03 ENGINE FAILURE BETWEEN V_1 AND UP/RET MIN MAN

The Engine Failure Crew Co-ordination Procedure is based on the n-1 obstacle clearance calculation and consequently applies to the corresponding track and assumes an engine failure at V_1.

ENGINE FAILURE CREW CO-ORDINATION PROCEDURE

NOTE: In the next presentation, the standard response "CHECKED" is not reproduced. No distinction is made between MANUAL and AUTOMATIC flight mode of operation.

FLIGHT PHASE/EVENT		COMMANDS		ACTIONS and CALLS
Engine failure			PF	Keep straight maintaining push force on the control column.
VR			PNF PF	"ROTATE" Rotate in normal way.
When airborne			PF	Keep pitchbar centered.
Positive rate of climb	PF	"GEAR UP"	PNF F/E	Comply. Wing anti-ice ON if required.
When aircraft is under control	CAPT	"TAKE ACTION"	F/E PNF	Perform memory items. Monitor F/E's actions.
When a turn is required	PF	"SET BANK LIMIT 15" "SET HEADING ..."	PNF	"BANK LIMIT 15 SET" "HEADING ... SET"
At 1000 ft HAA min unless otherwise specified	PF	"SET ALTITUDE HOLD"	PNF	"ALTITUDE HOLD"
At Flap Zero speed	PF	"FLAPS ZERO"	PNF	Comply
At Slats RET speed	PF	"SLATS IN" "SET AIRSPEED HOLD"	PNF	Comply "AIRSPEED HOLD"
When Slats are in	PF	"SET MCT" "SET N_1"	PNF	"MCT SET" "N_1"
Clear of obstacles See NOTE	PF	"SET ALTITUDE HOLD"	PNF	"ALTITUDE HOLD"
At UP/RET MIN MAN	PF	"SET AIRSPEED HOLD" -or- "SET SPEED MODE"	PNF	"AIRSPEED HOLD" -or- "SPEED"
If applicable	PF	"SET BANK LIMIT 25"	PNF	"BANK LIMIT 25 SET"
	CAPT PF	"EMERGENCY CHECKLIST" "AFTER TAKE-OFF CHECKLIST"	F/E	Comply

NOTE: Minimum 1500 ft HAA. Unless visual reference is available, or if dictated otherwise by special procedure, at least climb to the MSA or if applicable, to the ESA, MEA, MOCA or MORA.

03 EVACUATION PROCEDURE OPERATING COCKPIT CREW

General

- When cockpit task completed, take flashlight along when applicable. On water, put on life vest, board slide/raft with shoes off.
- When the slide/rafts are needed as shelter (desert, jungle) they should be disconnected from the aircraft when the captain considers it safe to re-enter the aircraft. Refer to AOM 4.2.2 - Post Evacuation.
  However, when during evacuation fire is observed, as many slides as possible should be disconnected from the aircraft before leaving the aircraft.
  On leaving the aircraft pull disengage handle and jump into the slide.

Flight Engineer

- Proceed to cabin area doors 11-21, and assist evacuation.
- When evacuation completed:
  . Check front area and leave aircraft at door 21, if possible.
  . On water: board at door 21.
- If door 21 is assigned to a cabin attendant, immediately after cockpit task is completed, leave aircraft and look after the passengers or in case of landing on water board the slide/raft.

First Officer

- Proceed to cabin area doors 13-23, and assist evacuation.
- When evacuation is completed:
  . Check area and leave aircraft.
  . On water: board slide/raft at door 13.

Captain

- Proceed to cabin area doors 11-21.
- Evaluate situation.
  Perform the final cabin check, proceeding to doors 14-24 to ensure that all occupants have evacuated.
- Check that the radio survival beacon at position 24 has been taken away.
- Leave aircraft:
  . On water: board slide/raft 24.

04 ADDITIONAL COCKPIT CREW

- Terrain:
  . Leave aircraft and assist at bottom of slide(s).
- Water:
  . Put on life vest and board slide/raft (shoes off).

FLIGHT CREW REFERENCE GUIDE(FCRG)抜粋

(V₁及びVRに関する主要な記述)

1.1.2. TAKE-OFF SPEEDS

01. SPEED SUMMARY AND DEFINITIONS

:

- V_1 : Speed at which the pilot can make a decision, following failure of critical engine:
  - . either to continue take-off within limits of available take-off length
  - . or to stop the aircraft within limits of available runway length
- V_R : Speed at which rotation is initiated to reach V2 at an altitude of 35 feet

04. TAKE-OFF DECISION SPEED, V1

This speed is used to identify the power failure point at which, for the purpose of determining the required runway length, sudden and total power lost of the critical engine is assumed to occur.

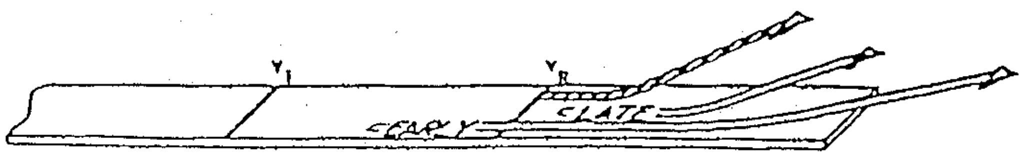
In actual operation this speed is used as a "go" or "no go" parameter.

05. ROTATION SPEED, V_R

V_R is the speed at which rotation to the lift-off attitude is to be initiated.

If the rotation is too late and/or too little, the aircraft will pass low over the end of the runway at a speed in excess of V_2.

If the rotation is too early and/or too much, drag is increased and acceleration will be affected unfavourable, so that also in this case the aircraft will pass low over the end of the runway. In both cases potential performance may be wasted to such an extent that safety is impaired.



AIRPLANE FLIGHT MANUAL抜粋

（V_1及びV_Rに関する主要な記述）

SECTION Ⅳ PAGE1．2

Takeoff Decision Speed, V_1

The takeoff decision speed, V_1, is the speed which the pilot uses as a reference in deciding whether to continue the takeoff or to abort.

The V_1 speeds given in the FAA Approved Airplane Flight Manual are selected such that: (1) if an engine failure is recognized at or above the V_1 speed, the takeoff may be continued, with one engine inoperative, to a 35-foot height; or, (2) if an engine failure is recognized at or below the V_1 speed, a stop may be made in the available accelerate-stop distance on a dry hard surfaced runway without the aid of reverse thrust; and without, in either case, exceeding the takeoff field length. The takeoff field lengths are based on stopping if the engine failure is recognized below V_1 and on continuing if the engine failure is recognized above V_1.

SECTION Ⅳ PAGE1．3

Takeoff Rotation Speed, V_R

The rotation speed, V_R, is the speed at which the pilot begins to rotate the airplane to the lift-off attitude.

The criteria used in establishing the rotation speed are as follows:

1. The V_R speed is a speed that is at least equal to the ground minimum control speed, $V_{MC\ G}$, and at least 5 percent above the air minimum control speed, $V_{MC\ A}$.

2. The V_R speed is a speed such that, with normal piloting technique, its use will result in the attainment of the V_2 speed at or below the 35 foot point.

3. The V_R speed is a speed such that, with normal piloting technique, its use will result in attainment of the required lift-off speed at or prior to airplane lift-off.

4. The V_R speed is a speed which will not result in increasing the takeoff distance if rotation is commenced 5 knots lower than the established V_R during one-engine-inoperative acceleration or 10 knots lower than the established V_R during all-engine-acceleration.

1/2

（離陸中のエンジン故障に関する記述）

SECTION Ⅳ PAGE2．0／2．1

Engine Failure During Takeoff

An engine failure light is provided to indicate an engine failure during takeoff. With engine failure lights operative the performance in this manual is based on the pilot initiating rejected takeoff procedures within 1 second after illumination of the engine failure light. The takeoff is rejected if failure is recognized prior to V_1 and is continued if failure is recognized after V_1. The rejected takeoff technique is: engine thrust to idle while simultaneously applying maximum anti-skid braking (full pedal deflection) and immediately extending the spoilers (auto spoilers may be used). The stopping performance used in determining the field lengths is based on a dry hard surfaced runway with no reverse thrust. Although not accounted for in the calculated performance, maximum reverse thrust should be used as quickly as possible after initiation of the abort procedure.

With engine failure at or after V_1, the nose wheel is maintained in contact with the ground until V_R is attained, at which point a smooth, steady rotation to the attitude for climbout is initiated. Liftoff will occur in approximately 4 seconds at a pitch attitude of about 12° to 14°. After liftoff a smooth rotation should be continued to the pitch attitude required to achieve V_2. A pitch attitude of between 13° and 20° will be required to maintain V_2, depending on gross weight and climb gradient. Minor variations in pitch attitude may be required to achieve the initial climb speed. During rotation the normal increase in indicated airspeed will slow due to static position error effect.

If an engine failure occurs after V_1 but not above V_2, maintain V_2 up to the altitude for level flight acceleration or to a height required for obstacle clearance (whichever is appropriate). If an engine failure occurs after V_2, maintaining the speed attained at time of failure but not more than V_2+10 knots up to the altitude for level flight acceleration or to a height required for obstacle clearance (whichever is appropriate) will result in improved aircraft performance and control. If an engine failure occurs at a speed higher than V_2+10 knots with flaps at the takeoff setting at a height lower than the altitude for level flight acceleration, reduce speed to V_2+10 knots until clear of obstacles. If the speed of V_2+10 knots has been exceeded, obstacle clearance may be impaired.

Landing gear retraction is initiated within 3 seconds after liftoff.

FLIGHT ATTENDANT MANUAL抜粋

Garuda Indonesia

RECURRENT TRAINING SYLLABUS FOR GARUDA
(REC. 1 : B 737-300/400, A 300-B4/600/330)
(REC.2 : DC 10, MD 11, B 747-200/400)

DAY - 1 OF 1

REVIEW

01. GENERAL SAFETY — 08.00 - 10.00

- Procedures
- Rules and Regulations
- Emergency Equipment
- First Aid
- Aviation Security
- Dangerous Goods

02. AIRCRAFT SPECIFICATION — 10.00 - 12.00

- General
- Exits
- Slide/Raft
- Oxygen System
- Communication System
- Emergency Equipment Location
- Lighting System
- Emergency Procedures
- Evacuation Procedures

LUNCH BREAK — 12.00 - 13.00

COMPETENCE EXAM — 13.00 - 14.00

02. PRACTICAL DRILL — 14.00 - 16.00

- Door Drill : - Preflight
  - Operation
- CPR (Cardio Pulmonary Resuscitation)
- Emergency Equipments
- Emergency/Evacuation

ALL OPERATORS WIRE(AOW)

June 16, 1994 No Export License Required

To: All CF6-50 Operators

Copy: All CF6-50 Reps
All Other Reps Information Only

Message No.: 94-50-07

Subject: CF6-50 Stage 1 HPT Blade

The purpose of this wire is to advise you that GE is recommending the retirement of high-cycle CF6-50 stage 1 Product Improvement Program (PIP) HPT blades (9299M30GXX other than G11 configuration). The purpose of this recommendation is to help you avoid future higher maintenance costs. Also, we would like to request your retirement plans for these parts to ensure that we can adequately support your future blade requirements.

Enhancements to the CF6-50 HPT stage 1 turbine blade, specifically the introduction of the PIP stage 1 turbine blades, have increased the life capability of the blade. The population of PIP blades now is beginning to age beyond this capability. As a result, plans need to be developed to retire older PIP blades before costly airfoil separations occur.

As the stage 1 blade ages, intergranular oxidation (IGO) attacks the internal passage walls. This IGO will result in cracking between the material's grain boundaries and eventually initiate high-cycle fatigue (HCF) cracking. The HCF will propagate along the airfoil walls until the airfoil separates from tensile overload. An improvement to the 9299M30G11 blade incorporates an internal aluminide coating that will protect the internal cooling passages from oxidation.

The IGO and airfoil separations are cyclic driven and occur between 4,400 and 6,500 cycles. GE feels a 6,000 CSN should be considered in a control program for blade retirement. There is a large number of blades that are in, or soon will be in, this cyclic range. The IGO condition cannot be determined by nondestructive inspections. Recommendations for a retirement plan can be customized for your particular fleet through your ATPM. Once your retirement plan has been established, please advise us as soon as possible so we can ensure adequate support.

Thank you for your cooperation in this matter.

L. L. Grage
Director Customer Support
GE Aircraft Engines
LAJ

リージョナル・ミーティング資料抜粋

Age-Related Problems

CF6-50 HPT Stage 1 Blade

Conclusion

- Prevention of IGO caused blade separation requires establishment of soft-time retirement threshold

  - Incorporation of retirement threshold will reduce the occurrence of IFSD/high-cost engine events

    - Also help prevent T/E thermal fatigue events

PPT-85852-041196 (CF6AO)

Summary

- Overall CF6-50 PIP and -80A reliability continues to improve
  - Added value for CF6-50/-80A customers

- Soft-time management of blades will increase/ maintain reliability and value

- New design release in 1996 incorporates proven technology into CF6-50/-80A HPT stage 1 blade design

GEAE Continues Investment in CF6 Mature Products

Recommendation

- Retire CF6-50 HPT stage 1 blades (pre-P/N 9299M30G11) at approximately 6,000 cycles since new
  - Probability of having separation below 0.1%
  - Compromise between cost of replacing blades versus cost of blade separation

7　インドネシア共和国及びアメリカ合衆国からの意見

（注）

編集上の理由により、最終報告書のページ番号は、最終報告書案と一致するとは限らない。

インドネシア共和国からの意見

（日本語版は、インドネシア共和国ＡＡＩＣ作成）

KOMISI PENELITIAN PENYEBAB KECELAKAAN
PESAWAT UDARA
(AIRCRAFT ACCIDENT INVESTIGATION COMMISSION)

DEPARTEMEN PERHUBUNGAN
(DEPARTMENT OF COMMUNICATIONS)

MERPATI BUILDING, JL ANGKASA BLOK B 15 KV2-3, KEMAYORAN, JAKARTA 10720, INDONESIA.
PHONE 62 22 6540674 , FACSIMILE 62 22 654 0675

Dr. Kazuyuki Takeuchi
Chairman,
Aircraft Accident Investigation Commission
Ministry of Transport
2-1-3 Kasumigaseki
Chyoda-ku, Tokyo, 100 Japan.

Jakarta, November 10, 1997.

Dear Dr. Takeuchi,

The Indonesian Aircraft Accident Investigation Commission has carefully read the

FINAL DRAFT AIRCRAFT ACCIDENT INVESTIGATION REPORT
September , 1997

of the Garuda Indonesia DC-10-30 accident at the Fukuoka Airport, June 13, 1996.

The Indonesian Aircraft Accident Investigation Commission is of the opinion that you have made a very thorough and comprehensive evaluation of the possible causes of the accident, and we congratulate you for the professional approach evident in your report.

The Indonesian Aircraft Accident Investigation Commission's comments on the Final Draft Aircraft Accident Investigation Report above, is as follows:

1 p.60 Chapter 4 Causes.

Quote:
It is estimated that contributing to the rejection of the take-off under this circumstance was the fact that the CAP's judgement in the event of the engine failure was inadequate.

Comment:

According to the Appendix. Format of the Final Report of the ICAO Annex 13 quote 3. Conclusions. List the findings and causes established in the investigation. The list of causes should include both the immediate and the deeper systemic causes unquote.

The final draft of the aircraft accident investigation reports a single cause of the accident, which is not according to the standards and recommended practice as stated above.

In accordance to above mentioned Appendix of ICAO Annex 13, the Indonesian Aircraft Accident Investigation Commission emphasizes that an accident is usually caused by more than one factor or cause. It is considered that an accident is usually caused by a chain of cascading failures, either human, technical or environmental, all contributing and eventually accumulating in the inevitability of an accident. If this is true, and looking at so many clues of failures in the Garuda accident at Fukuoka, such as indications of engine failure and unbalanced fuel during rotation occurring at approximately the same time, the issue of flight crew decision-making process resulting in the act to abort take-off, the perceived danger or unusual flight situation right after experiencing a sudden noise (a thud, or a *dun*-like sound), etc. etc., all these single factors may contribute, aggregate and culminate to the occurrence of the accident.

2 p.6, Para 2.1.2. Flight history until DFDR and CVR stopped.

Quote:
"About 1135 The CAP carried out a pre-departure crew briefing, which included briefing an emergency procedure".

Comment:
For the purpose of clarity, it is suggested to explain in detail what is meant by *pre-departure crew briefing* and *emergency procedure.*

3 p.18, Para 2.6.4. Fuel and Lubricating Oil.

Comment:
There is some factual evidence indicating the possibility of a fuel unbalance after the refueling process was completed, and this possibility was not further investigated in the final draft report.

The following table is based on cockpit fuel indicators readings:

FUEL STATUS BASED ON COCKPIT INDICATORS	FUEL TANK #1	FUEL TANK #2	FUEL TANK #3
PLANNED FUEL ORDERED	17,800	26,400	17,800
ACTUAL FUEL AFTER REFUELING	15,750	28,750	17,800
FUEL INDICATORS OF F/E PANEL	17,000	28,000	17,000

Further more, according to the Aircraft Flight Logbook records, the fuel quantity indicators were not reliable. On June 11, 1996, it was recorded that the #1 fuel quantity indicator was *unserviceable,* while on June 12, 1996, it was recorded that the #2 fuel quantity indicator was considered *unreliable.* It is worth mentioning that several complaints concerning the unreliability of the fuel quantity indicators were recorded in the Maintenance Log Book

From the Cockpit Voice Recorder it was also found that the time needed to balance fuel is 65 seconds. A simulation on a DC-10 ground simulator resulted that the process to balance by transferring fuel took approximately 3 (three) minutes to finish. This indicated that there is some uncertainty in the outcome of the fuel balance process, and if this is the case, Garuda procedures required a drip stick check.

The Indonesian Aircraft Accident Investigation Commission would like to include an analysis concerning the effect of this fuel unbalance as a possible contributing factor in the accident.

4 p.20, Para 2.11.2 DFDR recording

Quote:
Information recorded on the DFDR between 1207:53 and 1207.56 were unusable.

Comment:
The Indonesian Aircraft Accident Investigation Commission is concerned about the possibility of important information lost by not recovering some or more data. There are methods known to recover data by special manipulations. It is suggested that the utmost should be done to recover the data, and in this particular case, especially the final moments before the aircraft hit obstacles and the post impact fire.

5 p.36, Para 2.14 Test and research to find facts.

Comment:
On page 9, in his statement, the CAP mentioned that quote *while the aircraft was not positively climbing up with the pitch attitude being ten or more degrees nose up, the airspeed abruptly began to decrease by 3 to 6 knots. At the same time, I seemed to involuntarily make the aircraft pitch down. I heard a sound such as "dun", and I felt a thrust loss. As I instinctively sensed that if the aircraft continued the take-off, it would collide with neighboring buildings, I made a decision to abort the take off, pushed the control column, applied maximum braking and deployed full reverse thrust* unquote.

Comparing this statement with the DFDR results, there seems to be a discrepancy in DFDR speed data and the pilot's observations. The Indonesian Aircraft Accident Investigation Commission is of the opinion that a test-bench check on the airspeed indicators is necessary to ascertain that it was working normally at the time of the accident.

The Commission deemed necessary to study the human factors aspects to understand the reasons why the CAP took the decision to abort take-off.

In Para 2.14 no mention was found about the behavior of the CWS switch. In page 45 it was stated that there are indications that the CWS was not working properly. It is therefore appropriate to test-bench the CWS system and the results of said test to be included in the final draft report.

6 p. 46, Para 3.2.1.1 Flight sequence before the occurrence of the #3 engine failure.

Quote:
As it is likely that the aircraft was performing the take-off roll to the left of the runway centerline, it is considered that the aircraft was being rolled slightly left wing low during the low speed phase of the take-off roll, and that right rudder would have been applied to prevent the aircraft nose from veering to the left because of the runway lateral slope from the centerline to the left edge of the runway.

Comment:

This statement is not consistent with the statement on page 6, which is quote *the aircraft was aligned almost with the runway center line unquote.*

It is considered that the above statement is an opinion, hypothesis or assumption, it is not an actual and observed fact. The Commission is of the opinion that the analysis on page 46 should be based upon factual information on page 6.

The Indonesian Aircraft Accident Investigation Commission considered above statement not to be valid.

7 p.49 Para 3.2.3.1. Flight aspect until the take-off was aborted.

Quote:
.... *(1) Except for the failure of the No.3 engine, there were no other anomalies which contributed to the accident ....*

Comment:
The Indonesian Aircraft Accident Investigation Commission points out that there are other anomalies that is not reported in the investigation and the final draft report, i.e. the question of fuel unbalance, the question of the improper behavior of the CWS switch, the fact of a number of right rudder applications during the take-off run, etcetera, etcetera.

In particular the Indonesian Aircraft Accident Investigation Commission points out that in the statement of the Flight Engineer a possible serious problem was mentioned, i.e. quote *Immediately after the Vee one call, as I acknowledged the drops of N1, N2 and EGT on the No.3 engine, I called 'Engine Failure', immediately followed by 'Number one'. I intended to call 'Number three' but called 'Number one'. At that time, the Captain called 'Unable control'* unquote.

This indicates that there is at least one other problem than engine failure.

The Indonesian Aircraft Accident Investigation Commission requests to the Japan Aircraft Accident Investigation Commission to include and analyze all possible anomalies that might contribute to the accident individually, or cumulatively.

In particular, the Commission strongly suggest that a human factor aspect analysis of the Captain's decision making process should be included in the final report. Note that the Captain's decision to abort the take-off was based on his judgment about an abnormality quote *I felt something unusual because the aircraft would not become positively airborne .... if the aircraft continued the takeoff, it would collide with neighboring buildings, I made a decision to abort the take-off* unquote.

This abnormality was mentioned in the Flight Engineers statement quote *At that time, the Captain called 'Unable control'* unquote.

8 p.57 <u>Para 3.6.1 Emergency evacuation training for flight crew.</u>

<u>Quote:</u>
There were no rules for evacuation training for flight crew in the Garuda's FCTM (Flight Crew Training Manual), and thus it was not possible to determine the training syllabuses and training records.

<u>Comment</u>:
During the meeting on August 28, 1997, the Indonesian Aircraft Accident Investigation Commission submitted several pages concerning the syllabi for flight crew emergency evacuation training in Garuda Indonesia. The Commission considered the importance of including a review of the available records in the final draft.

Dear Dr. Takeuchi,

We finally would like to commend you for the thorough and comprehensive way you have conducted the investigation. We do think that the investigation will be very useful in helping us to understand the what, the how, and the why the accident happened. And in understanding the what, the how, and the why, I am sure that you have contributed to our common aim to prevent accidents to happen in the future.

Thank you very much for your kind attention,

Yours sincerely, .

Prof Oetarjo Diran
Chairman
Indonesian Aircraft Accident Investigation Commission

Attachment:
The Japanese translation of this document.

Attachment:

運輸省 航空事故調査委員会
委員長　竹内 和之 殿

1997 年 11 月 10 日

インドネシア航空事故調査委員会(Indonesian Aircraft Accident Investigation Commission)は、 1996 年 6 月 13 日、福岡空港において発生したガルーダ・インドネシア航空 DC-10-30 型機航空事故報告書（最終報告書案）(1997 年 9 月) を精読いたしました。

我々は、貴委員会が事故の推定原因の解明のために広範囲にわたる包括的な調査、また専門的観点からの調査をされたと理解しています。

この航空機事故調査報告書(最終報告書案) に対し、インドネシア航空事故調査委員会のコメントを以下に示します。

1. 本文 55 ページ 4 章
   原因

   「離陸を中断したことは、機長のエンジン故障の際の状況判断が的確でなかったものと推定される。」

   コメント： ICAO ANNEX 13 の付属書によれば、事故原因については、「調査において認定された調査結果と原因を列挙する。原因の列挙は、直接的なものと、より掘り下げたシステム的なものとの両方を含むべきである。」とされています。

   最終報告書案は、一つの原因しか挙げておらず ICAO 基準に準じていません。

   ICAO ANNEX 13 で述べられているように、我々は、航空機事故というものは複数の要因や原因により引起こされるものであることを強調したいと思います。通常、事故は人的、技術的或いは環境上の要因が連鎖して不可避的に起こるものです。この視点にたち、かつエンジン故障や搭載燃料のアンバランスのような多くの不具合が機首引き起こしとほぼ同時に発生した事実をみれば、突然の異常音(ドス! 又はドン　というような音) を聞いた直後に危険や異常な飛行状態を認識して離陸を中断することを決断した乗務員の意思決定プロセスより考えて、これら全

ての要因が個々に、或いは全体として事故の発生に繋がった可能性があるのではないかと考えられます。

2. 本文５ページ 2.1.2 項
DFDR および CVR が停止するまでの「飛行経過」について

「11 時 35 分頃、機長はテイクオフ・ブリーフィング及びエマージェンシ・プロシジャーのブリーフィングを行った」

コメント： 意味を明らかにするために、貴委員会が「出発前と緊急時のブリーフィング」と言われるものの内容を説明することを提案いたします。

3. 本文 16 ページ 2.6.4 項
燃料と潤滑油について

コメント： 我々は燃料補給後、燃料搭載料にアンバランスがあったことを示すいくつかの証拠があると思います。しかし、貴委員会の報告書案ではこの疑問点については検討がなされていません。

以下の表は操縦室内の燃料計の表示に基づく数値です：

操縦室内燃料計による燃料の状態	燃料タンク#1	燃料タンク#2	燃料タンク#3
計画搭載燃料値	17800	26400	17800
実際の搭載燃料値	15750	28750	17800
航空機関士席燃料計表示値	17000	28000	17000

更に、航空日誌の記録によれば、燃料計は不正確でした。1996 年 6 月 11 日に、#1 タンクの燃料計が使用不能と記録されています。同時に、1996 年 6 月 12 日、#2 タンクの燃料計が不正確と思われるとの記録があります。この燃料計の信頼性についていくつかのクレームが申立てられたことが整備記録に残されていたことは注目に値するものです。

ボイスレコーダー(CVR) によると、燃料バランスをとるために 65 秒必要とされたことが明らかになっています。我々は DC-10 のシュミレーターを使用してシュミレーションを試みました。その結果、燃料を転送してバランスを取り終わるの

に、およそ 3 分を要することが明らかになりました。このことは、燃料バランスを取ったにもかかわらず、その結果が若干正確にはなり得なかった可能性を示しています。このような状況の場合には、ガルーダ航空では、ドリップスティック・チェックが要求されています。

この燃料のアンバランスが事故に影響した可能性について分析をお願いしたいと思います。

4. 本文 19 ページ 2.11.2 項
DFDR 記録

「12 時 07 分 53 秒ごろから同 56 秒ごろまでのデータは使用不能であった」

コメント： 我々は、復元不能のために多くの重要な情報が見過ごされてしまうことを危惧しています。特殊な操作によってデータを復元する方法もあります。特に、本件事故では、航空機が障害物に衝突する直前から衝突後の火災発生までのデータの復元に最大限の努力が行われるべきことを提案します。

5. 本文 35 ページ 2.14 項
事実認定のためのテストと研究

コメント：9 ページに、機長は「10 度あるいはもう少し機首上げで、機体が Positive up をしないでいる時、突然速度が 3-6kt 減少した。無意識ではあったが、その時機首を下げたように思う。「Dun」というような音を聞いた。また、推力の低下を感じた。直感的に、離陸を継続すれば、周囲の障害物や建築物にぶつかると考え、離陸中止を決断し、機首を下げ、フル・ブレーキを踏み、フル・リバースをかけた。」と供述しています。

この供述を DFDR 結果と比較すると、DFDR のスピードデータとパイロットが認識した値との間に矛盾があるように思われます。我々は事故当時対気速度計が正常に作動していたことを確認するためのベンチテストが必要であると考えます。

我々は、機長がなぜ離陸中断の決定をしたかについて、その時の具体的な状況を前提とした決断の可否といった、ヒューマンファクターの観点からの調査が不可欠と考えています。

2.14 では、CWS スイッチの作動についても記述がありません。41 ページでは、

CWS が正常に作動していなかったことを示すものがあると記述されています。そのため、貴委員会が、CWS システムのベンチテストを行い、その結果を最終報告書に記述されるのが適当と考えます。

6. 本文 41 ページ 3.2.1.1 項
3 番エンジン不作動と飛行の経過

「同機は、滑走路中心線の左寄りを走行していた可能性があり、離陸滑走中、低速段階で機体がわずかに左に傾き、滑走路中心線左側の下り勾配により機首が左に取られないように、方向舵が右に操作されていたものと考えられる。」

コメント： 上記の内容は 6 ページの「航空機はほぼ滑走路に正対した」という事実認定と矛盾しています。上記の見解は意見または仮説・仮定であり事実ではなく、裏付けもありません。我々は、41 ページの解析は 6 ページの事実認定に基づくべきであると考えます。従って我々は 41 ページの内容は正しくないと考えています。

7. 本文 45 ページ 3.2.3.1 項
離陸中止までの状況

「. . . (1) 3 番エンジンの故障を除いて、事故に関連する不具合はなかった . . . 。」

コメント： 報告書案や調査の中に、他の（3 番エンジン以外の）異常な事実への言及が行われていないことを指摘しておきます。具体的には、搭載燃料のアンバランスに関する疑問、CWS スイッチの異常な作動の問題、離陸滑走中の右方向舵の操作の繰り返しなどです。特に航空機関士の供述「V1 コールの直後に No.3 エンジンの N1、N2、EGT の指示が低下したので、「Engine failure」とコールし、直後に「Number one」とコールした。「Number three」とコールするつもりであったが、「Number one」とコールした。そのとき機長が「Unable control」とコールした。」に注目すべきと考えます。

このことは、エンジン故障以外に、他の問題があったことを示しています。我々は貴委員会に対して、本件事故に個別または重複して影響を与えたであろうと思われるすべての不具合について解析がなされるよう要求します。

特に強く我々が要求する点は、機長の離陸中断の判断についてヒューマンファクターの観点からの解析が最終報告書に含まれるべきであるということです。機長は「何か通常と異なるものを感じた。なぜならば機体が浮揚しなかったからである。 .... 直感的に離陸を継続すれば、周囲の障害物や建築物にぶつかると考え、離陸中止を決断した。」と供述しているように、何らかの異常な状態に基づいて離陸中断の判断をしたという点に着目すべきです。

航空機関士の「その時、機長が "Unable control" とコールした」との供述がこの異常事態を示しているのです。

8. 本文 51 ページ 3.6.1 項
運航乗務員の緊急脱出訓練

> 「ガルーダ・インドネシア航空の FCTM (Flight Crew Training Manual) には、定期的な脱出訓練についての定めがなく、訓練内容及び実績を明らかにすることは出来なかった。」

コメント： '97 年 8 月 28 日の貴委員会との会議において、ガルーダ航空の運航乗務員脱出訓練マニュアルの一部を提出しました。我々は貴委員会が再度記録を確認されることを希望いたします。

竹内委員長 殿

最後に、我々は貴委員会が行った徹底的、包括的な調査に対して称賛の意を表したいと思います。この調査が私たちにとって、何が、どの様にして、そしてなぜこの事故が発生したのかを理解する上で大きな助けになるものと考えています。また何が、如何にして、そして何故、を理解する中で、あなた方は私たちの共通の目的である、将来の事故の防止に寄与するものと確信しています。

ご厚情に感謝いたします。

インドネシア航空事故調査委員会委員長
Oetarjo Diran

アメリカ合衆国からの意見

National Transportation Safety Board

Washington, DC 20594

1967 ~ 30 Years of Transportation Safety ~ 1997

November 9, 1997

Mr. Atsuhiko Wataki
Investigator in-Charge
Aircraft Accident Investigation Commission
Ministry of Transport
2-1-3 Kasumigasoki,
Chiyoda-Ku, Tokoyo 100, Japan

Dear Mr. Wataki,

Thank you for the opportunity to comment on the Final Draft report of the Garuda DC-10 accident, PK-GIE, June 13, 1996, Fukuoka Airport, Fukuoka, Japan. Although the initial letter stating the draft reports would be sent that day was dated September 12, 1997, we also received a revision letter from you dated October 16, 1997 which informed us of the changes incorporating comments from the General Electric representative, Mr. Robert Green. As of this time, we have not had any comments from the Flight Safety department of the Douglas Product Division.

Copies of the Final Draft report were reviewed by members of the U.S. team, to include NTSB and FAA personnel, and representatives from Douglas (Boeing) and General Electric. We appreciate that copies of the report were sent to us in both Japanese and English.

It is obvious from thoroughness of the report that a great deal of effort went into the investigation. Although we find no areas of disagreement, one area that was not explained pertains to the galley equipment. Other aircraft accident investigations that involved higher impact forces have not had galley equipment found spilled into the aisles like what was found in this aircraft. Although it did not appear to prevent any of the passengers from escaping from the aircraft (except for the flight crew who had to use the cockpit window exits), we found no explanation for why this equipment was not held in place by the galley locks.

The report does document the exit usage very well. A review of those numbers showed that the "flow control" of passengers to exits resulted in unequal use of exits.

Another thing that may also be useful would be information about the R4 door. It's arm/disarm lever was in the disarm position and the door was found slightly open.

The Safety Recommendations presented in Paragraph 5 of the final draft report appear to fully comply with the ICAO 13 (3.1) Objectives of the Investigation. These recommendations send an important message and should serve to promote the prevention of accidents and incidents throughout the world of civil aviation.

Although I was not able to be on hand during your teams visit to the US in January and February, it is obvious from the report that the work they accomplished made for a better and more through report.

With professional regards,

Alfred W. Dickinson
U.S. Accredited Representative