

Stichting IoT Apeldoorn

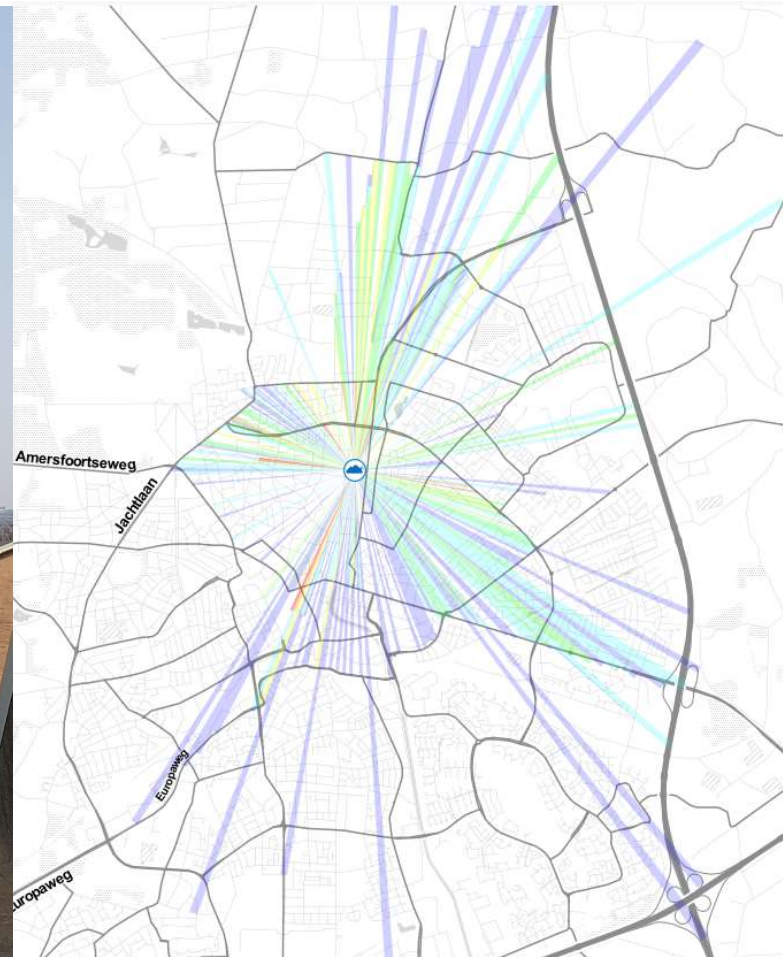
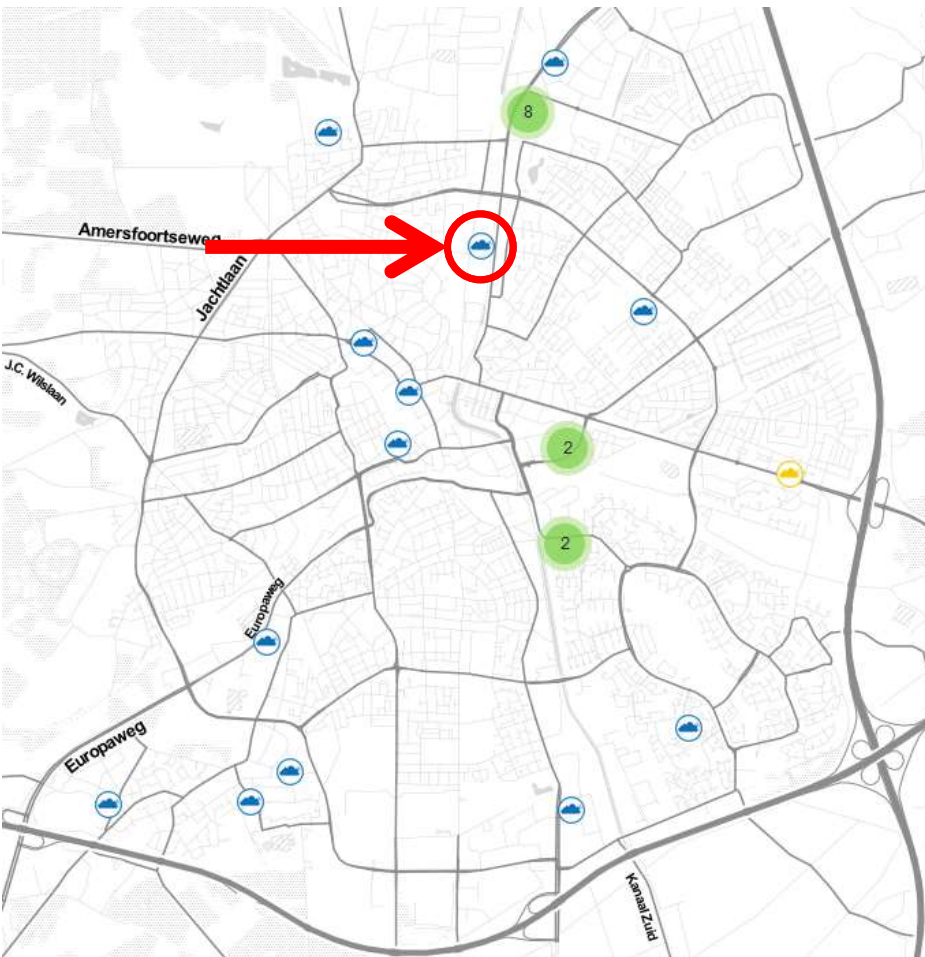
Meetup woensdag 17 maart 2020



Mededelingen

- **2 maart** KvK inschrijving IoT Apeldoorn ontvangen
- **9 maart** Installatie gateway Zwitsal
- **16 maart** bankrekening geopend ING
- **16 maart** Sponsorgeld en donaties naar de stichting over gemaakt.
- Nu: Facturen sturen aan verschillende bedrijven die een bijdrage hebben toegezegd.
- En verder:
 - Formele overdracht van de gateway in eigendom van de stichting.
 - Webhosting, email adressen van de stichting etc.
 - Recht van opstal bij de gemeente realiseren.

Gateway Zwitsal



Gateway Zwitsal

- Geplaatst met medewerking van Newtechpark

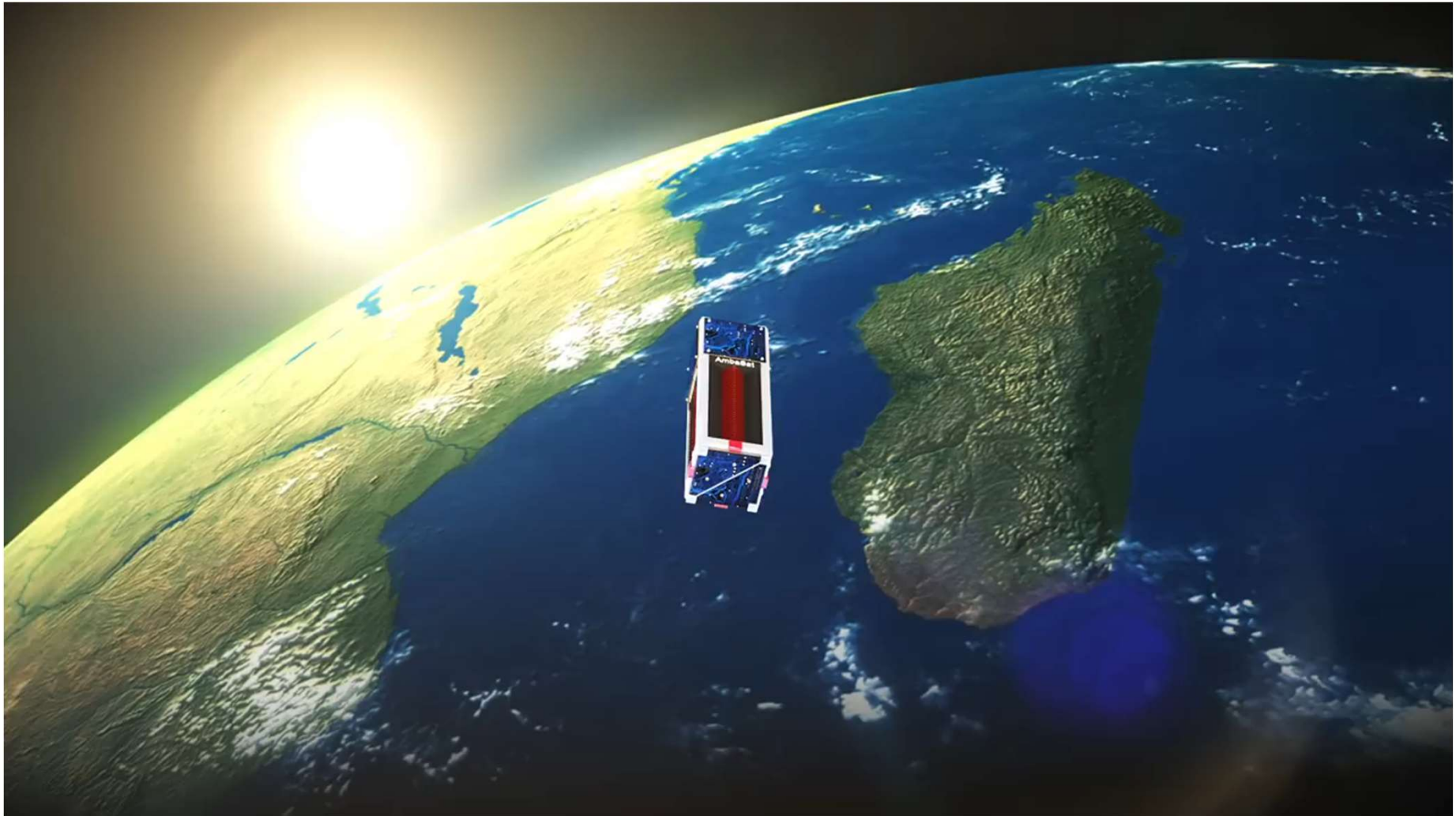
NewTechPark inspireert en faciliteert mensen, bedrijven en onderwijsinstellingen om te kiezen zich een leven lang te ontwikkelen in de techniek.

<https://newtechpark.nl>

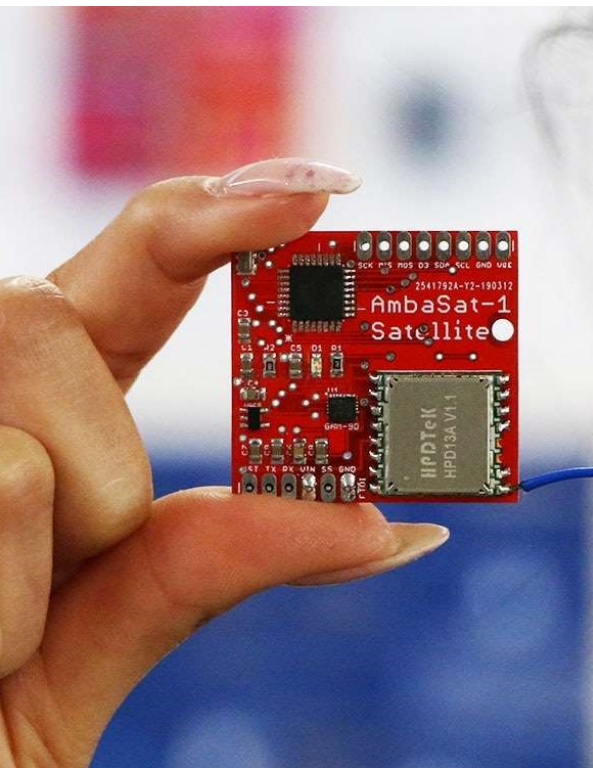


AmbaSat-1

Frank Woutersen



Kickstarter



AmbaSat-1 Satellite PCB

A tiny Sprite satellite measuring 35mm x 35mm x 5mm

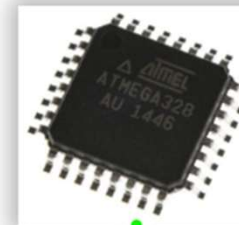
4MHz crystal/resonator
for perfect low-power
performance



LSM9DS1
Tri-Axis Gyroscope,
Tri-Axis Accelerometer,
Tri-Axis Magnetometer



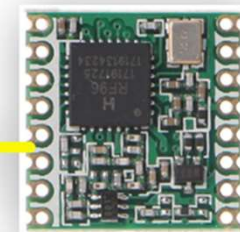
LDO Voltage Regulator
2.2V 280mV Dropout
2.5Vout, 150mAout



ATMEGA328P-AU is an 8-bit
high-performance picoPower
AVR RISC-based Microcontroller
with 32kB ISP flash memory.
This is the 'brains' of your spacecraft.



6 different sensors available.
This example is the STS21, a
fully calibrated high
accuracy Digital
Temperature Sensor.



LoRa RFM95 Radio
Transceiver
Featuring ultra-long range
spread spectrum
communication and high
interference immunity



ambasat.com

Kickstarter

KICKSTARTER

Thanks for backing this project—now
you're a part of it

Creating something new is hard, full of ups and downs. Your
pledge is an up—it's a sign that you believe in this project, and
a step toward making it a reality.

Fri 10/05/2019 08:58

Kickstarter



2x

£43,049

pledged of £26,000 goal

250

backers

You selected

Pledge £230 or more

AmbaSat-1 Assembled : ROCKET LAUNCH

A fully assembled AmbaSat-1. Plus a fully included rocket launch! Assembled and ready for you to code.

Secure your spot onboard the NEPTUNE rocket and get your AmbaSat-1 satellite launched into low earth orbit. A small step for some. A giant leap for others.

Rocket launch INCLUDED

INCLUDES:

- Assembled AmbaSat-1 : Solar
- ROCKET LAUNCH

ESTIMATED DELIVERY
Oct 2019

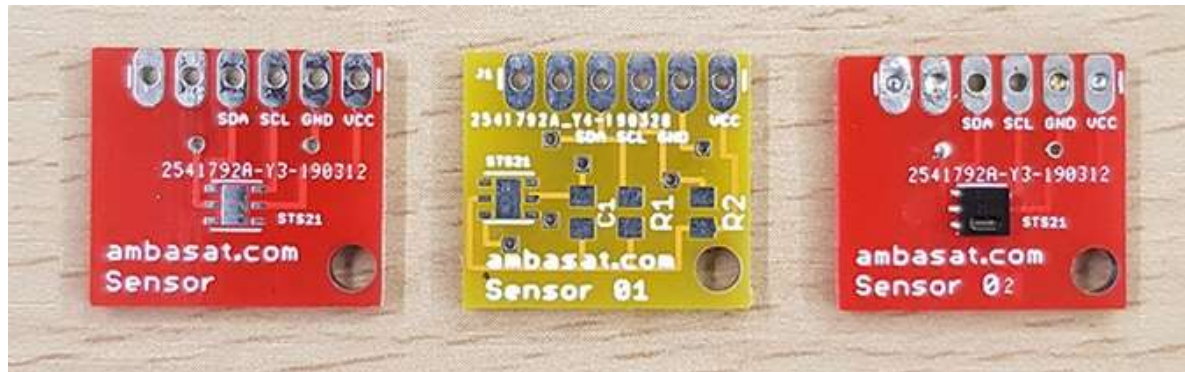
SHIPS TO
Anywhere in the world

Limited
41 backers

NO SURVEYS SENT

	Voornaam	Achternaam
1	Frank	Woutersen
2	Gert	Woutersen
3	Evert	Versteeg
4	Remko	Welling
5	Pieter	Holtrop
6	Ruud	Oskam
7	Henk	van der Hulst
8	Gert	Veldhuis
9	Jaap	Bruijn
10	Jacques	Emmen
11	Teije	ter Bals
12	Arnold	Kolkman
13	Inter Act industrial automation	
14	Lambertus	IJsselstein
15	Bertus	Huis in 't Veld
16	Wil	Put
17	Rene	Kuipers
18	Roland	Atos
19	Edsard	Boelen
20	Jeroen	van Bussel
21	Marcel	Meek

Sensoren



Temperature & Humidity Sensor – STS21

Environmental Sensor – BME680 (gas, pressure, temperature & humidity)

Ultraviolet (UV) Sensor - GUVAS12SD

Analog Gas Sensor - MQ2 probe (hydrogen and methane)

Ambient Light Sensor - VEML7700

Can I fit my own sensor? Yes, as long as your sensor conforms to certain criteria, including size and safety, then you can fit your own. Your AmbaSat satellite provides additional connectivity pins which expose the ATMEGA's I2C bus, as well as digital and analogue pins, plus power.

GPS?



Post



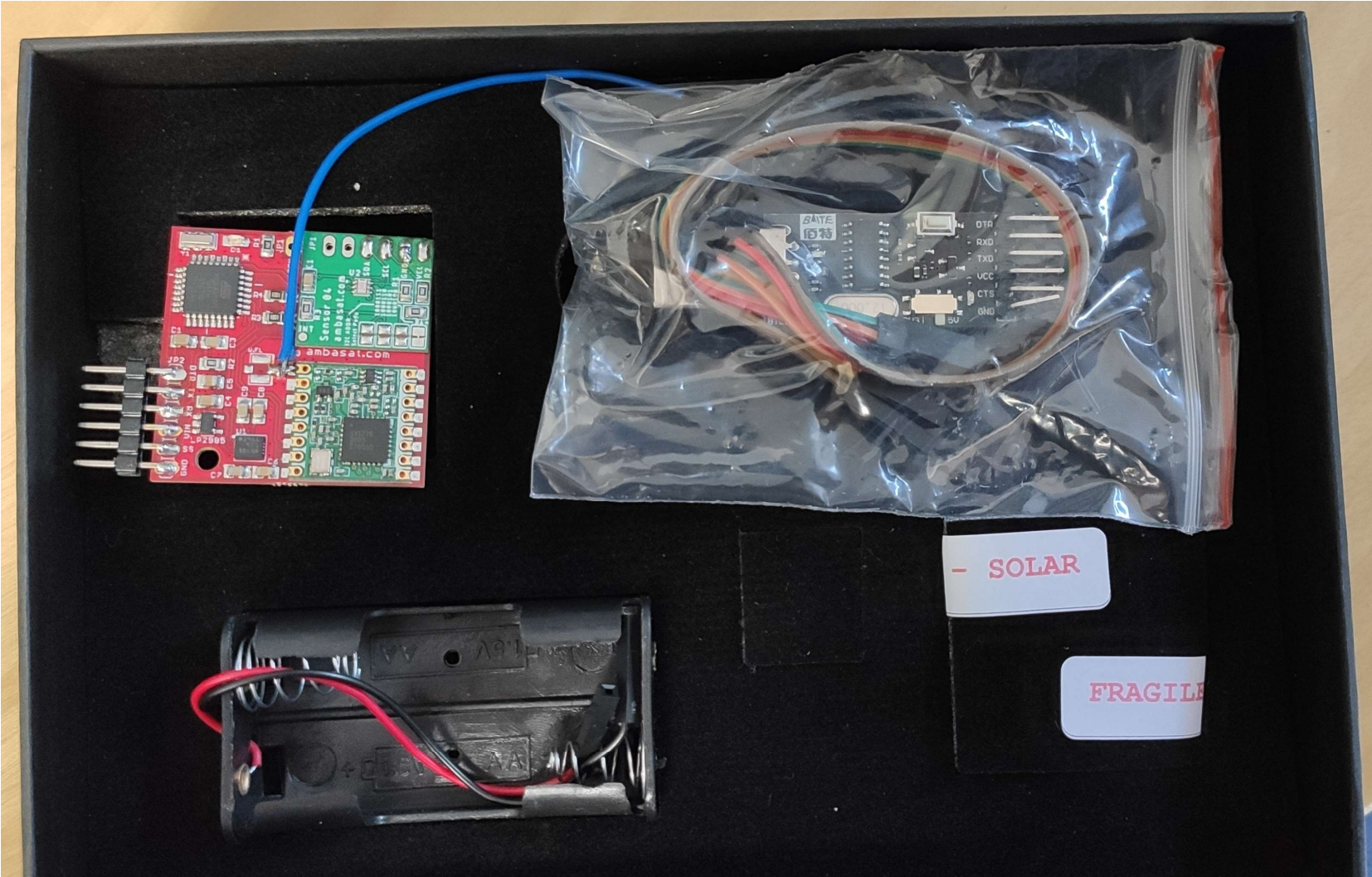
Post

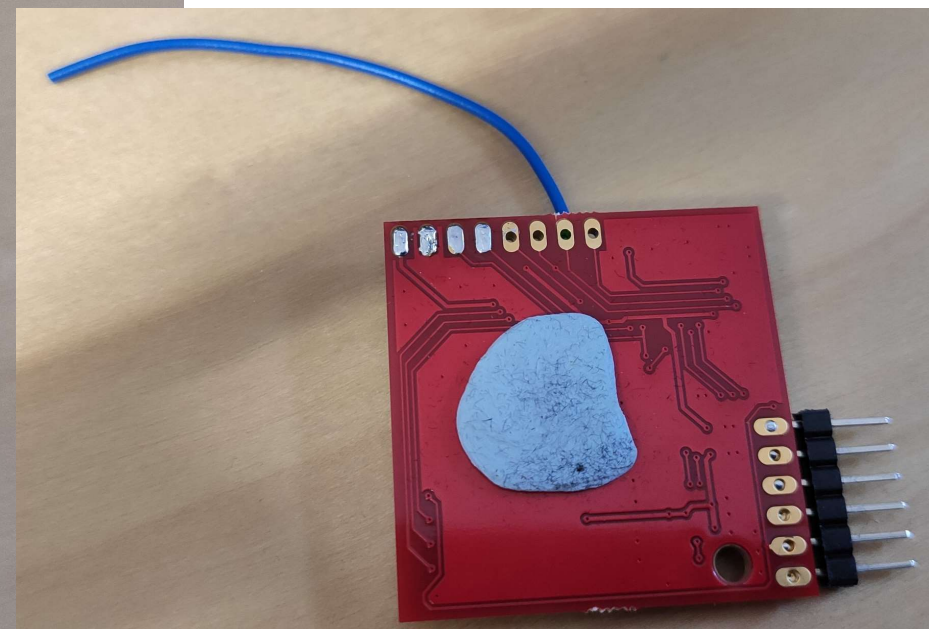
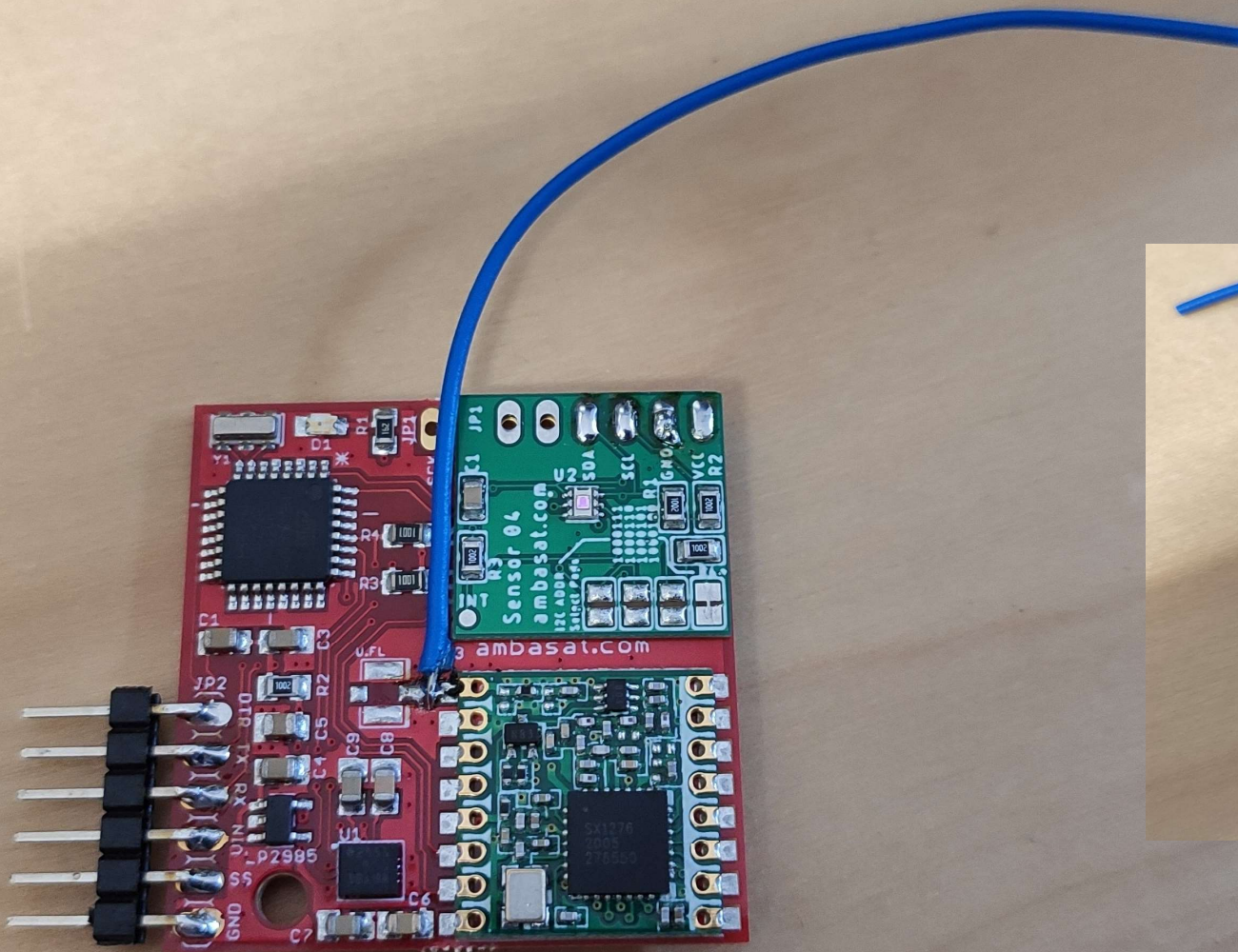


Post

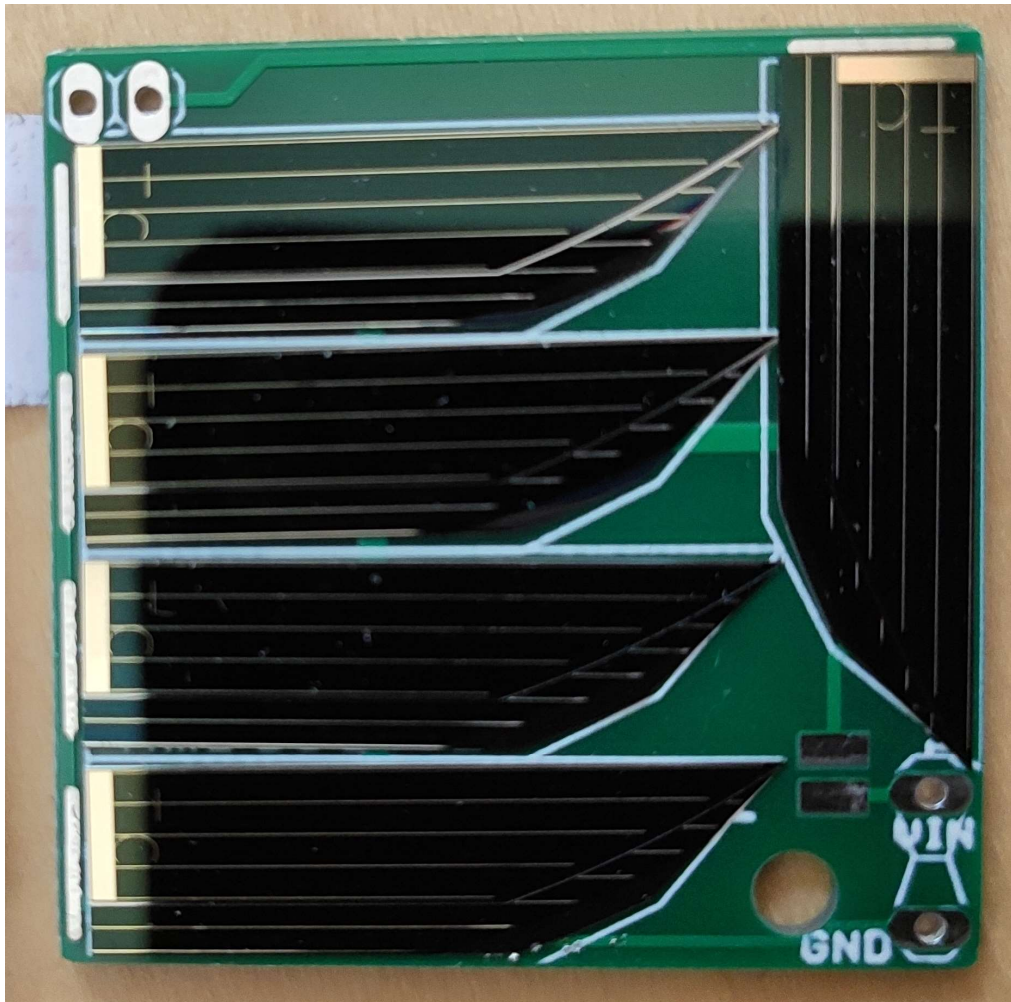


Post





Post



IMPORTANT - SOLARBOARD AND SOLAR PANELS

PLEASE TREAT THE SOLARBOARD AND PANELS WITH EXTREME CARE. THE PANELS ARE VERY FRAGILE.

THE SOLARBOARD IS DESIGNED TO POWER AMBASAT-1 IN LOW EARTH ORBIT AND DOES NOT USE THE VOLTAGE REGULATOR. FOR FURTHER DETAILS, PLEASE READ THE 'ATTACHING' GUIDANCE BELOW.

IF YOUR KIT INCLUDES A ROCKET LAUNCH, WE ADVISE LEAVING THE SOLARBOARD FOR US TO FIX TO YOUR AMBASAT-1 SATELLITE ONCE IT'S RETURNED TO US FOR PRE-LAUNCH TESTING. WE WILL MOUNT THE SOLARBOARD FREE OF CHARGE.

ATTACHING THE SOLARBOARD TO AMBASAT-1

DO NOT ATTACH THE SOLARBOARD UNTIL YOU HAVE COMPLETED CODING AND TESTING YOUR SATELLITE.

SOLDER A PIN TO GND AT THE BOTTOM RIGHT OF THE SOLARBOARD. DO NOT SOLDER VIN. AT THE TOP LEFT OF THE BOARD, SOLDER BOTH VCC AND GND PINS.

SOLDERING THE PANELS

TO COMPLETE THE POWER CIRCUIT, SOLDER THE TOP TAB OF EACH SOLAR PANEL TO THE SOLARBOARD TRACK BY BRIDGING THE GAP WITH A SMALL AMOUNT OF SOLDER.

Solarboard Insert v1.0 © AmbaSat Ltd

Post

Rocket Launch Certificate

This is to certify that your

AmbaSat-1

Has a reserved rocket launch slot allocation
onboard the AmbaSat LAUNCH DEPLOYER

SLOT No: 12

Signed: *Jackie Northrup*

Date: October 2020



Rocket Launch Certificate

This is to certify that your

AmbaSat-1

Has a reserved rocket launch slot allocation
onboard the AmbaSat LAUNCH DEPLOYER

SLOT No: 181

Signed: *Jackie Northrup*

Date: October 2020



Post



<http://ambasat.com/howto>

<https://github.com/ambasat/AmbaSat-1>



Your AmbaSat-1 Satellite Kit

Congratulations!

Thank you for purchasing your AmbaSat-1 Space Satellite Kit and welcome to the future of affordable space exploration.

Please visit the AmbaSat website link below to get started building your satellite:

<https://ambasat.com/howto>

Tools Required

To assemble your kit, you will need a soldering iron, multimeter, wire cutters and solder. If you don't have these, please visit the AmbaSat shop where you can purchase your toolkit, additional sensors & more:

<https://ambasat.com/shop>

WHAT'S IN THE BOX?

- 1 x AmbaSat-1 Satellite mainboard
- 1 x ATMEGA328P-AU Microprocessor
- 1 x LoRaWAN RFM95 transceiver
- 1 x Gyroscope/Accelerometer/Magneto
- 1 x your chosen environmental sensor
- 1 x two-AA size battery holder
- 1 x set of components - resistors, caps, etc
- 1 x CH340 USB to Serial Programmer
- Optional - solarboard & panels

SUPPORT

<https://ambasat.com>
support@ambasat.com

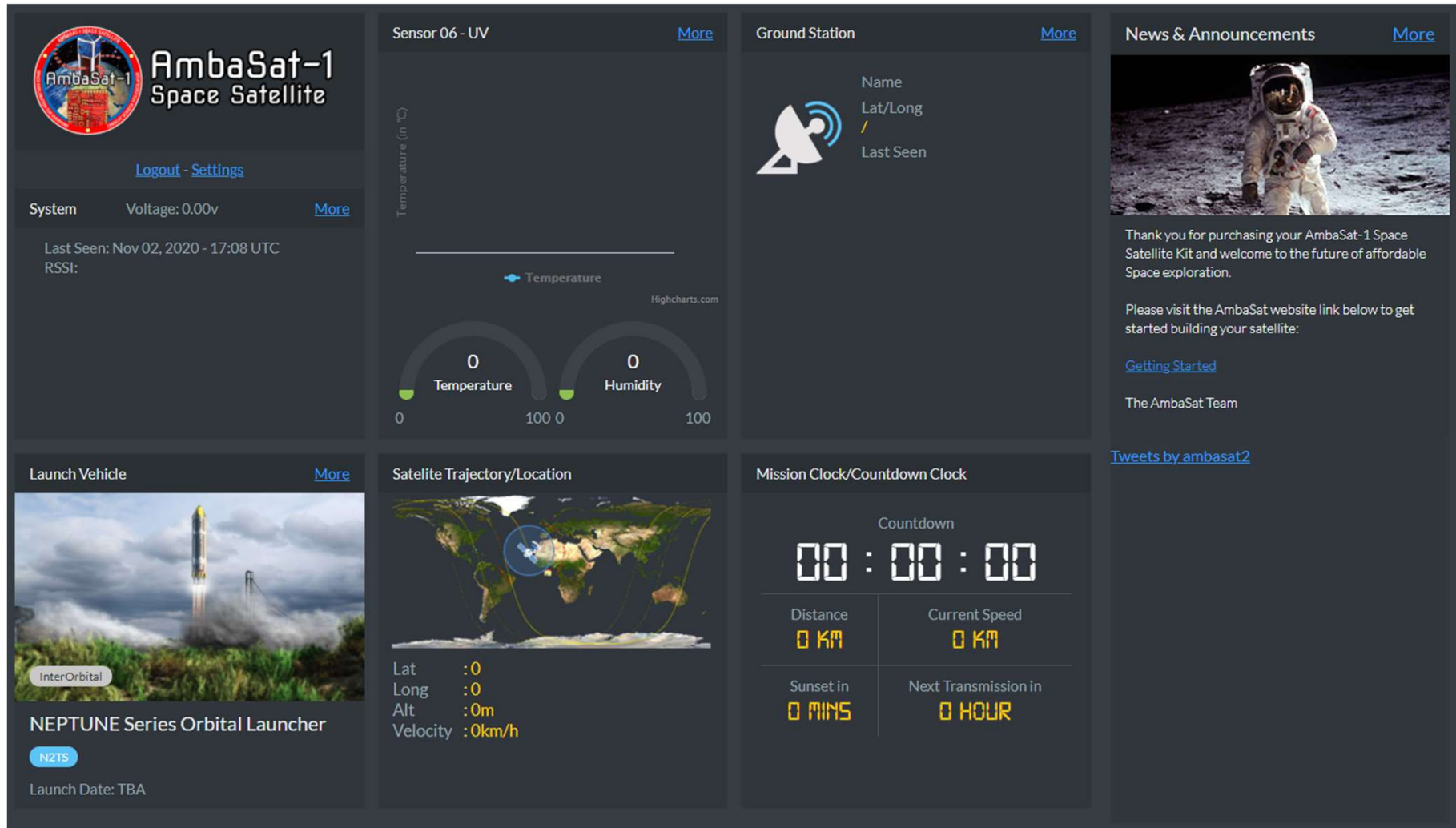
© 2020 AmbaSat Ltd



AmbaSat-1 Dashboard

555-01

Dashboard



AmbaSat-1



Interorbital Systems - Neptune



Interorbital

<https://www.interorbital.com/>

Customer	Payload
AmbaSat LLC	3U CubeSat

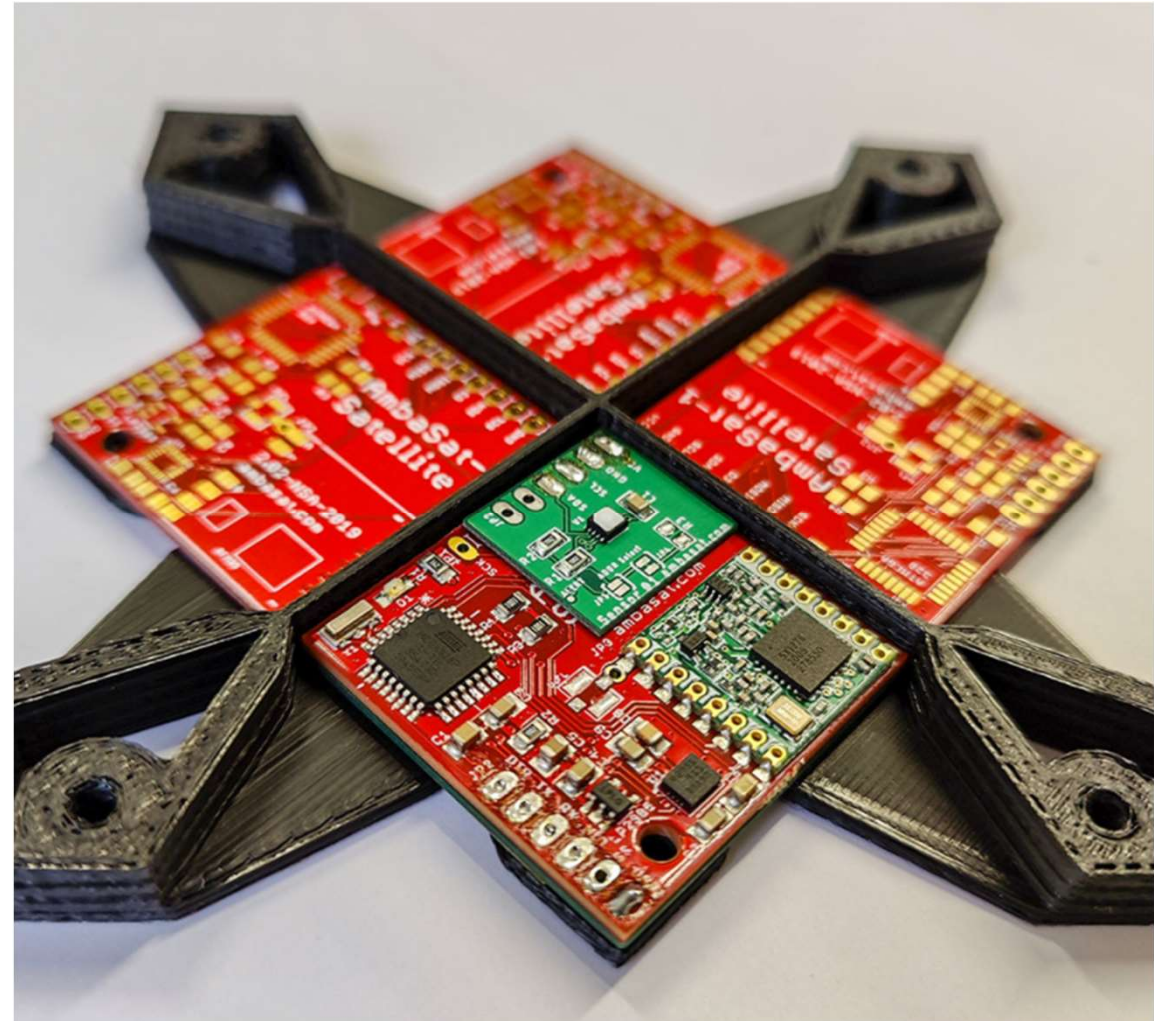
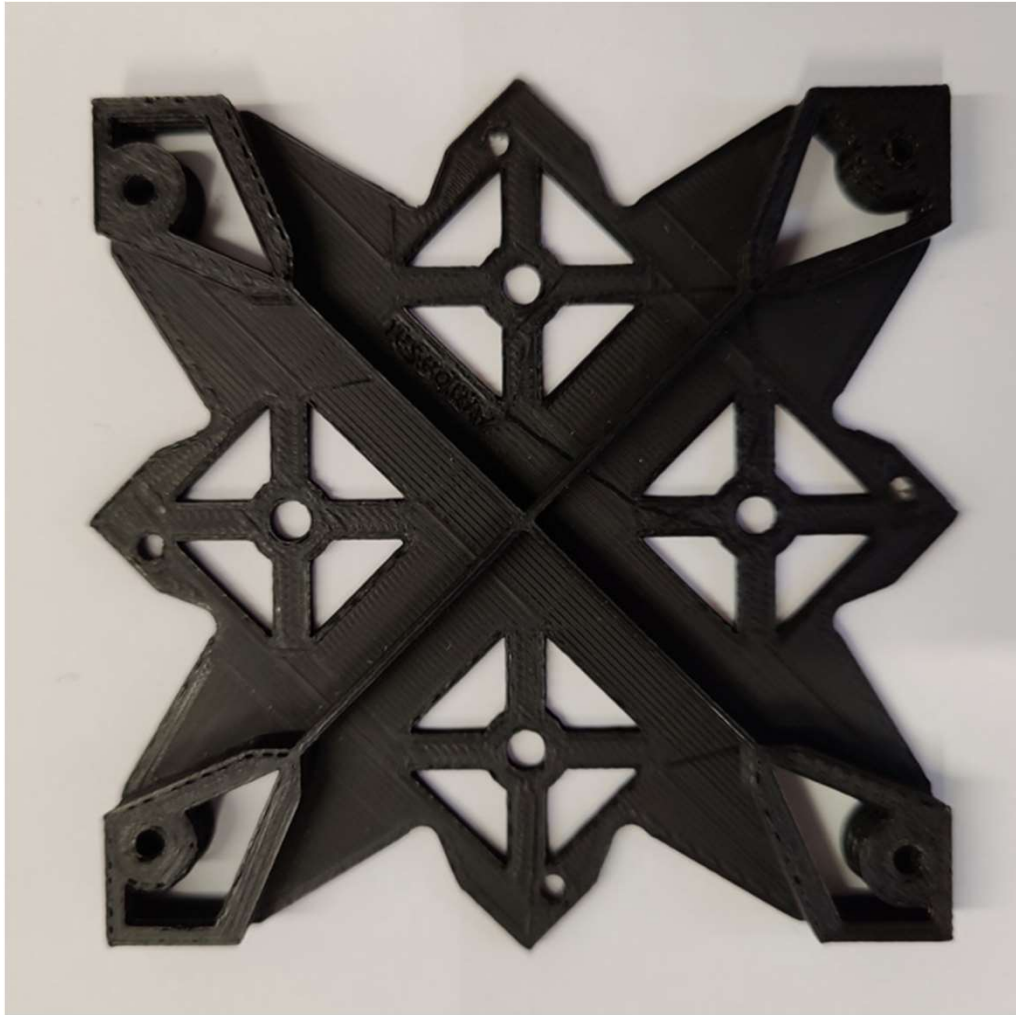


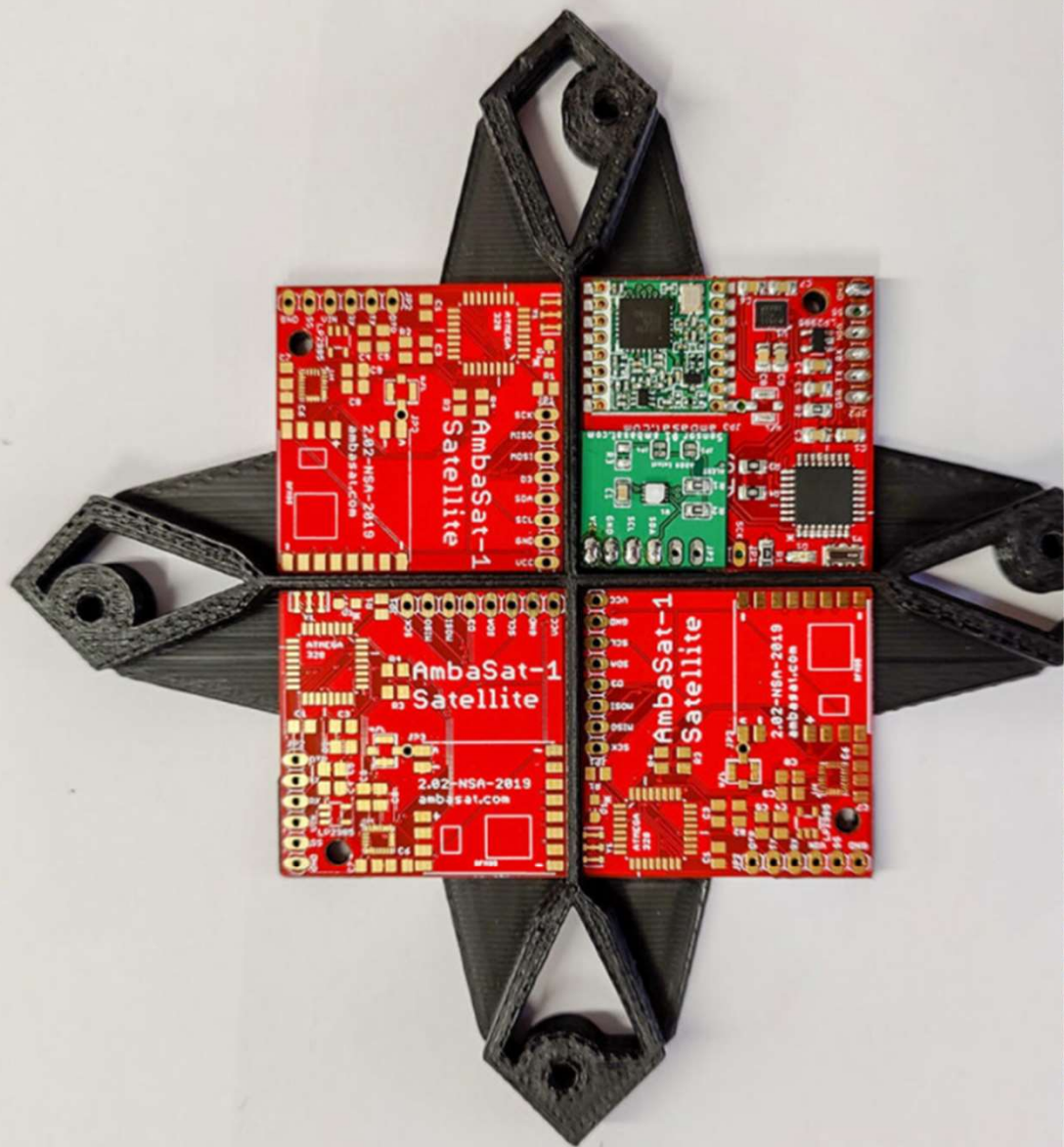
Interorbital

<https://www.interorbital.com/>



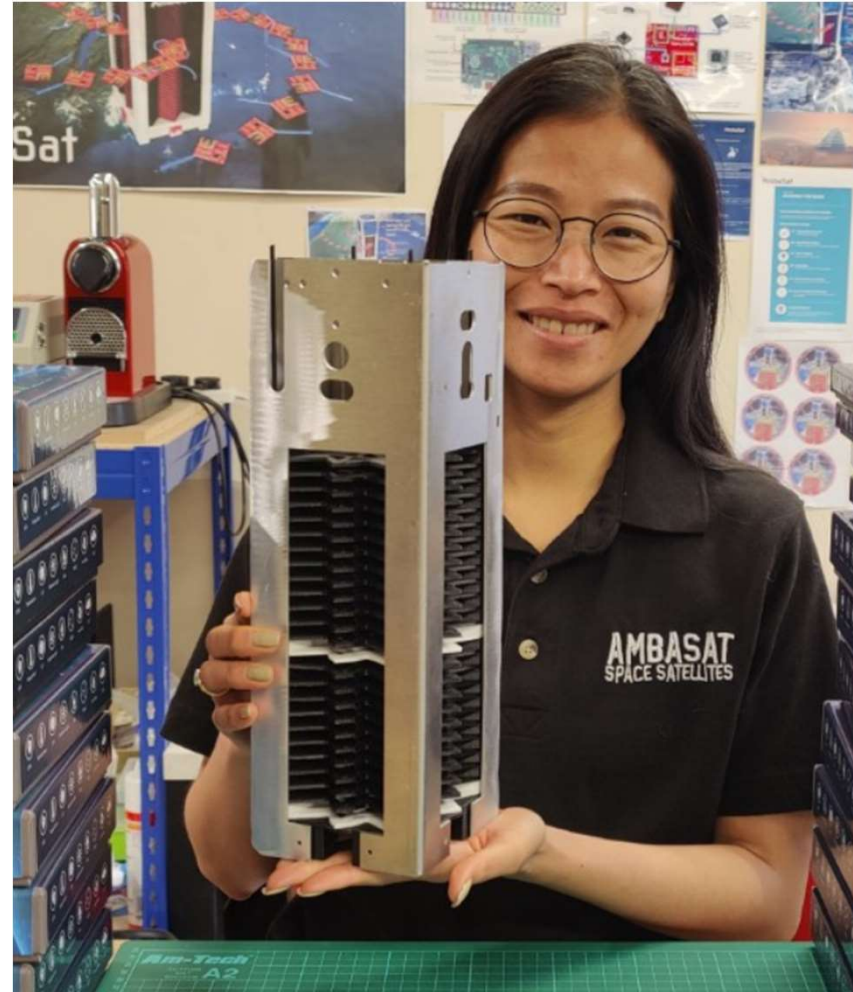
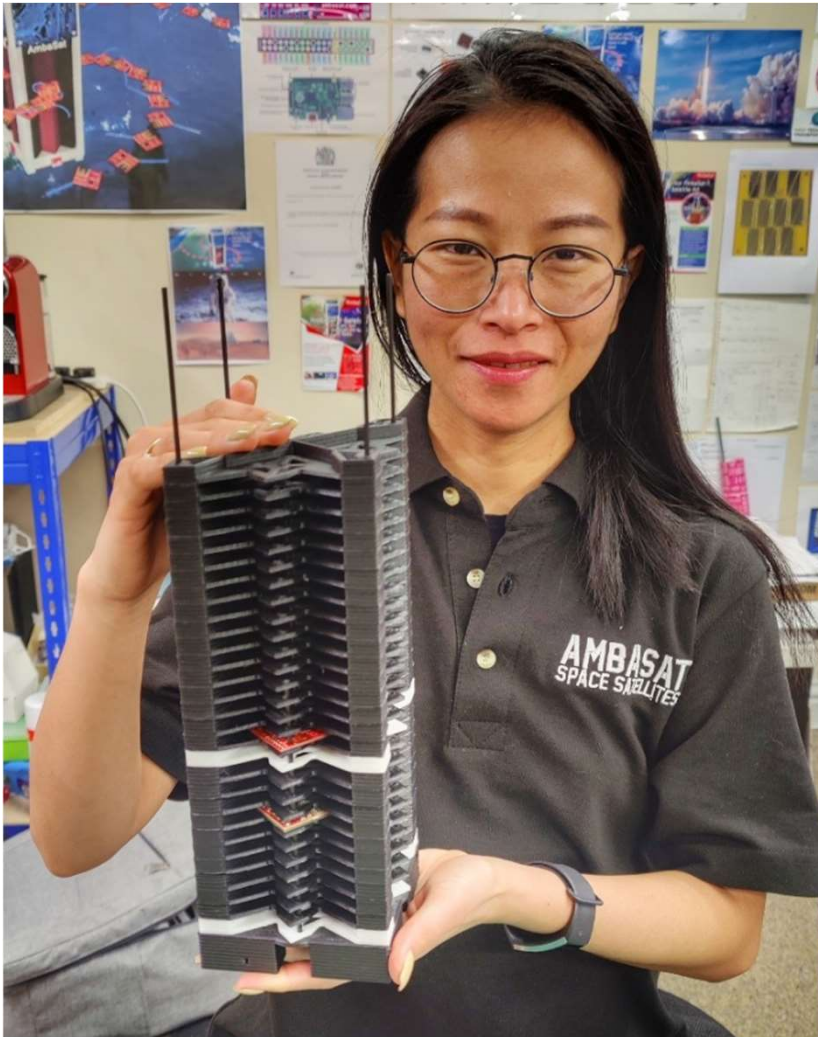
Planning





eldoorn

Planning



Planning

<https://www.interorbital.com/Launch%20Manifest>



Customer	Payload
Sighteo, France	1U CubeSat
Tom Wells, US	1U TubeSat
Take Me to Space! DNA Delivery	1U TubeSat
Menlo School, Atherton, CA	1U TubeSats (x2)
StackBlitz	1U TubeSat
Mendi+Keith Obadike, Pratt Institute	1U TubeSat
AmbaSat LLC	3U CubeSat

About

[Company](#)
[Destinations](#)
[Outreach](#)
[Manufacturing](#)
[Team](#)

Products

[CubeSat kits](#)
[TubeSat kits](#)
[Launch vehicles](#)

More

[Careers](#)
[Contact](#)
[Launch manifest](#)

Media

 [News](#)
 [Press Releases](#)
 [Gallery](#)
 [Facebook](#)
 [LinkedIn](#)
 [Twitter](#)

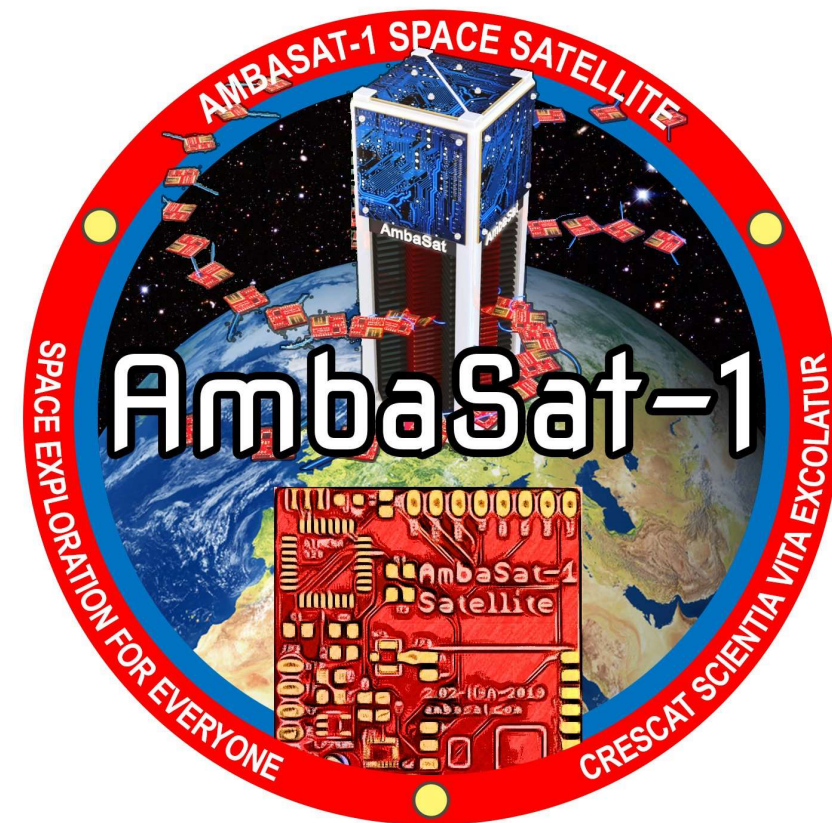


Last Updated: January 27, 2020

Copyright © 1996 - 2020 Interorbital Systems. All rights reserved.

Originele planning

- 6 juli 2019 – Einde kickstarter
- 1 augustus – Start project
- 31 oktober – fase 1
- Bouwen/software backers - uitlevering
- Testen
- Q1 2020 – Lancering????



Ambasat Sensor Development

Meetup woensdag 17 maart 2021, by Marcel Meek



AmbaSat Sensor development

- Requirements
- Development environment
- Software Architecture Sensor
- Output Payload
- URL's sources, questions

Requirements

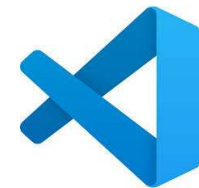
- Gemeten waarden in ruimte efficiënt oversturen naar aarde
 - Lichtsterkte in Lumen
 - Gyroscope (magnetisch, richting en versnelling)
- Ontvangen data visualiseren
 - Gemeten waarden
 - Ontvangstgegevens en locatie van de gateways
- Eigenschappen sensor
 - Laag energie verbruik
 - Wisselende voedingspanning (zonnepaneel vaak in de schaduw)

Development Environment

- Advies Ambasad: PlatformIO met Visual Studio Code
 - PlatformIO (voordeel, libraries worden automatisch opgehaald onder je project)
 - Visual Studio Code
- Ambasad heeft basis voorbeelden in Github zoals
 - TTN connectie
 - I2C scan
 - Diverse optionele sensoren
- Libraries
 - Board definitie
 - Sparkfun Gyroscope LSM9DS1
 - Optische sensor Closecube OPT3001
 - LoRa LMIC (Matthijs Kooiman)

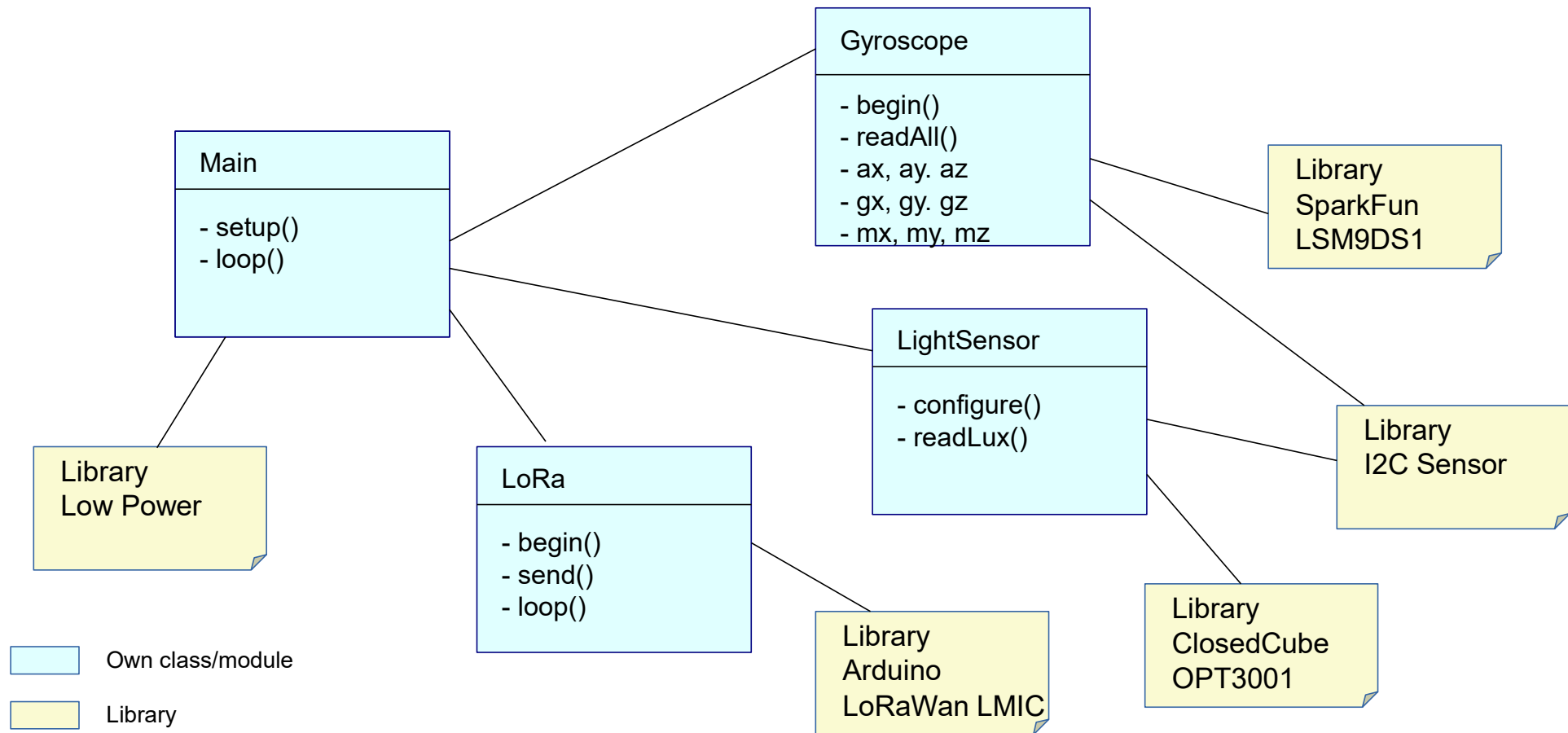


PlatformIO



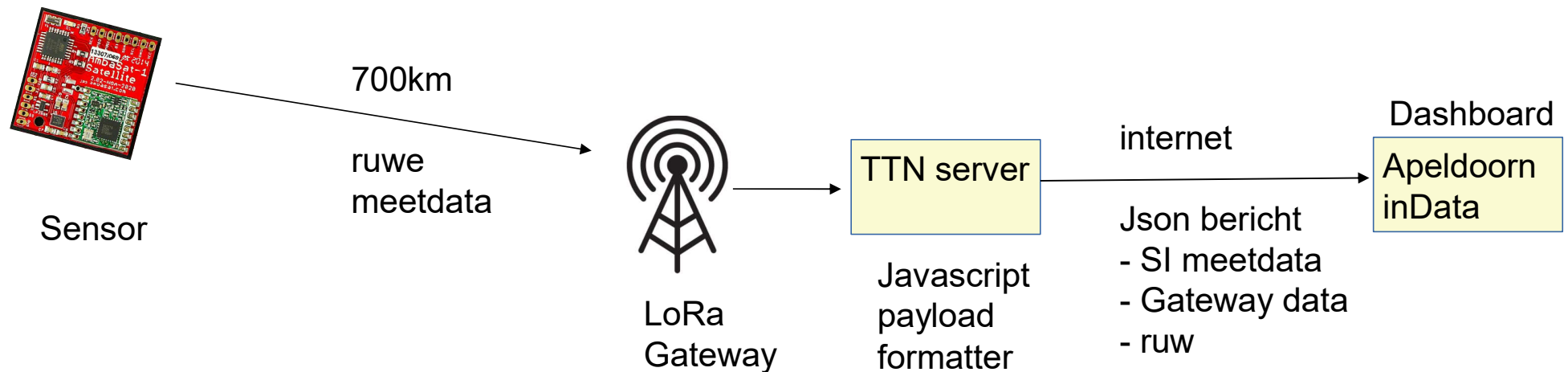
Visual Studio Code

Software Architecture Sensor



Output Payload

- Max LoRa bericht lengte is max 50 bytes
- Daarom alleen ruwe data oversturen
- Ruwe waarden in TTN Payload formatter omzetten naar SI stelsel





and sources and questions

- Apeldoorn source code Ambasat <https://github.com/TTNApeldoorn/Aid-AmbaSat>
- Ambasat source code examples <https://github.com/ambasat/AmbaSat-1>
- Ambasat Build guide <http://ambasat.com/howto/kit-2/#/?id=nbsp-ambasat-1-build-guide>
- Ambasat Forum <https://ambasat.com/forum3/public/>

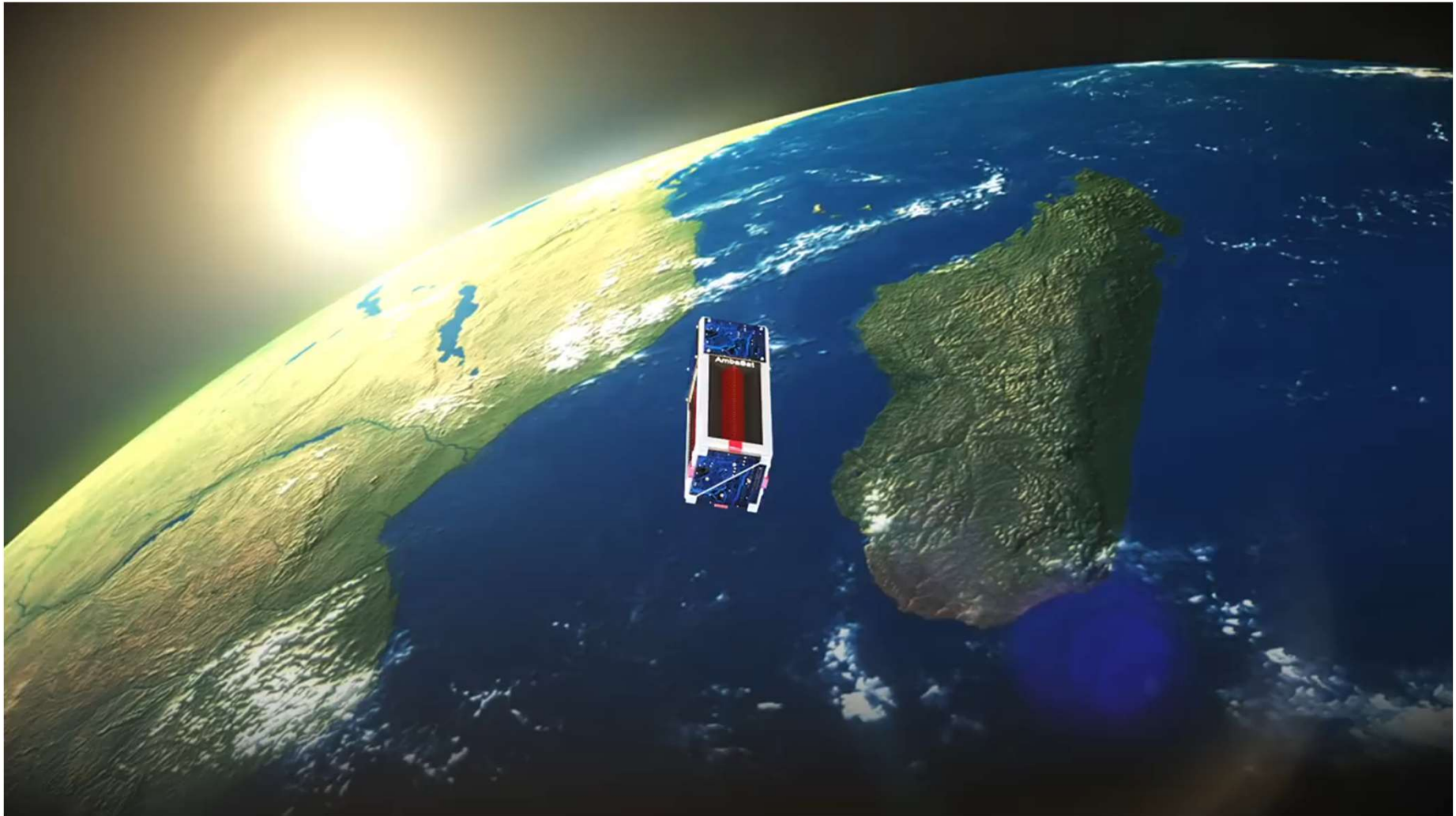
Things to do

- Gedrag testen bij wisselende voeding van Zonnecel
- Gedrag testen gyroscope
- Stroom besparing
- Gyroscope in sleep zetten
- Luistertijd verkleinen/ uitzetten
- US frequency plan ?



AmbaSat-1

Frank Woutersen



Stappenplan



Successful Steps to Build Your Satellite

The AmbaSat Kit build will take you from learning how to use a soldering iron all the way through to assembling and coding your very own satellite

How to Build a Satellite



#1 Unpacking Your Kit

What's inside. The Basics



#2 Electronics Basics

Resistors, capacitors, MCU and other components



#3 Your Toolbox

What you need. How to use it



#4 Assembly

The hardware and PCB. Putting it together



#5 Introduction to Coding

The hardware and PCB. Putting it together



#6 Your AmbaSat Dashboard

Connecting to your Dashboard. Sending data from your satellite



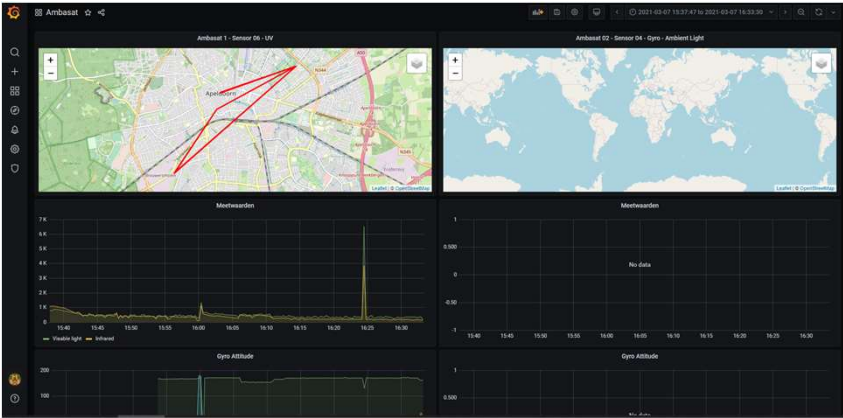
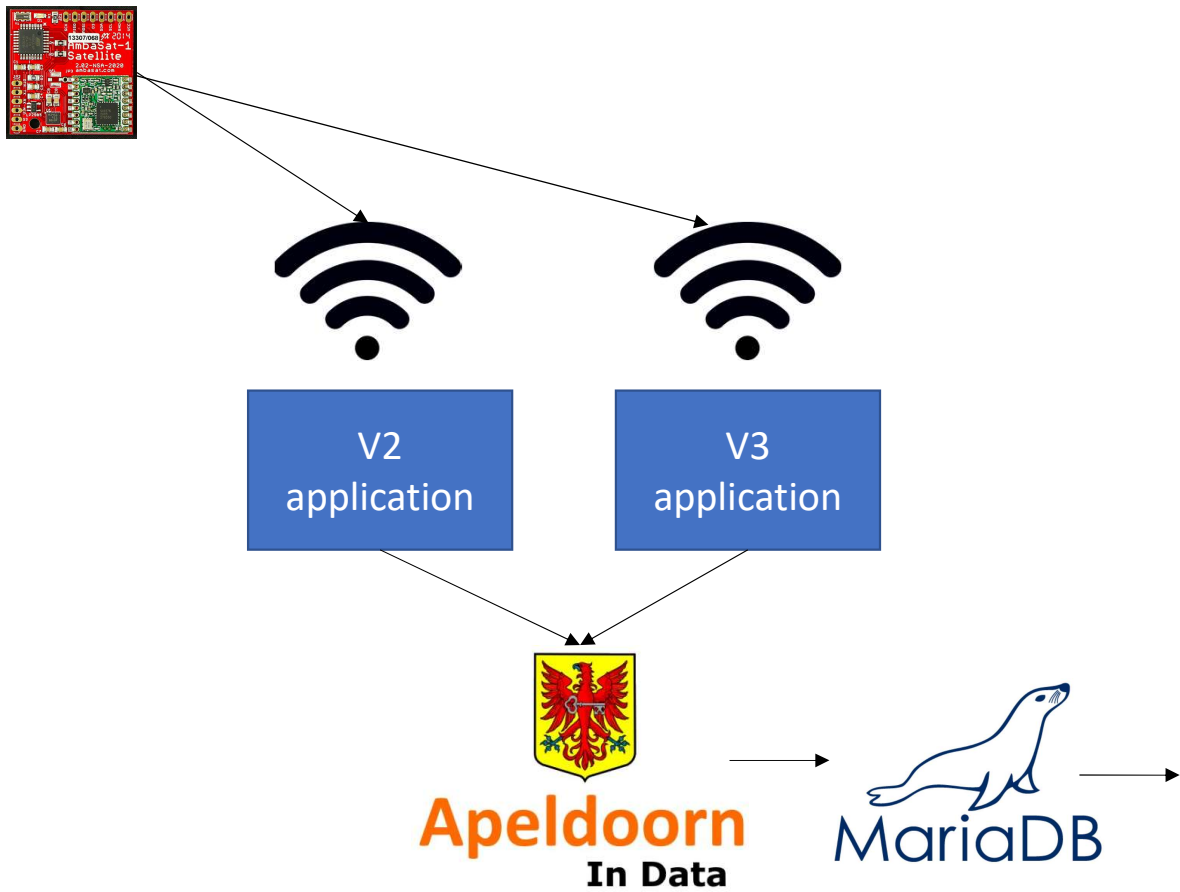
Congratulations!

You've built your very own AmbaSat-1 Satellite! Now you can program it to send any message back to Earth that you like. Add sensors and measure, explore, measure!

Programmeren



Route



TTN v2

<https://console.thethingsnetwork.org/applications/ambasatapeldoorn>



THE THINGS NETWORK CONSOLE COMMUNITY EDITION

Applications Gateways Support **IndustrialIT** ▼

Warning The Things Network is shutting down v2 clusters later this year. Start moving your applications and devices to a v3 cluster! [Click here to read more](#)

Applications > **ambasatapeldoorn** > Devices

Overview **Devices** Payload Formats Integrations Data Settings

DEVICES [+ register device](#)

< > 1 – 2 / 2

ambasat01	Ambasat 01
ambasat02	Ambasat 02

Overview **Devices** Payload Formats **Integrations** Data Settings

INTEGRATIONS [+ add integration](#)

HTTP Integration [ambasat](#)

TTN v3

<https://eu1.cloud.thethings.network/console/applications/ambasat1>



THE THINGS NETWORK

THE THINGS STACK

Overview

Applications

Gateways

Organizations

eu1 CommunityIndustrialit

Ambasat

Overview

End devices

Live data

Payload formatters

Integrations

Collaborators

API keys

General settings

Applications > Ambasat

Ambasat
ID: ambasat1

2 End devices3 Collaborators0 API keysCreated 27 days ago

General information

Application ID
ambasat1

Created at
Feb 10, 2021 18:30:04

Last updated at
Feb 10, 2021 18:30:04

Live data

See all activity →

Waiting for events from ambasat1...

End devices (2)

Search by IDImport end devicesAdd end device

ID	Name	DevEUI	JoinEUI	Created
ambasatpd01	Ambasat IoT Apeldoorn 01	00 B4 03 28 B0 B8 E9 98	none	13 days ago
ambasatpd02				

Applications > Ambasat > Webhooks

Webhooks (1)

Add webhook

ID	Base URL	Template ID	Format
apeldoornindata	http://apeldoornindata.nl/data/ambasatendpoint.php	None	json

Webhook v2



```
{
  "app_id": "ambasatapeldoorn",
  "dev_id": "ambasat02",
  "hardware_serial": "00474ED69B2567A4",
  "port": 1,
  "counter": 922,
  "payload_raw": "XI8SQQn1+9kmMwoAev9G/1j4uRTp9OYJ",
  "payload_fields": {
    "gyro_attitude": {
      "heading": 160.343,
      "pitch": 9.762,
      "roll": -36.624
    },
    "gyro_calc": {
      "ax": -0.171,
      "ay": -0.594,
      "az": 0.799,
      "gx": 0.088,
      "gy": -1.172,
      "gz": -1.628,
      "mx": -0.274,
      "my": 0.743,
      "mz": -0.397
    },
    "gyro_raw": {
      "ax": -2807,
      "ay": -9733,
      "az": 13094,
      "gx": 10,
      "gy": -134,
      "gz": -186,
      "mx": -1960,
      "my": 5305,
      "mz": -2839
    },
    ...
  }
}
```

Webhook v3



```
{
  "end_device_ids": {
    "device_id": "ambasatpd02",
    "application_ids": {
      "application_id": "ambasat1"
    },
    "dev_eui": "00474ED69B2567A4",
    "dev_addr": "26011D73"
  },
  "correlation_ids": ["as:up:01F02XB9GE9E07DYBE45V2DFZQ", "gs:conn:01EZZS79YSXR97WSBP7DCNMVX4", "gs:up:host:01EZZS7A04KRH8SXTJ028E2A1D",
"gs:uplink:01F02XB99V2BC60DQ9ERSEZP4H", "ns:uplink:01F02XB99WDMJTXN64GYJT98N", "rpc:/ttn.lorawan.v3.GsNs/HandleUplink:01F02XB99WFXGH5RFHYRM9GHXF",
"rpc:/ttn.lorawan.v3.NsAs/HandleUplink:01F02XB99GDGWS9WKSPMPMPB1M"],
  "received_at": "2021-03-06T04:39:51.054627884Z",
  "uplink_message": {
    "f_port": 1,
    "f_cnt": 724,
    "frm_payload": "AAAAAOLCVw8ICcP/af8n/zb0AArW+uYJ",
    "decoded_payload": {
      "gyro_attitude": {
        "heading": 130.926,
        "pitch": 73.761,
        "roll": 59.513
      },
      "gyro_calc": {
        "ax": -0.954,
        "ay": 0.24,
        "az": 0.141,
        "gx": -0.534,
        "gy": -1.321,
        "gz": -1.899,
        "mx": -0.423,
        "my": 0.358,
        "mz": -0.185
      },
      "gyro_raw": {
        .. .. -----
      }
    }
  }
}
```

PHP

```
24 $ruweData = file_get_contents('php://input');
25 if($ruweData != null) {
26     // Insert Raw data in ambasatraw
27     $sql = 'INSERT INTO ambasatraw SET Moment=NOW(), Data= \'' . addslashes($ruweData) . '\'';
28     $result = mysqlquery($sql);
29
30     // Get current time to make sure all inserts have the same timestamp
31     $date_utc = new \DateTime("now", new \DateTimeZone("UTC"));
32     $dateNow = $date_utc->format('Y-m-d H:i:s');
33
34     // Decode JSON string
35     $data = json_decode($ruweData);
36
37     $deviceName = null;
38     $ir = null;
39     $visable = null;
40     $batteryVoltage = null;
41
42     // V3 TTN
43     if(isset($data->end_device_ids->dev_eui)) {
44         $deviceName = $data->end_device_ids->device_id;
45         logWmsEvent('LoraEndpoint', 'V3 DevID set: ' . $deviceName, false);
46
47         $gyroAttitudeHeading = $data->uplink_message->decoded_payload->gyro_attitude->heading;
48         $gyroAttitudePitch = $data->uplink_message->decoded_payload->gyro_attitude->pitch;
49         $gyroAttitudeRoll = $data->uplink_message->decoded_payload->gyro_attitude->roll;
50         $gyroCalcAX = $data->uplink_message->decoded_payload->gyro_calc->ax;
51         $gyroCalcAY = $data->uplink_message->decoded_payload->gyro_calc->ay;
52         $gyroCalcAZ = $data->uplink_message->decoded_payload->gyro_calc->az;
53         $gyroCalcGX = $data->uplink_message->decoded_payload->gyro_calc->gx;
```

PHP



```
70 // V2 TTN
71 if(isset($data->dev_id)) {
72     $deviceName = $data->dev_id;
73     logWmsEvent('LoraEndpoint', 'V2 DevID set: '.$deviceName, false);
74
75     $gyroAttitudeHeading = $data->payload_fields->gyro_attitude->heading;
76     $gyroAttitudePitch = $data->payload_fields->gyro_attitude->pitch;
77     $gyroAttitudeRoll = $data->payload_fields->gyro_attitude->roll;
78     $gyroCalcAX = $data->payload_fields->gyro_calc->ax;
79     $gyroCalcAY = $data->payload_fields->gyro_calc->ay;
80     $gyroCalcAZ = $data->payload_fields->gyro_calc->az;
```

PHP

```
98     if(!empty($deviceName)) {
99         switch($deviceName) {
100             case 'ambasat01':
101             case 'ambasatapd01':
102                 // V2 TTN
103                 if(isset($data->dev_id)) {
104                     $visable = $data->payload_fields->light->visable;
105                     $ir = $data->payload_fields->light->ir;
106                     $batteryVoltage = $data->payload_fields->vcc;
107                 }
108                 // V3 TTN
109                 if(isset($data->end_device_ids->dev_eui)) {
110                     $visable = $data->uplink_message->decoded_payload->light->visable;
111                     $ir = $data->uplink_message->decoded_payload->light->ir;
112                     $batteryVoltage = $data->uplink_message->decoded_payload->vcc;
113                 }
114
115                 if(isset($visable)) {
116                     $sql = 'INSERT INTO measurement526 SET Moment=\''.$dateNow.'\'', Tagvalue='.addslashes($visable);
117                     $result = mysqlquery($sql);
118                 }
119                 if(isset($ir)) {
120                     $sql = 'INSERT INTO measurement527 SET Moment=\''.$dateNow.'\'', Tagvalue='.addslashes($ir);
121                     $result = mysqlquery($sql);
122                 }
123                 if(isset($batteryVoltage)) {
124                     $sql = 'INSERT INTO measurement528 SET Moment=\''.$dateNow.'\'', Tagvalue='.addslashes($batteryVoltage);
125                     $result = mysqlquery($sql);
126                 }
127             }
128         }
129     }
```

PHP

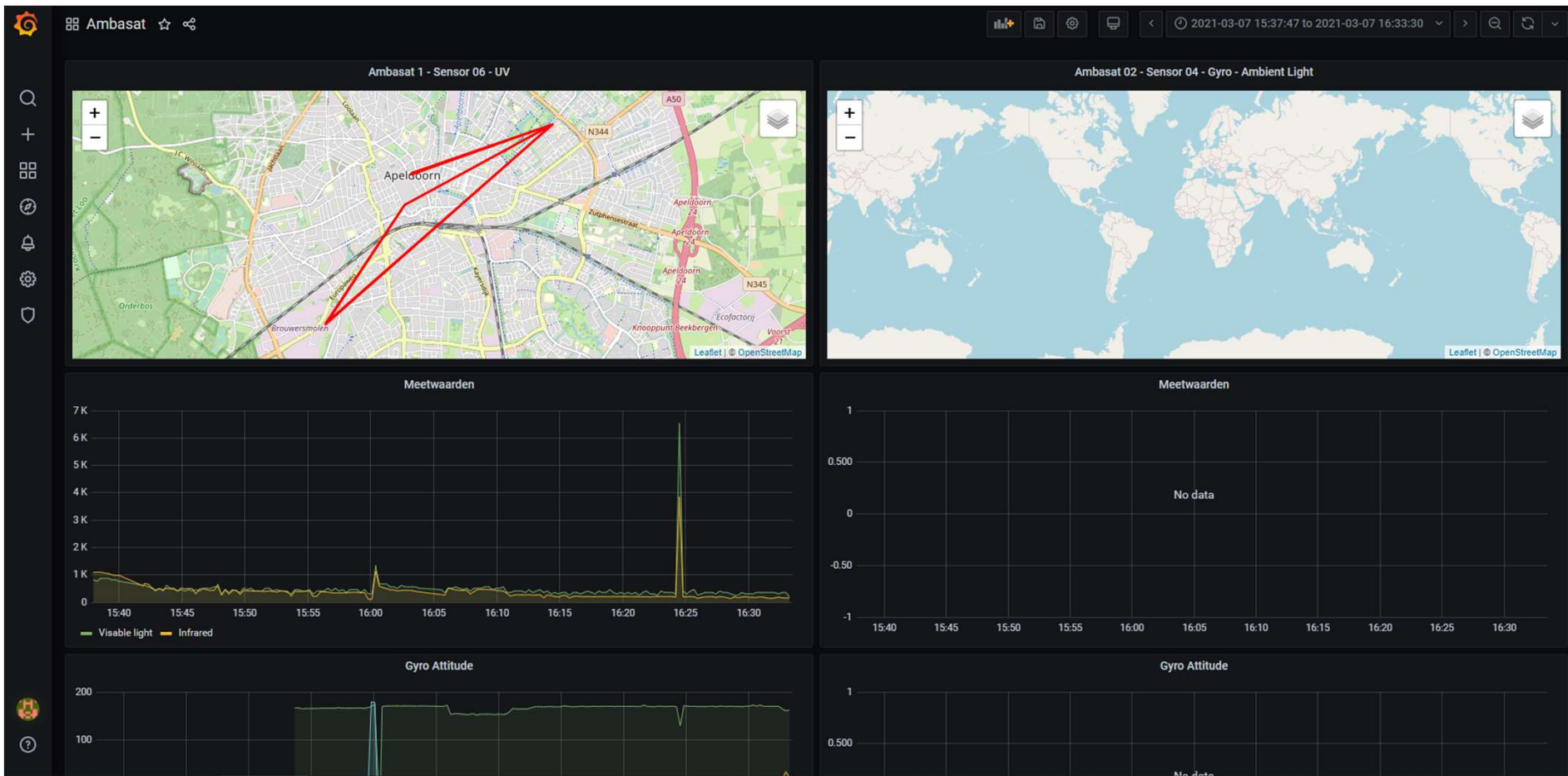


```
212 // gateway locations V2
213 if(isset($data->dev_id)) {
214     if(isset($data->metadata->gateways)) {
215         foreach((array) $data->metadata->gateways as $gateway) {
216             if(isset($gateway->latitude) && isset($gateway->longitude)) {
217                 $sql = 'INSERT INTO locationnodeambasat01 SET Moment=\'\'.$dateNow.\'', Lat=\'\'.$gateway->latitude.\'', Lon=\'\'.$gateway->longitude.\'', Alt=\'\'.$gateway->altitude.\'' ';
218                 $result = mysqlquery($sql);
219             }
220         }
221     }
222 }
```

Dashboard

<http://apeldoornindata.nl:3000/d/Lfr66rsMz>

User: lezen Pass: lezen



Dashboard



Ambasat space flight simulator

Remko Welling. Meetup woensdag 17 maart 2020



Ambasat space flight simulator

De situatie:

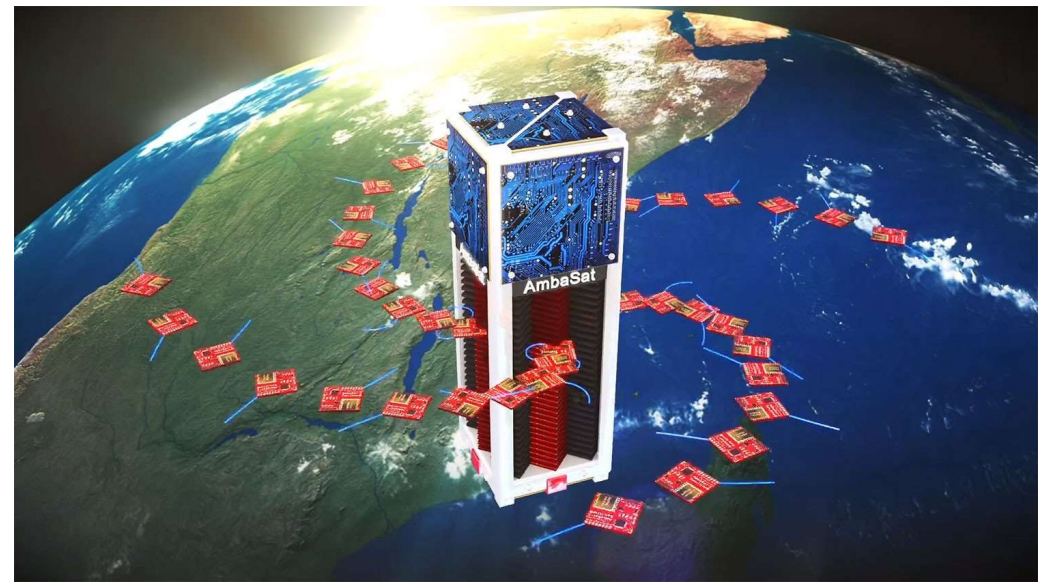
- Satellieten “tuimelen” door de ruimte, draaiend om de x-, y- en z-as.
- Onze satelliet heeft een gyrometer en lichtsterkte meter

Het probleem:

- Hoe simuleer ik de ruimte op aarde en kan ik mijn software testen?

Een oplossing:

- Gooi de satellite weg of laat hem vallen van grote hoogte.



Ambasat space flight simulator

De oplossing:

- Installeer de sprite satellite in een frame dat kan draaien om alle assen
- Zelf maken van 3 cirkels uit hout of metaal is lastig → 3D printen!
- Geen ontwerpen beschikbaar → Zelf tekenen in Sketchup
- Sketcup → Netfabb STL repair → Cura → printen.

Netfabb online STL repair: <https://service.netfabb.com>

Ambasat space flight simulator

- Alles printen in 1 keer printen!
- Assen grijpen in elkaar.
- Zwaartepunt sprite satellite met 2x AA batterij is lastig





Ambasat space flight simulator

MakerBot Thingiverse

pe1mew

Relevant

All Things

Filter By



Ambasat2 Space flight simulator



+ Collect Thing

5

Share

<https://www.thingiverse.com/thing:4709634>