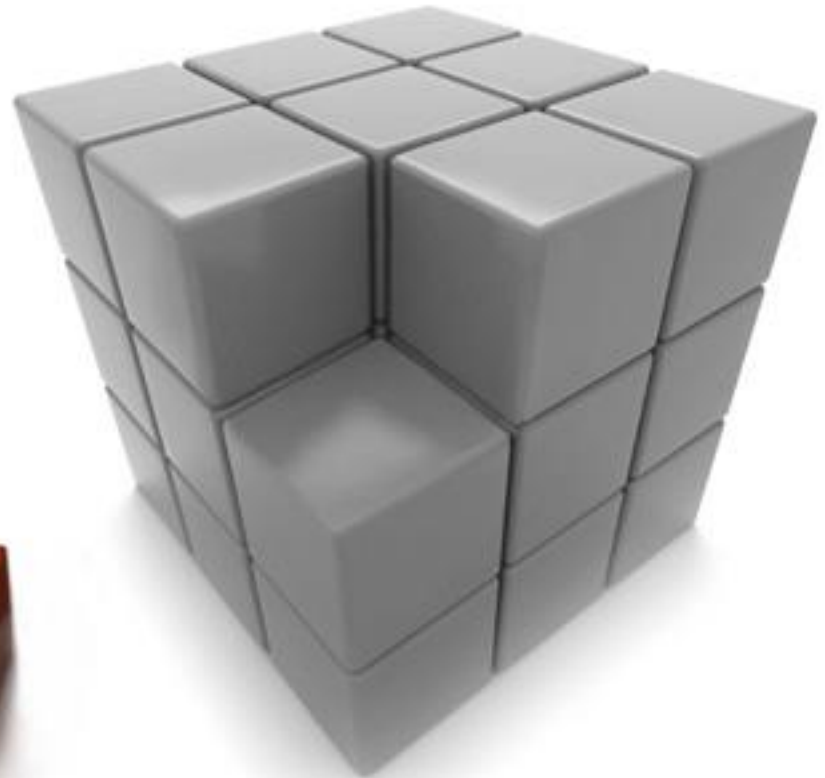




## Using drone technology, today and tomorrow.



**Tihomir Šašić**

Voditelj programa, poslovna rješenja s bespilotnim letjelicama

HrOUG 2016, 20.10.2016., Rovinj

# Što je novo u svijetu dronova?

## Qualcomm, AT&T to test how drones can use 4G LTE networks

Qualcomm said its researchers will team up with AT&T to test how unmanned aircraft systems can utilize cellular networks for processing, navigation, and flying beyond line of sight.

## IBM's courtesies

Aerialtronics is services across a wide range of industries.

## FACEBOOK TAKES FLIGHT

### INTEL CEO SPEAKS AT WHITE HOUSE DRONE WORKSHOP

**Update, 6 a.m. PDT Aug. 2:** Brian Krzanich, chief executive officer of Intel Corporation, speaks at an event sponsored by the The White House Office of Science and Technology Policy on the subject of drones and the future of aviation.

for inspection

## Amazon to test drone delivery in partnership with UK government

By Larry Dig...

The company will run tests to explore the viability of drones carrying deliveries weighing five pounds or less - which make up 90% of Amazon's sales.

## ect Wing

## Drone Delivery Service Could Work

Recent filing reveals a drone "delivery receptacle" to securely store packages

...to securely store packages

## Drone Delivery Service Could Work

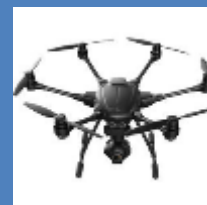
# Tržište dronova 2016.

DRONE INDUSTRY INSIGHTS

## The Drone Market Environment 2016



# Kategorije letjelica



Kategorija	Microdrone/Igračke	Prosumer	Profesionalna/komercijalna
Proizvođači	Parrot, Cheerson CX-10	DJI, Yuneec	Sensefly, DJI
Godišnja isporuka	> 10 M letjelica	do 1M letjelica	<10.000 letjelica
Cijena	<700 USD	<3.000 USD	>3.000 USD
Mogućnosti	HD/FHD video	Gimbal, FHD/UHD, senzori za udaljenost	Veća nosivost, veći domet i autonomija, napredni senzori

Source: Company reports, Oppenheimer & Co. Inc.

# Zrelost platforme i vrijednost tržišta

	EARLY STAGE	MIDDLE STAGE	LATE STAGE
<b>APPLICATION</b>			
Aerial photography			
Border patrol			
Construction and real estate images and monitoring			
Emergency management			
Infrastructure monitoring			
Mail and small package delivery			
Filmmaking and other media uses			
Oil and gas exploration			
Precision agriculture			
Public safety			
Weather forecasting and meteorological research			
Wildlife and environmental monitoring			
<b>TECHNOLOGY</b>			
Advanced manufacturing techniques			
Batteries and other power			
Communication systems			
Detect, sense, avoid capabilities			
GPS			
Lightweight structures			
Microprocessors			
Motors			
Engines			
Sensors			

Source: Oliver Wyman, Oppenheimer & Co. Inc.

Drone Market Scope	Market Size	Time Horizon	Source
<b>Estimates by sales</b>			
Consumer	\$1.7B (4.3M units)	2015	KPMG
US civil and commercial	\$125M	2015	IBISWorld
US consumer	\$1B	2018	Consumer Electronics Association
Commercial small	\$5.1B	2019	ABI Research
Prosumer and hobby small	\$1.1B	2019	ABI Research
Small UAS	\$1.9B	2020	Markets and Markets
Worldwide commercial	\$2.07B	2020	Grand View Research
Worldwide hobby	\$4.4B	2020	Frost & Sullivan
Worldwide commercial	\$6.4B	2020	Frost & Sullivan
Global aerial drone	>\$3B	2024	Business Insider Intelligence
Commercial	\$1.7B	2025	Lux Research
Worldwide production	\$14B	2025	Congressional Research Service
<b>Estimates by unit shipment</b>			
Non-military (\$200+)	1M+ units	2015	Deloitte
Small UAV intended as model aircraft	1.6M units	2015	FAA
Small UAV intended as model aircraft	1.9M units	2016	FAA
Small UAV intended for commercial purposes	600,000+ units	2016	FAA
China camera drone	3M units	2019	IDC
Small UAV intended for commercial purposes	11M units	2020	FAA

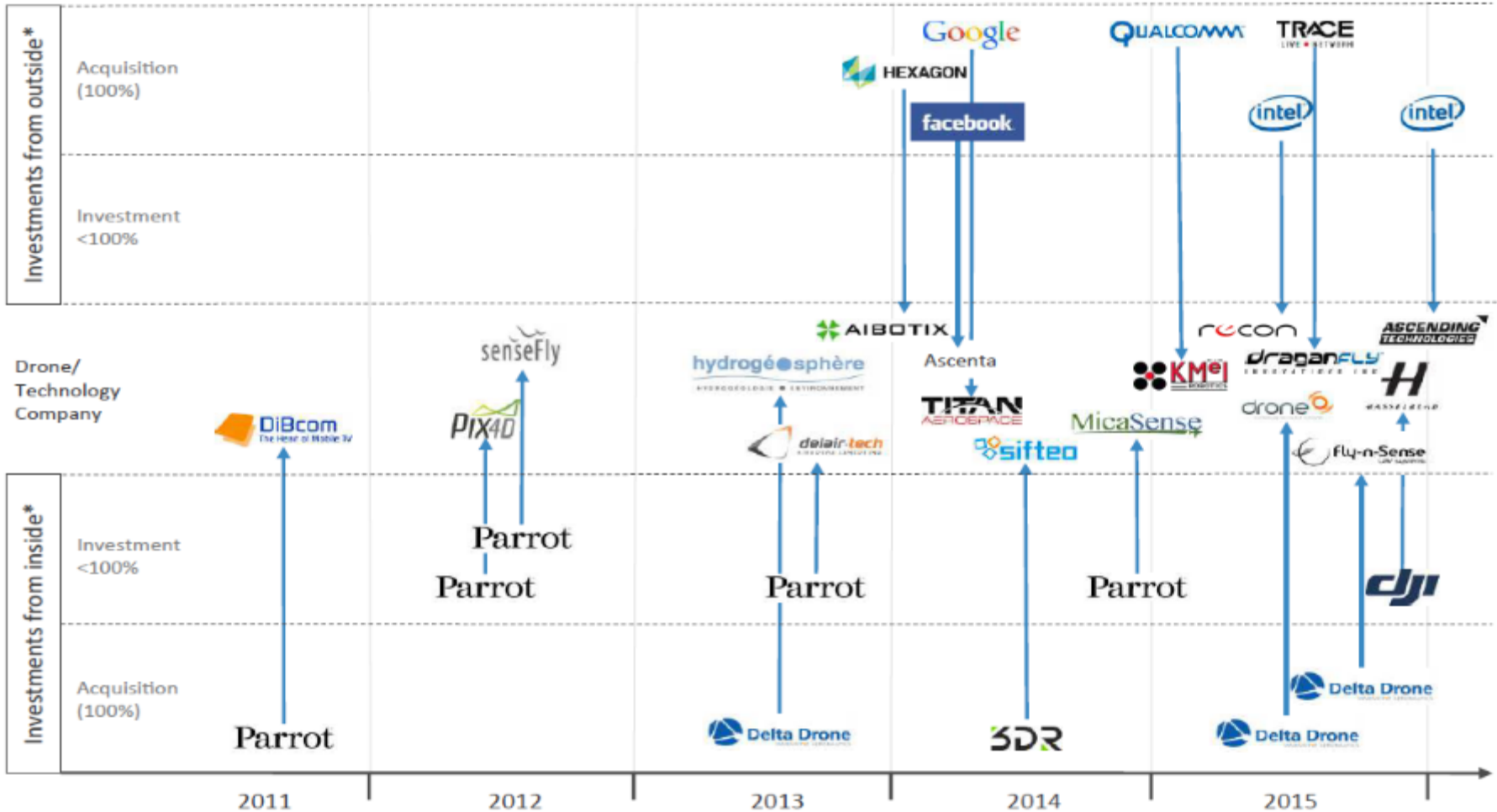
Source: KPMG, IBISWorld, CEA, ABI Research, Markets and Markets, Grand View Research, Frost & Sullivan, Business Insider, Lux Research, Congressional Research Service, Deloitte, FAA, IDC, Oppenheimer & Co. Inc.

# Udruživanja, spajanja i kupovine!



DRONE INDUSTRY INSIGHTS

M&A activity in the drone industry



Source: Dronell.com

\* Investments from outside = Acquisitions from 'out-of-segment' companies not directly involved into the drone industry

# Regulatorni okvir










Država	Mogućnost komercijalnih letova	Potrebna licenca za let	Mogućnost izvođenja BVLOS* letova	Potrebna dozvola za BVLOS* letove	Potrebno osiguranje letjelice za komercijalne letove	Potreban trening za dobivanje pilotske dozvole
SAD	✓	✓	X	X	X	✓
UK	✓	✓	✓	✓	✓	✓
Njemačka	✓	✓	X	X	✓	✓
Kanada	✓	✓	✓	X	✓	X
Francuska	✓	✓	✓	X	X	✓
Kina	✓	✓	✓	✓	X	✓
Meksiko	✓	✓	X	X	X	✓
Japan	✓	X	X	X	X	X
Rusija	X	X	X	X	X	✓
Hrvatska	✓	✓	X	X	?	✓ (C i D kategorija)

[www.ccaa.hr](http://www.ccaa.hr) – Hrvatska agencija za civilno zrakoplovstvo

\*BVLOS – beyond visual line of sight

# Upute za letenje dronom

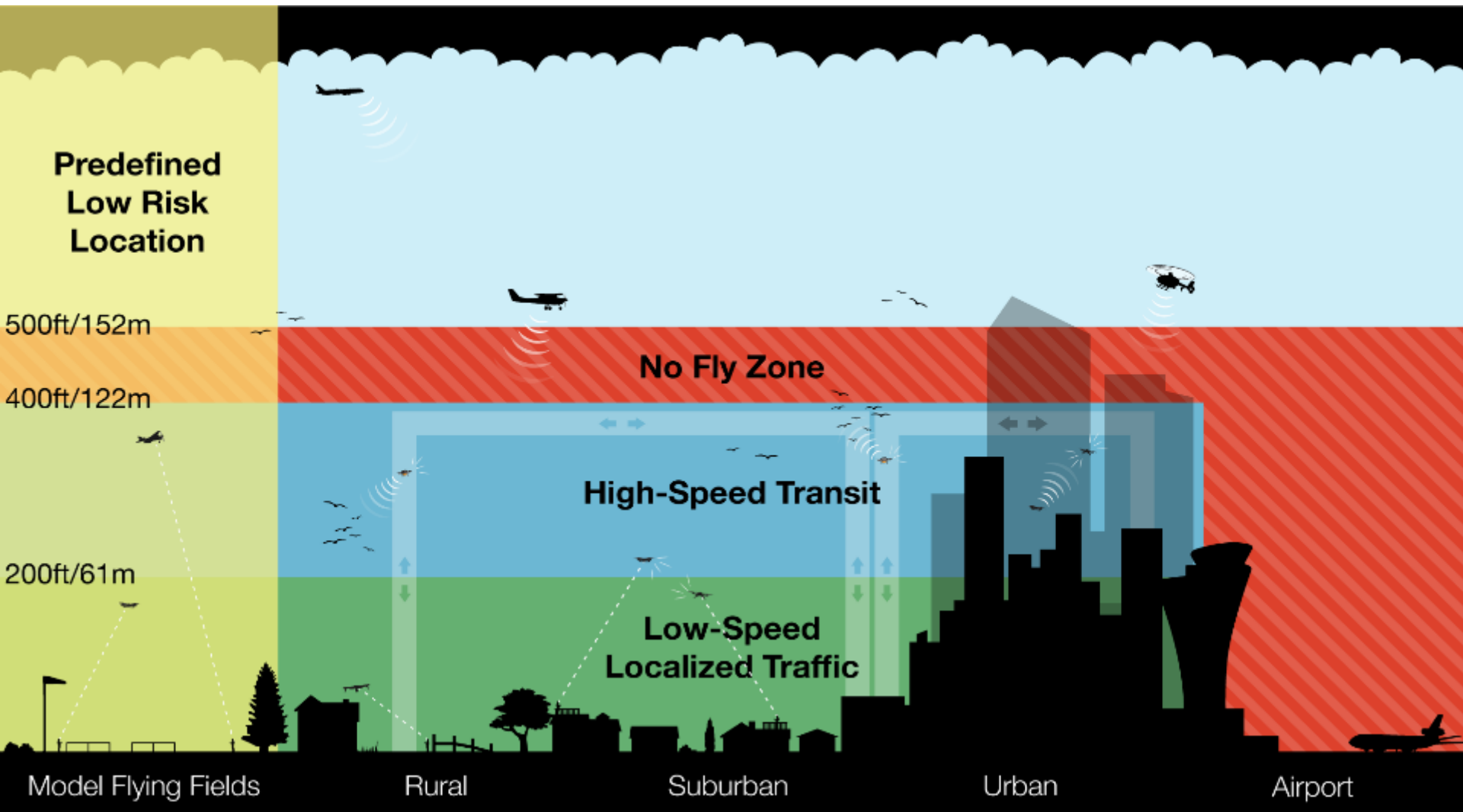
Letenje dronom

-  Prije svakog leta provjeriti da dron radi ispravno i da je sva oprema odgovarajuće pričvršćena
-  Nije dozvoljeno letenje na udaljenosti manjoj od 30 metara od ljudi, životinja, objekata, vozila, plovila, drugih zrakoplova, cesta, željezničkih pruga ili dalekovoda
-  Nije dozvoljeno letenje na udaljenosti manjoj od 150 metara od skupine ljudi
-  Nije dozvoljeno letenje izvan vidnog polja rukovatelja i na udaljenosti većoj od 500 m od rukovatelja
-  Nije dozvoljeno letenje noću
-  Nije dozvoljeno letenje u kontroliranom zračnom prostoru i na udaljenostima manjim od 3 km od aerodroma i prilazne i odlazne ravni
-  Nije dozvoljeno izbacivanje predmeta tijekom leta
-  Rukovatelj je odgovoran za sigurno izvođenje svakog leta
-  Letenje u svrhu radova iz zraka (snimanje, nadzor, ispitivanje...) smiju izvoditi operatori koji su dostavili izjavu operatora ili su ishodili odobrenje

Ovaj materijal se koristi isključivo u promotivne svrhe i nije zamjena za operativne postupke i primjenjive propise.



# Budućnost zračnog prostora - prijedlog in2 Amazona



# Odabir letjelice – letačke operacije

Vrsta letjelice ( <i>multirotor ili fixed wing</i> )	Samogradnja letjelice	Kupovina letjelice
Mogućnost nadogradnje	Da	Ograničeno
Potrebo modelarsko znanje	Da	Ne
Povoljna cijena komponenti	Da	Ne
Potrebno znanje programiranja uređaja	Da	Ovisno o scenariju
Dodatne aplikacije/Open source podrška (mission planner, itd....)	Da	Ograničeno „Standardizirano“ od strane proizvođača
Potrebno izraditi letački priručnik	Da	Ne
Laka prilagodba specifičnim scenarijima	Da	Ograničeno
(Pre)definirani scenariji korištenja	Ne	Da
Odobrenje HACZ/atest	?	Da
Jamstvo na uređaj	?	Da

# Popularne platforme za kontrolu letjelica

Letačka platforma	Cijena	Vrsta letačke operacije
Flyduino KISS	\$45	Utrke & rekreativan let
Lumenier LUX	\$40	Utrke & rekreativan let
SP Racing™ F3 flight controller	\$70	Profesionalne utrke
3DR PixHawk	\$250	Samogradnja & autonoman let
DJI NAZA-M V2	\$300	Autonoman let & snimanje iz zraka
DJI A3	\$900	Profesionalno snimanje iz zraka
????	????	?????

# Konfiguriranje i podešavanje kontrolera



**CLEANFLIGHT**  
CONFIGURATOR 1.3.3

2016-09-26 @ 15:18:25 - Running - OS: Windows, Chrome: 53.0.2785.116, Configurator: 1.3.3

COM1  
115200  
Auto-Connect  
Connect

Welcome to  
**CLEANFLIGHT**

Welcome to **Cleanflight - Configurator**, a utility designed to simplify updating, configuring and tuning of your flight controller.

**Hardware**  
The application supports all hardware that can run cleanflight (iSRacingF3, Vortex, Sparky, DoDo, CC3D/FVD, Air Hero 32, Fltp32/HDuLuxe, DragonFly32, CJMCU Microquad, Cheburz F3, STM32F3Discovery, Hermit, Naze32, Tricopter Frame, Skylite32, Naze32/MiniPro (Blackbox etc).  
The firmware source code can be downloaded from [here](#)  
The newest binary firmware image is available [here](#), development builds available [here](#)  
Latest **CP210x Drivers** can be downloaded from [here](#)  
Latest **STM USB VCP Drivers** can be downloaded from [here](#)  
Latest **Zadig** for Windows DPU flashing can be downloaded from [here](#)

**Contributing**  
If you would like to help make Cleanflight even better you can help in many ways, including:  
Answering other users questions on the forums and IRC.  
Contributing code to the firmware and configurator - new features, fixes, improvements  
Testing **new features/fixes** and providing feedback.  
Helping out with **issues** and **commenting on feature requests**.  
**Donating**, buying a T-Shirt or buying an iSRacingF3 board

**Open Source / Donation Notice**  
This utility is fully **open source** and is available free of charge to all **cleanflight** users.  
If you found the cleanflight or cleanflight configurator useful, please consider **supporting** its development by donating.

[Donate](#)

SPONSORS  
MesskeRC Armatran Quads Bungacow Multirotors Immersion RC RadioC  
MultiWiiCopter OverSkyRC Multi Rotor Maria Scorpion Power Systems MultiGP MakeItBuildIt

# Intel® Aero platforma

- ❑ Equipped with Intel® RealSense™ technology
- ❑ Runs on open-source Linux\* operating system
- ❑ Pre-programmed flight controller with Dronecode PX4\* software
- ❑ Support for AirMap\* SDK for airspace services



**Intel® Aero Ready-to-Fly Drone**



**Intel® Aero Compute Board**



**Intel® Aero Vision Accessory Kit**

# PX4 - platforma

- ❑ **Microprocessor:**  
32-bit STM32F427 Cortex M4 core with FPU  
168 MHz/256 KB RAM/2 MB Flash  
32 bit STM32F103 failsafe co-processor
- ❑ **Sensors:**  
ST Micro L3GD20 3-axis 16-bit gyroscope  
ST Micro LSM303D 3-axis 14-bit accelerometer / magnetometer  
Invensense MPU 6000 3-axis accelerometer/gyroscope  
MEAS MS5611 barometer
- ❑ **Interfaces:**  
5x UART (serial ports), 2x with HW flow control  
2x CAN  
Spektrum DSM / DSM2 / DSM-X® Satellite compatible input  
Futaba S.BUS® compatible input and output PPM sum signal  
RSSI (PWM or voltage) input  
External microUSB port
- ❑ **The Dronecode Project** is an open source, collaborative project that brings together existing and future open source drone projects under a nonprofit structure governed by The Linux Foundation. The result will be a common, shared open source platform for Unmanned Aerial Vehicles (UAVs).



# DJI platforma



A3



A2



Wookong-M



Naza-M V2



Naza-M Lite



Naza-M

## iOS i Android platforma

<https://developer.dji.com/mobile-sdk/documentation/introduction/index.html>

# DJI Dev Brief Overview

## □ Tri različita SDK

- Mobile SDK
- Onboard SDK
- Guidance SDK

## □ Mobile SDK

- High level kontrola leta (idi na tu i tu koordinatu na toj visini)
- Low level kontrola leta (ili X,Y,Z brzina, ili yaw/pitch/roll nagib)
- Realtime telemetrija (pozicija, brzina, visina, stanje baterija...)
- Sustav za automatsko izbjegavanje prepreka (na podržanim letjelicama)
- Kontrola kamere, live video feed s kamere, pristup zapisima na memorijskoj kartici kamere, upravljanje kontrolerom itd...



# DJI Dev Brief Overview – DJI Mobile SDK



## □ Potrebno

- Dron
- Računalo s instaliranim simulatorom (DJI ga nudi besplatno)
- Registrirati se na <https://developer.dji.com/>
- Pokupiti API key za svaku aplikaciju
- Skinuti SDK sa <https://developer.dji.com/mobile-sdk/>
- Razvojno okruženje



# DJI simulator leta



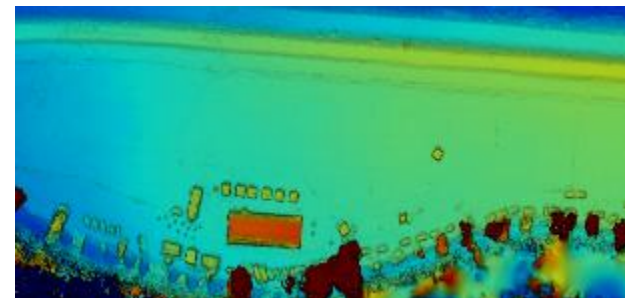
# Mobilne aplikacije



200njak aplikacija u *Google store* od toga 90% razne igrice i simulatori.

# Alati za analizu snimaka

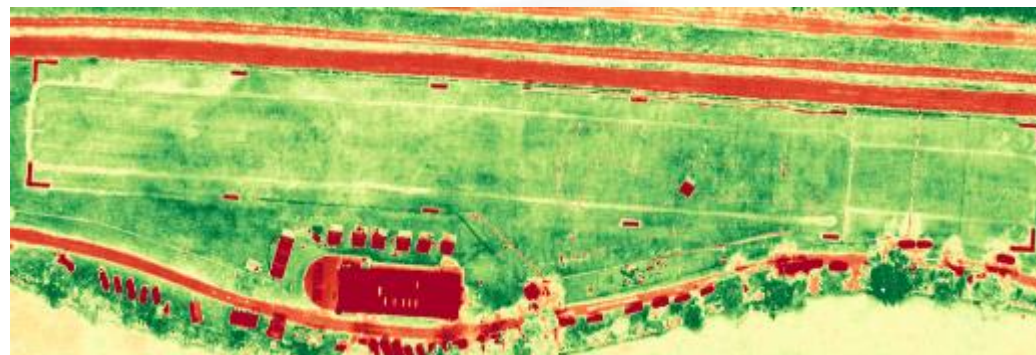
- Ortofoto karta
- Digitalni reljef terena
- 3D modeli

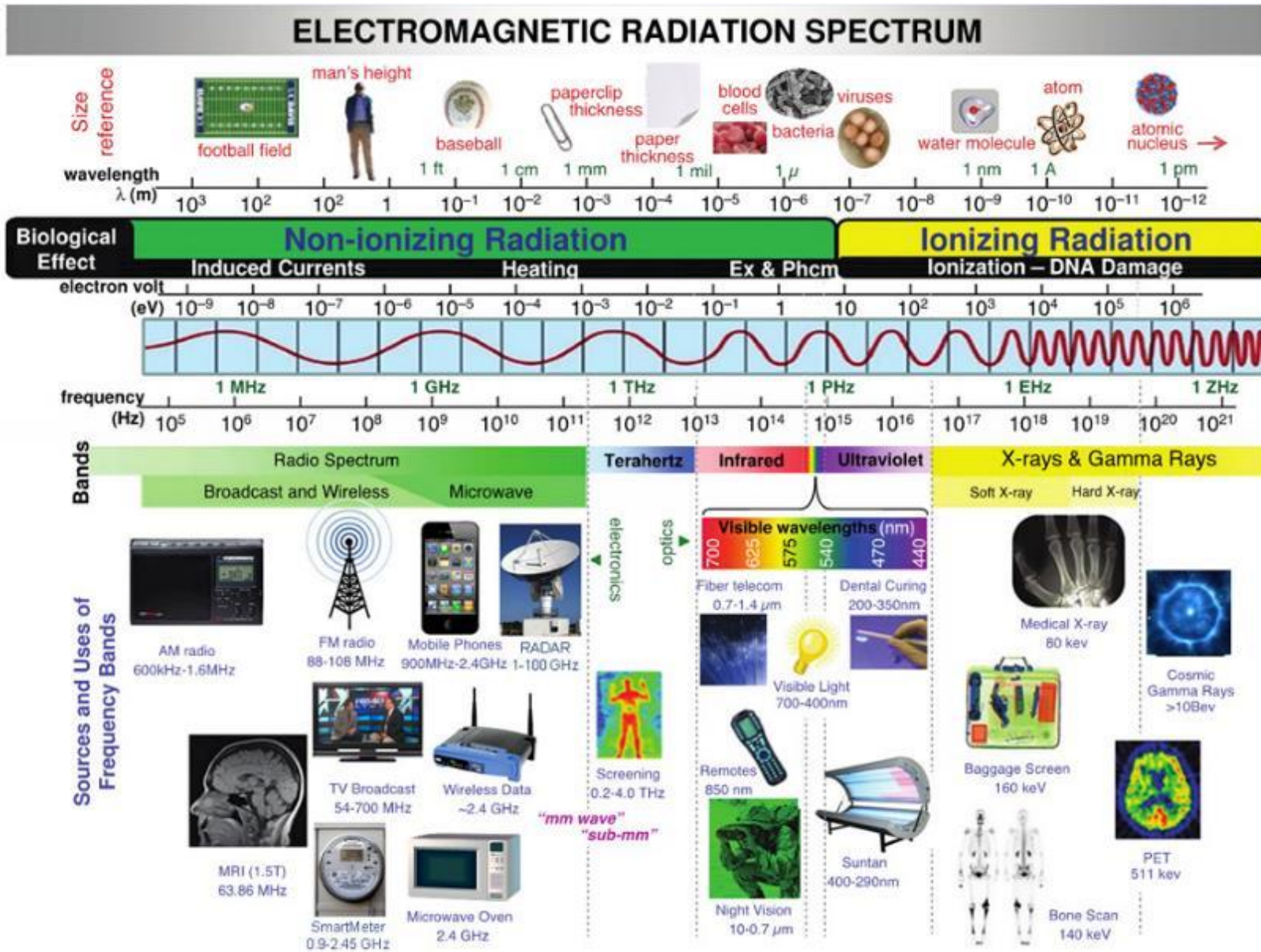


## Mogućnosti

- Mjerenje volumena
- Izmjere terena
- Vegetacijski indeks, stanje tla

**2-5GB podataka po misiji**  
**na 40tak hektara (bez telemetrije)**





# Scenariji uporabe dronova

## 20 Commercial Drone Use Cases

 Insurance Claim Validation	 Wind Turbine Inspection	 First Aid	 Agriculture	 Security	 Gas Flare Inspection	 Flash Flood Warning
 Organ Transplant Delivery	 Wildlife Conservation				 Oil Spill Monitoring	 Preventing Shark Attacks
 Shipping Emission Monitoring	 Railway Safety	 Construction Site Management	 Pipeline Leak Detection	 Reforestation		 Search and Rescue
 Cargo Delivery		 Cinematography	 Journalism			

Discover the leading drone innovators: <https://www.ventureradar.com/>

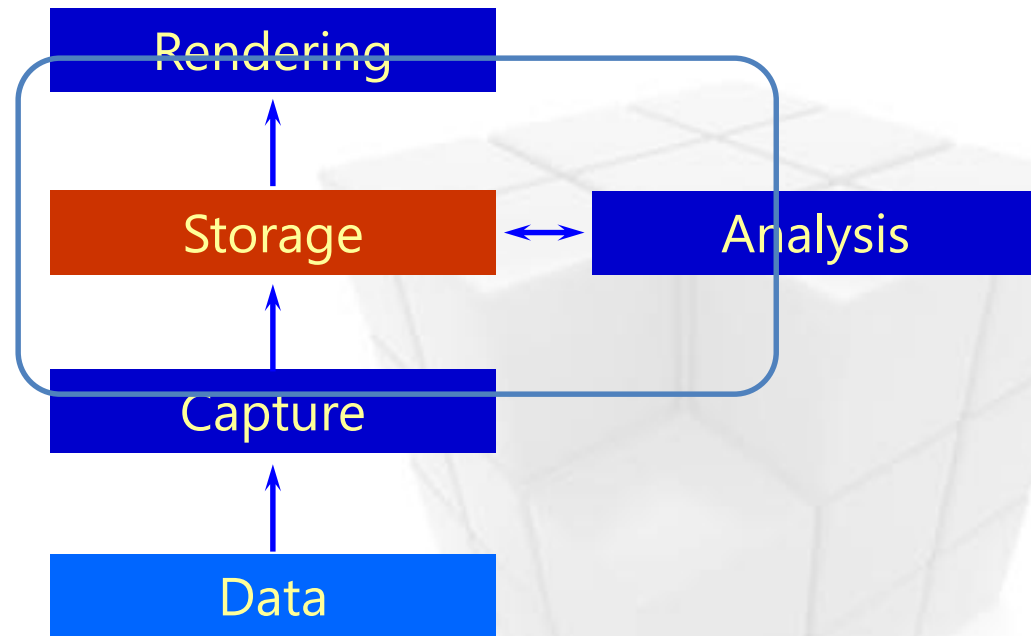
# Gdje je tu Oracle?

- ❑ Oracle Big Data Cloud Services
- ❑ Oracle Cloud Platform
- ❑ Oracle Java
- ❑ Oracle IoT Cloud Services
- ❑ Oracle Database 12c Enterprise Edition
- ❑ Oracle Spatial & Maps (Enterprise Edition DB)



# Where does Oracle fit in a Spatial/GIS System

ORACLE®





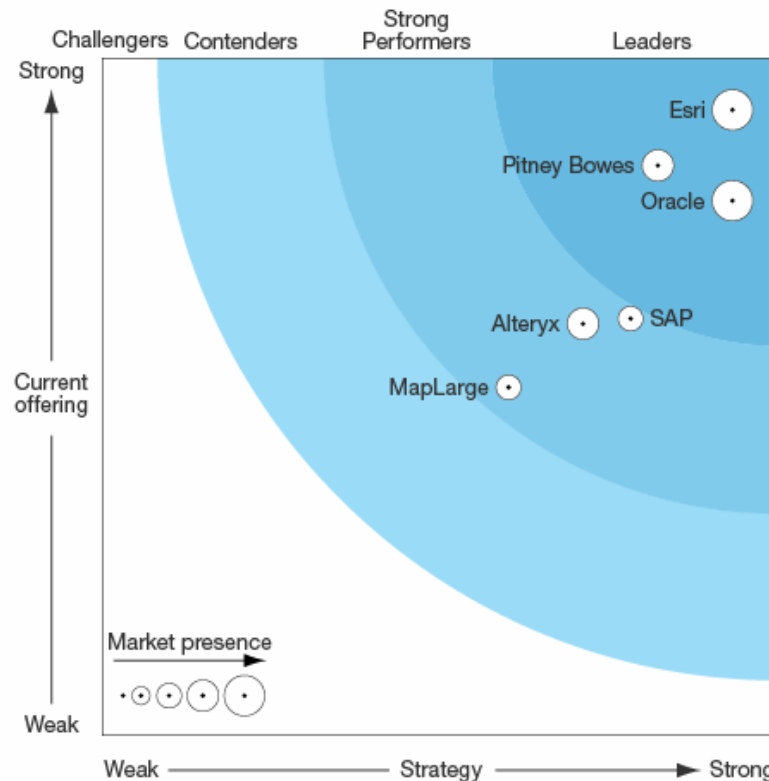
# The Forrester Wave™: Geospatial Analytics Tools And Platforms, Q3 2016 - The Six Providers That Matter Most



## VENDOR PROFILES

This evaluation of the geospatial analytics platforms market is intended to be a starting point only. We encourage clients to view the detailed product evaluations and adapt the criteria weightings to fit their individual needs through the Forrester Wave Excel-based vendor comparison tool ( see Figure 3 ).

**Figure 3: The Forrester Wave™: Geospatial Analytics Tools And Platforms, Q3 '16**



# Oracle Database 12c Location & Spatial Features

- ❖ **Vector Performance Acceleration:** Substantially faster querying and more efficient use of CPU, memory, and partitioning
- ❖ **Parametric Curves (NURBs):** mathematically precise representation of free form curves and reproduced exactly for 2D and 3D data.
- ❖ **GeoRaster virtual mosaic:** a large collection of GeoRaster objects, rectified or not, from one or more GeoRaster tables
- ❖ **GeoRaster raster algebra:** new analytical algorithms and faster, parallel raster operations
- ❖ **GeoRaster image processing:** More processing capabilities, more server-side and parallel processing
- ❖ **GeoRaster Java APIs:** more APIs that were previously supported only in the PL/SQL API
- ❖ **3D:** accounts for height when calculating distance between two 3D points
- ❖ **3D:** metadata views for 3D themes, scenes, and viewframes for visualization and analytics
- ❖ **3D:** pyramiding is supported for Point clouds and TINS
- ❖ **3D:** Contour lines can be generated from point clouds
- ❖ **3D:** geodetic data supported in Linear Referencing System functions
- ❖ **Geocoding:** supports point address geocoding for countries that don't have address ranges and language support for countries that have addresses in multiple languages.
- ❖ **Routing engine:** advanced routing restrictions and conditions, such as truck-specific routes
- ❖ **Spatial Web Services:** A Web-based Administrative Console for Web Feature Server 1.1

# Budućnost – iznimna brzina inoviranja



- #1 Podaci – kako upravljati, razmjenjivati i analizirati podatke.
- #2 GIS – integracija s GIS sustavima
- #3 Senzori – povezivanje i interpretacija podataka
- #4 *UTM* – integracija autonomnih sustava u postojeće sustave
- #5 *Sense & Avoid* sustavi – nova rješenja i scenariji
- #6 *BVLOS* – letačke operacije na daljinu >100km
- #7 Sigurnost i privatnost – zaštita sustava
- #8 Sustavi za detekciju i ometanje dronova

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2017

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