



## The Introduction of 14 Japanese SMEs that successfully developed innovative products and technologies.

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Currently, the preparation of mass production line for MRJ (Mitsubishi Regional Jet) , Japanese next-generation regional jet, which succeeded in its first flight in November 2015, is in progress.

The production of airframe parts, aero engine parts and aircraft systems continue to increase in Japan, so aerospace industry is considered as one of the most important industries that drives Japanese economic growth.

In Japan, many large scale companies are playing important role as Tier1 manufactures of airframe, aero engine and aircraft systems. Especially, in the Boeing 787 project, Japanese companies achieved 35% of work share, backed by molding and processing technology of carbon fiber composite material which Japanese companies have big advantage and the technological capabilities that is represented by Japanese automobile industry.

A large number of many SMEs (small and medium size enterprises) support Japanese aerospace industry.

These companies are making continuous efforts to develop unique products and technologies such as molding and processing of composite materials and difficult-to-cut materials or manufacturing precision equipments.

14 Japanese SMEs from all of Japan that developed innovative products and technologies will be introduced in this leaflet.

Having outstanding products and technologies, they are working actively on developing their new market. We hope this leaflet help you to find your strong business partners.

## Contents

AERO Inc. ....	2
<i>Automatic Inspection of Fasteners on Aircraft Main Wings</i>	
Asahi Kinzoku Kogyo Inc. ....	4
<i>Environment-Friendly HVOF Thermal Spray Coating System</i>	
HIBIKI SEIKI Corporation.....	6
<i>Cutting Technology for Hard-to-cut Materials</i>	
Imai Aero-Equipment Mfg. Co., Ltd. ....	8
<i>Global and Integrated Production System for Aircraft Structural Parts</i>	
Kanto Aircraft Instrument Co., Ltd.....	10
<i>Leading Company of Electric Control Equipment in Japan</i>	
KIGUCHI TECHNICS Inc.....	12
<i>Specimen Preparation, Material Testing, and Metallographic Services</i>	
KOGANEI SEIKI Co., Ltd.....	14
<i>High Precision and Short Delivery of Processing for Hard-to-cut Materials</i>	
MITSUYA Co., Ltd.....	16
<i>Innovative Products of CFRTP Base Materials</i>	
Miyagi Tanoi Corporation.....	18
<i>Innovative Drills for CFRPs</i>	
NASADA Co., Ltd.....	20
<i>Highly Efficient Production of Hard-to-cut Materials</i>	
SHINDO Co., Ltd. ....	22
<i>Innovative Products of CFRP Base Materials</i>	
TAMAGAWA SEIKI Co., Ltd .....	24
<i>Advanced High-precision Sensoring Technologies for Avionics</i>	
UCHIDA Co., Ltd. ....	26
<i>High-precision Processing Technology for Composite Materials</i>	
URANO Co., Ltd. ....	28
<i>Integrated Processing System for large and Hard-to Cut Materials</i>	

## ■Directory

Established by 2 aircraft parts manufacturers, Wada Seisakusho and Nishimura Seisakusho in 1997, we provide assembly of structural component and rigging of aircrafts, painting of airframe, design/manufacturing of jigs, sales of aircraft parts and specified worker dispatching.

We work on assembly of civil aircrafts, military aircrafts and rockets.

We have a proven track record in the assembly of structural components and the rigging, such as the wings for the Bombardier GX, the rear fuselage for the Boeing 777, the wings for the Boeing 787, as well as the manufacture of 'Inboard Fixed Trailing Edge(IFTE)' for the Boeing 787 and the multiple processes covering assembly and inspection of rear fuselage of the Mitsubishi Regional Jet (MRJ).

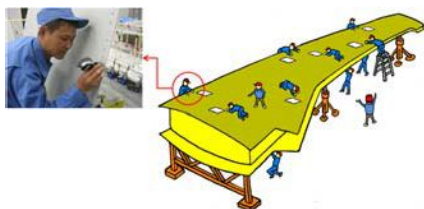
Sales of the aviation sector account over 90% of our total sales. We acquired AS/EN9100 certification at our main facility.

## ■Advantages

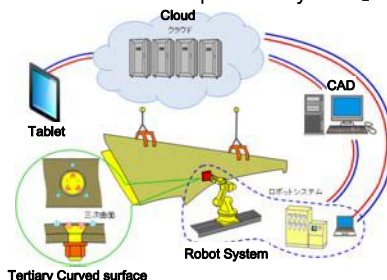
A full inspection of more than 40,000 riveting is required for the assembly of wings for the B787. Manual checking, which is widely used, needs 4000 hours and has the risk of human errors.

We developed our own automated rivet inspection system by robots, which carries out reliable full inspections and the data feedback in 50 times shorter working hour compared to manual inspection. This system enables us to manage the data and to prevent human errors, and we provide reliable rivet inspections at lower cost.

### 【Manual inspection】



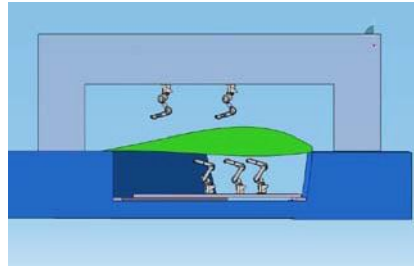
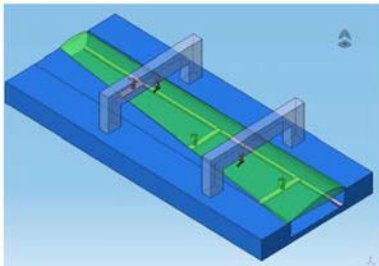
### 【Our automated inspection system】



Our automated inspection system consists of a vertical multi-joint robot, a high accuracy camera and 2 laser distance sensors. First, the robot specifies the point to be riveted and captures its image with the camera. After specifying the distinctive point to be inspected within the error range of 10 $\mu$ m by processing the captured image, the depth of the rivet is determined by two-dimensional laser scanning. The captured images are stored into a computer as the inspection history.

We recommend utilizing the tunnel type structure for inspection of wings, which mounts our image inspecting system on both upper and bottom sides, considering the size, structure and manufacturing site of the wings to be inspected.

**【tunnel type structure for inspection of wings】**



**-Company Profiles-**

Establishment : 1997

Number of employees : 368(2015)

Service & Items : Assembly and Rigging of airframe, Jigs, etc.

Main Customers : Mitsubishi Heavy Industries, Ltd., Kawasaki Heavy Industries Ltd., Fuji Heavy Industries Ltd., Mitsubishi aircraft corporation.

Capital : 25 million yen

Sales : 3.1 billion yen (2015.9)

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# Asahi Kinzoku Kogyo Inc.

## ■Directory

Founded in 1948 as an electroplating-company, we entered in aerospace industry when we started the surface treatment of aircraft parts for Japan Ministry of Defense in 1976. Since the establishment of Gifu factory, we have been focusing in manufacturing aero/space related parts so that 99% of total sales currently from aerospace industry.

Our special processes are approved by Boeing, Airbus, Rolls-Royce and heavy industries in Japan, and our specialty is the technologies on heat treatment.

We are the first Nadcap accredited company in Japan in 2004, and AS/EN9100 certified, thus we are receiving orders from overseas customers who require integrated production service covering from the procurement of materials to manufacturing parts.

## ■Advantages

Due to worldwide hazardous substance regulations, the alternative process of chromium plating is required. HVOF ( high speed flame ) thermal spraying, known as alternative technology, is coating parts with high density and high adhesion wear-resistant film by ultrasonic flame jet stream. It still has problems of insufficient dimensional accuracy, low productivity and high cost so that the practical use is still limited despite its environmental friendliness.

We successfully developed the HVOF thermal spray coating system which provides high quality, efficient and stably continuing coating to meet the requirements of coating thickness and surface roughness as sprayed without grinding. This technology is applied for the flap track rail for the MRJ in practical use.

【Chromium plating system】



【Our HVOF thermal spray system】



HVOF thermal spraying enables smooth surface and will eliminate polishing process. HVOF is applicable to the complex shaped material and the product that is unable to do polishing.

Furthermore, HVOF does not have any peeling problem while chrome plating causes some peeling and requires maintenance, which enables airlines to save the need of maintenance.

We have our own know-how with respect to thermal spraying conditions and powders being used. Since we are capable of improving fatigue strength of mother materials, we are capable to do this HVOF at about 30% less cost.

**【Our HVOF thermal spraying gun 】**



**-Company Profiles-**

Establishment : 1948

Number of employees : 564(2014.8)

Items : Aircraft body parts and engine parts that require special processing, etc.

Main Customers : Mitsubishi Heavy Industries, Ltd., Mitsubishi Aircraft Corporation, Fuji Heavy Industries Ltd., SHIMADZU CORPORATION

Capital : 99,5 million yen

Sales : 6,4 billion yen (2014.9)

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# HIBIKI SEIKI Corporation

## ■Directory

Since our establishment in 1967, we have grown to specialize in providing high precision products combining both lathe and machining elements. We consider the education and the development of our employees paramount. We aim to develop the craftspeople capable of the entire production process from diagram reading, machine programming, manufacture of jigs, set up and actual machining, to finishing and inspection.

Currently our main business is with the semiconductor industry where we manufacture vacuum chamber parts that require extreme precision and accuracy. Since acquiring AS/EN9100 in September 2013, we are now expanding our business into the aviation, energy and medical sectors.

## ■Advantages

We provide high quality complex and precision machining with high accuracy using the latest lathes and machining center machines. In addition to our main business in the semiconductor field, we are involved with the manufacture of aero engine parts and airframe parts in the aviation and space sector. Currently, we are involved in the development and mass production of the MRJ.

To expand our aviation business, we built a new factory in May 2014, which is equipped with a large multitasking lathe, 5-axis CNC machining centers, 3D coordinate measuring machines, and softwares including CATIA V5 and VERICUT.

The 5-axis CNC machining center is attached to the 24-pallet changing system and the extensive tool management system that make it possible to almost eradicate the risks from tool set or jig changes as well as human errors. We have the knowledge and experience to create the original jigs capable of processing hard-to-cut materials or hard-to-cut shapes, reducing cost and managing quality.

We specialize in machining aluminum, stainless steel, and hard-to-cut materials such as Inconel and titanium alloy. We are currently developing our experience working with the new anti-flammable magnesium alloy recently approved by the FAA. Magnesium is lighter (approx. 2/3) than aluminum but still possesses comparable stiffness and strength compared to the strong aluminum alloys, as well as superior damping performance. By increasing the autoignition temperature by 200-300°C, the new “anti-flammable magnesium alloy” was created. It is expected that this revolutionary new alloy, which takes advantages of the superior strength-to-weight ratio of magnesium, will have many uses, especially in the aerospace industry.



## ■Facilities

Classification	Manufacturer	Type	Size	Qty
Double column 5 sided MC	Okuma	MCR-A5C	3200×2400×650	1
Double Column MC	Yamazaki giken	YZ-1332ATC	3200×1300×850	1
	Osaka Kiko	VP1200	1600×1300×460	1
Simultaneous 5-axis MC	Makino Fleiss	A66ε-5XD	730×730×800	1
	Matsuura Kikai	MAM72-42V	520×730×510	1
		MX-520	630×560×510	2
Horizontal machining center	Okuma	MA-60HB	1000×800×810	1
	Mori Seiki	NHX5000	730×730×880	1
Turn-Mill Integrated MC	Mori Seiki	NTX1000	φ370×424	3
Vertical CNC Multitasking Lathe	Okuma	VTM1200YB	φ1270×1000×1080	1
CNC milling machine	Okuma	2SP-V80	φ800×840	1
	Mori Seiki	SL-603B	φ900×1000	2
All purpose NC milling machine	Takizawa	TAC-950	φ950×2000	1
Wire EDM machine	Seibu Denki	M75A	900×700×250	1
3D coordinate Measuring Machine	Tokyo Seimitsu	CONTUR A G2	1000×1200×600	1
	Mitsutoyo	Crysta-Apex	1205×1205×1005	1

Machine Details : Machining Center - 23 units / Lathe - 20 units /3D coordinate Measuring Machine 5 units /others

Software : CATIA V5 / Master Cam / VERICUT / HOLOS / BLADE PRO

【Main Plant】



【Products】



## -Company Profiles-

Establishment : 1967

Number of employees : 71(2015.12)

Items : Engine parts, Aircraft body parts, etc.

Capital : 75 million yen

Sales : 1,120 million yen (2015.8)

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# Imai Aero-Equipment Mfg. Co., Ltd.

## ■Directory

IAC started as a manufacturing company of automobile parts and machinery parts when founded in 1947. After receiving an order of jigs/tooling for T-33 jet trainer from Kawasaki Heavy Industries, Ltd. in 1958, we started business for aerospace field. In 1976, the aeronautic division spun off as Imai Aero-Equipment Mfg. Co., Ltd..

Our core business is manufacturing aircraft structure parts (especially for main wings), surface treatment, assemblies, designing and manufacturing jigs/tools and ground support equipments for aircrafts.

## ■Advantages

IAC group boast own global integrated production system. We acquired AS/EN9100 certification in 2003 at factories in Chubu area in Japan. In addition, we established the manufacturing sites with integrated production system in Malaysia and in Vietnam.

IAC introduced NC machining ahead of other companies and successfully established the production line in Japan, including 5-axis machining centers for hard-to-cut materials such as titanium alloy. IAC Malaysia provides Nadcap accredited surface treatment and subassemblies, and ADMS Vietnam offers the production of NC data and jigs design. Globally divided production system makes IAC possible to offer high quality service with low cost.

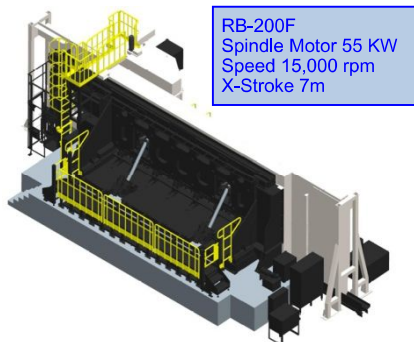
IAC is in the process of establishing a new factory in Tottori, Japan in 2016 with almost over twice higher than current domestic production capabilities.



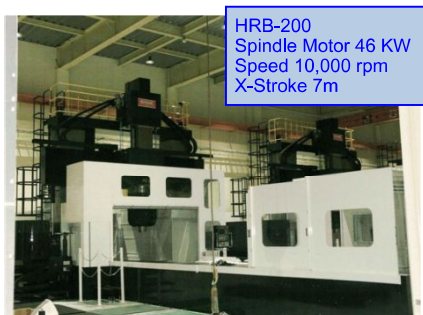
## ■Facilities

Machining Center	5-axis	52(58*)units	(* : number of spindles)
	4-axis	14 units	
	3-axis	41units	
CAD/CAM	CATIA	31 units	
	CADAM	5 units	
Coordinate Measuring Machine (CMM)		7 units	
Lazar Tracker		4units	

【Three axis Machining Center】



【Five axis Machining Center】



【High Spec Five axis Machining Center】



## -Company Profiles-

Establishment : 1947

Number of employees : 554(2015.12)

Capital : 96 million yen

Sales : 3,100 million yen(2015.2)

(Aircraft division : 3,100 million yen)

Items : Aircraft structure parts for main wings (Spars, Ribs, etc.)

Main Customers : Embraer, Spirit Aero Systems, Japanese heavy industries, the Ministry of Defense

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### ■Directory

Since the establishment in 1952 as an aircraft instrument maintenance and repair company, we have been expanding our production range as manufacturer and system integrator of innovative electronic equipments including FDR, HUMS, Gimbal Mounted Motion Simulator for aircrafts, flying objects, ships and special mission ground vehicles, and from wide range of military applications to commercial applications.

### ■Advantages

Data Recorder/Monitoring, Gimbal/Gyro, Signal Processing and Wireless Communication Technologies for wide range of aircrafts, ships and ground vehicles are one of our fields of expertise.

We have 90% of domestic market share of Flight Data Recorder (FDR) for the Japan Self Defense Force. And our FDRs have been adopted for wide range of fixed-wing aircrafts and rotary wing aircrafts including the F-15, the F-2, the T-4, the US-2, the SH-60K, the UH-60J, the CH-47JA that are possessed by the Japan SDF.

We established the mass production line of the Battery Monitoring Unit(BMU) for the lithium ion battery for the Boeing 787, which is expected to be adopting for other aircrafts. For Maritime SDF ships and Japan Coast Guard patrol ships, we deliver various testing tables and stabilizers to detect the vibration of a ship to stabilize searchlights and cameras.

Backed by high technology through our experience in defense field, we strive to increase our market share of commercial application market from 15% up to 30-50% up gradually in the medium- and long-term.

We aim at expansion of export of our main products, participating global supply chain by the development of new products by utilizing advantage of our technological capability.

## ■Products

### 【Data Recorder Electronic Equipment】



### 【Stabilizer & Gimbal System】

#### Camera Stabilizer



### 【Telemeter system 】

#### Micro missiles Telemeter



#### Telemeter for missiles



### 【Battery Monitoring Unit 】

#### Main board



#### Sub board



## -Company Profiles-

Establishment : 1952

Capital : 480 million yen

Number of employees : 224(2015.12)

Sales : 4,600 million yen(2014.3)

Items : FDR/Stabilizer, Gimbal System, Telemeter system, BMU for lithium ion battery, etc.

Main Customers : the Ministry of Defense, JAXA, Mitsubishi Heavy Industries, Ltd., Kawasaki Heavy Industries Ltd., Fuji Heavy Industries Ltd., ShinMaywa Industries Ltd., Mitsubishi Electric Corporation, NEC Corporation, Toshiba Corporation, GS Yuasa Corporation, GE Aviation Systems, Thales Defense & Security, Inc., L-3 Communications Avionics Systems, BAE Systems Inc., etc.

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## ■Directory

Since the establishment in 1961, we provide cutting out materials, heat treatment, specimen preparation, material testing and examination service. We have been working with aerospace industry for 13 years, and the sale of aerospace business accounts for 30% of the latest total sales.

Our testing process conforms to ASTM and JIS standards, and we obtained the important accreditations such as AS/EN 9100, Nadcap and ISO/IEC 17025.

Our main customers are Japanese heavy industry companies and material manufacturers, and we also hold their approvals.

## ■Advantages

We provide a sequence of in-house spectrum services of material testing from sectioning, machining, heat treatment, inspection, mechanical testing, metallography and to material testing, which guarantee high quality, quick delivery and cost saving for customers.

We boast cutting-out materials and technologies, such as the world's fastest and largest wire EDM capable of large size or hard-to-machine materials, low stress testing machines, creep rupture testing machines by MTS, rotary bending fatigue testing machines, etc.

We are actively investing for equipments at 0.4-0.5 billion yen every year, and the number of testing machines such as MTS fatigue testing machines and creep rupture testing machines is at top level in Asia.

In aerospace industry, we mainly provide evaluating high temperature materials for engines and testing composite materials for airframes that meet the demands of manufacturers both overseas and domestics.

To obtain more competitiveness in Asia and the world, we developed an aggressive strategy for more accredited laboratory and conforming to more quality standards and specifications.

### 【Accreditations:Nadcap】

AC7101/3 Rev C	(A) Room Temperature (B) Elevated Temperature Tensile (C) Stress Rupture (O) High Cycle Fatigue (P) Fracture Toughness (XA) Creep (XE) Crack Propagation/Crack Growth Testing (Y) Low Cycle Fatigue
AC7101/4 Rev E	(L) Metallography (General) (LS) Micro: Surface Conditions (L8) Near Surface Examinations - Alpha Case: Wrought Titanium (L9) Near Surface Examinations - Alpha Case: Cast Titanium
AC7101/7 Rev C	(Z) Standard Specimen Machining (Z1) Low Stress Grinding (Z2) Low Stress Grinding and Polishing (Z3) Cast Specimens



We aim for growth as a leading laboratory in aerospace industry and achieving sales of 5 billion yen in 2020.

#### ■Facilities

- Extra-Large wire EDM
- High-precision micro-profile grinding machine
- Abrasive jet cutter
- Sarvohydraulic fatigue testing machine
- Rotary bending fatigue testing machine
- Creep rupture testing machine
- Impact tester
- Tensile testing machine
- SEM/EDX, others

【Creep rupture testing machine】



【Fatigue testing machine】



【Head office 】



#### -Company Profiles-

Establishment : 1961

Capital : 15 million yen

Number of employees : 135(2015.12)

Sales : 2,160 million yen(2014.3)

Services : High temperature material testing for engines, Composite material for body testing, etc.

Main Customers : Major heavy industries

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## ■Directory

Since the foundation as an aircraft parts manufacturer in 1943, we have involved in engine parts business, and newly involved in prototyping engine parts for motorcycle and cars including F1 and CART from 1980s. Now we have direct accounts with globally leading manufacturers, and currently, automotive business is one of our main lines.

At our main factories in Saitama and Maebashi, besides manufacturing automotive parts, we work on machining and polishing of medium and high pressure casing for aircrafts for major heavy industries in Japan.

We acquired AS/EN 9100 at our 2 factories in 2013. While our automotive business continues to grow, we are keeping the sales of aerospace sector at steadily 5 - 10% among our total sales.

## ■Advantages

We know how to meet clients' needs of frequent design changes and short delivery through the experience in manufacturing engine parts for race cars. Our advantage is the flexible and prompt response capability to customers' requirements.

We can utilize our experience for increasing requirement for higher accuracy of processing in the background of downsizing of aero engines.

We provide super precision machining with cutting-edge machining centers and grinding machines with extremely high accuracy that are fully customized to meet our specification based on our know-how and various measurement instruments such as 3D roundness measurement devices.

We boast our steady supply of processing with 120 units of machining centers including 30 units of 5-axis machining centers, many cam grinders, pin grinders, pin miller machines and NC lathes, etc.

We continue aggressive investment such as the establishment of new factory in Haruna with 6,300 m<sup>2</sup> of site area at 3 billion yen. The 12 units of latest machining centers with ultra-high accuracy started operation in 2014.

## ■Facilities

Type	Manufacturer・Type・Specification, etc.	Qty
Vertical・Lateral Machining Center (Including 4 units of large 1,000 square and 30 units of 5 axis machining centers)	Mitsui Seiki/Yasuda Kogyo, etc. Large size 1,200square table-400square Majority of them are 630 square	120
NC Honing	Maximum stroke 400mm/φ130	6
Cam Grinder	KOPP/JUNKER	6
Pin Grinder	KOPP/JUNKER/NTC	5
Pin Milling	HELLER/BOEHRINGER	4
NC Lathe (Including 3 units of O-M vertical lathe)	OKUMA/TAKAMAZ/O-M	27
3 dimensional measuring instrument	ZEISS/Tokyo Seimitsu	20
Circularity measuring instrument	HOMMEL/MAHR/Tokyo Seimitsu/Kosaka	11

【Head office】



【The latest grinder [Head office]】



【Five-axis machining & 3D measuring instrument [Maebashi Factory]】



## -Company Profiles-

Establishment : 1943

Number of employees : 260(2015.12.1)

Capital : 80 million yen

Sales : 5,160 million yen (2015.7)

(Aircraft division : 300 million yen)

Items : Aircraft medium and high pressure casings, Disk shafts for rockets, etc.

Main Customers : Domestic heavy industrial manufacturers

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### ■Directory

Founded in 1968 as a textile processing manufacturer who stretched from weaving and dyeing to finishing, we offer chemical textiles, synthetic textiles and those composite textiles to many sectors including apparel, sports, industrial and life living. Besides, we work on development and production of composite materials, which accounts 10% of our total sales.

### ■Advantages

We develop and manufacture Carbon Fiber Reinforced Thermo Plastics (CFRTPs), which are more recyclable and high-cycle moldable than Carbon Fiber Reinforced Plastics (CFRPs) molded by thermosetting.

We successfully developed thermoplastic thin prepreg sheets by combining fibers spread uniformly thin and resin utilizing fiber opening technology patent owned by Fukui Prefecture. The thinness of our prepreg sheet is under 40μm, that is extremely thinner compared with the thinness of 120μm- 200μm of existing products.

By thinner laminate improved the resin impregnation and result in prevention of air and bubbles being contained when molding.

Besides, our products improved the primary failure capacity for tensile and compressive load, and their fatigue loading and impact properties are dramatically improved.

We developed our own mass production equipment producing Thin-ply prepreg sheet of various thermos plasticity opened yarn sheet such as:

semi prepreg sheet, made by laying carbon composite in one direction and resin being semi impregnated, that offers good formativeness at the time of lamination (standard: width 300mm x 100m~), stiff prepreg sheet fully resin-impregnated (standard: 300mm x 100m~) and thin-multi directional semipreg sheet produced by layering thin unidirectional fiber sheets in 4 axis at angle of 90 degree, -45 degree, 0 degree, 45degree and combining by heating and pressuring (standard: width 1,000mm x 100m~), thin-multi directional prepreg sheet (standard: width 1,000mm x 100m~).

Besides, we offer CFRTPs making various thermoplastic resins as a matrix including PA6, PC, PEI, and PEEK, and so on.

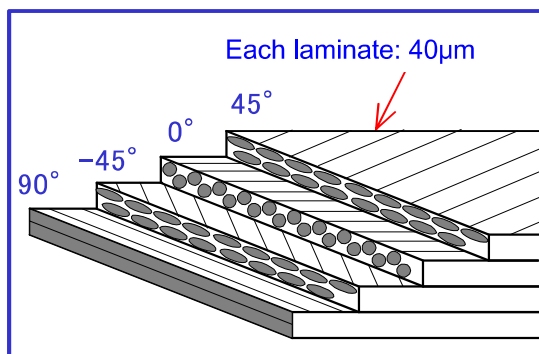
【thin unidirectional semipreg sheet】



【thin unidirectional prepreg sheet】



【image: thin-multi directional prepreg sheet】



### -Company Profiles-

Establishment : 1968

Number of employees : 218(2015.12)

Items : CFRP intermediate material

Main Customers : IHI AEROSPACE Co., Ltd.

Capital : 307.1 million yen

Sales : 3,200 million yen (2015.4)

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# Miyagi Tanoi Corporation

## ■Directory

We spun off as a tap production base of Tanoi manufacturing Co.,Ltd. in 1973, which was established as a tap and dice manufacturer specialized in screw machining in 1923.

## ■Advantages

Thermosetting CFRP, which is popular in the aviation industry, is susceptible to occur burrs and delaminations and also wear damages on the tools when being hole drilled. These problems are caused by an excessive load at the top of cutting tools. Thus, we developed the unique drills only for CFRP called [SCUTDRILL] by applying our know-how of dispersing the cutting load.

By applying the sequential cutting mechanism of taps, we realized to reduce the load and the damage to their blades. Multiple blades at the tip of the drill distribute the cutting load, and the blade shape is tapered toward tip, which enables to drill holes gradually. That also results in the prevention of burrs and delaminations.

Our new drills reduce 15% of cutting heat at hole drilling of thermosetting CFRP compared to other conventional drills. And also the drill life evaluation result shows that the delamination width after 1600 holes drilled is less than 0.3mm.

Generally, 100,000 holes drilling on CFRP is required for one aircraft. We already achieved to make 700 holes in CFRP for aircrafts or 2,000 holes in CFRP for general application using one our drill.

We are currently applying for a patent on the [SCUTDRILL], and we have started to sale it setting the aviation industry as a main target since October 2015.

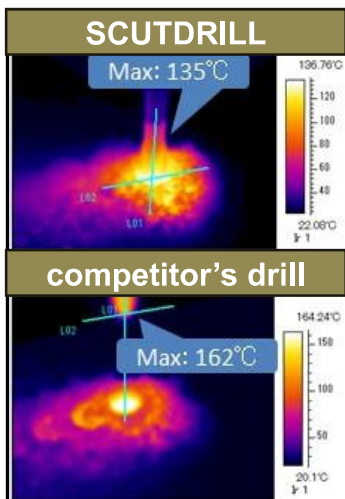
The potentials of our drills to realize the machining quality, longer tool life, as well as higher speed of machining, will be the key to reduce of a large amount of processing cost of CFRP.

【SCUTDRILL】





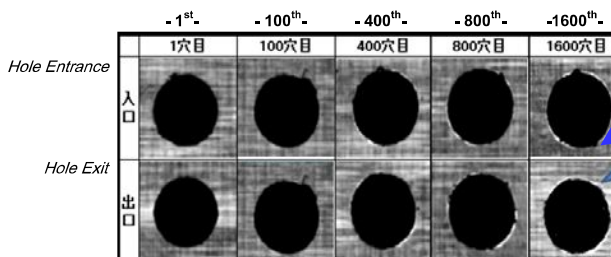
【generated heat reduction】 ~ Reduced heat reduction by 15%



【drill life evaluation】 ~ delamination width(<0.5mm)

Tool diameter :  $\Phi 6.35$   
Cutting speed : 100m/min  
Travel speed : 125mm/min  
Raw material CFRP ( for aircraft )  
Hole depth : 6mm  
Coolant : dry  
Number of holes : 1,600 holes

**Delamination width of  
1600th hole :  
Less than 0.3mm**



### -Company Profiles-

Establishment : 1973  
Number of employees : 74(2015.12)  
Items : CFRP cutting tools

Capital : 30 million yen  
Sales : 960 million yen (2015, first half)

### -Contact-

Name : Tomokazu Tabe , Chief  
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e-mail : tomokazu\_tabe@tanai-mfg.co.jp  
URL : -

## ■Directory

Based on unique technologies of processing hard-to-cut materials such as titanium alloy and nickel alloy etc., we provide aero engine parts, hydraulic equipment parts, gas turbine components and diesel engine components. Manufacturing aero engine parts is our main business and accounts for 30% of total sales, and we acquired AS/EN9100 and Nadcap accreditation.

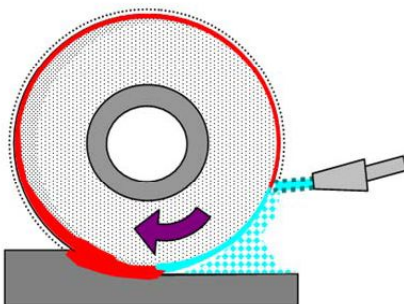
We have more than 30 years of experience in aero engine parts and specialize in processing hard-to-cut parts which require heat and pressure resistance such as turbine cases, burner inner cases and outer cases. We provide critical parts of the V2500 for the A320 series, the GENx and the Trent 1000 for the B787-8, the Trent XWB for the A350 XWB.

## ■Advantages

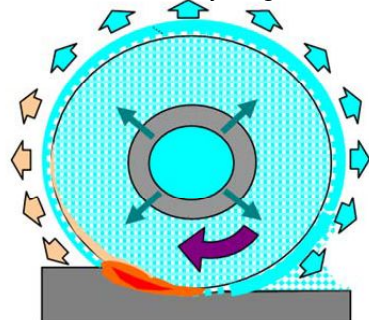
While grinding is generally used to process the complex shaped thin parts made of hard-to-cut materials such as turbine blades of aero engine, the material deformation due to a large amount of friction heat is often caused in this process. Therefore, the processing at lower speed and the reducing friction heat is required, which might lower working efficiency.

We succeeded in developing new technology of cooling the working point by supplying grinding fluid from the inside of the grindstone, that enables to lower friction heat from 450 to 250 degrees Celsius, and to grind twice faster and result in higher efficiency. The surface roughness is also improved from Ra0.8 to Ra0.3, so that it is also possible to keep quality and accuracy of processed parts.

【conventional grinding fluid jetting method 】

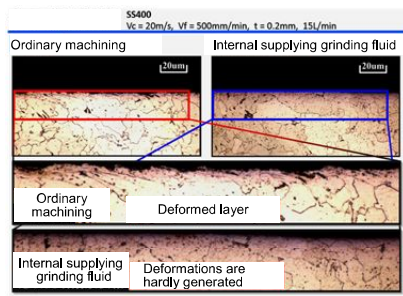


【our innovative jetting method】

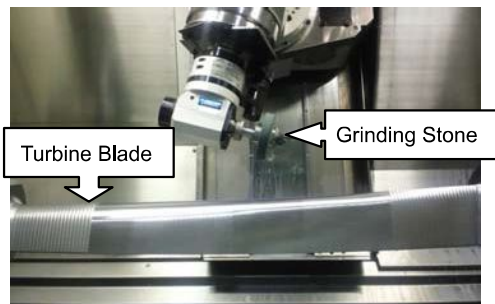


Besides, we have the high accurate NC lathes and CNC programs that cover continuous process from turning, drilling, rough grooving by wire EDM to finish grooving. These integrated technologies and automated operation have realized high productivity and increased the competitiveness reducing 50% of the cost in processing of turbine disks.

### 【Cross Section】



### 【Grinder】



## ■Facilities

Classification	Type	Manufacturer	Qty	Size
Multitasking Machines	e1060V/8 II	MAZAK	3	φ1200*1,330 5axis
	VTM-120YB	OKUMA	1	φ1200*1,000 5 axis
	INTEGREX300-IVST	MAZAK	1	φ760*1,500 5 axis
	INTEGREX J-200	MAZAK	12	φ400*500 5 axis
	MU6300V-L	OKUMA	2	φ800*500 5 axis/ grinding
Grinding Machines	NVGH-12TC	TAIYO KOKI	1	φ1200*600 grinding
Horizontal Machining Centers	YBM-90N	YASDA	1	φ1,200*1,000 4axis
	YBM-600N	PRECISION	2	φ800*700 4 axis
	YBM-660N	TOOLS K.K.	1	φ900*800 4 axis

## -Company Profiles-

Establishment : 1947

Number of employees : 85(2015)

Items : Engine component airframe parts

Main Customers : Mitsubishi Heavy Industries, Ltd., Kawasaki Heavy Industries, Ltd.

Capital : 20 million yen

Sales : 1.9 billion yen (2014.9)

## -Contact-

Name : Shigemi Shindou, President and C.E.O

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## ■Directory

Since the foundation in 1970, we mainly work on textiles including planning, manufacturing and sales of apparels, sportswears and fabrics for packaging materials. We have production and sales base in China, Hong Kong, Germany, France, Italy, and the USA.

We started the value-adding processing of silicon based material in 1991, and the development, manufacture and sales of industrial fabric materials as our third main business in 2000.

We are developing the fiber business into aviation and space field as well as transportation, transfer, construction, environment and medical fields.

In aviation and space field, we started the joint program of developing carbon composite materials for rockets in 2002 with Japanese heavy industry companies. And in 2007, we succeeded in development of composite materials for aerospace independently, and established the mass production system in cooperate with Japanese heavy industries.

## ■Advantages

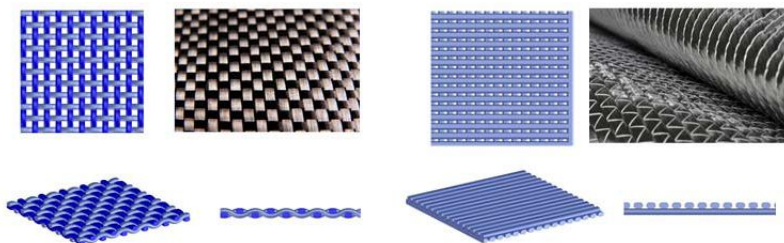
We provide Non Crimp Fabrics (NCF), which is produced by weaving technique of layering carbon fibers without interlaced, binding fibers by stitch bonding to combine fibers unidirectionally.

By adopting stitch bonding, shaping workability and followability to a shape of a molding die are improved, in addition, the straightness of fibers are also guaranteed. Therefore, we can effectively produce shaped products with enough reinforcement in higher precision.

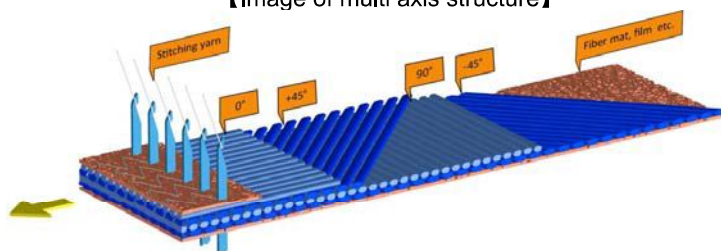
Utilizing the technology of spreading fibers uniformly thin and wide, we introduced the equipment that laminates NCF in multi-directional structure in 4 directions of -45 degree, 90 degree, 45 degree and 0 degree and established the mass production system.

We continue to improve the equipment utilizing our know-how in the way of manufacture and the technology of spreading fibers which was developed in Industrial Technology Center of Fukui Prefecture.

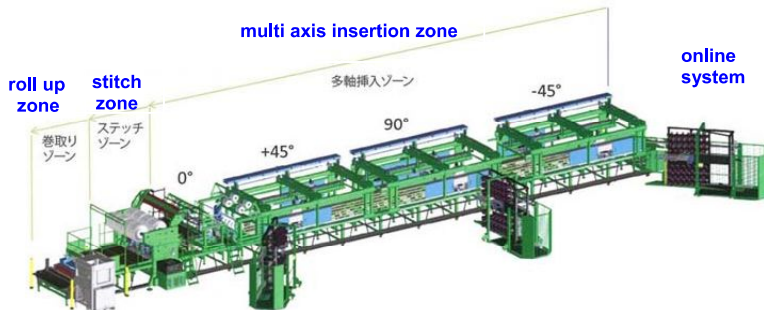
【structural difference of typical fiber(left) and NCF(right)】



【Image of multi axis structure】



【Production facility of open weaving NCF】



**-Company Profiles-**

Establishment : 1970

Number of employees : 251(2015.12)

Items : Carbon composite intermediate material

Capital : 30 million yen

Sales : 10 billion yen (including overseas group, 2014)

**-Contact-**

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## ■Directory

Founded in 1938, TAMAGAWA SEIKI grew as Synchros and resolvers manufacturer. Expanding aviation sector since the start of manufacturing gyros in 1960 and overhaul service in 1961, we now provide ranges of gyros, electric instruments, actuators and controllers. We boast our AS/EN9100, ISO17025 and Nadcap accredited and OEM approved including Boeing facility and provide reliable products with high accuracy. The sales in commercial transport sector including aerospace, automobiles and railway is approximately one-third of our total sales.

Specializing in high accuracy angle control of control devices such as sensors, motors and gyros, we provide world-leading technologies of development and manufacturing 2 and 3 dimensional position and angular velocity sensors.

We have worldwide customers including Boeing, Rockwell Collins, Honeywell, UTC, Aerospace Systems, Liebherr, Moog, SHIMADZU, Nabtesco, IHI and Sumitomo Precision Products, etc. With our overseas subsidiaries in Germany, China, Hong Kong and our branch offices at Singapore, Taiwan, and USA, we provide global sales and support services to our customers.

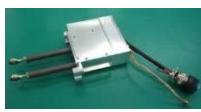
## ■Advantages

Our services include design, manufacture, repair and overhaul of various control devices for aircrafts. We also have unique technologies for developing and producing brushless resolvers, RVDTs, LVDTs, brushless DC motors for the cockpit of commercial aircrafts, the electrical actuators for small aircrafts, levers and fuel pumps.

### 【Electro Mechanical Actuators & Levers】



Electro Mechanical  
Actuator  
(Ball-screw type)



Electro Mechanical  
Actuator  
(Jack-screw type)



Flap Slat Control  
Lever



Throttle Quadrant  
Assy



## 【Application for Mitsubishi MRJ】



## 【Commercial aircraft components】



Motors, Resolvers  
(Angular Sensors)



LVDT (Linear Variable  
Differential Transformer)



RVD T (Rotary Variable  
Differential Transformer)  
Products

By manufacturing products of three fields such as aircraft, automobiles and railway in our one factory, we create synergies and strengths of unique technology.

### -Company Profiles-

Establishment : 1938

Number of employees : 730 (2015)

Items : Equipments for Control

Main Customers : Mitsubishi Heavy Industries, Ltd., Toyota Motor Corporation, Honeywell, Rockwell Collins

Capital : 100 million yen

Sales : 35.7 billion yen (2015)

### -Contact-

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e-mail : [info2www@tamagawa-seiki.com](mailto:info2www@tamagawa-seiki.com)

URL : <http://www.tamagawa-seiki.com/english/index.html>

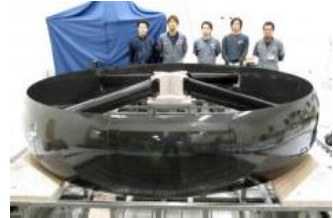
## ■Directory

Uchida was established in 1968 as a molding company. We have worked on prototyping parts for racing motorcycles and developed and manufactured of aero parts for 4 wheel vehicles.

In 1999, we introduced the new autoclave and made a full-scale entry into the development of parts for 2 or 4 wheel vehicles for racing, which accounts 70% of our total sales now.

Starting the development for aircraft related parts, manufacture of die for aircrafts, prototyping, manufacture of test pieces and jigs since 2004, we worked on manufacture of the jet engine blades that need bonding between carbon and titanium in 2008. We successfully delivered prototype parts to an oversea helicopter manufacturer in 2011. The sales amount of aeronautical and space fields expanded up to 21% of our total sales. We acquired AS/EN9100 certification in 2007.

【Rotor blade】



## ■Advantages

Our strength is the capability for a sequence of manufacturing of CFRP from engineering, analysis, mold production, lamination, fabrication, secondary processing, painting, and to inspection in-house. We design our products with consideration of layering and proper shape formation by utilizing 3D CAD/CAM to counteract against dimensional distortion.

All layering is performed in the clean room adapted for FED-STD-209E. We are capable of layering woven materials and unidirectional (UD) materials, and fabrication of mixed shape of different thickness from very thin to very thick.

We also produce high precision, quality and heat resistant CFRP units using two autoclaves, one is capable of 400°C and the other is for large-sized materials.

For secondary processing, we utilize high-performance 5 or 3 axis machining centers, and our experienced technicians perform processes manually that machines are not capable. Thus, we meet our customers' requirement for high accurate processing by both machine processing and manual processing.

We acquired AS/EN 9100. We provide NDT by ultrasound flaw detector to see if there are any contaminations in the layered surface, and verification of actual accuracy of products by 3D measurement using laser tracker.

Currently we are introducing new equipment in order to establish high-cycle molding of CFRTS/CFRTP/HP-RTM for semi-automated production line and the laboratory equipped with universal testing machines.

## ■Facilities

Type	Manufacturer・Type・Specification, etc.	Qty
CAD/CAM	CATIA V5 THINK DESIGN MASTER CAM Others 3D/CAD 2D/CAD	15
Large Scale Clean Room	US FED-STD-209D JIS B 9920 Class5 Room Volume : 760m <sup>3</sup> (16,000×16,000×3,000mm)	1
Resin/CFRP Special Processor	Mori Seiki NV5000B/40 (3axis)	1
	Mori Seiki VS1000/40/2050 (3axis)	1
	DMG M/C DMU125P M/C DMU100P (5axis)	2
	NEO (5axis)	1
Cutting plotter	W1,500×L3,500mm W1500,×L2000mm	2
Autoclave	Ashida Seisakujo (Φ1,150×1,000mm/Φ3,000×6,000mm)	3
Oven	W450×H450×D450mm	1
	W1,000×H1,000×D1,000mm	1
	W3,000×H2,000×D3,000mm	1
	W7,000×H3,000×D2,000mm	1
Non Destructive Tester/ Measuring Instrument	Leica Laser Tracker (Non contact 3D measuring instrument)	1
	Layout Machine (3D measuring instrument)	1
	Toshiba Matrix Eye EX (Ultra-Sonic Flaw Detector)	1
	Instron Type 5985 (250Kn All Purpose Composite material Tester)	1
	Olympus GX51 (Standup metal microscope)	1
Other Facilities	Pre-heater w1000×H200×D1000mm	
	Pressing Machine 630t	
	Mold Temperature Control System 400℃	

【Pressing Machine(Krauss Maffei)】



【Autoclave】



【Prototype 'Carbone Mirai'】



【Head office】



【Prototype 'BONSAI' made of carbon】



## -Company Profiles-

Establishment : 1968

Number of employees : 45(2015.12)

Capital : 50 million yen

Sales : 700 million yen (2015)

(Aircraft division : 21%)

Services : Prototype engine parts development

Main Customers : HONDA Motor Co.,Ltd., IHI Corp., JAXA, MELCO

## -Contact-

Name : Ayumu Aoyama, Department of sales

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e-mail : uchida\_info@uchida-k.co.jp

URL : <http://www.uchida-k.co.jp/>

## ■Directory

Founded in 1950, our main business is manufacturing machining parts for aerospace products, semiconductor manufacturing equipments, energy systems and medical equipments with metals such as titanium, aluminum and stainless steel, etc.

We started the service of the aerospace field in 1990 and have been provided aircraft structural parts and complex-shaped parts of difficult-to-machining materials such as turbine blades and casings of engines in main 2 factories located in Japan. The sales in aerospace industry grew up to 42% of our total sales in 2014.

We are AS/EN 9100 certified and hold the official approvals by leading aerospace manufacturers in Japan. For providing flap peening service, we are preparing for the approval on the special process by Boeing.

## ■Advantages

We are specialized in machining parts in complex-shaped, large and thin or difficult-to-machining materials with 5-axis machining center. In the aerospace field, we have the wide experience in dealing with difficult-to-machining materials including titanium alloy, Inconel, nickel based materials such as Wasparoy.

We have special equipments capable of 3-4 meters titanium only for aviation parts.

We are joining major program of the B777, the B787, the A380 and the MRJ through business with domestic major suppliers.

Our strength is an integrated production system including machining, special process, and subassembly. Joining in aerospace clusters in Tokyo and Kyushu, we boast our strong suppliers network.

Our new factory for the mass production line of the MRJ and the development of engine for the B777X and other aircrafts will be open in March 2016.

【Nagasaki Plant】



【Models of machining parts】	【Main customers(their QMS Qualification)】
Boeing : 787,787-8,787-9,787-10,747 Airbus : 380 Bombardier : G7000 Embraer : ER-J170,190 MHI : MRJ Rolls-Royce : Trent XWB-84 GE(General Electric) : TechX=passport Pratt & Whitney : PW1100G	Mitsubishi Heavy Industries, Ltd. (MSJ4000,MS84001) Kawasaki Heavy Industries, Ltd. Aerospace Company (KWMS-7200,7222) Fuji Heavy Industries, Ltd. Aerospace Company (FASOP Q-009) ShinMaywa Industries Ltd. Aircraft Division (SQR-001) NIPPI Corporation Aerospace Division IHI Corporation Aero-Engine & Space Operations (ISAJT-02043) Minebea Co., Ltd.

## ■Facilities

Simultaneous 5-axis horizontal	12 machines
Simultaneous 5-axis vertical	9 machines
4-axis horizontal	21 machines
Vertical/Gate-form	32 machines
Turning center	1 machine
NC lathe	1 machine
Other NC equipment, general-purpose machinery	33 machines
3D measuring machinery	10 machines

## 【Products】



## -Company Profiles-

Establishment : 1950  
Number of employees : 349(2015.12)

Capital : 80 million yen  
Sales : 3,500 million yen (2015.7)  
(Aircraft division : 1,500 million yen)

Items : Body structural parts engine blades, casings, etc.

Main Customers : Fuji Heavy Industries, Ltd., Mitsubishi Heavy Industries, Ltd., Kawasaki Heavy Industries, Ltd., ShinMaywa Industries Ltd., NIPPI Corporation, IHI Corporation, Minebea Co., Ltd.

## -Contact-

Name : Keita Sozu, Manager, Production Control Div.  
Add : 57-27 Hattandago, Higashisonogi, Nagasaki, 859-3922 Japan  
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