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2025

# Section 1: Home

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| **Seq** | **Page Name** | **Audio File** | **Audio Text EN** |
| 1 | Disclaimer | thu01p02.mp3 | The material presented in this program is for training purposes only. This program is accurate as of Dec 31, 2021. Changes to procedures after this date have not been incorporated. |
| 1a | Disclaimer | thu01p02a.mp3 | Please consult company technical or operational documents for additions, deletions, revisions, or amendments that may have occurred since the date this program was released. |
| 2 | Reference | thu01p03.mp3 | The list shown here represents the regulatory framework upon which this course was developed and is presented here for students to refer to if needed. |
| 3 | Objectives | thu01intro.mp3 | This course is intended for Flight Crew undergoing initial and recurrent training. It covers the weather effects and aviation hazards associated with thunderstorms and microbursts. |
| 3a | Objectives | thu01introa.mp3 | The course learning objectives include: The Different Types of Thunderstorms, How Thunderstorms and Microbursts Form, The Hazards Related To Flight In The Vicinity of Active Convective Weather, The Use and Interpretation of Weather Radar Returns, and Techniques For Avoiding The Effects of Convective Weather. |

# Section 2: Thunderstorms and Microbursts

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| **Seq** | **Page Name** | **Audio File** | **Audio Text EN** |
| 1 | Introduction | thu01p05.mp3 | In this lesson we will discuss the weather and aviation hazards associated with thunderstorms, including: Life Cycle of A Thunderstorm, Types of Thunderstorms, Movement of Thunderstorms, Hazards of Thunderstorm. |
| 2 | Hazards To Flight Operations | thu01p06.mp3 | The dynamic nature of thunderstorms presents many hazards to aviation. Some of these hazards are: tornadoes, turbulence, icing, hail, microbursts and downbursts, electrical discharges in the form of lightning or precipitation static, water ingestion, and Effect on Altimeters. |
| 3 | What Is Thunderstorm | thu01p07.mp3 | A thunderstorm is a local storm, invariably produced by a cumulonimbus cloud, and always accompanied by lightning and thunder, usually with strong gusts of wind, heavy rain, and sometimes with hail. |
| 3a | What Is Thunderstorm | thu01p07a.mp3 | Thunderstorms are barriers to air traffic because they are usually too tall to fly over, too dangerous to fly through or under, and can be difficult to circumnavigate. |
| 4 | Necessary Ingredients For Thunderstorm Cell Formation. | thu01p08.mp3 | Thunderstorm cell formation requires three ingredients: sufficient water vapor, unstable air, and a lifting mechanism. Sufficient water vapor must be present to produce unstable air. |
| 4a | Necessary Ingredients For Thunderstorm Cell Formation. | thu01p08a.mp3 | A conditionally unstable air mass requires a lifting mechanism strong enough to release the instability. Lifting mechanisms include: converging winds around surface lows and troughs, fronts, upslope flow and etc... |
| 5 | Thunderstorm Cell Life Cycle | thu01p09.mp3 | A thunderstorm cell is the convective cell  of a cumulonimbus cloud having lightning and thunder. It undergoes three distinct stages  during its life cycle: towering cumulus, mature, and dissipating.  The total life cycle is typically about 30 minutes. |
| 6 | Cumulus Stage -1 | thu01p10.mp3 | The distinguishing feature of the towering cumulus stage is a strong convective updraft.  The updraft is a bubble of warm, rising air concentrated near the top of the cloud which leaves a cloudy trail in its wake. Updraft speeds can exceed 3,000 feet per minute. |
| 7 | Cumulus Stage -2 | thu01p10\_1.mp3 | The cumulus cloud continues to develop vertically past the  freezing level and moisture condenses into super-cooled water droplets or ice. If the coalesced water droplets or ice are large enough then they begin to fall as rain. |
| 8 | Cumulus Mature Stage -1 | thu01p11.mp3 | The cell transitions to the mature stage when precipitation reaches the surface.  Precipitation descends through the cloud and drags the adjacent air downward, creating  a strong downdraft alongside the updraft. |
| 9 | Cumulus Mature Stage -2 | thu01p12.mp3 | The mature stage is the most violent stage of the thunderstorm; it is in this stage that hail and lightning are likely to occur. The mature stage usually lasts for 20 - 30 min but may last several hours. |
| 10 | Cumulus Mature Stage -3 | thu01p13.mp3 | Falling precipitation causes cold air to pour out of the cloud base at great speed and produce strong gusty winds. This produces very turbulent conditions that pose a threat to aircraft operations, in particular during the arrival and departure phase of flight. |
| 11 | Cumulus Mature Stage -4 | thu01p14.mp3 | The dissipating stage is marked by a strong downdraft embedded within the area of precipitation. Subsiding air replaces the updraft throughout the cloud, effectively cutting off the supply of moisture provided by the updraft. |
| 11a | Cumulus Mature Stage -4 | thu01p14a.mp3 | Precipitation tapers off and ends. Compression warms the subsiding air and the relative humidity drops. |
| 12 | Types of Thunderstorms | thu01p15.mp3 | There are three principal thunderstorm types: single cell,  multicell (cluster and line), and supercell. All thunderstorms are hazardous to aircraft. |
| 13 | A Single Cell Thunderstorm | thu01p16.mp3 | A single cell thunderstorm also called ordinary cell thunderstorm consists of only one cell. Its life  cycle was covered in the previous section. It is easily circumnavigated by pilots, except  at night or when embedded in other clouds. Single cell thunderstorms are rare; almost all  thunderstorms are multicell. |
| 14 | Multicell Thunderstorm -1 | thu01p17.mp3 | A multicell cluster thunderstorm consists of a cluster of cells at various stages of their life cycle. With an organized multicell cluster, as the first cell matures, it is carried downwind, and a new cell forms upwind to take its place. |
| 14a | Multicell Thunderstorm -1 | thu01p17a.mp3 | A multicell cluster may have a lifetime of several hours (or more). New cells will continue to form as long as the three necessary ingredients exist. |
| 15 | Multicell Thunderstorm -2 | thu01p18.mp3 | Multicell cluster thunderstorm's size and persistence make it a bit tougher to circumnavigate than a single cell thunderstorm. An area of multicell cluster thunderstorms can be like a mine field for air traffic. |
| 16 | Multicell Thunderstorm - Squall | thu01p19.mp3 | Sometimes thunderstorms will form in a line that can extend laterally for hundreds of miles. New cells continually re-form at the leading edge of the system with rain, and sometimes hail, following behind. Sometimes storms which comprise the line can be supercells. |
| 16a | Multicell Thunderstorm - Squall | thu01p19a.mp3 | The line can persist for many hours (or more) as long as the three necessary ingredients continue to exist. |
| 17 | Supercell Thunderstorm | thu01p20.mp3 | A supercell thunderstorm is an often dangerous convective storm that consists primarily of a single rotating updraft that persists for an extended period of time. Updraft speeds may reach 9,000 feet per minute (100 knots). |
| 17a | Supercell Thunderstorm | thu01p20a.mp3 | Nearly all supercells produce severe weather (e.g., large hail or damaging wind) and about 25 percent produce a tornado. |
| 18 | Factors That Influence Thunderstorm Motion | thu01p21.mp3 | A thunderstorm is a process, not a solid  object or block of wood. Storm motion equals the combined effects of both advection and  propagation. |
| 19 | Factors That Influence Thunderstorm Motion - Advection | thu01p22.mp3 | Advection is the component of storm motion due  to individual cells moving with the average wind throughout the vertical depth of the  cumulonimbus cloud. The wind at FL180 (500 millibars) usually provides a good  approximation. |
| 20 | Factors That Influence Thunderstorm Motion - Propagation | thu01p23.mp3 | Propagation is the component of storm motion due to old cell dissipation and the new cell development. Storm motion may deviate substantially from the motion of the individual cells which comprise the storm. |
| 20a | Factors That Influence Thunderstorm Motion - Propagation | thu01p23a.mp3 | As showed in the picture. Individual cells which comprise the storm move northeast (advection), but dissipate and are replaced by new cells  (propagation). Storm motion equals the combined effects of both advection and propagation. |
| 21 | Thunderstorm Hazards | thu01p24.mp3 | A thunderstorm can pack just about every aviation weather hazard into one  vicious bundle. These hazards include: lightning, adverse winds, downbursts, turbulence,  icing, hail, rapid altimeter changes, static electricity, and tornadoes. |
| 22 | Thunderstorm Hazards - Lightning | thu01p25.mp3 | Lightning. Every thunderstorm produces lightning and thunder by definition. Lightning is a visible electrical discharge produced by a thunderstorm. The discharge may occur  within or between clouds, between the cloud and air, between a cloud and the ground, or between the ground and a cloud. |
| 22a | Thunderstorm Hazards - Lightning | thu01p25a.mp3 | Lightning can damage or disable an aircraft. |
| 23 | Thunderstorm Hazards - Adverse Wind | thu01p26.mp3 | Adverse winds are always found within thunderstorms and often many miles away from the precipitation area. Crosswinds, gusts, and variable winds/sudden wind shifts can lead to a crash during takeoffs, approaches, and landings. |
| 23a | Thunderstorm Hazards - Adverse Wind | thu01p26a.mp3 | The area along and immediately behind the gust front is particularly dangerous because this is where rapid and sometimes drastic changes in surface winds occur. |
| 24 | Thunderstorm Hazards - Downburst 1 | thu01p27.mp3 | Shower and thunderstorm cells sometimes produce intense downdrafts called downbursts that create strong, often damaging winds. Downbursts can create hazardous conditions for pilots and have been responsible for many low-level wind shear accidents. |
| 24a | Thunderstorm Hazards - Downburst 1 | thu01p27a.mp3 | A downburst is especially dangerous to airplanes when it is encountered when climbing from takeoff or approaching to land. |
| 25 | Thunderstorm Hazards - Downburst 2 | thu01p28.mp3 | A microburst is particularly dangerous during landing if the pilot has reduced power and lowered the nose in response to the headwind shear. |
| 25a | Thunderstorm Hazards - Downburst 2 | thu01p28a.mp3 | This leaves the aircraft in a nose-low, power-low configuration when the tailwind shear occurs, which makes recovery more difficult. It can cause the airplane to stall or land short of the runway. |
| 26 | Thunderstorm Hazards - Turbulence | thu01p29.mp3 | Turbulence is present in all thunderstorms. Severe or extreme turbulence is common. Gust loads can be severe enough to stall an aircraft at maneuvering speed or to cause structural damage at cruising speed. |
| 26a | Thunderstorm Hazards - Turbulence | thu01p29a.mp3 | Outside the cumulonimbus cloud, turbulence has been encountered several thousand feet above, and 20 miles laterally from, a severe storm. |
| 27 | Thunderstorm Hazards - Hail | thu01p30.mp3 | Hail is precipitation in the form of balls or other irregular lumps of ice produced by thunderstorms. An individual unit of hail is called a hailstone. Hailstones can range in size from a pea (0.25 inch diameter) to larger than a softball (4.5 inch diameter). |
| 27a | Thunderstorm Hazards - Hail | thu01p30a.mp3 | Hailstones that are 3/4 inch in diameter and larger can cause significant damage to aircraft and make it difficult to control. |
| 28 | Thunderstorm Hazards - Static Electricity | thu01p31.mp3 | Static electricity, a steady, high level of noise in radio receivers, is caused by intense corona discharges from sharp metallic points and edges of flying aircraft. It is encountered often in the vicinity of thunderstorms. When an aircraft flies through clouds, precipitation, it accumulates a charge of static electricity. |
| 29 | Thunderstorm Hazards - Tornado | thu01p32.mp3 | A tornado is a violently rotating column of air in contact with the ground, either pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud. An aircraft entering a tornado is almost certain to suffer structural damage. |
| 30 | Summary | thu01con.mp3 | In this lesson we have discussed the weather and aviation hazards associated with thunderstorms and microbursts, including: Types of Thunderstorms, Life Cycle of A Thunderstorm, and Microbursts. |

# Section 3: Thunderstorm Avoidance

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| **Seq** | **Page Name** | **Audio File** | **Audio Text EN** |
| 1 | Introduction | thu02intro.mp3 | In this lesson we will discuss: the hazards to flight operations that are associated with thunderstorms and some effective techniques (including use of airborne weather radar) for thunderstorm avoidance. |
| 2 | Thunderstorm Distances | thu02p01.mp3 | As a general rule of thumb, avoid thunderstorms by at least 10 nm when flying below the freezing level and 20 nm if above the freezing level. |
| 2a | Thunderstorm Distances | thu02p01a.mp3 | At all altitudes, and in particular above 20,000 ft, strong radar echoes should be avoided by 10 nm or more. In particular, prominent scallops and other protrusions on the radar image should be avoided by a minimum of 10 nm. |
| 2b | Thunderstorm Distances | thu02p01b.mp3 | When flying above 30,000 ft, maintain a distance of at least 20 nm keeping in mind that turbulence and icing can be found in the anvil up to 30 nm away. Additionally, hail may be thrown out down wind of the anvil and flying under it should be avoided. |
| 3 | Visual Cues | thu02p02.mp3 | When assessing how close to a thunderstorm an aircraft can safely fly, pilots can use visual cues such as lightning, presence of an anvil head and/or heavy precipitation to help determine the intensity of the storm. |
| 3a | Visual Cues | thu02p02a.mp3 | These conditions can indicate areas of moderate to severe turbulence and should be avoided by flight crews. |
| 4 | Airborne Weather Radar | thu02p03.mp3 | When properly used, airborne weather radar allows flight crews to avoid thunderstorms and associated weather (turbulence, lightning) at long range, at night and in cloud. |
| 5 | Radar Reflectivity | thu02p04.mp3 | Effective use of airborne weather radar requires that pilots are knowledgeable about the equipment and its limitations. |
| 5a | Radar Reflectivity | thu02p04a.mp3 | Radar energy returns from different precipitation types vary. Radar reflectivity is better when the precipitation is bigger and wetter (for example, heavy rain and wet hail) than when smaller and drier (ice crystals, dry snow). |
| 6 | Turbulence | thu02p05.mp3 | As mentioned, the greatest turbulence can be found within the storm in the shear between updrafts and downdrafts. Typically, these wind shears exist in areas where there is a high rainfall gradient. |
| 6a | Turbulence | thu02p05a.mp3 | Using radar properly, a high rainfall gradient is indicated by a large change between light rain to heavy rain in a very short distance. |
| 7 | Lightning Strike Avoidance | thu02p06.mp3 | Aircraft flying in the tops of cumulonimbus clouds in temperatures below -40°C are particularly prone to lightning strikes. Avoiding these conditions will mitigate the chances of a lightning strike. |
| 7a | Lightning Strike Avoidance | thu02p06a.mp3 | However, if flight into cumulus cloud is unavoidable, radar will aid in circumnavigation by indicating threatening areas or areas of high rainfall gradient. |
| 8 | U Or V Image | thu02p07.mp3 | Some basic radar patterns such as a U or V shape indicate severe weather conditions and need to be avoided by flight crews. |
| 8a | U Or V Image | thu02p07a.mp3 | These patterns indicate storms that have either dry air mixing in the middle altitudes, which can create an intrusion, or hail rising and descending within a thunderstorm. |
| 9 | Hook Or Finger | thu02p08.mp3 | Beware of any radar image with a hook or finger appearance. Hook and finger shapes are indicative of rotations taking place within severe thunderstorms. This is a strong clue that hail and tornadoes are possible. |
| 10 | Asymmetric Shapes | thu02p09.mp3 | As mentioned, some severe storms are created by strong winds aloft that tilt the thunderstorm to one side. The radar image of these storms is a non-concentric shape, asymmetric or arrow shaped. |
| 11 | Scalloped Edges | thu02p10.mp3 | Radar images with scalloped edges show turbulent motions taking place within the cloud. This or any target changing shape is a strong indicator of violent drafts and possibly hail. |
| 12 | Hail Formation | thu02p11.mp3 | Hail is most predominant during the mature stage of a storm. It is caused by falling rain that is caught in an updraft and carried above the freezing level. There, as a super-cooled water droplet it will continue to grow and finally freeze. |
| 12a | Hail Formation | thu02p11a.mp3 | The hail will continue to fall and coalesce with other super-cooled water droplets as it descends. Depending upon the size of the hail and the strength of the updrafts it will either fall to the earth or be caught in another updraft and repeat this process. |
| 13 | Hail Damage | thu02p12.mp3 | Hail is usually present within the storm cell at altitudes between 10,000 and 30,000 ft. |
| 13a | Hail Damage | thu02p12a.mp3 | On occasion, it is thrown out into the clear air ahead of the storm and beneath the anvil. Unless the hail is wet, it will not be readily detectable by radar. This image illustrates damage incurred following flight through hail. |
| 14 | Flying Above A Storm -1 | thu02p13.mp3 | When encountering thunderstorms there may be a temptation to avoid it by over-flying. This is not recommended as the aircraft may be in a regime where the maneuvering margins may be small and the aircraft will be prone to jet upset. |
| 15 | Flying Above A Storm -2 | thu02p14.mp3 | If over-flight is unavoidable keep in mind that thunderstorms grow rapidly, up to 7,000 ft/min. It is recommended to clear the thunderstorm by at least 1,000 ft for every 10 kt of wind and in no case less than 5,000 ft. |
| 16 | Flying Under A Storm | thu02p15.mp3 | Although turbulence will be most severe at the mid to upper levels of a thunderstorm, severe turbulence will also exist under the storm. |
| 16a | Flying Under A Storm | thu02p15a.mp3 | Downbursts and microbursts are an additional hazard under thunderstorms. Successful recovery from an encounter with a downburst or gust front penetration depends upon aircraft speed and altitude above terrain. Pilot recognition and recovery techniques are critical to a safe outcome. |
| 17 | DOES and DOESN'T | thu02p16.mp3 | There are 3 aspects to thunderstorms and their hazards: 1. Avoidance 2. Precautions 3. Recovery. |
| 18 | Thunderstorm Avoidance -1 | thu02p17.mp3 | We have seen through this lesson that the best measure against thunderstorms is avoidance. Use all available resources to determine the severity, size and direction of the thunderstorm. |
| 18a | Thunderstorm Avoidance -1 | thu02p17a.mp3 | Turning to deviate around the thunderstorm as soon as practical will reduce the total distance travelled once proceeding back on track. |
| 19 | Thunderstorm Avoidance -2 | thu02p18.mp3 | Golden Rules for thunderstorm avoidance: (1) Don't land or takeoff in the face of an approaching thunderstorm. A sudden gust front of low-level turbulence could cause loss of control. |
| 19a | Thunderstorm Avoidance -2 | thu02p18a.mp3 | (2) Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be hazardous. |
| 19b | Thunderstorm Avoidance -2 | thu02p18b.mp3 | (3) Don't attempt to fly under the anvil of a thunderstorm. There is a potential for severe and extreme clear air turbulence. |
| 20 | Thunderstorm Avoidance -3 | thu02p19.mp3 | (4) Don’t fly without airborne radar into a cloud mass containing scattered embedded thunderstorms.  (5) Don’t trust the visual appearance to be a reliable indicator of the turbulence inside a thunderstorm.  (6) Don’t assume that ATC will offer radar navigation guidance or deviations around thunderstorms. |
| 21 | Thunderstorm Avoidance -4 | thu02p20.mp3 | (1) Do listen to chatter on the ATC frequency for Pilot Weather Reports (PIREP) and other aircraft requesting to deviate or divert. (2) Do ask ATC for radar navigation guidance or to approve deviations around thunderstorms, if needed. |
| 21a | Thunderstorm Avoidance -4 | thu02p20a.mp3 | (3) Do advise ATC, when switched to another controller, that you are deviating for thunderstorms before accepting to rejoin the original route. |
| 21b | Thunderstorm Avoidance -4 | thu02p20b.mp3 | (4) Do ensure that after an authorized weather deviation, before accepting to rejoin the original route, that the route of flight is clear of thunderstorms. |
| 22 | Thunderstorm Precautions | thu02p21.mp3 | Dos Before Entering a Storm. If unable to avoid penetrating a thunderstorm: (1) Tighten the safety belt, put on the shoulder harness (if installed), and secure all loose objects. |
| 22a | Thunderstorm Precautions | thu02p21a.mp3 | (2) To avoid the most critical icing, establish a penetration altitude below the freezing level or above the level of -15ºC. |
| 22b | Thunderstorm Precautions | thu02p21b.mp3 | (3) Establish power settings for turbulence penetration airspeed recommended in the aircraft manual. |
| 23 | Thunderstorm Recovery | thu02p22.mp3 | Dos and Don'ts for Thunderstorm Penetration. (1) Do keep your eyes on the flight instruments. Looking outside the cockpit can increase danger of temporary blindness from lightning. |
| 23a | Thunderstorm Recovery | thu02p22a.mp3 | (2) Don't change power settings; maintain settings for the recommended turbulence penetration airspeed. |
| 23b | Thunderstorm Recovery | thu02p22b.mp3 | (3) Do maintain constant attitude. Allow the altitude and airspeed to fluctuate. |
| 23c | Thunderstorm Recovery | thu02p22c.mp3 | (4) Don't turn back once in the thunderstorm. A straight course through the storm most likely will get the aircraft out of the hazards most quickly. |
| 24 | Conclusion | thu02con.mp3 | In this lesson we have discussed: The Hazards To Flight Operations That Are Associated With Thunderstorms and some Effective Techniques (including use of Airborne Weather Radar) For Thunderstorm Avoidance. |

# Section 4: Thunderstorm Accidents

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| **Seq** | **Page Name** | **Audio File** | **Audio Text EN** |
| 1 | Case Study | thu03intro.mp3 | In this lesson we will discuss the circumstances surrounding the following accidents related to flight in or in the vicinity of thunderstorms: All Nippon Airways Flight 963. |
| 2 | Synopsis | thu03p01.mp3 | In 2019, an All Nippon Airways Boeing 787-8, took off from Tokyo International Airport for Beijing Capital International Airport as a scheduled flight 963. The aircraft shook while flying, and two passengers were seriously injured and two cabin crew members sustained minor injuries. |
| 3 | The Crew Is Aware of The Thunderstorm Over Destination | thu03p02.mp3 | There were 225 people on board the aircraft. The PIC and the FO were flying the aircraft while paying attention to the weather conditions because they confirmed the weather information before departure and knew that thunderstorm would occur around its scheduled arrival time around the destination. |
| 4 | Detour Weather -1 | thu03p03.mp3 | While the aircraft was cruising over the Inner Mongolia Autonomous Region of China, the crew confirmed with airborne weather radar and visual observation that there were locally developed cumulonimbus and strong echo en route from DABMA to SABEM. |
| 4a | Detour Weather -1 | thu03p03a.mp3 | The PIC decided to set the heading to 230° around UPNAT after obtaining a clearance from the ATC and fly avoiding the CBs to the south side. |
| 5 | Detour Weather-2 | thu03p04.mp3 | After changing its heading, the aircraft was flying in thin clouds spreading to the south of the CBs, but the airborne weather radar did not display any cloud echo on the course and there was no disturbance, therefore, the PIC flew the aircraft with the fasten seat belt sigh turned off. |
| 5a | Detour Weather-2 | thu03p04a.mp3 | After that, the aircraft started descending after receiving an instruction from the ATC to descend to 3,600 m. |
| 6 | Detour Weather-3 | thu03p05.mp3 | The aircraft made a right turn while continuing to descend because of having received from the ATC an instruction to change the heading to the right to go straight to GITUM and pass it at an altitude of 3,600 m in order to avoid flight restriction area. |
| 6a | Detour Weather-3 | thu03p05a.mp3 | When the Aircraft moved beneath the clouds during descent, the airborne weather radar did not display any cloud echo, but cumulus clouds were gathering down below, |
| 6b | Detour Weather-3 | thu03p05b.mp3 | therefore, the PIC informed the senior cabin crew member in the cockpit that the fasten seat belt sign would be turned on as shaking would be expected. |
| 7 | Detour Weather-4 | thu03p06.mp3 | After the senior cabin crew member left the cockpit, the PIC stopped temporarily descending and maintained level flight at an altitude of about 5,500 m between cloud layers in order to fly away from the cumulus clouds gathering down below. |
| 7a | Detour Weather-4 | thu03p06a.mp3 | However, judging that it would not be able to avoid the towering cloud top, the PIC turned on the fasten seat belt sign. The aircraft instantaneously shook violently when closely skimming the cumulus cloud top. |
| 8 | Encounter Turbulence -1 | thu03p07.mp3 | The fasten seat belt sign was turned on in the same time as the senior cabin crew member returned to the forward galley from the cockpit, and very soon the aircraft encountered intense turbulence. |
| 8a | Encounter Turbulence -1 | thu03p07a.mp3 | For this reason, the senior cabin crew member could neither inform other cabin crew members that the PIC told the fasten seat belt sign would be turned on as shaking was expected, nor make a PA announcement to alert the passengers. |
| 9 | Encounter Turbulence-2 | thu03p08.mp3 | When the fasten seat belt sign was turned on, Passenger A, who was in line for the restroom waiting and standing in front of the lavatory (L3), lost the balance, fell to the floor, and injured the right foot. |
| 9a | Encounter Turbulence-2 | thu03p08a.mp3 | In addition, the other Passenger B was sitting down in the lavatory (R4) suffered an injury to the loin as the upper body was strongly squeezed longitudinally. The aircraft continued to fly, and landed at Beijing uneventfully. |
| 10 | Encounter Turbulence-3 | thu03p09.mp3 | According to the aircraft’s QAR records the vertical acceleration was greatly fluctuated between +2.16 G and +0.37 G instantaneously for about two seconds. |
| 11 | Meteorological Information | thu03p10.mp3 | Based on the Meteorological Satellite Images announced by the Japan Meteorological Agency (JMA), the cumulus-like clouds swelling like a hump covered around the flight route. |
| 11a | Meteorological Information | thu03p10a.mp3 | In addition, according to the Convective Cloud Information, the area where the aircraft shook was near the rapidly developing cumulus areas including cumulonimbus area. |
| 12 | Analysis of Findings -1 | thu03p11.mp3 | It is highly probable that because the radar image displayed that there were vertically developed tall cumulus and high cloud top in the vicinity where the aircraft shook, these clouds were associated with vigorous convective activity. |
| 12a | Analysis of Findings -1 | thu03p11a.mp3 | It is probable that strong disturbance relating to the convective activity occurred near the cloud top of the cumulus where the aircraft closely skimmed. |
| 13 | Analysis of Findings -2 | thu03p12.mp3 | The aircraft changed its heading to fly avoiding the cumulonimbus; However, it is probable that because unexpectedly the aircraft received an instruction from the ATC to change the heading in order to avoid flight restriction area, it was not able to fly far enough away from the significant weather area. |
| 13a | Analysis of Findings -2 | thu03p12a.mp3 | For this reason, the PIC turned on the fasten seat belt sign without being able to give the cabin crew members and passengers ample notice about the expected shaking. |
| 14 | Lessons Learned | thu03p13.mp3 | When making requests to the ATC, pilots should confirm whether it is flyable route by providing the ATC with information as much detail as possible, such as the heading, the deviation from the planned route and the expected distance to proceed after the deviation required to avoid the weather, |
| 14a | Lessons Learned | thu03p13a.mp3 | which is useful to judge the timing or the necessity of whether to turn on the fasten seat belt sign and provide safety information to people in the cabin. |
| 15 | Safety Actions | thu03p14.mp3 | SAFETY ACTIONS (1) The Company shall provided the flight crew with the newly issued flight safety information in order to ensure that each crewmember knows the outline of the accident and understands how to respond to turbulence. |
| 15a | Safety Actions | thu03p14a.mp3 | (2) The Company revised Announcement Manual so that cabin crew members make a PA announcement to urge the passengers to go to the lavatory earlier in order sit in their seats 30 minutes before landing. |
| 16 | Case Study End | thu03con.mp3 | In this lesson we have discussed the circumstances surrounding the following accidents related to flight in or in the vicinity of thunderstorms: All Nippon Airways Flight 963. |