

Unified Flight Control System as the Next Generation Platform For Autonomous Unmanned Aerial Vehicles

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Education

2015: MSc degree with honors in Flight Dynamics & Control

Moscow Institute of Physics and Technology

2013: BSc degree with honors in Applied Math & Physics

Moscow Institute of Physics and Technology

Experience

2014: EECS Engineer

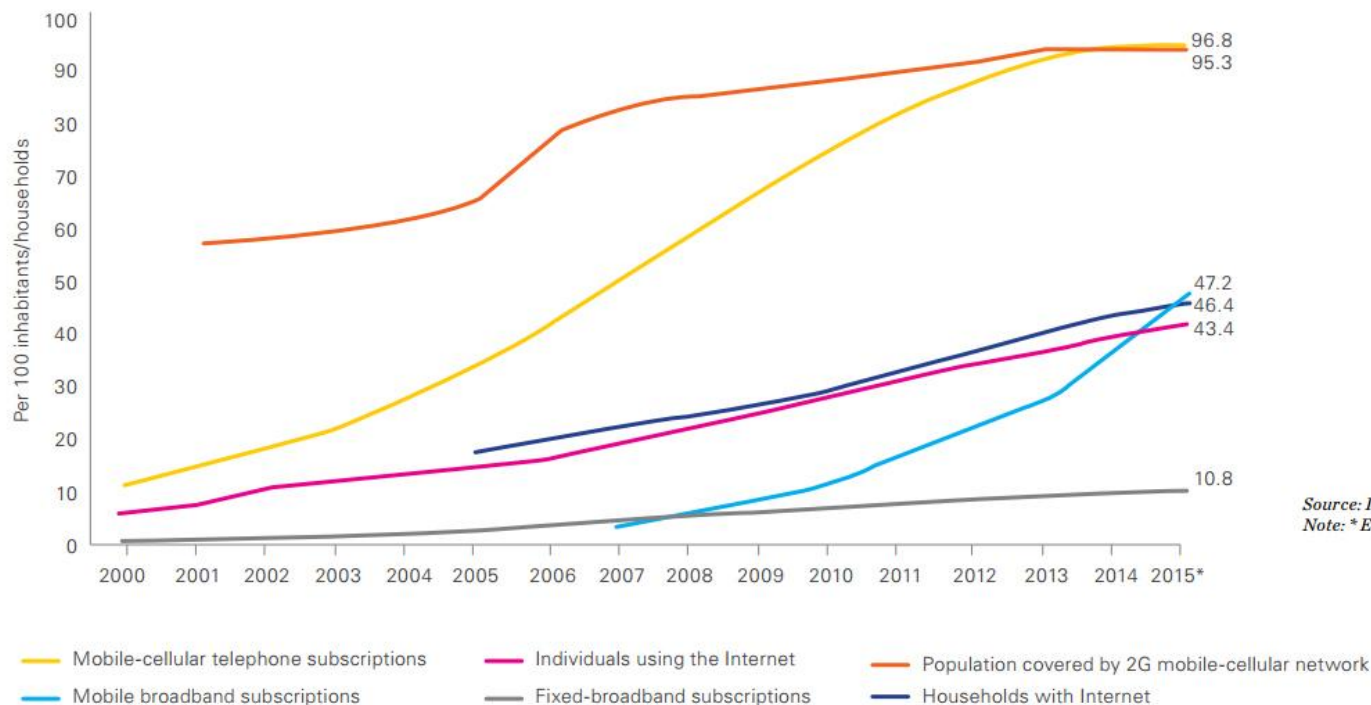
Autonomous Control Systems Lab, Tokyo, Japan

2015: EECS Engineer

Perspective Robotics, Zürich, Switzerland

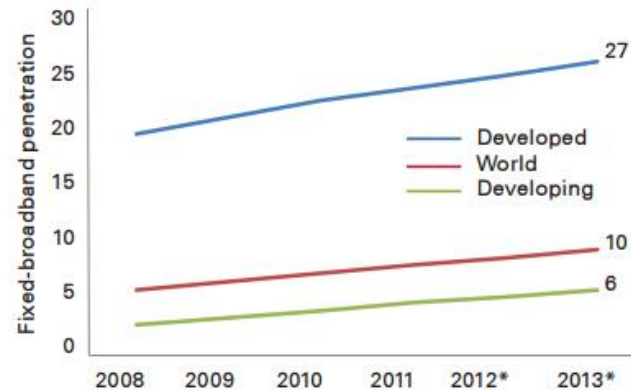
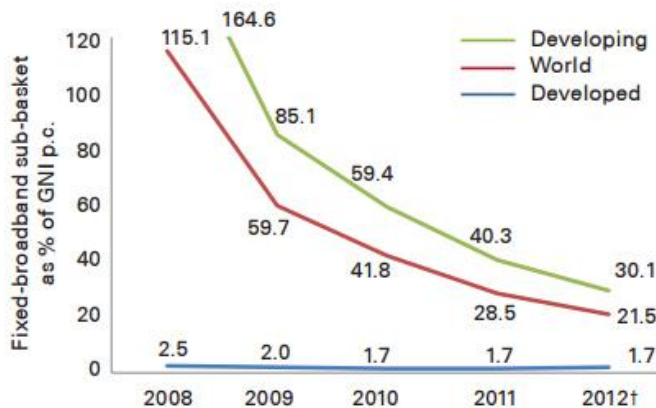


15 years of ICT growth: what has been achieved?



FIXED-BROADBAND PRICES DROP BY 82% BETWEEN 2008 AND 2012

As fixed-broadband services become more affordable, penetration increases



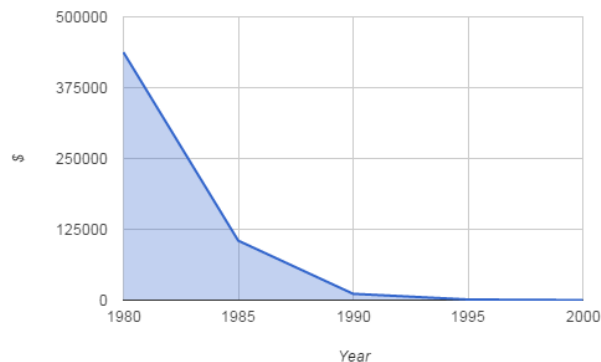
Source: ITU World Telecommunication /ICT Indicators database

Note: Simple averages. † Preliminary result. * Estimate

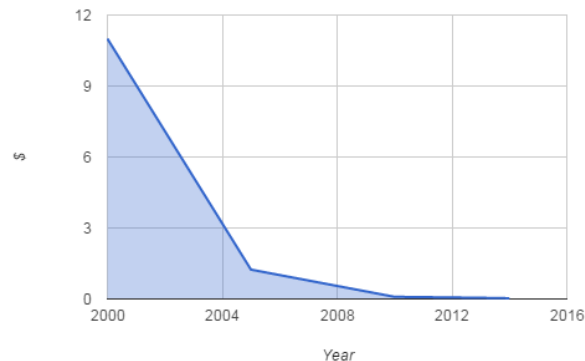
Market preview – Storage

Year	Average Cost Per Gigabyte
2014	\$0.03
2013	\$0.05
2010	\$0.09
2005	\$1.24
2000	\$11.00
1995	\$1,120
1990	\$11,200
1985	\$105,000
1980	\$437,500

Average Cost of Hard Drive Storage



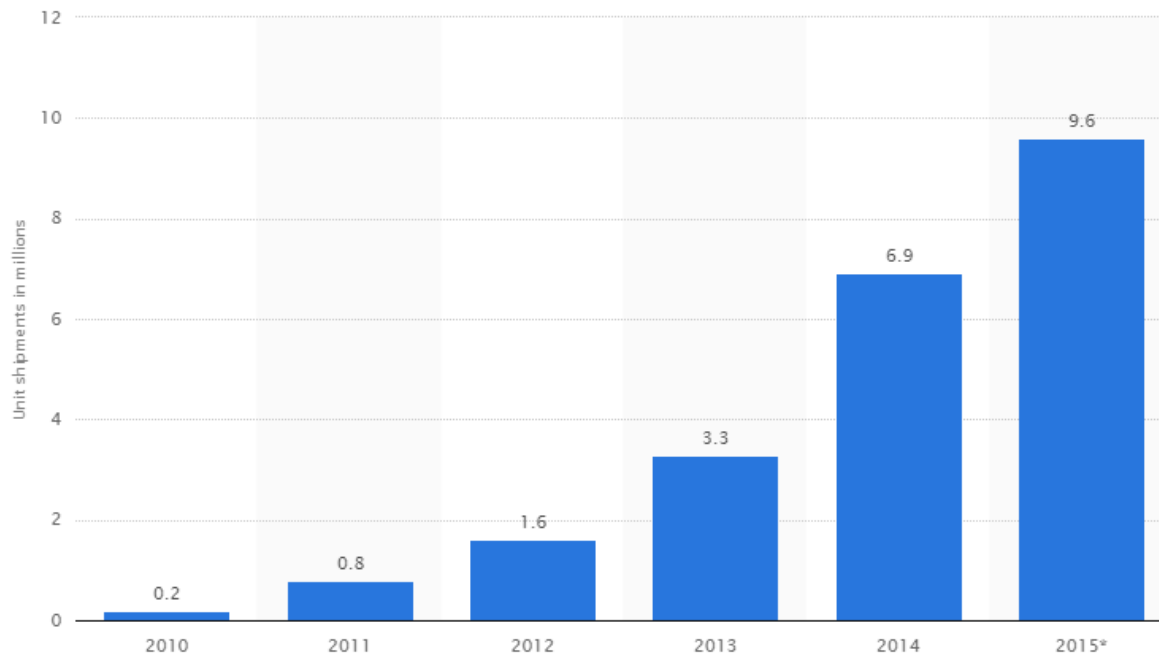
Average Cost of Hard Drive Storage



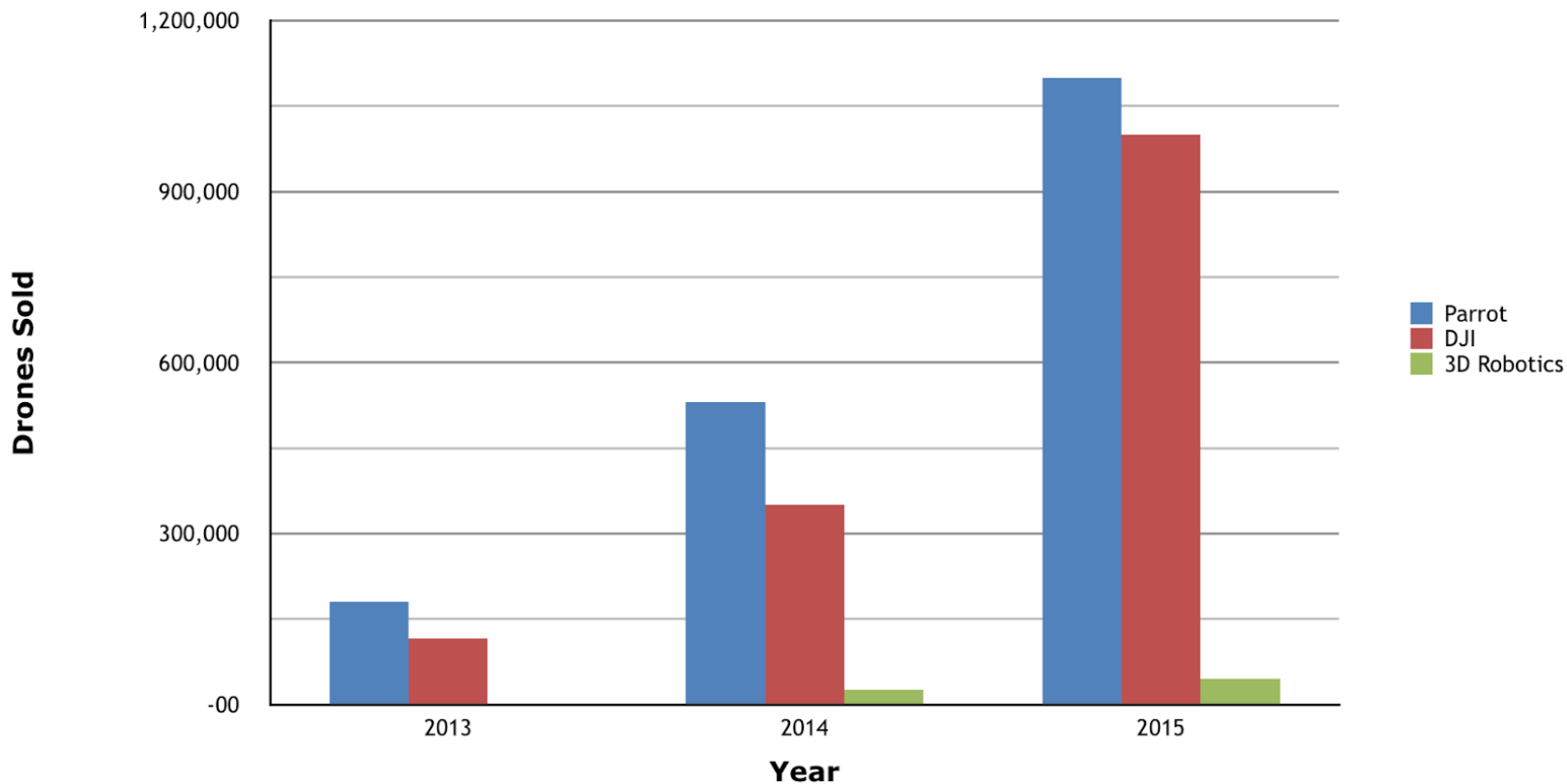
Market preview – Action Cameras

Unit sales of action cameras worldwide from 2010 to 2015 (in millions)

This statistic shows the global unit shipments of action cameras from 2010 to 2015. In 2013, 3.3 million units of action cameras were shipped worldwide.

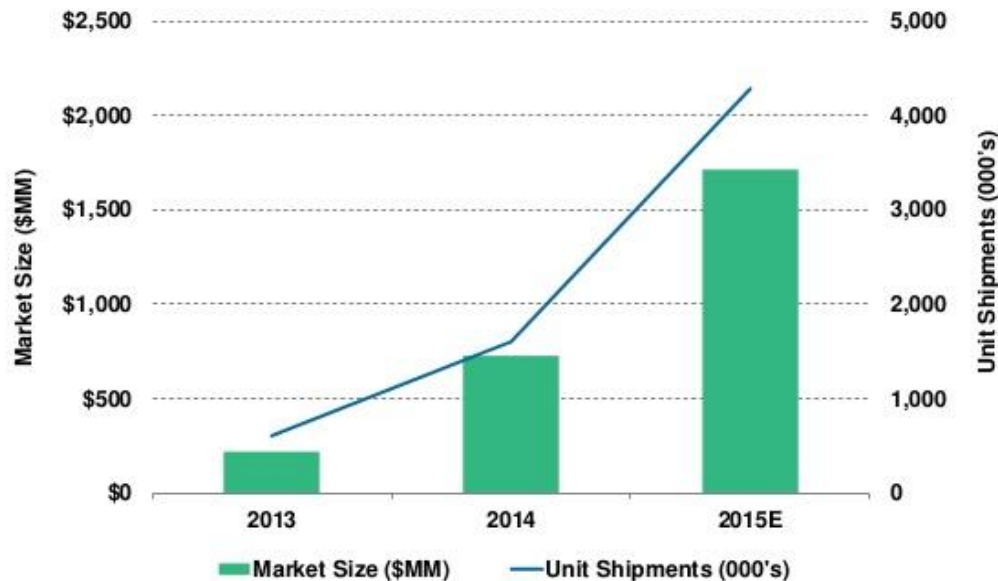


Drones Sold per Year

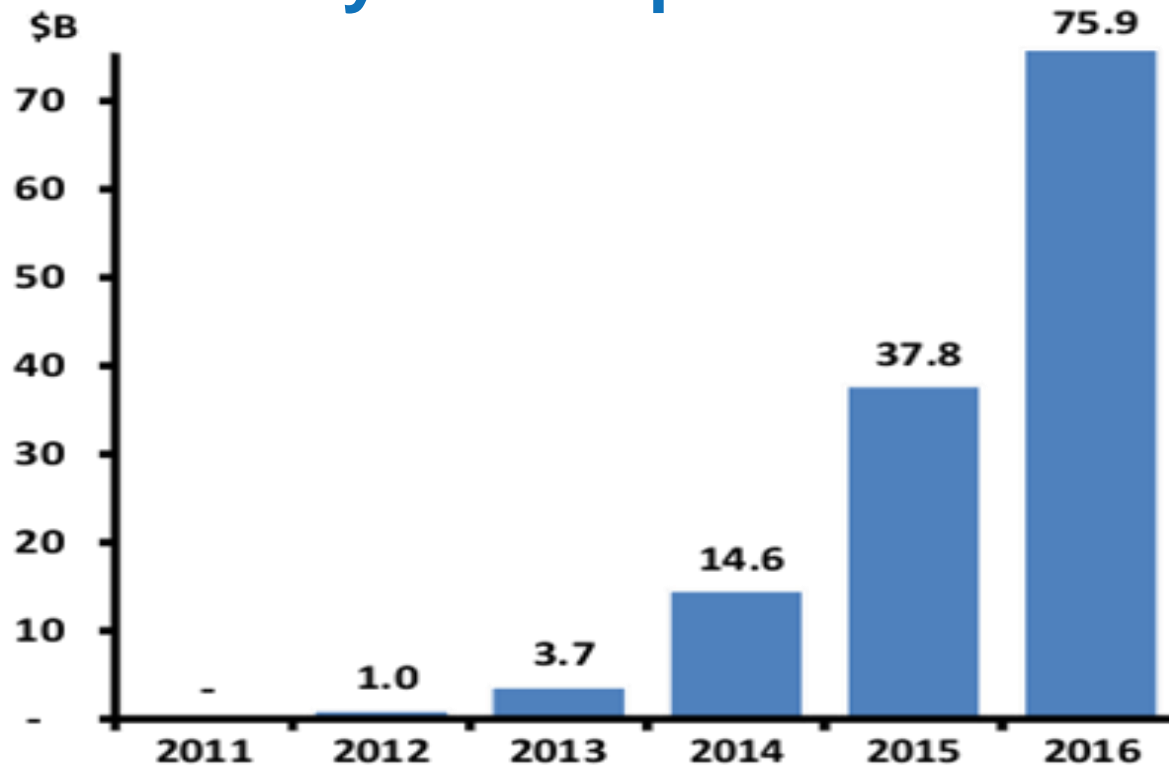


Consumer Drone Shipments = Rising Rapidly...
@ 4.3MM Units in 2015E, + 167% Y/Y, Revenue to \$1.7B

Global Consumer Drones – Revenue & Unit Shipments, 2013 – 2015E



History and Expectations



Applications



**Geographical
Survey**

**Agricultural Operations
Support**

**Movies and
Advertising**

**Disaster site
Monitoring**

**Security and
Surveillance**

**Drones Delivery
Service**

**Aerial Photography and
Videography**

**Fire Localization and
Fighting**

The Problem

Highly trained employees required

Sophisticated equipment required

Limited Flight Area

Complicated

Expensive



Solution - Drone



Easy to operate

**Training is not
required**

Unlimited Flight Area

Affordable

**Simple solution for
aerial applications and tasks**



Regulations



- ✓ **DO** fly a model aircraft/UAS at the local model aircraft club
- ✓ **DO** take lessons and learn to fly safely
- ✓ **DO** contact the airport or control tower when flying within 5 miles of the airport
- ✓ **DO** fly a model aircraft for personal enjoyment

- ✗ **DON'T** fly near manned aircraft
- ✗ **DON'T** fly beyond line of sight of the operator
- ✗ **DON'T** fly an aircraft weighing more than 55 lbs unless it's certified by an aeromodeling community-based organization
- ✗ **DON'T** fly contrary to your aeromodeling community-based safety guidelines
- ✗ **DON'T** fly model aircraft for payment or commercial purposes



Sky-Drones: About

Project started: **2011**

General developments:

UAV Flight Control Systems:

- Electronics
- Navigation and Control Algorithms
- Software

Currently:

- Three generations of the system
- Fully Autonomous flight support
- Professional applications vehicles





UAV Manufacturers
> 1000 companies



Electronics?
UAV must be autonomous!
But it's difficult, so:

Flight Control System
Manufacturers
< 20 companies

Few. And guess what?!
The don't meet customers'
requirements!



Drone Airframes
> 300 types

SmartAP
Smart AutoPilot

Solution for all types of UAVs and
applications which meets customer's
requirements!



SmartAP

Smart AutoPilot

Autonomous UAV

Various sensor's data acquisition

- Inertial Measurement Unit (IMU)
- Global Positioning System (GPS)

Airframe

1

Attitude and Position estimation

- Data fusion
- Accuracy improvements

Flight Control System

2

Ground Control Station

Control

- Stabilization
- Navigation

3

Flight Control System



Any types of
multirotor UAVs



Simple Integration
& Ease of Use



Custom Hardware &
Software Design



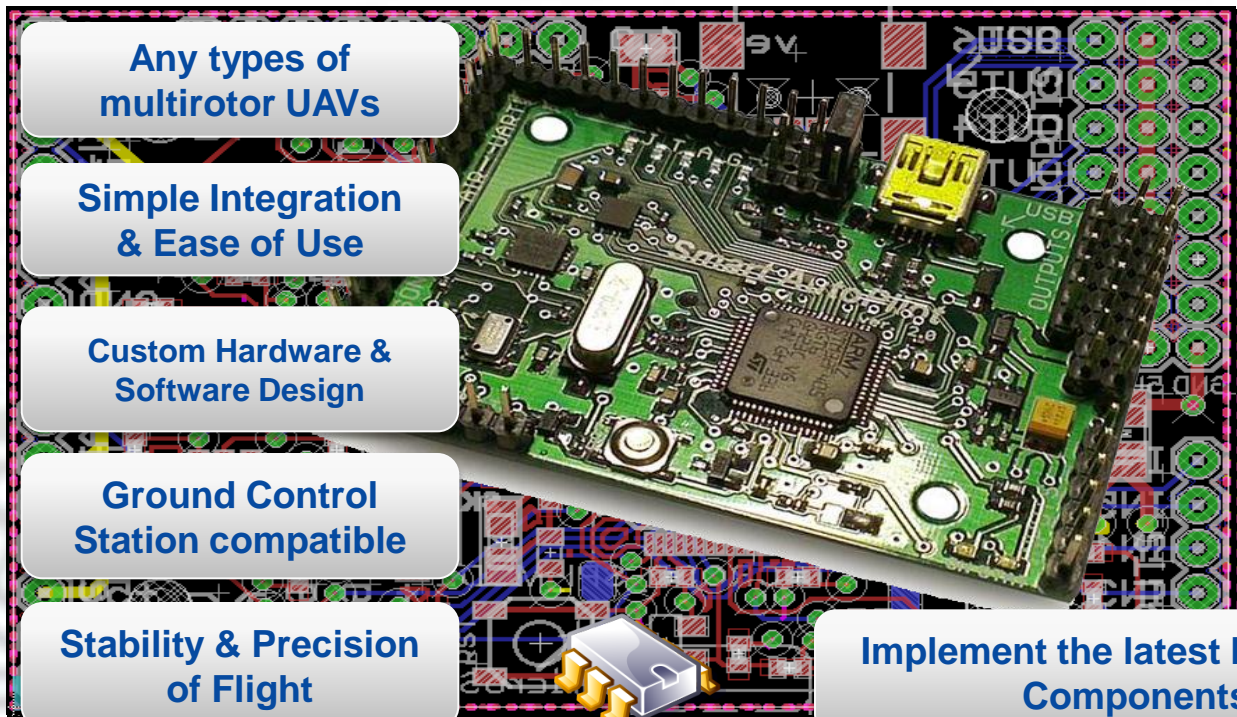
Ground Control
Station compatible



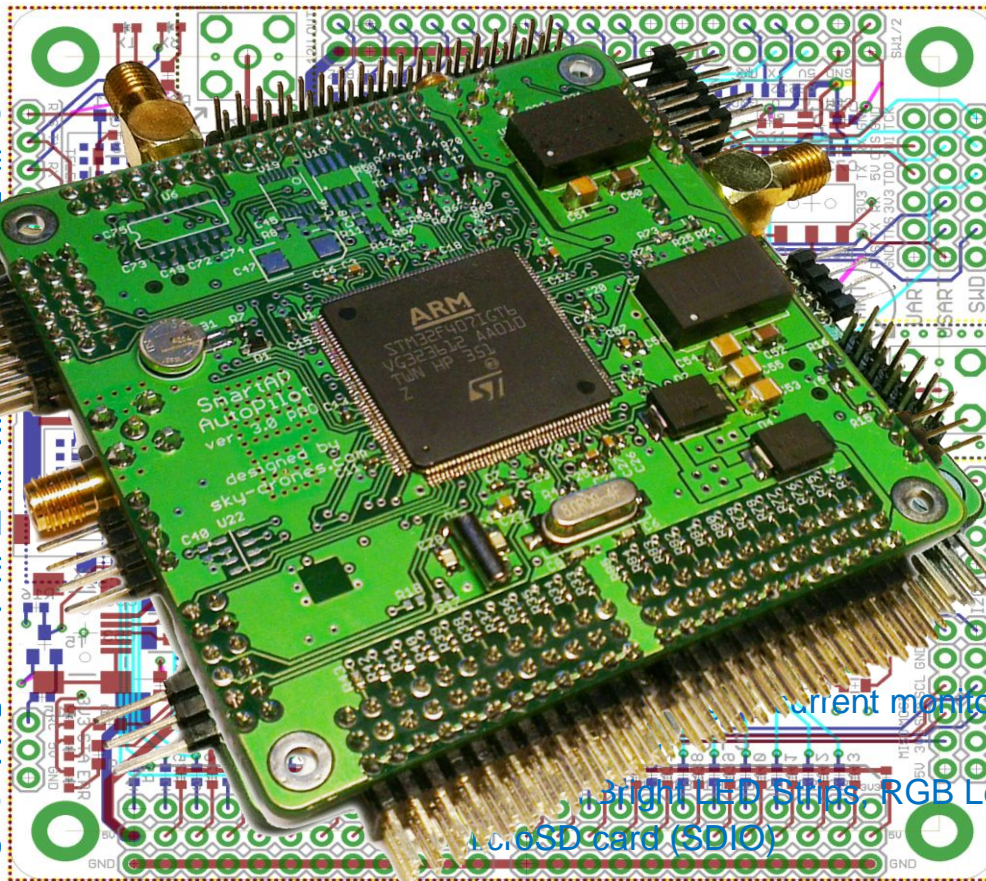
Stability & Precision
of Flight



Implement the latest Electronic
Components



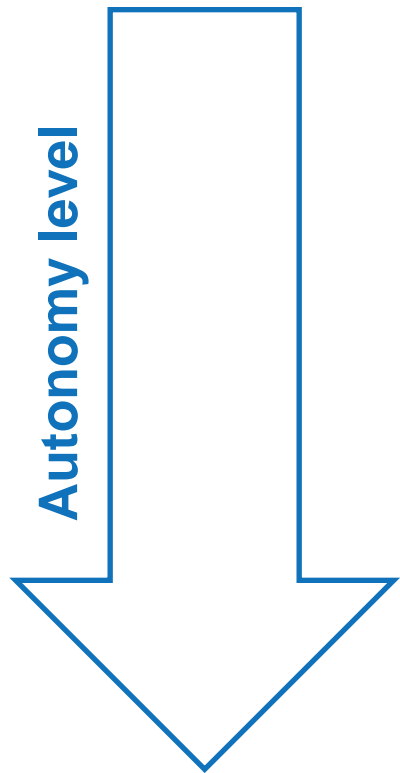
- Size: 8x8 cm, 65g
 - 6 layers PCB design
- Power supply: 3-8S Lipo
 - 12V, 5V, 3.3V generators
- ARM Cortex M4 (STM32F407IGT6)
 - 32 bit, 168 MHz, 1M Flash
- 24 PWM I/O, SBUS
 - Configurable
- Various communication
 - I2C, SPI, USART, RS485
- IMU – Accel + Gyro + Magnetometer
 - InvenSense MPU-9150
 - Bosch BMA280, HMC5883L
- Pressure sensor MS5611
 - 15cm resolution
- Integrated GPS Ublox Neo-M7
 - 24 SATs, GPS / GLONASS
- Integrated Telemetry module
 - External supported telemetry



Current monitoring

Bright LED Strips RGB Led

MicroSD card (SDIO)



Attitude rates stabilization

Attitude angles stabilization

Altitude hold mode

Position hold mode

Altitude and Position hold mode

Auto Return to Home mode

Auto Waypoints flight mode

Auto Take off mode

Auto Landing mode

Auto Guided flight mode



Other projects



SmartAP
Smart AutoPilot

Moscow, Russia



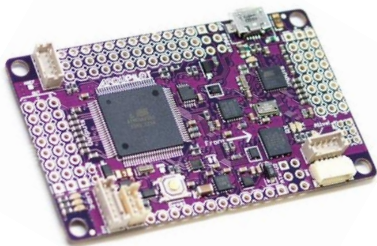
pixhawk

Zurich, Switzerland



AUTO QUAD
AUTONOMOUS MULTI ROTOR VEHICLE CONTROLLER

Seattle, USA



3DRobotics

Berkeley, USA



Germany



Hong Kong





千葉大学
Chiba University



ACSL Laboratory

Tokyo, Japan

Prof. Kenzo Nonami

- Flight tests
- Systems verifications
- Navigation and control algorithms development

MiniSurveyor (Tokyo, Japan) – SmartAP 2.0



SmartAP
Smart AutoPilot


MINI SURVEYOR

SmartAP
Smart AutoPilot



More info

www.sky-drones.com



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SmartAP Smart AutoPilot

Advanced UAVs & Flight Control Systems

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SmartAP 3.0 PRO

Integration Made Simple.

Developed specially for professional
long endurance and heavy lift drones

Want to purchase?

[Let us know here](#)



Latest News

SmartAP GCS

Preview of SmartAP Ground Control Station has been released for public. Now you can do everything from board configuration to autonomous high-level flight control in a single app.

What is UAV?

Unmanned Aerial Vehicle (UAV), also known as a drone, is an aircraft without a human pilot onboard. A key feature of UAV is its autonomy, meaning that no pilot intervention since take off required. The variety of UAV applications are mainly focused on aerial photography, videography and monitoring.

Video Tutorials

SmartAP 3.0 Connection and Configuration tutorials are available! If you still have issues with PDF tutorials, then check out the video tutorials, available in Manuals section.

What is SmartAP?

SmartAP Autopilot is the next generation flight control system for multirotor Unmanned Aerial Vehicles capable of fully autonomous flight. It has a powerful microcontroller STM32F4 from STMicroelectronics, 9-axis Inertial Measurement Unit and the latest GPS receiver from UBlox integrated onboard. SmartAP supports any type of multirotor UAV with outstanding navigation and control precision. Unlike our competitors SmartAP was developed using the latest electronic components available at the moment, which allowed us to achieve such amazing results.

SmartAP Configurator

SmartAP Configurator is officially released and available for download! Configure your SmartAP Autopilot in just 5 minutes with this configuration tool!

Customers and Users



Thank you!

More info

www.sky-drones.com

Friedrichshafen, March 7th 2016

