

An abstract graphic consisting of several overlapping, flowing blue lines that swirl around the central text, creating a sense of motion and depth.

# Future Outlook

The slide features several decorative, hand-drawn style blue lines that swirl and loop around the central text. These lines are light blue and vary in thickness, creating a dynamic, abstract background for the title.

# I . Orders and Initiatives

# I -1. Consolidated orders, by region

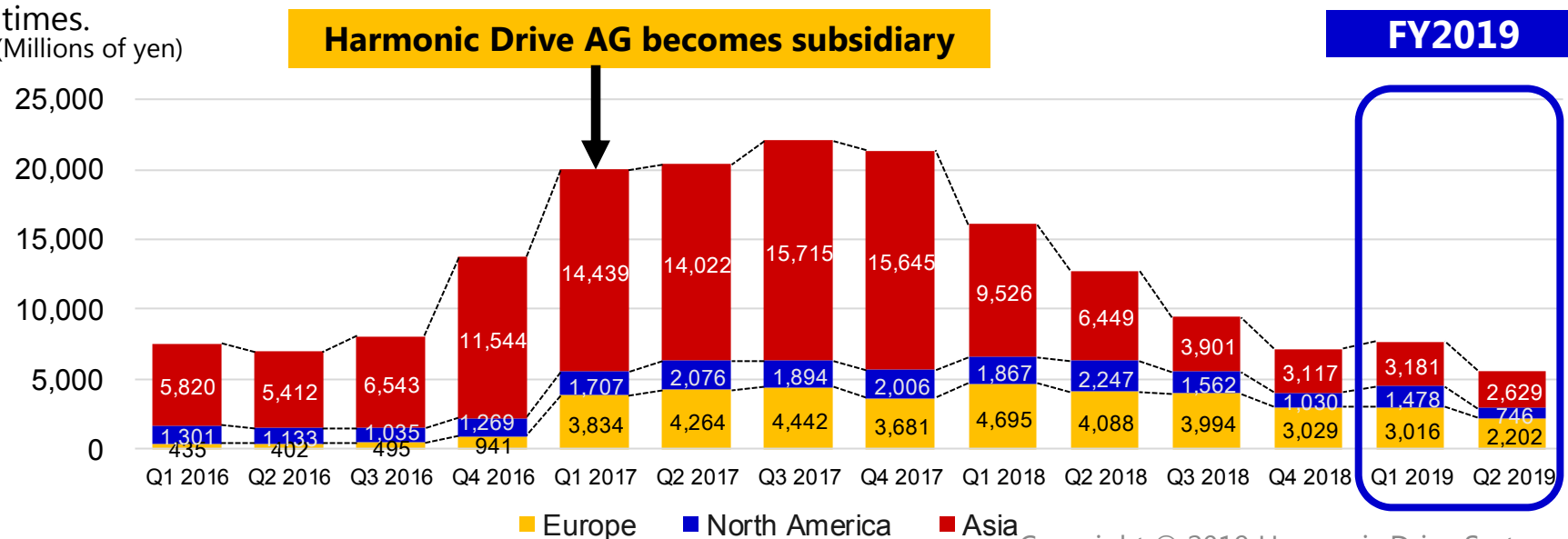
## External environment

- Prolonged US–China trade friction is prompting concerns about a global economic slowdown.
  - Manufacturers are less willing to make capital investments, adopting a wait-and-see attitude.
- An “overheating of investments” in industrial robots mainly for China in 2017 and 2018 is now undergoing correction.
  - Overall orders are in a downtrend (according to Japan Robot Association).
- “Advance orders” we received in previous years have led to inventory adjustments.
  - Distributors and customers alike are adjusting inventories (but cancellations and requests for delayed deliveries have recently toned down).

## Internal environment

- Customers are still satisfied with our products; customer relations are solid (no change in our competitive advantage).
- By increasing our production capacity, we have worked through order backlogs and normalized lead times.

(Millions of yen)



## I -2. Initiatives to counter a prolonged downturn in demand

- Freeze some capex plans
- Reduce overhead expenses
- Lower personnel costs

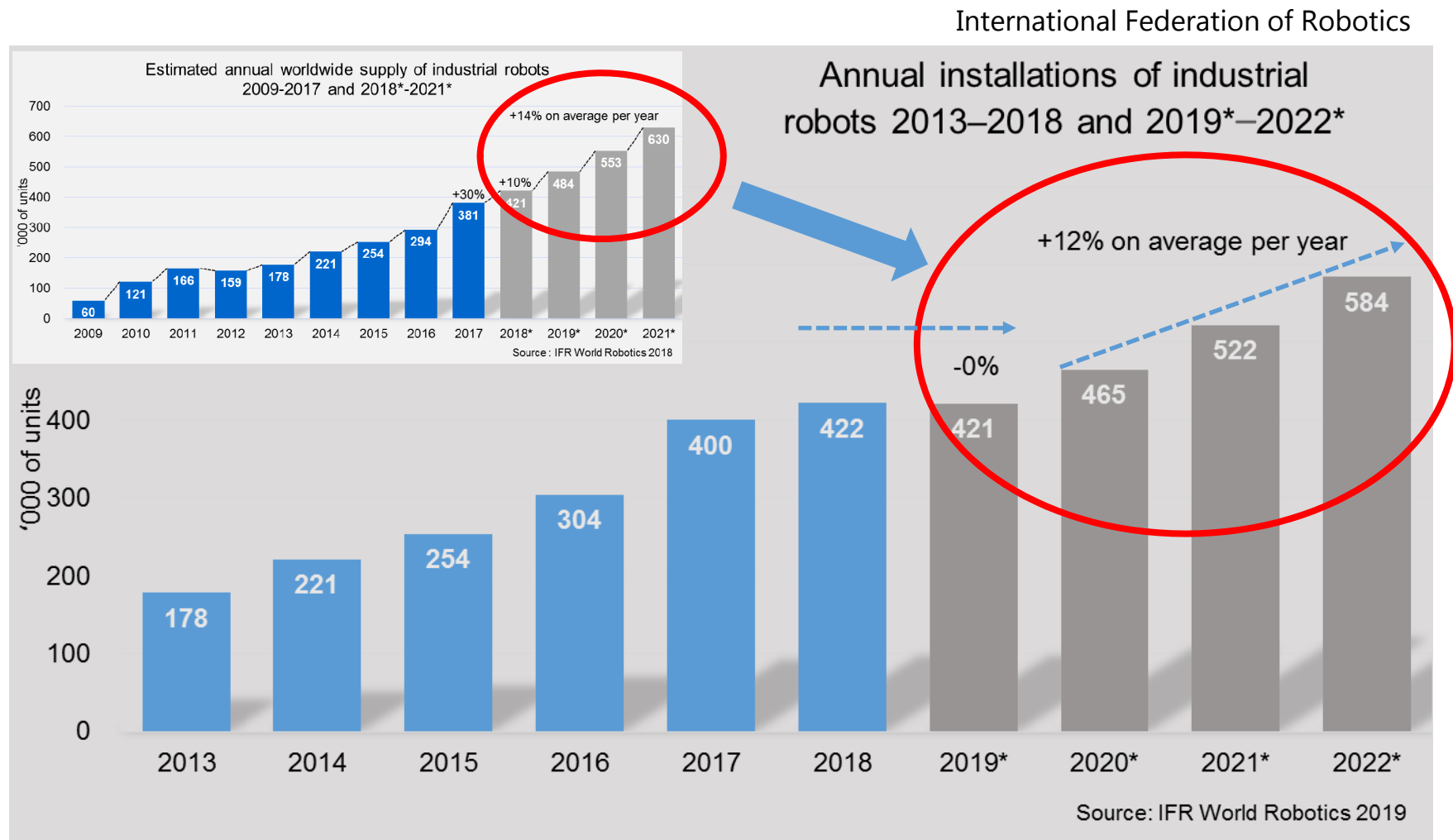
Maintain business foundations to allow  
response to future market recovery  
and growth

The slide features several decorative, hand-drawn style blue swirls that frame the central text. One swirl starts from the top left, loops around the top, and points towards the center. Another swirl starts from the bottom left, loops around the bottom, and also points towards the center. A third swirl starts from the right side and loops around the right edge. These swirls are composed of thin blue lines.

## II. Trends in Main Fields of Application

## II -1. Worldwide outlook for number of industrial robots sold

- Downward revision due to slowdown in Chinese market growth
- Meanwhile, robust appetite for investment in labor-saving and automation



## II -2. Collaborative robots (co-bots)

- Expanding adoption in the manufacturing and service sectors
- Robust demand, centered on Europe
- Business alliance between Omron and Techman Robot Inc.
- Business alliance between Canon and Universal Robots



Courtesy of Techman Robot Inc.

## II -3. Semiconductor manufacturing equipment, LED and OLED manufacturing equipment

### Semiconductor manufacturing equipment

- Growth in the smartphone market is decelerating.
- Capex by large US IT companies is currently leveling off, but signs point to a startup in investment.
- Non-memory demand is starting to recover.
- Demand is solid for AI, VR, and CASE (automobile-related).
- We also expect 5G-related investment to fuel demand.
  - ⇒ Demand in related markets is beginning to emerge (base stations, new smartphone models).
  - (3G [voice] → 4G [data] → 5G [video])



### LED and OLED manufacturing equipment

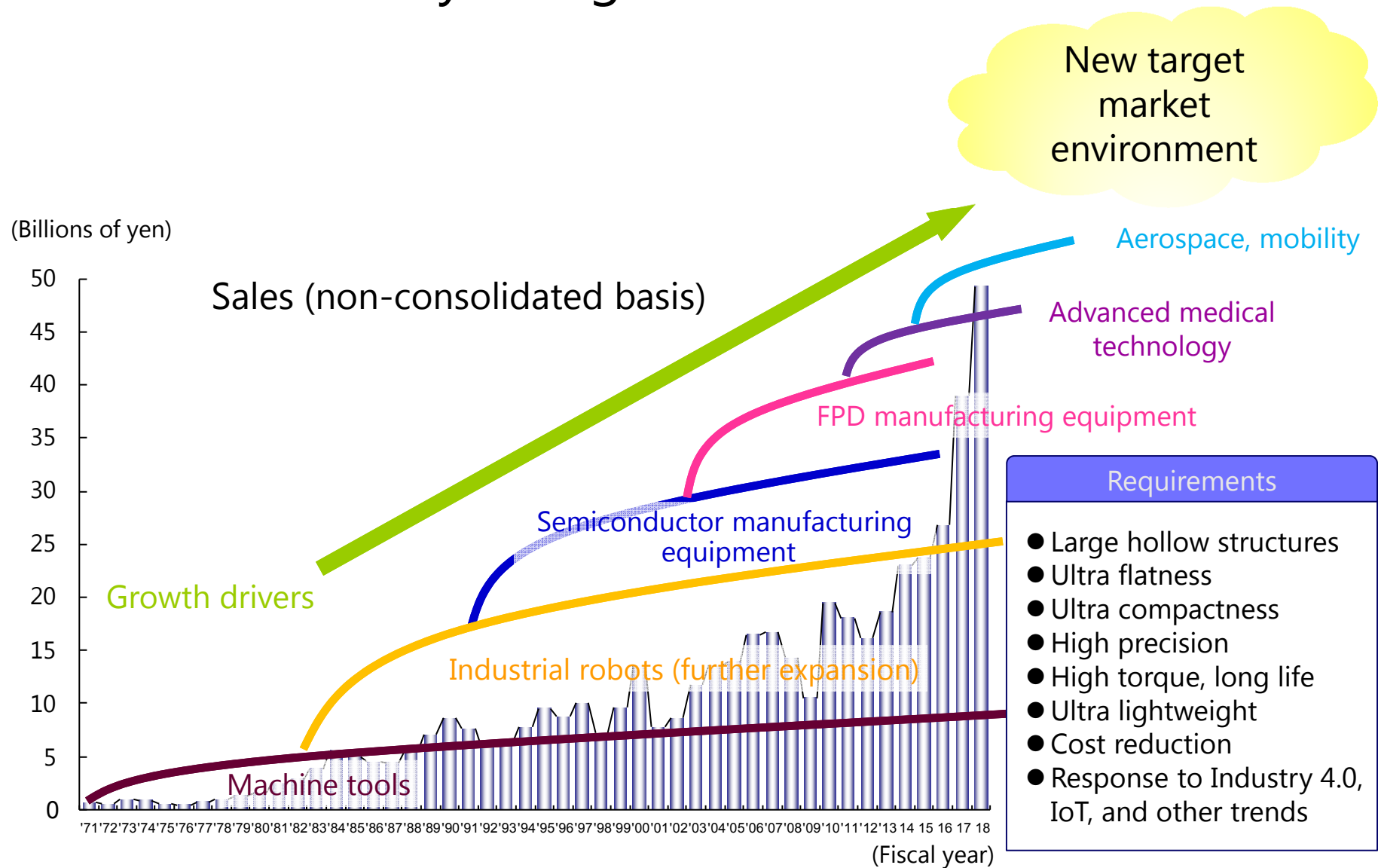
- Demand for small and medium-sized FPDs is falling, as smartphone growth decelerates.
- However, demand is budding for OLEDs used in large TVs and onboard automotive electronics.



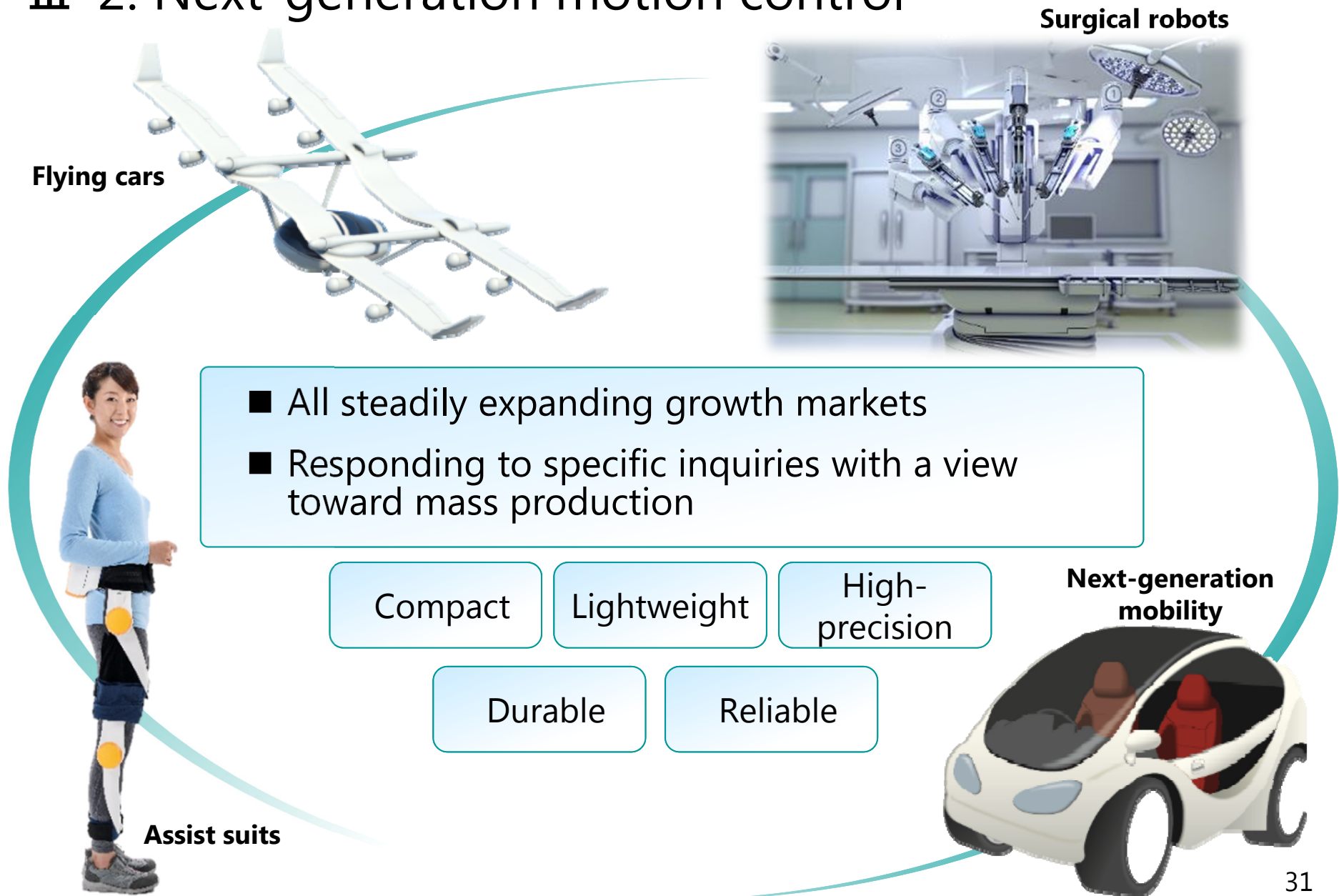
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## **III. New Applications**

# III-1. Sales history and growth drivers



## Ⅲ-2. Next-generation motion control



### III-3. Development of new products for new applications

#### Advanced medicine, amusement



#### Tabletop robots



Source: Mecademic Inc.

#### Small collaborative robots, semiconductor manufacturing equipment



Source: Techman Robot Inc.

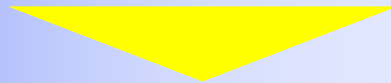
Applications should accelerate further, as demand increases to make various types of equipment more **compact and lightweight**.  
Customers have growing expectations for our products.

We are developing a **new series** with market launch scheduled for FY2020.  
**We plan to exhibit a prototype at the International Robot Exhibition 2019.**

## III-4. Growing areas of application

### ■ Steadily growing market for leading-edge medical equipment

- Increasingly, robotic surgery being covered by medical insurance
- Growing number of potential players in Japan and overseas

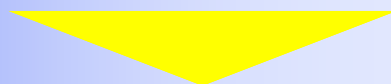


- Customized development to meet customer requirements
- Rollout across our entire product lineup (HD, MT, and AD):  
Conceptualize on the basis of ultra compactness and high precision

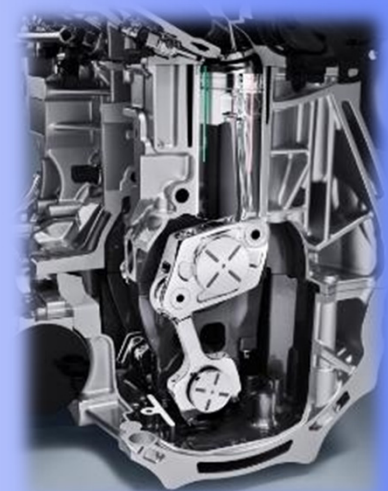


### ■ Automotive: Used in variable compression ratio (VCR) engines

- Surpasses various countries' environmental restrictions due to substantially improved thermal efficiency
- Expected use in more than 80% of internal combustion engines by 2040 (IEA forecast)
- Steadily responding to mass production demand since 2018



- Full-fledged rollout of VCR engines anticipated

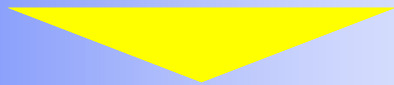


Courtesy of Nissan Motor Co., Ltd.

## III-5. New area of application: the aerospace industry

### ■ MaaS “flying taxis”

- Nearly 100 venture companies around the world
- Responding to demand for reducers in response to shift to commercialization and mass production

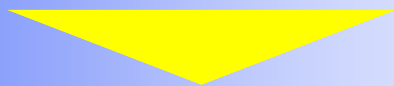


- Requirements our products are expected to meet:  
**Light weight, high torque, high reliability**



### ■ Space debris business

- Growing focus on this new space business
- We have a track record in space applications, so have an opportunity to contribute to this business with our products



- Continue to monitor trends



### III-6. New applications: **Hayabusa** and **Hayabusa2** planetary probes

Hayabusa2 operating its ion engine as it approaches 162173 Ryugu, an asteroid

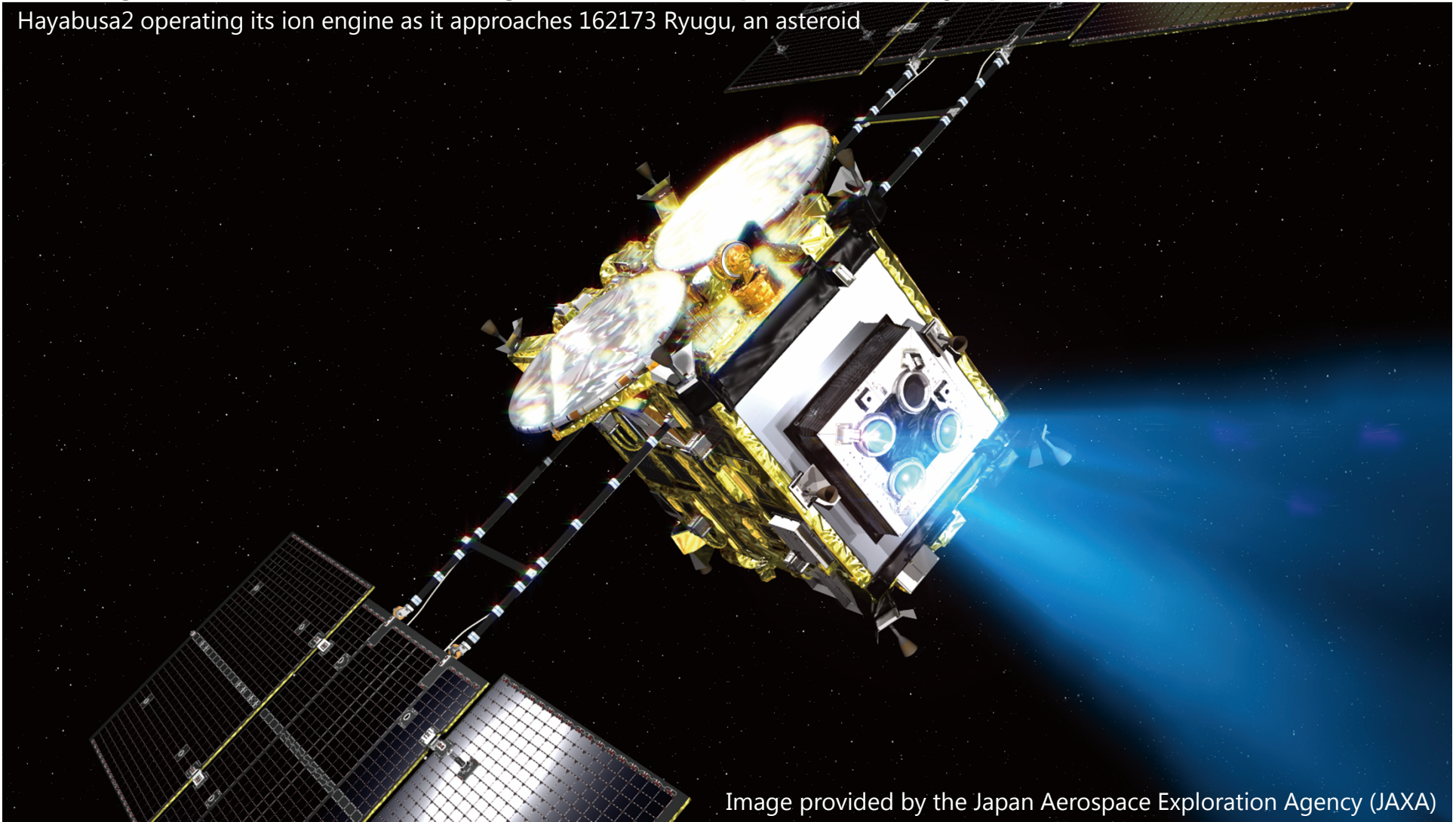
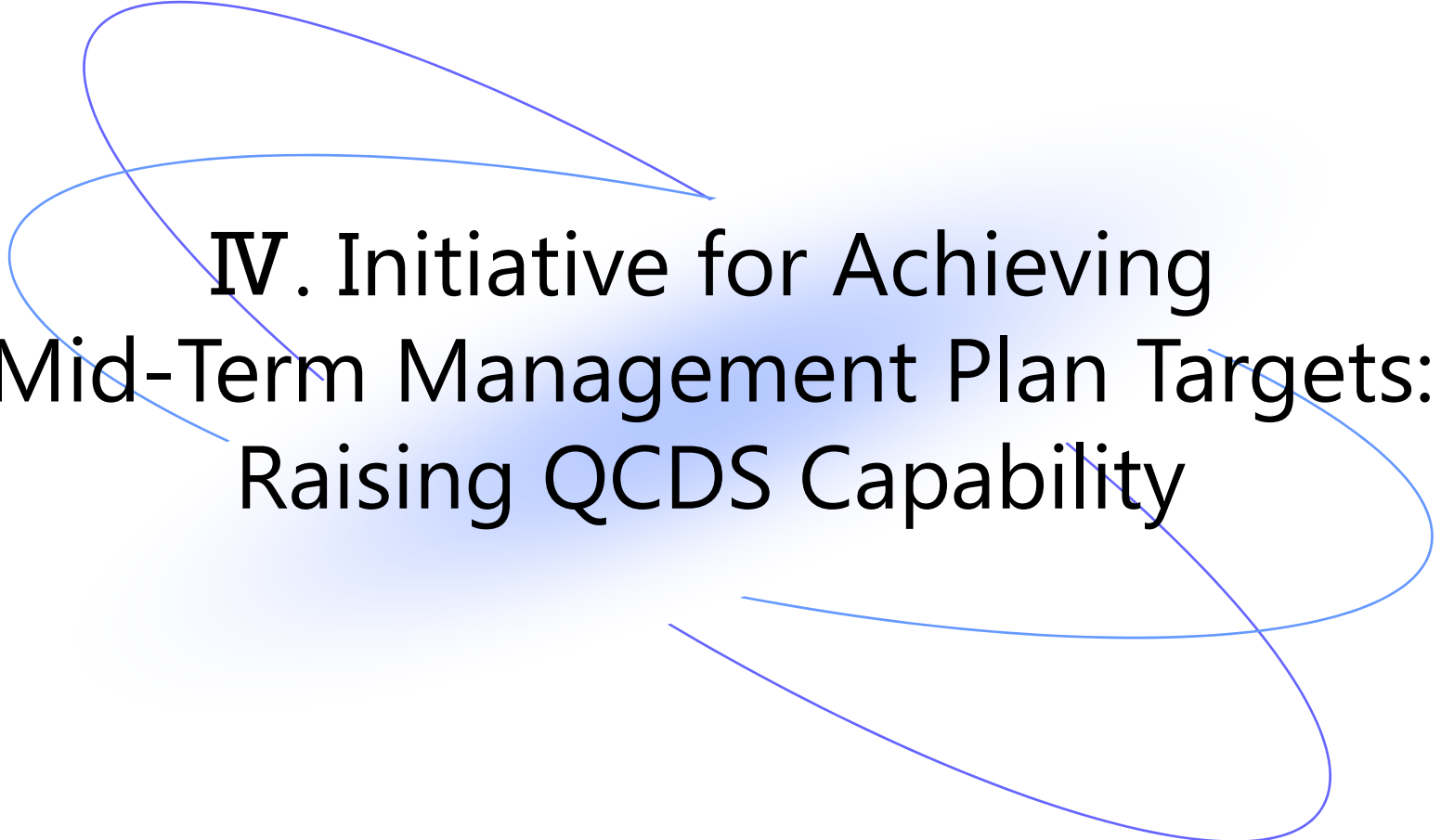


Image provided by the Japan Aerospace Exploration Agency (JAXA)

Harmonic Drive® used in the actuator of the gimbal mechanism  
on an ion engine manufactured by Moog (US)

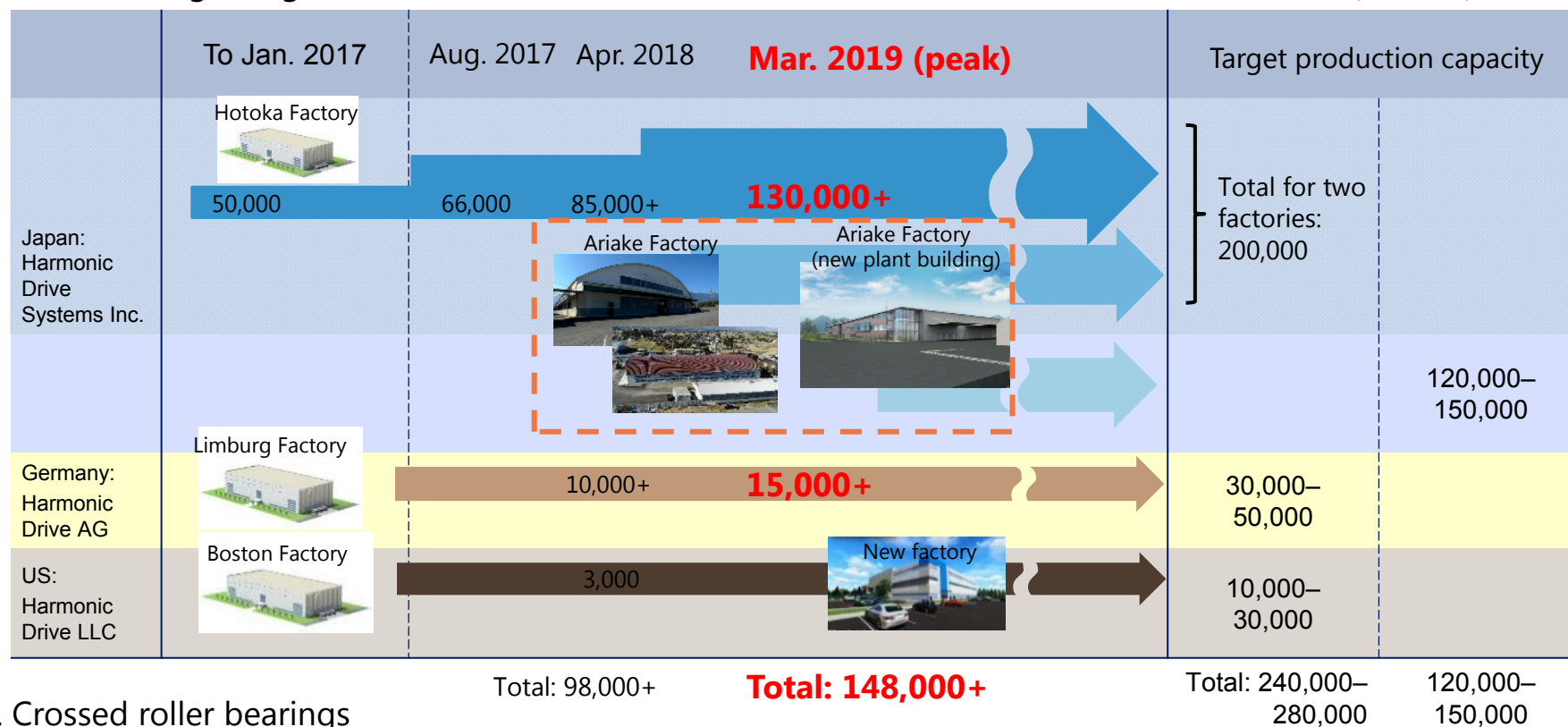
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## IV. Initiative for Achieving Mid-Term Management Plan Targets: Raising QCDS Capability

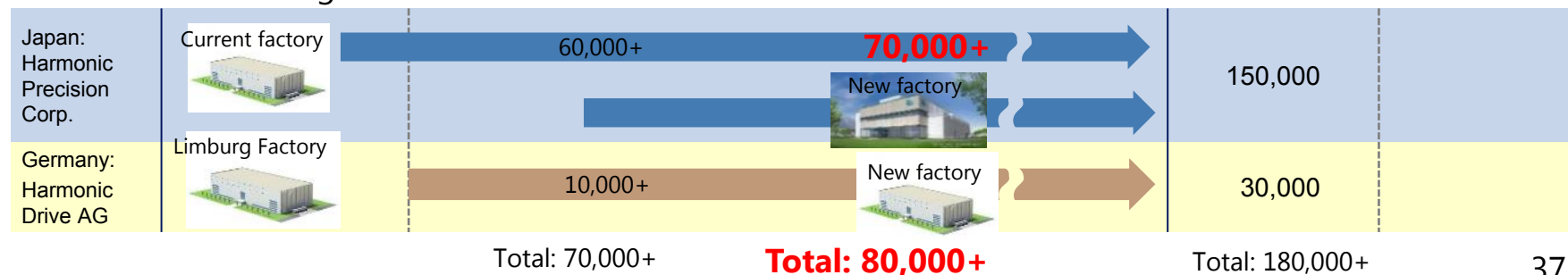
# IV-1. Roadmap to raising production capacity

## 1. Strain wave gearing devices

(Numbers indicate units produced per month)



## 2. Crossed roller bearings



## IV-2. Raising capacity at production facilities



Ariake Factory  
(Azumino, Nagano Prefecture)



Matsumoto Factory  
(Matsumoto, Nagano Prefecture)



Harmonic Drive LLC's  
new factory (US)



Harmonic Drive AG's  
second factory (Germany)

## IV-3. Status of initiatives to raise productivity and enhance quality

### ■ The production system our Group envisions

We aim to manufacture products that meet the individual needs of customers to the finest detail, backed by our advanced technology and skills.

#### ● **Small-lot, multi-variety production**

[Applications: small-lot robots, semiconductors, and other general equipment]

1. Our engineers possess advanced skills (processing, assembly, and inspection) that will help flexibly meet customer needs.
2. We have an extensive track record of small-lot, multi-variety production, leveraging our optimal production technology and management system.

#### ● **Large and medium-lot, small-variety production**

[Applications: automotive products and mass-production robots]

1. Our production lines are geared toward automation.
2. We also use our long-standing knowledge and expertise to optimize our automation equipment.
3. Sophisticated production technology and quality control enable us to maintain a high first-pass yield.

#### ■ **Production management system**

Use IT to create flexible systems.

#### ■ **Further improve quality**

Continue reinforcing efforts to cultivate specialists.

#### ■ **Strengthen partner companies' capacity**

Support efforts to strengthen structures to meet future growth opportunities.

#### ■ **Mass-production lines for FA applications**

Steadily expand process automation.

#### ■ **Mass-production lines for automotive applications**

With the exception of some existing lines, introduce new lines that are highly automated and provide highly finished products.

## IV-4. Status of initiatives to raise productivity and enhance quality

### ■ Automated lines

- Automated processing line for mainstay products



- Automated assembly process



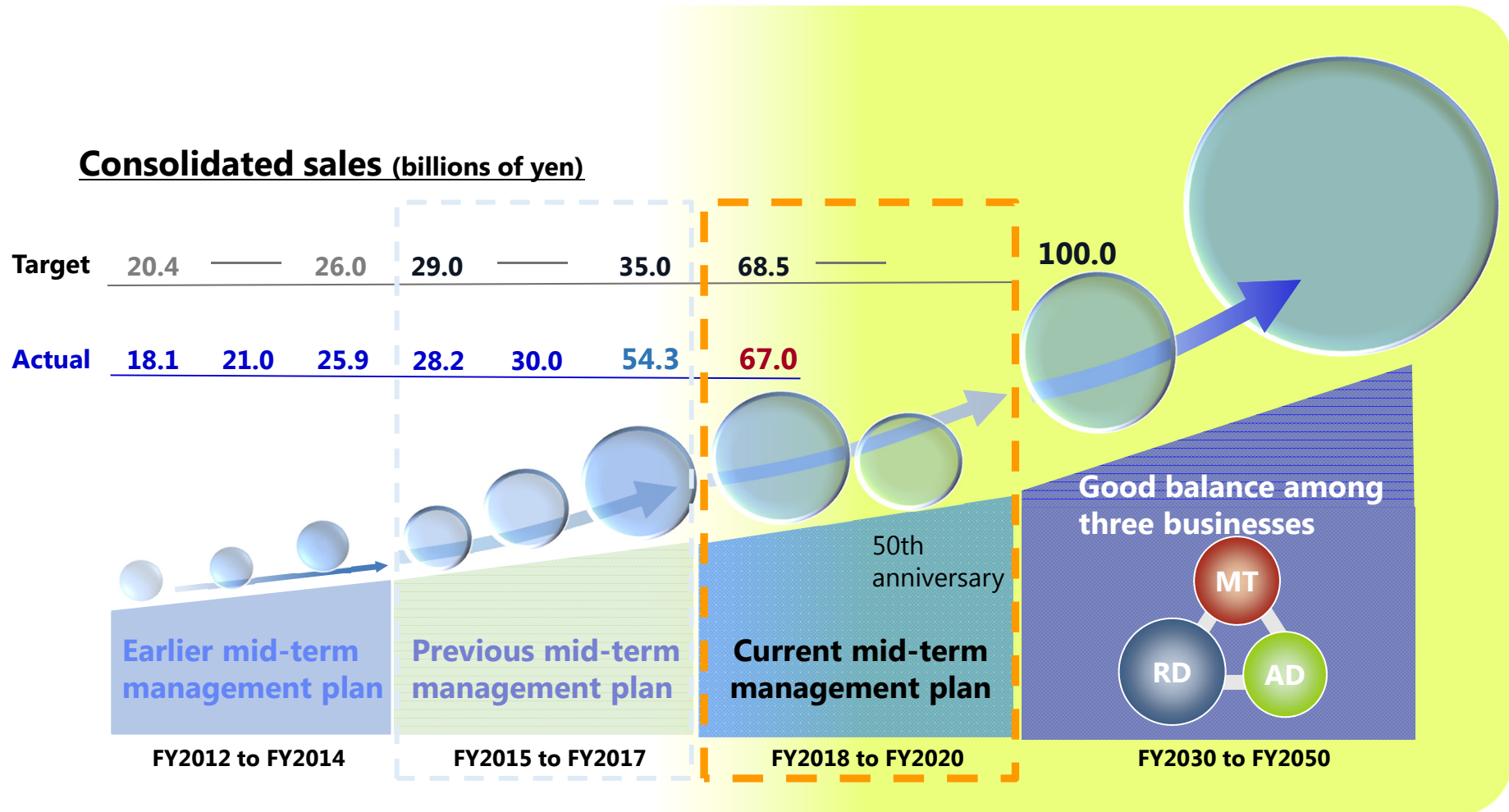
- We maintain quality control by using sophisticated measurement technology.
- Production capacity can be increased without being affected by personnel numbers.
- We are putting in place an environment to cultivate workers as engineers able to handle more advanced processes and pass on this knowledge.

Hone technologies/skills and achieve automation

The text is surrounded by several overlapping, hand-drawn style blue loops and swirls that frame the central message.

## V. Current Mid-Term Management Plan and Aiming for Further Growth toward 2030 and 2050

# V-1. Mid-term management plan and long-term vision



The performance targets and other numerical data presented herein are forecasts based on information available to the HDS Group at the time this material was prepared, and are subject to the influence of uncertainties including those in the economic and competitive environment. Actual performance may therefore differ materially from the forecasts given in this material.

***Harmonic Drive Systems Inc.***

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