

[Translation Purpose Only]

January 31, 2019

Whom it may concern

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Representative: Tadaaki Naito, President

(Stock Code: 9101, First Sections of the Tokyo Stock  
Exchange and the Nagoya Stock Exchange)

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**Our Response to the Administrative Measures for Nippon Cargo Airlines Co., Ltd.**

We take seriously the Administrative Measures for the Business Improvement and the Operations Improvement (hereinafter “Administrative Measures”) issued by the Minister of Land, Infrastructure, Transport and Tourism (hereinafter the “MLITT”), for inappropriate aircraft maintenance operation carried out by Nippon Cargo Airlines Co., Ltd. (hereinafter “NCA”), our consolidated subsidiary company, and hereby report that we have decided on the measures to be taken based on the investigation report of the NCA investigation committee published by NCA today.

**1. Background**

On July 20, 2018, MLITT issued the Administrative Measures to NCA for its inappropriate maintenance operations over a period of several years. On the 27th of the same month, NCA established an investigation committee (hereinafter the “NCA Investigation Committee”) chaired by the president, and conducted an investigation (hereinafter “NCA Investigation”) to clarify the whole picture and investigate the causes.

In order to support and supervise NCA's efforts to improve its business operations appropriately, strengthen its compliance system, and prevent a recurrence, we, along with the external law firm, Nagashima Ohno and Tsunematsu, established a Response Committee chaired by the president of NYK.

## 2. Summary of NCA investigation results

NCA Investigation Committee's report and the NCA news were released on January 31, 2019, for information on the findings of inappropriate maintenance cases, the direct causes, background and factors found through the NCA Investigation, and reoccurrence preventive measures taken by the NCA.

Please refer to these documents shown on NYK website only for translation purpose.

## 3. Our response

### (1) Voluntary Return of Remuneration by Directors and Officers Concerned

The following Directors and Officers will voluntarily return their executive remuneration as below, as they are taking the Administrative Measures seriously and are clarifying the management responsibilities for group governance. Their titles are as of January 31, 2019.

Chairman, Representative Director, Chairman Corporate Officer (formerly Chairman of the NCA Board)

Yasumi Kudo Voluntary Return 30% of Monthly remuneration for 3 months from February 2019

President, Representative Director, President Corporate Officer

Tadaaki Naito Voluntary Return 30% of Monthly remuneration for 2 months from February 2019

Director, Senior Managing Corporate Officer

Eiichi Takahashi Voluntary Return 10% of Monthly remuneration for 1 month from February 2019

Former President & Chief Executive Officer

Fukashi Sakamoto Voluntary Return 50% of Monthly remuneration for 3 months from February 2019

Last year, NCA imposed the following measures on its officers.

#### (a) Salary reduction

President & Chief Executive Officer

Hitoshi Oshika 30% reduction in remuneration (3 months from September 2018)

Senior Executive Managing Director

Keita Sataka 30% reduction in remuneration (3 months from September 2018)

#### (b) Resignation

Senior Vice President in charge of Engineering & Maintenance

Kiyoji Matsuda (at the end of August 2018)

### (2) New chairman of NCA

As of January 31, the position of chairman at NCA will be a full-time position from the present part-time

position, and Naoya Tazawa, our former Representative Director, Executive Vice-President Corporate Officer, has been assigned to the chairman of NCA. We will reorganize our NCA management system to provide stronger support.

(Former) Yasumi Kudo, Chairman of NCA Board (Part-time)

(New) Naoya Tazawa, Chairman of NCA Board (Full-time)

(3) Measures to strengthen the governance of group companies

a) In light of the causes, backgrounds, and other matters, found by the NCA Investigation Committee, the issues NCA is facing are not only maintenance issues, but also those on a company-wide basis related to business operations and organizational structures.

In view of the high level of expertise and special characteristics of air transportation, the department in charge of air transportations business at NYK has managed NCA based on the policy of respecting autonomy of NCA. In the future, we will assign a full-time Chairman of the Board of Directors, and strengthen management by the involvement of NYK Legal, Compliance, and Internal Audit functions.

b) We will strengthen internal controls and group governance as NYK group, assistance from the Governance Group, which was newly established on January 1, 2019. Specifically, we will review company rules related to business and risk management, and clearly share the rules and reporting obligations for business management within our Group. Through these activities, we will strive for the early detection and correction of problems at the workplace, as well as the timely and accurate reporting of on-site information to management, in order to ensure more appropriate management at Group companies.

c) A new Governance Committee will be established to ensure the effectiveness of the activities mentioned in (b) above. The Governance Committee consists of five independent outside officers (three directors and two Audit & Supervisory Board Members) and four internal officers (two directors and two Audit & Supervisory Board Members). As an organization with a high degree of objectivity and independence, the Committee will actively identify and report problems and make recommendations for improvement. This includes supervising and monitoring the progress of NCA's preventive measures.

We will steadily implement these measures to strengthen our group governance.

We sincerely apologize for the inconvenience caused to our customers, shareholders and all other stakeholders.

[Translation Purpose Only]

31 January 2019

To whom it may concern:

Nippon Cargo Airlines Co., Ltd.

Receipt of Internal Investigation Committee's investigation report in response to the Business Improvement Order and the Operations Improvement Order

Nippon Cargo Airlines Co., Ltd. (hereinafter referred to as "NCA") received the Business Improvement Order and the Operations Improvement Order relating to air transport safety (hereinafter collectively the "Business Improvement Orders") from the Minister of Land, Infrastructure, Transport and Tourism on July 20, 2018, and in response NCA established an Investigation Committee (hereinafter referred to as the "Committee") on July 27, 2018, with the participation of Nagashima Ohno & Tsunematsu Law Firm, an external expert, in order to ensure the objectivity of, and secure expertise for, the investigation. The Committee has conducted an investigation to ascertain the entirety of the circumstances and causes.

Today, NCA received an investigation report (hereinafter referred to as the "Report") from the Investigation Committee that focuses on the fact findings of the investigation, root cause analysis, and the recommendations on reoccurrence prevention measures made by the external expert to the Committee. Accordingly, we hereby inform you as follows:

1. Contents of the report

For the details of the report, please refer to the attached document prepared by the Committee for publication. Essentially, the names of the parties concerned have not been identified in the report.

2. Plans for future measures based on the findings of the investigation by the Committee

A summary of the recommendations on reoccurrence prevention measures made by the external expert, who was a member of the Committee, is as follows:

(1) Eliminating the direct causes of the cases of improper maintenance for which Business Improvement Orders were issued

NCA should eliminate the shortage of personnel in the Line Maintenance Department and the lack of business expertise and experience that directly led to Business Improvement Orders, and, in conjunction with facilitating communication, improve compliance awareness including abiding by the manual.

(2) Strengthening management and supervisory functions

NCA should establish a structure and risk management system so as to appropriately glean and improve problems on-site, not only in the Line Maintenance Department but also on a company-wide basis, and foster among employees a sense of belonging to the company and a sense of unity.

(3) Creating a better decision-making process for future business operations

In the course of performing international cargo airline business whose results are heavily influenced by external factors, NCA should carry out sufficient preparation and consideration, including more precise risk analysis, when making management decisions, including major changes in the maintenance system, changes in the number of flights, and the introduction of new types of aircraft.

We will take these recommendations seriously, and apply them to our future management. Among the 42 specific recommendations, we have already implemented the following:

- Reduction of the scale of flight operations in accordance with production capacity in terms of maintenance, and establishment of a flight operation system using only one type of aircraft (B747-8F).
- Balancing the production resources (number of personnel, number of qualified personnel, amount of operating equipment, etc.) of each division appropriately with the scale of operations (including the setting of flight schedules).
- Supplementing the maintenance engineers with expertise and experience in structural maintenance and the back-office staff in the respective areas of expertise, by obtaining personnel support from All Nippon Airways Co., Ltd.
- Increasing the number of new graduates and mid-career hires in the Maintenance Group and increasing the number of employees.
- Enhancing support systems for the Line Maintenance department by stationing the staff in charge of engineering, production control, quality control, and parts and material control.
- Performing company-wide compliance education which is not limited to awareness of abiding by the manuals.

We will also fully consider other recommendations and promptly formulate and implement specific measures to prevent reoccurrences.

Again, we sincerely apologize to the parties concerned for the loss of trust in the air transportation business and the enormous inconvenience caused by Business Improvement Orders. In the future, all executives and employees will strive to comply with laws, regulations, and rules, and to reinforce safety awareness.

END

*[English summary; for general reference only]*

# **Investigation Report**

January 31, 2019

Nippon Cargo Airlines Co., Ltd.  
Investigation Committee

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This document, a summary and translation of the original Japanese version, has been prepared for general reference purposes only. In the event of any discrepancy between the original Japanese version and this document, the former shall prevail.

## **I Background of the Investigation, etc.**

On July 20, 2018, Nippon Cargo Airlines Co., Ltd. (hereinafter referred to as “NCA”) received an order for improvement in operational management and an order for business improvement (hereinafter collectively referred to as the “Improvement Order”) from the Minister of Land, Infrastructure, Transport and Tourism regarding cases in which NCA performed services related to aircraft maintenance without following the Maintenance Manuals or Approved Organization Exposition (hereinafter referred to as “Improper Maintenance”). On July 27, 2018, NCA established the Investigation Committee (hereinafter referred to as the “Investigation Committee”) headed by the President of NCA.

From the same day to January 22, 2019, the Investigation Committee retained Nagashima, Ohno, and Tsunematsu law firm to ensure objectivity of, and secure expertise for, the investigation, and (1) identified the direct causes of Improper Maintenance cases, which were the subject of a serious warning from the Civil Aviation Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (hereinafter referred to as “Civil Aviation Bureau”) on October 5 (hereinafter referred to as the “Serious Warning”), 2016 (hereinafter referred to as “Serious Warning Case”), Improper Maintenance cases that were the subject of the Improvement Order, and Improper Maintenance cases that were newly discovered in the investigation conducted from June 23 to July 5, 2018 (hereinafter referred to as the “Emergency Investigation”), but were not the subject of the Improvement Order (hereinafter referred to as the “Emergency Investigation Cases” and collectively referred to as “Improper Maintenance Cases”); (2) identified the background factors of the Improper Maintenance Cases, such as problems with organizational structure, corporate culture, internal governance problems of NCA, and problems with the status of measures against the Serious Warning Case after receiving the Serious Warning; (3) proposed remedial measures to prevent reoccurrence; and (4) investigated to clarify the facts related to the Improper Maintenance Cases (hereinafter referred to as the “Investigation”) to the extent necessary for the consideration of (1) to (3) above.

In the Investigation, a total of 114 interviews were conducted with 84 current or past executives and employees, and a detailed examination was done of materials related to NCA’s organizational structure, documents related to in-house meetings, materials related to maintenance work, documents related to rules and standards (including rules for maintenance and Operation Standards thereunder), and materials related to Improper Maintenance Cases, among other documents and materials.

## **II Business and organization of NCA**

### **1 NCA Business Overview**

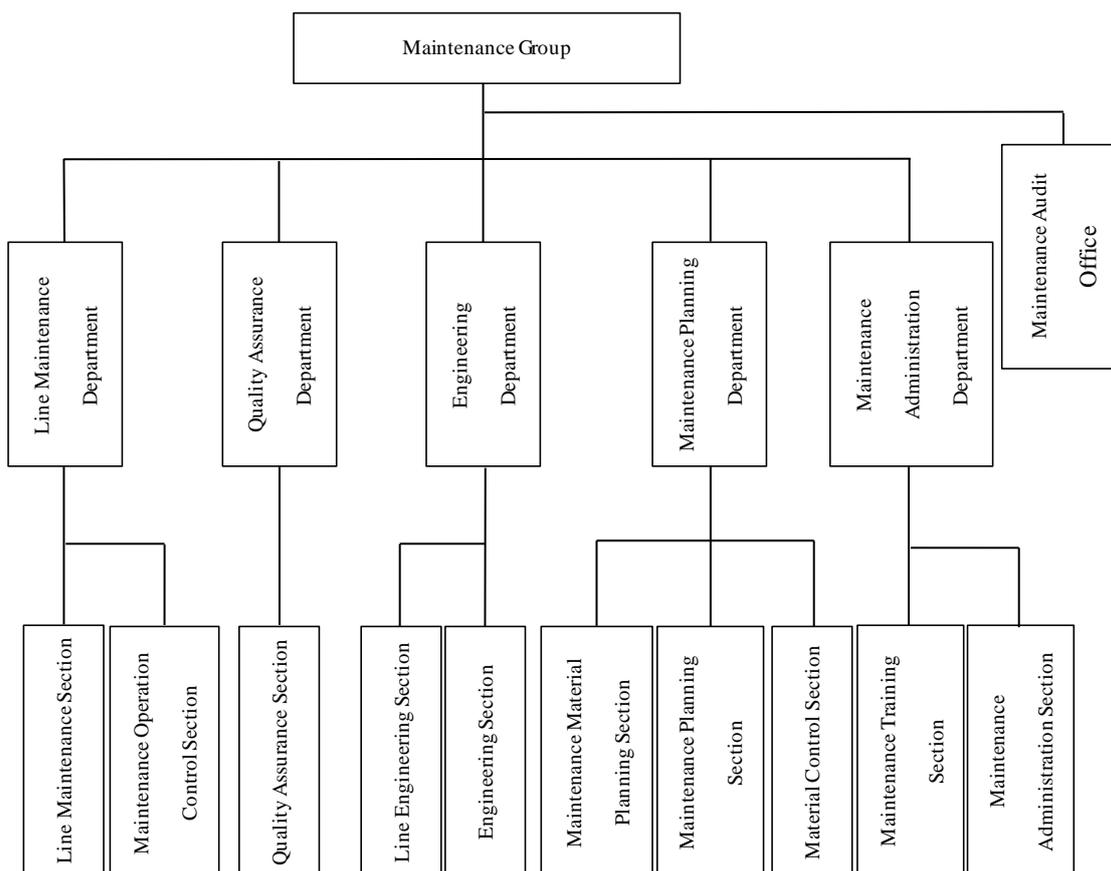
NCA is a joint-stock company established by ALL NIPPON AIRWAYS CO., LTD. (hereinafter referred to as “ANA”) and four shipping companies including Nihon Yusen Kabushiki Kaisha (hereinafter referred to as “NYK”) in September 1978, whose purposes are regular air transport cargo services and irregular air transport cargo services, among other services.

Subsequently, in August 2005, NYK acquired all of ANA’s shares in NCA, making NCA a subsidiary of NYK. Accordingly, NCA decided to carry out the aircraft maintenance work that had previously been entrusted to ANA (hereinafter referred to as “Maintenance Independence”). In July 2007, NCA achieved the Maintenance Independence of its B747-400F aircraft (hereinafter referred to as “B747-400F”). NCA became a wholly-owned subsidiary of NYK in 2011, and in July 2012, it commenced operation of B747-8F aircraft (hereinafter referred to as “B747-8F”) in addition to B747-400F.

### **2 Organization of the Maintenance Group, etc.**

#### **(1) Organizational Structure and Business Description**

NCA is certified as an approved organization for aircraft maintenance and alteration whose main organization is the Narita organization, which has six satellite organizations, including the Kansai organization, the Anchorage organization, and the San Francisco organization (Civil Aeronautics Act, Article 20, para.1, subpara.4). The organizational structure of the Maintenance and Engineering Group (hereinafter referred to as the “Maintenance Group”), the maintenance division of Narita organization, is shown in Fig. 1 below.



**Figure 1 Organization of the Maintenance Group (as of April 1, 2018)**

As of April 1, 2018, the Maintenance Group comprises the Maintenance Audit Office, Maintenance Administration Department, Maintenance Planning Department, Engineering Department, Quality Assurance Department, and Line Maintenance Department. According to the Division of Duties Regulations, the details of the work of each department are summarized below.

**A Maintenance Audit Office**

The Maintenance Audit Office is responsible for audits within the Maintenance Group. The Maintenance Group is a division that constitutes an approved organization, Since the Circular recommends that an internal auditing function be in place in an approved organization, the Maintenance Audit Office was established along with the Safety Internal Audit Office for auditing the safety management system (hereinafter referred to as “SMS”) of the entire NCA.

**B Maintenance Administration Department**

The Maintenance Administration Department carries out activities related to planning and management, personnel allocation, and training for the entire Maintenance Group.

**C Maintenance Planning Department**

The Maintenance Planning Department constructs maintenance production systems, formulates production plans, and manages production, parts, and facilities and equipment. This department is composed of Maintenance Material Planning Section and Material Control Section, as well as Maintenance Planning Section for formulating and implementing maintenance production plans, managing the execution the Circular and performance of outsourcing agreements, and establishing and managing maintenance production systems.

**D Engineering Department**

The Engineering Department issues, modifies, and cancels Bulletins (see (4) below), provides technical support for repairing aircraft defects, and issues technical directives, including Engineering Deviations (hereinafter referred to as “ED”). The department consists of Engineering Sections that revise maintenance standards, formulate policies and plans for technical operations, plan, formulate and publish maintenance implementation methods, obtain and share technical information, and a Line Engineering Section that mainly provides technical support for problems that arise during pre-departure maintenance and periodic maintenance.

**E Quality Assurance Department**

The Quality Assurance Department, composed of the Quality Assurance Section, maintains and manages the approved organization, and its work includes revising the Administrative Regulations, supervising safety management activities, managing the qualifications of maintenance personnel, and negotiating with the Civil Aviation Bureau.

**F Line Maintenance Department**

The Line Maintenance Department is composed of the Line Maintenance Section, which carries out maintenance work, including mainly line maintenance at the Narita Plant of NCA, and MOC (Maintenance Operation Control) Section, which carry out monitoring of the status of maintenance work at the main maintenance bases and stations, and provide technical advice on repairing defects that occurred at the line maintenance contract

bases.<sup>1,2</sup>

## **(2) Position and organization of the Maintenance Group**

In the Maintenance Group, one Maintenance Group Manager is assigned, one Department Manager (*bucho*) or Office Manager (*shitsucho*) is assigned to each department (*bu*) or each office (*shitsu*), and one section leader (*team leader*) is assigned to each section (*team*). In addition, the Line Maintenance Section has been divided into three shifts in total, and a system that enables maintenance work to continue from early morning to late night has been established. One shift manager is assigned to each shift, and each shift manager manages the shift as a head of the shift under each section leader.

## **(3) System for implementation of maintenance work in Line Maintenance Section**

When performing maintenance work, one Maintenance Supervisor is assigned based on the designation of the Line Maintenance Section Leader.<sup>3</sup> The Maintenance Supervisor is responsible for formulating the entire process plan for the maintenance work of its own shift and for managing the progress. Regarding the maintenance work to be implemented, the Maintenance Supervisor designates an Operation Supervisor (i.e., the person responsible for the maintenance work), operators, Certifying Staff, among others, and instructs the maintenance work. The Maintenance Supervisor designates line controllers that assign the maintenance work to operators and support the Maintenance Supervisor.

The Operation Supervisor is responsible for formulating a work plan, managing and supervising operators, performing maintenance work, and reporting the work to the Maintenance Supervisor and Certifying Staff. The Certifying Staff is responsible for confirming that the aircraft maintenance work plans, processes, and current conditions implemented mainly by the respective Operation Supervisor comply with the standards set forth in the Civil Aeronautics Act.<sup>4,5</sup>

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<sup>1</sup> The term "line maintenance" refers to performing maintenance work such as visual inspection of aircraft, visual inspection of the system, functional inspection, and lubrication work, which do not require the removal of special fixed panels, among regular maintenance (maintenance performed according to flight hours, etc.). Conversely, the term "base maintenance" refers to performing maintenance work, such as visual inspection of the aircraft, visual inspection of the main structural members, functional inspection, and lubrication work, which require removal of fixed panels, as well as visual inspection of the aircraft with special access, detailed visual inspection of the airframe structure, and non-destructive inspection according to the frequency of work.

<sup>2</sup> "Stations" shall mean satellite workplaces and line maintenance bases.

<sup>3</sup> In many cases, shift managers serve as Maintenance Supervisors.

<sup>4</sup> The term "Certifying Staff" as used herein refers to the Certifying Staff of the Maintenance and Modification Approval.

<sup>5</sup> An Operation Supervisor can serve as a Certifying Staff for operations requiring verification.

#### **(4) Maintenance Manuals and Approved Organization Exposition**

The Maintenance Manuals and Approved Organization Exposition of NCA stipulate that (1) manuals prepared by airframe manufacturers, such as AMM (Aircraft Maintenance Manual: Aircraft Maintenance Manual), SRM (Structural Repair Manual: Structural Repair Manual), and IPC (Illustrated Parts Catalog: Part Catalogue) pertaining to the B747-400F and B747-8F operated by NCA (hereinafter referred to as the "Manual"), and (2) airframe Operation Standards Bulletin and other Maintenance Manual Bulletin (hereinafter referred to as the "Bulletin"), which are issued in the Engineering Department and function to supplement the Manual (hereinafter referred to as the "Operation Standards") must be fixed as maintenance work in accordance with the Manual.

### **III Facts revealed in connection with the Improper Maintenance**

An outline of the fact-findings regarding the Improper Maintenance found under the Investigation, and the causes and background that led to the occurrence of the Improper Maintenance are below.<sup>6</sup>

#### **1 Serious Warning Case**

##### **(1) Summary of Events**

On February 26, 2016, regarding the replacement work of the OBV (a type of valve) of the engine of JA18KZ (B747-8F), the maintenance engineers (i) intentionally removed the OBV in a manner not specified in the manual to be strictly observed, and (ii) intentionally did not repair the bolt, although it was broken mistakenly in the course of the work, and let the aircraft be used for flight operation in violation of the manual.

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<sup>6</sup> The case described in 1-1(1) of Improvement Order is hereinafter referred to as "Case (1)"; the case described in 1-1(2) of Improvement Order is hereinafter referred to as "Case (2)"; the case described in 1-1(3) of Improvement Order is hereinafter referred to as "Case (3)"; the case described in 1-1(4) of Improvement Order is hereinafter referred to as "Case (4)"; the case described in 1-1(5) of Improvement Order is hereinafter referred to as "Case (5)"; the case described in 1-1(6) of Improvement Order is hereinafter referred to as "Case (6)"; the case described in 1-1(7) of Improvement Order is hereinafter referred to as "Case (7)"; the case described in 1-1(8)A is hereinafter referred to as "Case (8) A"; the case described in 1-1(8)B of Improvement Order is hereinafter referred to as "Case (8) B"; and the case described in 1-1(8)C of Improvement Order is hereinafter referred to as "Case (8) C."

**(2) Causes and background**

**A Causes and background of removal of OBV in a manner not specified in the manual**

- Inadequacy of the manual
- Mistrust and resignation of the maintenance engineers toward the Engineering Department
- Prioritizing one's own judgment based on own experience over Operation Standards

**B Causes and background of letting the aircraft be used for flight operation without repairing the bolt**

- Concept of overemphasizing skills and concealing failures
- Excessive authority gradient
- The checks and supervision functions within the Line Maintenance Department were vulnerable, and the maintenance engineers also had a sense of mistrust and resignation toward the administration.
- Prioritizing one's own judgment based on own expertise and experience over Operation Standards

**C Causes and background of the fact that the Line Maintenance Section Leader did not confirm the facts about the safety problem of the aircraft and did not report this problem to the Line Maintenance Department Manager**

- Busy working conditions
- Insufficient awareness of safe flight operation of aircraft in compliance with Operation Standards

**2 Case (1)**

**(1) Summary of Events**

(i) On January 22, 2017, regarding the inspection of the dent damage of the aircraft that was carried out because JA11KZ (B747-8F) suffered a bird strike, the maintenance engineer forgot to measure the distance between the position of the dent damage and the structural parts, and let the aircraft be used for flight operation mistakenly in violation of the manual. In addition, (ii) when repairs were made on March 20 of the same year, the Engineering Department mistakenly treated the repairs as "Minor Repairs," although the repairs were

originally required to be processed as “Major Repairs.”

**(2) Causes and background**

**A Causes and background of letting the aircraft used for flight operation in violation of the manual**

- Lack of expertise and experience in structure maintenance of maintenance engineers
- Weakness of the Engineering Section’s support function

**B Causes and background of treating the repairs as “Minor Repair”**

- Lack of awareness of fulfilling responsibilities in compliance with regulations
- Shortage of Engineering Department Staff with expertise and experience in structure maintenance

**3 Case (2)**

**(1) Summary of Events**

(i) On April 12, 2017, a maintenance engineer at Kansai International Airport intended to defer (carry over) permanent measures (fundamental measures against damage, etc.) verbally to Narita International Airport in connection with maintenance work carried out in response to a lightning strike to JA08KZ (B747-400F). However, the maintenance engineers at Narita International Airport misunderstood that the permanent measures had been completed and that they mistakenly violated the manuals and let the aircraft be used for flight operations, coupled with insufficient maintenance records by maintenance engineers at Kansai International Airport and insufficient checks by maintenance engineers at Narita International Airport. In addition, (ii) between April 18 and May 1, 2018, during the process of checking the accuracy of the maintenance records, representatives of the Quality Assurance Section made several deliberate modifications to the maintenance records regarding the implementation of the above permanent measures and concealed items that should have been reported to Civil Aviation Bureau.

## **(2) Causes and background**

### **A Causes and background of continuing flight operation without taking permanent measures to the Aircraft**

- Lack of specific and clear rules on the content of maintenance records
- Lack of communication between departments
- Carelessness in prioritizing one's own judgment over accuracy of work
- Shortage of personnel and excessive work

### **B Causes and background of post-hoc maintenance records corrections**

- Environments that make it easier to modify maintenance records
- Lack of awareness of compliance with regulations
- Lack of checks and supervision by the Quality Assurance Section

## **4 Case (3)**

### **(1) Summary of Events**

On January 21, 2018, a maintenance engineer discovered dent damage during maintenance A (periodic maintenance performed every 1,000 flight hours) on JA08KZ (B747-400). However, the maintenance engineer let the aircraft be used for flight operation without checking for damage to structural members, which should be proactively checked in light of compliance with manuals.

### **(2) Causes and background**

- SRM uncertainty
- Shortage of maintenance engineers
- Lack of expertise and experience in structure maintenance of maintenance engineers

## **5 Case (4)**

### **(1) Summary of Events**

On March 27, 2018, in pre-departure maintenance of JA13KZ (B747-8F), a maintenance engineer discovered dent damage, but (i) overlooked the damage to structural members and

mistakenly violated the manual and let the aircraft be used for flight operation. In addition, (ii) as a result of the Line Maintenance Department Manager forgetting to report the event to the Quality Assurance Section, reports of the event from NCA to Civil Aviation Bureau or the Minister of Land, Infrastructure, Transport and Tourism were delayed.

**(2) Causes and background**

**A Causes and background of the maintenance engineer's failure to perform enough checks to detect stringer damage**

- Lack of expertise and experience in structure maintenance of maintenance engineers
- One's own judgment based on overconfidence in one's own experience

**B Causes and background of the delay in sharing the accident with the Quality Assurance Section**

- Inadequacy of regulations
- Excessive work
- Lack of awareness of information sharing

**6 Case (5)**

**(1) Summary of Events**

On September 4, 2017, in the external inspection of JA11KZ (B747-8F), a maintenance engineer discovered dent damage, however, due to the maintenance engineer mistakenly measuring the distances between the damaged and structural parts, the maintenance engineer accidentally violated the manuals and let the aircraft be used for flight operations.

**(2) Causes and background**

- Lack of clarity of SRM
- One's own judgment based on overconfidence in one's own experience
- Vulnerability of checks and supervision functions within the Line Maintenance Section
- Lack of expertise and experience in structure maintenance of maintenance engineers

## **7 Case (6)**

### **(1) Summary of Events**

Regarding three repair works conducted from around August 2013 through around February 2015, the Engineering Department incorrectly treated all of them as “Minor Repairs” (i.e., having issued EDs classifying such works as “Minor Repairs”), when they should have been treated as “Major Repairs” for reasons such as the rules for repair classification (i.e., the Major Repair Criteria), including unreasonable provisions, had not been properly revised and had been miss-construed.

### **(2) Causes and Backgrounds**

- Engineering Section’s failure to properly revise the Major Repair Criteria
- Attitude of prioritizing one’s own judgment based on one’s own experience over given manuals
- Engineering Section members’ lack of awareness to responsibly perform their duties

## **8 Case (7)**

### **(1) Summary of Event**

On April 3, 2017, an oil leakage was discovered in the outer transmission (a flap-actuator) on the left main wing of JA14KZ (B747-8F), and the amount of replenished oil was measured. The measurement revealed an amount of oil that actually required a follow-up examination; however, a maintenance engineer intentionally entered false amounts in the maintenance records and data sheets several times. The person in charge on the Engineering Section also acquiesced to the false entries.

### **(2) Causes and Backgrounds**

- Attitude of prioritizing one’s own judgement based on one’s experience over the Operation Standards
- Shortage of maintenance engineers, etc.
- Excessive authority gradient and maintenance engineers’ distrust toward supervisory functions

- Weak monitoring functions of Engineering Section
- Insufficient rules and system environment to prevent falsification of the maintenance records

## **9 Case (8)**

### **(1) Case (8) A**

#### **A Summary of Event**

In around 2016, an inspection was conducted on tire air pressure of JA18KZ (B747-8F), which revealed that a value required re-inspection after 24 hours; however, a maintenance engineer intentionally entered a false value in the maintenance records, violating the manual, in order to avoid the re-inspection being done.

#### **B Causes and Backgrounds**

- Maintenance manpower shortage
- Excessive authority gradient
- Attitude of prioritizing one's own judgment over the Operation Standards
- Maintenance engineers' distrust and resignation toward the Engineering Section

### **(2) Case (8) B**

#### **A Summary of Event**

Regarding a replacement of a logo light (a light to illuminate the log on the vertical tail of the airframe) of JA14KZ (B747-8F) on May 8, 2018, a maintenance engineer intentionally failed to measure the resistance value by using a milliohm meter (a measuring instrument to measure resistance values), violating the manual.

#### **B Causes and backgrounds**

- Time constraints
- Shortage of maintenance engineers with driver's license for large-sized motor vehicles
- Attitude of prioritizing one's own judgement based on one's experience over the Operation Standards
- No-requirement to enter resistance values in the maintenance records

**(3) Case (8) C**

**A Summary of Event**

On June 17, 2017, a maintenance engineer who lacked the in-house qualification as a G2-Certified Engineer (an engineer with expert knowledge and skills in maintenance corresponding to accredited tasks for certain types of aircraft) solely carried out a task required to be conducted by a G2-Certified Engineer.

**B Causes and backgrounds**

- Unclear rules in relation to guidance to be provided by certified engineers
- Shortage of maintenance engineers who provide guidance

**10 Cases detected through Emergency Investigation**

**(1) Summary of Events**

In the Emergency Investigation, the following cases were reported:

- (i) non-use and/or substitution of equipment, parts, materials, etc., stipulated under the Operation Standards;
- (ii) omission and/or substitution of tasks stipulated under the Operation Standards;
- (iii) preparation of inaccurate maintenance records and failure to prepare necessary maintenance records;
- (iv) implementation of maintenance tasks by persons without necessary maintenance certification;
- (v) commencing tasks prior to issuance of instructions; and
- (vi) inadvertent violations of the Operation Standards.

**(2) Causes and backgrounds**

As described in (1) above, the types of conduct reported in the Emergency Investigation are wide-ranging; however, among these, the following could be considered as causes and backgrounds, etc., common to this conduct:

- (i) diminished or a lack of awareness of compliance with rules including Operation Standards;
- (ii) unclear positioning and provision of rules including the Operation Standards, and inconsistency of such rules with the actual operation of maintenance; and

- (iii) excessive workload, manpower shortage and time pressure in the Line Maintenance Section.

## **IV Cause Analysis of Improper Maintenance Cases**

### **1 General**

Based on the consideration of the causes of each case mentioned in section 3 above, the direct causes of the Improper Maintenance Cases were (1) lack of expertise and experience concerning structure maintenance, (2) lack of personnel, (3) miscommunication, (4) unsatisfactory manuals, (5) insufficient awareness of compliance with manuals, (6) inadequacy of maintenance records systems and maintenance records rules, and (7) employees' dulled awareness of compliance (in a broad sense). All of these problems are those of the Maintenance Group, including the Engineering Department and other back-office departments that support the Line Maintenance Section, as well as problems related to systems and rules related to maintenance.

On the other hand, it can be pointed out that the root causes of the Improper Maintenance Cases were (i) that the management and supervision in the Maintenance and Engineering Group were not sufficiently functioning and the problems on the site were not addressed, (ii) that there were no institutional procedures to proactively grasp the problems on the site other than the management review process based on the Safety Management Manual, and (iii) that, in the investigation of the Serious Warning Case, the root causes were not sufficiently and deeply analyzed, thus the management team was unable to adequately grasp the problems related to the maintenance site and has not adequately addressed them. Furthermore, looking back at the background of the above-mentioned problems in the maintenance site of NCA, in the first place, (iv) the preparation for and consideration of the Maintenance Independence and the introduction of B747-8F were insufficient, and the risks that the maintenance department were likely to face in the future were not adequately grasped.

### **2 Direct Causes**

#### **(1) Lack of expertise and experiences in structure maintenance**

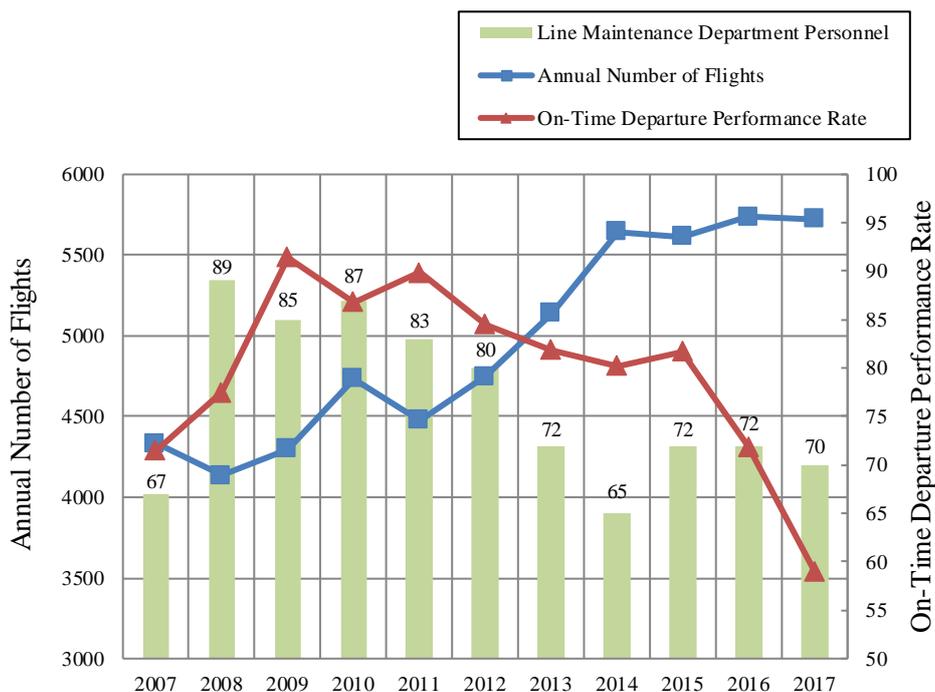
The lack of expertise and experience concerning structure maintenance was one of the causes of the failure of maintenance engineers and Engineering Department staff to act

improperly due to carelessness.

The backgrounds for this can be pointed out as follows: (1) the difficulty of developing expertise and experience concerning structure maintenance in the course of day-to-day work because of the NCA's maintenance system that was developed only for pre-departure maintenance and line maintenance; (2) the lack of educational and training opportunities for structure maintenance to address such difficulty; and (3) the lack of support from the Engineering Department as it itself lacked the manpower, expertise and experience in structure maintenance (particularly before the Line Engineering Section was established in April 2017).

## **(2) Lack of personnel**

Since around 2013 and 2014, the number of maintenance engineers in NCA has been shorted both qualitatively and quantitatively, meanwhile the number of flights has increased. As a result, it is believed that NCA has fallen into a situation where it is impossible to anticipate the maintenance and growth of its medium-to long-term organization (hereinafter referred to as the "Lack of Organizational Personnel"), because it has no capacity other than to carry out its daily maintenance work. Moreover, as the number of flights continued to increase every year since then, the number of maintenance personnel did not continue to increase. In addition, the number of aircraft defects became more frequent than expected. Therefore, it is probable that between 2015 and 2016, the daily maintenance work itself had to be carried out with insufficient personnel (hereinafter the problem of the lack of personnel in the narrow sense of a situation in which the maintenance work had to be carried out in order to sustain scheduled flight operations while the number of personnel was insufficient in light of the original size is simply referred to as the "Lack of Personnel"). The decline in on-time departure performance rate after 2015 may have been affected by the Lack of Personnel at the maintenance site (Fig. 2). The problem of the Lack of Personnel is considered to have been a major cause of both cases of violations due to negligence and cases of intentional violation.



**Figure 2 Trends in the Annual Number of Flights, On-Time Performance Departure Rate and Line Maintenance Department Personnel (Fiscal 2007-2017)**

The background for this (qualitative and quantitative) Lack of Personnel can be pointed out as follows: (1) the employment of maintenance engineers was curtailed through personnel cost reduction measures after 2009; (2) the number of maintenance engineers who retired increased because of personnel system changes from FY2014 and the rise of LCC (Low-Cost Carriers); (3) sufficient education and training opportunities were not provided to maintenance engineers due to the Lack of Organizational Personnel; (4) maintenance and production capacity may not have been accurately grasped in the process of scheduling flight plans (in the annual maintenance and production plan, on which the personnel plan considered by the NCA management team was based, the number of personnel in the Maintenance Department has been indicated as sufficient, although it might not have been, and the calculation methods thereof may not have accurately reflected the situation in the maintenance site); and (5) there are frequent defects in equipment and materials related to the B747-8F.

### **(3) Miscommunication**

For some Improper Maintenance Cases, there was not only (1) the problem of the inadequacy of communication but also (2) the problem that there was no communication where there should have been communication. This problem mainly caused violation due to negligence. However, there were also cases of intentional violations, which were caused in part by the failure of maintenance engineers who received inappropriate instructions from their superiors to escalate them to the section leader.

The background for this can be pointed out as follows: (1) communication rules were unclear (including discrepancies between regulations and practices); (2) communication was hampered due to excessive authority gradient in the Line Maintenance Section; (3) daily communication between the Line Maintenance Section and other departments was deficient (including the problem that the back-office departments lacked awareness of supporting the site).

### **(4) Unsatisfactory manual**

In NCA, it became clear that, where there were any defects in the manuals, the Engineering Department could not respond quickly, for example by contacting the airplane manufacturer and issuing a Bulletin; consequently, many items in the manuals were not clear or consistent with the actual circumstances. Such defects in the manuals may have been one of the causes, both in relation to the case of intentional violations and in relation to the case of negligence. In addition, the fact that the defects in the manuals were not corrected is considered to have caused the maintenance engineers to give up on revising of the manuals (the meaning of the correction by the Bulletin issued by the Engineering Department and the revision by the airplane manufacturer that received the correction; the same shall apply hereinafter), which led to an insufficient awareness of compliance with the manuals.<sup>7</sup>

The backgrounds for this can be pointed out as follows: (1) the Engineering Section was unable to revise the defective manual due to reasons such as its Lack of Personnel and inadequate skills (particularly before the establishment of the Line Engineering Section); and (2) the Engineering Section was not adequately staffed on the introduction of the B747-8F, which was a new aircraft and which may require a particularly high degree of manual revision.

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<sup>7</sup> The NCA Major Repair Criteria are set forth in the Detailed Regulations for Work and differ from the AMM and SRM produced by the airplane manufacturer. Therefore, they do not strictly fall under the category of "Manuals." However, the defects in the contents of such Criteria are considered to be common to the defects in the Manuals, such as AMM and SRM. Therefore, in this section, such Criteria will be discussed in the same way as the Manuals.

**(5) Insufficient awareness of compliance with manuals**

Some veteran maintenance engineers tend to place more emphasis on their own experience and intuition than on the contents of the manuals, and such lack of adequate awareness of compliance with manuals among maintenance engineers is considered to have been one of the most important direct causes, especially in relation to intentional violations.<sup>8</sup>

The background for this can be pointed out as follows: (1) among maintenance engineers, there was a deep-rooted misperception of craftsmen that “the maintenance engineer who could devise the same maintenance results in a simpler manner than the procedures described in the manual is the best maintenance engineer”; (2) there were defects in the manuals that were not being corrected and the Engineering Department did not provide enough support to the maintenance engineers; and (3) before the Serious Warning Case was discovered, there was no clear message from the management team that the manuals should be thoroughly complied with even at the expense of scheduled flight operations, and that, even after the Serious Warning Case was discovered, the management team did not sufficiently communicate the message that “compliance” with the manuals had the extremely strict meaning that free interpretation of the manuals by maintenance engineers would not be tolerated (i.e., a zero tolerance compliance method).<sup>9</sup>

**(6) Inadequate maintenance records systems and maintenance records rules**

An environment in which ex-post corrections to maintenance records can be easily made, and the absence of clear rules for corrections and additions to maintenance records, were also considered to have contributed to cases of intentional violations, such as maintenance records falsification cases, and cases of violations due to negligence resulting from communication concerning maintenance records.

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<sup>8</sup> In this investigation, some Improper Maintenance Cases that occurred due to insufficient awareness of compliance with regulations such as Administrative Regulations and Approved Organization Exposition were found. Although these are not “Manuals” such as AMM and SRM, awareness of compliance with such regulations is a common issue with the awareness of compliance with manuals. Therefore, when referring to “awareness of compliance with manuals” in this investigation report, it is deemed to include “awareness of compliance with regulations such as Administrative Regulations and Approved Organization Exposition.”

<sup>9</sup> In this investigation, many of the maintenance engineers who have worked for major airlines stated that maintenance engineers in the major airlines also had this awareness 20 to 30 years ago.

**(7) Dulled awareness of compliance**

In NCA, problems such as falsification of maintenance records, concealment of maintenance mistakes, and failures to report the findings of internal investigations to the Civil Aviation Bureau were found. The employees involved in these problematic activities have issues that are not limited to an insufficient awareness of compliance with the manuals mentioned in (5) above, but also include a dulled awareness of compliance in broad sense, and those were also considered to have been a cause of these problematic activities.

**3 Background factors**

In NCA, the organization of the Maintenance Group was established in accordance with aviation laws and regulations. The Line Maintenance Department Manager and Line Maintenance Section Leader took the lead in managing and supervising on-site maintenance engineers, and the internal control system was established so that, in the event any problem at the maintenance site should arise, such problem would be reported through the organization to the management team. In addition, as described in (2) below, a management review mechanism was separately established, and periodic checks on the effectiveness of SMS were also carried out. However, despite the establishment of these systems, the problems mentioned in 2(1) to (7) above, which were the direct causes of the Improper Maintenance Cases mentioned in the third above, existed in NCA and remained unfixed. It can be pointed out that the background of the above was that the management team could not sufficiently understand the problems related to maintenance due to the reasons mentioned in (1) to (3) below and could not attempt to improve them. It can also be pointed out that the background to the problems mentioned in 2(1) to (7) above at the NCA maintenance site could have been that the management was unable to take measures to prevent the occurrence of these problems for the reasons mentioned in (4) below.

**(1) The management and supervision systems within the Maintenance Group were not functioning sufficiently, and the problems faced at the site were not grasped.**

Part of the direct causes of the Improper Maintenance Cases and the underlying problems, such as lack of knowledge and experience on structure maintenance, shortage of organizational personnel, inadequate manuals, and communication issues, had been recognized by field maintenance engineers before September 2016, when the Serious Warning Case was discovered. However, as shown below, the management/supervisory system within the Maintenance Group was not functioning properly, and the information was

not gathered. Until the Serious Warning Case was discovered in September 2016 and the causes were discussed in subsequent analyses of the causes, these problems were not clearly reported to the management team, and the management team was not fully aware that these problems were inherent in NCA.

**A Insufficient management and supervision within the Line Maintenance Section.**

Until the Serious Warning Case was discovered, even the Line Maintenance Section Leader was unable to grasp problems such as excessive authority gradient and the insufficient awareness of compliance with the manuals. As a reason for the above-mentioned issue, it can be pointed out that the Line Maintenance Section was an organizational structure in which as many as 80 maintenance engineers were placed under the supervision of one section leader, and that it was difficult for the section leader to fulfill his/her responsibility as a manager for each maintenance engineer. In addition, although a shift manager (20 to 30 people per manager are supervised) was appointed to assist the section leader, the shift manager had to participate in on-site maintenance work that would not otherwise be carried out by him/her due to the problem of the Lack of Organizational Personnel, which made it impossible for the section leader to carry out his/her duties sufficiently as a manager.

Therefore, for these reasons, the Line Maintenance Section system in which the Line Maintenance Section Leader manages and supervises the maintenance engineers through the shift managers was not functioning sufficiently, and it is considered that the Line Maintenance Section Leader was unable to grasp the problems at the maintenance site.

**B The Maintenance Group did not have a reporting route other than reporting through the organization.**

Lack of knowledge and experience on structure maintenance, shortage of organizational personnel, inadequate manuals, and inability of the Engineering Section to respond to the problem of manuals have been recognized for some time by and among the Line Maintenance Department Manager and Line Maintenance Section Leader since FY2014 at the latest. However, within the Line Maintenance Department, these were not considered to be issues that could be solved immediately, so problems were not raised. Rather, discussions were held on how to maintain the scale of maintenance production with a limited number of people, and problems were not raised with management (although the Maintenance Group Manager was aware of some of these problems, he was not aware of their significance).

Be the above as it may, the management team could have grasped these problems if

there were a means of communicating the problems that had been faced at the maintenance site to the management team, in addition to reporting through the organization; i.e., through the Line Maintenance Section Leader, Line Maintenance Department Manager, and Maintenance Group Manager. Therefore, the absence of such a mechanism at NCA was one of the factors that lead the management team not to be able to grasp these problems.

- (2) In addition to management reviews under Safety Management Manual, there were no institutional procedures to grasp (proactively) the problems at the maintenance site.**

Even if the normal organizational reporting line did not function adequately and problems were not reported from the front line, the NCA management may have been able to recognize these problems if there had been a process in place for the management team to proactively identify the risks faced by each department of the company and to confirm with each department how those risks were controlled.

As one of the internal control systems under the Company Law, NCA conducts management reviews as regards the identification of risks faced by each department of the Company once a year at the Safety Promotion Committee in accordance with the Safety Management Manual. However, this management review was conducted mainly to confirm the validity of SMS as an airline company, and it was not an analysis primarily intended to identify business risks and organizational structure problems that do not immediately lead to safety problems.

In addition to this management review procedure, NCA did not have any institutional procedures to proactively and effectively grasp on-site problems from the perspective of risk management, which may have contributed to management's lack of awareness of these issues.

- (3) The root causes of these problems could not be pinned down in the course of the Serious Warning Case response.**

When the Serious Warning Case was discovered in September 2016, NCA immediately reported it to the Civil Aviation Bureau and subsequently investigated the facts related to the event. As a result of the investigation, NCA considered that the causes of the Serious Warning Case were problems such as an organizational climate with poor openness, excessive authority gradient within the Line Maintenance Section, and a culture of

insufficient adherence to manuals, and based on this understanding, the company formulated and introduced measures to prevent reoccurrence. Among these measures, there were measures that led to the improvement of awareness among maintenance engineers, the gathering of opinions from the maintenance site, and the improvement of the support system by the Engineering Section. It is probable that these measures contributed to the improvement of the problems faced at the maintenance site to a certain extent. NCA frequently held meetings of the Safety Promotion Committee to analyze factors related to the Serious Warning Case and confirm the progress of measures taken to prevent reoccurrence. The status of such analyses and measures was also regularly reported at the meetings of the Board of Directors and the Committee of Directors. In addition, NCA regularly reported to the Civil Aviation Bureau on the progress of measures to prevent reoccurrence, and received regular or temporary safety audits by the Civil Aviation Bureau. In addition to measures to prevent reoccurrence related to Serious Warning Case, NCA has been implementing measures since FY2017, such as a reduction in the number of its aircraft (from 13 to 11), and asking for support from ANA, and has been actively engaged in activities to mitigate the burden on maintenance sites. In this way, it can be said that NCA has responded sufficiently to the facts discovered through the above-mentioned investigation and the causes identified, while receiving guidance from the Civil Aviation Bureau throughout the long period during which NCA has taken responsive measures to the Serious Warning Case.<sup>10</sup>

However, in the investigation of the Serious Warning Case conducted by NCA, such problems as the shortage of personnel (including the shortage of organizational personnel) and the inadequacy of manuals could not be detected primarily because special consideration was given to the characteristics of the case and the problems of excessive authority gradient. Therefore, the preventive measures that should be effective in resolving these problems were not sufficiently examined and implemented. In addition, regarding the insufficient awareness of compliance with manuals, even though the investigation has revealed through interviews with maintenance engineers that there was a culture of insufficient adherence to manuals in the Line Maintenance Section, it was not possible to pin down the root causes (background) of the existence of such problems. As a result, most of the contents of preventive measures remained direct, and measures were not implemented to eliminate the root causes.

The reason why NCA was unable to conduct in-depth causal analyses in the investigation

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<sup>10</sup> The Managing Director Conference of NCA is composed of all full-time directors and executive officers. It discusses matters to be resolved by the Board of Directors in advance, decides on a presentation to the Board of Directors, receives reports on the status of the execution of operations of each department, and supervises them. In addition, certain important matters not required to be presented to the Board of Directors are deliberated and decided by the Managing Director Conference. In view of the fact that the information of the entire company of NCA is aggregated and important matters, including the matters to be resolved by the Board of Directors, are discussed, Managing Director Conference is in effect the central body of NCA's management.

of the Serious Warning Case is that, because the Serious Warning Case had an element of power harassment, the protection of those covered by the investigation was emphasized, the investigation was entrusted mainly to a limited number of members of the Maintenance Group from the viewpoint of confidentiality of information, and the investigation was conducted as that of an isolated case of violations of compliance. Therefore, the depth of the investigation was insufficient, and it could not detect fundamental problems that the maintenance site and the company itself faced. Since Serious Warning Case was a serious event that received written Serious Warning from the Civil Aviation Bureau, it may have been an option that investigation, analysis of the causes and consideration of measures to prevent reoccurrence not be entrusted to a limited number of members of the Maintenance Group. Even after the investigation, the company could have done continuous probing, including probing whether any serious causes had been overlooked, with the assistance of outside experts, but such efforts were insufficiently implemented.

**(4) The preparations and studies for the Maintenance Independence and the introduction of B747-8F may have been insufficient.**

From among the problems such as lack of knowledge/experience on structure maintenance, frequent occurrence of B747-8F equipment defects, insufficient support of the Engineering Department, and inadequate manuals, which were revealed as a result of the investigation, many of them could be considered to have arisen due to inadequate preparations and considerations in the Maintenance Independence of 2007, in the decision to introduce B747-8F in 2005, and in preparations for its introduction afterwards. However, as shown in (a) and (b) below, NCA may not have been sufficiently prepared or conducted investigations in making such decisions that had a serious impact on the maintenance site. Accordingly, the risk that the maintenance site may have faced in the future as a result of any decision taken may not have been adequately ascertained, which may have contributed to the occurrence of the above-mentioned problems.

**A Maintenance Independence**

Originally, NCA was jointly established by four shipping companies, including NYK, and ANA, but in August 2005, NYK acquired the shares in NCA held by ANA and made NCA a subsidiary. Prior to this, in July of the same year, the NCA Commission on the way Forward was established within NCA as an organization for “formulating and implementing various measures for achieving self-reliance and formulating corporate visions after becoming self-reliant,” and the committee began its study toward the

Maintenance Independence. In July 2007, the Maintenance Independence with regard to B747-400F was achieved. However, as far as the minutes of meetings of the Board of Directors and the Committee of Directors from 2005 to 2006 were scrutinized, during which period Maintenance Independence was internally studied, it is impossible to infer that substantive discussions took place on the risks associated with Maintenance Independence and the workload that was expected in order to appropriately deal with them, and the management of NCA at that time may not have sufficiently examined the risks that the maintenance site could face if the Maintenance Independence was implemented.

## **B Introduction of B747-8F**

In November 2005, NCA signed a contract with Boeing to purchase B747-8F as a launching customer. Since July 2012, when NCA received delivery of the first B747-8F aircraft, NCA has introduced a total of eight aircraft.

However, as far as the minutes of the meetings of the Board of Directors and the Committee of Directors were scrutinized during the period from FY2003 to FY2005, when the B747-8F purchase contract was being considered, and during the period from when the decision was made to introduce the Aircraft to July 2012, when the B747-8F aircraft was actually received, there was no sign of substantial discussions on the risks of introducing a new B747-8F as a launch customer, and the management of NCA at that time may not have sufficiently considered the risks that the maintenance site may have faced if the B747-8F were to be introduced as a launch customer, before the decision was made, or even after that.<sup>11</sup>

If the above assumption is correct, while it is unclear at present why the introduction of the B747-8F was decided without consideration of such serious risks and why the maintenance system was not sufficiently examined during the period until the receipt of the B747-8F, it is possible that the management team may not have noticed such risks because the management members, who had been dispatched by ANA and had extensive knowledge of management of the airline, left NCA in August 2005 and thereafter as a result of the dissolution of the capital relationship with ANA. Be that as it may, now that the introduction of B747-8F requires a significant amount of capital investment for NCA, it may have been an option for NCA to seek advice from a person familiar with the airline

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<sup>11</sup> Certain risks are associated with the introduction of new aircraft as a launch customer, because the new aircraft is prone to malfunctions, the airline needs to be actively involved in the development stage to improve the maintenance capability, the technical support system after the introduction needs to be enhanced for the same reason, the number of parts distributed is small and the procurement of parts is not easy even if a malfunction occurs, and the huge amount of human and technical resources are necessary in the first place to select and prepare for the introduction of new models.

business to fully consider the risks associated with the introduction of new aircraft, but no evidence has been detected thus far that such an investigation had actually been carried out.

## **V Recommendations for measures to prevent reoccurrence of the Improper Maintenance Cases**

The preventive measures listed in this section<sup>12</sup> were proposed to the Investigation Committee by Nagashima Ohno & Tsunematsu law firm, whom the Investigation Committee requested to investigate the Improper Maintenance Cases. The Investigation Committee believes that NCA should consider the formulation and introduction of appropriate measures to prevent reoccurrence in light of the recommendations, taking into consideration the details of measures already formulated and introduced and the status of their implementation.

### **1 To eliminate the direct causes of Improper Maintenance Cases**

#### **(1) Lack of expertise and experiences in structure maintenance**

- Assign a certain number of maintenance engineers and back-office staff to maintenance companies and airlines which are engaged in base maintenance, for a certain period of time to provide them with opportunities to develop their knowledge and experiences with regard to structure maintenance. (\*)
- Subcontract maintenance companies and airlines that are engaged in base maintenance to provide training programs on structure maintenance within NCA. (\*)
- Take in maintenance engineers and back-office staff with expertise and experience in structure maintenance from maintenance companies and airlines that are engaged in base maintenance. (\*)
- Strengthen training on structure maintenance to improve knowledge regarding structure maintenance for maintenance engineers and back-office staff as a whole. (\*)
- Aim to acquire and firmly establish specific knowledge through case studies by sharing precedents of problems related to structure maintenance between Line Maintenance

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<sup>12</sup> Among the preventive measures, the measures already implemented or considered for introduction at NCA are indicated with (\*) at the end.

Section and Engineering Section. (\*)

**(2) Elimination of personnel shortages**

- Increase the number of new graduates and mid-career employees and increase the number of maintenance personnel. (\*)
- Reduce the scale of flight operations in accordance with the scale of maintenance production. NCA will also review our two-model system of airplanes. (\*)
- Revise the personnel system and consider changing the system so that maintenance engineers do not feel a sense of unfairness within NCA or are not subjected to unfavorable treatment compared to other companies. When such a review is carried out, it is important to listen to the opinions of the maintenance engineers at the site and make institutional changes taking such opinions into consideration.
- Develop medium-to long-term policies related to training for maintenance engineers and develop education programs in accordance with the policies (do not leave education for maintenance engineers to the maintenance site). (\*)
- Review training programs for class 1 aircraft maintenance engineers to improve the success rate. In addition, NCA will review the education system to ensure that maintenance engineers who take examinations have enough time to study. (\*)
- With regard to organizing the flight schedules, build a system to accurately grasp the actual capabilities of maintenance sites. In particular, when the Maintenance Planning Department ascertains the production capacity in terms of maintenance, it is necessary not only to make calculations on a desk using historical statistics, etc., but also to directly confirm the status of the maintenance site. (\*)
- Remove the dual post system wherever possible (especially in the Maintenance Audit Department, there is a shortage of full-time auditors with only concurrent posts). Although the concurrent appointment can create an appearance that apparently meets the standard personnel, it may make it difficult to ascertain actual production capacity and may weaken the necessary management and supervisory functions. (\*)

**(3) Clarification of communication rules and facilitation of communication**

- Revise various regulations to clarify communication rules, including the correction of

discrepancies between manuals and operations. In addition, the necessary operational manuals should be prepared to ensure that such revisions are firmly established in the work flow, and the reporting line should be made visible (for example, a contact network should be created to provide specific contact information for the reporting line in the event of a failure or a report event, and should be shared among related departments). (\*)

- Given the tendency that each shift in the Line Maintenance Section tends to lead to isolated work environments, introduce measures to stimulate communications between shifts (e.g., cross-shift study sessions, periodic personnel transfers between shifts, among other measures).
- Implement measures to actively communicate with the Line Maintenance Department, the Engineering Department, the Quality Assurance Department, and other back-office departments on a daily basis. Since there is a problem that the relationship between maintenance engineers and back-office staff is weak, personnel exchanges between the Line Maintenance Department and other back-office staff should be considered. In addition, since there are opinions that the physical distance between the Line Maintenance Section's work location on the first floor of the office and other departments' work location on the second floor has led to a psychological sense of distance, measures including the sharing of work spaces should also be considered. (\*)
- Introduce tablet devices and applications for internal communication, etc., to develop a system that facilitates distance communication (including not only communication between different bases but also between maintenance engineers performing maintenance at airframe and offices). (\*)

#### **(4) Elimination of manual deficiencies**

- In the event that a maintenance engineer points out a defect in the manuals, a system should be developed to enable the Line Engineering Section and the Engineering Section to promptly revise the manuals. (\*)
- Currently, MOC Section is responding to inquiries from overseas bases. Since the MOC Section does not have the authority to issue Bulletin, NCA will increase the number of the Line Engineering Section staff and enable the Line Engineering Section to respond 24-hour a day so that they can respond to such inquiries on the Line Engineering Section basis in the future.
- In connection with maintenance works that are particularly important and easy to make

mistakes, the Engineering Department and the Quality Assurance Department should prepare and distribute to maintenance engineers supplementary manuals that illustrate the work procedures in addition to manuals and note human errors that are likely to occur.

- In order to enable easy reference of manuals at maintenance sites by tablet devices, among other devices, the digitization of manuals will be promoted.

#### **(5) Reinforcement of back-office departments in the Maintenance Group**

- At NCA, people who have graduated from a university and acquired about one year to two years of experience as maintenance engineers are generally transferred to the Engineering Department. However, since they have little experience in the maintenance sites, there are opinions from the Line Maintenance Department that it is difficult to communicate with each other. In light of the opinions, the personnel rotation will be revised so that personnel can be assigned to the Engineering Department after three to five years of experience as maintenance engineers. (\*)
- Increase the number of new graduates and mid-career employees in back-office departments in Maintenance Group as well. (\*)
- In particular, the Quality Assurance Department should be staffed with personnel with expertise in negotiations with the Civil Aviation Bureau, such as former Civil Aviation Bureau officers and those who have previously worked in the quality assurance department in airlines (NCA will newly hire mid-career employees if required). (\*)

#### **(6) Thorough awareness of compliance with manuals**

- Conduct compliance training with manuals for maintenance engineers on the assumption that compliance with the manual is “compliance” under a zero tolerance policy. The training in question should be carried out thoroughly and promptly, bearing in mind that the problem of incorrect craftsmanship is a deep-rooted one. (\*)
- The President and the Chief Safety Officer should, without hesitation, continuously send a message that the flight may be delayed or canceled when necessary for maintenance in compliance with the manual.
- Create a working environment and awareness that maintenance engineers may of course refer to the Line Engineering Section and the MOC Section if they do not know. In order to activate such inquiries, it is effective to create situation that benefits the maintenance

engineers; that is, where the inquiry benefits maintenance engineers (delays and cancellations due to manual inquiries could conceivably not be regarded as cancellations due to maintenance reasons, and could be positively evaluated in terms of personnel evaluation).

- For maintenance engineers who have intentionally violated the manuals or those who have induced or suggested a violation of the manuals (including not only maintenance engineers but also employees of the Operation Control Department and the Sales Department, among other departments), the Company should declare that it will impose severe punishment including disciplinary dismissal. Even in the case of a violation of the manual due to time pressure, among other factors, since the top officer has issued a message saying that flights may be delayed or canceled if necessary, they should be subject to severe punishment if the violation of the manual is intentional.
- Regularly monitor the status of compliance with manuals and maintenance engineers' awareness of compliance. The monitoring method may include direct dialogue with maintenance engineers at the site and group discussions. However, it is considered effective to conduct regular questionnaire surveys on the status of compliance with manuals, and other policy documents, at a rate of approximately once a year (or once every six months for the next two years). (\*)
- Avoid letting the fact fade away that NCA received the Improvement Order due to Improper Maintenance Cases. For example, on July 20, when the Improvement Order was issued, continuous training through case studies, etc., may be conducted and messages from the president may be issued every year. In addition, in order to hand over this initiative to future executives and employees, it is also worth considering preparing a booklet summarizing the summary of the Improper Maintenance Cases, the causes, and preventive measures (including the status of implementation).
- Make it widely known in NCA that violations may be reported to the compliance consultation desk regarding violations of the manuals.

#### **(7) Improving systems and rules for maintenance records**

- The systems should be modified to require approval from the Quality Assurance Department, among other departments, when making ex-post modifications to maintenance records, and a system should be established in which the Quality Assurance Department checks the details of the modifications and the reasons for the modifications

when approving such modifications. (\*)

- Revise the rules for maintenance records and clarify what items should be recorded for each maintenance work. (\*)

## **(8) To raise awareness of compliance throughout NCA**

- In order to raise awareness of compliance not only in the manuals, but also in the broad sense, along with the measures for thorough awareness of compliance with the manuals mentioned in (6) above, the same kind of necessary measures should also be taken regarding awareness of compliance. (\*)

## **2 Strengthening management and supervisory functions**

### **(1) Strengthening systems for control and supervision in the Line Maintenance Section**

- Increase the number of managers so that the number of maintenance engineers managed and supervised by one manager can be reduced to approximately 10. In order to do so, it is necessary to increase the number of maintenance engineers who can work as a manager. Therefore, it is necessary to train maintenance engineers who have a certain number of years of experience about their duties as a manager.
- The system in which the Line Maintenance Section Leader manages and supervises all 70 maintenance engineers and the Line Maintenance Department Manager manages and supervises 80 maintenance engineers, including the MOC Section, is undesirable in light of the effectiveness of management and supervision. Therefore, NCA will proceed to consider reducing the number of personnel managed and supervised by one Line Maintenance Section Leader by setting up more than one Line Maintenance Section.
- Ensure that the Line Maintenance Section Leader and the Line Maintenance Department Manager communicate closely with on-site maintenance engineers so that they can recognize problems at an early stage. (\*)

### **(2) Establishment of a system in which management team can recognize problems on the site and link them to improvement**

- Establish a route for collecting information other than reporting through the corporate organization (such as a “complaints box” system to raise awareness of problems in the site,

direct dialogue by management team, and a regular review system, etc.).

- In order to utilize the collected information in actual improvement measures, rather than simply gathering information, a process will be established to integrate the information, review the content of the information, and use it for improvement measures. (\*)
- In order to maintain the trust of on-site employees in management team and lead to further transmission of information from the employees, a system will be established in which the employees can see what responses were taken by management team based on the information gathered from the employees.

**(3) To establish a system for company-wide risk management**

- Establish a system for management team to recognize and control risks in the business and organizational structure, including but not limited to safety.

**(4) To foster a sense of belonging to NCA and a sense of unity as NCA**

- In the Investigation, it became clear that there was a problem that NCA employees lacked a sense of belonging to NCA and a sense of unity as NCA. Although this problem did not directly cause improper conduct, it may have indirectly affected such problems as lack of communication, increase in the number of retirees, and lack of support by back-office departments. Therefore, improvements related to this point should be made.
- Employees' sense of belonging to NCA and a sense of unity at NCA are not easily developed, and specific measures to do so should be considered taking into account the special characteristics of each company. However, in the interviews conducted in the Investigation, there were indications that the company's goals and corporate identity are not clear, and that NCA, which is engaged in the cargo airline business, has difficulty identifying customers and making it difficult for employees to picture what they were working for. It is believed that improving these points can foster a sense of belonging to NCA and a sense of unity at NCA.

**3 Adequate preparation and consideration for future business operations**

As pointed out in Section 4-3(4) above, it can be said that NCA may have failed to make sufficient preparations and considerations in deciding the Maintenance Independence and the introduction of B747-8F.

In the first place, the business performance of the international cargo airline business that NCA operates is heavily influenced by external factors such as international cargo demand in terms of sales and fluctuations in fuel prices and foreign exchange rates in terms of expenses. On the other hand, the maintenance production capacity that supports the business depends on individuals with national qualifications; i.e, class 1 aircraft maintenance engineers, and it is not easy to train and hire them. Therefore, it is difficult to flexibly adjust production capacity in response to changes in the business environment. Accordingly, in expanding the business scale, such as increasing the number of operating aircraft and the number of flights, unless it is sufficiently verified that there is sufficient maintenance production capacity to support it, the shortage of personnel as pointed out in the above-mentioned fourth 2(2) could occur (in this regard, although the annual maintenance production plan, which the management of NCA used as the basis for their personnel plan, had a sufficient number of personnel in Line Maintenance Department, there is a possibility, as is pointed out in the above-mentioned fourth 2(2), that the calculation methods, etc., may not have accurately reflected the situation of the maintenance site).<sup>13</sup>

Therefore, it is important for NCA to make sufficient preparations and considerations, including appropriate risk analysis, taking into account past lessons and the characteristics of the international cargo airline business, when making management decisions including major changes in the maintenance system, introduction of new type of aircraft, and changes in the number of flights.

Although there is no clear answer on how to make adequate preparations and considerations in making management decisions, in light of the fact that the NCA management team, after NCA becoming a subsidiary of NYK, had few persons familiar with the management of the airline business in the first place, it may be worth considering, for example, inquiring about opinions from persons familiar with the management of the airline business, such as a person formerly in the position of senior management of a major airline company, consult with current or former senior officials of the Civil Aviation Bureau about matters related to regulations, or obtain advice from a consulting firm or advisory firm with expert knowledge of the airline business, if any.

[END]

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<sup>13</sup> It is also pointed out in the internal documents of NCA that such characteristics exist in the international cargo airline business.