



Relaxations of operating restrictions on Noise and resident's reaction at Narita International Airport

Saburo OGATA¹; Naoaki SHINOHARA²

¹Narita International Airport Corporation, Japan

²Narita International Airport Promotion Foundation, Japan

ABSTRACT

At Narita International Airport, air traffic movements have been controlled under various noise related operating restrictions as well as to conform to agreements with residents around airport so as to minimize noise impact because the airport is located inland. In response to needs for airport capacity expansion, Narita International Airport Corporation and Ministry of Transport have had to relax some such restrictions to ensure safety and to improve operating efficiency. This paper makes a brief review of noise mitigation measures at Narita, describes measures to cope with relaxation and resident's reactions like noise complaints and examines the effectiveness of the relaxation. Especially, it speaks about current situation after the enforcement of night curfew relaxation, which came into operation since March 31 last year.

Keywords: Relaxation, Capacity, Complaints I-INCE Classification of Subjects Number: 66.2

1. INTRODUCTION

Narita International Airport Corporation (abbr., NAA) has carried out various noise measures to continue to play an important role as an international hub airport in Tokyo metropolis over 35 years. Aircraft movements at Narita increased rapidly after the opening of the second runway: The total of aircraft movements in Fiscal 2013 became 226,182 (see Figure 1). The airport authority and the Ministry of Transport set several operational restrictions since the opening of the airport, so as to prevent the spread of noise area, in response to requests from local governments around the airport, because the airport was located inland. On the other, NAA is still expanding airport capacity in order to cope with the increasing demands in air and to enhance competitiveness of the airport within East Asia. Thus, it is necessary to increase operating efficiency while ensuring safety in flight, by relaxing current restrictions on noise in preparation for open sky policy, entry of Low Cost Carriers and Tokyo Olympic Game in 2020. This paper discusses the trend in aircraft noise exposure situations and noise complaints around the airport as a result of relaxations of operating restrictions and rules.

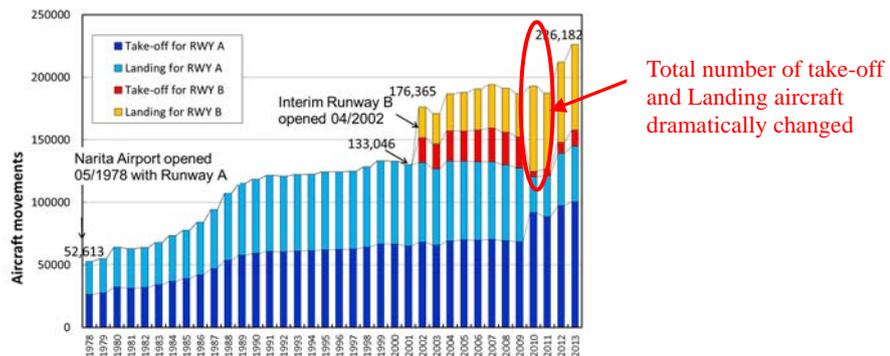


Figure 1- Trend in aircraft movements at Narita International Airport

¹ s-ogata@naa.jp

² shino@napf.or.jp

2. BACKGROUND OF RELAXATIONS OF OPERATIONAL RESTRICTIONS

2.1 Noise measures at Narita

NAA has carried out noise measures under the two laws of ANPL (Aircraft Noise Prevention Law) and SAANP (Special Act for Aircraft Noise Prevention). The former is aimed at remedial measures for noise impact by subsidization for relocation or sound proofing works of existing houses. The latter is aimed at preventing urbanization of the airport surroundings by land use control, but residents who live in the same place since before the notification of SAANP are admitted as subjects of subsidization for remedial measures (See Figure 2). The total amount of environmental expenditure so far is JPY 380 billion. Other than the measures under the laws, there are supplemental noise measures that have been performed by the Narita Airport Regional Symbiosis Promotion Foundation (NSF) and local governments: NSF carries out measure for adjacent areas outside the noise zones for ANPL, whereas local governments do for areas between the two runways.

Apart from these measures, NAA introduced a landing charge system, using a noise index of Narita Aircraft Noise Index, from October 2005. This index, which was designed by ACI (Airports Council International), is calculated based on ICAO noise certificate levels. Aircraft are classified into six categories A through F, being based on noise margin from ICAO Chapter 3 Standards. For example, the landing charge for aircraft belonging to the highest category A is reduced by 30% lower than the original charge of JPY 2400 per ton (1).

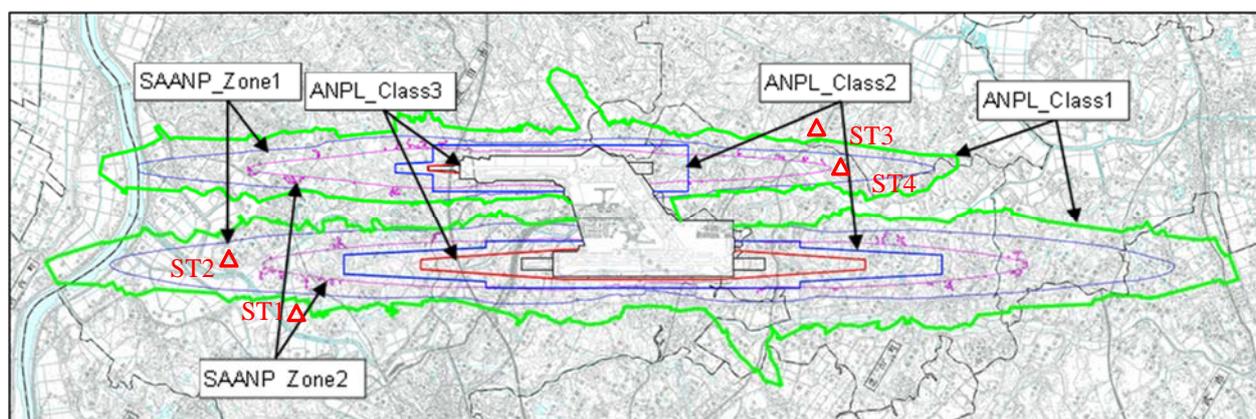


Figure 2 – Noise zones determined for measures under ANPL and SAANP

2.2 Operating restrictions on noise

Operating restrictions that have been required at Narita are as follows;

- a. Aircraft except for take-off and landing must fly over an altitude of 6000 feet in Chiba Prefecture.
- b. The maximum number of aircraft movements in the time period of 22:00 and 23:00 for each runway is basically limited to ten per day. Sometimes, however, there are more than ten movements for the sake of reasons like delay of freighter flights.
- c. Abolishment of Approved Runway Operation (ARP)
- d. Aircraft must fly straight to the south till Kujukuri coastline, 20km distant from the airport. Aircraft must also fly straight to the north till Tone River, 11km distant from the airport. In February 1999 flight corridors for take-off and landing aircraft were specified: If an aircraft flies outside the corridors without valid reason, its flight number will be disclosed to the public. Aircraft in violation of this provision in Fiscal 2013 was two, i.e., 0.00009% of all flights.
- e. Nighttime flight movements are prohibited in the time period of 23:00 to 06:00 except exceptions of aircraft movements due to emergency or other unavoidable reasons.

2.3 Background toward relaxation of operating restrictions

The Ministry of Transport and NAA performed planning and construction of the second runway in consultation with residents, which was different from the former compulsive way. Moreover, afterwards, NAA has been disclosing information on airport and aircraft operations to the public and sought views of residents. On the other, further capacity expansion has been needed to respond to strong demands in air and to enhance competitiveness as a hub airport in East Asia., but it was difficult to expand capacity without relaxation of the restriction of operating hours (6:00 to 23:00).

3. RELAXATION OF OPERATING RESTRICTIONS

3.1 History of relaxing operating restrictions

Table 1 shows a history of operational topics and relaxation of operating restrictions since before the opening of the airport at Narita.

Table 1 – History of topics and relaxing operating restrictions at Narita

Topics	Date	Event
OT1	May 20, 1978	Restriction of over-flight below an altitude of 6000 feet (← 2.2/a)
OT2	Dec 10, 1994	Restriction on the maximum of movements during 22:00~23:00 (← 2.2/b)
OT3	APR 18, 2002	Opening of interim parallel Runway B:2180m
OT4	JUL 11, 2006	Altitude reduction at Lakes (Relaxation-1)
OT5	OCT 22, 2009	Northward extension of Runway B to 2500m
OT6	MAR 28, 2010	Abolishment of Approved Runway Operation (Relaxation-2 ← 2.2/c)
OT7	MAR 27, 2011	Measures for mitigation of traffic congestion Relaxation of flight route restriction (Relaxation-3 ← 2.2/d)
OT8	OCT 20, 2011	Commencement of simultaneous departures and approaches
OT9	DEC 13, 2012	4000m operation of Runway A for Landing
OT10	MAR 31, 2013	Relaxation of curfew operations (Relaxation-4 ← 2.2/e)

3.2 Altitude reduction at Lakes (Relaxation-1)

Requirement for minimum flight altitude at a fix “Lakes” for aircraft approaching to runway 16R or 16L (see Figure 3) was lowered from 6000 feet to 4000 feet to secure both horizontal and vertical separation from July 11, 2006.

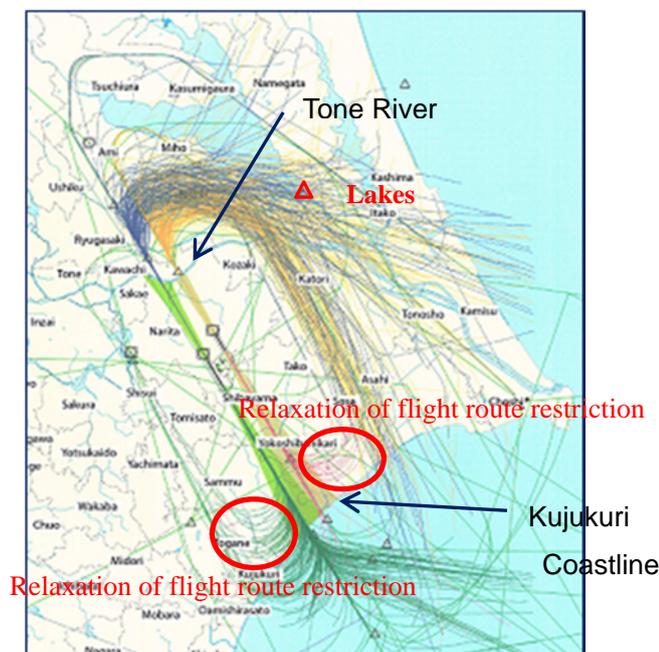


Figure 3 – Flight Track Monitoring

3.3 Abolishment of Approved Runway Operation (Relaxation-2)

At Narita Airport, the two runways of Runway-A (4000m) and Runway-B (2500m) had been used long time according to an operational procedure of Approved Runway Operation (ARP), in which arrival and departure slots had been assigned to airlines for each runway, resulting in an inefficient runway use. For example, take-off or landing aircraft assigned to one runway cannot use the other even if the latter runway has a sufficient margin in operational capacity. The Ministry of Transport abolished the conventional way of runway operation on MAR 28, 2010 and decided not to specify using runway in advance except for the time period after 20:00 (2), so as to dissolve the inefficient runway use. From Figure 1, we can see that the total number of take-off and landing aircraft dramatically changed after the abolishment of ARP.

3.4 Relaxation of flight route restriction for aircraft taking off to the south (Relaxation-3)

The flight corridors for take-off and landing aircraft were specified in February 1999, because a lot of noise complaints had been brought from regions distant from the standard flight route. As a result, aircraft had to fly straight within the corridors. But, on MAR 27, 2011, it became possible to fly aircraft after taking off to the south so as to deviate from the specified corridor and to make a turn before reaching Kujukuri Coastline in case it is past the sky above the Category-1 noise zone and if it has reached an altitude of 6000 feet or higher. See Figure 3.

3.5 Conditional Relaxation of nighttime curfews (Relaxation-4)

As stated above, nighttime curfew except emergency is imposed from 23:00 to 6:00 at Narita, but the restriction was relaxed to permit flight movements if it falls under any of the following reasons in a time period of 23:00 to 23:59 since March 31, 2013:

- a. Delayed landing of aircraft destined to Narita due to unavoidable reasons such as unusual bad weather, sudden/serious medical cases or failure of airport functions at the port of departure.
- b. Delayed landing of aircraft destined to Narita but once landed at another airport due to unavoidable reasons such as unusual weather conditions or other unavoidable situation in flight
- c. Delayed landing of aircraft destined to Narita as a result of cascaded delays caused by unusual bad weather, unavoidable situation or ensuring safety of flight operation
- d. Landing of aircraft that once took off and returned due to unusual bad weather or other unavoidable situation at destination airport
- e. Delayed take-off or landing of aircraft due to unavoidable situation other than the above reasons of a-d or ensuring flight safety

Target aircraft for the relaxation of the flight ban are limited to those belonging to any of aircraft categories A through C, specified using Narita Aircraft Noise Index. Airlines to fly aircraft by virtue of the application of this rule have to pay an additional landing charge per flight, which is equal to the normal charge. The money will be distributed equally to six local governments over the Category-1 Noise Zone under ANPL and be used for noise measures or regional development. NAA is requested to make a report of the status of the implementation of the Relaxation and discloses information on the applications, i.e., airline name, flight number, reasons for the delay and so on. During the one year from the enforcement of the conditional curfew relaxation rule in March 31, 2013, there were 249 pre-registrations for the application to the rule, finally resulting in 58 implementations. In other word, there were about 20 registrations and 5 implementations per month in average. Analysis of monthly statistics shows that there were many implementations both in summer (June to September) and in winter (January to February): The main reason is guessed to be seasonal weather conditions: thundery rain or typhoon in summer and heavy snow or dense fog in winter. Finally, Table 2 shows an illustration of actual application to the conditional curfew relaxation.

Table 2- Actual case for the conditional relaxation in nighttime curfew

Date	Departure/Arrival	Runway	Flight number	Origin/Destination	Time	A/C type	Noise Index
Nov 17, 2013	Arrival	16L	ABC123	PEK/NRT	23:14 (STA21:00)	A320	B
Reasons	Flight ABC123 for NRT departed from PEK at 17:45 was forced to land at ICN due to on-board medical crisis. After that, the flight departed for NRT. Finally Flight ABC123 landed at NRT at 23:14 arising from the delay. Note that all time are in Japanese Standard Time.						

4. EFFECTS OF RELAXING OPERATING RESTRICTIONS ON NOISE SITUATION

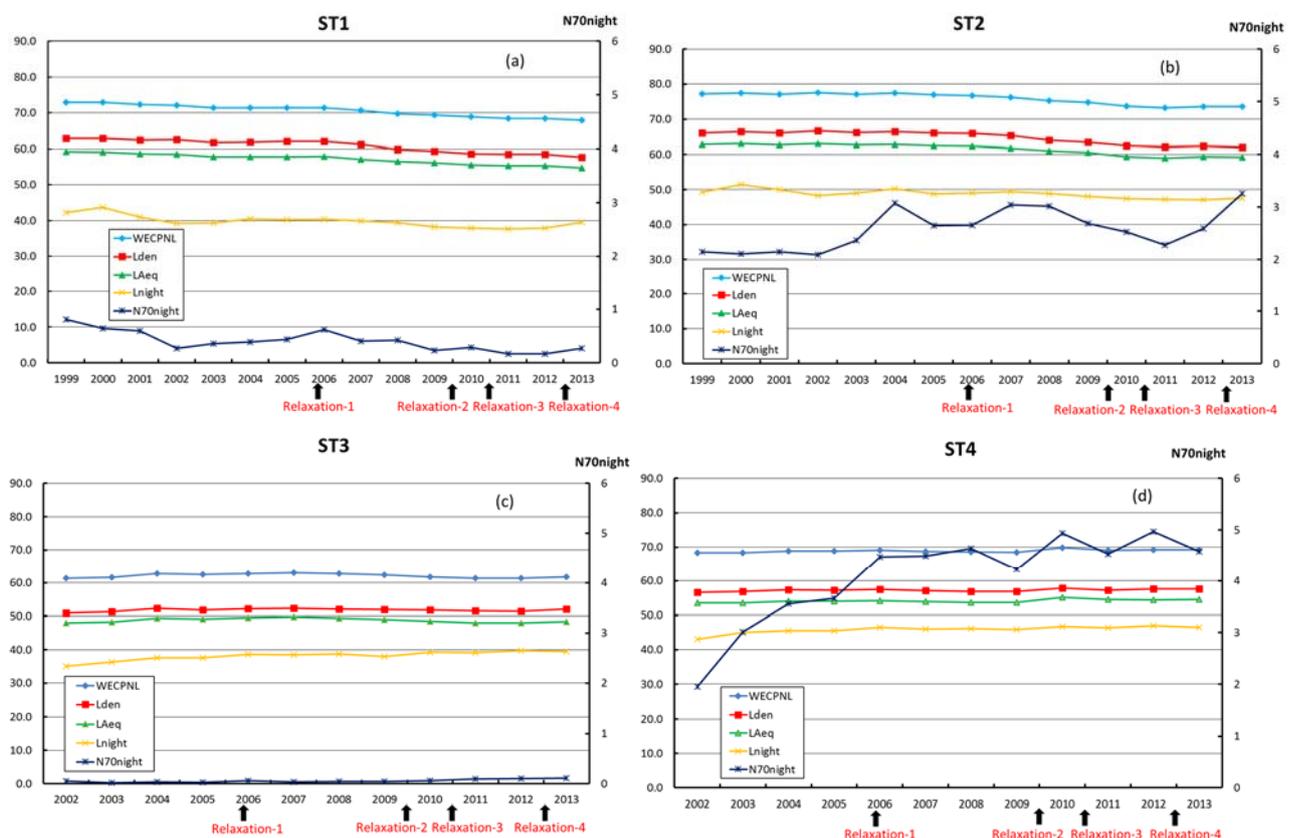
4.1 Trend in noise exposures

Figure 4 shows the trend in noise exposure, expressed using five noise indices (WECPNL, L_{den} , L_{Aeq} , L_{night} and $N_{70,night}$) over the last 15 years at four locations (ST1~ST4) for unattended noise monitoring: As is shown in Figure 2, ST2 & ST4 are located under the flight path, whereas ST1 & ST3 are by the side of the flight path: On the other, ST1 & ST3 are located in the north of Runway A, whereas ST3 & ST4 are in the south of Runway B. WECPNL and L_{den} are respectively noise indices used in the earlier and current versions of the noise guideline of Environmental Quality Standards for Aircraft Noise in Japan (3). L_{night} is A-weighted time average sound level in the time period of 23:00 to 7:00, whereas the metric of $N_{70,night}$ is a noise index of Number Above, defined as the number of noise events higher than 70dB in L_{ASmax} within the nighttime of 23:00 to 7:00. Note that the year of the enforcement of relaxations 1~4 are indicated in the figure using arrows.

The trend in the yearly-average cumulative noise exposure is almost the same among the three noise indices of WECPNL, L_{den} and L_{Aeq} . Each of these metrics at ST1 and ST2 shows a trend of gentle decrease due to the introduction of lower noise aircraft and aircraft downsizing even if the number of aircraft movements increases. Each at ST4 under the flight path in the south of Runway-B shows a trend of gentle increase due to the increase of landing aircraft after the abolishment of ARP (Relaxation-3) in March, 2010. On the other, roughly speaking, each metric at ST3 stays the same. It is considered that increases of aircraft movements and low noise aircraft cancel each other out for Runway B.

The trend in L_{night} shows a gentle increase at ST3 and ST4, while it remains the same at ST1 and ST2. But, no clear trend can be found to be related with the relaxations 1~4. The value of L_{night} stays around 40dB at ST1 and ST3, whereas it remains about 50dB or lower at ST2 and ST4. Note that, in 2007, WHO/Europe recommended a noise guideline of 40dB in $L_{night,outside}$ and a temporal target value of 55dB.

The trend of $N_{70,night}$ is different among stations of ST1~ST4: it gradually decreases at ST1 by the introduction of low noise aircraft, while it gradually increases at ST2 ~ ST4 as the number of aircraft movements increases after the opening of Runway-B in 2002 (OT3) as well as after the abolishment of ARP in 2010 (Relaxation-2).



4.2 Effects of relaxing operating restrictions

Before and after the altitude reduction (Relaxation-1) in 2006, noise measurement was carried out near the fix of Lakes, but no clear change in noise exposure was found. As for Relaxation-2, each noise index slightly increased at ST4 after the abolishment of ARP because of increase of landing movements. Noise measurement was also carried out in the side of flight corridor in the south side of the airport before and after the relaxation of flight route restriction (Relaxation-3), but no clear change was found. Finally, the total of aircraft movements operated in the time period of the nighttime curfew as exceptions owing to both the conditional curfew relaxation (Relaxation-4) and the conventional emergency reasons was 156 during the one year. Noise exposure contributions of such aircraft movements to the annual average noise metrics like L_{den} were little and insignificant. There were, however, several movements which caused high level noise observations due to large aircraft (B747-400 or A380) satisfying conditions for the rule relaxation. It is necessary to watch carefully the changes in the situation in future.

5. ANALYSIS OF LONG-TERM NOISE COMPLAINTS

NAA set up three regional consultation centers outside the airport. Residents around the airport can visit those centers freely and have consultation about environmental issues related with the airport and aircraft such as noise. NAA received 1857 noise complaints including repeated ones, in which the highest frequency of repetition was 156, over the last 15 years from April 1, 1999 to March 31, 2014. Most noise complaints were received at the centers. There were 651 noise complainants who told their address or residential area. Figure 5 shows plots of noise complainants' residential areas on the map around the airport. In the figure, each plot is color-coded according to the number of repeated complaints from the same person. This chapter firstly describes communication framework on airport operations and environmental issues such as aircraft noise through the Narita Airport Noise Mitigation Committee as well as framework based on the regional consultation centers.

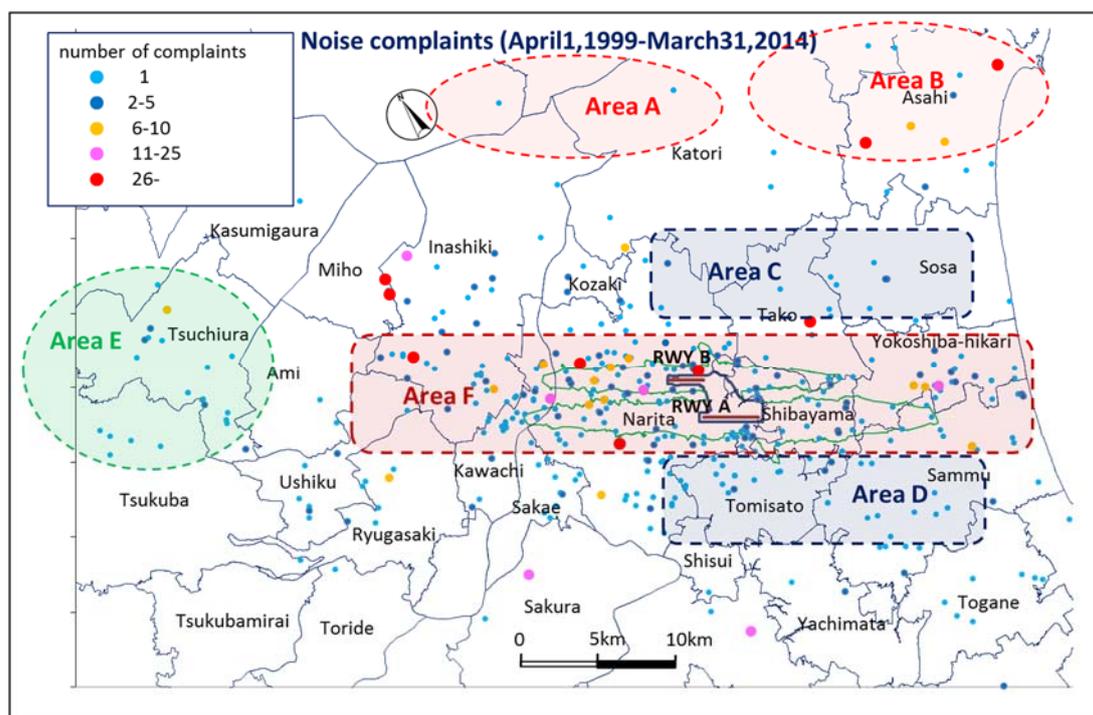


Figure 5 – plots of noise complainants

Note that noise complaints were mainly received in Area A through F according to kind of relaxations or flight patterns.

Area A and B: Relaxation-3 (OT7) --- Lowering of landing altitude to 4000ft

Area C and D: Relaxation-3(OT7) --- Early turn of take-off aircraft

Area E: OT8 --- Simultaneous departures and approaches (new flight routes)

Area F: Relaxation-4(OT10) --- Relaxation of curfew operations

5.1 Narita Airport Noise Mitigation Committee

Narita Airport Noise Mitigation Committee (abbr., NANMC) intended to discuss measures to prevent and reduce disturbances caused by aircraft noise. The Committee consists of Chairman, mayors and chairs of local governments around the airport, Ministry of Transport, Chiba Pref., Airlines, NAA and representatives of residents around the airport. And the committee set up 7 regional sub-committees. The NANMC ensure fruitful noise measures and safe and appropriate airport operation by discussing noise issues arising in regional subcommittee at NANMC plenary session. And the plenary session is held in March every year from 1972. Figure 6 shows the structure of NANMC.

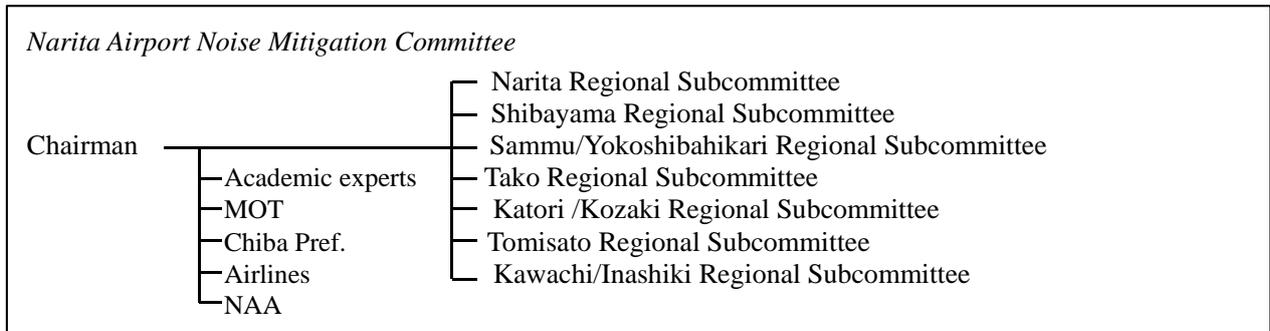


Figure 6- Structure of Narita Airport Mitigation Committee

5.2 Frequency distribution of noise complaints by distance from Runway A

As seen from Figure 5, cities, towns and villages related to noise complainants spread across a wide area. Both runways lie north and south and this section focused on the relation between the distance from flight course and number of noise complaints. Figure 7 shows frequency distribution of noise complaints by distance from extended centerline of Runway A every three years. From these figures, the number of noise complaints from the east area is greater than that of the west area. As one of reason, the landing flight courses for Tokyo-Haneda Airport are set in the west area and almost of flight courses for Narita Airport are set in the east area. And recently, the number of noise complaints received from long-distance area (25km in the east, 17km and 27km in the west) is increasing. Note that Runway B is located 2.5 km to the east of Runway A.

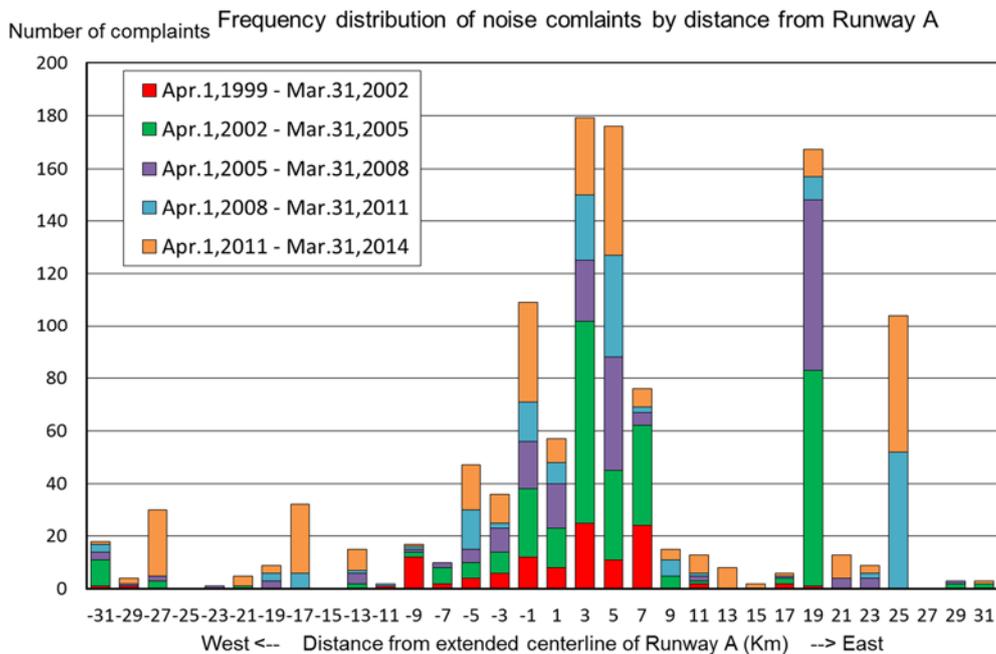


Figure 7 – Frequency distribution of noise complaints by distance from Runway A

5.3 Trend in number of complaints

Figure 8 shows the trend in the number of noise complaints every month for 15 years from Apr 1, 1999. In this figure, the projecting parts (OT3, OT6, OT8 and OT10) encircled with red correspond to the Operational Topics in Table 2, Chapter 4. For example, in the OT3, remarkable number of complaints persisted for a few months. In the next OT6 (Relaxation-2), the number of landing aircrafts dramatically increased after the abolishment of ARP, and the consultation center received many complaints. In the third OT8, the new flight courses were specified by the introduction of simultaneous departures and approaches. And we received many complaints. In the last OT10 (Relaxation-4), the number of complaints was large only in April, 2013. But in these projecting parts, noise complaints were just temporal tendency due to large change in operation.

The consultation center, which receives noise complaints, is open in daytime of weekday and the ratio of the way of noise complaints by phone was 68% and 5% of complaints were by visit. As for sex of complainants, 74% by male, 19% by female and 7% unknown. In addition, the complainants are almost relatively aged people even though there were no precise age records.

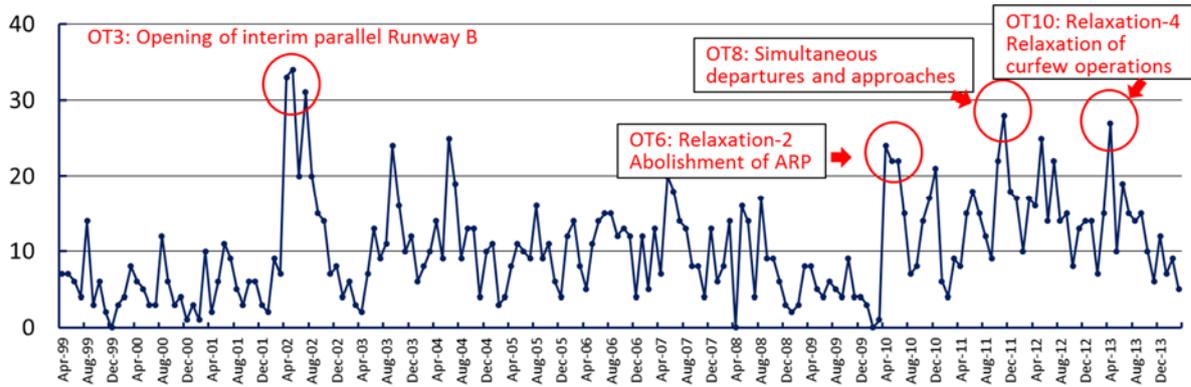


Figure 8- Trend in number of noise complaints

5.4 Reasons for noise complaints

We classified all noise complaints by reasons as shown in Figure 9, although it is difficult to classify complaints clearly. The largest number of complaints was by reason R0 (general, just noisy). As for other reasons, noise complaints caused by other airport flights fly over with 30000 feet altitude have a large number (R1). And it is hard to handle the complaints from repeater or people with psychotic condition (R2). We sometimes receive many complaints from same person. Reasons R3-R7 are cases that have high noise level than usual or unusual noise. For example, the reason R4 is by flight inspections. In the flight inspection, the aircraft type and flight pattern are differ from commercial one. At the present, the implementation of flight inspections are announced to local governments around the airport, but are not reached to residents. From here on, we need to consider the way of announcement of flight inspection.

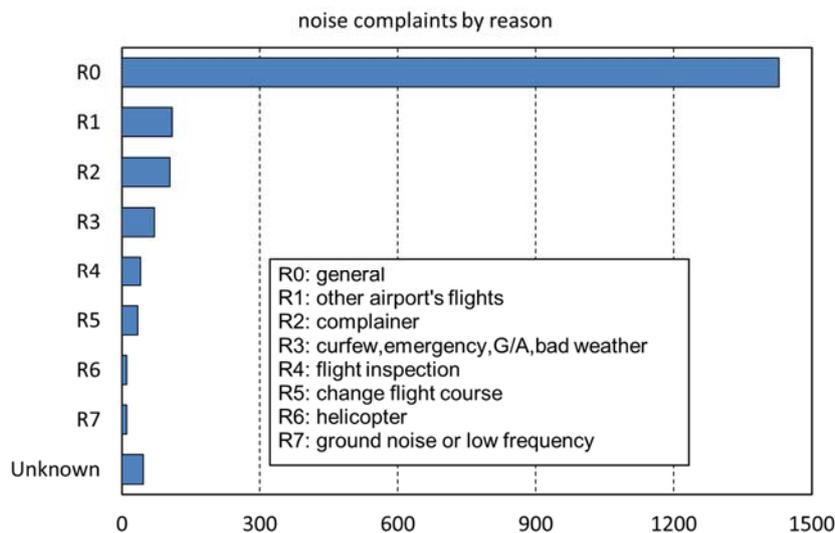


Figure 9- Noise complaints by reason

5.5 Noise complaints by month

In this section, we compiled the number of complaints for 15 years by month. However, we excluded complaints between April, 2002 and July, 2002, because the number of complaints was extremely large caused by the opening of interim parallel Runway B. As shown in Figure 10, we received the largest number of complaints in Jun. In general, we received many noise complaints in summer season and a few in winter season.

Residents around airport say that they sometimes hear aircraft sound louder than usual when the cloud hangs over the sky. We therefore surveyed recent cloudiness and humidity at Narita. In the result, both cloudiness and humidity were high value in Jun or July. These months are peculiarly Japanese rainy season. We have researched the relationship between noise level and weather such as cloudiness or humidity (4). But we couldn't get clear results.

As stated above, we analyzed noise complaints in many viewpoints. But it is considered that the number of noise complaints is generally smaller than other airports, although Narita Airport is located inland. As one of reason, communicating about noise issues by making effective use of NANMC or its regional subcommittee with resident participation works to absorbs latent noise complaints. However, it will be desirable to establish a system to provide consultation for residents by website or e-mail instead of making use of phone-based contact. At the same time, we need to offer information on airport operation and noise issues adequately from airport operator.

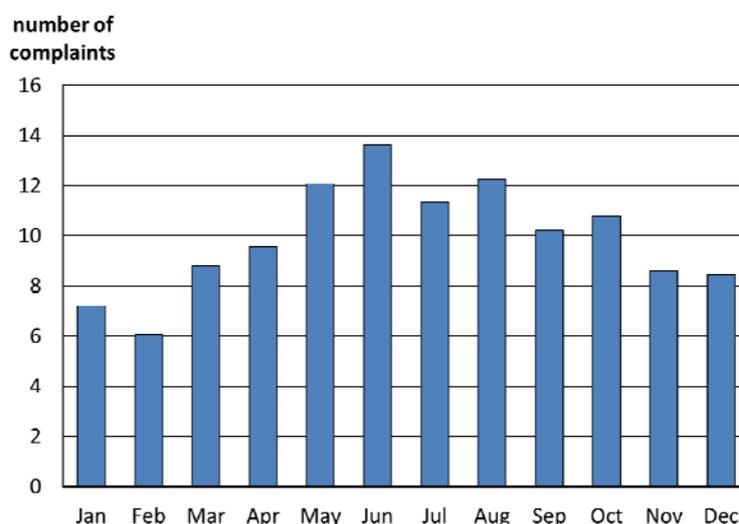


Figure -10 Noise complaints by month

6. CONCLUDING REMARKS

Narita Airport is located inland and the Ministry of Transport imposed some operational restrictions in response to request from local governments around the airport. However, it became need to expand airport capacity by relaxing operational restrictions, that were serious promise, and operating effectively in order to maintain status of gateway and competitiveness in East Asia. Furthermore, we had to respond open sky or LCC entry.

This paper described trend in noise exposure and noise complaints in response to change in operations and relaxations of operational restrictions on noise. As a result, noise exposure around airport is decreasing and relaxation of operational restrictions did not cause problems although the status of operation in 15 years varied dramatically and we received many noise complaints temporally. Especially, NANMC has important role and the committee is an important occasion to communicate with residents around the airport.

To summarize what we mentioned above, we can say that there is little direct influence caused by the status of operation or the relaxation of operational restrictions in analyzing noise complaints, which is one of resident's reactions. And it was confirmed the effectiveness of relaxations of operational restrictions. However, it will be needed measures to minimize sensory damage by aircraft noise. At the present time, there were not remarkable influences by introducing the relaxation of Night-time. Finally, it is desirable that we will study the sleep disturbance by night-time flight operation.

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