



***Daido Steel Co.,Ltd
Forging Products Div.***

Aerospace Products Introduction

Farnborough Air Show 2014

***Daido Steel Co.,Ltd
Aerospace Materials Dept.***

Main Plant Location



Organization



Shibukawa Plant Overview

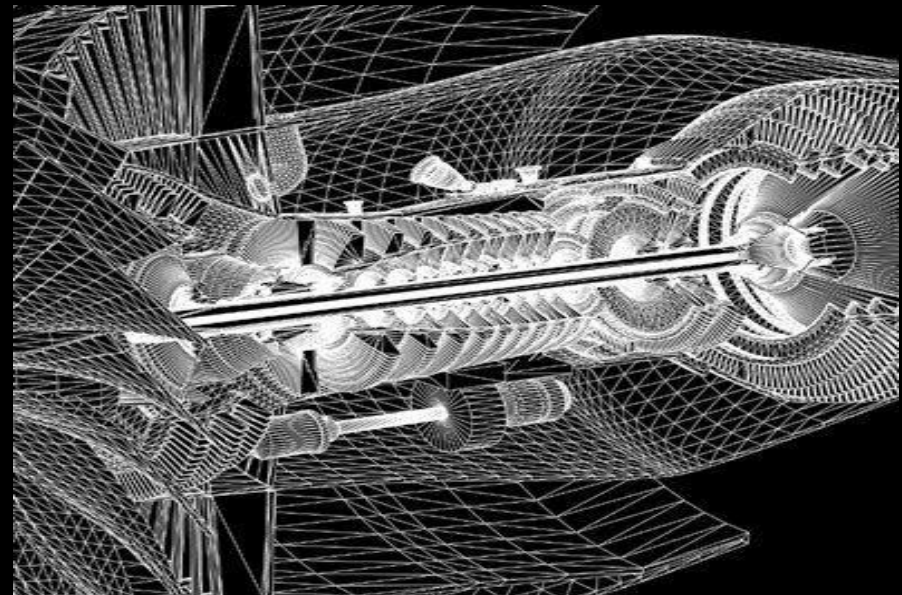


Main Products in Aviation

Engine Mainline Shaft



Material : Maraging
Cr-Mo-V Steel
Inco718
Length : ~3,000mm
(Capability)



Certificates Quality System

Overseas	Domestic(Japan)
GE(General Electric) Boeing CAA(Civil Aviation Association) Rolls-Royce P&W(Pratt&Whitney) SNFA etc	IHI Corporation Kawasaki Heavy Industries Mitsubishi Heavy Industries IHI Aerospace Co.,Ltd Fuji Heavy Industries NSK etc



Certificates **Special Process** **Material Testing**

User	Specification
GE	S400
Rolls-Royce	MSRR9968
P&W	MCLM F-26
NADCAP	AC7101, AC7006



Certificates *Special Process* *Heat Treatment*

User	Specification
GE(IHI)	BG
Rolls-Royce	RPS953
P&W	MCLM F-40
Boeing	AMS-H-6875
NADCAP	AS7102



Certificates

Special Process

Non Destructive Inspection

User	Specification
GE(IHI)	USI(Ultra Sonic Inspection) MPI(Magnetic Particle Inspection)
Rolls-Royce	
P&W	
NADCAP	AC7114 (USI, MPI)



Material Development

Material used for GE90-115B Shaft Forging

Collaboration with GE

- From 1995: Joint development program with GE Aviation
- From 2000: Developed shaft for GE90-115B engine
⇒ GE1014 is applied to GENx-1B/2B



Material Line-up -1

		Material	Chemical Composition	Specification
Heat-Resistant Alloys	Ni-base	Hastelloy-X Inconel 625 Inconel X750 Inconel 718 Waspaloy Nimonic 80A	22Cr-1.5Co-9Mo-W, Fe-47.5Ni 21.5Cr-9Mo-3.7(Cb+Ta)-62Ni 15.5Cr-1(Cb+Ta)-Ti/Al-7Fe-72Ni 19Cr-3Mo-5(Cb+Ta)-Ti/Al-7Fe-52Ni 19.5Cr-13.5Co-4Mo-Ti/Al-57Ni 19Cr-Ti/Al-76Ni	AMS5754 AMS5666 AMS5671 AMS5663, (MSRR7115), (PWA79201) AMS5706 -
	Co-base	L-605	20Cr-10Ni-15W-52Co	AMS5759
	Fe-Ni base	A286 Incoloy 800 Incoloy 901 N-155 Nimonic 263	25Ni-15Cr-1Mo-Ti, B, V-Fe 32Ni-21Cr-Ti/Al-Fe 42.5Ni-12.5Cr-6Mo-2.7Ti-Fe 20Ni-20Cr-20Co-Mo, W, Cb-Fe 50Ni-20Cr-20Co-5.8Mo-Ti/Al-Fe	AMS5735 AMS5766 AMS5660 AMS5769 AMS5886

Material Line-up -2

	Material	Chemical Composition	Specification
Bearing Steels (Aerospace Bearing and Gear Alloys)	M50 M50Ni 440C	4Cr-4.2Mo-1V-0.8C-Fe 4Cr-4.2Ni-Mo, V, Mn-0.13C-Fe 17Cr-0.5Mo-1C-Fe	MSRR6083, C50TF56, AMS6491 C50TF84, AMS6278 AMS5630
Stainless Steels	17-4PH 15-5PH PH13-8Mo AM355	16Cr-4Ni-4Cu-(Cb+Ta)-Fe 15Cr-4.5Ni-3.5Cu-(Cb+Ta)-Fe 13Cr-8Ni-2.2Mo-Al, V-Fe 15Cr-4Ni-2Mo-0.1C-Fe	AMS5643 AMS5659 AMS5629 AMS5743
Maraging Steels	Maraging 250 Maraging 300	18Ni-8Co-5Mo-Ti/Al-Fe 18Ni-9Co-5Mo-Ti/Al-Fe	AMS6512 AMS6514
Alloy Steels	17-22A 3Cr-1Mo-0.2V 4330M 4340 4340M 4130 9310	1Cr-0.5Mo-V-0.4C-Fe 3Cr-1Mo-V-0.4C-Fe 0.88Cr-1.8Ni-0.42Mo-V-0.3C-Fe 0.8Cr-1.8Ni-0.25Mo-0.4C-Fe 0.8Cr-1.8Ni-0.40Mo-V-1.6Si-0.4C-Fe 0.95Cr-0.20Mo-0.3C-Fe 1.2Cr-3.25Ni-0.12Mo-0.1C-Fe	AMS6304, PWA733 MSRR6012, MSRR6119 BMS 7-122, AMS6411 BMS 7-28, AMS6414 BMS 7-26 AMS-S-6758 AMS6265
Ti-Alloys	6Al-4V DAT54	6Al-4V-Ti 6Al-4Sn-Zr, Mo, Nb, Si-Ti	AMS4298 DAT54 (Daido Original Brand)

Size Capability of Engine Shaft

- Size
 - Max. $\phi 500$ (flange) $\times$ 3000L
- Material
 - Marage Steel
 - Ex. GE1014/MA250
 - Cr-Mo-V steel
 - Inconel 718
 - 6Al-4V-Ti



Disk, Disk shaft and Blisk

- Material
 - SAE4140
 - AM355
 - A286
 - FV448
 - FV535
 - Incoloy 901
 - Inconel 718
 - Titanium alloy



Casing, Seal, Spacer and Ring(Bearing)

- Material
 - Cr-Mo-V steel, AM355
 - M50, M50NIL
 - AISI321, FV448, A286
 - JETHETE M152
 - Nimonic 75
 - Inconel-W, Inconel 600
 - Incoloy 901, Inconel 718
 - Waspaloy, Hasteloy-X
 - Ti-6Al-4V

*Ring Mill process at Sub-con

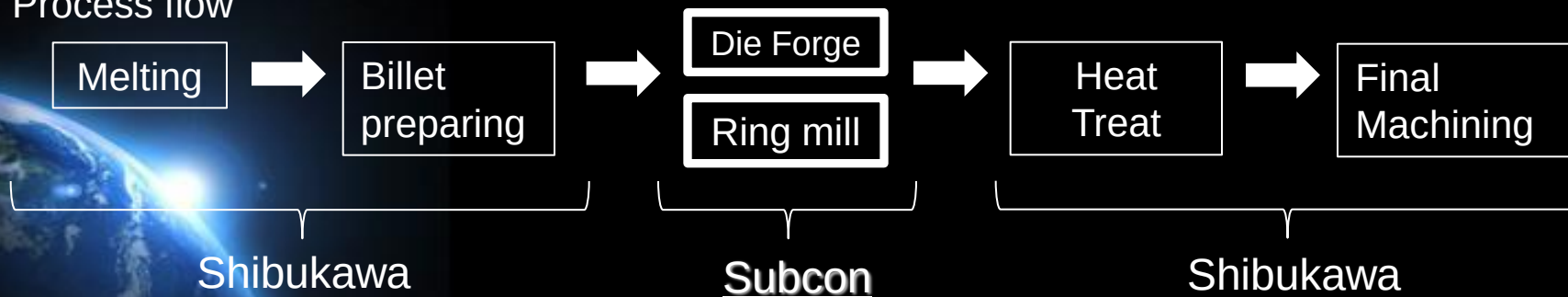


Applicable Size in Products

Process		Size
Bar (GFM)		20~300mm dia
Bar (Press)		300~ dia
Bar (Rolling)		4.4~90mm dia
Shaft		Max. 3,000 length
Disk	Free forge	Max. ϕ 2,800
	Die forge	Max. ϕ 500
Ring	Free forge	Max. ϕ 3,400
	Ring mill	Max. ϕ 1,500

- Ring Roll Forgings to be carried out in sub tiers.

Process flow



End

