ANA, Thinking of People and Earth.

Environmental Report

2 0 0 2

ALL NIPPON AIRWAYS CO., Ltd.
September 2002

ANA Environmental Policy

ANA's Attitude toward the Environment

Basic Policy

We will pursue :

Protection of the environment

Effective utilization of limited natural resource

Awareness of the public good

Course of Action

1. We will evaluate the impact of our commercial activities on the environment, and persevere in our efforts to protect the environment.
2. We will observe environmental laws and regulations, and furthermore, think and act independently to protect the environment.
3. We will make our best endeavor to minimize the environmental impact arising from operations of the airline industry.
4. We will make every effort to save energy and resources, to recycle articles, and to reduce waste.
5. We will contribute to the communities in which we live and work, through participation in social activities on environmental protection.
6. We will educate employees so that each may pay much more attention to environmental protection.

Global Environment Committee

This ANA Environmental Policy is declared inside and outside company.

(Settled in May. 1998)

Message from the President

Today, global environment problems have become our common agenda. 10 years after the Global Environment summit (UN Conference on Environment and Development) in Rio de Janeiro, the effectuation of the Kyoto Protocol on measures to prevent global warming has now come in sight. The ANA Group is actively committed to protecting the environment as an important part of its management policy.

The airline industry is closely linked to the global environment. Environmental problems we have to address include the greenhouse effect caused by the use of fossil fuel, noise pollution near airports, waste disposal, and energy consumption and so on.

ANA started implementing environmental policies more than 30 years ago, initially focusing on the problem of noise pollution. We have adopted the quietest aircraft and taken other noise abatement measures in daily operations. Already in 1994, our fleet was officially classified as compliant with “Chapter 3”, meeting the most stringent noise standard. Now, most of our aircraft have met “Chapter 4”, the new standard of noise pollution control to be applied to new aircraft in future. We announced in July this year that we would gradually retire our mainstay aircraft (B747SR and B767-200) by the end of fiscal 2006 and adopt the most advanced and fuel efficient types (B747-400, B777 and B767-300).

The ANA Group’s newly adopted Corporate Philosophy states that we must contribute to society, which means that we are committed to protecting the environment through appropriate management of our business. In February this year, we acquired the ISO14001 environmental accreditation for our Narita Maintenance Center. Drawing on this experience, we have started renewed efforts in this fiscal year focusing on a company-wide environmental compliance program and the disclosure of environmental accounting. We will further develop our environmental management system.

We ask for your continued support to the ANA Group’s efforts to protect the global environment.

September 2002

Yoji Ohashi
President & CEO

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From the FY2001 Topics

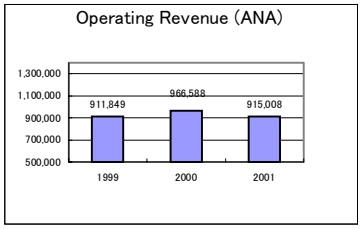
Unless otherwise specified, this Environmental Report describes the state of affairs relating to the environment in all the ANA company (excluding overseas establishments) in Fiscal Year 2001. (Apr. 2001 to Mar. 2002)

Outline of ANA

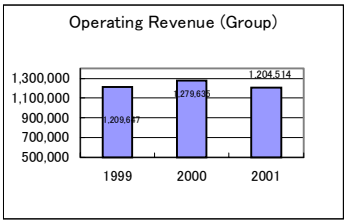
Company Name	ALL NIPPON AIRWAYS Co., Ltd.
Foundation	Dec. 1952
Head Office	3-5-10, Haneda-Airport, Ota-ku, Tokyo, 144-0041, Japan
President & CEO	Yoji Ohashi
Paid-in Capital	¥86,239 million
No. of Employees	12,978(Non-consolidated) employees
Operation Revenues	¥915,008 million
Core Business	Scheduled air transport service
The ANA Group	No. of subsidiaries：150、 No. of affiliates：47

Operating Revenues

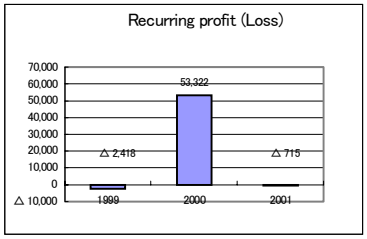
ANA

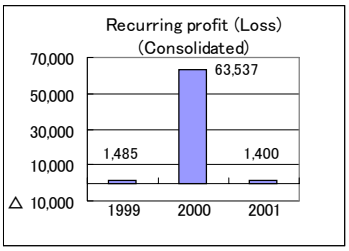


Ref: ANA Group

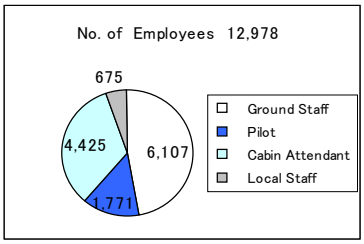


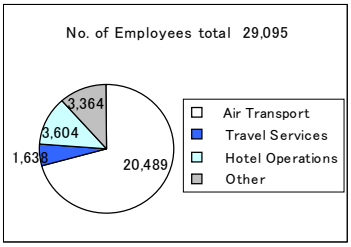
Recurring profit





Employees





ANA's principal group companies

Airtransport
- Air Nippon Co., Ltd. (ANK)
- Air Japan Co., Ltd. (AJX)
- Air Hokkaido Co., Ltd. (ADK)
- Nippon Cargo Airlines Co., Ltd. (NCA)

(Flight Support)
- ANA Aircraft Maintenance Co., Ltd.
- ANA Skypal Co., Ltd.
- International Airport Utility Co., Ltd.
- New Tokyo Int'l Airport Service Co., Ltd.
- ANA Catering Service Co., Ltd.
- ANA Telemart Co., Ltd.

Travel Services
- ANA Sales Holding Co., Ltd.
- ANA World Tours Co., Ltd.
- ANA Travel Co., Ltd.
- ANA Sky Holiday Tours Co., Ltd.

Hotel Operations
- ANA Hotels Co., Ltd.
- ANA Hotel Tokyo Co., Ltd.
- ANA Hotel Sapporo Co., Ltd.
- Okinawa ANA Resort Co., Ltd.

Other Businesses
- ANA Information Systems Planning Co., Ltd.
- Infini Travel Information, Inc.,
- ANA Logistic Service Co., Ltd.
- ANA Trading Co., Ltd.
- ANA Real Estate Co., Ltd.
- Saywa Service Co., Ltd.
- Jamco Corporation

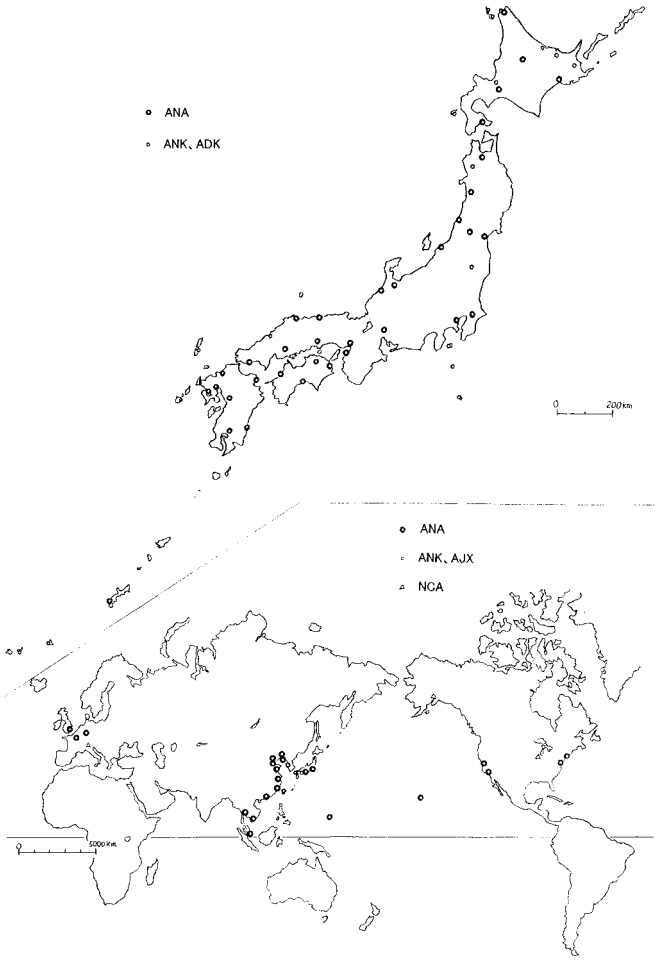
City/Airport served by ANA Group (as of Mar.2002)

Wakkanai	WKJ	Washington,	IAD	Mombetsu	MBE
Memanbetsu	MMB	New York	JFK	Nakashibetsu	SHB
Kushiro	KUH	Los Angeles	LAX	Sapporo	OKD
Asahikawa	AKJ	San Francis	SFO	Odate Noshiro	ONJ
Sapporo	CTS	Honolulu	HNL	Fukushima	FKS
Hakodate	HKD	London	LHR	Oshima	OIM
Aomori	AOJ	Paris	CDG	Miyake	MYE
Akita	AXT	Frankfurt	FRA	Hachijo	HAC
Sendai	SDJ	Vienna	VIE	Iwami	IWJ
Shonai	SYO	Beijing	PEK	Tsushima	TSJ
Yamagata	GAJ	Tianjin	TSN	Fukue	FUJ
Niigata	KIJ	Dalian	DLC	Miyako	MMY
Narita	NRT	Shenyang	SHE	Ishigaki	ISG
Tokyo(Haneda	HND	Shamen	XMN		
Toyama	TOY	Chingtao	TAO	Air Hokkaido (ADK)	
Komatsu	KMQ	Shanghai	PVG	Rebun	RBJ
Nagoya	NGO	Hong Kong	HKG	Rishiri	RIS
Kansai	KIX	Singapore	SIN	Okushiri	OIR
Osaka (Itami)	ITM	Bangkok	BKK		
Tottori	TTJ	Ho Chi Minh	SGN		
Yonago	YGJ	Guam	GUM	Air Nippon (ANK)	
Okayama	OKJ	Soul	ICN	Taipei	TPE
Hiroshima	HIJ				
Yamaguchi Ube	UBJ			Nippon Cargo Airlines	
Tokushima	TKS			Anchorage	ANC
Takamatsu	TAK			Chicago	ORD
Kochi	KCZ			Amsterdam	AMS
Matsuyama	MYJ			Milan	MIL
Fukuoka	FUK			Manila	MNL
Saga	HSG			Kuala Lump	KUL
Nagasaki	NGS				
Kumamoto	KMJ				
Oita	OIT				
Miyazaki	KMI				
Kagoshima	KOJ				
Okinawa	OKA				

Fig. indicate ANA & subsidiaries destination airpot/city

Vienna: Not fly as of Aug. 2002.

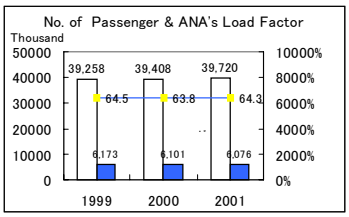
Soul : Fly by Air Japan(AJX) as of Aug. 2002

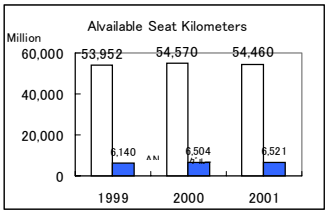


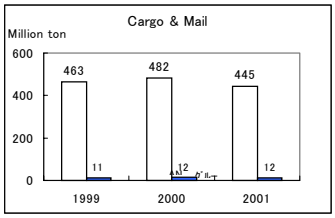
Flight Operation（2001Fiscal）

	Domestic	Interernational	Total	
No. of Flt. ANA	194,091	18,754	212,845	
Total ANA Group	280,961	20,006	300,967	
Flt Length of ANA	167,878	94,312	262,190	(1000 km)
Total ANA Group	216,048	96,319	312,367	(1000 km)
Flt Hour of ANA	279,991	110,976	390,967	(Hr)
Total ANA Group	369,977	110,976	480,953	(Hr)

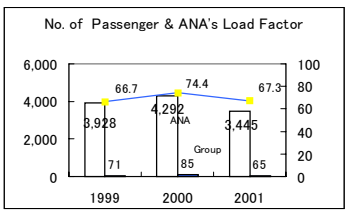
Domestic Service

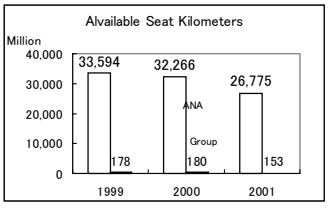


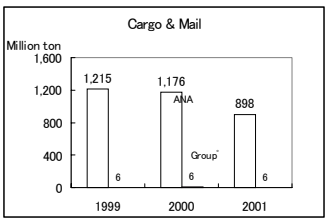




International Service







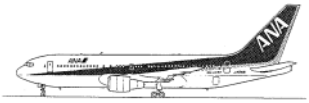
Group = Domestic: ANK ADK,
International: ANK AJX+ Code-Share Flight

ANA fleet

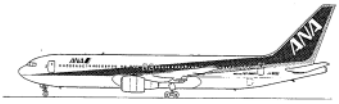
(As of Mar. 2002)

Aircraft Type (No. of seats)	No. (Change)	ENG Type	Ave. Age	ICAO Noise Standard conformity to Chapter 3/4 **
A320 (166)	25 (±0) *Include ANK	CFM 56-5A1	9.0	Ch-3/4

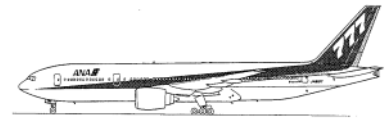
A321 (195)	7 (±0)	V2530-A5	3.0	Ch-3/4



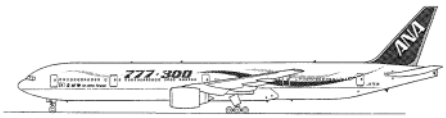
B767-200 (234)	9 (-2) * Include ANK	CF 6-70A	16.3	Ch-3/4



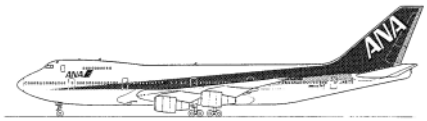
B767-300 (216-288)	42 (±0) * Include Air Japan (AJX) and ANK	CF6-80C2 B-2 /B6/B6F	10.5	Ch-3/4



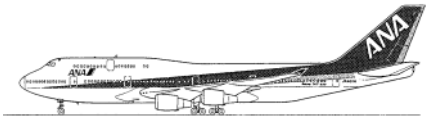
B777-200 (234-382)	16 (±0)	PW 4074/4077 /4090	4.4	Ch-3/4



B777-300 (477-525)	5 (±0)	PW4090	3.8	Ch-3/4



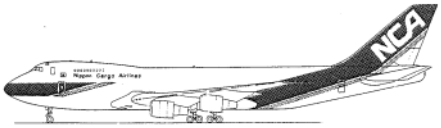
B747-200B (310~377)	2(-1)	CF6-50E2	15.8	Ch-3
B747SR (536)	9(-2)	CF6-45A2	21.1	Ch-3



B747-400 (320-569)	23 (±0)	CF6-80C2B1F	8.3	Ch-3/4

Total	138 (-5)	9.7 (+0.7:diff. with the previous year)	

Group airlines Fleets [Ref]



Aircraft Type (No. of seats)	No. (Change)	ENG Type	Ave. Age	ICAO Noise Standard conformity to Chapter 3/4 **
DHC-6-200 (19)	2 (±0) Air Hokkaido (ADK)	PT 6-27	29.9	—
DHC-8-300 (56)	2 (±0) Air Nippon (ANK)	PW-123B	0.7	—
YS-11 (64)	6 (±0) Air Nippon (ANK)	Dart Mk543-10K	32.6	—
B737-500 (126-170)	23 (+5) Air Nippon (ANK)	CFM 56-3C1	5.7	Ch-3/4
B737-400 (168-170)	2 (+1) Air Nippon (ANK)	CFM 56-3C1	8.7	Ch-3/4
B747 F/SRF (Cargo capacity 758m3)	11 (+1) Nippon Cargo Airlines (NCA)	CF 6-50E2	15.5	Ch-3

** ICAO Chapter 4 – New standard for after 2006 newly type certification (Ref. P.18)

Overview

ANA Group Corporate Philosophy and Environmental Policy

The ANA Group adopted a new Corporate Philosophy in April 2002.

ANA Group Corporate Philosophy

- Our Commitment -

On a foundation of security and reliability, the ANA Group will:

Create attractive surroundings for customers
Continue to be a familiar presence
Offer dreams and experiences to people around the world

To fulfill our commitment, we are taking the following course of action.

Course of Action

(1) Maintain top priority on safety
(2) Be customer oriented
(3) Contribute to society
(4) Embrace new challenges
(5) Debate with active interest, decide with confidence, and execute with conviction
(6) Build a powerful ANA Group by effectively using human resources and focusing on teamwork as a competitive strength

The third article, "Contribute to society", means that

ANA will always carry on its business in an open and fair manner so that it can contribute to the shareholders and society at large and to the environment.

Bearing these in mind, we focus our efforts on protecting the global environment.

In fiscal 2001, we were granted the ISO14001 environment accreditation for our maintenance division. ANA's environment account, on which we have worked since last year, and part of which is shown in this report, will be published by the end of this year. We are continuing our efforts to develop it. Fiscal 2002 marks the start of a new, enhanced environmental management system focusing on environmental compliance.

Environment-related Events in Fiscal 2001

Month	General	ANA
April	PRTR LAW (Law concerning Pollutant Release and Transfer Register) took effect Law concerning Material Recycling took effect. Law concerning Electric Appliance Recycling took effect. Law concerning Green Purchase took effect.	Held the 28th Environment Committee (comprised of directors). Conducted a lan-based questionnaire on environment problems (497 responses).
May		
June	The Automobile NOx Emission Control Law was amended (to take effect in October 2002).	The company magazine featured environmental conservation to raise employees' awareness.
July	The PCB Disposal Law took effect. ANK launched the Bombardiar DHC8-300 to replace YS11s flying between Haneda and Oshima.	
August	The Land, Infrastructure and Transport Ministry set the new shortened (10 minutes) air route between Kansai International Airport and Haneda.	
September		Held the ANA Group Environmental Liaison Conference.
October	The ICAO general meeting adopted the Chapter 4 noise standard, etc.	Sent to shareholders the 52nd ANA Interim Report focusing on flight schedules and environmental conservation.
November		Adopted in Chisato Airport a new low-noise snowplow Elephant Beta in Blower using less antifreeze fluid. Installed heating equipment in ANAM's Itami painting hanger to reduce the volume of paint release agent used.
December	The CFC Recovery Law took effect.	
January	RSVM was introduced in Europe, Southeast Asia and Canada. (The vertical separation minimum was reduced from 4,000 to 2,000 feet with the optimal altitude selected.)	Co-hosted environment briefings with the Scheduled Airlines Association at 9 branch offices in 9 airports. Participated in E-Square's environmental scenario preparation with Matsushita Electric Industrial Co., Ltd, Sony Co., etc.
February		Acquired ISO14001 from UKAS for Narita Maintenance Center.
March	AJX took over ANA's Narita-Seoul Route. (B6-300ER, 1 flight per day)	

Environmental Management

In 1998, we laid down our environmental policy "ANA's Attitude toward the Environment", which is shown on the first page. In 1999, ANA became a member of the Star Alliance and signed its Environmental Commitment Statement.

In February 2002, we acquired the ISO14001 environmental accreditation from UKAS for our Narita Maintenance Center. We have gained a large amount of know-how in environmental management through our efforts to get the certificate and expect to utilize it company-wide.

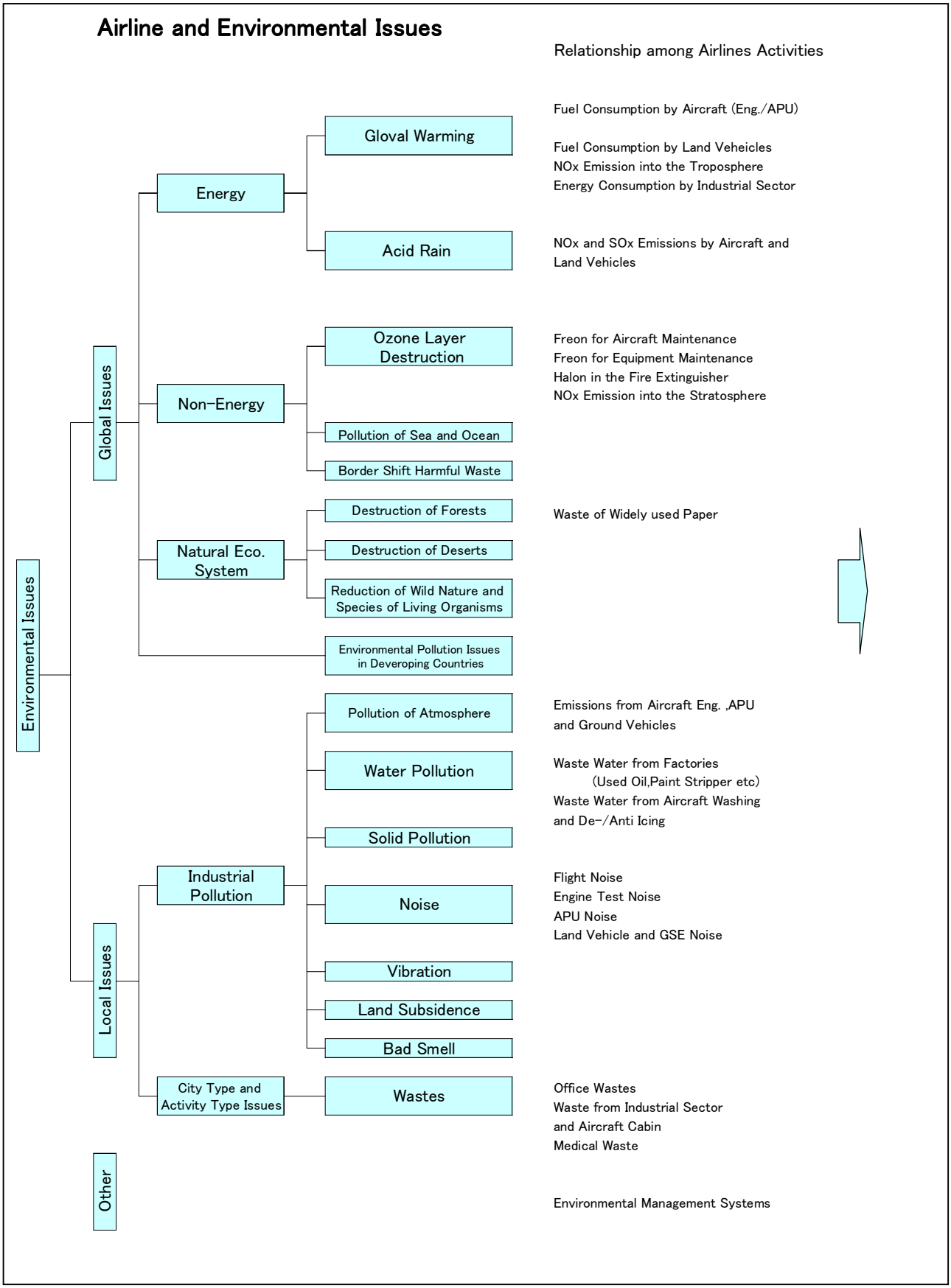
The Environmental Action Plan laid out in 1999 has been carried out satisfactorily, completing its numerical targets including the reduction of aircraft exhaust gas. We will set higher targets in the future.

An environment accounting program was introduced to Narita and other branches (See Chapter 1-7), and we are now carrying it out company-wide.

Another program we have started in this fiscal year is the development of a framework for company-wide environmental compliance.

(B777-200)

Airline and Environmental Issues



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Law and Reguration	ANA's Present and Theme
United Nations Agreement of Climate Change「Kyoto Protocol」	Emission Amount of CO2 from Aircrafts 7260 Thousand-ton
「Law Concerning the Promotion of the Measures to Cope with Global Warming」	(1980 thousand ton-carbon)
Vountary Plan by Airline Industry in Japan :	(Fuel Consumption 2940 Thousand-kl)
by 2010, CO2 Emission per Tranportunit(ASK:Available Seat Kilometer)	Actual in 2000 24.5gram-carbon (target in 2010 24.4gram-c)
will be Reduce 10% from 1990 Level	Reducing APU Use
* 「Environmental Tax(Carbon Tax)」?	Class 2 Designated Energy Management Factry
* 「Law Conserning the Rational Use of Energy」 Amended	(Over 6Mega-KWh/Year)
「Air Polution Control Law」	(Inf. Ctr., Training Ctr., Aircraft Maint. Ctr., TYO Apo Office)
「The Law for Total Emission Reguration of Nitrogen Oxides from Automobiles」	
* Metropolitan's Ordinance : Nox from Automobiles	ANA Group:Low Emission Vehicles:78/2200 Cars→to Increase
「Vienna Agreement」・「Montreal Protocol」	Fluorocarbon Complete Abolished from Maintenance(1994)
「Ozone Layer Protection Law」「Fluorcarbons Recoverry and Destruction Law」	Remove/In-operative Fluorocarbon Used Aircraft Components
Halon,Fluorocarbon was Suspended、CFC Alternatives will Suspend by 2020	Replaced by CFC's Substitude
「Fire Law」	Collect HFC、Harmlessness when Scrap CFC and HFC
	Fuel Dump due to Unexpected Landing
「Fundamental Law for the Promotion of the Formation of Recicleing Style Soci	Use Recycled Paper, Green Purchasing of Stationery
「Law on Promoting Green Purchasing」	Enforce Classified Collection of Papers and Recycle
「Convention on Int'l Trade in Endangered Species of Wild Fauna and Flora	Inform about Inport Prohibit Animals and Plants
: Washington Convention」	
	ANA's Aircrafts Complied with ICAO Emission Standard
ICAO Aircraft Emission Standard、「Civil Aeronautics Law」	Use Simulator at most phase of Flight-training and Check
「Air Polution Control Law」	Reducing Emission(NOx、SPM) from Airport Vehicles
	Thoroughness of Eng. Stop when Vehicles Stay
* 「Water Pollution Control Law」	Low VOC Paints 、Examination Non-chlorine Paint Remover
* 「Sewerage Water Law」	Completed Waste Water Facilities、Study to Inc. of Water Reuse
「Natural Environment Consevation Law」	Changed Low Pollution De-/Anti-Icing Fluid(Propylene Glycol)
	from Ethylene Grycol
ICAO Aircraft Noise Standard、「Civil Aeronautics Law」	All ANA's Aircrafts Complied with ICAO Chapter 3
「Airport Regulations」、Curfew etc	Counterplan with Meet New Chapter 4
「Environmental Standard for Aircraft Noise」	Obey and Study Noise Abatement Operational Prosedure
* 「Industrial Safety and Health Law」	Reduce T/R Operation at Night、Reduce ENG Test Run
	Noise Suppression Facility for Test-run(NRT,HND,OSA,KIX)
	Change to Low Noise GSE
「Waste Disposal and Public Cleaning Law」	Use the Re-molded Tire/Wheel
* 「Pollutant Release and Transfer Resister Law」・「Material Safety Data Sheet」	Classification Collection ・ Recycle
* 「Industrial Safety and Health Law」	Management by PRTR/MSDS
「Fundamental Law for the Promotion of the Formation of Recicleing Style Society」	Manage by Manifest Sheet
「Law for the Protection of Utilization of Recycled Resources」 etc	Eco-Airport Planing(JCAB) ,Compliance for concerning Emvironm
「Law for the Promotion of Sorted Collection and Recycling of Containers and Pakaging」	
	ISO14001(Narita Maint. Center)
Public Information、Propaganda Value	ANA Environmental Report/Home Page、Environmental Account

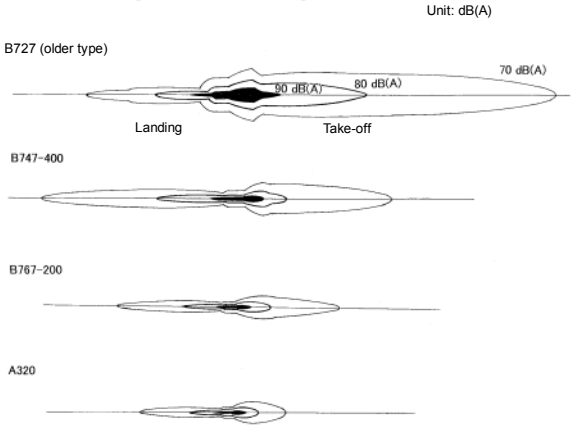
* with Some Penalty
□ Recentry Executed or Tightened Law and Reguration

__ ANA's Theme

Noise

All ANA's aircraft met ICAO's noise standard Chapter 3 ahead of other airlines in 1994. Most of ANA's aircraft comply with Chapter 4, which was adopted in last year's ICAO general meeting to be applied to airplanes to be type-certificate after 2006. In addition, ANA operates its fleet in such a way that noise disturbance near airports may be minimized. We are committed to becoming an airline that is friendly to the environment and people.

Noise profiles of different types of aircraft



Global Warming

Aircraft have to use fossil fuel (kerosene). ANA has always tried to introduce the most advanced types of aircraft to reduce fuel consumption.

As a result, we have succeeded in improving fuel efficiency by nearly 10% in the past 10 years. This has greatly reduced CO_2 emissions.

ANA will replace its B747s and B767-200s with newer B777s and B767-300 and optimize operations to further reduce the level of emission.

Fuel efficiency improvements by replacement of aircraft

Old (No. of seats)		New (No. of seats)	Improvement
YS11 (64)	→	A320 (166)	36%
B727-200 (178)	→	B767-300 (272)	37%
L1011 (341)	→	B777-200 (379)	27%
B747SR (528)	→	B747-400D (569)	14%
B747SR (528)	→	B777-300 (477)	21%
B747-200 (326)	→	B747-400I (337)	14%

(Fuel consumption per seat compared under ANA's standard operating condition)

Waste and recycling

Maintenance of aircraft and other operations produce various types of waste. ANA tries to recycle as much and discharge as little of such waste as possible.

Emissions

Aircraft engine emissions include HC, CO, NOx and Smoke.

ANA's aircraft are equipped with low-emission engines and meet the ICAO and JCAB Engine exhaust emission standards.

Ozone Layer Protection

CFCs are no longer used in the refrigerators and air conditioners on ANA airplanes, having been replaced by their alternatives by 1999. Use of CFCs and trichloroethane for maintenance was abolished by 1994. Halon is still used for fire extinguishers on airplanes because no substitute has been developed.

Chapter 1 ANA's Efforts to Protect the Environment

1) Key events in ANA's environmental management

Date	Event
November 1973	Established Airport Department to oversee ANA's environmental protection measures.
February 1974	Established Environmental Protection Committee to report to the President. Set up under Committee 4 Sub-committees specializing in Aircraft Noise Issue, Ground Noise & Air Pollution Issue Emission, Factory Waste Water Issue, and General Evaluation. Held the 1st Committee meeting in July.
July 1990	Established Environmental Conservation Office to address global environment problems rather than piecemeal measures for source control. Reorganized the Sub-committees into 3 specializing in Aircraft Noise Issue, Ground Noise & Pollution Issue, and Resource Preservation. The Resource Saving Sub-committee was renamed Global Environment Sub-committee in April 1993.
May 1993	Published the 1st Environmental Report (for 1992). Subsequently, the Report has been published every year.
June 1996	The Environmental Conservation Office was renamed Environment Affairs. The Environmental Preservation Committee was made to report to the Global Environment Committee and the 3 Sub-Committees for Environment Issue, Operation Environment Issue, and Ground Operation Environment Issues.

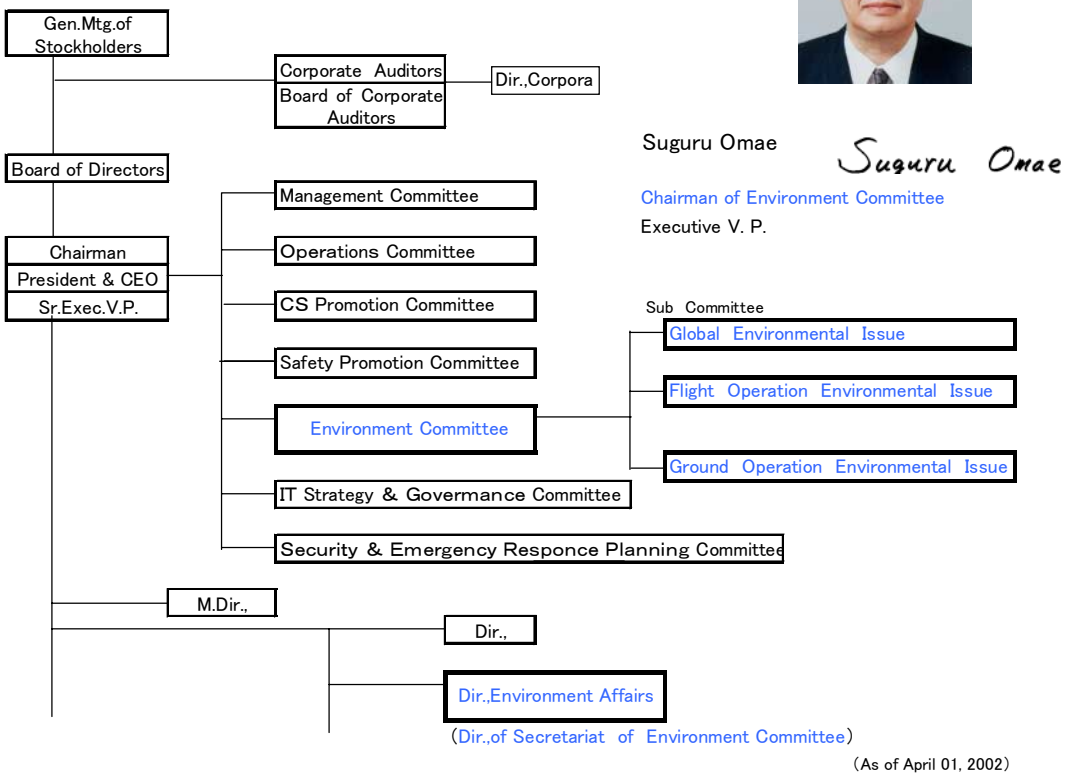
2) ANA Company Organization (Environment)

Suguru Omae

Suguru Omae

Chairman of Environment Committee

Executive V. P.



(As of April 01, 2002)

3) Environmental Policy

The ANA Group is now addressing environmental problems on the basis of its Corporate Philosophy revised in April 2002 (see Overview), Environmental Policy (see the first page) adopted in May 1998 and the Star Alliance Environmental Commitment Statement signed in May 1995.

Outline of the Star Alliance Environmental Commitment Statement

Star Alliance creates opportunities for cooperation and information-sharing as its members seek to integrate environmental considerations into all aspects of their business.

The member airlines are committed to promoting awareness and protection of the environment through an appropriate management system, will comply with environmental regulations and have their employees do so, will work and communicate with customers to identify and resolve environmental issues, will reduce waste and recycle it, and will follow "green purchasing", will promote enhanced environmental standards in purchasing aircraft, and will seek to balance development with environmental protection.


STAR ALLIANCE

Environmental Commitment Statement

Star Alliance, the first global airline alliance was established to deliver worldwide service to our customers. We believe this global alliance creates important opportunities for cooperation and information-sharing as each of our companies seeks to integrate environmental considerations into all aspects of our business.

We recognize that each of our carriers operates in diverse regions of the world and faces many unique and local challenges, however, we share some important core principles. The following principles challenge us to reduce our impact on the environment and maintain a healthy balance between progress and environmental sustainability.

- We are committed to promoting awareness and protection of the environment through an appropriate management system.

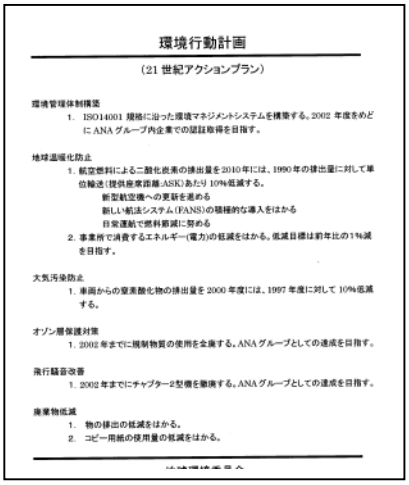
  We will conduct our business in compliance with all applicable environmental regulations and expect every employee to take responsibility for meeting these standards when performing his or her duties.
- We will work and communicate with customers, governments, local communities, unions, employees, and suppliers to identify and resolve environmental issues.
- We will prevent pollution at the source by reducing waste, recycling or disposing of items, and purchasing products that are reusable or that contain recycled materials.
- We will strive to develop and use technology that is environmentally sound and we will promote enhanced environmental standards in our purchasing of new aircraft, equipment, and facilities.
- We will seek new methods to balance the constant need for development with a commitment to protecting the environment, by continuous improvement.

Air Canada
Scandinavian Airlines System
Air New Zealand
Thai Airways International
All Nippon Airways
United Airlines
Ansett Australia
VARIG Brazilian Airlines

4) Environmental Action Plan and Results

ANA devised in May 1999 an Environmental Action Plan (Action Plan toward the 21st Century) on the basis of the Environmental Policy. The Action Plan focuses on EMS (environmental management system), global warming, emissions, ozone layer protection, aircraft noise, and waste. The ISO14001 accreditation for Narita Maintenance Center acquired in February 2002 marked a success in EMS. Goals set at the start of the Plan have been achieved (or almost achieved) in the items of emission, aircraft noise and ozone layer protection. We are continuing our efforts with regard to other items.

The Environmental Action Plan will be revised in this fiscal year since almost all of its goals have been attained.


環境行動計画

（21 世紀アクションプラン）

環境管理体制構築

1. ISO14001 規格に沿った環境マネジメントシステムを構築する。2002 年度をめどに ANA グループ内企業での認証取得を目指す。

地球温暖化防止

1. 航空燃料による二酸化炭素の排出量を2010年には、1990年の排出量に対して単位輸送（提供座席距離:ASK）あたり 10%低減する。
   - 新型航空機への更新を進める
   - 新しい航法システム（FANS）の積極的な導入をはかる
   - 日常運航で燃料節減に努める
2. 事業所で消費するエネルギー（電力）の低減をはかる。低減目標は前年比の1%減を目指す。

大気汚染防止

1. 車両からの窒素酸化物の排出量を 2000 年度には、1997 年度に対して 10%低減する。

オゾン層保護対策

1. 2002 年までに規制物質の使用を全廃する。ANA グループとしての達成を目指す。

飛行騒音改善

1. 2002 年までにチャプター2型機を撤廃する。ANA グループとしての達成を目指す。

廃棄物低減

1. 物の排出の低減をはかる。
2. コピー用紙の使用量の低減をはかる。

Action Plan devised in May 1995	Track records till fiscal 2001
EMS Acquire ISO14001 by the end of 2002.	Acquired ISO14001 for Narita Maintenance Center in February 2002.
Global Warming Reduce CO2 emission caused by aircraft fuel consumption in 2010 by 10% compared to 1990. Reduce electric power use at facilities by 1% year on year.	Reduced CO2 emission by 9.5% in terms of ASK in fiscal 2001. Larger facilities started electric power use control in line with the Law concerning the Rational Use of Energy.
Emission Reduce NOx emission from ground vehicles in fiscal 2000 by 10% compared to fiscal 1997.	Reduced by 53% (all vehicles in Tokyo).
Ozone Layer Protection Abolish the use in the ANA Group of prohibited materials by fiscal 2002.	CFCs were gradually disused in all aircraft (except ANK and YS11, in which no CFC substitutes are available. We will retire them soon.)
Aircraft Noise Retire all ICAO Chapter 2 aircraft by fiscal 2002.	Retired all in November 2000.
Waste Reduce waste. Reduce the amount of paper used for photocopying.	Is reducing waste and final disposal amount. Is reducing the amount of paper by double-sided copying, digitalization,

5) ISO14001 Certification for Environmental Management System

ANA has worked toward the establishment of an environmental management system to meet the ISO14001 standards for several years, and acquired the certification for its Narita Maintenance Center from UKAS (United Kingdom Accreditation Service) in February 2002.

The Narita Maintenance Center, which handles ANA's international flight aircraft, is the first fuselage maintenance center in Japan that has acquired the ISO14001 certificate. ANA is utilizing the know-how obtained through its efforts in company-wide environment management.

Certificate of Approval

Awarded to

NARITA MAINTENANCE CENTER, ENGINEERING & MAINTENANCE
ALL NIPPON AIRWAYS CO., LTD.
COMPANY DETAILS ARE SHOWN ON THE APPENDIX

Bureau Veritas Quality International certify that the Management System of the above operator has been assessed and found to be in accordance with the requirements of the environmental standards and operational scope detailed below

ENVIRONMENTAL STANDARDS

ISO 14001:1996
JIS Q 14001:1996

OPERATIONAL SCOPE

MAINTENANCE OF LARGE AIRCRAFT

Original approval date: 13 FEBRUARY 2002

Subject to the continued satisfactory implementation of the operator's Management System, this Certificate is valid for a period of three years from:

15 FEBRUARY 2002

Date: 15 FEBRUARY 2002

(Certificate of UKAS ISO14001 obtained from BVQI)

6) Environmental Compliance Program

In response to the growing need to fulfill corporate social responsibility, ANA started in fiscal 2001 a program to establish a framework of compliance with environmental laws and regulations. In order that ANA may carry on business in a fair and open manner, better able to handle crises and contribute to society, all employees must know and comply with laws, ordinances and other regulations on environmental conservation. To establish such a framework, the program addresses the following matters.

To be implemented in 30 departments/sections in charge of environmental control in the headquarters and branches

(1) Identification of the department/section/person in charge of environmental control in each branch/site
(2) Regular reports on environmental compliance from the departments in charge
(3) Education of employees on environmental laws and regulations
(4) Establishment of a system to support environmental compliance

In fiscal 2002, we started with (1) and (2). The environmental compliance program will cover (1) to (4) from next year onward.

In the ANA, there were no environment related accidents or breaches of environmental laws last year that might bring about penalties.

7) Environmental Accounting

To ascertain the cost of the environmental conservation activities, ANA has a plan to introduce environmental accounting from fiscal 2002. In fiscal 2001, we started a pilot program as a preliminary to a company-wide environmental accounting project.

The following table shows the provisional results of environmental accounting conducted in Narita and other sites.

In fiscal 2002, environmental accounting will be conducted in most sites in Japan on the basis of this pilot program.

Provisionary Results of the Fiscal 2001 Environmental Accounting (Unit: Million yen)

Cost Item		Amount	Activity
In-house cost	Antipollution	29	・Wastewater treatment ・Air pollution control
	Environmental conservation	8,743	・Introduction of energy-efficient aircraft ・Utilization of GPU in apron
	Resource utilization	376	・Waste treatment ・Waste reduction and recycling
Upstream/downstream cost		3	・Purchase of green articles ・Compliance with the Containers and Packaging Recycling Law
Administration cost		811	・ISO14001 accreditation ・Education on the environment
Social activity cost		144	・Education on the environment
Total		10,106	

The pilot program was conducted covering

- the branches of Purchasing, Environment Affairs and Narita (Airport Branch, Cabin, Operation and Maintenance) and
- the period from April 1, 2001 to March 31, 2002, and
- in compliance with the Ministry of Environment guidelines.

8) Environmental Report, etc.

ANA has published 9 Environmental Reports since 1992 for employees and stakeholders. The English version was started in 1998, and a summary of the report has been placed on the ANA home page (http://www.ana.co.jp) since 1999.

In fiscal 2001, the 52nd Interim Report included some pages on environmental issues. The "Review and Prospects" published every year and the Annual Reports also include reports on environmental issues.

An e-mail address (kankyou@ana.co.jp) is available for inquiries concerning the environment.

52nd Interim Report sent to shareholders

The ANA Group companies held the 7th Environmental Liaison Conference in September to discuss environmental issues and share information.

ANA has promoted environmental education of its employees, conducting questionnaires and featuring global environment problems in its in-house magazine (June).

9) Cooperation with other organizations

ANA has participated in or cooperated with the following environmental outside organizations.

Year	Organization	Participation/cooperation
1991	Environmental Information Center	Organization for the dissemination of environmental technology and information founded with the support of the business community. ANA extended cooperation in its founding.
	Global Environment Forum	Organization for scientific research of global environment problems, exchange, information dissemination, support to environmental conservation, international cooperation, etc. ANA became a member and has received information and other services.
	Japan Flower Promotion Center	Organization under the jurisdiction of the Ministry of Agriculture, Forestry and Fisheries for the promotion of flowers and tree planting after the International Flower EXPO. ANA extended cooperation.
1992	Japan International Forestry Protection and Cooperation Center	ANA extended cooperation to the tree planting promotion fund under the jurisdiction of the Ministry of Trade and Industry and the Ministry of Agriculture , Forestry and Fisheries.
	IATA ETAF (ENTAF: Environmental Task Force)	ANA first participated in the 5th regular meeting in May 1992 as observer and has exchanged opinions and obtained information since then. ENTAF's first international seminar on the air transport environment was held in March 1993 at ANA Hotel in Washington D.C., and ANA co-
1993	International Noise Control Engineering Conference and Exhibition	Extended cooperation to the 23rd Inter Noise '94 Yokohama.
	Council on Life-Innovation	Participated in the organization's research group for "Asian investigation committee concerning development and the environment".
1994	Global Environment Tokyo Conferen	Supported the Conference in October.
1995	Oze Conservation Foundation Nikko Cedar Avenue Conservation Fund	Extended cooperation to the preservation of Oze and Nikko Cedar Avenue.
1996	Green Purchasing Network	Became a member of the network for purchasing products with less environmental load in February 1997.
1997	FCCC (Framework Convention on Climate Change)Conference	Made a donation to the Conference in Kyoto in December.
1999	Japan National Trust	Extended cooperation to the Trust's efforts for the preservation of cultural heritage and nature.
2000	Star Alliance Environment Consultant Conference in Tokyo	Hosted the conference of environment officers in Tokyo.
	Green Port 2000 in Narita	International conference on airport environment co-hosted by ACI (Airport Council International), Narita Airport Authority and IATA. ANA extended cooperation.
2001	Environmental Sub-Committee, Scheduled Airlines Association Japan	Environmental Liaison Conference of the three airlines was dissolved into the Sub-Committee under the planning committee of SAA. ANA was a founding member.
	Eco-mmerce Scenario Project	Participated in the preparation of environment-oriented business

ANA has participated in the following environmental organizations in the airline industry.

- ANA Airlines Group (ANA, ANK, AJX and NCA)
- ANA Group Environmental Liaison Conference (30 companies)
- Environment Sub-Committee, Scheduled Airlines Association Japan
- Environment Working Group, Star Alliance
- Environment Asia League(NH, SQ, TG), Star Alliance
- Environment Working Group, ENTAF, IATA
- Environment Working Group, AAPA
- Jet Gas Working Group, CAEP, ICAO

Chapter 2 Noise

1) Airport Noise

Followings are airport noise issues.

(1) Aircraft noise (aircraft engine sound at landing and takeoff)

(2) Ground noise

① Engine ground running noise

② APU (Auxiliary Power Unit) running noise

③ GPU (Ground Power Unit) running noise

④ Others (ground support equipment operating noise, maintenance facility operating noise and so on)

To reduce the influence of noise, the condition of the airport establishment becomes a big factor. As an airline company, ANA will continue to consider minimizing noise disturbance.

2) Aircraft Noise

(1) Noise Standard

Noise certification standard is referenced to ICAO Annex 16, Volume 1. In the present standard, it is divided into three standards; Chapter 2 standard (established in 1972), Chapter 3 standard (established in 1977) and Chapter 4 standard (adopted at ICAO Assembly/33 in 2001, applicable in March 2002).

① Chapter 2 standard

In Japan, Certification to the quieter Chapter 3 standard became a mandatory requirement on April 1, 2002.

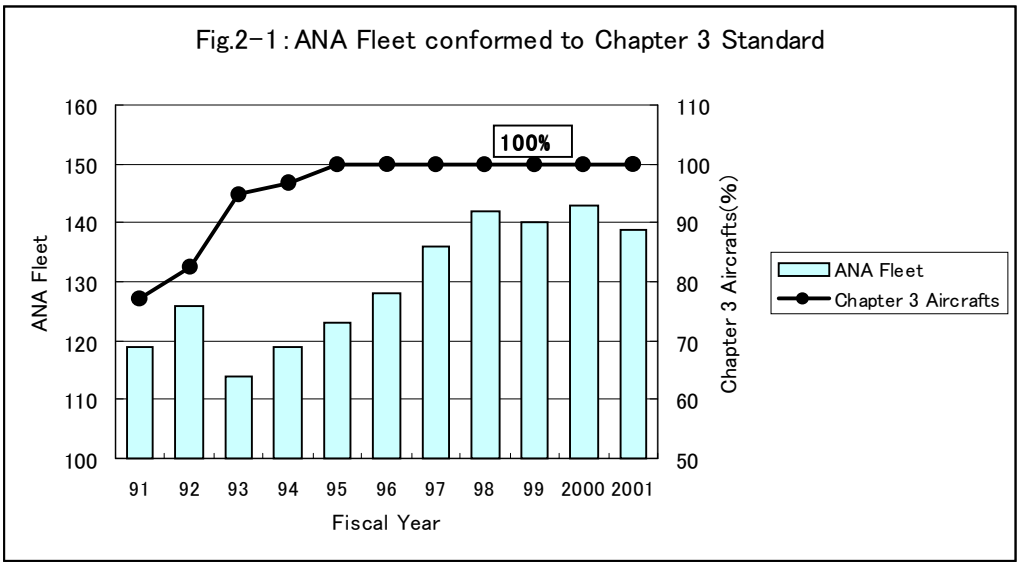
② Chapter 3 standard

Outline of the standard is shown at the end of this chapter.

All ANA's aircraft have fully complied with Chapter 3 requirement in 1994.

All ANA group's aircraft have fully complied with Chapter 3 requirement in November 2000. (See Figure 2-1, Figure 2-2 (1))

Fig.2-1 : ANA Fleet conformed to Chapter 3 Standard



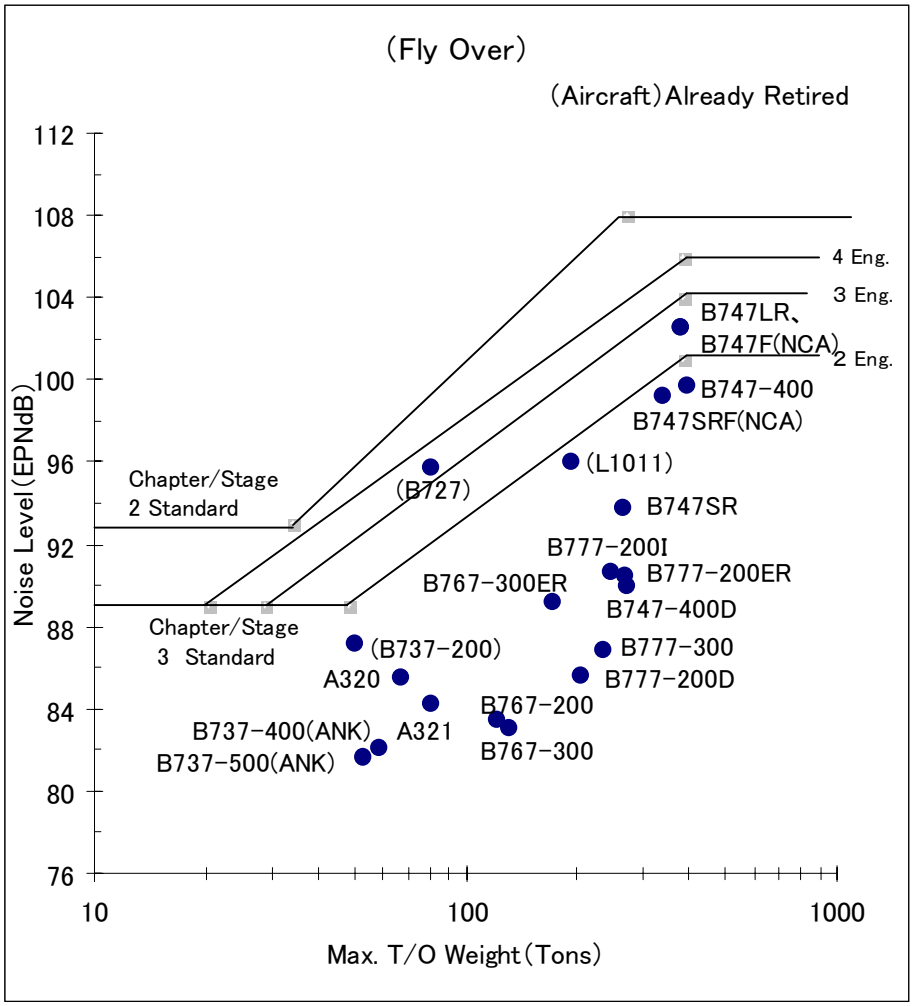


Fig.2-2 (1) ANA Fleet Noise Level and ICAO Standards (Chapter 3)

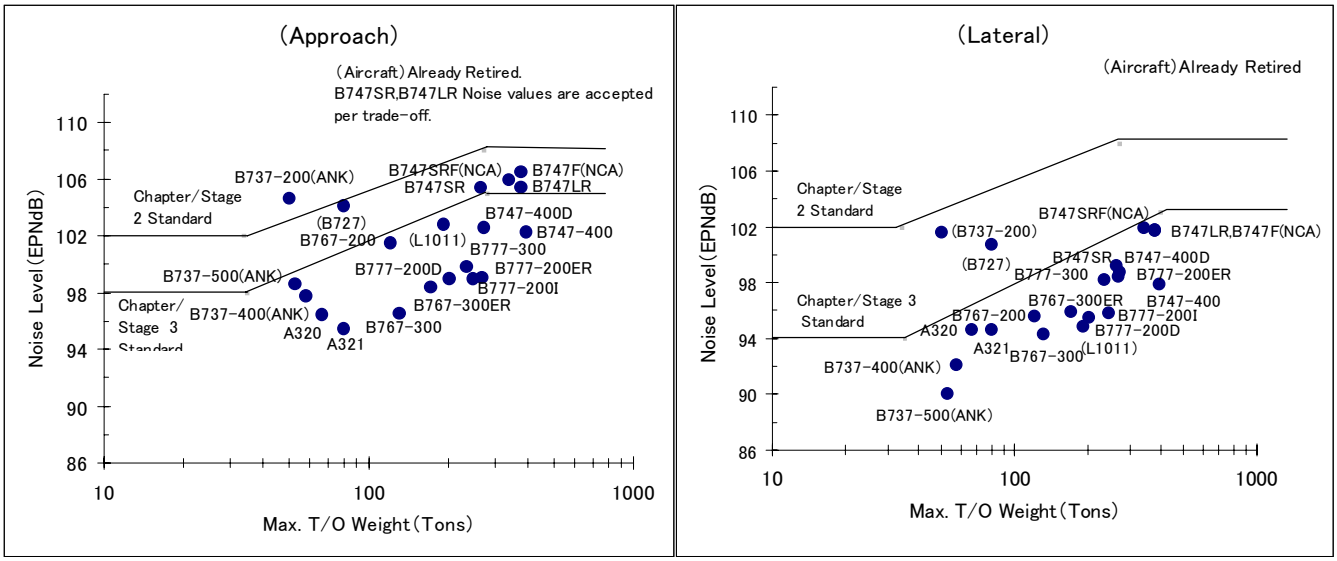


Fig.2-2(1) ANA Fleet Noise Level and ICAO Standards (Chapter 3)

③ Chapter 4 standard

Outline of the standard is shown at the end of this chapter.

New stricter standard was adopted and introduced in March 2002. New standard is applicable for new type certificated aircraft after 01 January 2006. Re-certification rule and procedure from existing Chapter 3 to Chapter 4 are going to be fixed. At this stage 90% of ANA's fleet is going to be complied with Chapter 4 requirement (see Figure 2-2 (2)).

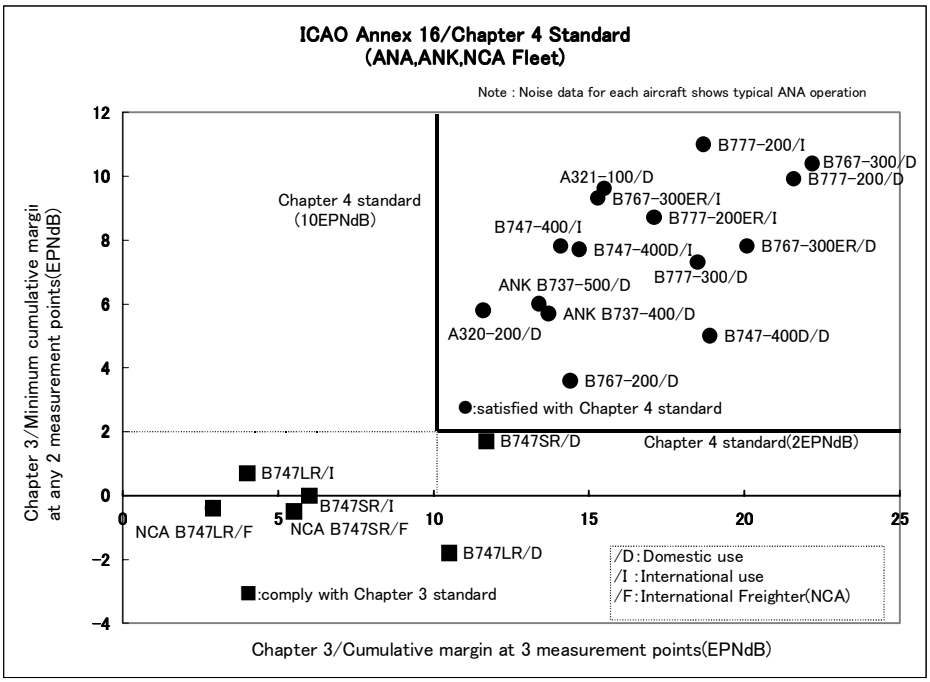


Fig.2-2 (2) ANA Fleet Noise Level and ICAO Standards (Chapter 4)

(2) Change in Noise Contour

The area influenced by the same noise level has been reduced with the introduction of new quieter aircraft. (Refer to Figure 2-3).

ANA has been participating in "Aircraft Noise Issue Sub-committee" and its working group that are formed by the government and the people combination, and continuing the review work to improve the accuracy of the noise-forecast program.

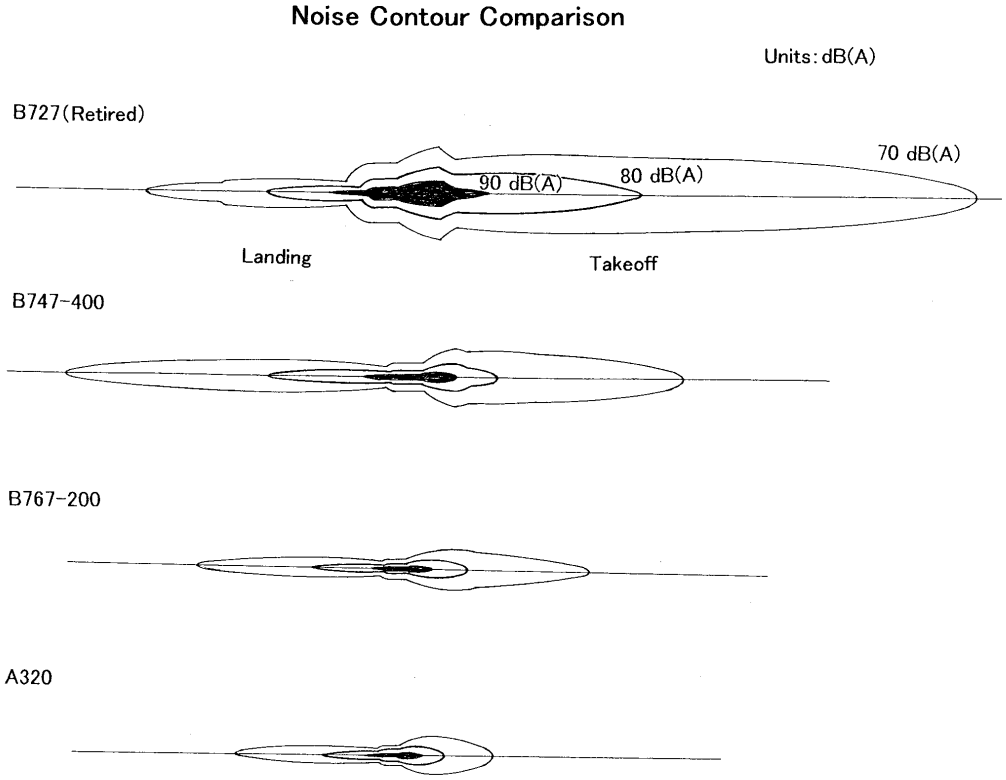


Fig.2-3 (1) Noise Contour comparison

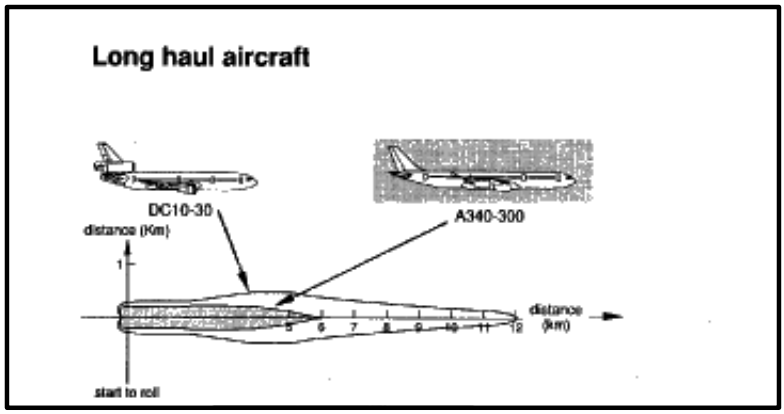


Fig.2-3 (2) Noise Contour comparison (Sources: Airbus Industries)

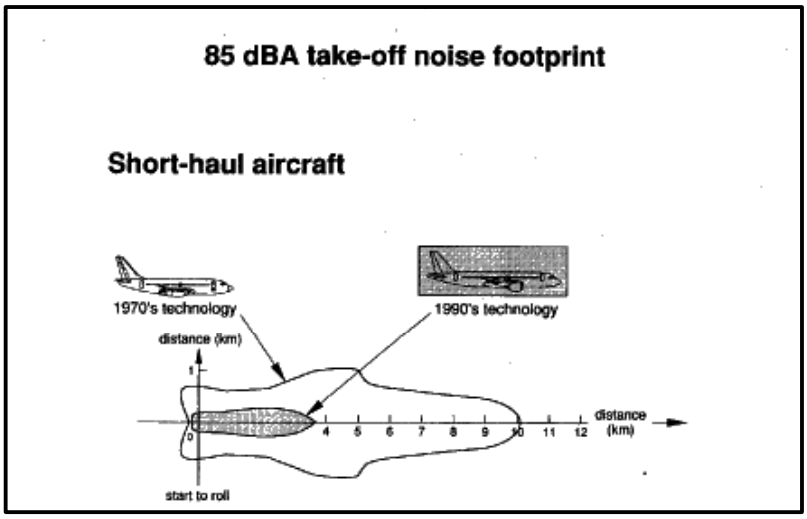


Fig.2-3 (2) Noise Contour comparison (Sources: Airbus Industries)

(3) Balanced approach/No phase-out of Chapter 3 Aircraft

ICAO Assembly/33 in 2001 adopted following conclusions.

① New Standard is intended for certification purposes only and is not intended to be used as a basis for operational restrictions

② The results of the cost/benefit analyses conducted do not support general phase-out of Chapter 3 aircraft in the non-exempt regions

③ The four elements of the balanced programme had to be applied on an airport-by-airport basis

- Source noise reduction
- Land-use management
- Noise abatement procedure
- Noise mitigation measures

④ The results of the cost/benefit analyses conducted do not support any regional phase-out

⑤ Operating restrictions should be considered under the ICAO balanced programme of noise mitigation and there is a need for further work on ICAO framework conditions of operating restrictions as part of the ICAO balanced programme

(4) ANA's Noise Mitigation

① Introduction of Noise Abatement Operational Procedure

Based on the examination of "Promotion Committee of Noise Abatement Operational Procedure", which was established by the united efforts of the government and the people in 1975, ANA introduced Noise Abatement Operational Procedure at domestic airports and have been improving it up to the present.

Also, FMS (Flight Management System) operation in a terminal area to fly effectively

avoiding densely built-up area has been started at Haneda Airport in March 1999 and the operation was expanded. It is expected to expand into other effective domestic airports. Oversea airports at Kuala Lumpur, Frankfurt, Paris and Bangkok have FMS operation in a terminal area.

For domestic operation R-NAV (Area Navigation) operation started on 13 June 2002 to improve operation efficiency by making smooth air traffic flow. It contributes to shorter flight distance.

② Kansai International Airport

The investigation flight has been implemented for the evaluation on the "ground route" which was introduced in December 1998. As a result shorter route than existing was developed on Kansai to Haneda route.

Kansai International Airport Authority has issued their 'Environmental Management Plan' in June 2001. New B-runway is scheduled in use in 2007.

③ Osaka International Airport

Noise area was judged to have been decreased remarkably by the improvement of the landing noise, the introduction of quieter jet aircraft, and a functional share with Kansai International Airport and so on. Consequently, the Ministry of Transport brought up the reviewed proposal of Osaka International Airport Noise Area. The noise-measured district was scaled down based on the Aircraft Noise Regulation law in April 2000.

④ Tokyo International Airport (Haneda)

The noise problem in Haneda Airport area was improved extensively by the use of the new C-runway beginning in March 1997. As a result, Tokyo International Airport became to be operated for 24 hours. And new B runway was started its operation from March 2000. From February 2001 international charter flight operation during nighttime has been permitted and ANA has started its operation.

⑤ New Tokyo International Airport (Narita)

Interim parallel runway, 2,180m, has been constructed in November 2001 and started its operation from April 2002.

3) Ground Noise

(1) Osaka International Airport

Sound isolating walls for the engine run-up were set up in 1971, which are still in use, also have been making a best effort to shorten the run-up time and the high power operation time as well as the APU operation time. A new engine test-run facility with large-scale sound-proof walls was constructed to contribute to the ground noise reduction and started its operation from May 2002.

New engine test-run facility with large-scale soundproof (Osaka International Airport)

(2) New Tokyo International Airport (Narita)

① With the beginning of the operation of terminal 2, ANA consider an influence over the area near taxiway, and voluntarily refrain from operating APU at the time of ramp-in and ramp-out. As for our operation of APU, APU OFF operation has been our standard since 1992 from the viewpoint of ramp noise reduction according to a request from NAA as well as from the viewpoint of the fuel cut down (the reduction of CO_2 emission). When the repair of terminal 1 was completed, NAA notified all the airlines "to implement APU OFF operation as much as possible from April 1, 1998" with a document from the viewpoint of the global warming prevention.

② The hanger type noise suppression facility (engine ground running noise) for the south wind was constructed by a joint investment of ANA, JAL, and NAA in April 1999, which is a part of the countermeasures on the aircraft noise. It is expected to be more efficient than the existing facilities for the north wind, to be possible to correspond to all kinds of airplanes, to be possible to operate for 24 hours, and to contribute to the region environmentally. The modification of facility to resist the crosswind and to improve the performance was carried out in March 2000. Full-dress operation started from April 2001. Engine run-up for maintenance purpose during midnight and early morning (22:00 to 06:00) has to be done in this facility.

Hanger type noise suppression facility (Narita)

(3) Tokyo International Airport (Haneda)

① New run-up area was established in offshore area of Haneda and started its operation from January 1994. The noise problem to the area was considerably eased by the operation of 7 spots in total.

② ANA built the new engine test cell in October 1995, which is considered to restrain low frequency noise, and also built an APU run-up facility aside in April 1998.

ANA Facilities (Haneda Airport)

(4) Countermeasure on Noise of Maintenance Facilities and Vehicles

ANA has been carrying forward the renewal of our vehicles to low noise type and 70% of the AC power supply cars ANA possess are low noise type. Also, ANA introduced 1 low-noise type de/anti-icing vehicle with blower by 2001.

Low-noise type AC Electrical Power Supply Car

Low-noise type de/anti-icing vehicle (New Chitose Airport)

[Note]

1. Chapter 3 Noise Standard

(1) 3 Measurement Points

① Lateral reference noise measurement point : 450m from the runway center line

② Flyover reference noise measurement point : 6.5km from the start of roll

③ Approach reference noise measurement point : 2.0km from the threshold

(2) Noise Limit

ICAO Annex16 Volume I Chapter 3

W : Max. take-off weight in 1,000 LBS		0	44.673	77.2	106.25	617.3	882.0
Sideline(EPNdB)		94		77.94+8.51 logW			103
Approach(EPNdB)		98		83.37+7.75 logW		105	
Take-off (EPNdB)	2 engine	89		62.08+13.29 logW			101
	3 engine	89		65.07+13.29 logW			104
	4 engine	89		67.07+13.29 logW			106
W : Max. take-off weight in 1,000 LBS			63.177			850.0	

Note : Lateral and Approach limits for 2/3/4 engine aircraft are the same

EPNdB (Effective Perceived Noise Level)

Trade-offs

If the maximum noise levels are exceeded at one or two measurement points:

① the sum of excess shall not be greater than 3 EPNdB

② any excess at any single point shall not be greater than 2 EPNdB

③ any excess shall be offset by corresponding reductions at the other point or points

2. New Chapter 4 Noise Standard (ICAO Assembly Resolution)

(1) A cumulative margin of 10 dB over current Chapter 3 levels

(2) The sum of the improvements at any two measurement points shall be at least 2 dB

(3) No trade-offs are permitted

(4) The applicability date is 01 January 2006

(5) New noise standard is only intended for certification purposes and not for the purpose of new operational restrictions such as phase-outs

(6) Specific consideration for exemptions from new operating restrictions for developing countries

Chapter 3 Global Warming

1) Global Warming Issue

Global Warming is caused by excess concentration of Greenhouse gases in the Earth's atmosphere. Greenhouse effect has been growing by increasing natural greenhouse gases, and by adding new greenhouse gases like CFCs. Humankind is capable of raising the average global temperature.

Since the late 19th century, global mean temperature has increased by 0.3 to 0.6 ºC according to the report of IPCC (Intergovernmental Panel on Climate Change)in 1995. Due to the accumulation of greenhouse gases (GHG) until present, the temperature is expected to be increased by about 1 ºC in around 2050. In addition, it is estimated that global mean temperature will be increased by 1.4 to 5.8 ºC and the mean sea level will rise by 9 to 88 cm by 2100 if greenhouse gases keep increasing at the present increase rate.

2) IPCC (Intergovernmental Panel on Climate Change)

IPCC was established by WMO (the World Meteorological Organization) and UNEP (United Nations Environmental Programme) in 1988 to provide an objective source of the scientific, technical and socio-economic information available about climate change, its environmental and socio-economic impacts, and possible response options, including costs and benefits of action versus inaction.

IPCC has published its Special Report "Aviation and The Global Atmosphere" assesses the effects of aircraft on climate and atmospheric ozone in May 1999. Outline of the Special Report is shown at the end of this chapter.

3) UNFCCC (United Nation Framework Convention on Climate Change)

FCCC was adopted in May 1992 and COP 1 (1st Conference of the Parties to the Convention) was held at Berlin in March 1995. At COP 1 it was decided to make quantified GHG emission limitation and reduction commitments for developed countries by 1997.

4) Kyoto Protocol

At COP 3 held at Kyoto in December 1997 "Kyoto Protocol" including quantified GHG emission limitation and reduction commitments for developed countries was adopted. Also some legal restriction power was expected and the constant participation by the developing counties was urged.

As for Japan, the target, which reduces 6% of the average emission amount of greenhouse gases between 2008 and 2012 from its level in 1990, was set.

At COP 7 held at Morocco in November 2001 operating rules for "Kyoto Protocol" was adopted under the nonparticipation of USA.

5) Law Concerning the Promotion of the Measures to Cope with Global Warming

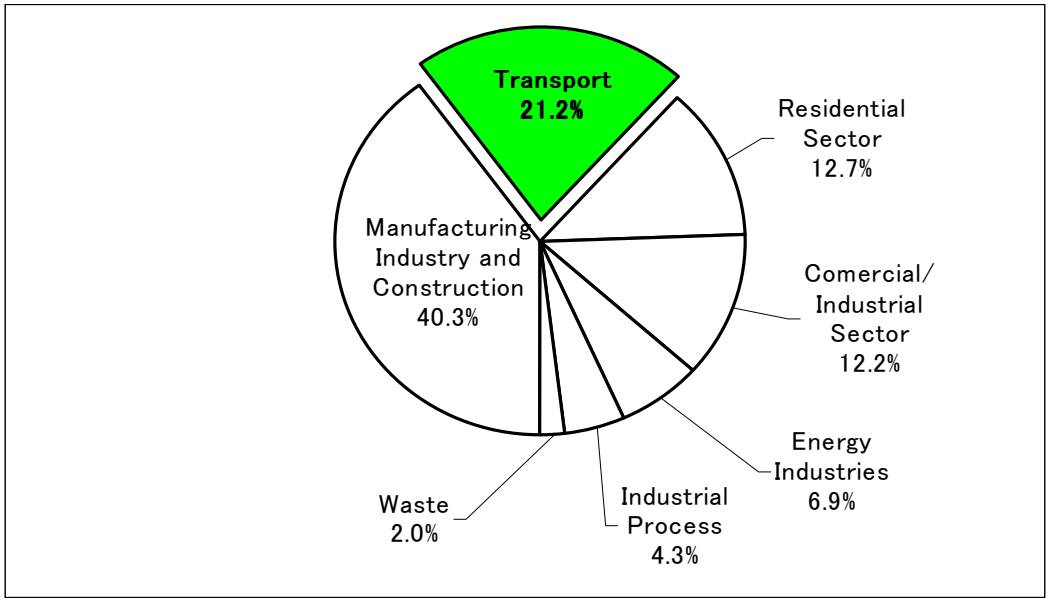
In Japan, original “Law for the Promotion of the Measures to Cope with Global Warming “ was set to promote policies to limit greenhouse gas emissions and enhance sinks in 1998 and revised in January 2002. "Energy consumption efficiency improvement", "Understanding and actions of the people", "Technological development and its spread", and "International cooperation" are to be examined as the measures.

Revised “Law for Energy Saving” was effective in April 1999.

In June 2002 Japan has ratified “Kyoto Protocol” and new “Law for the Promotion of the Measures to Cope with Global Warming” was approved.

Taking a look at the amount of the CO_2 emission of each categories in Japan in 1999 fiscal year, an industrial section was 40.3%, the public welfare section was 25.0%, and the transportation section was 21.2% (refer to Figure 3-1). The public welfare section and the industrial section were increasing slightly compared with in 1998.

CO_2 Emission Sources (Fiscal Year 1999)



(Source: Ministry of the Environment, White Paper 2002)

Fig.3-1 CO_2 Emission Inventories All Over Japan

6) Relationship between Air Transport and Global Warming

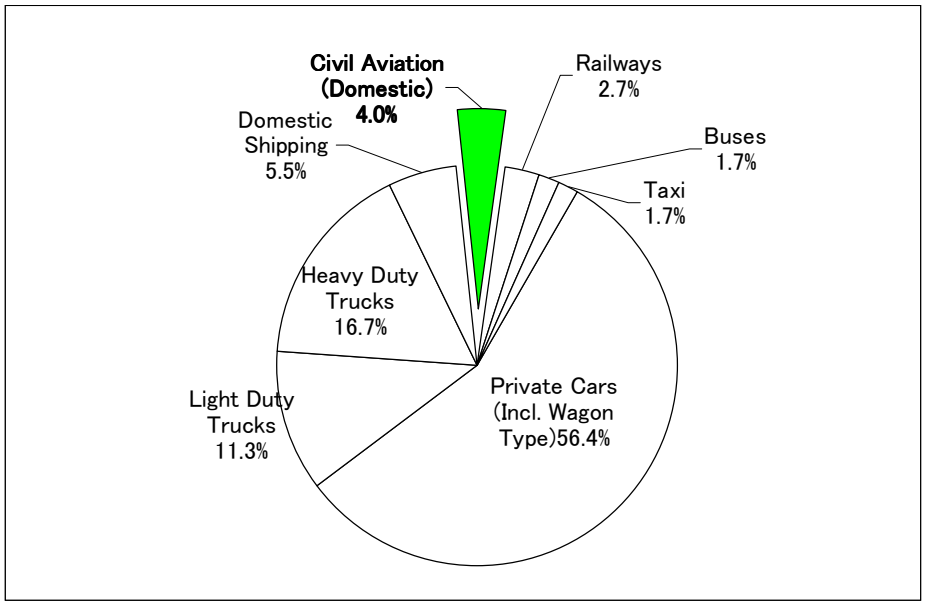
CO_2, Nox (it increases tropospheric Ozone), H_2O, CFC and HCFC are greenhouse gases emitted along with air transport. CFC and HCFC will be described in Chapter 6, Protection of Ozone Layer. The amount to be used in the airline company is not only very small but the restriction based on Montreal protocol has already been effective so that it does not have to be a big problem to be assumed.

The amount of CO_2 emitted by the aircraft in the world is said about 3% of the total amount of CO_2 emission from the fossil fuel according to statistics of ICAO. The domestic emission ratio of CO_2 by airlines in Japan accounts for 4.0% of the transportation sections. It is only 0.9% or less

among entire domestic CO_2 emission. Therefore, the contribution to the global warming by airlines can be said as quite little. (Refer to Figure 3-2)

CO_2 emission limitation and reduction from international transportation (Aviation and Maritime) has been considering by ICAO (International Civil Aviation Organization) and IMO (International Maritime Organization).

Transport Sector Details (Fiscal Year 1999)



(Source: Ministry of the Environment, White Paper 2002)

Fig.3-2 CO_2 Emission Inventories All Over Japan

7) Energy Efficiency Improvement for Domestic Aviation

New "Law for the Promotion of the Measures to Cope with Global Warming" has indicated the energy efficiency improvement target for domestic aviation "Approx. 7% reduction of the average CO_2 emission per unit output between 2008 and 2012 from its level in 1995 by means of the introduction of new efficient aircraft in place of less efficient aircraft and GPU (Ground Power Unit) utilization in place of APU (Auxiliary Power Unit) and on".

8) Action Plan by Airline Industry

In September 1996, the Federation of Economic Organizations had requested all domestic industries to make a plan for independent course of action (the target value of the CO_2 emission reduction and the concrete measures for the reduction etc.) concerning the environmental protection. Japanese Airline Industry (ANA,JAL,JAS) have set the target value of CO_2 emission reduction that is "By 2010, CO_2 emission per transport unit (ASK : Available Seat Kilometer)will be reduced by 10% from the 1990 level". Followings are the main works in the concrete measure to achieve the goal. Promotion of adoption of new type aircraft and switching equipment and materials to new type aircraft, Adoption of FANS(Future Air Navigation System, CNS/ATM), and execution of daily service consuming as little fuel as possible etc.

In February of 1998, there was a request to make a Voluntary Plan to Arrest Global Warming Prevention from the Ministry of Land, Infrastructure and Transport so that Scheduled Air Transport Service Association of Japan represents Japanese 10 scheduled airlines (13 airlines in 2002) has arranged and submitted a plan which was almost the same content as the one submitted to Federation of Economic Organizations. The plan has been reviewing regularly.

9) Transition and Current State of Fuel Saving Measures by ANA

(1) The emission amount of carbon dioxide

The amount of CO_2 emitted along with the operation of the aircraft in our company in 2001 fiscal year was about 1.98 million tons in terms of carbon converted amount (7.26 million tons of CO_2). The aircraft fuel consumption has no choice but will increase because the growth of passenger traffic is forecasted to increase more and more in the future.

In the current state that we have no suitable substitution except the fossil fuel, the airlines company should effectively use the fuel, that is to carry the customer efficiently with lesser energy.

Figure 3-3 shows the transition of the amount of CO2 emission for each Available Seat Kilometer (ASK). The number of ASK and fuel use increases greatly as the demand of passenger traffic increases to 1999 but decreasing from 2000 because of economic depression and 9.11 tragedy. The amount of CO2 emission per ASK shows the tendency to decrease constantly.

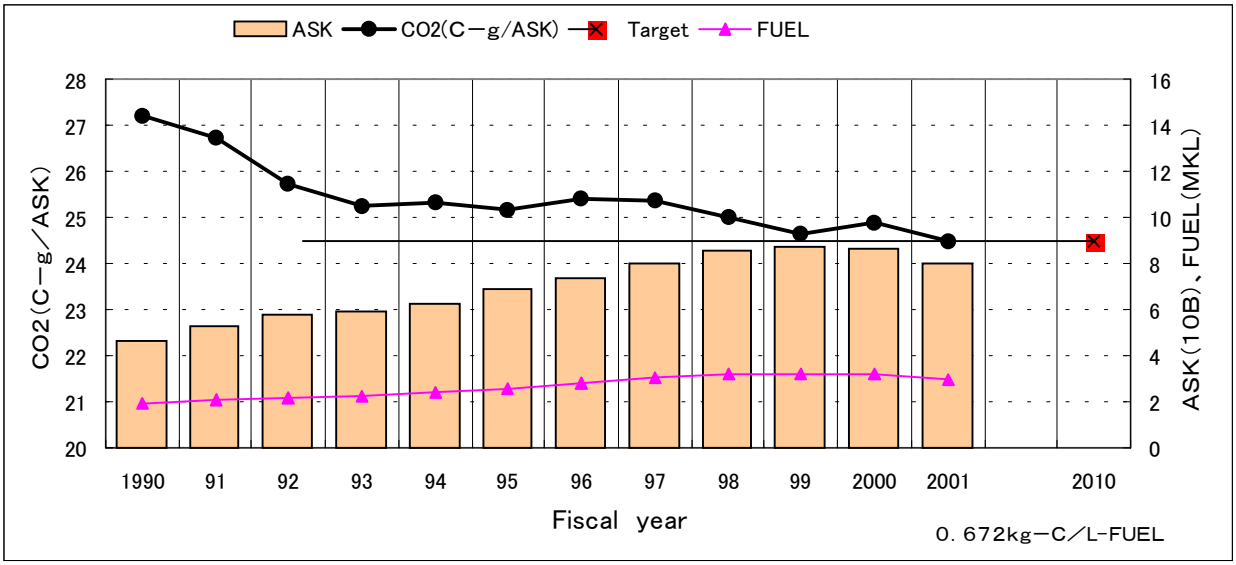


Fig.3-3 CO2 Emission per Available Seat-Kilometer (ASK) by Aircraft Operation

(2) The Fuel Efficiency

The transition of the fuel efficiency of ANA fleet (fuel consumption per ASK) is shown in Figure 3-4 (Overall, domestic, and international). The fuel quantity consumed increases with ASK expansion too, but it is understood that the fuel efficiency improves by about several % every year. Because of joining (interruption) to (from) new routes and so on, the fluctuation is violent depends on each fiscal year in the international service. However, the decrease is re-

markable in the domestic service. The improvement of such fuel efficiency was achieved by the combination of the fuel saving measures and the introduction of a new aircraft model to be described next section.

Figure 3-5 shows the Fuel consumption per RPK for comparison. “Fuel consumption per RPK” is influenced by market driven factors like load factor and does not reflect airline’s measures for fuel efficiency improvement program directly.

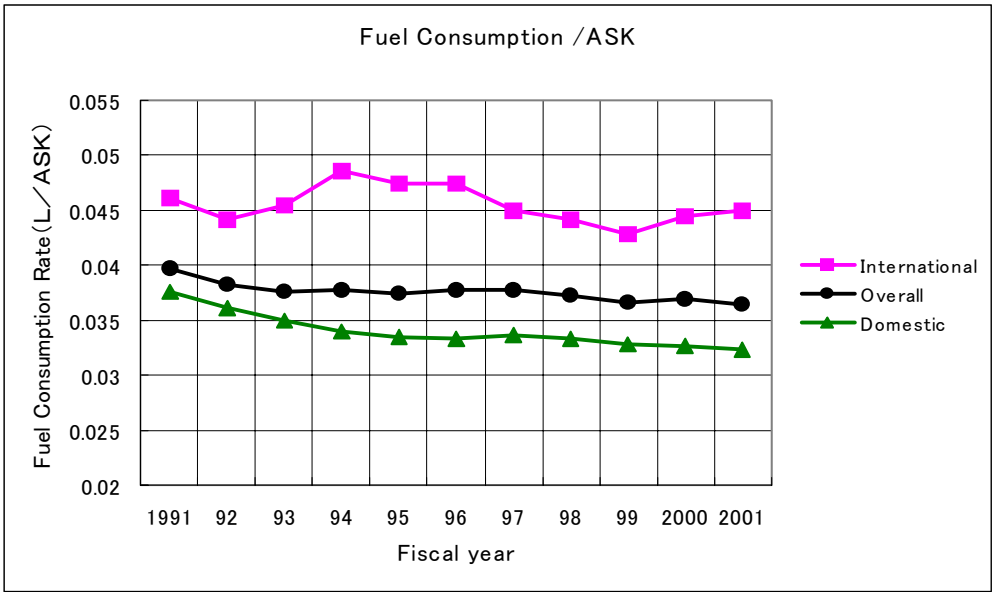


Fig.3-4 Actual Fuel Efficiency (Fuel Consumption/ASK)

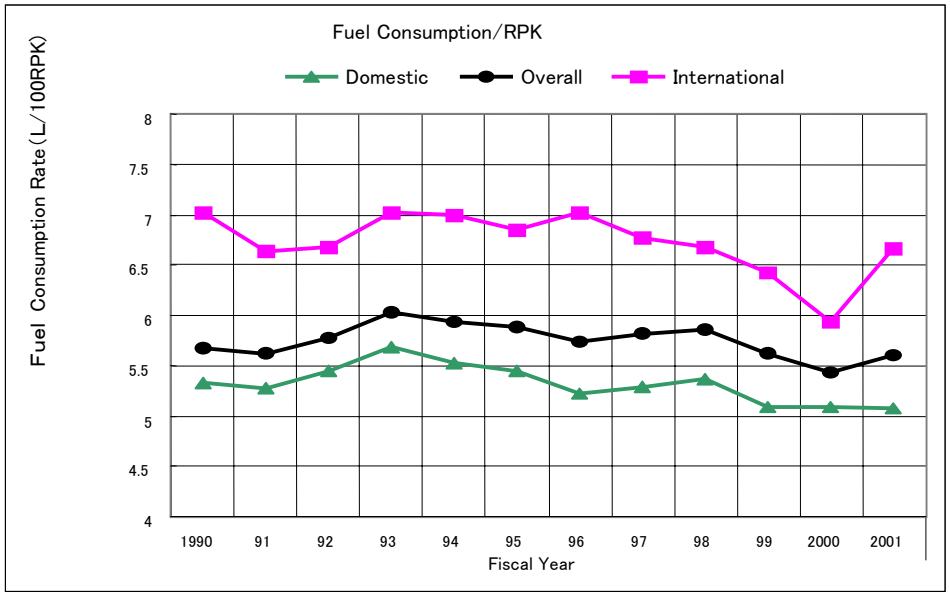


Fig.3-5 Actual Fuel Efficiency (Fuel Consumption/RPK)

(3) Introduction of New Generation Aircraft

The most effective method to reduce CO_2 emission, that is to cut down the fuel consumption, is achieved by introducing fuel efficient new generation aircraft. Using the latest engine technology, it adopts an efficient engine with high by-pass ratio, the improved wing shape etc. to decrease the air resistance and reduced weight by the use of composite materials etc. Figure 3-6 shows how introducing a new model aircraft has reduced CO_2 emission. The model name is shown from the left to the right in order of the introduction period.

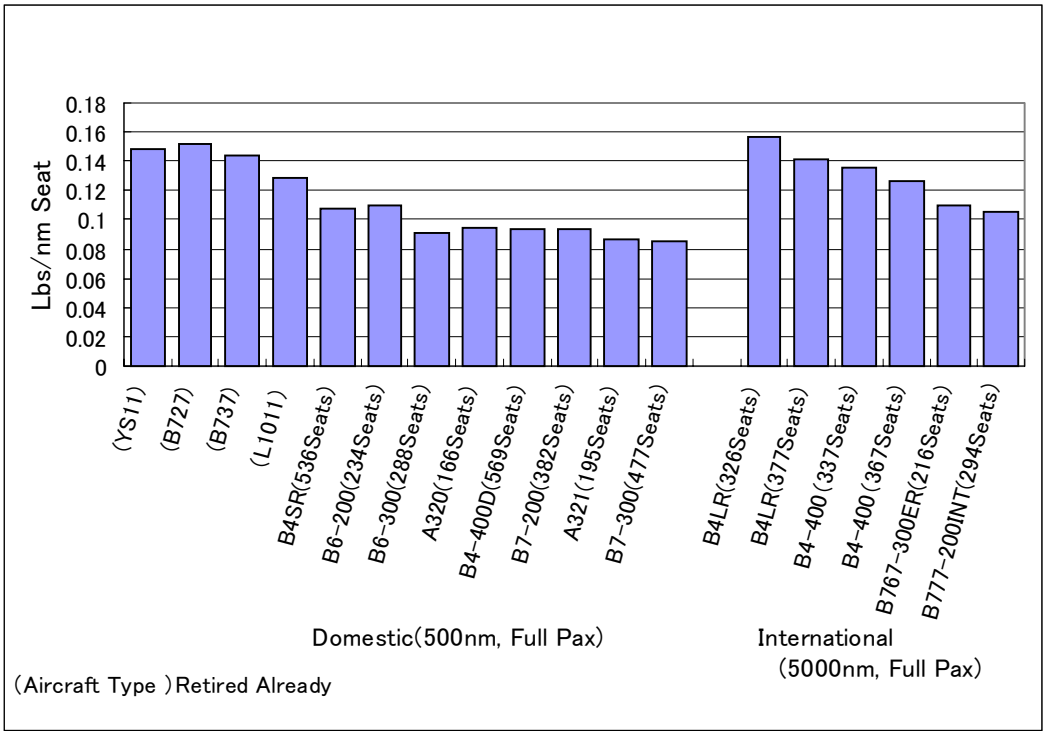


Fig.3-6 ANA Fleet Fuel Efficiency Comparison

Aircraft introduction and retirement status for ANA group fleet is shown on the table at the end of this chapter.

(4) The Fuel Saving Measures

All thought fuel saving measures was examined from the first oil crisis in 1973 and also from the second oil crisis in 1979 in ANA, and a lot of measures had been introduced. In addition, in 1994 fiscal year these measures were reviewed, and in 1999 fiscal year the fuel saving by reducing the airplane weight was examined. Table 3-1 shows the main fuel saving measures.

Table 3-1 the main fuel saving measures

No.	Fuel saving measure items	Contents
1	Suitable approach and departure method for Kagoshima airport	Improvement of departure and approach method To revise SID (Standard Instrument Departure) method and STAR (Standard Arrival Route), and to shorten the route in order to reduce the fuel consumption.
2	Profile Descent to new Chitose airport RWY01	
3	Selection of suitable approach method and shortening radar inducement route in Kumamoto airport	
4	Improvement of radar inducement route in Fukuoka airport	
5	Change of Matsuyama airport departure route	
6	Passing through the test and training area of the Air Self Defense Forces	To shorten the route distance by passing the area on weekends (Saturday, Sunday, and national holiday) in which the Air Self Defense Forces do not train.
7	Select the best cruise speed	To save the fuel by optimizing the cruise speed.
8	Select the best cruise altitude	To save the fuel by optimizing the cruise altitude. As the altitude is raised, the efficiency improves at 1% per 1000 feet.
9	Delayed Flap Approach	To delay the use of the flap with a lot of air resistance when approaching the airport in order to reduce the fuel consumption.
10	Use of low flap angle	To use a low flap angle that decreases the air resistance in order to save the fuel.
11	The best bleed air management (Reduced Pack Flow Operation)	Air for the air conditioner is taken from the engine. By optimizing the amount of taking this, the lowering of efficiency of the engine is minimally suppressed, which in turn saves the fuel.
12	Unnecessary engine shut down when taxing in	Stopping unnecessary engines after the landing to ramp in leads to save the fuel.
13	Engine start during push back	The aircraft used to be pushed out to the taxiway after all engines are started. But from now on the engines will start going during push back.
14	Standardization of Max. Climb Thrust (MCLT) use	To stop the use of delayed thrust, and to use the thrust with which the higher altitude can be reached early with the efficient fuel consumption.
15	The best effect approach	An effective approach by the idling pass planning leads the fuel saving.
16	Optimization of the loading fuel	Reviewing the fuel loading standard and improving its operation leads the fuel saving.
17	Expansion of reducing APU (Auxiliary Power Unit) operation	Delaying the time of the APU start before the departure and after the landing will save the fuel.
18	Reducing APU use	Not to use APU until right before the departure (so far operated in ramp area during en-route). To expand its operation to other airports.
19	Washing the engine in clear water (CF6-45 Engine)	The decreasing compression efficiency is recovered by washing the compressor with clear water and by taking off the dirt of the compressor blades.
20	Modification of Thrust Reverser Nacelle Seal (CF6-45 Engine)	Thrust reverser and the seal around nacelle are improved and added in order to prevent the air leakage that will improve the efficiency of the thrust of the fan.
21	Controlling the position of center of gravity	In general, the fuel saving of about 0.05% can be expected once the center of gravity moves backward by 1%.
22	Using a simulator for flight training	The flight training is done with the simulator instead of actual flight. Using the simulator for the co-pilot promotion training at the right seat. Using the simulator at the periodical check.
23	Using a simulator for maintenance training	The maintenance crew training for the engine run-up is done with the simulator, and it saves the fuel.
24	Removal of Brake Cooling Fan	Fans are removed for weight reduction by examining the necessity in operation.
25	Removal of Rain Repellent System	Depletion of ozone layer related problem. This system was removed by examining the necessity in operation.

26	Tankering	The tankering becomes an increase of the weight of the airplane. Evaluate carefully the expenses and effects when the tankering is executed.
27	Lightening cargo containers	Development of container made of carbon fiber.
28	Reduction in loading of drinking water	Reduction in loading of the drinking water is examined in the international flight.
29	Removal of drinking water cooler	Removal of cooler which is not in use. Reduction of about 40 lbs.
30	Other weight reduction measures	Reducing the amount of equipped blankets. Lightening trays for wagon. Removal of a drinking water tank. Lightening seat cushions. Lightening seats for passenger. Lightening carpets. Replacement to lighter life jackets. Review of necessary number of knives and forks. Review of necessary number of wet towels. Changing the wet towel made from the fabric to the paper. In-flight articles are loaded at each station. Reduction of cockpit manuals. Reduction of the number of spare in-flight magazine "Kingdom of Wing". The reduction of in-flight magazine (weekly magazine etc.). The reduction of ice and dry ice. Lightening servicing cart.
31	Introduction of FMS/R Navigation Method on Domestic route	Reduction of flight time due to R-Nav route setting and R-Nav operation around terminal area.
32	RVSM (Reduced Vertical Separation Minimum) operation on International flight	Vertical separation of aircraft by 1,000 ft above FL290. This will allow aircraft to safely fly more optimum profiles, gain fuel savings and increase airspace capacity.
33	CAT Ⅲ Automatic landing system Operation	Effective on bad weather condition.
34	Execution of Economy Re-clear Flight plan method	The purpose of the re-clear method is expanded not only to the former payload relief, but also to the reduction of the amount of the loading fuel (weight saving).
35	Reduction of flight route distance (Kansai to Haneda)	Flight route was changed in 2001 and saved 6 minutes per flight.
36	Expansion of ETOPS (Extended Twin Engine Operation)	It permits long range oversea flight by twin-engine B767 and B777.

(The main fuel saving measures)

(5) Fuel saving in daily operation

The airport congestion is also a cause of a fuel consumption increase. The waste fuel is consumed by holding over the airport and go-around at landing (re-doing of the landing). At Haneda airport where is crowded most in Japan for example, 148 go-around took place in total of all airline operation in 1994. There are many reasons for the go-around, 43 % is due to the shortage of the interval between a preceding aircraft caused by its delay of the breaking away from the runway. If each aircraft make a prompt breakaway from the runway, it is expected to be improved traffic flow. ANA is always bearing the followings in mind.

① Before landing, understand the capable distance for stopping and the distance to the taxi-way.

② After landing, decelerate smoothly to break away from a runway at a safe speed without the delay.

③ When departing, prepare for the lineup at once after the preceding aircraft begins take-off roll.

④ Work in the cockpit after the take off permission will be finished in a short time as possible.

Excluding above, "Intersection take-off" and "Rolling take-off" are appropriately executed.

(6) Airport Congestion

The airport congestion is one of the big obstacles to consume fuels efficiently.

Moreover, the length of the distance from the spot to the runway also produces a big influence on the fuel consumption.

The completion of the second terminal of Narita International Airport and a new C runway of Haneda made an increase of the time to taxi. The taxiing time before and after the using of Haneda new C runway (March, 1997) was investigated. As a result, the taxi-out time increased about three minutes on the average at the take off to the north in winter (January 1997: 12.6 minutes versus January 1998: 15.7 minutes). However, the taxi-in time has been shortened from 6.7 minutes to 5.7 minutes oppositely at the same season. In fiscal 2000 average taxi-out time was 14.0 minutes and average taxi-in time was 4.5 minutes at Haneda airport. In fiscal 2001 average taxi-out time was 13.9 minutes and average taxi-in time was 6.1 minutes at Haneda airport.

(7) Conservation of Energy other than Aircraft Fuel

Even though it is insignificant amount compared with the fuel consumption of the aircraft itself, consideration of the reduction measures of various energy that ANA uses in each ground facilities are important as well. The energy conservation activities of ANA for electric power,

gas, water and fuel consumed by facilities and offices, and ground vehicle fuel used have been developed. The transition of the amount of the electric power consumption in Haneda area is shown in Figure 3-7 as one example.

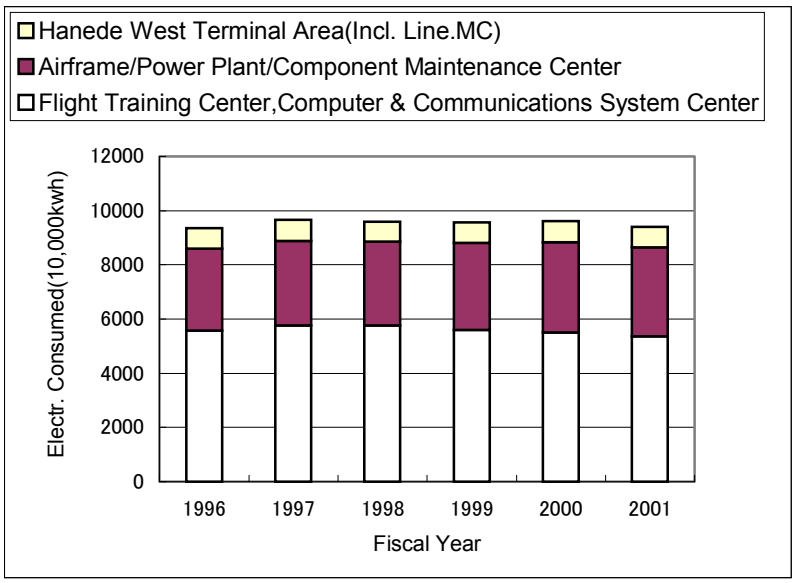


Fig.3-7 Electricity Consumption (Haneda Area)

(8) Energy saving at Offices and Factories

"Law Concerning the Rational Use of Energy" was amended, and became effective from April 1999, as one of the global warming prevention measures aiming to reduce the quantity of energy consumed. The Class II designated energy management factory, in addition to a present Class I designated energy management factory, was added to this amendment. Our four offices are designated as the Class II energy management factory. We have been doing our best by establishing the "Energy Management Study Group Meeting", which is composed of the offices that consume much energy, including those designated factories.

Ordinance on Global warming action plan by the Tokyo Metropolitan Government (TMG): Businesses who consume a large amount of energy are required to submit a Global Warming Action Plan to the Governor. In the plan how much greenhouse gas such as CO_2, they usually emit, and their targeting goal with measures to reduce it should be stated. The results of the plan should also be submitted to the TMG and open to the public. ANA has submitted actual result of 2001 fiscal year and action plan for coming 3 years.

[REFFERENCE]

1. IPCC Special Report "Aviation and the Global Atmosphere"(May 1999)

The IPCC published a special report on Aviation and the Global Atmosphere, in response to a request by the ICAO, to assess the effects of aviation on the earth's climate and atmospheric ozone. The report also examines Scientific, technological, social and economic issues associated with Various options to mitigate adverse effects of aviation on climate and Atmospheric ozone. The brief overview of the report is as follows.

(1) In response to a request by the ICAO, IPCC assesses the effects of aircraft on climate and atmospheric ozone, both in the past and in the future (2050).

(Note) IPCC Second Assessment Report, published in 1995, estimated reaching approximately 1.4 times the CO_2 concentration levels in 1994 by the end of the 21st century, if CO_2 emissions were maintained at 1994 levels, the rise in global average surface air temperature from 1 to 3.5 °C and the rise in sea level from 15 to 95cm by 2100 relative to 1990. IPCC Second Assessment Report estimated also stabilization scenarios that assumes policy measures are enacted which begin to reduce CO_2 emissions in the year 2000 relative to business as usual with eventual stabilization of the CO_2 concentration at 550 PPM by 2150 (current CO_2 concentrations are about 360 PPM).

(2) Global passenger air travel, as measured in RPK, is projected to grow by 3.1 to 4.7% per year in average between 1990 and 2050, whereas total aviation fuel use (CO_2 emissions) is projected to increase by 1.7 to 3.8% per year.

(3) The range of increase in total aviation carbon dioxide emission to 2050 would be 2.6 to 11 times the value in 1992.

(4) Emissions of carbon dioxide by aircraft were about 2% of anthropogenic carbon dioxide emissions in 1992 and will be 3% of the projected total anthropogenic Carbon dioxide emissions in 2050.The best estimate of the radioactive forcing, The perturbation to the energy balance of the earth-atmosphere system, in 1992 by aircraft is about 3.5% of the total radioactive forcing by all anthropogenic activities. Radioactive forcing by aircraft in 2050 will be about 5% of the radioactive forcing by all anthropogenic activities.(the effects of possible changes in cirrus clouds is not included)

(5) Over the period from 1992 to 2050, the overall radioactive forcing by aircraft (excluding that from cirrus clouds) is a factor of 2 to 4 larger than the forcing by aircraft carbon dioxide alone. The overall radioactive forcing for the sum of all human activities is estimated to be at most a factor of 1.5 larger than that of carbon dioxide alone.

(6) **CO_2:** The range of increase in aviation emissions to 2050 would be 1.6 to 10 times the value in 1992.

(7) **Nox:** The NOx emissions from subsonic aircraft in 1992 are estimated to have increased ozone (O_3) concentrations at cruise altitudes in northern mid-latitudes. Aircraft NOx emissions are expected to decrease the concentration of Methane (CH_4) that are global in extent. Global average radioactive forcing are of similar magnitude and opposite in sign, but the net regional radioactive effects are not cancelled.

(8) **Water vapor (H_2O):** Water vapor is a greenhouse gas. For subsonic aircraft this effect is smaller than those of other aircraft emissions such as carbon dioxide and NOx. For high speed civil transport (HSCT) aircraft, although there is considerable uncertainty, additional radioactive forcing due to accumulation of stratospheric water vapor is estimated as supersonic aircraft consume more than twice the fuel per passenger-km.

(9) **Contrails:** Contrails are triggered from the water vapor emitted by aircraft and their optical properties depend on the particles emitted or formed in the aircraft plume and on the ambient atmospheric conditions. Contrails tend to warm the Earth's surface, similar to thin high clouds. In 1992, aircraft line-shaped contrails are estimated to cover about 0.1% of the Earth's surface on an annually averaged basis with larger regional values. The contrail cover is projected to grow to 0.5% by 2050. The radioactive effect of contrails is similar to that of CO_2 and O_3, but still uncertain.

(10) **Cirrus Clouds:** Extensive cirrus clouds have been observed to develop after the formation of persistent contrails. The mechanisms associated with increases in cirrus cover are not well understood and need further investigation. An increase in cirrus cloud cover tends to warm the Earth's surface.

(11) **Sulfate (Sox) and Soot Aerosols:** The aerosol mass concentrations in 1992 resulting from aircraft are small relative to those caused by surface sources. Increase in soot tends to warm while increases in sulfate tend to cool the Earth's surface. The direct radioactive forcing is small compared to those of other aircraft emissions.

(12) **Impacts of Supersonic Aviation:** Supersonic aircraft consume more than twice the fuel per passenger-km compared to subsonic aircraft. The radioactive forcing of civil supersonic aircraft is estimated to be about a

factor of 5 larger than that of the displaced subsonic aircraft. The addition of a fleet of civil supersonic aircraft is assumed to begin operation in the year of 2015 and grow to a maximum of 1,000 air craft by the year of 2040, which is projected to add a further 40% Increase of radioactive forcing. Most of this additional forcing is due to Accumulation of stratospheric water vapor.

(13) **Aircraft and Engine Technology Options:** A 40 to 50% improvement in fuel efficiency is projected by 2050. The typical aircraft and engine life expectancy, 25 to 35 years, have to be taken into account when assessing the Improvement rate. (Substantial aircraft and engine technology advances are already incorporated the aircraft emissions scenarios used for climate change calculations)

(14) **Operational Options:** Improvement in air traffic management (ATM) and other operational procedures could reduce aviation fuel burn by between 8 and 18% (The Air traffic management improvements are already incorporated in the aircraft emissions scenarios used for climate change calculations). The large majority (6 to 12%) of these reductions comes from ATM improvements which it is anticipated will be fully implemented in the next 20 years.

(15) **Regulatory, Economic, and Other Options:** Policy options to reduce emissions further include more stringent regulations, environmental levies (charges and taxes), emission trading, modal shift (substitution of aviation by rail and coach) and so on. Some of these approaches have not been fully investigated or tested in aviation and their outcomes are uncertain.

2. Outline of Kyoto Protocol

(1) **Greenhouse Gases:** Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulpher Hexafluoride(SF_6)

(2) **Commitment period:** 2008-2012 (1st Commitment period)

(3) **Quantified emission limitation or reduction commitment:** At least 5 per cent below 1990 levels (Japan:6 %, EC:8%, USA:7%-nonparticipation)

(4) **Sink:** Partial consideration for new forestation after 1990

(5) **Kyoto Mechanism:**
- Joint Implementation (between Annex I Parties)
- Emission Trading (between Annex I Parties)
- Clean Development Mechanism (between Annex I Party and non- Annex I Party)

(6) **EU bubble:** Accepted subject to legal responsibility

(7) **Banking:** Accepted

(8) **Borrowing:** Not accepted

(9) **Entry into force:** Ninetieth day after the date on which not less than 55 Parties to the Convention, incorporating Parties included in Annex I accounted in total for at least 55 per cent of the total CO_2 emissions for 1990 of the Parties included in Annex

. **ANA Group Fleet (Subsonic Jet Aircraft) Introduction and Retirement** (*) ANK retired in 2000

Aircraft Type	Engine Type	Introduction start	Retirement finished	Aircraft age (2002.3.31)
B727-200	JT8D-17	1969	1990	—
B737-200 (*)	JT8D-17	1969	1992	—
L1011	RB211-22B	1974	1995	—
B747SR	CF6-45A2	1979	(planed to be retired in 2006)	21.1
B767-200	CF6-80A	1983	(planed to be retired in 2006)	16.3
B747F (NCA)	CF6-50E2	1984	—	15.5
B747LR	CF6-50E2	1986	(planed to be retired in 2006)	20.1
B767-300	CF6-80C2B2	1987	—	10.5
B737-400 (ANK)	CFM56-3C1	1990		8.7
B747-400	CF6-80C2B1F	1990	—	8.3
A320	CFM56-5A1	1991	—	9.0
B737-500 (ANK)	CFM56-3C1	1995	—	5.7
B777-200	PW4074,PW4077	1996	—	4.4
A321	V2530-A5	1998	(planed to be retired in 2006)	3.0
B777-300	PW4090	1998	—	3.8

Chapter 4 Waste and Recycling

1) Air transport and waste

The wastes related to air transport are classified below:

(1) Waste materials or drainage/waste water from the maintenance facilities, etc., resulting from aircraft maintenance work

(2) Garbage from the aircraft cabin

(3) Garbage from the offices

(For the aircraft engine emissions, please see Chapter 5 "Air Pollution".)

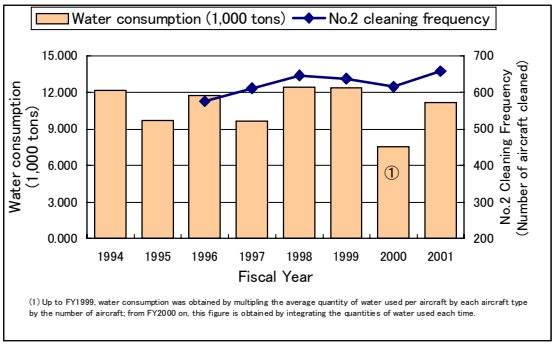
2) Our situation

The actual results in our company in FY 2001 are as follows:

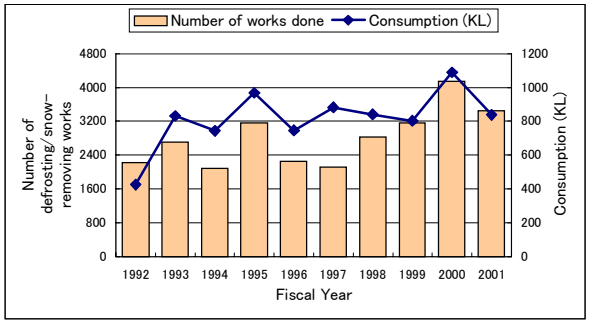
Industrial waste	813t
General waste	9,988t
(Of which, garbage from the aircraft cabin)	5,293t
Sewage	81,274,084m^3
(Of which, industrial liquid waste)	25,191m^3

Aircraft surface cleaning and water consumption

The results of our aircraft surface cleaning done within a hangar or in a specified area in the airport are shown in the graph. The resulting wastewater is properly treated.



Aircraft anti-icing/snow-removing work and anti-/de-icing fluid



Propylene glycol (outside the scope of the PRTR Law) is used for aircraft anti-/de-icing and snow-removing purposes. It is applied together with a large quantity of warm water for melting snow. Further efforts are being made to reduce the consumption of anti-/de-icing fluid by introducing new, more powerful equipment, such as blowers blowing snow off at Chitose Airport in the severe winter season. (Photos on Page 23 show two types of new, more powerful equipment.)

3) Measures taken by ANA to reduce and recycle wastes

Our company is taking the following measures to reduce and recycle wastes:

(Reduction of industrial wastes)

Changing the procedures of measuring the weight and the center of gravity of the aircraft (measuring without emptying fuel tanks)
Recycling the active carbon used for the aircraft air-conditioning system and for the water processing in the hangar
Removing the paint of engine parts with super-high pressure water (to reduce the use of chemicals)
Development of a new non-chlorine paint-removing agent in cooperation with a U.S. manufacturer.
Changing the repainting procedure (Combined application enables repainting without removing old paint)

(Waste water treatment)

Processing and recycling of rainwater and kitchen wastewater
Introduction of non- or low-pollution snow-removing fluid

(Reduction of general wastes)

Recycling the used air ticket stubs by dissolution
Separate collection of garbage from the aircraft cabin

4) Compliance with the PRTR (Pollutant Release and Transfer Register) Law

Our company has been making efforts to comply with the PRTR law since FY1999. In FY2000, together with the Scheduled Airlines Association of Japan, we participated in a project to prepare a "PRTR manual for calculating the quantity of release, etc." led by the Ministry of Economy, Trade and Industry and The Society of Chemical Engineers, Japan . We organized the "Briefing session on the enforcement of the PRTR law for the air transport industry" at our company's meeting hall with the cooperation of the Tokyo Metropolitan Government. Further, we helped the Ministry of the Environment and the Tokyo Metropolitan Government in their "Feasibility study of the PRTR law pilot project."

Based on these activities, we established our internal control and reporting system in FY2001. At the same time, we have restructured and improved our existing system for collecting and spreading MSDSs (Material Safety Data Sheets) so that their latest versions may be retrieved over our internal LAN.

ANA's chemical substances subject to the PRTR law are related to aircraft maintenance; we use approximately 500 items containing 45 kinds of chemical substances in total. However, any of these substances are used in extremely small quantities and have not reached the quantity of use required to report under the PRTR law that is 5 tons or more (or 0.5 ton or more according to the substance type) per year at each establishment. So none of our establishments has made any reports.

Major PRTR substances used by ANA and their applications

Name of designated chemical substance	Law No.	Application (as material)
Tributyl phosphate	354	Aircraft hydraulic fluid
Polyoctyl phenyl ether	308	Cleaning agent
Toluene	227	Paint, thinner, sealant
Xylene	63	Paint, thinner
Manganese compounds	311	Parts cleaning agent, sealant
Poly nonylated phenyl ether	309	Parts cleaning agent
Cellosolve acetate	101	Thinner
Ethylbenzene	40	Paint
Hexavalent chromium compounds	69	Paint
Bisphenol A diglycidyl ether	30	Sealant

Chapter 5 Emissions

1) Our measures to cope with air pollution issues

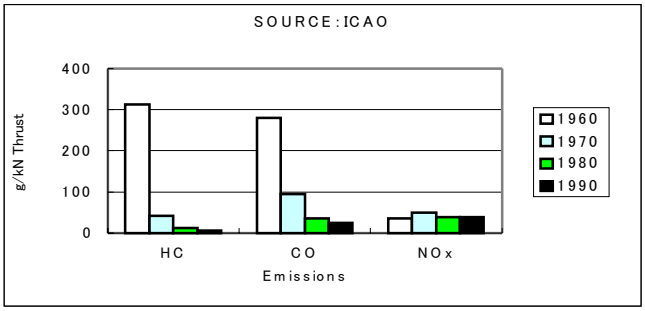
Air pollution issues in our company are mainly related to (i) aircraft engine emissions, (ii) emissions from ground vehicles, and (iii) the release of volatile gas during aircraft exterior painting work.

(1) Reduction of aircraft engine emissions

① Use of low-emission aircraft engines

As the most effective way to reduce emissions from the aircraft, our company has positively introduced a new-type aircraft equipped with improved new-type engines, and has achieved a remarkable improvement during the past 20 years. (See Fig.5-1)

Progress of emissions per unit of thrust at the Landing Take-off (LTO) cycles set by ICAO Fig 5.1



CO have shown a significant decrease in emissions in the past 30 years, but NOx has not. The use of a high-temperature high-pressure combustion chamber to improve the engine combustion efficiency has made the reduction of NOx difficult.

Fig.5-2

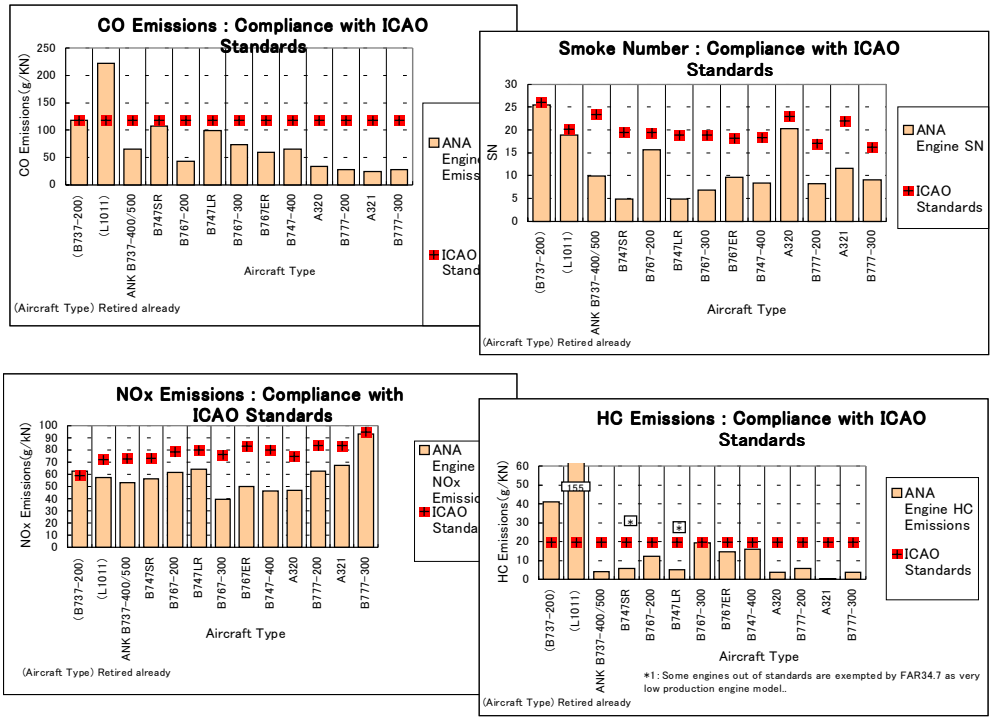


Fig shows the comparison of the ANA Fleet Engine Emissions with the ICAO Standards. With the exception of a few very low production models, the engines currently used by our company meet the ICAO Emission Standard.

② **Operational improvement**

In order to restrain emissions in the operation, our company has taken the following measures: decreasing the operational time of engines as much as possible, reducing the use of Auxiliary Power Unit (APU) by Ground Power Power Unit (GPU), shortening the time of engine tes trun-up by improving the maintenance procedures, executing practical flight training with a simulator, and cutting the time of ground run-up training.

Flight simulator

③ **Actual measurement of emissions**

A.P.U. (Auxiliary Power Unit), an auxiliary power unit installed in the aircraft that is mainly used while the aircraft is on the ground, has an impact on the air quality in and around the airport. For this reason, our company provided an A.P.U and an engine test cell to help the Airport Environment Improvement Foundation (AEIF) in carrying out their "Actual measurement of emissions" as one of the measures to control the aircraft emissions at the airport.

The measurement was carried out in our test cell at Haneda Airport in November 2001, by using A.P.U. (GTCP331-200 model) installed in our B767 aircraft.

(2) Measures to reduce emissions (NOx, SPM) from airport vehicles

Our group companies have approximately 2,200 vehicles of various kinds (ground support equipment cars, airport handling cars, tug cars, AC power supply cars, maintenance cars, forklifts, etc.) for use in airports all over the country. We are making efforts to introduce low-pollution vehicles and replace them with the latest vehicles with less harmful emissions to the maximum extent practicable. As of the end of July 2002, our low-pollution vehicles totaled 85, seven more than in the previous year, including electric (battery), natural gas, and hybrid types.

In the operational area, we are also emphasizing the need to stop running vehicles in idle while stopped.

(3) Reducing emissions of volatile gas, etc., in the aircraft exterior painting work

We are planning to introduce low VOC (volatile organic compound) paints for the aircraft exterior in 2002. In 2001, we introduced a new neutral paint-removing agent of non-methylene chloride type to avoid water and soil pollution.

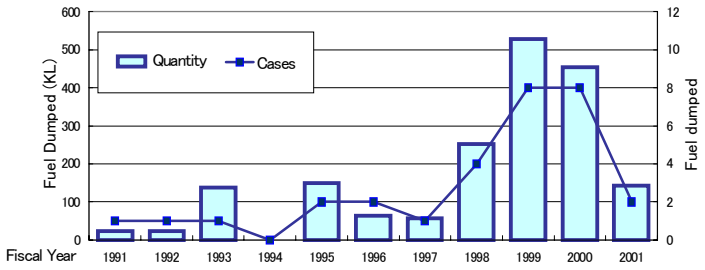
In order to promote the use of such paints and paint-removing agents, we introduced, in the autumn of 2001, a heating system to warm the entire hangar at the ANA Aircraft Maintenance Co., Ltd., Osaka, which handles the repainting and maintenance work of ANA aircraft.

(4) Others

Fuel dumps due to unexpected landing

There were two fuel dumps by ANA aircraft in FY2002, totaling about 142 kiloliters (6 cases and 312 kiloliters less than in the previous year).

Fig.3-3 Change in the number of fuel dump cases and the quantity of fuel dumped



Fuel dump:

Fuel dumps are done to reduce the weight of the aircraft so that it can land safely in case of unexpected landing due to aircraft system malfunction and/or a sudden passenger illness. The airport authority and other rules specify the location and altitude where fuel dumps are allowed, avoiding urban areas. The fuel dumped at a high altitude will be vaporized and diffused, having no direct effect on life on the earth.

2) Improved aircraft and air pollution

Research and development (R&D) of aircraft emission reduction techniques have remarkably improved in the past 30 years, and the emissions of HC, CO and smoke have been substantially reduced. Fig.3-1 shows the change every 10 years from 1960 to 1990 in emission quantity per unit of engine thrust at the Landing Take Off (LTO) Cycle set by ICAO. HC and CO have shown a substantial reduction over the 30 years, but NOx has not. The use of a high-temperature, high-pressure combustion chamber to improve engine combustion efficiency has made the reduction of NOx emission difficult.

Also, trying to suppress NOx emission will result in increased fuel consumption. It is our intention to balance the two. The following methods for reducing NOx have been studied, and parts of them have been made practicable: multi-staged combustion chamber, pre-mixed rarefaction combustion method, concentration/rapid cooling/rarefaction combustion method, and pre-mixed catalyst combustion method. Incidentally, the fuel used decides the emission of sulfur oxides (SOx). However, the currently used Jet-Aviation fuel (kerosene type) contains sulfur of 0.01 % or less (the standard requires 0.3% or less), and its effect on the air pollution (especially the acid rain problem) can be considered very small.

Chapter 6 Ozone Layer Protection

1) Influence on Ozone Layer Depletion

The substances contributing to the depletion of ozone layer include chlorofluorocarbon, halon, methylchloroform, trichloroethane, and carbon tetrachloride. On the other hand, nitrogen oxides (NOx) in aircraft emissions are said to be effective in producing ozone in the troposphere. (For NOx, please see Chapter 5 "Emissions")

Aside from NOx in aircraft emissions, substances contributing to ozone layer depletion are used by our company (i) in aircraft equipment, (ii) in aircraft maintenance work, (iii) in aircraft maintenance vehicles, and (iv) in the buildings used by our company.

In order to reduce such substances, we are taking measures to promote the use of alternatives and improve handling procedures as follows:

(1) Substances used in the aircraft equipment:

For halon, chlorofluorocarbon, etc., used in the aircraft equipment, we are taking the following measures:

① Gas cylinder for injecting rain repellent (material to be injected to the cockpit windshield to repel raindrop)

The specific chlorofluorocarbon solution (CFC113) was used in the raindrop repellent injection system, but it has been established (by JCAB and FAA) that there is no problem in operational safety without this system, except for YS-11. So, the system itself was deactivated in FY1998 (except for ANK YS-11; Five airplanes were used by ANK as of July 2000, but they are gradually being replaced with the latest DHC-8-400).

② Air chiller (food refrigerator in the cabin)

The specific chlorofluorocarbons (CFC12/CFC113) used for the refrigerant in air chillers were completely replaced with a non-restricted CFC substitute (HFC134a) in FY1999. Moreover, the CFC substitute discharged is collected and recycled by the maintenance company.

Incidentally, from the beginning, our B747-400D, B777 and A320 aircraft were not equipped with such air chillers. Carts using ice were developed and used as a substitute.

③ Water cooler

ANA aircraft other than B747SR and B767-200 are not equipped with water coolers. The water coolers installed in the B747SR and B767-200 aircraft are no longer used, and are being removed (the removal from B747SR is already completed). Now, mineral water is used as a substitute.

④ Fire extinguisher

The halon fire extinguishers installed in the aircraft are still used because no substitute has been developed yet.

Flight attendants are regularly trained in fire fighting in preparation for fires in the plane. In this connection, the fire-fighting training with the use of an actual halon fire extin-

guisher has been changed to training with a mock fire extinguisher and a water fire extinguisher along with video use since February 1993. The mock fire extinguisher is almost identical to the halon fire extinguisher installed in the aircraft in terms of shape, weight, handling methods, the jet duration time of the extinguisher, etc., and has a fire extinguishing capacity, too. This has allowed unnecessary release of halon into the air to be avoided.

Check and maintenance of fire extinguishers installed in the aircraft

The halon fire extinguishers installed in the engine, cargo bay and cabin of the aircraft are regularly dismounted and serviced (maintenance of gas cylinder) by the maintenance company. Halon (1311) collection equipment has been installed at the maintenance company to establish an effective halon recycling system. As a result, it has become possible to reduce the chlorofluorocarbon leakage at the maintenance center to less than 2%. The halon 1211 collection system is also being introduced soon.

(2) Substances used in the aircraft maintenance work

The use of specified chlorofluorocarbon and trichloroethane in the aircraft maintenance work was totally discontinued in 1994 in accordance with the reduction plan prepared in 1990. The quantity of specific chlorofluorocarbon used was reduced by introducing the cleaning solution recovery system to recycle the fluorocarbon solution. Then the specified chlorofluorocarbon was replaced with an alternative cleaning agent. Trichloroethan was replaced with an alkali cleaning agent.

(3) Refrigerant chlorofluorocarbon used in air conditioners for vehicles

When renewing our vehicles, we are actively replacing them with ones using CFC substitutes.

(4) Halon fire extinguishers used in buildings

Halon fire extinguishers are installed in transformer rooms, computer rooms, etc., in our company buildings. Recently, a gaseous fire-extinguishing agent has been developed as a substitute for the halon fire-extinguishing agent, and we are introducing it to the new buildings. Also, thorough control is exercised to avoid accidental release of fire extinguishers except in emergency.

Montreal Protocol

The "Montreal Protocol on Substances that Deplete the Ozone Layer" was adopted in 1987 out of the necessity to protect the ozone layer. Since then, the regulation has been strengthened by revising the protocol five times by 1999, based on new scientific findings. The production of halon was suspended at the end of 1993, and that of chlorofluorocarbon, trichloroethan, and carbon tetrachloride was suspended at the end of 1995. Production of CFC substitutes, too, will be mostly suspended by the end of 2019.

Japan enacted the "Ozone Layer Protection Law" and ratified the Montreal Protocol in 1989.

In the United Nations Environment Program (UNEP) report, it is predicted that the depletion of ozone layer will be at its peak by 2020 and that, by 2050, the ozone density will return to the level before 1980 if all countries observe the protocol.

Relations between Aircraft and Depletion of Ozone Layer

The influence of aircraft emissions on the ozone layer has not been fully elucidated yet. According to the "SPECIAL REPORT" on the influence of aircraft emissions on climate change, issued by the United Nations IPCC (Intergovernmental Panel on Climate Change) in 1999, nitrogen oxides (NOx) in aircraft emissions are effective in producing ozone in the troposphere, especially in the northern hemisphere mid-latitudes, where flight services are frequent. In the stratosphere, however, it is predicted that ozone is depleted by sulfur and moisture emitted by the aircraft, although its level has not been quantified yet. Consequently, the report suggests the necessity to assess the effect of aircraft emissions on the ozone in the stratosphere in the future.
Besides emissions from aircraft engines, such substances as chlorofluorocarbon and halon influencing the ozone layer are used in aircraft equipment and in aircraft maintenance work.

Substances contributing to ozone layer depletion and their depletion coefficients and major applications

	Ozone layer depletion coefficients	Global warming coefficients	Major applications
CFC (Chlorofluorocarbon): Specific CFC	0.6～1.0	8,100	Refrigerant, cleaning of electronic equipment
HCFC (Hydrochlorofluorocarbon): CFC substitute	0.005～0.52	1,500	Refrigerant, cleaning of electronic equipment
HFC (Hydrofluorocarbon): CFC substitute	0	1,300	Refrigerant, cleaning of electronic equipment
Trichloroethane	0.1	100	Cleaning of electronic equipment
Halon	3.0～10.0	5,400	Fire extinguishing agent (aircraft, buildings)
(Reference substance)	(CFC－11＝1)	(CO_2＝1)	

Chlorofluorocarbons, used for a cooler refrigerant, a cleaning agent for electronic parts, etc., are classified into two kinds. One is the specific chlorofluorocarbon (CFC), which is restricted as a substance contributing to ozone layer depletion, and the other is the CFC substitutes (HCFC, HFC), which are developed as alternatives of CFC to avoid ozone layer depletion. HCFC is still subject to restriction (because of its influence on global warming), although its potential for ozone depletion is smaller than that of CFC. HFC is also a target of reduction due to its strong influence on global warming as a greenhouse effect gas, although it does not damage the ozone layer. Halon, used for fire extinguishing appliances in aircraft and buildings, has a stronger ozone-destroying power than chlorofluorocarbon has.

On Depletion of the Ozone Layer

The ozone layer plays a role in protecting life on the earth by blocking much of the dangerous ultraviolet rays from the sun. In recent years, the ozone layer has been on the decrease globally, which, it is feared, would have a bad effect on human health. The decrease rate is especially high in high latitudes, and a statistically significant rate of decrease is also observed in Sapporo, Japan. The so-called ozone hole is observed over the Antarctic. (Fig.6-1 shows the transition of the ozone hole area observed over the Atlantic.)
The substances contributing to the ozone layer depletion include fluorocarbon, halon, methylchloroform, trichloroethane, and carbon tetrachloride.
Fluorocarbon and halon are extremely stable materials; however, they diffuse to the stratosphere after being emitted to the troposphere, and produce chlorine atoms when decomposed by strong solar ultraviolet radiation. This one chlorine atom reacts with tens of thousands of ozone atoms, which depletes the valuable ozone layer.

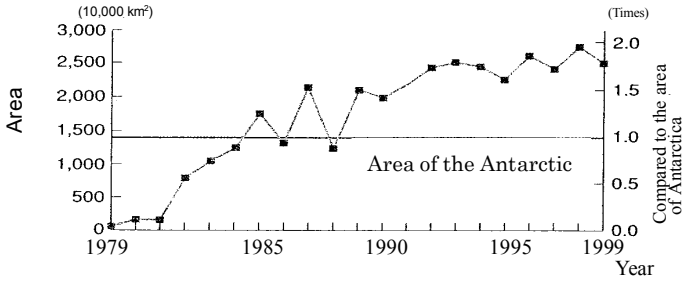


Fig.6-1 Transition of ozone whole area over the Antarctic

Source: The Japan Meteorological Agency

Chapter 7 Contribution to the Society

Making use of the special character of air transport, ANA has made contributions to the society as follows:

ANA flight attendants and ground hostesses visited 74 hospitals across the country with lilies of the valley transported by plane from Hokkaido to express their sympathy. (Since 1956)
Flew red feathers as the “first mail by air” to 39 districts all over the country and cooperated in Community Chest campaigns. (Since 1962)
Cooperated with UNICEF in their in-flight Community Chest campaign “Change for Good”, and conducted it in our flights departing from the U.S.A. and arriving at Japan. (Since 1998)
Held charity bazaars and community chest campaigns at our individual establishments, and participated in events at local home for neglected and abused children and nursing homes for the aged. Also, made contributions to the Japanese Red Cross Society and the guide dog associations in Japan and the United Kingdom.
Cooperated with the Okazaki Kaheita International Scholarship Foundation (established in conformity with the wishes of Mr. Kaheita Okazaki, ANA’s second president) in receiving 13 scholarship students in FY2001. (Since 1991)
ANA group companies cooperated in presenting a tour to Ishigaki Island, Okinawa, as a Christmas gift to 40 primary and secondary school children from Miyake Island from where all the villagers are evacuated due to volcanic eruptions.
Cooperated in collecting the “world’s recycled paper toilet tissues” to be exhibited at the Paper Expo (in Shizuoka) organized by the “Zenkoku Shigyo Shinkokai” (National paper industry promotion association) .
Organized study tours to our aircraft maintenance factories for children from schools and home for neglected and abused children and for the general public (in FY2001, we received 28,000 persons at Haneda, and 2,000 persons at Narita). Our aircraft maintenance center at Haneda will receive the 200,000th visitor in this program in September 2002.

・For inquiry about the factory study tour, please call at 03-5756-5094 (Haneda) or 0476-32-5120 (Narita).

Chapter 8 Activities through April to August 2002

ANA make our environmental activities improve day by day.
We are going to report our current activities through April and August.

Main Activities	Contents
Management Principle & course of action	We improved upon our management Principle and its course ofaction covering over our conpanys group. (ref.P-6) They are based on the concept of the safety, the superior service for customers and the co-existence with society & environment. All of the staffs have strong mind to make the best efforts to realize the concepts.
Compliance for environment	The laws or the social reqiurements for the environment are never realized without the conscious efforts of company. We started the project to know and comply them under the system as"compliance program" and will complete it 2002. More than 30 departments take charge of the environmental activities and have the responsibilities for them.(ref.P-13)
Open Forum for environment	Any environmental activities need the underatsnding of our staffs. We had the open forum for the environment in which our president,bord-members,many staffs and many guests from Japanese government, airlines or jet-fuel company attended. Through these opportunties we would like to diffuse our concept for the environment and realize our environmental
Environmental accounting	We are trying to account our environmental activities by the amount of cost as waste-reduction, environmental training or so many environmental affairs totally. We have made the environmental account of Narita airport and will complete one reflected close to whole company's cost this year. (ref.P-14) We believe that it makes our environmental activeties clear to the society and encourages ourselves to advance.
Purchasing from Eco-products	We have started the purchasing system in order to increase Eco-products (mainly stationery) in our company this year. This system is performed through our company web. We let our subsidiary companies co-work under this system within a couple of years.
Environmental Conference in AAPA	The aviation environment is not the issues individually but ones among the aviation industry. We have the environ-mental organization in Japanese aviation industry. ANA cooperated with JAL to appeal the necessity of the same kind of organization to Association of Asian and Pacific Airlines. The first conference will be held in Nov.'02.
Inr'l Aviation Environment Conference by UNEP	United Nation Environment Program held the int'l aviational environment conference in Paris before Johanesburg summit in Sep. ANA was invited there as a panelist, alone from Asia and Japan. We explained our environmental concept and efforts, then discussed how to mitigate the impact to the environment from the aviation. From now on, we are willing to proceed our activities opened toward the world wide environmental

Handling Environmental Products as a Trading Company

ANA Trading Company has been striving "to add value that cannot be imitated" as a general trading firm in the ANA Group. As our business is based on the aviation industry, we have been deploying shops at airports throughout Japan. We also conduct various operations related to procuring aircraft component parts and rendering fuselage-related services, such as import, lease and sale of airplanes, including a variety of operations to improve in-flight services. We have also been diversifying into a wide range of fields, including the import and export of electronic parts, such as semiconductors, agricultural and marine products, paper products, pulp, hotel accessories and so on, while monitoring and reacting to the changing environment by expanding our existing lines. We were quick to become involved in the environment-related business, and now promote the sales of environment-friendly goods as described below.

Selling Carbon Fiber Materials

Carbon fiber is a regenerated material made from the raw material of tar extracted from cinders of coal, coke or the like. It is a promising substitute for urethane that has long been used to make cushions. Carbon fiber as a cinder-regenerated product has outstanding physical properties of complete incombustibility and light weight, and so is expected to be increasingly used for cushions and heat-insulation materials for the seats in railway cars and airplanes. Use of this material also reduces CO2 emissions by 30% while reducing electric power and fuel consumption. Urethane materials which have become unnecessary must be disposed of as industrial waste, whereas carbon fiber materials are recyclable. At present, several companies are testing finished products of carbon fiber for their practicality; once problems concerning durability have been eliminated, the use of carbon fiber as products will accelerate.

Selling a Waste-regenerated Material

A composite wooden material is made of waste timber (wood powder) and waste plastics. It excels in rigidity, bending strength and dimensional stability compared with wood. Although it appears to be the same as timber, this composite material is characterized by freedom from corrosion, attacks by grubs, and discoloration. The material is a completely recycled product made of raw materials produced from pulverizing and reusing discarded products. Office partitions and furniture, for example, are usually discarded as industrial waste, but converting them to products made of this new material will also reduce industrial waste.

Encouraging the Use of Used Paper, Reclaimed Paper and Non-wooden Paper

Used paper and reclaimed paper are mainly used for printing applications. Although we have been encouraging companies to use this type of paper, it remains unpopular because of its lower quality, higher price and unstable availability compared with high-quality paper.

We have also been actively handling non-wooden paper. The main raw materials for non-wooden paper include natural plant fiber such as bamboo, esparto, reed and papyrus; agricultural waste fiber such as sugar cane, banana and wheat straw; and cultivated plant fiber such as kenaf, jute and ramie. These materials are expensive and of lower quality than paper. Nevertheless, we have been recommending use of this type of paper mainly to companies that show a positive attitude toward environmental problems.

We source the materials for these products from companies that have been accredited under the ISO14000 certification system.

Third Party Review of ANA 2002 Environmental Report

Peter David Pedersen
Chief Executive,
E-Square Inc.

As a person who has been a keen observer of ANA's environmental reports through the last couple of years, I highly value the great improvements seen in this year's edition. So far, I honestly did not see the environmental report to be representative of a corporation which through its business is responsible for considerable amounts of CO_2 emissions. This year, however, many elements have been greatly improved and the overall readability of the report has increased and much practical and useful information has been added.

Major points of evaluation:

* In clear contrast to previous reports, many visual elements, graphs and tables have been included thus making the report vastly more readable. The report has moved a great step toward becoming a communication tool taking the standpoint of the company's stakeholders.
* The report includes detailed information on environmental issues particular to the airlines industry, such as "Noise", "Global Warming", and "Air Pollution." Explanations are clear and well documented with an appropriate use of technical terms.
* The relationship between an airline company and environmental issues is described in a systematic manner and the pro-active stance of ANA is well presented.
* Although it is not a obligatory requirement, the inclusion of data on PRTR (Pollutant Release and Transfer Register) and the inclusion of a third party review shows the pro-active attitude of ANA.
* Overall, the impression received form the report is that ANA is working hard and with dedication on global environmental issues. The report proves that even without colourful and fancy layout, it is quite possible to get an important message through to stakeholders.

Proposal for improvements:

* The goals, action plan and medium term roadmap for ANA is not clear. It is important to be able to show what way ANA is heading in this field.
* The sections about stakeholder communication or community involvement are rather insufficient. There is only a short message concerning environmental communication and a list about social activities. Putting more emphasis on the cooperation with stakeholders, in particular customers, and judging how you can develop an ongoing dialogue on the environment are important points. The use of in-flight magazines would be a form of

environmental communication unique to an airline company.

* As an airline company, ANA is at present not able to avoid the usage of fossil fuels. And, as indicated in the report, further energy saving measures will be hard to realize. Exactly because of this there are two main areas where urgent action is needed and which will hopefully be included in next years material for next year's report.
  (1) Efforts to move beyond petroleum in the airlines industry. What are the global trends? How is ANA involved in this, etc.
  (2) As a corporation using large amounts of important natural capital, one would hope to see detailed descriptions in the report of how ANA is involved in the restoration of natural capital. This would be important for ANA to show the true attitude as A corporate citizen of the world..

From comments received in the questionnaire to our readers

Many comments have been received from individuals and companies on our environmental report for the fiscal year 2000. Thank you for your cooperation.

Comments received	Response by our company
Detailed data are good, but somewhat difficult for general readers.	Figures and photos are increased, and writing is reduced. The glossary of abbreviated words is enriched, and explanation is added.
A little more supplementary explanation is necessary on the technical terms of the aviation industry.	
It would be easier to understand if a few more figures and photos were used.	
It may be good to get third party reviews.	Comments from third parties are now placed.
It is better to specify the scope and period to be covered by the report.	It is now stated expressly that the report covers all the ANA group domestic companies (individual companies) for FY2001.
It is better to explain the relations between the environmental concept and action plan more clearly.	Further studies will be made in reviewing the action plan in the future.
It is desirable to describe environmental management (EMS), education, social contribution, and environmental accounting.	ISO14001, environmental accounting, etc. will be enriched gradually.
I am impressed to know that airline companies are tackling environmental issues squarely and disclosing information.	Thank you. We are encouraged to make further efforts.
Introduction is easy to read, and explanatory diagrams on air transport and environmental issues are good, too.	
Aircraft paint and peeling are common and interesting to other industries, too.	
It is informative to know that fuel is occasionally dumped for safety.	

Abbreviations

ACI Airport Council International
The ACI was established in 1991 and is the international association of the world's airports.

AEA Association of European Airlines
Cooperative body for European airlines (28 Airlines).

AESA Atmospheric Effects of Stratospheric Aircraft Flyer

APU Auxiliary Power Unit
APU ensures an aircraft's energy supply and air conditioning when no infrastructure is available on the ground. Also it provides pressurized air for engine starting.

ASK Available Seat Kilometers
The available number of passenger seats multiplied by the distance flown in kilometers.

ATEC Association of Air Transport Engineering and Research
ATEC is one of the public foundations in aviation society in Japan and was established on September 13, 1989 based upon contributions from major air carriers in Japan namely JAL, ANA and JAS. The foundation is a non-profit organization under the supervision of Civil Aviation Bureau of Japan. Their primary objectives are to contribute to the flight safety and enhancement of any activities toward improvement and/or development in the flight operation and maintenance.

BOD Biochemical Oxygen Demand

CAEP (ICAO)Committee on Aviation Environmental Protection
CAEP is a technical committee responsible directly to the ICAO Council. CAEP is responsible for keeping the Annex 16 Standards.

CFC Chlorofluorocarbons
Certain halogenated hydrocarbons, best known under the trademark Freon. Ozone depletion material and also greenhouse gas.

CH_4 Methane
One of the greenhouse gases. Aircraft NOx Emissions are expected to decrease tropospheric methane concentration.

CNS/ATM Communications, Navigation and Surveillance Systems for Air Traffic Management
Communication: To use Data-link with phonetic communication system for the conveyance of data and messages. To use Satellites instead of Hi-fi for oversea communication.
Navigation: To replace the assisting navigation equipment on ground such as VOR/DME or ILS system with ground navigation satellites system (GNSS).
Surveillance: To replace the oversea phonetic location report system as well as conventional radar function with the Automatic Dependent Surveillance (ADS).
Air Traffic Management: To synchronize the operation of CNS and to reduce some procedures for the management. To provide more appropriate routes for aircraft within the limited space. See FANS.

CO Carbon Monoxide
Toxic and combustible gas formed by incomplete burning of substances containing carbon, e.g. fossil fuels.

CO_2 Carbon Dioxide
Gas resulting in nature from the burning or decomposition of organic masses and the

breathing process of humans and animals. CO_2 is an important greenhouse gas.

COD Chemical Oxygen Demand

COP Conference of the Parties (to the UNFCCC)

DPM Diesel Particles Matter

ECAC European Civil Aviation Conference
A forum for cooperation and coordination between European national authorities in matters related to civil aviation.

EPNdB Effective Perceived Noise Level (dB).
A unit commonly used in an aviation context to express the average perceived noise level.

ETOPS Extended-Range Twin-Engine Operations. Most twin engine airliners are certified so that has to be able to fly normally within an hour of an airfield in the event of an emergency. The ETOPS program allows operators to deviate from this rule under certain conditions. By incorporating specific hardware improvements and establishing specific maintenance and operational procedures, operators can fly extended distances more than 60 min from the alternate airport.

EU European Union

FANS Future Air Navigation System
FANS is the adaptation of modern technology to enhance communication links between aircraft and air traffic controllers, improve a pilot's ability to safely navigate his aircraft and increase an air traffic controller's capability and capacity to monitor and control flights. In the mid-90's, the Future Air Navigation System (FANS) committee defined a plan for Communication Navigation Surveillance (CNS) and Air Traffic Management (ATM) - launching the next generation of en-route and terminal area airspace management concepts. See CNS/ATM.

FCCC (United Nation) Framework Convention on Climate Change
The 1992 United Nations Framework Convention on Climate Change is one of a series of recent agreements through which countries around the world are banding together to meet this challenge.

FIP Federal Implementation Plan

FMS Flight Management System
The Flight Management Computer System (FMCS), in conjunction with other interfacing equipment in the aircraft, forms an integrated, full-flight regime control and information system which provides automatic navigation, guidance, map display, and in-flight performance optimization.

g / KN Gram / Kilo Newtons

GSE Ground Support Equipment

GPS Global Positioning System
The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. GPS uses these satellites as reference points to calculate positions accurate to a matter of meters, with advanced forms of GPS to better than a centimeter.

GPU Ground Power Unit

GWP Global Warming Potential. The GWP is the ratio of the warming caused by a substance to the warming caused by a similar mass of carbon dioxide. Thus, the GWP of CO_2 is defined to be 1.0.

HC Hydrocarbons

Chemical compound of carbon and hydrogen. Unburned Hydrocarbons : Mixture of hydrocarbons that results from incomplete combustion processes.

HCFC Hydrochlorofluorocarbon

A compound consisting of hydrogen, chlorine, fluorine, and carbon.

The HCFCs are one class of chemicals being used to replace the CFCs. They contain chlorine and thus deplete stratospheric ozone, but to a much lesser extent than CFCs.

HFC Hydrofluorocarbon

A compound consisting of hydrogen, fluorine, and carbon. The HFCs are a class of replacements for CFCs. All HFCs have an ozone depletion potential of 0. Some HFCs have high GWPs.

IATA International Air Transport Association

The general organization of international commercial aviation with more than 270 member airlines.

ICAO International Civil Aviation Organization

A specialized agency of the United Nations for international civil aviation.

IPCC Intergovernmental Panel on Climate Change

An expert panel established by UNEP (United Nations Environment Program) and WMO (World Meteorological Organization) to assess the consequences of human-induced climate change.

ISO International Organization for Standardization

LTO Landing/Take Off Cycle

To control pollutants from aircraft in the vicinity of airports, ICAO established emissions measurement procedures and compliance standards for soot, unburned hydrocarbons, carbon monoxide, and oxides of nitrogen. A landing and take-off cycle was defined to characterize the operational conditions of an aircraft engine within the environs of an airport.

Operating mode	Thrust setting	Time in mode(min)
Take-off	100%	0.7
Climb	85%	2.2
Approach	30%	4.0
Taxi / Idle	7%	26.0

MSDS Material Safety Data Sheet

NASA National Aeronautics and Space Administration

NO_2 Nitrogen Dioxides

It forms in the combustion process and is an important air pollution material.

NO_X Oxides of Nitrogen

Chemical compound consisting of one nitrogen and several oxygen atoms. NO_X are generated in combustion processes under high pressures and temperatures. These parameters have been increased in modern engines to reduce fuel consumption, and emissions of CO and HC.

N_2O Nitrous Oxides.

One of the greenhouse gases emissions from aviation.

O_3 Ozone.

Molecule consisting of three oxygen atoms. Close to the ground it is a component of smog. In the stratosphere ozone absorbs ultraviolet light. Nitric oxide emissions from air traffic at cruising altitudes cause an increase in atmospheric ozone.

ODA Official Development Assistance

ODP Ozone Depletion Potential

The ODP is the ratio of the impact on ozone of a chemical compared to the impact of a similar mass of CFC-11. Thus, the ODP of CFC-11 is defined to be 1.0.

PCB Polychlorinated biphenyl

PCBs are mixtures of synthetic organic chemicals. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications. Concern over the toxicity and persistence in the environment and health effects prohibited the manufacture, processing, and distribution in commerce of PCBs

ppm Parts per million

RPK Revenue Passenger Kilometers

The number of revenue passengers multiplied by the distance flown in kilometers.

PRTR Pollutant Release and Transfer Register

R-NAV Area Navigation

Conventional aircraft navigation in airspace is based on the use of ground-based navigation aids (i.e. VOR/DME/NDB) and the resultant ATS route structure is anchored on these point source aids, being totally dependent upon the location of the ground facilities. R-NAV - a method of navigation which allows aircraft to operate on tracks joining any two points, within prescribed accuracy tolerances, without the need for the over flight of specific ground facilities. R-NAV is a method of navigation which permits aircraft operations on any desired flight path within the coverage of station referenced navigation aids or the limits of the capability of self-contained aids, or any combination thereof.

RVSM Reduced Vertical Separation Minimum

The goal of RVSM is to reduce the vertical separation above flight level (FL) 290 from the current 2000-ft minimum to 1000-ft minimum. This will allow aircraft to safely fly more optimum profiles, gain fuel savings and increase airspace capacity.

SO_2 Sulphur Dioxides

Formed in combustion of fossil fuels. A colorless gas with an acid odor that is toxic when inhaled in large quantities. Jet fuel contains a minute proportion of sulfur, accordingly causes only minor emissions of this substance.

SO_X Oxides of Sulphur

SPM Suspended Particle Matter

SST Super Sonic Transport

VOC Volatile Organic Compound

Emitted during incomplete combustion of fossil fuels. In aviation emitted when the engine is run at low speed and the temperature in the combustion chamber is low. Also includes all types of solvents that evaporate from detergents and paints.

WECPNL Weighted Equivalent Continuous Perceived Noise Level.

It is generally referred to as a "high level of aircraft noise" and is units showing the level of aircraft noise per day at one point.The calculations are made considering noise level per aircraft, hours of flying and number of flights. In the Environmental Standard for Aircraft Noise, the level WECPNL 70 or lower is applied to residential areas and WECPNL 75 or lower to non-residential areas where normal living level is to be maintained.

[FY2001 Topics]

The History of Obtaining ISO14001 Certification

ANA has been researching environmental management systems for some years now, and in February 2002 we gained UKAS ISO14001 certification from BVQI (Bureau Veritas Quality International). Narita Maintenance Center (MC), the site which obtained certification, encountered a range of problems, each of which had to be resolved one at a time.

Narita MC has an equipped with large hangar with staff capable of performing maintenance on three B747-400 (Jumbo Jets) simultaneously. It is a plant that supports ANA's 140 international flights per week which arriving from and departing for 20 cities throughout the world. The reason why the Aircraft Maintenance Division was selected was that the whole airplane including engines and other components are handled, so it was deemed to have a significant spin-off effect. However, it was the first in Japan to have such divisions was certified, so we made a great deal of effort for the large number of environmental items (approximately 11,000 items including facilities, tool and equipment , parts, materials and waste), pertaining laws and regulations gaining a clear picture of the state of management, and the barriers of shift work.

The interpretation of legislation and formulation of evaluation criteria, while working with our internal Legal Affairs Department and receiving support from consultants (Japan Management Association Consultants), a great deal of time was spent. The preparation of environmental management manual and regulations which started in parallel, and the understanding by all employees advanced relatively smoothly, thank to ANA's being an airline company that operates according to manuals that correspond to ISO9000 in an effort to ensure safe flights.

Operation started with the completion of manuals in August, and all employees working within the Narita MC underwent basic training. All employees of the Narita MC including the Line maintenance div. which was to be the certification site, together with employees of affiliates that carry out facility management, underwent specific education concerning their respective environmental items and handling of these items.

We also carried out internal audits once monthly, correcting problems in terms of management and manuals, and stimulating improvements in operations. This process was carried out repeatedly to refine the system. The reason why UKAS in UK was chosen was that as a member of the Star Alliance, ANA shares the common goal of obtaining ISO14001 certification, and we were seeking internationally recognized certification, and that all employees had to tackle activities to obtain certification without precedent in the Japanese airline industry. Having passed the surveillance inspection in August this year, continued improvements have been made.

ANA is committed to making the most of this know-how on a company-wide basis. With implementing environmental compliance programs and environmental accounting, we would strength our environmental management further.

(Narita Maintenance Center)

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Summarized information concerning ANA environmental conservation efforts is also available on URL (http://www.ana.co.jp)