



AUTONOMOUS CONTROL SYSTEMS LABORATORY

CORPORATE INFORMATION

Summary

- Sales in Q1 resulted in 60 MM JPY
 - ✓ Steady growth of “Solution development”(STEP1, 2) and “Mass production” on YoY basis
 - ✓ “Solution development”(STEP1, 2) : 25MM JPY to 27MM JPY
 - ✓ “Mass production” : 10MM JPY to 24MM JPY
 - ✓ Decrease in total sales as no “National Project” were booked in Q1, compared to 65 MM JPY booked in last year Q1
 - ✓ Development of large sales projects with existing clients are on track (No change in annual forecast)
- Steadily developed new clients (e.g., ANA, UNISYS), in addition to drones being used in actual operations of existing clients (e.g., NJS)
- Accelerated business footprints in ASEAN regions through collaboration with Leave a- Nest
- Released next generation industrial platform drone “PF2” and initiated development of “MINI” driven by high demand for smaller size drones

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Financial Results

Achieved 60MM JPY Sales in Q1. Total sales decreased as no “National Project” were booked in Q1, compared to 65 MM JPY booked last year

[MM JPY]

	FY20/03 Q1		FY19/03 Q1	FY19/03 Annual
	Actual	YoY	Actual	Actual
Sales	60	▲41%	104	807
Gross Profit	8	▲38%	13	403
Gross Margin	13.7%	+0.7pt	13.0%	50.0%
Operating Loss(▲)	▲197	-	▲143	▲330
Ordinary Loss(▲)	▲80	-	▲70	▲176
Net Loss(▲)	▲81	-	▲71	▲183

Sales trend

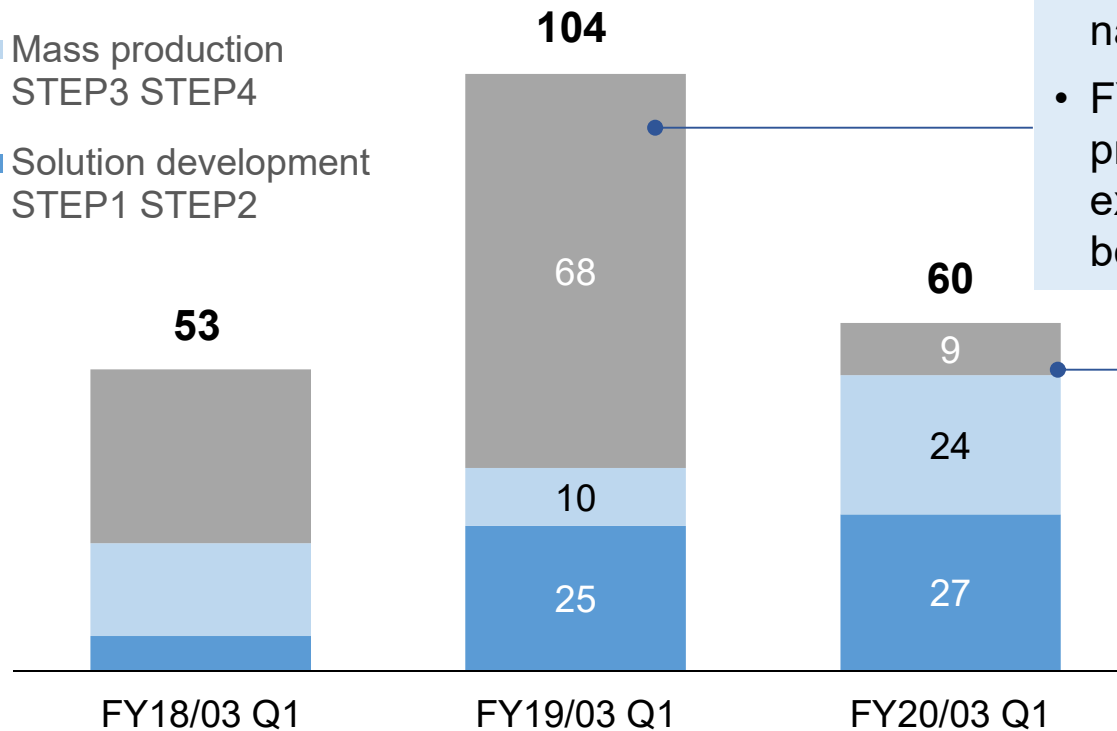
“Solution development” (STEP1, 2) and “Mass production” (STEP3, 4) grew on YoY basis. “Others” decreased due to no national projects booked

Sales by STEP
[MM JPY]

■ Others

■ Mass production
STEP3 STEP4

■ Solution development
STEP1 STEP2

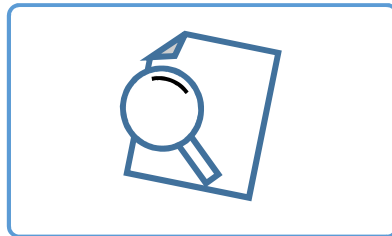


- FY19/03 Q1 “Others” includes 65MM JPY sales from one national project
- FY20/03 national project sales expected to be booked in Q2

Solution development

Increase in both sales and number of projects, driven by new client development and project expansion from existing clients

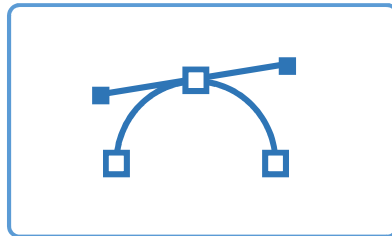
STEP 1 Proof of Concept



Proof of Concept (Detail out drone usage)

- Verification of concept for drone usage is feasible or not
- Closed trials
- Use of ACSL platform drones

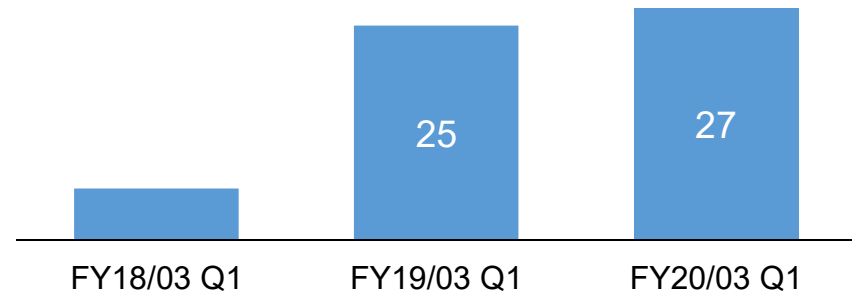
STEP 2 Custom development



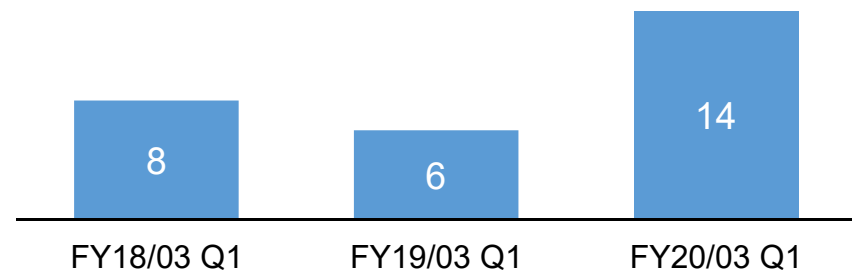
Custom development (Design and develop entire system)

- Detail test designs
- Development of customized drones and systems
- Testing at low risk environment

“Solution development” (STEP1,2) Sales (MM JPY)



“Solution development” (STEP1,2) Number of deals



Mass Production Sales

Increase in sales driven by higher ASP, while number of units sold remained at same level as previous years

STEP 3 / STEP 4 Mass production

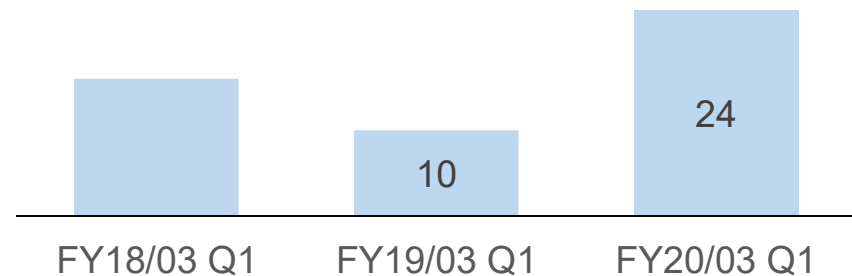


Deployment for commercial usage (Sales of mass production model)

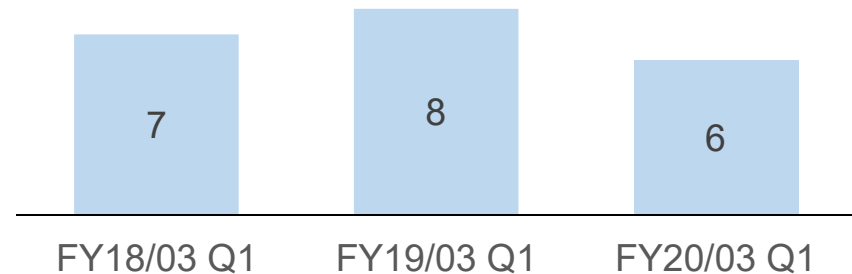
- Supply improved customized drones and systems
- Piloting or commercial use at actual sites by clients

*STEP4 is more than 10 units sales per client in a year. Standard model sales is also included.

"Mass production" (STEP3,4) sales (MM JPY)



"Mass production" (STEP3,4) number of unit



Others

Sales from maintenance grew from 3MM JPY to 9MM JPY on YoY basis.
Total sales decreased due as no national project sales booked in Q1

Others

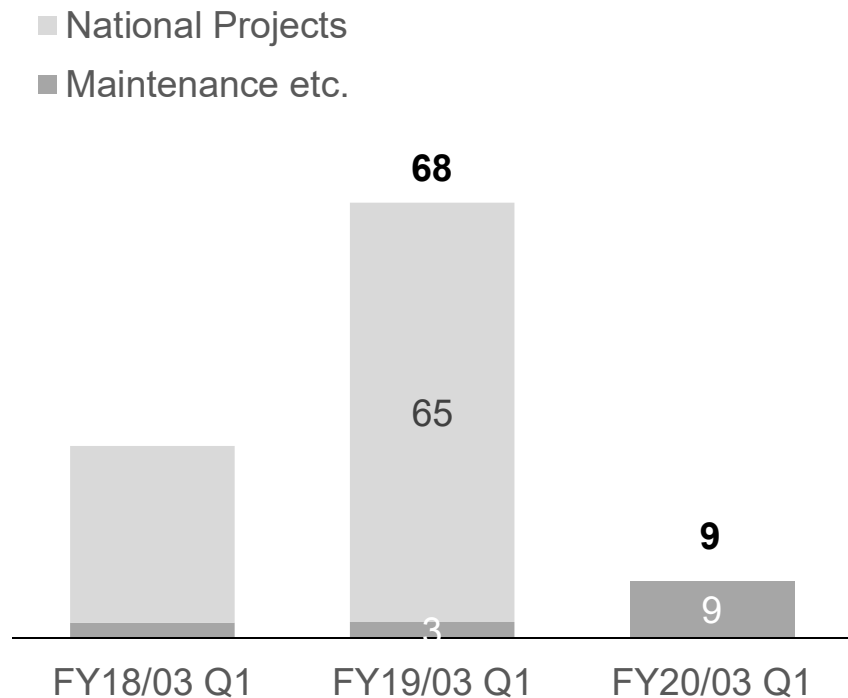


Maintenance after drone installation (Parts sales, Repair etc.)

- Sales of drone parts
- Repair service
- Some national projects

* While subsidy from National project should be in general count as a non operating income, some national project is count as a sales

Others sales (MM JPY)

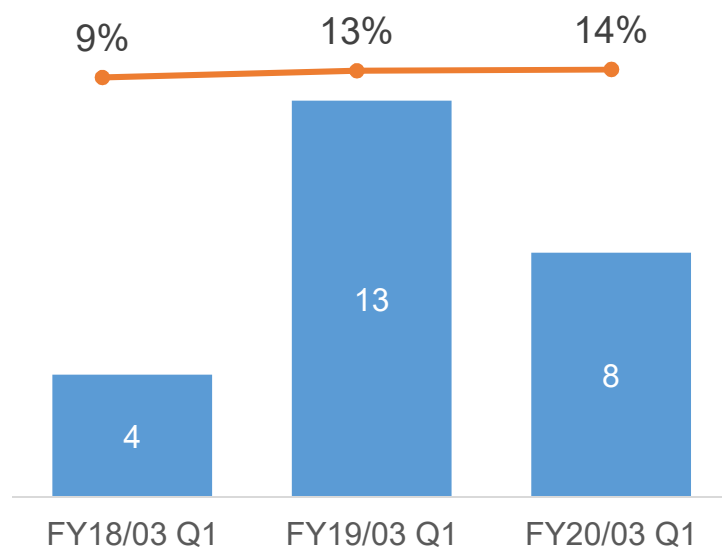


Gross profit and R&D expenditure

Gross ratio improved from FY19/03 Q1. Same level of R&D investment as previous years, though small fluctuation will happen throughout the year

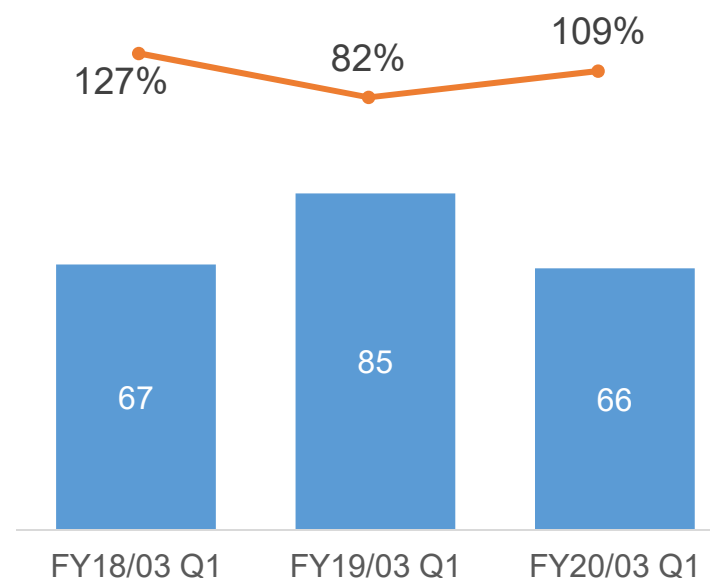
Gross Profit and Gross margin

MM JPY



R&D expenditure and vs. sales ratio

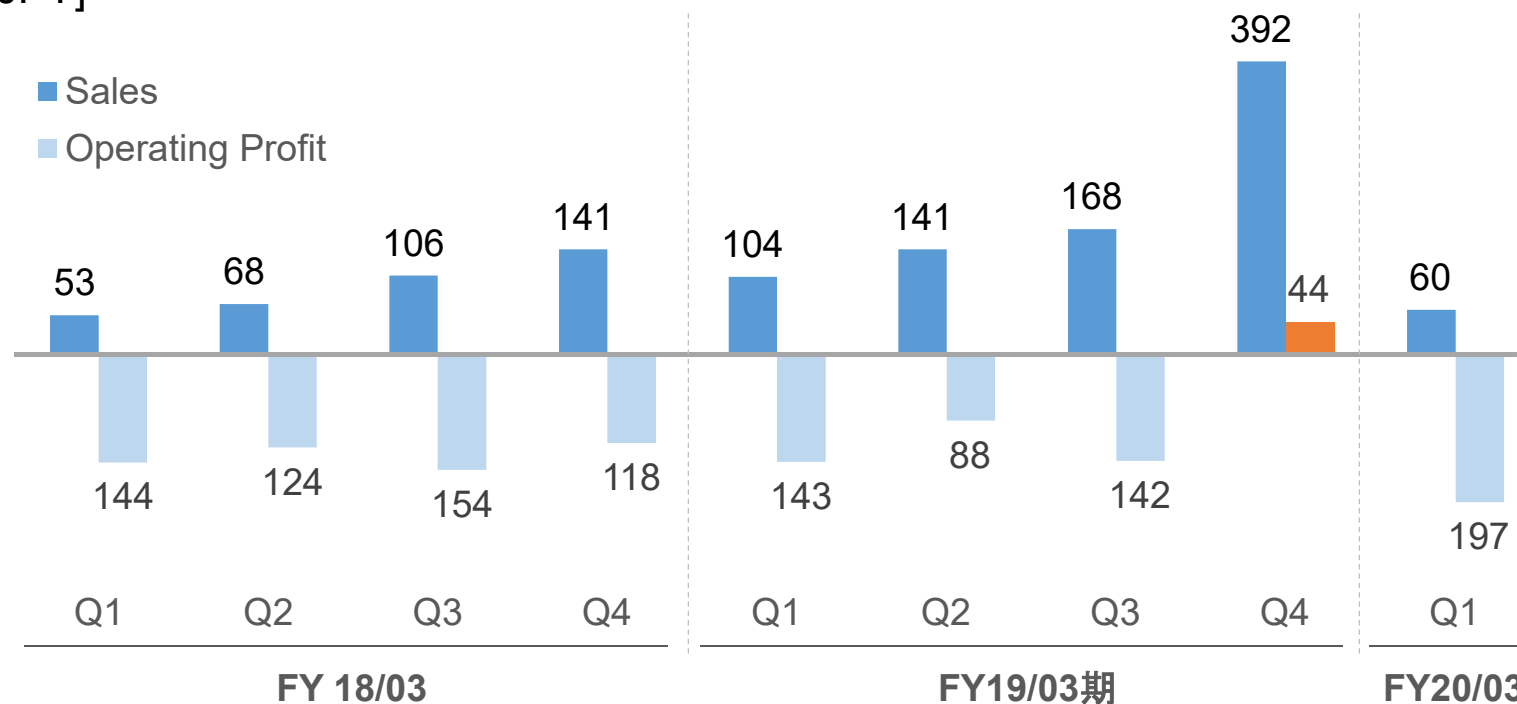
MM JPY



Sales and Operating profit by quarter

Majority of sales expected to be booked in Q4, as project scope and size grow larger

Quarterly Sales and Operating Profit
[MM JPY]



Projects are booked as sales when they are completed – majority of the sales expected to be booked at the later half of the year as project scope and size grow larger. This seasonality is expected to continue.

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Business Highlights

Conducted PoC and progressed installation of drones in actual operations.
Released new industrial platform “PF2” and developed smaller size “MINI”

April	Demonstrated non-GPS drone flight at “Unmanned Systems Asia” in Singapore	
	Pitched ACSL to Hirai Minister in charge of Information Technology Policy	
	TYPE-S exhibited 「Drone Flow type Fushi(DFF)」 at the 5 th International Drone Expo, that can measure waterflow of rivers (ACSL provides industrial platform drone)	
May	ANA Holdings conducted BVLOS (Beyond Visual Line of Sight) flight at Fukuoka city with support of NTT DoCoMo and Fukuoka city	
	NEDO introduced autonomous drone flight using high precision location information with Quasi Zenith Satellite System	
	KEPCO, NJS KANSO CO , announced business alliance to enter into inspection business with drone in hydroelectric power stations (Drone developed by NJS and ACSL will be used)	
	The Ground Self-Defense Force Eastern Division conducted disaster survey training as part of field training exercise (FTX) (ACSL signed agreement with the GSDF Eastern Division)	
	TrueBizon and Fukuoka city conducted delivery demonstration using drones in urban areas where buildings are lined up (ACSL was in charge of the delivery drone)	
	UNISYS supported Tohoku Electric Power's "automate equipment patrols at thermal power plants" initiative with robot and AI technology (ACSL provides autonomous drones)	
July	Expanded business into Southeast Asia with Leave a Nest and Leave a Nest Singapore	
	ACSL released new platform “ ACSL-PF2 ” and developed smaller size drone “ MINI ”	
	ACSL selected as one of the top 10 drone technology solution provider by APAC CIOoutlook	

Conducted inter-island BVLOS delivery with ANA

Conducted two routes BVLOS flight simultaneously with ANA and additional 3 parties and succeeded in inter-island delivery

ACSL provided drones for inter-island delivery

- ANA Holdings, LINE Fukuoka, etc. conducted an experiment to deliver goods by air to two locations in Fukuoka City in Jul to Aug 2019
- ACSL provided full autonomous drone capable of “BVLOS without any assistance” (Level 3) flight
- First time ever for multiple drones to fly simultaneously with separate routes under “BVLOS without any assistance” (Level 3)
- This experiment served as an important test to realize drone delivery service

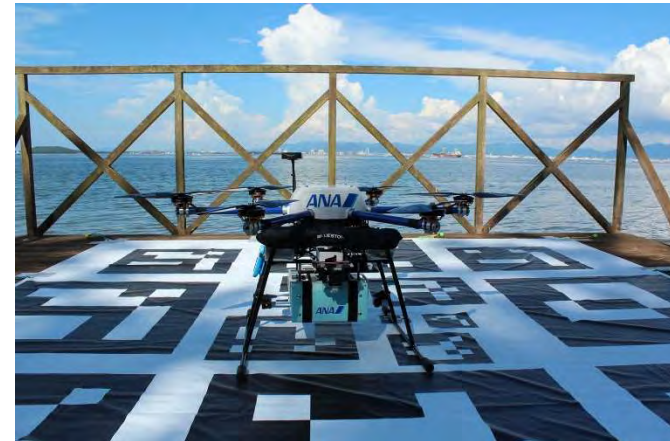


Photo: ANAHD



Photo: ANAHD

Alliance with UNISYS for automation of equipment patrol

Supported UNISYS in their technical verification of Tohoku Electric Power's "Automation system for equipment patrol at thermal power plants using robots and AI technology" initiative

UNISYS

Foresight in sight

News Release

日本ユニシス株式会社 広報部
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日本ユニシス

東北電力の「火力発電所における設備パトロール自動化」に向けた取り組みを ロボット・AI 技術で支援 ～パトロール業務の効率化と設備異常の早期発見に期待～

日本ユニシスは、東北電力の「火力発電所における設備パトロール業務を、ロボットや AI 技術等により自動化させるシステム」の開発検討および実証に 2018 年度より参画しており、昨年度の実証において基礎技術の有効性を確認できたことから、2019 年度より本格的にシステム開発を支援します。

本システムは、2023 年 6 月に営業運転を開始する上越火力発電所第 1 号機および東北電力既設発電所での実用化を目標とし、更なる実証・開発を進め、将来的には他の設備産業への展開も見据えた汎用性の高いシステム構築を目指します。

【背景】

近年、設備点検におけるロボットや AI 技術の活用に大きな期待が寄せられています。火力発電所では、設備の異常兆候を早期に発見しトラブルを未然に防止するため、発電所員が日々、設備および関連機器の状態を巡視により点検する設備パトロールを行っています。広い発電所内に設置された多数の設備一つ一つをきめ細やかにパトロールする必要があるために多くの時間と労力を要していることから、東北電力と日本ユニシスはロボットや AI 技術の活用による業務効率化について検討を重ねてきました。

【本システム開発について】

日本ユニシスは、2018 年度より東北電力の火力発電所の設備パトロールを自動化するシステムの開発検討および実証に参画し、基礎技術の検証を進めてきました。

2018 年 9 月に廃止した新潟火力発電所 4 号機の建屋内を試験環境とした実証では、非 GPS 環境下で操縦者を必要としない自律飛行可能なドローンを用いて飛行性能などの検証を重ね、パトロールの移動手段としての有効性を確認しました。



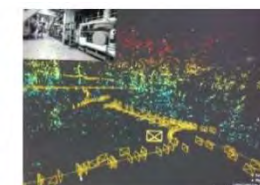
発電所内を自律飛行中のドローン



ドローン搭載カメラからの映像



高所や閉所もパトロール可能



周囲の環境を 3D マップ化して自己位置を把握

※画像内ドローンは「株式会社自律制御システム研究所」の製品

Source: UNISYS

ACSL provided autonomous drone in GPS denied environment
Source: UNISYS

Expanded business into SEA with Leave a Nest support

Collaboration with Leave a Nest on networking with local partners and governments, and recruiting to accelerated business in South East Asia

2019年7月5日
株式会社自律制御システム研究所

  Leave a Nest

リバネスおよびリバネスシンガポールと連携し、東南アジアへの事業展開を本格化

株式会社自律制御システム研究所（代表：太田 裕朗、本社：千葉県千葉市、以下「ACSL」）は、株式会社リバネス（代表：丸幸弘、本社：東京都新宿区、以下「リバネス」）とLeave a Nest Singapore Pte. Ltd.（代表：徳江紀穂子、本社：シンガポール、以下「リバネスシンガポール」）と連携し、シンガポールを主軸とした東南アジアへの事業展開を本格化することが決定いたしましたので、ご報告いたします。

ACSLは、これまで2019年4月にシンガポールで開催されたUnmanned Systems Asia 2019への出展や、エンドユーザーへの概念検証（Proof-of-Concept）プロジェクトを実施するなど、東南アジア諸国における顧客ニーズの把握、コア技術競争力の調査、規制関連の調査などを進めてまいりました。特に、ACSLが強みとする画像処理を用いた非GPS環境下での自律飛行技術（Visual SLAM）に対するニーズはインフラ点検や倉庫管理分野で顕著であり、東南アジアへの事業展開を本格化することにいたしました。

今後成長性の高い東南アジアへの進出を果たすためには、現地支社の設立や活動拠点の確保、現地事業会社・政府との連携、人材採用といった種々のハードルを乗り越える必要があります。これらには現地におけるノウハウやネットワークが必要であり、この度、リバネスとリバネスシンガポールを現地パートナーとして、活動拠点確保や営業活動、人材採用などの多方面において連携することとなりました。

リバネスとリバネスシンガポールでは、世界の課題解決に挑戦する人々が集まるイノベーションスペースL-HUB【L-nest Innovation HUB；通称 L-HUB（エルハブ）】SGをオフィススペースとして提供し、日本と現地スタートアップの技術連携を促すとともに、これまでに培ってきたイノベーションのノウハウや事業会社・政府機関・大学とのネットワーク等を駆使して、日本のスタートアップの東南アジア進出を後押ししております。

ACSLは、日本国内のみならず、東南アジア諸国に対するドローン・ソリューションの社会実装に向けて、引き続き取り組んで参ります。

Example of collaboration with Leave a Nest

- ✓ Establishment of local branch offices and activity base camp
- ✓ Collaboration with local business companies and government
- ✓ Recruitment of local talent
- ✓ Sales and public relations support

Developed next-gen ACSL-PF2 and MINI

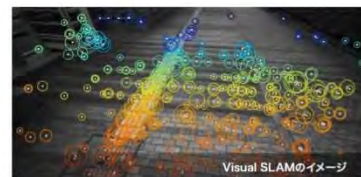
Released medium-sized ACSL-PF2 as the next generation industrial platform and initiated development of smaller size MINI

ACSL-PF2 (medium size)



非GPS環境下(橋梁下、室内)での自律飛行が可能

ACSL独自の画像処理技術を使用した自己位置推定技術(Visual SLAM)により、橋梁下や室内などGPS・GNSSデータが取得できない環境下においても自律飛行が可能です。自律飛行可能な一般的なドローンは、GPS・GNSS、気圧センサ、電子コンパスで自己位置を推定していますが点検を行う環境ではこれらのセンサが使用できない環境が多く存在します。ACSLのVisual SLAM技術を使用すればこれまで自律飛行できなかった環境でも飛行をすることが可能となります。また画像処理技術はAI(人工知能)との親和性が高く、今後求められるあらゆるニーズに対応が可能です。



MINI (small size)





SOLUTION

GPS環境下での自律飛行が可能
衝突回避機能も搭載

GPS・GNSSデータが取得できる屋外などの環境下においても自律飛行が可能無機体です。ジンバルに搭載した2,000万画素、光学30倍ズームのカメラにより高解像度の画像が取得可能です。また、前方・後方に搭載したステレオカメラ及び左右に搭載したToFセンサを用いた、衝突回避機能を実装しております。

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Balance Sheet

[MM JPY]

	FY20/03 Q1		FY19/03 Q1	FY19/03 Q4
	Actual	YoY	Actual	Actual
Current Assets	4,753	+139%	1,992	4,858
Cash	4,531	+140%	1,884	4,465
Fixed Assets	67	+16%	58	68
Total Assets	4,820	+135%	2,050	4,926
Current Liability	200	+102%	99	225
Fixed Liability	0	-	0	0
Total Liability	200	+102%	99	225
Net Asset	4,620	+137%	1,951	4,701
Total Asset	4,820	+135%	2,050	4,926

Forecast FY2020/03

High sales growth ratio likely to continue, with total sales expected to be 1,418 MM JPY. Operating profit expected to be 9 MM JPY.

[MM JPY]

	FY 2020/03 Annual		FY2019/03 Annual
	Forecast	YoY	Actual
Sales	1,418	76%	807
Gross Profit	850	111%	403
Gross Ratio	60.0%	+10.0 pt	50.0%
Operating Profit	9	Turn Positive	▲330
Ordinal Profit	187	Turn Positive	▲176
Net Profit	119	Turn Positive	▲183

Sales forecast

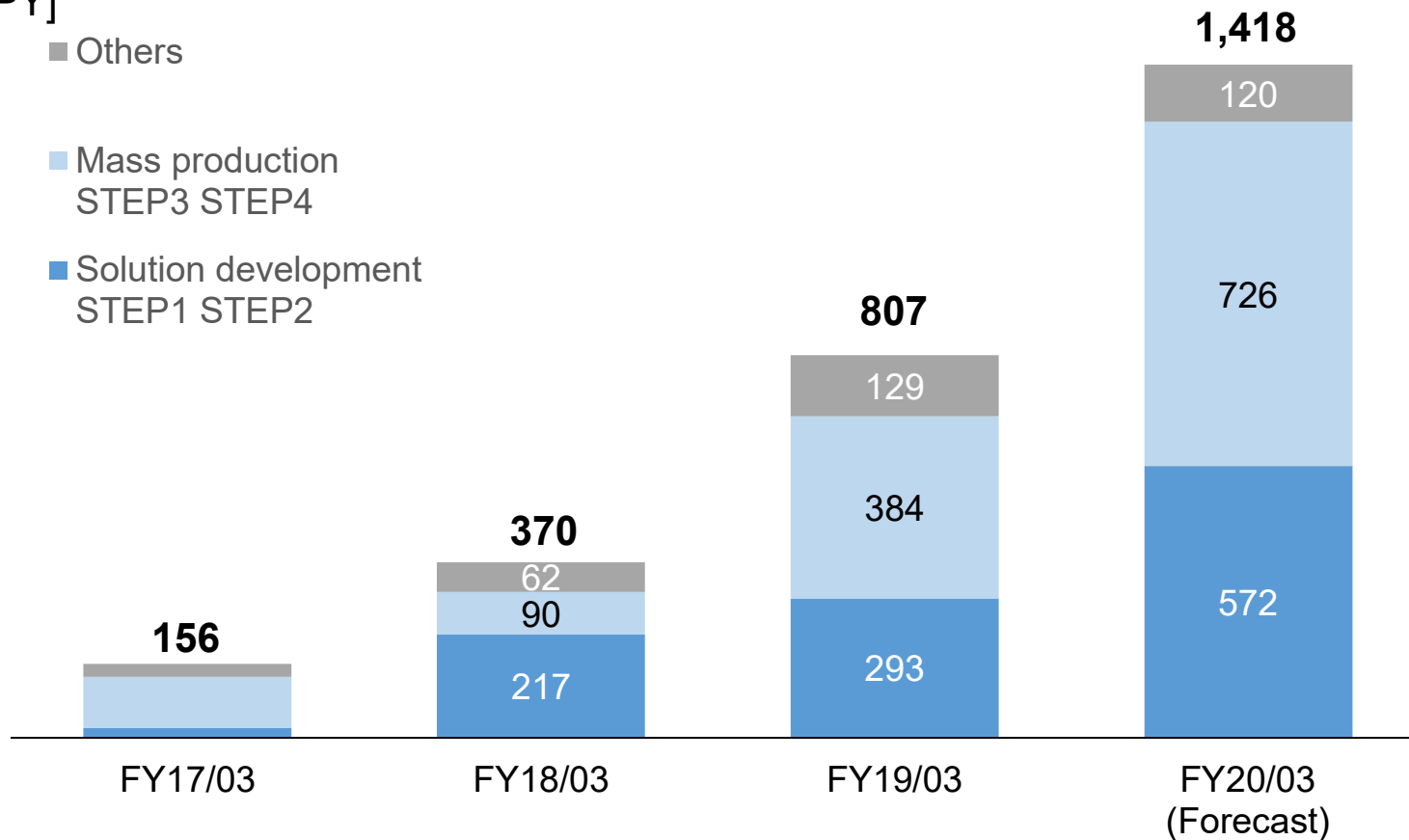
Client-base expansion through Solution development expected to continue, in addition to installation of drones in actual operations of existing clients

Sales by STEP
[MM JPY]

■ Others

■ Mass production
STEP3 STEP4

■ Solution development
STEP1 STEP2



KPI by STEP

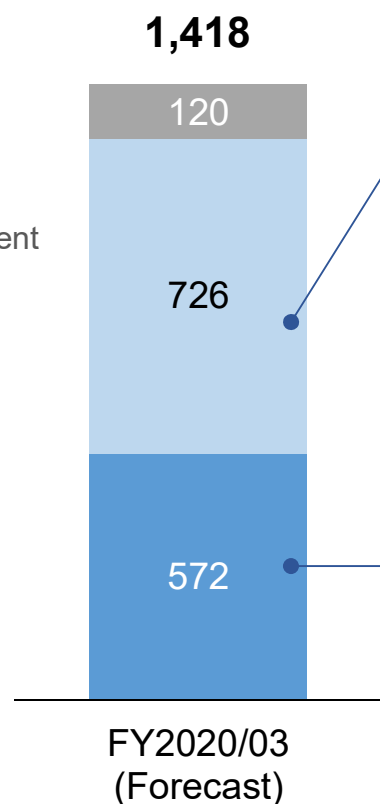
In FY 20/03, KPI target is set as number Solution development project as 110, and 220 drone unit sales

Sales by STEP
[MM JPY]

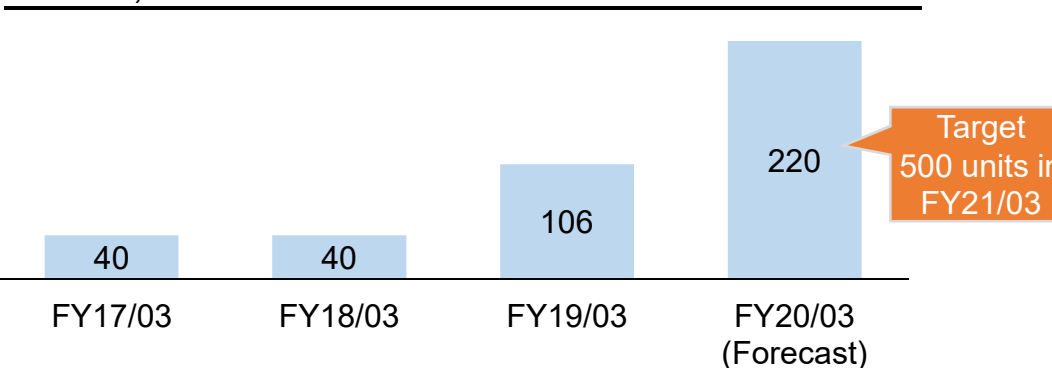
■ Others

■ Mass production
STEP3 STEP4

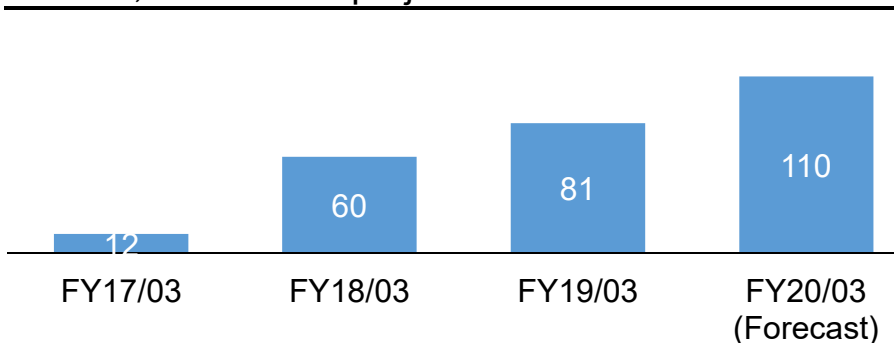
■ Solution development
STEP1 STEP2



STEP3,4 number of unit



STEP1,2 number of projects

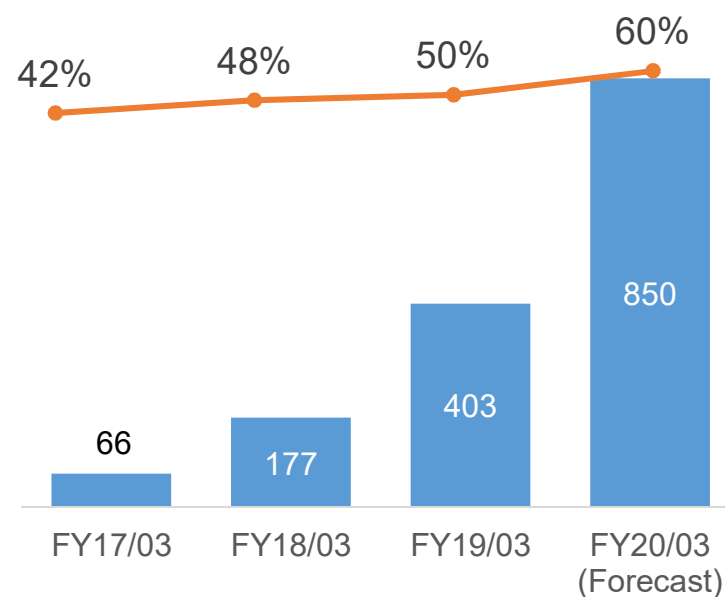


Gross profit and R&D expenditure

Gross profit is expected to improve due to sales expansion. R&D investment is expected to maintain the same level

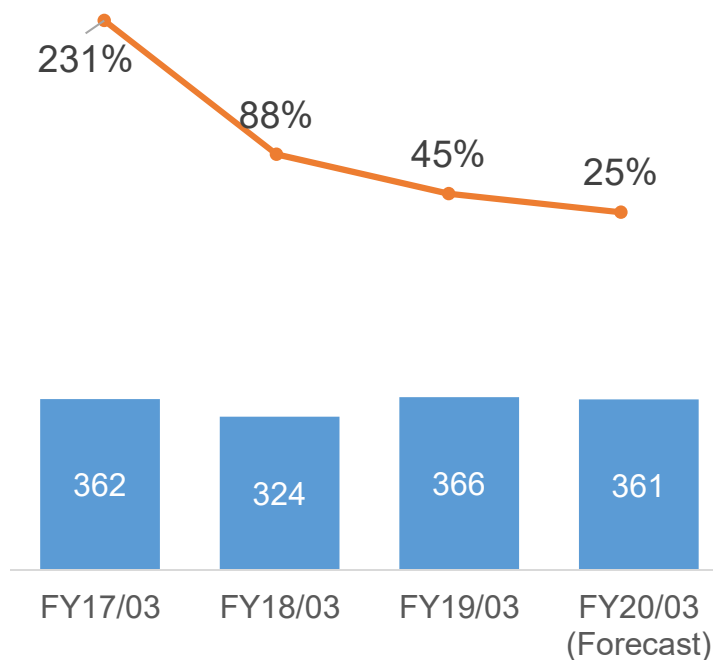
Gross profit and Gross Margin

MM JPY



R&D expenditure and vs. sales ratio

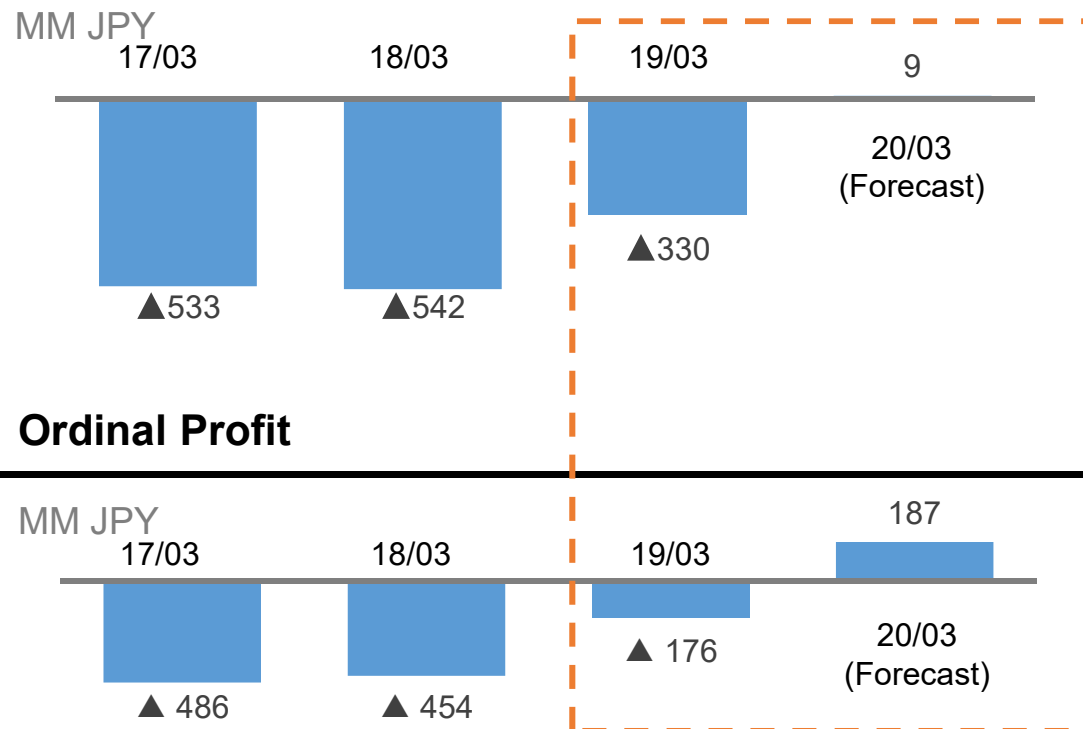
MM JPY



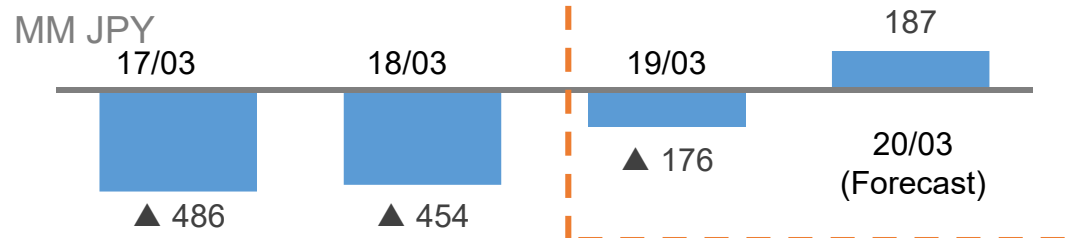
Profit forecast

Operating Profit is expected to be positive in FY2020/03. Ordinal profit is expected to be 187 with subsidy of national projects

Operating Profit



Ordinal Profit



- Expenditure for national projects is booked under R&D
- Subsidies for projects is booked as non-operating income in the following fiscal year
- About 150MM JPY is booked in FY19/03 as subsidies for projects completed in FY18/03
- About 180MM JPY is expected in FY20/03 as subsidies for projects completed in FY19/03

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About ACSL

- **Name** **Autonomous Control Systems Laboratory Ltd.**
- **Office** **WBG Marive West 32F, 2-6-1 Nakase, Mihama-ku, Chiba-city, Chiba**
- **Established** **2013 November**
- **Capital** **2,963 MM JPY**
- **#of Employee** **47(As of 2019 June)**
- **Business** **Manufacturing and providing industrial drone and providing
solution service for automation with autonomous technology**

Management team

President

Dr. Hiroaki Ohta



Ph.D. from Kyoto University. Assistant professor at Department of Aeronautics and Astronautics, Kyoto University, followed by research scientists at University of California, Santa Barbara. Also served as Technical Advisor for a start-up in Silicon Valley. McKinsey & Company from 2010. Joined ACSL as COO from July 2016 and became President from March 2018.

COO

Satoshi Washiya



M.S. of Architecture from Waseda University. Served both domestic and multinational companies in corporate wide transformation projects at Tokyo and Stockholm office of McKinsey & Company. Joined ACSL in July 2016.

CFO/CAO

Kensuke Hayakawa



M.S. of Management of Technology from Tokyo institute of technology. Implemented operational improvement/transformation of Portfolio companies at KKR Capstone. Joined ACSL as CFO in March 2017.

CTO

Dr. Chris Raabe



Ph.D. from University of Tokyo. Embedded software engineer at Boeing from 2006. Assistant professor at Department of Aeronautics and Astronautics, University of Tokyo from 2014. Joined ACSL as CTO in April 2017.

External Director

Masanori Sugiyama

External Director

Shinichi Suzukawa

Audit & Supervisory member

Akira Ninomiya

Audit & Supervisory member

Hideki Shimada

Audit & Supervisory member

Takeshi Ohnogi

Mission, Corporate value

Mission

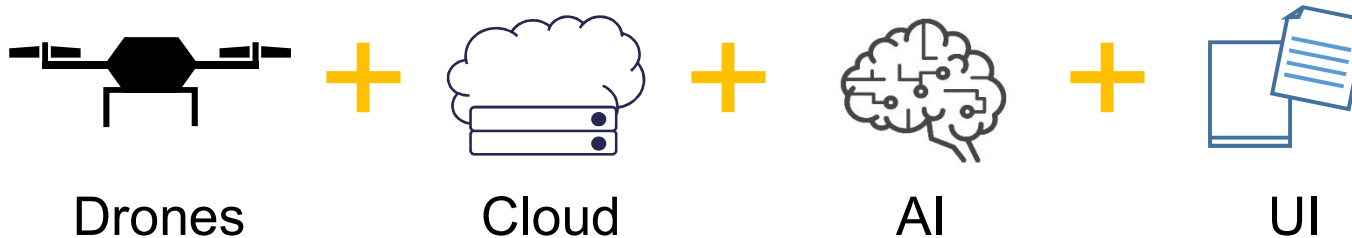
Liberate Humanity through Technology

Corporate value

Pursue world-class autonomous technology and accomplish social implementation, to automate and unman human tasks and promote evolution of humanity

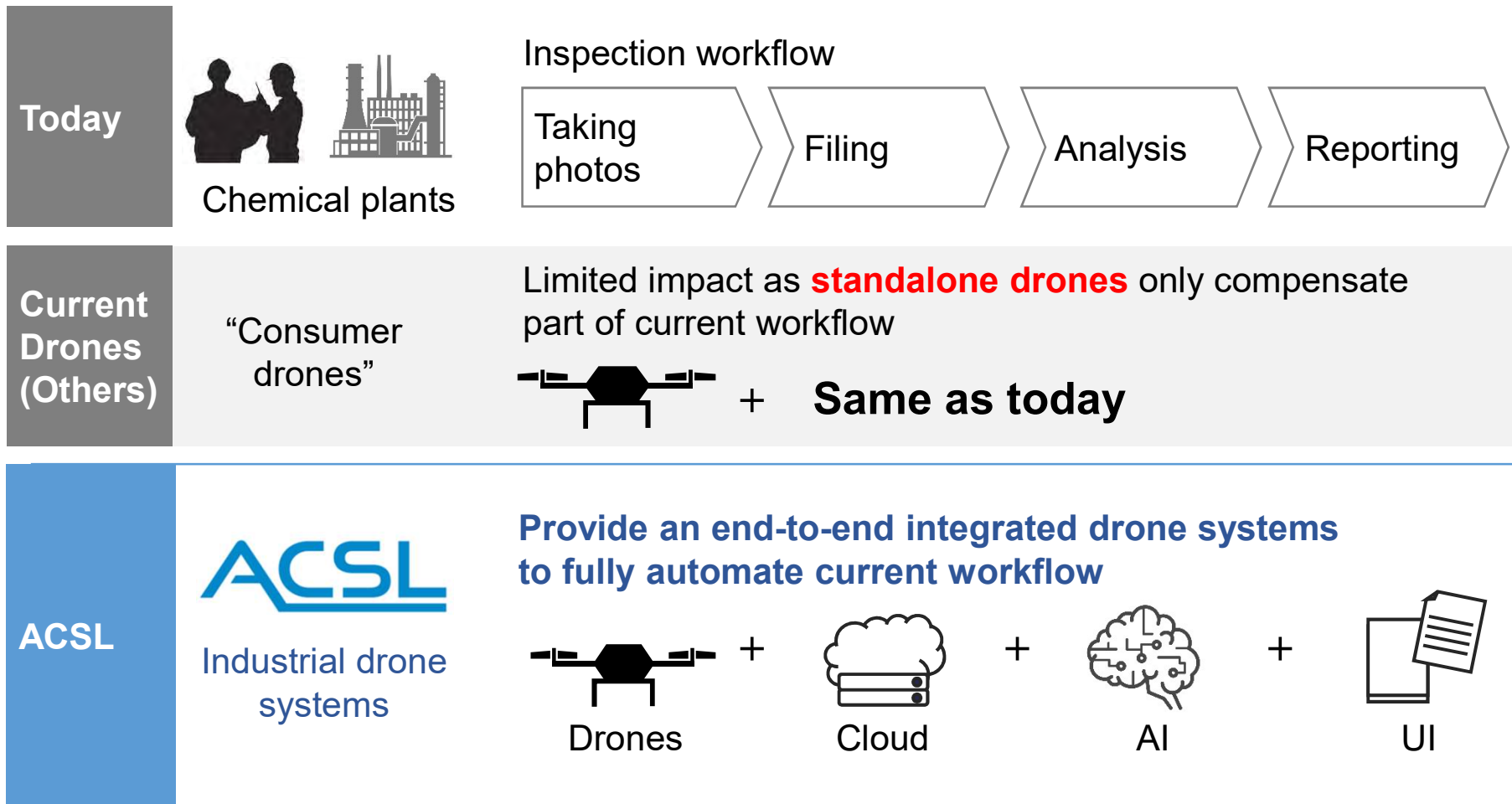
Business overview

Unmanned IoT platform for industrial applications using drones



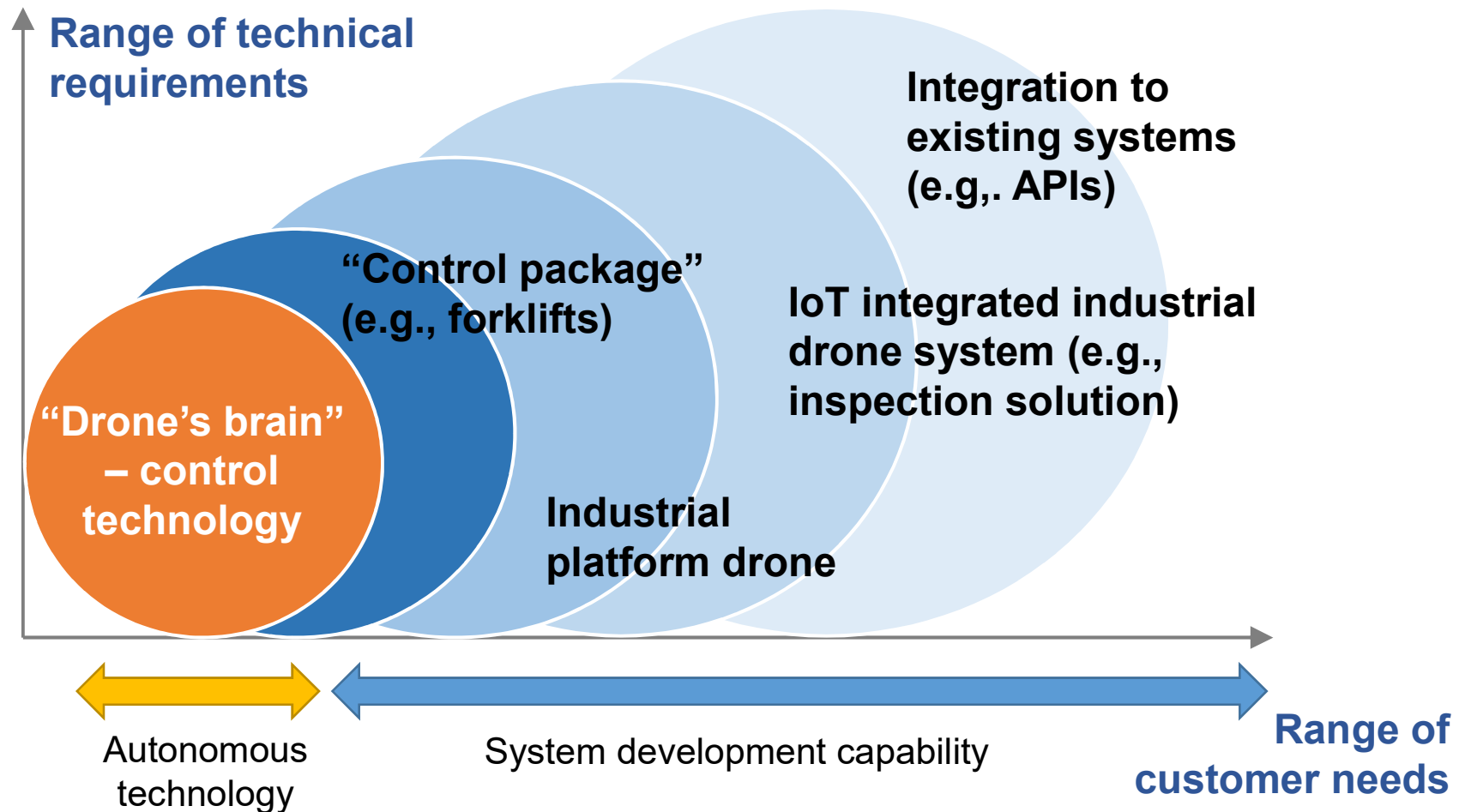
Why autonomy – ACSL realizes unmanned IoT systems

ACSL provides an integrated, autonomous, unmanned IoT drone systems to supplement human labor in inspection, delivery, disaster and surveys



Core technology – Drone's brain and system development

Proprietary “drone’s brain” – environmental recognition and controls – enables ACSL to meet a wide range of customer demands



Core technology – Cutting edge non-GPS based controls

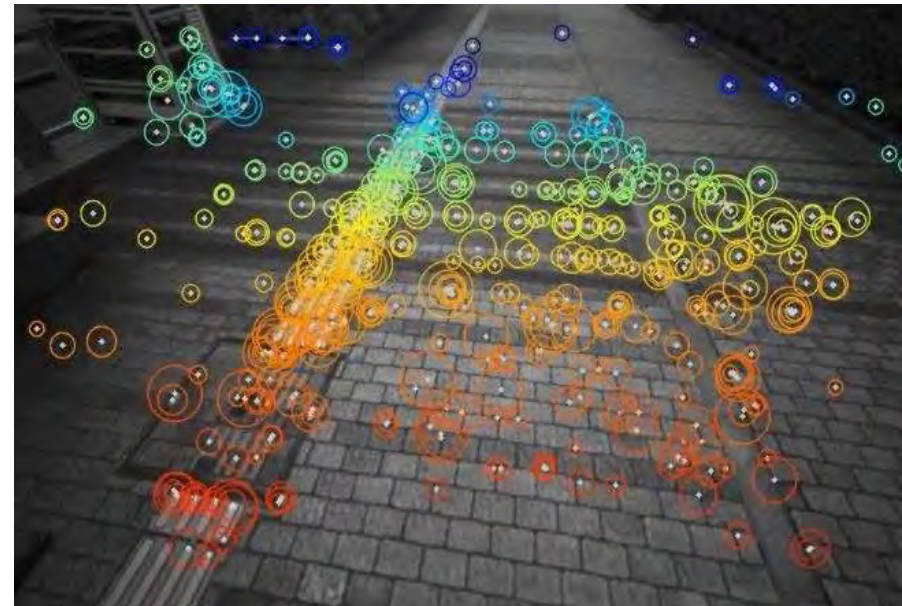
Image processing based localization and mapping (i.e., Visual SLAM) enables drones to fly in GPS-denied environment

Visual SLAM does not use air pressure sensor, magnetic compass or GPS/GNSS for autonomous flight

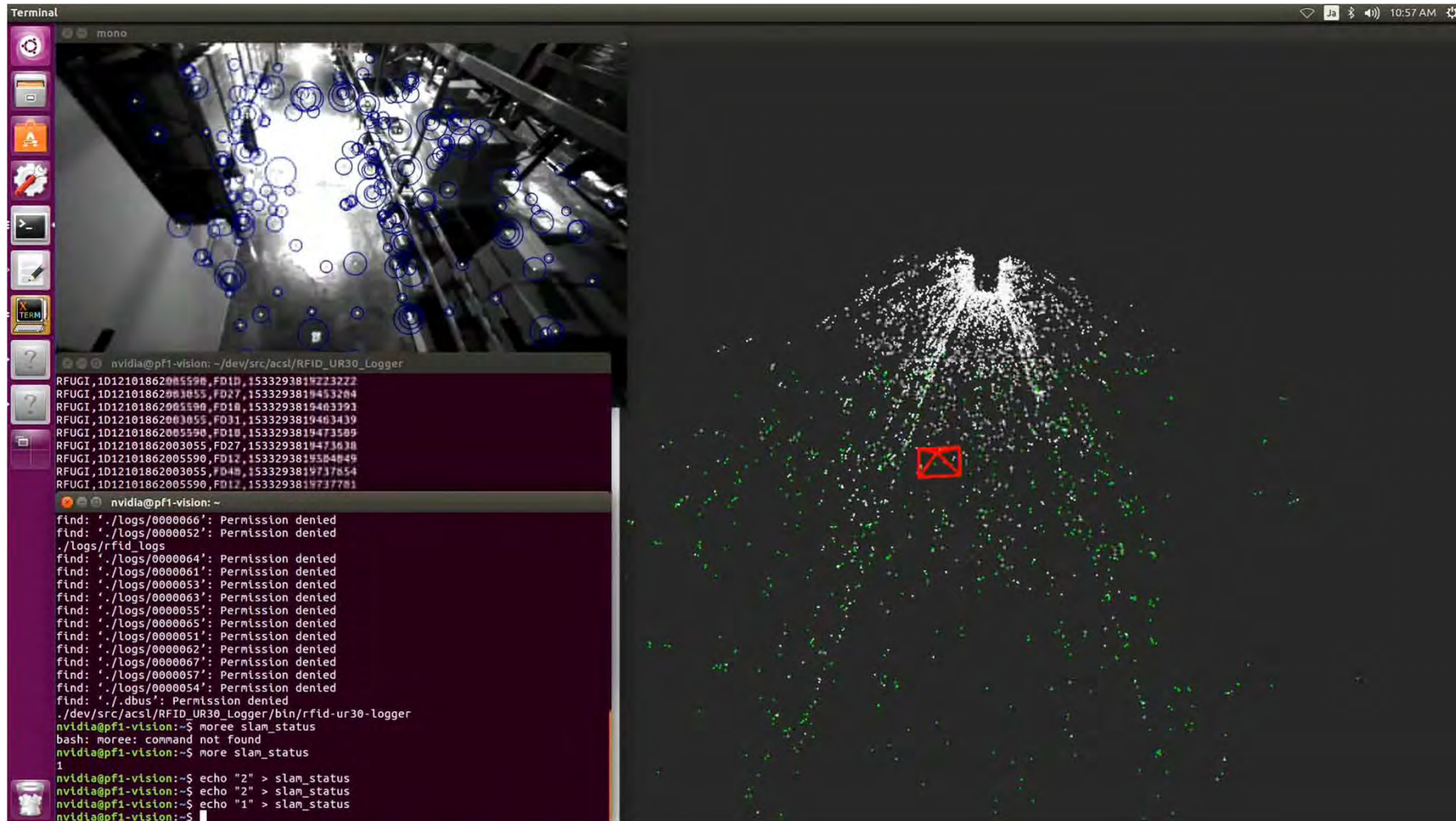
Visual SLAM cameras



Extraction of feature points



Core technology – GPS-denied flight for inventory management



Core technology – Customization capability

Realize custom response by adding options based on drone for various needs such as delivery, inspection, surveying, etc.

4-eye high-speed camera for measurement surveying

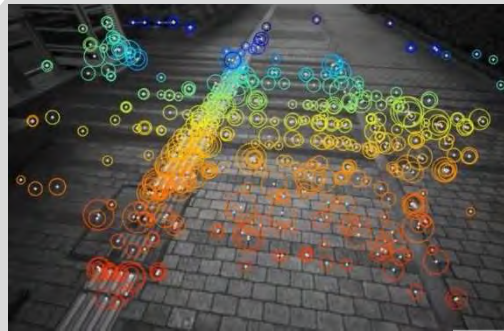


Catcher that automatically opens and closes for delivery

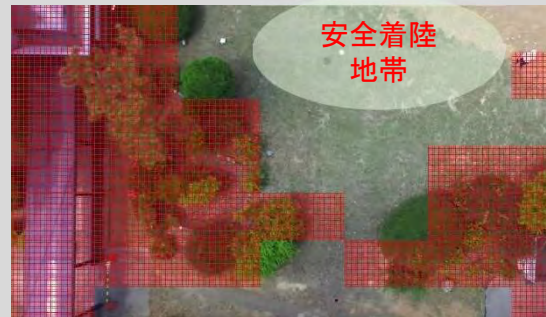


Core technology – Edge computing

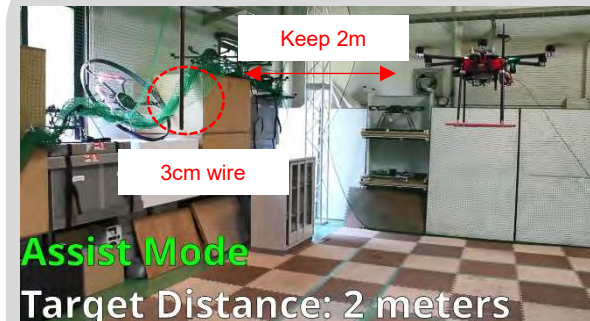
NVIDIA's embedded PC module Jetson TX2 enables highly reliable processing in real time with functions that meets various client needs



Visual SLAM

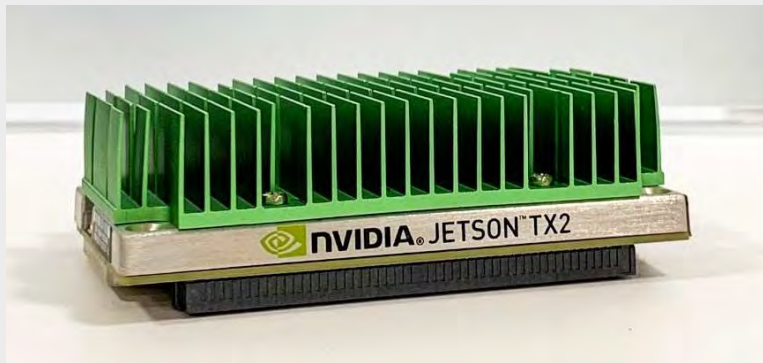


AI detecting safe landing area



Distance control

Software is installed in embedded PC module mounted on drone

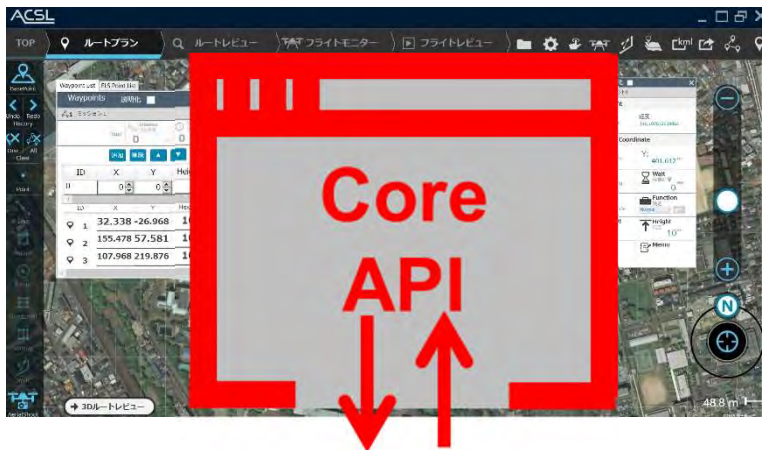


- ✓ Real-time and reliable data processing with edge computing
- ✓ Differentiate flight performance with image processing and AI
- ✓ Add safety features such as collision avoidance in combination with stereo cameras and LiDAR

Core technology – Embedded system (Core API)

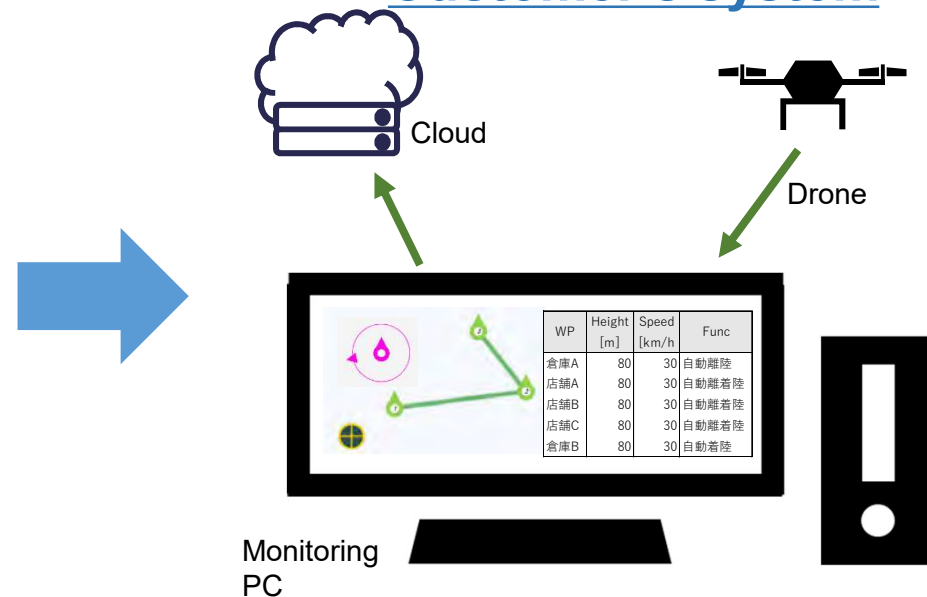
By opening APIs of proprietary control technology, drones can be embedded into existing client systems

Core API



- ✓ API to communicate with ACSL drone
- ✓ Ground control station functions required for flight operations such as route plan creation and flight monitoring

Customer's system



- ✓ Optimize integration with customer's operations in system
- ✓ Integration into dedicated systems such as equipment inspection, logistics, and disasters

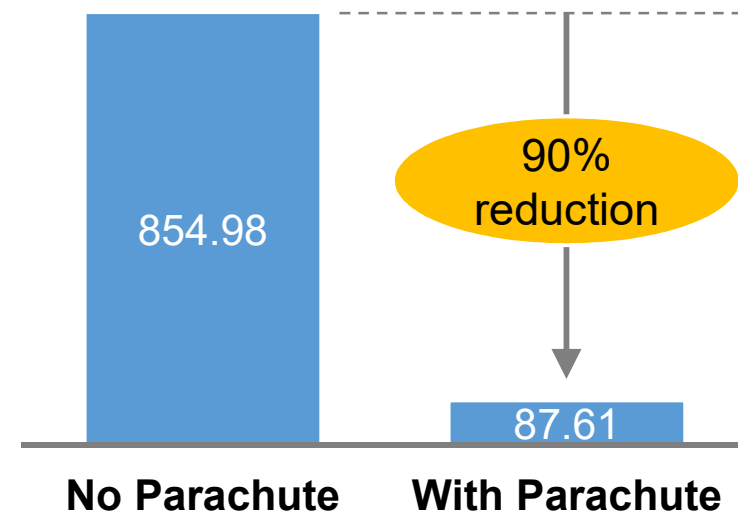
Core technology – Customized parachute for safety

ACSL provides customized parachutes to reduce 90% of falling energy, closely integrated to controls for autonomous performance

Parachute



Falling energy [J]^(*1)

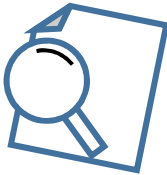


*1: Physical energy of 8kg drone dropped from 150m height

Growth model – Step-wise Proof-of-Concept approach

STEP 1

Proof of Concept

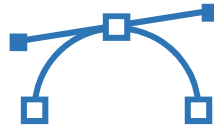


Proof of Concept (Detail out drone usage)

- Verification of concept for drone usage is feasible or not
- Closed trials
- Use of ACSL platform drones

STEP 2

Custom development



Custom development (Design and develop entire system)

- Detail test designs
- Development of customized drones and systems
- Testing at low risk environment

STEP 3 / STEP 4

Mass production



Deployment for commercial usage (Sales of mass production model)

- Supply improved customized drones and systems
- Piloting or commercial use at actual sites by clients

✓ **Lower entry barrier for clients and verify economic impact through PoCs**

✓ **Enhance relationship and continuity with clients supported by customized systems**

Growth model – Example of end-to-end drone systems

Rakuten Drone



Rakuten drone “Tenku”

Rakuten promotes delivery drone systems to tackle last-one-mile issues across Japan

- Customized drone
- CoreAPI for software development

エアスライダー Air Slider



NJS “Air Slider”

NJS rationalizes inspection of closed-loop environment (e.g, sewages) through this drone system

- Custom small drone
- Custom software designed for user-experience

MORITA



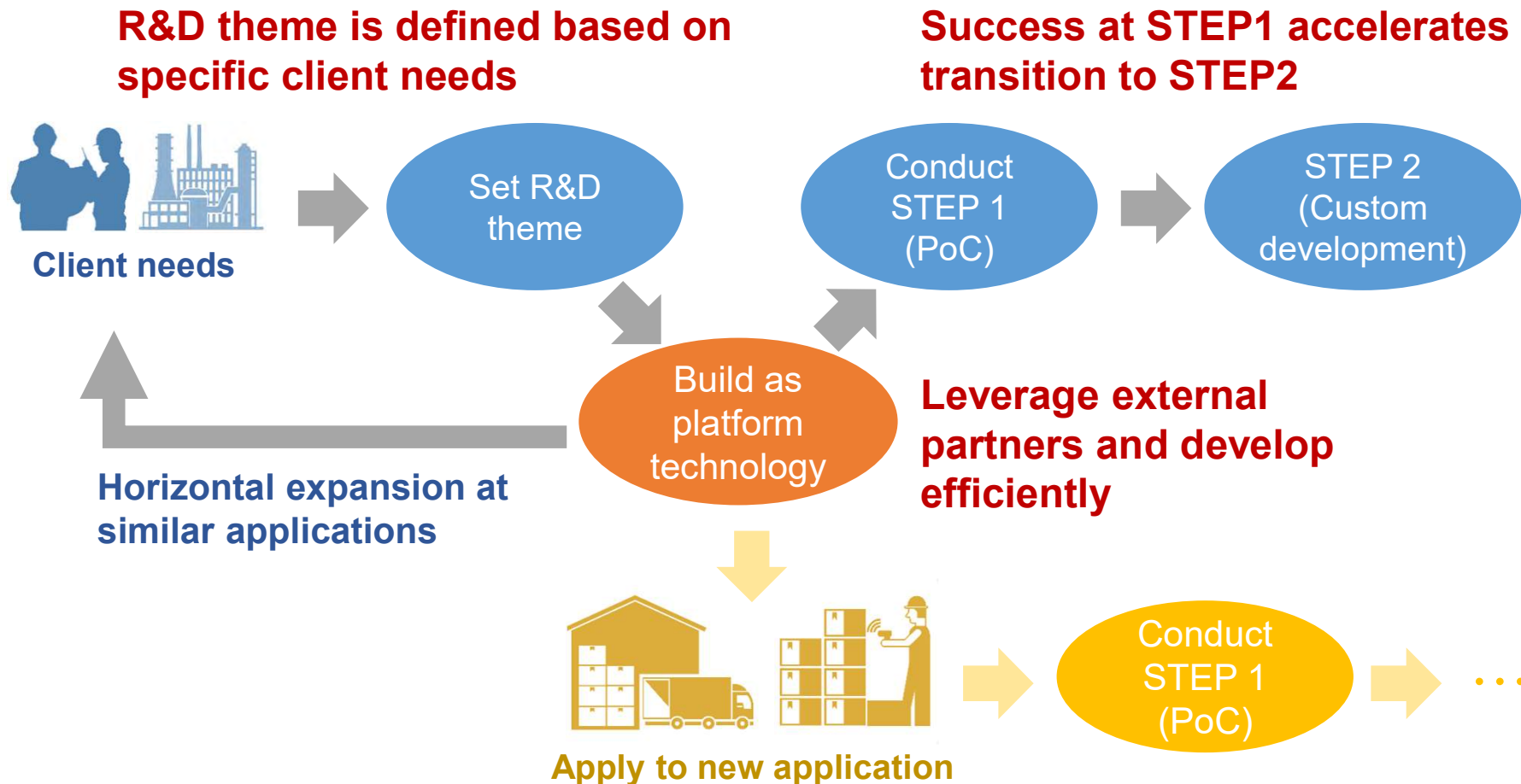
MORITA “Rei-Humming”

MORITA revolutionaries fire fighting by embedding aerial survey drone as part of the fire trucks

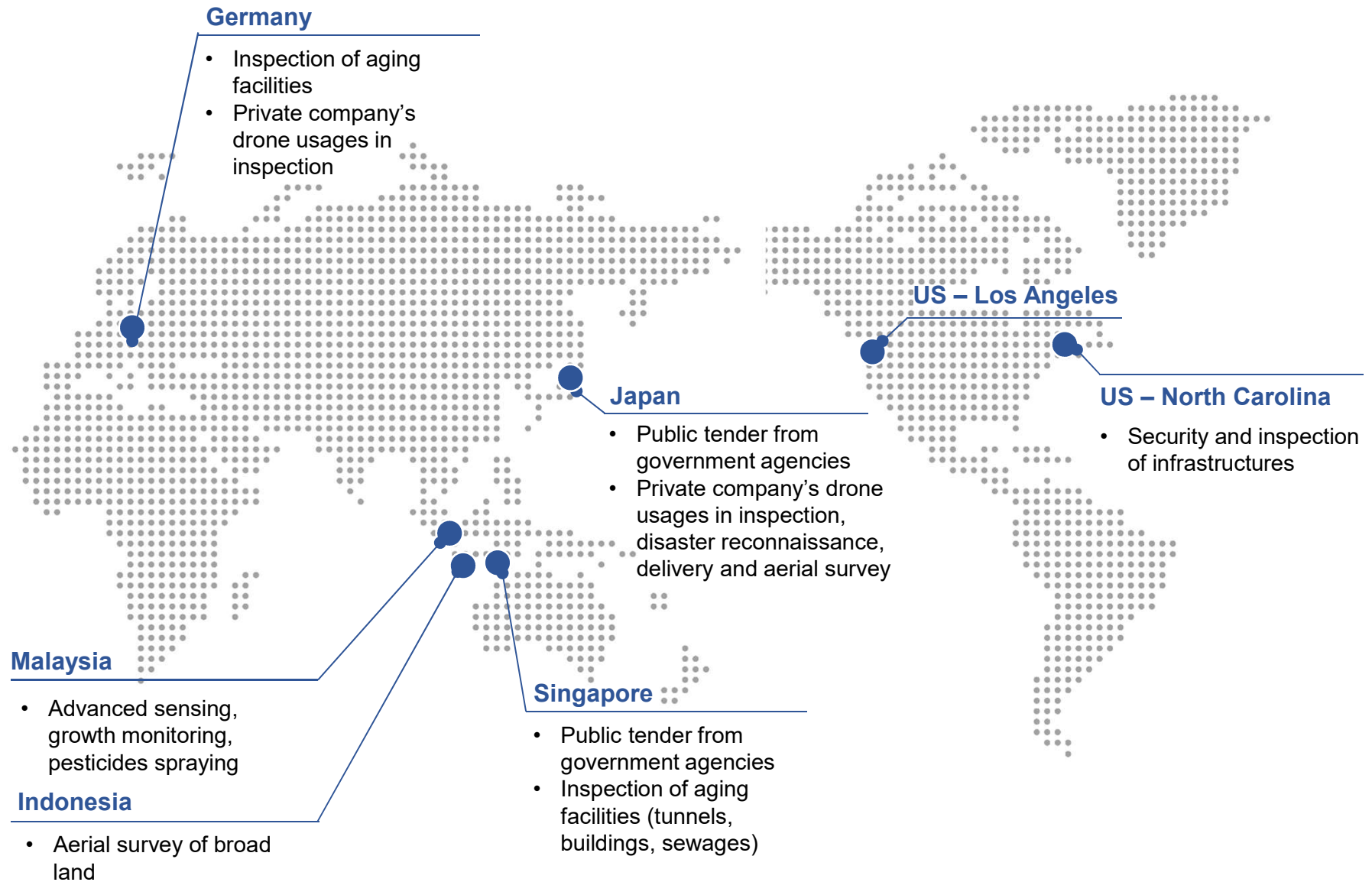
- Custom fire-fighter drone
- Switch between wired charging and battery

Growth model – Effective R&D cycle centering on client needs

Themes are defined based on client needs, developed as platform technology, and tested as STEP1 (PoC) for successful transition to STEP 2



Potential market – Similar demand seen overseas



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