

FOUR NEW SATELLITES IMAGING THE WORLD

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Abstract: With four new satellites to launch in three years, Astrium Services is gearing up to bring its customers the best that space technology has to offer, ensuring continuity of service up to 2024.

The Pléiades twins are very-high-resolution satellites delivering 50-cm orthorectified colour products as a standard. SPOT 6 and 7 are designed to extend SPOT 5's success to the 1.5-m product family. Phased on the same orbit, the constellation will enjoy unprecedented reactivity, with intra-day revisit capacity anywhere on the Earth. Multiple tasking plans per day result in an unrivalled optimization of data collection: unforeseen weather changes, as well as last-minute requests, can be taken into account for a first-class level of service.

Furthermore, the constellation enjoys an unheard-of commercial availability. SPOT 6 and 7 are perfectly suited for any kind of application requiring broad coverage (60-km swath), whereas Pléiades affords the largest swath in the sub-metric market (20 km at nadir), ensuring all users maximized coverage as well as easier data processing and handling. All satellites are equipped with CMGs for state-of-the-art agility, enabling more simultaneous requests to be satisfied on the same pass. With an acquisition capacity reaching more than 1 million square kilometres per day and per satellite for Pléiades, and 3 million square kilometres for SPOT 6 & 7, Astrium Services is more than ever committed to delivering data.

The consecutive launches of Pléiades 1A & 1B and SPOT 6 & 7 signal a paradigm shift for Astrium Services. Now all set to enter the very-high-resolution market, the company is developing its role as a multi-sensor distributor operating a coherent, optimized multiresolution constellation to serve applications such as defence, civil protection, hazard management, urban or national mapping, agriculture, network and infrastructure management.

ASSURED MISSION CONTINUITY

Built by Astrium, Europe's leading space technology company, the SPOT 6 Earth observation satellite has been successfully launched by a PSLV launcher from the Satish Dhawan Space Centre in India. Just three days after its launch, Astrium Services posted the first images acquired before the satellite reached its final orbit.

After ten days, SPOT 6 joined Pléiades 1A, the very-high-resolution Earth observation satellite with products distributed by Astrium Services on a phased orbit. Together with Pléiades 1B and SPOT 7, as of 2014 it will form a complete Astrium Services optical constellation, ensuring continuity of Earth optical imaging services up to 2024. These satellites will operate as a true constellation, combining a twice-daily revisit capability with an ingenious range of resolutions.

Ideal match of detail and coverage

The images taken by the SPOT 5 optical satellite have the benefit of combining a wide swath (60 kilometres) with a spatial resolution of 2.5 metres. This characteristic has made SPOT 5's mission a huge success, providing users and customers with an excellent trade-off between coverage and resolution for a correct balance between the levels of information obtained and the cost to the user. As the end of SPOT 5 is now scheduled for mid-2015, the question was raised about how to continue delivering the service our users have come to expect. This was the brief underpinning the design of SPOT 6 and SPOT 7. An in-depth market survey and careful canvassing to ascertain users' expectations were conducted. Conclusions led to keeping the best features of SPOT 5, retaining a 60-kilometre swath, while improving agility and product resolution (1.5 metres).

However, the needs of commercial and military users have progressively widened. They now also require images with increased resolution. Designed by the French space agency (CNES), the twin Pléiades satellites tie into this vision, adding local detail to the synoptic picture from SPOT. The system delivers imagery products with a resolution of 50 centimetres combined with a 20-kilometre swath, the widest in their class of optical sub-metric satellites.

Images from the new constellation are orthorectified as standard on Astrium Services' global orthorectification database called Reference3D (a package including a DTED-2 DEM, an ortho image and quality layers). The registration of Pléiades and SPOT images on Reference3D ortho image enables a perfect overlay in a GIS for applications implying multi-source or multi-date data, facilitating data post-processing or map edition.

The right information at the right time

The four satellites will be 90-degree phased on the same orbit (see figure 1).

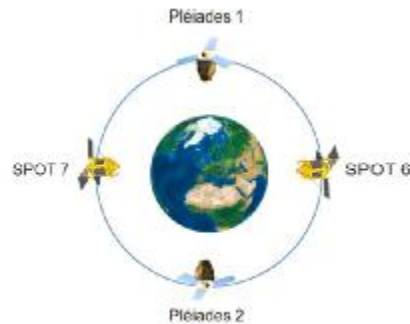


Figure 1: Pléiades 1A&1B and SPOT 6&7 in phased orbit
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This feature, coupled with the ability to view off track up to 30 or even 45 degrees, offers a twice-daily revisit capability to commercial and government customers. To make the most of this repeat imaging potential, the constellation tasking will be updated and uploaded several times a day (3 for Pléiades, 6 for SPOT 6 & 7, see figure 2). As a result, it will be possible to schedule requests up to two hours before each satellite pass, and to fully leverage weather forecasts updated four times a day for improved data collection success rate.



Figure 2: Two polar stations, located in Inuvik and Kiruna, are used to uplink the 6 daily tasking plans related to the 6 zones: Pacific, Japan/Oceania, Asia, Middle East/Europe/Africa, South America, North America.
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In addition, Pléiades is designed to allow Direct Tasking to partners' Direct Receiving Stations. Direct Tasking offers the best reactivity from collection planning to mission-ready data (less than one hour), to support ultimate near-real time applications such as disaster support or tactical intelligence. It provides a dedicated and guaranteed access to the satellite resource with the maximum reactivity and the highest confidentiality (all information is encrypted).

The *Instant Tasking* web service is an alternative to collect urgent fresh imagery. Users are free to post tasking requests and take full advantage of the responsiveness offered by several work plans uploaded each day to the four satellites. They simply log on and then key in their area of interest. The system indicates which satellite - Pléiades 1A, Pléiades 1B, SPOT 6 or SPOT 7 - will be the first in position to image the area. They then task the satellite of their choice with a maximum priority attached to their request, the imagery is acquired, validated by the user and the product is generated and delivered. This gives users real access to multisatellite tasking, leaving them free to choose between resolution and broad coverage depending on their needs.

Once downlinked to receiving stations, data from all four systems will be available through the GeoStore e-business portal which provides 24/7 access to the full range of Astrium Services products and services, including the archive catalogue -that contains more than 30 million scenes-, tasking and subscription services, as well as online geo-information for an immediate access to the appropriate geospatial data solutions.

Flexibility, agility and availability

Equipped with Control Moment Gyros, the four satellites will benefit from exceptional performances in terms of agility. Time to slew over 200 kilometres will be reduced to 11 seconds including stabilization time, when satellites not equipped with CMGs will do it in approximately 20 seconds (see figure 3). Consequently, the number of images acquired over an area is maximized (typically 15 targets over 1,000 km within a corridor of +/-30 degrees for Pléiades and SPOT 6/7, see figure 4), which will increase acquisition opportunities and success probability, even more so since the constellation also benefits from massive acquisition capacity. The effective capacity of the constellation will reach close to 7 million square kilometres per day, the maximum theoretical acquisition capacity surpassing 9 million square kilometres per day.

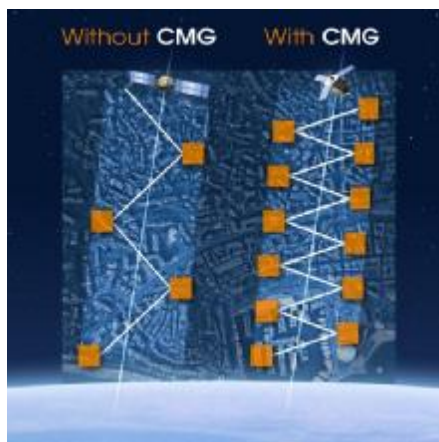


Figure 3: benefits of CMGs

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Figure 4: Multiple acquisition during the same pass

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This agility also paves the way to various acquisition scenarios, to match different applications. The strip mapping mode will entail the possibility to acquire easily 60-by-60-kilometre areas with Pléiades, 180 by 180 with SPOT 6&7 for mapping applications over large areas. All four satellites are able to acquire stereo or tristereo images, for 3D applications. Lastly, the nominal acquisition scheme for the satellites is North to South, but they may also turn to follow linear targets such as roads, pipelines, borders or coasts.

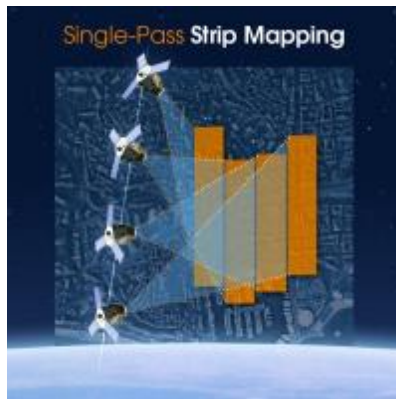


Figure 5: strip mapping over large areas

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Figure 6: stereo and tristereo acquisitions

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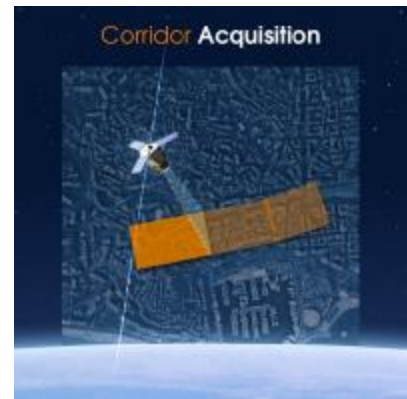


Figure 7: corridor acquisition over linear targets

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Poised for launch

Astrium Services CEO Eric Beranger officially announced funding for the SPOT 6 & 7 programme in June 2009. This is the first time in the remote-sensing industry that a satellite has been built with entirely private funds, proving Astrium Services' confidence in this market.

Pléiades 1B has been completed and delivered to CNES, the prime contractor, by Astrium Satellites. It is currently ready for shipment to the Kourou spaceport this month in readiness for launch by the end of this year. SPOT 7 is being integrated at Astrium Satellites for a launch planned in January 2014.

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