## Airborne Remote Sensing\_Italia – Albania Protocol

Airborne Remote Sensing for detection and monitoring Albanian cannabis plantations

2018, 30th November



To make compatible ecology and economy for the ecosustainable development of the natural and constructed environment: To sustain the scientific and technological innovation through the analysis and diagnosis multicriteri@; To promote the economic development through the increase of working places in the fields of conservation research and fruition of cultural and environmental heritage; To increase the value of material culture in order to develop local and tourism monomy: To stimulate the participation of the inhabitants in the local activities in order to consolidate the relationship between Man and Environment; To do a spin off in order to identify the state, define strategies and construct the scope for develop educational projects and working places.

ambiente af benecon strutture

## benecon a bridge between the world of knowledge and the world of know-how

Benecon features a human resource of 250 researchers, belonging to four athenaeums (Napoli Second University, Napoli Federico II University, Sannio University, University of Salerno), and a resource of scientific instruments of about 9,6 millions euro. The Center created a network for the

The Center created a network for the upgrading of multicriteri@ competences for the technological transfer and support to the territorial stakeholders.

Regional Agreact Contex Boncom Project Leader Paul Arth. Carryon Gariaantic Nator San Lorenz al Antonian - Norgo San Lorenz 1922: Anna 2021 artifa-hitter al Norgo San Lorenz 1922: Anna Carl Activity and Antonia Santa International Context and Context and Context and Context and Context and International Context and Context and Context and Context and International Context and Context and Context and Context and International Context and Context and Context and Context and International Context and Context and Context and Context and International Context and Context









#### **BENECON** increases its asset

#### The TECNAM P2006T Aircraft

- Tecnam P2006T is a twin-engine four-seat aircraft
- The superior high-wing configuration offers stability, superior cabin visibility and easy access for passengers and equipment
- The specifically modified version to carry out airborne remote sensing actions, the Tecnam P2006T provides inside the presence of special trapdoors to host the onboard sensors
- Integral fuel tanks are located outboard of the engines, holding 100 litres each for a total of 200 litres



- Particular attention has been paid to the cabin's structural design in order to ensure the required crashworthiness as prescribed in recent amendments to the FAA-FAR23 and EASA-CS23 codes.
- The engines have automatic mixture adjustment, so there is no mixture control required on the panel. The link between the flight controls and the flight surfaces is by pushrod, rather than the usual cables





# Airborne Remote Sensing open-source platform



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As the eyes perceive passively radiation emitted by the light sources (natural or artificial) and refracted by the objects, so the sensors:

- hyperspectral sensor records passively radiation emitted by natural and artificial elements below in specific segments of the light spectrum

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- high resolution photogrammetric camera measuring the three-dimensional reality of the Territory through photogrammetric pairs at very high resolution.





Hyperspectral sensor



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Data type Multidimensional images save 'invisible' territory data in a large number of bands between 370 and 1040 nm

Ground resolution > 40 cm





Data type Orthographic Nadiral Images 80Mpx

Ground resolution > 1 cm



Data type Thermal images of the investigating surface

Sensitivity > 0,5 °C













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## From the Flight Path to the Plantation report



#### **Research Laboratory and work flow**



> Flight-planning
> Acquisition
> Processing
> Analysis

#### The team:

- Draws Flight plans
- Monitors flights
- Stores data acquired
- Processes data acquired by five different sensors
- Integrates data for complex analysis
- Analyzes the cannabis' spectral signatures
- Draws thematic maps
- Perimeters and calculates the position of the cannabis plantations

All the collected data will be necessary to define the semi-automatic algorithm to detect cannabis plantations all over the World.



#### Airborne Remote Sensing data and Analysis data are collected and managed in the Geographic data-base



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#### Hyperspectral and very high resolution photographic data comparison



Each plantation is identified by ID Code / Geographic coordinate / spectral signature / area / hyperspectral picture / photographic picture



#### Plantation Report example delivered to Albanian State Police





Code	Area [12 <sup>2</sup> ]	Sana	FightDate	ReportTate	District	Manicipality	Coordinetes Moutes,	Coordinates in Decidal Degrees*		
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Each plantation is identified by ID Code / Area / Growth status / Flight date / District / Municipality / Geographic coordinate

# Each plantation is described by spectral signature / hyperspectral image / photographic image





#### Agreement for Remote Sensing activities BENECON - Guardia di Finanza GEA



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#### CONVENZIONE PER ATTIVITA' DI TELERILEVAMENTO MEDIANTE SENSORI AVIOTRASPORTATI TRA

- il Comando Generale della Guardia di Finanza, con sede in Roma, Viale XXI Aprile, 51, in persona del Capo di Stato Maggiore del Comando Generale

- il CRdC Benecon Centro Regionale di Competenza "Beni culturali, ecologia, economia per il recupero produttivo, la riconversione ecocompatibile e il design di supporto di sistemi ambientali a valenza culturale", (in seguito denominato CRdC Benecon) Consorzio interamente a capitale pubblico di quattro Università della Campania (Capofila Seconda Università degli Studi di Napoli, Federico II, Università del Sannoi, Università degli Studi di Napoli, Federico II, Università del Sannoi, Università della Campania (CE), alla Via S. Lorenzo, Monastero di San Lorenzo ad Septimum e in Frignano (CE) in persona del Prof. Arch Carmine Gambardella, Preside della Facoltà di Architettura e Presidente del CRdC Benecon, il Rettore della Seconda Università degli Studi di Napoli, Prof. Francesco Rossi

#### premesso che

- il Centro Regionale di Competenza "Beni culturali, ecologia, economia per il recupero produttivo, la riconversione ecocompatibile e il design di supporto di sistemi ambientali a valenza culturale - BENECON" nella realizzazione dei proprio progetto ha acquisito sofisticate strumentazioni per il monitoraggio, l'analisi e lo studio ambientale dei territorio, sia da terra che da plattaforma aerea:
- il CRdC Benecon, a supporto delle proprie attività, ha costituito un potente centro di calcolo, già operativo, per l'elaborazione e l'ottimizzazione dei dati acquisiti, ivi compresa la rappresentazione tridimensionale georeferenziata del rilevato e la modellazione atta ad effettuare simulazioni dinamiche di eventi calamitosi e/o previsionali nel campo ambientale sia terreste che marino;
- è interesse del CRdC Benecon non soltanto incrementare le proprie esperienze in settori di intervento scientificamente consolidati, ma anche individuare e mettere a punto nuova metodologie di monitoraggio, analisi, studio ed intervento ambientale mediante l'applicazione integrata di avanzate tecnologie a mare, sul territorio, aviotrasportate e da piattaforma satellitare:
- a tal fine, è intenzione del CRdC Benecon avviare alcuni innovativi progetti modulari di ricerca applicata pluridisciplinare, che richiedono anche il compimento di attività di telerilevamento aereo;
- I CRdC Benecon non dispone di velivoli per l'utilizzo dei propri sofisticati sensori aviotrasportati;





Le comunicazioni redatte dal Comitato non sostituiscono, né possono comportare ritardo nel produrre le forme di comunicazione adottate operativamente dalla Guardia di Finanza in aderenza alle procedure ed ai flussi informativi adottati dal Corpo.

#### ART. 6 (Durata della convenzione)

La presente convenzione ha durata pari ad anni 2 (due) a decorrere dalla data di sottosorizione ed alla scadenza è tacitamente rinnovata per un ulteriore biennio, fatta salva la facottà per ciascuna delle Parti di:

- a. proporre, in qualsiasi momento, la modifica dei contenuti dell'accordo. Detta modifica opererà solo in caso di accoglimento dalla controparte;
- b. manifestare, entro la scadenza del biennio di operatività, la volontà di non dar luogo al rinnovo tacito.

#### per il CRdC Benecon

#### per la Guardia di Finanza Il Capo di Stato Maggiore

Il Preside della Facoltà di Architettura e Presidente del CRdC Benecon

Prof. Arch, Carmine Gambardella



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#### The Air fleet of Guardia di Finanza GEA - Gruppo Esplorazione Aeromarittima



The P180 Avanti II aircraft to three surfaces, one of a kind, that contribute to the optimization of the performance in terms of higher speed, lower power consumption and greater autonomy. Because of these characteristics is used as a tactical transport aircraft for the fast operational units and support vehicles and personnel employed outside air.

The Piaggio P166 plane, used for maritime air medium-long range exploration, is characteristic for the wing to "gull" and engines with pusher propeller. On the P166 version DP1 are installed engines P & WC PT6A-121, the most powerful and highest performing and a new supply system and fuel system. The carriers, supplied with the GEA perform, in addition to a training function, tasks of exploration and maritime patrol, search and rescue and anti-pollution prior surveillance through the use of a sensor for remote sensing.

The aircraft ATR42MP (Multi pourpose) is a twin-engine turboprop, characterized by a wide fuselage where the heart is the seat of the operating system, the ATOS (Airborne Tactical System Operator): from the console you can control various operational mission sensors interfaced and integrated by a sophisticated computer management. This aircraft is dedicated to operational missions such as Maritime Patrol (Maritime Patrol), the airdrop Paratroopers (Paratroops), Evacuation Health (Medevac), the passenger transport / troop (Passengers) and the transport of goods / materials (Cargo). Its high degree of autonomy (7 hours in research) makes it suitable for long-range patrols, with frequent transfer also in international contexts.



2015, July 17th

12 1 1 1 1 1 1 1 1

2015, August 23th













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Source: Guardia di Finanza / Benecon

2015, July 17th

2015, August 23th

MINISTERO DELL'INTERNO



2015, July 17th

2015, August 23th











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#### The Lazarat case



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Source: satellite image





Source: satellite image



#### Lazarat 2013, July 22th





#### Lazarat 2014, June 8th





#### Lazarat 2015, July 23th





#### Lazarat 2013, July 22th

Lazarat 2015, July 23th























#### Lazarat 2013, July 22th

#### Lazarat 2015, July 23th









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#### Airborne Remote Sensing Missions: chronological table

The following data are not comparable analytically,

because they refer to Albanian areas geographically close, but not perfectly overlapping; and then the total amount of scanned Albanian surface was different year by year.

YEAR	2012	2013	2014	2015	2016	2017	2018
PERIOD (months)	1	2	5	4	4	5	7
FLIGHT MISSIONS	12	25	39	39	32	47	65
OVERFLOWN AND SCANNED AREA	990 Km <sup>2</sup>	3618 Km <sup>2</sup>	4313 Km <sup>2</sup>	4549 Km <sup>2</sup>	5066 Km <sup>2</sup>	7488 Km <sup>2</sup>	7336 Km <sup>2</sup>
ALBANIAN SCANNED AREA PERCENTAGE	3,4 %	12,6 %	15,1 %	15,8 %	17,6 %	23,8 %	25,5 %
NUMBER OF SUSPECTED CANNABIS PLANTATIONS REPORTED	61 + Lazarat	304 + Lazarat	815 + Lazarat	1368	2086	90	27
AREA OF SUSPECTED CANNABIS PLANTATIONS REPORTED	0,02 Km <sup>2</sup> + 0,385 Km <sup>2</sup> (Lazarat)	0,045 Km <sup>2</sup> + 3,19 Km <sup>2</sup> (Lazarat)	0,162 Km² + Lazarat	0,447 Km <sup>2</sup> + 0,00 Km <sup>2</sup> in Lazarat	2,135 Km <sup>2</sup>	0,022 Km <sup>2</sup>	0,0085 Km <sup>2</sup>
HYPERSPECTRAL COLLECTED DATA	325 GB	497 GB	892 GB	2100 GB	1700 GB	2200 GB	3980 GB
TRUECOLOR IMAGES COLLECTED DATA	675 GB	680 GB	792 GB	524 GB	450 GB	635 GB	892 GB

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Data elaboration from Plantation Reports on 2018, 10th September

NUMBER OF PLANTATIONS REPORTS 60

NUMBER OF SUSPECTED CANNABIS **PLANTATIONS REPORTED** 27

**AREA OF SUSPECTED CANNABIS PLANTATIONS REPORTED** 0,85 ha

AVERAGE AREA OF SUSPECTED CANNABIS PLANTATION **315** m<sup>2</sup>

MINIMUM AREA OF SUSPECTED CANNABIS **PLANTATION 51** m<sup>2</sup>

MAXIMUM AREA OF SUSPECTED CANNABIS PLANTATION **925** m<sup>2</sup>

PLANTATIONS IN GREENHOUSE 0

PRPCOR

esearch Team on Airborne Remote Sen Benecon SCaRL Prof. Arch. Carmine Gambardel 11/19

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Guardia di Finanz ontiera Marittima in Alb er in Tactical Command (OTC) Lt Col Nuca De Paol



Guardia di Finanza







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Data elaboration from Plantation Reports on 2018, 25th June



NUMBER OF PLANTATIONS REPORTS 60

NUMBER OF SUSPECTED CANNABIS PLANTATIONS REPORTED 27

AREA OF SUSPECTED CANNABIS PLANTATIONS REPORTED 0,85 ha

AVERAGE AREA OF SUSPECTED CANNABIS PLANTATION  $315 \text{ m}^2$ 

MINIMUM AREA OF SUSPECTED CANNABIS PLANTATION 51 m<sup>2</sup>

MAXIMUM AREA OF SUSPECTED CANNABIS PLANTATION 925 m<sup>2</sup>

# PLANTATIONS IN GREENHOUSE

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P0001 Longitude (DD): 19,899305 Latitude (DD): 41,814998

INISTERO



Guardia di Finanza Nucleo di Frontiera Marittima in Albania The Officer in Tactical Command (OTC) Lt. Col. Luca De Paolis



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#### Flight plans, 2018

Airborne Remote Sensing for Detection and Monitoring Albanian Cannabis Plantation \_ Flight mission 2018

#### MAP OF FLIGHT PLANS (4th April – 31th October)

- 66 designed flight plans

- 52 completed flights
- 6 incompleted flights
- 8 not flown flights





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Legend

Completed flights
 Incompleted flights
 Not flown flights
 Albanian districts

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#### Airborne Remote Sensing for Detection and Monitoring Albanian Cannabis Plantation \_ Flight mission 2018

Flight tracks, 2018

MAP OF FLIGHT PATHS (4th April – 31th October)



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#### Airborne Remote Sensing for Detection and Monitoring Albanian Cannabis Plantation \_ Flight mission 2018

#### Scanned areas, 2018

MAP OF SCANNED AREA (4th April - 31th October)



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#### Suspected plantations, 2018

Airborne Remote Sensing for Detection and Monitoring Albanian Cannabis Plantation \_ Flight mission 2018



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Airborne Remote Sensing for Detection and Monitoring Albanian Cannabis Plantation \_ Flight mission 2018

#### MAP OF SUSPECTED PLANTATIONS (2017 - 2018) Tropojês Malèsi e Madhe - 27 sospected plantation fileds in 2018 Has Shkodres Pukes - 90 sospected plantation Kukésit. fileds in 2017 Shkodrés Midities Lezhês Dibres • Kurbinit Matit 63 Bulgizês Knujės Durresit Tiranës Librazhdit Kavajēs Elbasanit Peginit Lushnjës Pogradecit Kuçovês Gramshit Fierit Beratit Korçês Devalit Mallakastrēs Skraparit 0 Viores Tepeienès Legend Kolonjës Permetit Sospected plantation fields (2018) Gjirokastrés Sospected plantation fields (2017) Delvinës Albanian districts Sarandés 100 km 50 25

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Airborne and Satellite Remote Sensing\_Fire-risk and Flooding Monitoring Protocol

> Airborne and Satellite Remote Sensing for monitoring and preventing forest fires and flooding phenomena

> > 2018, 30th November



#### **Fires risk prevention protocol**



- Regional scale of observation
- Costant updates
- Pixel dimension: 20 m
- Processing based on reflectance measurements at VNIR, SWIR and Thermal Infrared wavelength

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The innovative BENECON technology with the extension for an appropriate use of the Canadair





#### **BENECON** increases its technological asset











#### **BENECON** activities for fire risk monitoring in Campania – Best practices 2016-2017

#### Diachronic compare of the realised fire risk maps





#### **BENECON** activities for the fire risk monitoring in Campania

#### Active mes maps after Sentinei-2B satemite data processing Legenda Pollen I Trocchia SancAnastasa Somma Veruvian Somma Veruvian

entravian

San Cluseppe

Active fires maps after Sentinel-2B satellite data processing



#### **BENECON** activities for the fire risk monitoring in Campania

#### Burned area maps on CASI-1500 hyperspectral images





## **BENECON** activities for fires risk monitoring in Campania

# VESUVIO FIRES ON 22 LUGLIO 2016 **ACTIVE FIRES AND BOUNDARY**















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## **BENECON** activities for fires risk monitoring in Campania

# VESUVIO FIRES ON 12 LUGLIO 2017 ACTIVE FIRES AND BOUNDARY



CO on Landscape Cultural Heritage and Territorial











#### **BENECON** activities for the fire risk monitoring in Campania – Best practices 2017-2018

#### Diachronic compare of the realised fire risk maps



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#### BENECON activities for the fire risk monitoring in Campania – Analytical data upgraded on 02/07/2018

- Compare between NDWI and meteorological conditions (avarage precipitation) for the Vesuvio area
- The rainy season just passed has been determined an almost costant trend of the NDWI





#### **BENECON** activities for the fire risk monitoring in Albania – The Valona fire on 2017





#### **BENECON** activities for the fire risk monitoring in Albania – The Valona fire on 2017





#### **BENECON** activities for the fire risk monitoring in Albania – Focus on Orikum fire





#### **BENECON** activities for the fire risk monitoring in Albania – Focus on Orikum fire





Flooding event	Flight pianification	Flight date	Delivering of the scientific report			
12 August 2015	13 August 2015	14 August 2015	24 August 2015			

	Satellite SENTINEL	Itres CASI 1500	Itres TABI 1800	Leica ALS50II	PhaseOne iXA	MMS Topcon IPS2	Faro Laser Scanning 3D	Georadar	Spectrometry γ-Ray	ROV Nautec Perseo
Perimeter of FLOODING AREAS		r	4		>	1		- 44		







#### CALABRIA: Thermal, hyperspectral and optical Remote Sensing activity after the flooding event in Rossano e Corigliano Calabro (Calabria, Italy) on 12 August 2015.



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CALABRIA: Thermal, hyperspectral and optical Remote Sensing activity after the flooding event in Rossano e Corigliano Calabro (Calabria, Italy) on 12 August 2015.



False color images "RedVeg" have been used to make the perimeter of flooding areas in agricolture environment.

Thermal images have been used to make the perimeter of flooding areas in agricolture environment. The PhaseOne IXA images allow us to define infrastructure damages. In the figure above we can see the subsidence of a road

The processing of hyperspectral and thermal data and the application of a mathematical algorithm allow us to make the detailed perimeter of the foolding areas in the extra-urban environment



## Airborne Remote Sensing\_Future developments



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## Serbia – Country and its limits



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# Slovenia 2D-Visual К0 Croatia Bosnia and 3D-Visual Carbia San Θεσσαλονικη ra bann £20 legii biudi leffeCarsp forum unesco benecon .....

Serbia – Digital Elevation Model (DEM)

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#### Serbia – True color images

Slovenia

## RGB images by Sentinel 2B - Focus around the Bovansko Jezero lake

Romania



#### Serbia – Vegetation monitoring

Slovenia

## RedVeg images by Sentinel 2B - Focus around the Bovansko Jezero lake

Romania



## Serbia – Agricolture and Water State Monitoring

Slovenia

## False Colour images by Sentinel 2B - Focus around the Bovansko Jezero lake

Romania

