)	Aerial	Satellite
Operating Time	7.1h	-
Number of Sorties	2	-
Number of GCP	12	25
Acquisition Time	1 week	1 month
Stereo Imagery	Aerial	Satellite
Production Planning	+ 4 weeks	+ 3 weeks
Budget Estimation	100k€	430k€
Price per km ²	10€	43€
Licensing	End-user full property rights	Limited user license
Ortho Imagery	Aerial	Satellite
Production Planning	+ 3 months	+ 7 months
Budget Estimation	+20k€	+40k€
Price per km ²	+2€	+4€
Licensing	End-user full property rights	Limited user license

Aerial or Satellite Imagery?

Description	Aerial	Satellite
Operations deployment	-	+
Operational flexibility	+++	+
Repeatability	+	+++
Weather Conditions	+	-
Data Acquisition	+++	+
Mapping Accuracy	++	+
Licensing	+	-
Budget	*	*

For new acquisition of visible images at 50cm or lower GSD

- Satellite provides a better quality on price ratio on small AOIs with/without repeatability needed
- Aircraft is more suitable on larger AOI, for more accurate data with extended license possibility and has more operational flexibility to combine GSD and/or sensor and deal with tough weather conditions

Thanks for your Attention





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