ULTRA

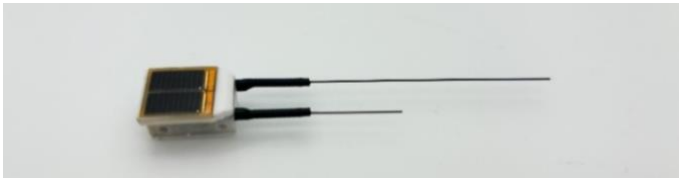
Debut ULTRA series is lightest tracker with standard GNSS function (more accurate than snapshot GPS technology), solar charging, accelerometer and other environment sensors.

ULTRA series uses either long-range Bluetooth or 4G cellular network as the data transmission method.

Thanks to its compact size and versatile functionality, it holds potential for a wide array of applications.

CONTENTS

BASIC SPECIFICATIONS

MODEL	ULTRA
Appearance	 (ULTRA P1 with strengthened antenna root protection)
Battery Type	15mAh lithium polymer rechargeable battery
Battery Life	Over 150 positions under optimal GNSS satellite view at 5-minute interval
Solar Type	GaAs solar unit (30% efficiency) with good performance under weak light
Housing	X-Glue
Color	White, or customized color
Antenna	External, 0.2mm titanium alloy with protective coating (by default) Length: 45mm, 30mm for ULTRA (INTELINK), 96mm, 48mm for ULTRA (4G)
GNSS Module	Precision: CEP (50%) 5m Maximum update rate: 10 Hz
Working Temperature	-20°C~60°C (enough for very cold winter if close to warm-blood animal body)
Waterproof	> IP 68 (2 ATM for injection molding)
Data Types	- GNSS: longitude, latitude, altitude, altitude (ellipsoid), course, satellite quantity - ENV: voltage, light intensity, temperature - ODBA (overall dynamic body acceleration) - ACC: x/y/z acceleration data (upon request) - Beacon: with Debut series gateway devices
Data Storage	Collected data will be stored in memory before transmission. - Flash memory: 32 MB - Regular data storage: 460 days at default setting (1h GNSS+1h ENV+10 min ODBA) - BOOST data storage: 280,000 pieces - ACC data storage: 28,700 pieces
Working Schedule	Programmable from 1 min
Firmware Upgrade	Instantly via INTELINK (Bluetooth)

ULTRA

ULTRA utilizes long-range Bluetooth for data transmission. When paired with a professional gateway device like the HUB from Druid, ULTRA enables data downloading from distances of up to 1200 meters in an ideal field environment, meaning that both the ULTRA device and the HUB are 2 meters away from the ground, no obstacles in between, no electromagnetic interference, and the air is not too moist.

The good part of ULTRA is that every who has a mobile phone with Bluetooth function can scan for it using Ecotopia App, but access will be required for operating ULTRA or download data it collected.

TRANSMISSION BANDS

Specifications	INTELINK
Frequency Bands	2.4 GHz
Maximum Output Power	8 dBm (default)
Maximum Data Rate	1 Mbps/1 Mbps
Transmission Distance (ideal condition in field)	1200 m

TRANSMISSION STRATEGY

ULTRA is configured to broadcast its INTELINK (Bluetooth) signals all the time. Professional gateway devices, such as a HUB and TAG G, are usually configured to scan for INTELINK devices following a duty cycle pattern, say, 30s in every minutes. ULTRA can connect to them only when HUB or TAG G is at “ON” duty. This duty cycle is configurable.

Gateway device like a mobile phone, with Bluetooth activated, will be able to pick up a ULTRA immediately. For certain ULTRA sub-models that requires battery saving and thus configured also to broadcast in duty-cycle mode, you may have to wait longer before it can be picked up by a gateway device.

SUB-MODELS

ULTRA features high flexibility in customization due to its compact size. Below are the existing models. If you have any customization ideas, please feel free to contact us.

Name	Weight	Dimensions (LWD, antennae excluded)	Energy Supply
ULTRA P1 [1]	1.7~1.8g	17 x 13 x 8 mm	15mAh rechargeable by solar
ULTRA XC 40 [2]	2~2.1g	20 x 14 x 8 mm	40mAh rechargeable by solar
ULTRA XF [3]	1.4~1.5g	--	15mAh rechargeable battery
ULTRA XF 80	2.5~2.6g	--	80mAh rechargeable battery
ULTRA XF P500	4.8~4.9g	--	500mAh primary battery

Note: [1] P1 refers the version using X-Glue technique. (For details, check later chapter of this file.) [2] XC refers to a special sealing technique called “X-Coating”. For details, check later chapter of this file.) [3] XF refers to a special sealing technique called “X-Filming”. For details, check later chapter of this file.) The weight slightly increased when users require that the battery be wrapped with silicone tubing for further protection.

ULTRA 4G

Note that, though ULTRA 4G also supports INTELINK for connecting and data downloading, the distance is not comparable to ULTRA the dedicated INTELINK type.

TRANSMISSION BANDS

4G Band	Uplink（MHz）	Downlink（MHz）	Output Power（dBm）
LTE-FDD B1	1920 ~1980	2110 ~2170	23 dBm±2.7 dB
LTE-FDD B3	1710 ~1785	1805 ~1880	23 dBm±2.8 dB
LTE-FDD B5	869 ~ 894	824 ~ 849	23 dBm±2.9 dB
LTE-FDD B8	880 ~915	925 ~960	23 dBm±2.1 dB

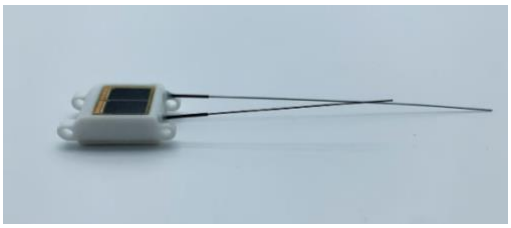
Maximum output power: 23 dBm

Maximum uplink/downlink data rate: 5 Mbps/10 Mbps

SUB-MODELS

Name	Weight	Dimensions (LWD, antennae excluded)	Energy Supply
ULTRA 4G P1 [1]	2.7±0.1g	17.7 x 12.8 x 8.6 (mm)	15mAh rechargeable by solar
ULTRA 4G XC [2]	2.3±0.1g	17.7 x 12.8 x 8.6 (mm)	15mAh rechargeable by solar
ULTRA 4G XC 95	4.0±0.1g	28 x 12.5 x 8 (mm)	95mAh rechargeable battery
ULTRA 4G XF [3]	1.9~2.0g	--	15mAh rechargeable battery
ULTRA XF 210	5.6~5.7g	--	210mAh rechargeable battery
ULTRA 4G C3 [4]	3.8±0.1g	31 x 15 x 9 (mm)	30mAh rechargeable by solar

Note: [1] P1 refers the version using X-Glue technique. (For details, check later chapter of this file.) [2] XC refers to a special sealing technique called “X-Coating”. For details, check later chapter of this file.) [3] XF refers to a special sealing technique called “X-Filming”. For details, check later chapter of this file.) The weight slightly increased when users require that the battery be wrapped with silicone tubing for further protection. [4] Photo to the right shows ULTRA 4G C3.



ANTENNA OPTIONS

ANTENNA MATERIAL OPTIONS

Type	Description	Weight Change
A	0.2mm titanium alloy wire with waterproof coating	Default [1]
B	0.4mm titanium alloy wire with waterproof coating	0.1g for 4G

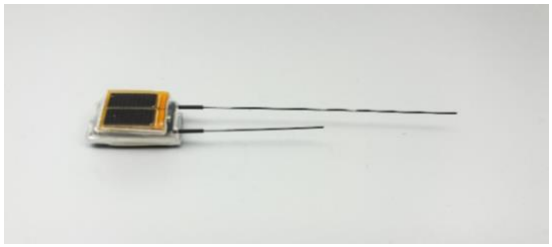
ANTENNA ROOT PROTECTION OPTIONS

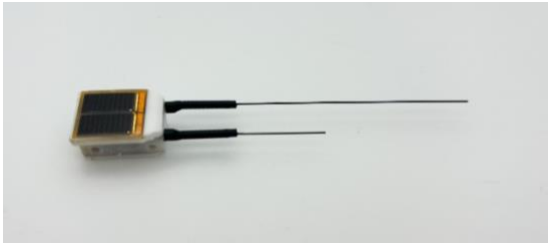
Type	Description	Weight Change
Default	Short plastic tube	Default [2]
Extra strengthened	Small spring with longer plastic tube	+ 0.3g

Note: [1] By default, 0.2 mm titanium alloy wire with waterproof coating will be used, to achieve the balance between weight and toughness. The weight change is calculated based on it. Generally, the thicker the antenna, the more resilient it is.
[2] By default, only plastic tube is used to achieve the balance between weight and toughness. The weight change is calculated based on it.

In the below photos:

- the left one shows default antenna (A)+ default antenna root protection;
- the right one shows antenna material B + extra strengthened antenna root protection.





PRICING

Sub-Model	Device (Feed Subscription)		Ecotopia Data Services [1] (per unit per year)	Debut Renewal Plan [2]
	Retail	Promotion		
ULTRA P1	1199	599	59.88	N/A
ULTRA XC 40	1199	599	59.88	N/A
ULTRA XF	1199	599	59.88	N/A
ULTRA XF 80	1199	599	59.88	N/A
ULTRA XF P500	1199	599	59.88	N/A
ULTRA 4G P1	2399	1199	131.88	N/A
ULTRA 4G XC	2399	1199	131.88	N/A
ULTRA 4G XC 95	2399	1199	131.88	N/A
ULTRA 4G XF	2399	1199	131.88	N/A
ULTRA XF 210	2399	1199	131.88	N/A
ULTRA 4G C3	2399	1199	131.88	N/A

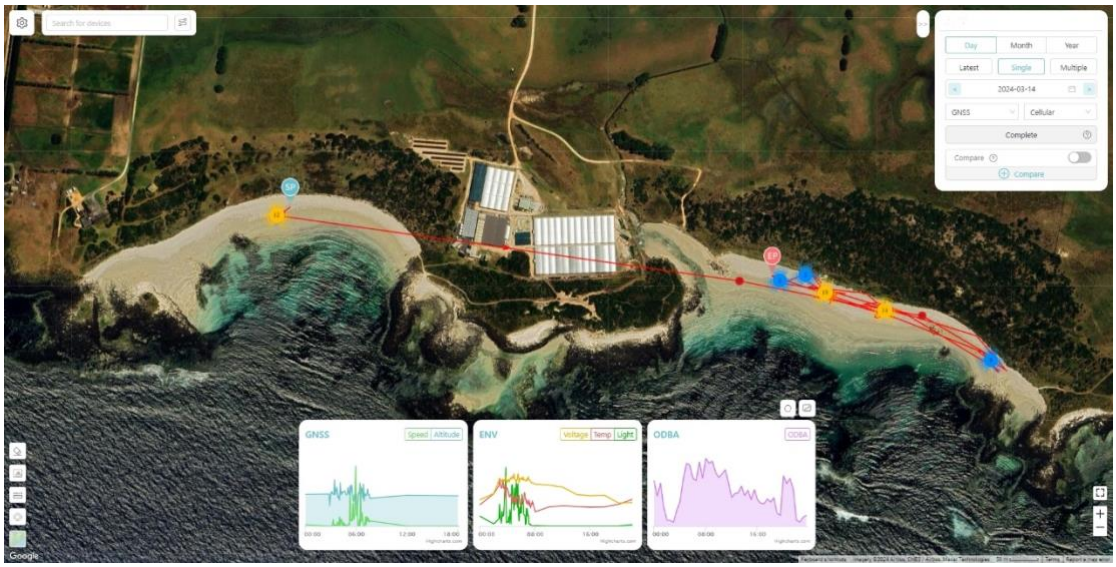
Note: The prices are in US dollar.

[1] To know more about Ecotopia Data Service, please click:
https://www.ecotopiago.com/help/en/#/essential/data_service/overview

[2] To know more about Debut Renewal Plan, please click:
https://www.youtube.com/watch?v=IM75JLGhsHU&t=6s

DATA SAMPLES

Equipped with a high-efficiency solar unit, ULTRA has the capability to gather dozens of GNSS data daily. The screenshot below displays one-day track of a small shorebird wearing ULTRA P1, in March, at south latitude 37°. The device generated over 60 GNSS data in one day.



Additionally, the accompanying small charts illustrate the variations in flying speed, altitude, light intensity, temperature, and activity index throughout this timeframe.

ULTRA also witnessed many species completed their migration cycle. We will share the data sample when we received permission from the users.

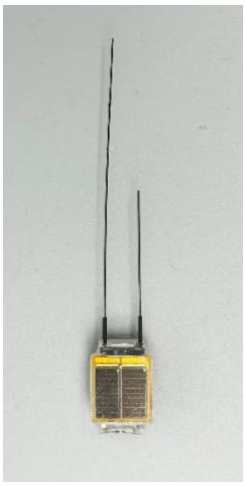
X SERIES CRAFTS

X-GLUE

X-Glue is a sealing technique is used for manufacturing P versions of devices, e.g., MINI 4G P1, NANO P1, ULTRA P1. This technical is used primarily for reducing weight, especially when compared with traditional epoxy-resin sealing method.

X-COATING

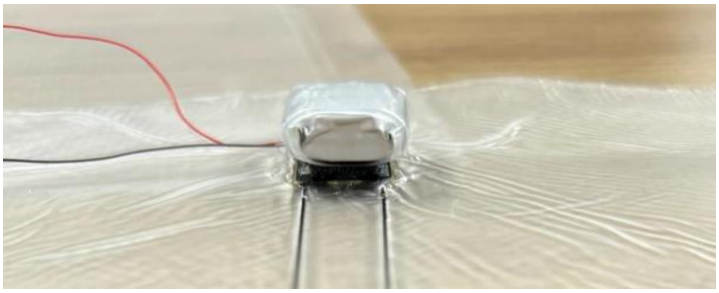
X-Coating is a specialized technique that applies an extremely thin, invisible layer to electronic components, rendering them waterproof. Devices treated with X-Coating appear unprotected, yet extensive testing, including submersion under 30 cm of water for extended periods, confirms their normal functionality during and after exposure.



However, a drawback of X-Coating is its susceptibility to scratching due to the thin layer. To mitigate this vulnerability, we typically encase the device in silicone tubing for added protection against scratches.

X-FILM

X-Filming is an advanced technique that envelops the PCBA (printed circuit board assembly) containing chips and sensors within a specialized film, rendering it waterproof. The film itself boasts exceptional anti-light-aging properties and remarkable durability. It's important to note that the solar unit and battery are typically not encapsulated within the film due to the high-temperature environment (over 100°C) and specific pressure required during the process.



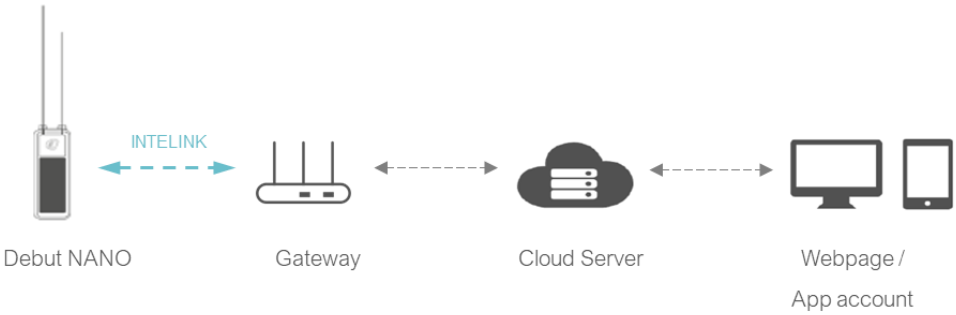
When preparing devices with the X-Filming technique, we will intentionally leave an excessively large film to allow users the flexibility to trim it to their desired shape.
Some researchers opt to trim all excess film, leaving 1-2mm margin from edge, and then affix the device directly to the animal using glue or attach two short plastic hollow

tubes along the sides for a leg-loop harness. Others may utilize the excess film material to fashion harnesses or other attachment styles.

The provided weight in the table above is measured after the excess filming is removed. The ± range accounts for variations, primarily when users opt to protect the battery with silicone tubing.
X-Filming is commonly employed by researchers seeking to customize their own devices, utilizing Debut series PCBA while incorporating their own battery or adding to other devices.

INTELINK: UBIQUITOUS NETWORKING

INTELINK®, derived from "intelligent linking," represents a patented communication technology rooted in Bluetooth innovation, distinguished by its extended range and remarkably low power consumption.
Empowered by INTELINK®, ULTRA seamlessly establishes connections with conventional smartphones and other Debut series products. This integration unlocks a myriad of additional functionalities, fostering the generation of novel data types through the interaction among diverse devices.
Below chart illustrate how the data flow goes using NANO as an example.



(For options of the gateway products, see page 13.)

DATA RELAY

Data gathered by ULTRAs can be retrieved by gateways through INTELINK, either through manual or automatic means.
Individuals with smartphones, using an authorized account, can easily scan for nearby ULTRA devices and download stored data. This data is subsequently uploaded securely to the cloud server via the phone's network connection, whether it's cellular or Wi-Fi.
Alternatively, you can deploy a gateway at a fixed location in the field to continuously and autonomously scan for ULTRA devices. Once connected, the gateway will retrieve data from the ULTRA and automatically upload it via the cellular network.

BREEDING & NEST-USAGE RESEARCH

By situating a gateway near the nest, it will log the timestamps for when a ULTRA device enters or exits its scanning zone. This yields important data for understanding nest usage and parenting strategies, particularly pertinent for breeding research purposes.

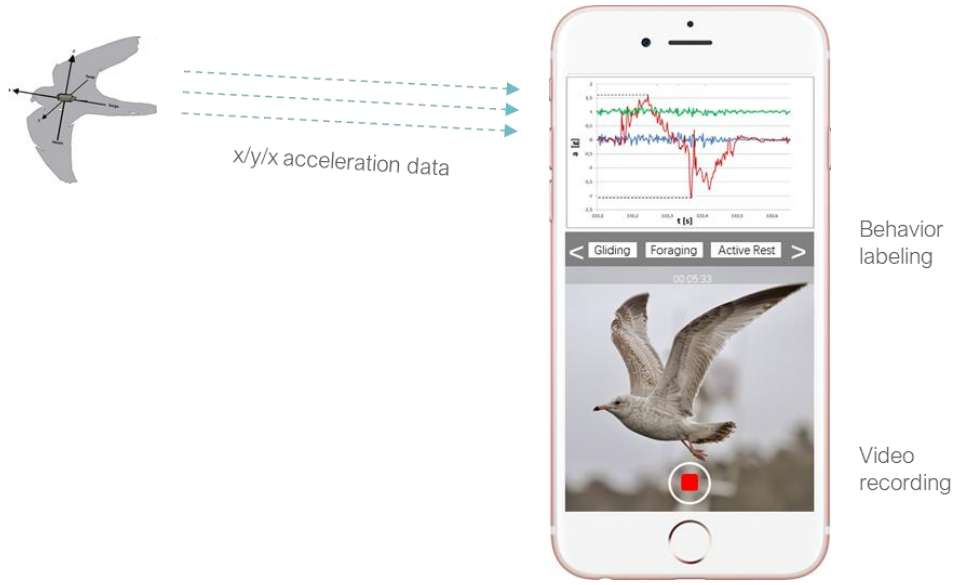
RAW ACCELERATION DATA

ULTRA possesses the capability to gather raw x/y/z acceleration data, ideal for behavioral research, particularly when synchronized with GPS, environmental variables, and individual activity patterns. Utilizing INTELINK, users can not only download raw acceleration data from the device memory, but also access real-time, continuous data by establishing a connection between the ULTRA and a gateway.

IN-SITU BEHAVIOR MODELING

When accessing real-time continuous raw acceleration data as described above, users can also annotate the data with behavior tags via the Ecotopia/IntelinkGO App.

With INTELINK facilitating the connection, real-time x/y/z acceleration data from the ULTRA device linked to your phone is visualized on the phone screen via the Ecotopia/IntelinkGO App. Simultaneously, the App records videos using the phone's camera. While observing the birds through your phone, you can tap to apply behavior tags in real-time. These behavior tags, along with the data and video, are combined under precise timestamps and saved on your phone. Later, you can upload to webpage for subsequent analysis, further calibration, and validation.



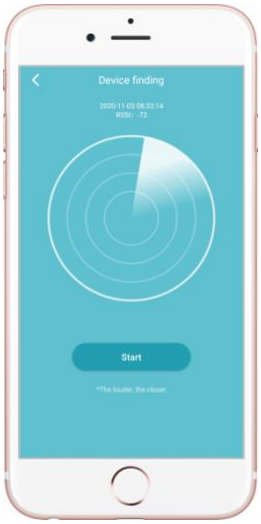
With the assistance of Druid's AniAct® behavior algorithm platform, users can create species-specific x/y/z acceleration-based behavior algorithms. Moreover, these algorithms can be uploaded back into the device and executed onboard. Subsequently, the device automatically processes acceleration data sampled at 25Hz or higher on board, and transmits behavior tags as the computation results.

This eliminates the need for users to compromise energy balance or incur high data fees to access raw acceleration data from distant locations. Additionally, it alleviates the burden of processing vast volumes of raw data, providing computed results effortlessly.

This functionality introduces a new dimension of data, offering fresh insights into bird research and conservation efforts.

GROUND SEARCH

Utilizing INTELINK technology alongside the Ecotopia/IntelinkGO, ULTRAs and smartphones seamlessly create a beacon system.
Activating the "Finding Device" feature within the App triggers an audible alert on the smartphone if a ULTRA is detected in proximity. The volume of the alert increases as the ULTRA gets closer, offering a convenient means to locate birds or fall-off devices in the field. Upon nearing the devices, users can effortlessly download all stored data as well.



CITIZEN SCIENCE

INTELINK technology facilitates diverse interactions between bird tracking devices and smartphones, offering novel avenues for volunteers and the general public to contribute to scientific research and conservation efforts.
Here are some potential ways:

- With over 3 billion smartphone users worldwide, each device serves as a potential mobile "gateway". By simply tapping on the Ecotopia/IntelinkGO App to scan for birds in their vicinity, individuals can provide precise reports of bird resighting, including accurate location and time information. These reports are promptly forwarded to the relevant researchers, who can then share them within the species' online community.
- Beyond resighting reports, users can utilize the Ecotopia/IntelinkGO App to download/upload data stored in ULTRAs. Imagine the excitement for researchers when their data is safely updated by helpers they've never met.
- Advanced users can further contribute by applying behavior tags through the in-situ modeling function, drawing upon their own knowledge and observations. This collective input from participants worldwide could culminate in a shared database with varying levels of contribution, enriching research endeavors globally.

Visit the IntelinkGO webpage for more information: https://www.intelinkgo.com/.

GATEWAY PRODUCTS

The gateway can be an ordinary smart phone with Bluetooth function, or a Debut HUB, QUEST, or TAG G. Select the gateway that suit your project to go with ULTRA. (Note that the distance is only for ULTRA Intelink type, not the 4G type.)

Type	Photo	Range (Optimal)	Operation	Description
Phone		150m	Manual	Conveniently accessible anytime, anywhere, at no extra cost, the system taps into a vast potential network of over 3 billion mobile gateways across the globe.
Phone +QUEST		500m	Manual	A half-palm-sized rechargeable device (26 grams) engineered to extend the INTELINK range of a standard mobile phone.
Phone +QUEST III		700m	Manual	A Yagi antenna (62cm long, 230 grams) crafted to amplify the INTELINK range of a standard mobile phone. This is highly directional antenna, which is particularly suitable for ground searching tasks.
TAG G		600m	Manual / Auto	A palm-sized solar charging device (32g) designed for easy hanging in any garden area. Affordable enough to blanket every residential region, fostering citizen science projects.
HUB		1200m	Manual / Auto	A router-sized gadget (730 grams) encased in a robust metal housing, powered by battery, solar energy, or cable. Featuring high-resolution scanning capabilities, it stands as the most durable option for wilderness environments.