AI2021-3

AIRCRAFT SERIOUS INCIDENT

INVESTIGATION REPORT

SHANGHAI DEER JET CO., LTD.
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OKAYAMA AIR SERVICE CO., LTD.
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March 25, 2021

JTSB Japan Transport Safety Board

The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board (and with Annex 13 to the Convention on International Civil Aviation) is to prevent future accidents and incidents. It is not the purpose of the investigation to apportion blame or liability.

TAKEDA Nobuo
Chairperson
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

AIRCRAFT SERIOUS INCIDENT INVESTIGATION REPORT

RUNWAY INCURSION
SHANGHAI DEER JET CO., LTD.
GULFSTREAM AEROSPACE G-VI, B-3276,
ON RUNWAY 22 ENGAGED BY CESSNA 510, JA123F
AT TOKYO INTERNATIONAL AIRPORT, JAPAN
AROUND 12:38 JST, OCTOBER 27, 2018

February 5, 2021
Adopted by the Japan Transport Safety Board
Chairperson TAKEDA Nobuo
Member MIYASHITA Toru
Member KAKISHIMA Yoshiko
Member MARUI Yuichi
Member NAKANISHI Miwa
Member TSUDA Hiroka

1. PROCESS AND PROGRESS OF THE AIRCRAFT SERIOUS INCIDENT INVESTIGATION

1.1 Summary of the Serious Incident	On Saturday, October 27, 2018, when Cessna 510, registered JA123F, operated by Okayama Air Service Co., Ltd., was on final approach to Runway 22 with a landing clearance, Gulfstream Aerospace G-VI, registered B-3276, operated by Shanghai Deer Jet Co., Ltd., which was instructed to hold short of the runway, entered and crossed the runway without clearance at Tokyo International Airport. JA123F executed a go-around as instructed by the air traffic controller.
1.2 Outline of the Serious Incident Investigation	The occurrence covered by this report falls under the category of "Attempt of landing on a runway being used by other aircraft" as stipulated in Article 166-4, Item (ii) of the Ordinance for Enforcement of Civil Aeronautics Act (Ordinance of the Ministry of Transport No. 56 of 1952) prior to revision by the Ministerial Ordinance on Partial Revision of the Ordinance for Enforcement of Civil Aeronautics Act (Ordinance of Ministry of Land, Infrastructure, Transport and Tourism No. 88 of 2020), and is classified as a serious incident. The Japan Transport Safety Board (JTSB) designated an investigator-in-charge and an investigator on October 28, 2018. The JTSB additionally designated an investigator on November 22, 2018. On October 29, 2018, radar track record and ATS communication record were confirmed, and interviews with air traffic controllers were conducted. On

	October 30, 2018, information was collected from the fixed-base operator (FBO). On November 1, 2018, an interview with the captain of JA123F was conducted. In late November 2018, interviews with crewmembers of B-3276 were conducted by an accredited representative of the People's Republic of China. From August 6 until September 11, 2019, radio communication tests by flight inspection aircraft were conducted. From September 24 until October 25, 2019, an analysis was conducted at Electronic Navigation Research Institute. And on October 13, 2019, a radio communication test using the incident aircraft (B-3276) was conducted. An accredited representative of People's Republic of China, as the State of Registry and Operator of the aircraft involved in the serious incident, and an accredited representative and advisers of the United States of America, as the State of Design and Manufacture, participated in the investigation. Comments were invited from parties relevant to the cause of the serious incident and the relevant States.

2. FACTUAL INFORMATION

2.1 History of the Serious Incident

According to statements of the captain and the first officer (FO) of Gulfstream Aerospace G-VI, registered B-3276 (hereinafter referred to as "Aircraft A"), operated by Shanghai Deer Jet Co., Ltd. (hereinafter referred to as "the Company"), the captain of Cessna 510, registered JA123F (hereinafter referred to as "Aircraft B"), operated by Okayama Air Service Co., Ltd., and the aerodrome controller at the local north position of Tokyo Airport Traffic Control Tower (hereinafter referred to as "LN (Local North)") and the ground controller at the ground north position of Tokyo Airport Traffic Control Tower (hereinafter referred to as "GN (Ground North)"), ATS communication record, radar track record and illumination record of variable message signs (hereinafter referred to as "VMS"), the history of the serious incident is outlined below.

Figure 1: Aircraft A

On October 27, 2018 about 12:31 JST (UTC+9 hours; unless otherwise noted, all times are indicated in JST in this report on a 24-hour clock), Aircraft A commenced taxiing from Spot 953, where it had been parked, to Departure Runway 16R (hereinafter referred to as "A-RWY") at Tokyo International Airport for the flight to Wuxi Airport, People's Republic of China (See ① in Figure 2). There were a total of ten persons on board Aircraft A, consisting of a captain, three crewmembers, one mechanic, and five passengers. The captain was sitting in the left pilot's seat as PF*1 and the FO in the right pilot's seat as PM*1 in the cockpit. At 12:35:25, Aircraft A

*1 "PF" and "PM" are terms used to identify pilots by their roles when an aircraft is operated by two pilots. PF is an abbreviation of Pilot Flying and is mainly responsible for maneuvering the aircraft. PM is an abbreviation of Pilot Monitoring and mainly monitors flight status, cross-checks operations of PF and undertakes other non-operational tasks of aircraft.

was instructed by GN to taxi to the runway-holding position markings on Taxiway T7 and hold short of Runway 22 (hereinafter referred to as "B-RWY") (See ② in Figure 2).

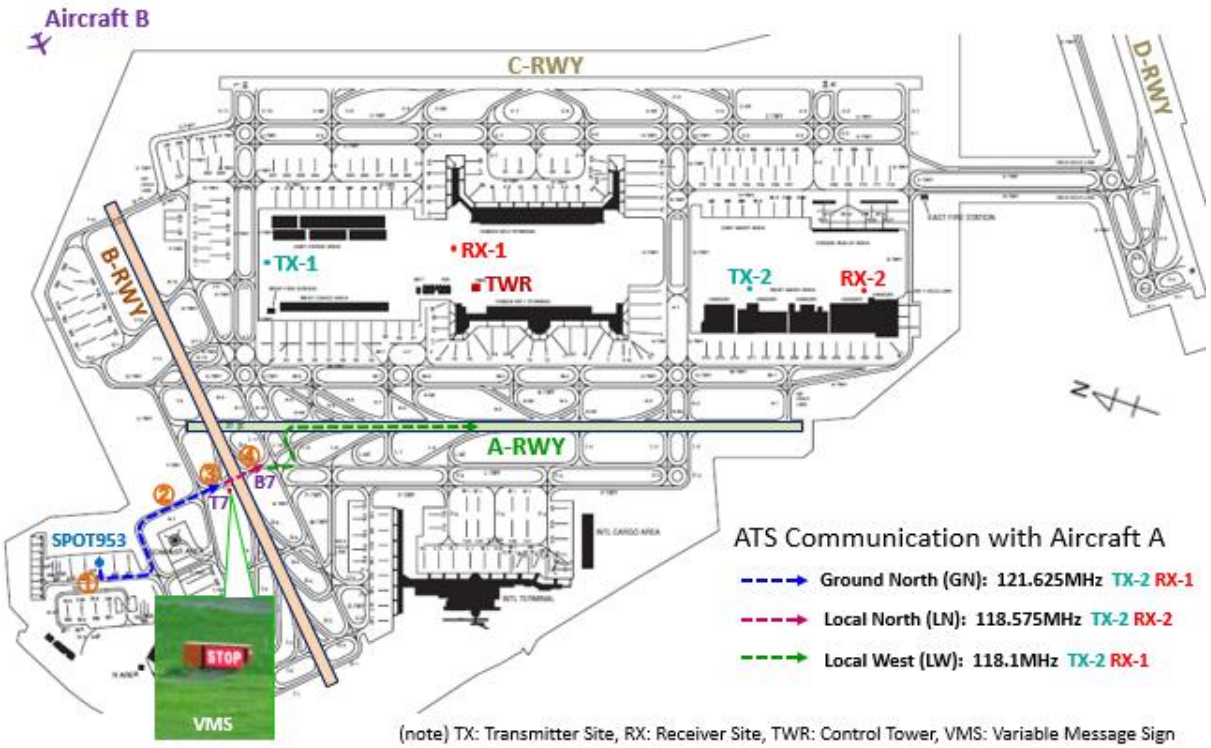


Figure 2: Taxiing route of Aircraft A, location of transmitter/receiver sites and VMS for Taxiway T7 at Tokyo International Airport

Aircraft B was flying from Kohnan Airfield to Tokyo International Airport. After being cleared for an LDA approach to B-RWY by Tokyo Approach Control, Aircraft B changed the radio frequency to LN and received a landing clearance from LN at 12:36:11. Around this time, GN instructed Aircraft A to change the radio frequency to LN (See ③ in Figure 2). Aircraft A immediately changed the radio frequency and called LN to establish communication*2. However, there was no trace of voice message that Aircraft A had called LN in the record of ATS communication, and the transmission from Aircraft A did not reach LN. At around 12:37:00, LN transmitted instructions to Aircraft A saying "B3276, TOKYO TOWER, HOLD SHORT OF RUNWAY 22 AT T7, STAND BY FURTHER INSTRUCTION DUE TO SEQUENCE". The captain and the FO of Aircraft A heard LN call their call sign saying "B3276…..", however, they

Figure 3: Aircraft B

*2 See 2.7 (5) for "communication establishment".

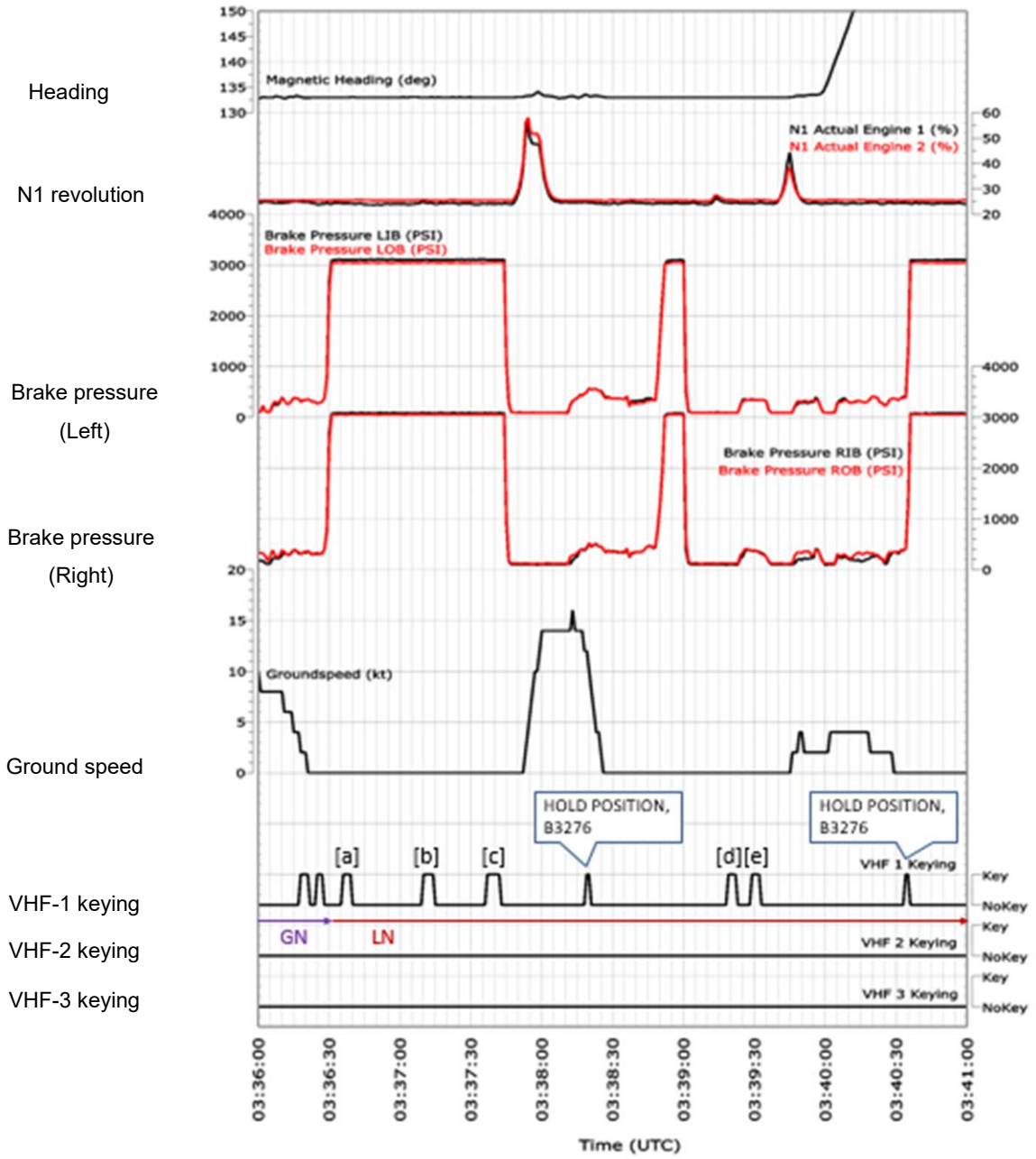
could not hear the voice message following their call sign due to interfered transmission from other aircraft. The captain directed the FO to confirm what the message was, and the FO transmitted "CONFIRM, YOU ARE CALLING B3276, CLEARED TO CROSS RUNWAY 22 VIA T7, B7?" The captain heard the FO's voice transmitted to LN through his headset, but there was no trace of this transmission from Aircraft A in ATS communication record, and this transmission from Aircraft A did not reach LN. As there was no response from LN, the FO transmitted again the same message saying "CONFIRM, YOU ARE CALLING B3276, CLEARED TO CROSS RUNWAY 22 VIA T7, B7?" to LN for confirmation, but this transmission was not also traceable in ATS communication record, nor did the transmission from Aircraft A reach LN. LN did not obtain a read-back from Aircraft A, but communicated with other aircraft after visually confirming Aircraft A was holding short of B-RWY. At 12:37:40, LN transmitted a message saying "ANA644, CONTACT TOKYO TOWER 1181" to the landed arrival aircraft on the taxiway. On the other hand, the captain and the FO of Aircraft A thought that they heard the response of "AFFIRM" from LN after transmitting the second confirmation. The captain and the FO mutually confirmed the clearance for crossing B-RWY. At around 12:37:53, Aircraft A commenced moving in the direction of B-RWY. It was around 12:37:54 when the VMS installed in the grassy area on the right side of Taxiway T7 was illuminated. The captain and the FO visually confirmed each other the right and left sides of the runway, but they did not remember clearly seeing the illuminated VMS. Weather was so fine that the captain could have in sight an arriving aircraft on base leg before crossing the runway; however, he could not see an aircraft on the final approach course. At 12:38:10, as finding Aircraft A entering B-RWY, LN instructed Aircraft B to execute a go-around, and instructed Aircraft A which had crossed B-RWY to hold at the present position. Aircraft A read back saying "HOLD POSITION, B3276" and halted on Taxiway B7 (See ④ in Figure 2). Aircraft B received the go-around instruction from LN shortly after reaching minimum descent altitude for LDA approach and commencing left turn. The go-around maneuver was in no rush with enough room for the time.

According to Aircraft A, radio communication on the frequency of LN was good enough to hear. And according to Aircraft B, the voice of LN was clear enough to hear well, and there was no noise mixing into the radio communication. On the other hand, according to GN, radio communication with Aircraft A was in good condition, and all transmissions from GN to Aircraft A were responded. In addition, according to LN, when timing of transmission from a controller overlaps with the same from aircraft, the feeling of "overlapping" occasionally becomes noticeable, but the overlapping was not felt with the transmissions either before or after the occurrence of this incident.

	The serious incident occurred on October 27, 2018 around 12:38 on B-RWY at Tokyo International Airport (35°33'26" N, 139°46'03" E). At this time, Aircraft B on approach was in the position of approximately 2.0 nm (approximately 3,700 m) away from Aircraft A and approximately 1.2 nm (approximately 2,200 m) away from B-RWY threshold.
2.2 Injuries to Persons	None
2.3 Damage to Aircraft	None
2.4 Personnel Information	(1) Captain of Aircraft A Age 52 Airline transport pilot certificate (Airplane) August 9, 2005 Type rating for G-VI June 30, 2017 Class 1 aviation medical certificate Validity May 4, 2019 Aviation English proficiency certificate Validity June 19, 2020 Total flight time 15,600 hours 00 minutes Flight time in the last 30 days 25 hours 00 minutes Total flight time on the type of the aircraft 320 hours 00 minutes Flight time in the last 30 days 25 hours 00 minutes (2) FO of Aircraft A Age 34 Commercial pilot certificate (Airplane) July 18, 2011 Type rating for G-VI (Co-pilot only) June 30, 2017 Class 1 aviation medical certificate Validity January 25, 2019 Aviation English proficiency certificate Validity January 23, 2019 Total flight time 1,368 hours 50 minutes Flight time in the last 30 days 45 hours 00 minutes Total flight time on the type of the aircraft 558 hours 00 minutes Flight time in the last 30 days 45 hours 00 minutes
2.5 Aircraft Information	(1) Aircraft A Type: Gulfstream Aerospace G-VI Serial number: 6266 Date of manufacture: April 4, 2017 Certificate of airworthiness: AC7841 Validity: during the period from September 13, 2017 until the aircraft is maintained in accordance with maintenance manual Category of airworthiness: transport category (passenger transport) Total flight time: 322 hours 12 minutes (2) VHF-1 Radio Equipment of Aircraft A Manufacturer: Honeywell International Inc. Model number: TR-866B

	Transmission/Reception: both transmission and reception Power consumption: normally 15 W with the maximum 210 W Output power: normally 15 W with the maximum 20 W Frequency: between 118.000 and 136.975 MHz
2.6 Meteorological Information	The aviation routine weather report for Tokyo International Airport around the time of the serious incident was as follows: 12:30 Wind direction: 220°, Wind velocity: 17 kt, Maximum: 28 kt, Minimum: 10 kt, Prevailing visibility: 30 km Cloud: Amount: 1/8, Type: Cumulus, Cloud base: 1,500 ft Amount: 3/8, Type: Cumulus, Cloud base: 2,500 ft Amount: 6/8, Type: Altocumulus, Cloud base: 13,000 ft Temperature: 23°C, Dew point: 19°C, Altimeter setting (QNH): 29.66 inHg
2.7 Additional Information	(1) Information on radio facilities at Tokyo International Airport Air traffic control tower at the Airport is built in the position surrounded by the four runways. In the circle shaped operation room on the top floor of the control tower, each control position is placed adjacently in a circular arc. Aerodrome control position is assigned to each of the four runways; e.g. A-RWY is controlled by the local west position, and B-RWY is controlled by the local north position. Likewise, the airport movement area excluding the four runways is divided into north, south, east and west and controlled by the four ground control positions respectively. Aircraft A was required to communicate with GN, LN and the aerodrome controller at the local west position of Tokyo Airport Traffic Control Tower (hereinafter referred to as "LW (Local West)") from spot 953 until reaching A-RWY. Around the time of the occurrence of the serious incident, the transmitter site (TX) and the receiver site (RX) described below were selected for use by pertinent control positions that communicated with Aircraft A at the Airport: • GN (121.625 MHz): TX-2 and RX-1 • LN (118.575 MHz): TX-2 and RX-2 • LW (118.1 MHz): TX-2 and RX-1 According to the latest inspection record (conducted in April 2018), there was no abnormality found in transmitting and receiving equipment of the Airport. Besides, there was also no abnormality found in transmitting and receiving equipment on the day of the serious incident. Furthermore, around the time of the serious incident, there occurred no abnormality in communication with aircraft other than that with Aircraft A. (2) Receiving conditions of voice messages from Aircraft A Aircraft A had three VHF radios equipped on board and used VHF-1 for communication with air traffic controllers. Besides, VHF-2 radio was used for monitoring emergency frequency (121.5 MHz) and VHF-3 radio for data

communications, respectively. By comparing the keying*3 record of VHF-1 radio kept stored in Digital Flight Data Recorder (DFDR) of Aircraft A with the voice record of ATS communications kept stored in the Digital Recording/Playback Equipment of Tokyo Airport Traffic Control Tower, it was revealed that receiving conditions of voice messages transmitted from Aircraft A to air traffic controllers around the time of the serious incident were as follows:



(Note 1) [a] to [e] indicate keyings with no voice record.

(Note 2) Time is expressed in Coordinated Universal Time (UTC: Japan Standard Time – 9 hours)

Figure 4: Recorded Data in the DFDR of Aircraft A

*3 Radio telephones used by pilots and air traffic controllers are switched over with push-to-talk (PTT) button by "push to transmit, release to receive". "Keying" denotes pushing PTT button for transmission.

- Transmission to GN: Keying record: 10 times, Voice record: 10 times
- Transmission to LN: Keying record: 8 times, Voice record: 3 times
- Transmission to LW: Keying record: 6 times, Voice record: 6 times

According to the flight crew of Aircraft A, radio communication on the frequency of LN was good enough to hear; however, as is shown by the discrepancy between keying record and voice record above, transmission from Aircraft A to LN was sometimes received and sometimes not received. Besides, Aircraft A was equipped with cockpit voice recorder (CVR) capable of recording for two hours; however, the record at the occurrence of the serious incident was overwritten because Aircraft A continued flight until notice of the occurrence of this serious incident was delivered to the Company, and therefore, voice messages in keying could not be confirmed from CVR records. The FO of Aircraft A, who was in charge of ATS communication as PM, wore headset equipped in the aircraft. Besides, he only pressed PTT button with his right hand to communicate with LN, and did not touch a headset plug, a boom microphone or control panel of radio equipment. On the other hand, with regard to radio communication between Aircraft A and GN/LW, the number of times of keying and that of ATS voice recording were matched, and the timings of them were synchronized. Besides, as shown in Figure 4, there was no record of keying in VHF-2 radio and VHF-3 radio at the time of the occurrence of the serious incident. According to the Company, there was no record of malfunction in the radio equipment of Aircraft A or there was no malfunction reported from pilots.

(3) Runway status light system

Runway status light (RWSL) system is an automated warning system that provides runway status information to aircraft and vehicles that the runway is in use by other aircraft or vehicle so that runway incursion can be prevented. The operation of RWSL system is independent of instructions from air traffic controllers. At Tokyo International Airport, the operation of RWSL is provided by using VMS. Taxiway T7 where Aircraft A was holding short before crossing B-RWY had VMS installed in the grassy area on the right side facing B-RWY. (See Figure 2)

(4) "AFFIRM"

In ATS communication, the term of "YES" or "NO" is not used, and instead, radio communication terms of "AFFIRM" meaning agreement or acknowledgement and "NEGATIVE" meaning denial or refusal are used. 1984 Amendment of Annex 10 Volume Ⅱ forces the use of "AFFIRM" instead of previously used "AFFIRMATIVE". "AFFIRM" is normally pronounced "əfɚːm" and is occasionally pronounced "éɪfɚːm" depending on pilots or air traffic controllers.

(5) Communication Establishment

When an aircraft in service establishes communication with a given/different ATS facility, communication is normally established in a way that a pilot firstly makes an initial call to the pertinent ATS facility, followed

	by the reply from the facility. Communication establishment in ATS communication means that a sequence of call and reply has been performed. The International Civil Aviation Convention, Annex 10, Volume Ⅱ stipulates as follows, and Standards for Air Traffic Control Procedures established by Japan Civil Aviation Bureau (JCAB) also stipulates as follows: *5.2.1.7.3.2.5 Communications shall commence with a call and a reply when it is desired to establish contact, except that, when it is certain that the station called will receive the call, the calling station may transmit the message, without waiting for a reply from the station called.* (6) Information on tests (i) Test by flight inspection aircraft From August 6 until September 11, 2019, near the incident site, radio communication tests by flight inspection aircraft (Textron Aviation 525C) of JCAB were performed five times to verify whether radio wave in VHF band transmitted from the flight inspection aircraft can be received by receiving equipment at RX-1 and RX-2 in Tokyo International Airport. The result of reception both at RX-1 and RX-2 was in good condition. (ii) Test by Aircraft A About a year after the serious incident, a radio communication test using Aircraft A was performed, taking the opportunity of its flight to Tokyo International Airport, near the incident site to see whether similar situations to the serious incident occurred again. Radio and antenna actually used by Aircraft A in the serious incident were used for the test. The result of reception both at RX-1 and RX-2 was good, and the situation where the transmission from Aircraft A was inaudible did not occur again. (iii) Analysis of radio wave emission patterns from Aircraft A Analysis was requested to Electronic Navigation Research Institute in order to verify characteristics of radio wave emission patterns from VHF-1 antenna of Aircraft A. As for analytical method, finite element method was used to compute emission patterns dividing the airframe and peripheral space of the airframe into edge elements setting airframe materials as complete conductor. In emission pattern in a vertical plane, significant decline of gain was not confirmed from the front of nose to three degrees on the upper side. Besides, in emission pattern in a horizontal plane, significant decline of gain was not confirmed from the front of nose to 15 degrees on the right and left sides.

3. ANALYSIS

3.1 Involvement of Weather	None
3.2 Involvement of Pilot	Yes
3.3 Involvement of Aircraft	Yes

3.4 Analysis of Findings	(1) Radio communication between Aircraft A and air traffic controllers It is highly probable that no malfunction occurred in the radio communication when Aircraft A was communicating with GN and LW. Aircraft A performed keying for approximately four seconds (Keying [a]) from about 12:36:36 after Aircraft A made the last communication with GN. Although there was no trace of voice transmission from Aircraft A in ATS communication record, and this voice transmission did not reach LN, it is probable that Keying [a] was made by Aircraft A with intention to establish communication with LN because it was recorded approximately eight seconds after Aircraft A read back the frequency change to GN. After that, the captain and the FO of Aircraft A heard LN called the call sign of Aircraft A saying "B3276…..", however, they could not hear the voice message following their call sign due to interfered transmission from other aircraft. Accordingly, the FO of Aircraft A stated that he transmitted to LN in order to confirm what the message was, however, there was no trace of voice transmission from Aircraft A in ATS communication record, and this voice transmission did not reach LN. The keying of Aircraft A for approximately five seconds (Keying [b]) from around 12:37:10 was performed immediately after the transmission of LN that is considered to have been interfered, therefore, it is probable that Keying [b] was performed with intention to confirm the transmitted message from LN.

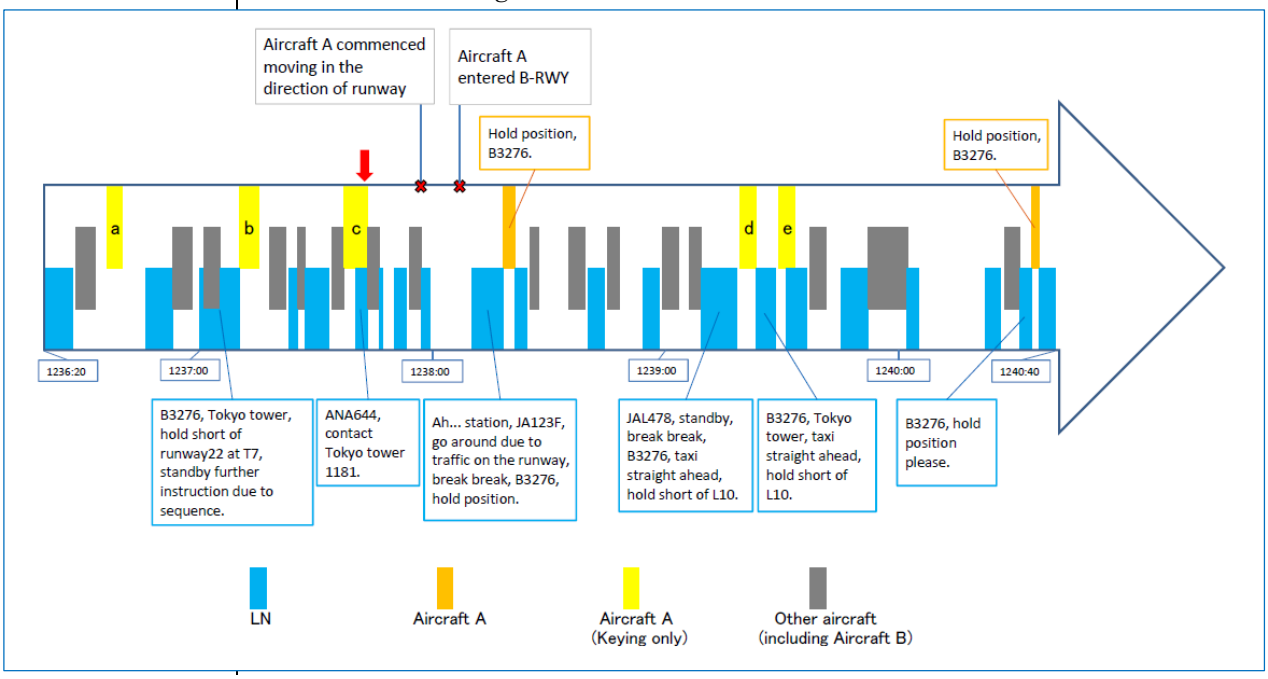


Figure 5: ATS Communication Record of LN and the Keying of Aircraft A

Because there was no response from LN, the FO of Aircraft A transmitted the message again saying "CONFIRM, YOU ARE CALLING B3276, CLEARED TO CROSS RUNWAY 22 VIA T7, B7?" to LN, then, the flight crew of Aircraft A stated that they received the response of "AFFIRM" from LN. However, ATS communication record did not store such a voice message from Aircraft A nor the response from LN. On the other hand, the keying was

	performed for approximately six seconds (Keying [c]) from around 12:37:37. It is probable that Keying [c] was performed in order to confirm again the transmitted message from LN because Keying [c] was recorded immediately after LN finished the communication with other aircraft following Keying [b]. Besides, LN transmitted a message to communicate with other aircraft for approximately three seconds from 12:37:40 when Aircraft A was performing Keying [c] because the voice message of the FO of Aircraft A, which is considered to have been transmitted in Keying [c], did not reach LN. While it is highly probable that both the transmission by LN and Keying [c] were completed about 12:37:43, it is somewhat likely that voice message of LN before completing the transmission was heard depending on the timing of releasing PTT button by the FO of Aircraft A. According to the communication record, the transmission by LN ended with "….one one eight one". By the way, "AFFIRM" is normally pronounced "əf ɚ:m" and is occasionally pronounced "éɪf ɚ:m" depending on pilots or air traffic controllers. It is somewhat likely that the captain and the FO of Aircraft A misheard the last two words of "eight one" in the transmission by LN as "éɪf ɚ:m", accordingly, they misunderstood that crossing B-RWY was cleared. (See red arrow in Figure 5) It is probable that because the transmitted voice messages intended by Aircraft A in Keying [a], [b] and [c] did not reach LN, which caused a situation where the communications between Aircraft A and LN were not established. Besides, it is probable that Aircraft A heard part of voice messages intended for other aircraft transmitted by LN and misunderstood that crossing runway was cleared, Aircraft A entered the runway which Aircraft B was approaching for landing. (2) Verification of causes of undelivered voice messages from Aircraft A to LN It could not be found any concrete fact that the VHF radios have any malfunction. In addition, it could not be determined that any operation of radio equipment by the flight crew of Aircraft A was considered to cause the messages to be undelivered to LN. Besides, it is probable that the result of tests by flight inspection aircraft indicated that the blind spot of receiving equipment of Tokyo Airport Traffic Control Tower did not exist near the occurrence site of the serious incident. Furthermore, it is highly probable that characteristics of VHF radio wave emission patterns of Aircraft A were not contributed to the undelivered voice messages to LN. Given the above, it could not be determined why the communications from the Aircraft A to LN did not reach temporarily. (3) Communications between Aircraft A and LN The call in Keying [a] made by Aircraft A with intention to establish communication with LN did not reach LN. In addition, at around 12:37:00, LN instructed to hold short of runway to Aircraft A, which had not called up, but it is highly probable that this instruction was transmitted in such a state that the communication with Aircraft A was not established. As the International

	Civil Aviation Convention, Annex 10, Volume II and the Standards for Air Traffic Control Procedures stipulate that the calling station may transmit the message without waiting for a reply from the station called when it is certain that the station called will receive the call, it is probable that LN found the situation to be applicable to this, and sent the message to Aircraft A. Eventually, Aircraft A received the transmission from LN, but could hear only part of it due to interfered transmission from other aircraft. In this way, as communication had not been established surely between Aircraft A and LN, and a sequence of call and reply was not performed between them, and therefore, it is probable that this was contributed to the occurrence of the serious incident. (4) Operation of VMS at Tokyo International Airport Before crossing B-RWY, the captain and the FO of Aircraft A visually confirmed the right and left sides of the runway, but could not stop the aircraft in accordance without noticing the illumination of VMS, which was operated independently of instructions from air traffic controllers in order to prevent runway incursion. It is probable that the captain and the FO of Aircraft A did not fully grasp the operation of VMS at the Airport where VMS was installed to be operated as RWSL. (5) Classification of Severity It is highly probable that the distance between Aircraft A and Aircraft B, when Aircraft A entered B-RWY, was approximately 2.0 nm (3,700 m). The serious incident falls under the severity classification of Category C (An incident characterized by ample time and/or distance to avoid a collision) of "Manual on the Prevention of Runway Incursions" of ICAO with classification tools provided by ICAO. (See Attachment)

4. PROBABLE CAUSES

In this serious incident, it is probable that because of the situation where the radio voice transmission of Aircraft A did not reach LN, communication between Aircraft A and LN was not established, and furthermore, Aircraft A misunderstood that crossing runway was approved by hearing part of voice messages intended for other aircraft, which resulted in Aircraft A entering the runway which Aircraft B was approaching with a landing clearance. Regarding that the voice of transmission of Aircraft A did not reach LN could not be determined its reason.

Besides, it is probable that the following matters are contributed to the occurrence of this serious incident.

(1) When Aircraft A changed frequency to LN, the communication with LN was not established surely, and a sequence of call and reply was not performed between them.

(2) Flight crew of Aircraft A could not notice the illuminated VMS.

5. SAFETY ACTIONS

The Company has taken following measures after the serious incident in order to prevent occurrence of similar cases in the future.

(1) Issuance of Safety Circular

Safety circular in relation to Tokyo International Airport was issued for thorough dissemination to flight crew along with using this serious incident case as one of educational materials.

(2) Follow-up of radio equipment of Aircraft A

The Company has set to continuously gather information from flight crew to follow up reliability of VHF-1 radio of Aircraft A, and in the event that the radio does not function, the pertinent radio is set to be replaced without delay.

(3) Review and improvement of preventive measures against runway incursion

The Company carried out review and improvement of the preventive measures described in the SOP (Standard Operating Procedures) of Gulfstream Aerospace G-VI, and provided education to flight crew.

(4) Measures to address potential risks of radio communication

With TEM (Threat and Error Management), the Company conducted an analysis on potential risks of radio communication and devised a method to control them so that flight crew would be able to address those risks.

Attachment

Severity Classifications of Runway Incursions

Severity classifications described in ICAO "Manual on the Prevention of Runway Incursions" (Doc 9870) are as described in the table below.

Severity classification	*Description*[**1]
A	*A serious incident in which a collision is narrowly avoided.*
B	*An incident in which separation decreases and there is significant potential for collision, which may result in a time-critical corrective/evasive response to avoid a collision.*
C[**2]	*An incident characterized by ample time and/or distance to avoid a collision.*
D	*An incident that meets the definition of runway incursion such as the incorrect presence of a single vehicle, person or aircraft on the protected area of a surface designated for the landing and take-off of aircraft but with no immediate safety consequences.*
E	*Insufficient information or inconclusive or conflicting evidence precludes a severity assessment.*

[**1] Refer to Annex 13 for the definition of "incident".

[**2] Shaded to show the pertinent classification of the serious incident.