RAPPORT FINAL

ÉTUDE D'IMPACT SUR LE MILIEU SOCIAL ET L'ENVIRONNEMENT DE L'ÉRECTION D'UNE CLÔTURE CEINTURANT LE COMPLEXE AÉROPORTUAIRE DE KUUJJUAQ ET DE LA CONSTRUCTION D'UNE ROUTE DONNANT ACCÈS AU "RANGE"

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SOUMIS AU MINISTÈRE DES TRANSPORTS DU CANADA

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Introduction

Dans le cadre du programme de planification de l'Administration canadienne du transport aérien (ACTA), Transports Canada s'est donné comme tâche première d'élaborer un plan directeur pour chaque aéroport qui lui appartient ou qu'il exploite.

Le plan directeur de l'aéroport de Kuujjuaq propose un plan de travail visant à réaliser les projections établies jusqu'à l'an 2003 et même au-delà. Il se veut un guide souple traçant les lignes directrices et suggérant des projets de développement qui devront être soigneusement analysés au fur et à mesure. Le plan directeur propose un projet à trois volets. Il s'agit, dans un premier temps, d'ériger une clôture qui ceinturerait tout le complexe aéroportuaire; dans un deuxième temps, de construire une route qui borderait la piste 08-26 au sud et au sud-est laissant ainsi libre accès aux terres connues sous le nom de "range"; dans un troisième temps, d'acquérir des terrains pour satisfaire aux besoins de Transports Canada.

Dans le rapport préliminaire d'étude d'impact de ce projet, soumis à la fin mars, les Inuit proposaient en contrepartie l'érection de sections de clôtures à cinq endroits jugés stratégiques, la réparation d'une route longeant la rivière Koksoak et son prolongement le long de la piste 08-26. Ils s'opposaient cependant à l'acquisition de terres de la catégorie 1 par Transports Canada mais offraient de louer les parcelles de terrains requises par le ministère.

Le rapport préliminaire montrait également des divergences de vues quant à la situation. Transports Canada croyait avoir reçu, tant de la municipalité que de la corporation foncière, l'autorisation d'ériger une clôture d'enceinte. Les Inuit soutenaient qu'ils n'avaient jamais accordé cette autorisation. Transports Canada ne se tenait responsable que de la partie de la route bordant la piste 08-26; les Inuit prétendaient que lui incombait la responsabilité de toute la route, à partir des réservoirs de la Société Shell jusqu'au "range".

Pour concilier ces divergences de vues, le rapport recommandait la tenue d'une réunion à Kuujjuaq réunissant les responsables de Transports Canada et les membres de la collectivité. Une réunion fut convoquée pour le 17 avril 1985 à 14:00 heures. Elle réunissait les représentants de toutes les parties: Transports Canada, Nordair, Johnny May Air Service, la corporation foncière et la municipalité.

Le présent rapport vient compléter le rapport préliminaire et forme le rapport final de cette étude des répercussions sur le milieu social et l'environnement. La section "Méthodologie", explique les démarches entreprises depuis la remise du rapport préliminaire jusqu'à la tenue de la réunion à Kuujjuaq. La section "Réunion à Kuujjuaq" présente le procès-verbal de la réunion à Kuujjuaq. La troisième section rapporte les mesures correctives discutées et acceptées par les deux parties. Enfin, la conclusion résume la situation, et indique les points en suspens.

MÉTHODOLOGIE

Le rapport préliminaire a été expédié à Transports Canada, à la municipalité et à la corporation foncière. Transports Canada après avoir étudié le rapport et consulté les transporteurs, nous a fait savoir qu'il ne pouvait accepter les propositions des Inuit. Une réunion, rassemblant tous les intéressés, s'imposait donc dans les plus brefs délais.

Nous nous sommes chargés de communiquer avec la municipalité et la corporation foncière afin de fixer une date pour cette réunion. De son côté, Robert Francis, de Transports Canada, communiquait avec les transporteurs. La journée du 17 avril convenait à tous et la réunion fut organisée à Kuujjuaq pour la dite date.

Entre-temps, la corporation foncière et la municipalité examinaient elles aussi le rapport préliminaire. Elles n'apportèrent toutefois aucuns commentaires.

Les notes prises lors de la réunion en vue de la rédaction du procès-verbal allaient constituer l'essentiel du présent rapport car aucun travail supplémentaire n'avait été prévu, que ce soit à Kuujjuak, à Transports Canada ou ailleurs. En fait, la réunion fut la seule démarche ayant suivi le rapport préliminaire; elle a permis de compléter celui-ci pour qu'il tienne lieu de rapport final.

LA RÉUNION À KUUJJUAQ

Cette réunion rassemblait dix-sept (17) personnes représentant toutes les parties intéressées : plusieurs services de Transports Canada, Nordair, Johnny May Air Service, la corporation foncière et la municipalité. Ce fut une réunion d'échange d'information et surtout de prise de décisions.

D'entrée de jeu, Transports Canada insista sur la sécurité à l'aéroport de Kuujjuaq. Le nombre de véhicules de tous genres s'accroît rapidement et plus particulièrement les véhicules tous-terrains présentent un double danger pour les aéronefs. Premièrement, ils empruntent l'une ou l'autre des deux pistes à leur convenance et les sillonnent en tous sens, ce qui présente un danger évident pour les appareils qui s'apprêtent à atterrir ou à décoller. Deuxièmement, la présence de ces véhicules peut interférer le fonctionnement des appareils électroniques qui guident les avions lors des atterrissages. Il y a ainsi danger que les pilotes soient mal informés sur la distance qui les séparent de la piste et sur l'angle de descente de leur avion; second danger évident sur lequel Transports Canada insiste abondamment.

Pour mettre en lumière ses affirmations, Transports Canada explique à l'aide de graphiques et de diapositives l'accident survenu à Cranbrook en Colombie-Britannique le 11 février 1978 (annexe 1). L'accident impliquait un Boeing 737 de la Pacific Western Airlines (PWA) et une déneigeuse; c'est le genre d'accident qui pourrait se produire à Kuujjuaq. Son analyse montre que la présence d'un véhicule sur la piste, même si celui-ci possède l'autorisation de s'y trouver, présente toujours un danger pour les avions. Cela s'applique d'autant plus aux véhicules non autorisés qui n'ont pas de radio-émetteur et dont les conducteurs n'ont jamais suivi les cours de sécurité offerts par Transports Canada à tous ceux qui doivent emprunter les pistes avec des véhicules-moteurs.

L'accident de Cranbrook est un des facteurs qui sous-tend la politique actuelle de sécurité aux aéroports, et c'est pourquoi des clôtures sont érigées à plusieurs aéroports tels Val-d'or et Alma : la vie des passagers doit avoir préséance sur toutes autres considérations qu'elles fussent sociales ou environnementales.

Donc, pour la sécurité des passagers, des appareils et des usagers en général, Transports Canada veut ériger une clôture qui ceinturerait le complexe aéroportuaire. Le ministère ne peut accepter l'érection de sections de clôture implantées ici et là sur le pourtour du complexe même si, pour des raisons sociales et environnementales, ces sections sembleraient plus appropriées.

Le ministère reconnaît en effet qu'une clôture ceinturant tout le complexe aéroportuaire peut présenter des dangers pour les lagopèdes et les caribous, comme le mentionnent les Inuit dans le rapport préliminaire. L'élimination de tout accident étant la priorité, le ministère maintient néanmoins sa position d'ériger une clôture mais suggère de prendre les mesures correctives pour remédier à ces problèmes.

MESURES CORRECTIVES

Après que Transports Canada ait présenté sa politique de sécurité aux aéroports, expliqué l'accident de Cranbrook et affirmé qu'il maintient sa position au sujet de la clôture, ce en quoi les transporteurs l'appuient, les représentants de la corporation foncière et de la municipalité décidèrent (après un long conciliabule) d'accorder l'autorisation de construire la clôture. Toutefois, ils exigent certains engagements de la part de Transports Canada au sujet de la clôture, de la route conduisant au "range" et de l'acquisition des terres de la catégorie 1.

La clôture

Comme le mentionne le rapport préliminaire, la crainte exprimée par les Inuit au sujet de la clôture se rapporte particulièrement aux caribous, aux lagopèdes et à la cueillette des airelles. Pour la protection de la faune, il est recommandé par les Inuit et accepté sur le champ par Transports Canada que:

1) la clôture soit de treillis métalliques ayant des ouvertures de 6" sur 6" afin de permettre aux lagopèdes de passer au travers de la clôture sans s'y heurter, et

2) qu'un ou plusieurs "objets" mobiles fabriqués de matériaux résistants aux intempéries soient fermement fixés à la clôture afin que les animaux puissent en discerner la présence à la lumière comme dans le noir.

Avec ces mesures correctives, disent les Inuit, Transports Canada pourra construire une clôture qui ceinture tout le complexe aéroportuaire tout en assurant une certaine protection à la faune.

La route

La question de savoir à qui incombe la responsabilité de la construction de la route devait être résolue. En effet, le rapport préliminaire faisait mention d'un désaccord à ce sujet : Transports Canada soutenait qu'il n'était responsable que de la partie qui longe la piste 08-26 tandis que la municipalité maintenait que Transports Canada était responsable de toute la route, à partir des réservoirs de la société Shell jusqu'au "range".

Lors de la réunion, il fut entendu et accepté par les parties que Transports Canada sera responsable de la construction de toute la route à partir des réservoirs de Shell jusqu'au "range". La construction pourrait débuter cet été si les budgets le permettent, mais dans tous les cas, la route devra être construite avant l'érection de la clôture. Elle sera construite pour accommoder d'abord les petits véhicules, puis Transports Canada y apportera graduellement des améliorations. Dans l'intervalle, les camions assignés au transport de gravier et autres cargaisons lourdes pourront toujours emprunter le présent chemin en bordure de la piste 08.26.

En contrepartie, les Inuit verront à l'entretien de la route durant la saison estivale seulement. L'hiver, le déblayage n'est pas nécessaire car la carrière n'est pas exploitée et l'accès au "range" se fait habituellement par motoneige. Si, pour quelque raison, l'accès au "range" s'avérait nécessaire durant cette saison, Transports Canada pourrait autoriser un passage contrôlé de camions sur le chemin présentement utilisé.

Les terres de la catégorie 1

Au cours de l'enquête à Kuujjuaq, les Inuit s'étaient catégoriquement opposés à l'acquisition de terres de la catégorie 1 par Transports Canada. Toutefois, du fait que la municipalité a maintenant donné son accord pour l'érection d'une clôture, la corporation veut également donner son accord de principe pour l'acquisition de terres. Cependant, elle ne peut pour l'instant déterminer l'endroit exact où la clôture sera érigée.

La corporation foncière recommande donc que l'érection de la clôture se fasse sur la propriété de Transports Canada suivant les limites de celle-ci qui seront établies au cours des négociations éventuelles entre Transports Canada, le Gouvernement du Québec et la corporation foncière. Transports Canada a immédiatement accepté cette recommandation.

CONCLUSION

Au cours de l'enquête à Kuujjuaq, des divergences de vues sont apparues. D'une part, Transports Canada proposait l'érection d'une clôture qui ceinturerait le complexe aéroportuaire, la construction d'une route qui borderait la piste 08-26 au sud et au sud-est et, l'acquisition de terres de la catégorie 1.

D'autre part, les Inuit proposaient plutôt l'érection de sections de clôture à cinq endroits stratégiques, la réparation d'une route déjà en place et son prolongement le long de la piste 08-26. Ils s'opposaient enfin à l'acquisition de terres de la catégorie 1 par Transports Canada.

En outre, Transports Canada croyait avoir reçu, tant de la municipalité que de la corporation foncière, l'autorisation d'ériger une clôture d'enceinte. Les Inuit n'avaient jamais accordé cette autorisation. Enfin, le ministère soutenait qu'il n'était responsable que de la partie de la route bordant la piste 08-26; les Inuit prétendaient qu'il était responsable de toute la route, à partir des réservoirs de la société Shell jusqu'au "range".

Les points de vue étaient donc très différents et pour concilier ces divergences de vues le rapport préliminaire recommandait la tenue d'une réunion dans les meilleurs délais. Transports Canada, suite à des consultations avec les transporteurs, ne pouvait accepter les propositions des Inuit et demanda la tenue d'une telle réunion. Lors de celle-ci les parties se sont entendues sur l'érection d'une clôture d'enceinte et sur la responsabilité de Transports Canada de construire la route sur toute sa longueur. Elles ont également convenu de mesures correctives appropriées: la route doit absolument être construite avant l'érection de la clôture; la clôture sera construite de treillis métalliques avec des ouvertures de 6" sur 6", et des "objets" mobiles y seront fixés; enfin, la clôture sera érigée sur les terrains de Transports Canada après que ceux-ci auront été délimités par entente entre le ministère, le Gouvernement du Québec et la corporation foncière.

À toute fin pratique, les parties se sont entendues sur presque tous les points. Il ne reste en suspens que la question de la délimitation de la propriété de Transports Canada.

En terminant, mentionnons que l'aspect "archéologie" n'a pas été soulevé. Cependant, le rapport préparé par la firme Archéos recommandait un bref travail sur le terrain dès la fonte des neiges. Transports Canada s'est engagé à voir à ce que ce travail soit accompli au printemps.

FINAL REPORT

ENVIRONMENTAL AND SOCIAL IMPACT STUDY ON THE CONSTRUCTION OF A FENCE SURROUNDING THE KUUJJUAQ AIRPORT COMPLEX AND A ROAD GIVING ACCESS TO THE "RANGE"

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SUBMITTED TO:
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INTRODUCTION

In the framework of the planning program of the Canadian Air Transportation Administration (CATA), Transport Canada's priority is to develop a master plan for every airport it owns or operates.

The master plan for the Kuujjuaq airport contains a work program to meet projections up to the year 2003 and beyond. It is a flexible instrument which provides guidelines and suggests development projects that should be carefully evaluated as they are implemented. The master plan proposes a three-phase study. First, it proposes that a fence be built around the entire airport complex; second, that a road be built alongside runway 08-26 to the south and southwest in order to allow free access to the area known as the "range"; and third, that land needed by Transport Canada be acquired.

In the preliminary report on the impact study for this project, submitted at the end of March, the Inuit made a counterproposal calling for the erection of fence sections at five points considered strategic and repair of a road along the Koksoak River and its extension alongside runway 08-26. Furthermore, the Inuit opposed acquisition by Transport Canada of Category I lands, but offered to rent the department the parcels it needs.

The preliminary report also presented the differences in the views held of the situation. Transport Canada believed that it had received authorization from both the municipality and the landholding corporation to build a fence, but the Inuit maintained that they had never granted such an authorization. Transport Canada accepted responsibility only for the part of the road beside runway 08-26, while the Inuit claimed that the department must be responsible for the entire road, from the Shell tanks to the "range."

In order to reconcile these differences, the report recommended that a meeting be held in Kuujjuaq between the Transport Canada officials and members of the community. The meeting took place on April 17, 1985 at 2:00 p.m., and was attended by representatives of all the parties: Transport Canada, Nordair, Johnny May Air Service, the landholding corporation and the municipality.

This document is an update of the preliminary report and constitutes the final report of the study on the social and economic impact of the proposed fence. The "Methods" section describes what occurred between submission of the preliminary report and the meeting in Kuujjuaq. The section on the "Meeting in Kuujjuaq" presents the minutes of that meeting. The third section reports on the corrective measures discussed and accepted by the two parties, and the "Conclusion" summarizes the situation and indicates the points that are still left to be resolved.

METHODS

Copies of the preliminary report were sent to Transport Canada, the municipality and the landholding corporation. After studying the report and consulting with the carriers, Transport Canada informed us that it could not accept the Inuit's proposals. Thus, it was necessary that a meeting of all the parties involved be held as soon as possible.

We set a date for the meeting with the municipality and landholding corporation. Robert Francis of Transport Canada communicated with the carriers. April 17 was convenient for everyone, and the meeting was organized for that date in Kuujjuaq.

In the meantime, the landholding corporation and municipality studied the preliminary report, but made no comments on it.

The notes taken during the meeting for the preparation of the minutes constitute the basis of this report, since no further work had been planned for Kuujjuaq, Transport Canada or elsewhere. The meeting was, in fact, the only activity that occurred after the preliminary report had been submitted, and, thus, a summary of the proceedings is given as the final report on the study.

MEETING IN KUUJJUAQ

The meeting brought together 17 people representing all the groups involved: several branches of Transport Canada, Nordair, Johnny May Air Service, the landholding corporation and the municipality. It was a meeting for information exchange and, primarily, decision-making.

From the outset, Transport Canada insisted on safety at Kuujjuaq airport. The number of vehicles of all types is growing rapidly and presents a double hazard for aircraft. This is especially true of all-terrain vehicles. The first hazard is that they use either of the runways indiscriminately, crisscrossing them everywhere; this is obviously dangerous for aircraft preparing for takeoff or landing. Second, the presence of these vehicles can interfere with the operations of electronic equipment used to direct planes in landing. Thus, there is a danger that the pilots could be misinformed about their distance from the runway and their aircraft's angle of descent; Transport Canada placed considerable stress on this decided danger.

To illustrate these dangers, Transport Canada used graphs and slides to explain the cause of the accident in Cranbrook, British Columbia on February 11, 1978 (Appendix 1), involving a Boeing 737 belonging to Pacific Western Airlines (PWA) and a snowplow; it is the kind of accident that could occur in Kuujjuaq. The department's analysis of the accident showed that the presence of a vehicle on a runway, even with authorization to be there, inevitably poses a danger to aircraft. The problem is even greater with non-authorized vehicles without radios, especially if the drivers have not taken the safety courses offered by Transport Canada to people who must use motor vehicles on runways.

The accident at Cranbrook is one of the reasons for the present airport safety policy, and that is why fences have been built around a number of airports, such as those at Val-d'or and Alma: the lives of passengers must take precedence over any other considerations, be they social or environmental.

Thus, for the safety of passengers, aircraft and users in general, Transport Canada wants to build a fence around the airport complex. The department cannot agree to have sections of fence erected here and there at the perimeter of the complex even if such sections might seem more appropriate for social and environmental reasons.

The department recognized that a fence around the entire complex could represent a danger to ptarmigan and caribou, as pointed out by the Inuit in the preliminary report. Since the department's priority is accident prevention, Transport Canada maintained its position on building a fence, but suggested that steps be taken to alleviate the problems.

CORRECTIVE MEASURES

After Transport Canada had presented its airport safety policy, discussed the Cranbrook accident and stated its position on the fence, which the carriers support, the representatives of the landholding corporation and the municipality decided (after a lengthy discussion) to grant authorization to build the fence. However, they asked for certain commitments by Transport Canada concerning the fence, the road leading to the "range" and acquisition of Category I lands.

The fence

As mentioned in the preliminary report, the fears expressed by the Inuit on the fence concern mainly the caribou, ptarmigan and cloudberry harvest. It was recommended by the Inuit and immediately accepted by Transport Canada that, in the interest of protecting the wildlife:

(1) the fence be in wire-mesh, with 6" x 6" openings so that ptarmigan could fly through it without accident, and

(2) that one or more mobile and weather-resistant "objects" be firmly attached to the fence so that both during the day and night, animals could see that it was there.

According to the Inuit, if these corrective measures are applied, Transport Canada could build a fence surrounding the airport complex that would provide some protection for the wildlife.

The road

The question of responsibility for building the road had to be resolved. The preliminary report had mentioned the disagreement on this issue: Transport Canada maintained that it was responsible only for the section beside runway 08-26, while the municipality claimed that Transport Canada was responsible for the entire road, from the Shell tanks to the "range."

At the meeting, it was understood and accepted by all parties that Transport Canada would be responsible for building the entire road, from the Shell tanks to the "range." The construction work could begin this summer, budgets permitting, but in any event, the road should be built before the fence is put in. The road would be built at first for small vehicles, and Transport Canada would gradually improve it later. In the meantime, trucks transporting gravel and other heavy loads could use the existing road alongside runway 08-26.

For their part, the Inuit will be responsible for maintaining the road during the summer only. In winter, snow-removal is not necessary because the quarry is not in operation and access to the "range" is usually by snowmobile. If, for some reason, access to the "range" is necessary in winter, Transport Canada could authorize restricted truck use of the road now taken.

Category I lands

During the hearing at Kuujjuaq, the Inuit categorically opposed the acquisition of Category I lands by Transport Canada. Nevertheless, since the municipality had already given its approval for the erection of a fence, the corporation wanted to give its approval in principle for the acquisition of land. However, for the moment, it could not determine exactly where the fence was to be built.

Thus, the landholding corporation recommended that the fence be built on Transport Canada property along the limits of this land, which will be established in future negotiations between Transport Canada, the Québec government and the landholding corporation. Transport Canada immediately accepted this recommendation.

CONCLUSION

During the Kuujjuaq hearing, a number of differences became apparent. Transport Canada proposed that a fence be erected around the airport complex, a road be built alongside runway 08-26 to the south and southeast, and that Category I lands be acquired.

The Inuit, however, proposed that sections of fence be erected at five strategic locations and that an existing road be repaired and extended beside runway 08-26. They also opposed acquisition of Category I lands by Transport Canada.

Transport Canada also believed that it had received authorization to build the fence from the municipality and the landholding corporation. Yet the Inuit had never granted this authorization. Finally, the department maintained that it was responsible solely for the part of the road alongside runway 08-26, but the Inuit claimed that Transport Canada was responsible for the entire road, from the Shell tanks to the "range."

The points of view were, therefore, very divergent, and, to resolve the differences, it was recommended in the preliminary report that a meeting be held as soon as possible. After consulting with the carriers, Transport Canada could not accept the Inuit proposals and asked that such a meeting be held. At the meeting, the parties agreed on erection of the fence and on Transport Canada's responsibility for building the entire road. They also agreed on the corrective measures:

the road absolutely must be built before the fence is erected; the fence will be built of wire-mesh with 6" x 6" openings, and mobile "objects" will be attached to it; finally, the fence will be erected on Transport Canada land after its limits have been defined by an understanding between the department, the Québec government and the landholding corporation.

For all practical purposes, the parties agreed on almost all points. All that remains now is the question of defining the limits of the Transport Canada property.

In ending, it should be mentioned that the archaeological aspect was not raised. However, the report prepared by the firm Archéos recommended that some archaeological work be done in the field as soon as the snow melted. Transport Canada agreed to make sure that this work was carried out in the spring.

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ᖃᐅᔨᔭᐅᕆᐊᖓᑎᑦ ᓯᒍᑏᑦ

ᐃᓯᒪᕐᓴᓂᐊᑎᔭᐅᓯᒪᔪᒥ ᐊᓪᓚᑕᐅᓯᒪᒻᒪᑕ ᐅᑯᓄᖓ "ᑲᓇᑕᒥᐅᑦ ᖃᖓᑕᓲᑦ ᐊᐅᓪᓗᑎᐅᒍᓐᓇ-ᑐᓕᒪᓄᑦ ᐊᐅᓚᑦᓯᕕᖓ" ᐊᓪᓚᓯᒪᒻᒪᑕ ᐃᒫᒃ ᑖᑯᐊᒍᖅ ᐊᐅᓚᓂᓕᑎᕗᒃ ᑯᑦ ᑲᓇᑕᒥ ᓯᕗᓪᓕᐸᐅᑦᑏ-ᒥᐊᖅᑲᖅᒪᑕ ᐊᖅᑭᓯᐃᓗᑎᒃ ᖃᓄᐃᓕᖓᒥᐊᖅᑲᖅᓂᖓᓂᒃ ᒥᑉ ᐱᑦ ᓇᒻᒥᓂᖁᔨᑦ ᐊᐅᓚᑦᔨᑦᓗᓂᑦ.

ᐃᓯᒪᑦᓴᓂᐊᑎᔭᐅᓯᒪᕙᖅ ᑯᑦ ᕙᐊᑉ ᒥᑉ ᐱᖓ ᐸᓇᓯᑦ ᑕᐅᒥᐊᖃᓕᕈᓂ ᑎᑭᒍᓇᐅᓚᔭᖅᑐ ᐅᑭᐅᒧᑦ 2003-ᒧᑦ ᐅᖓᑖᓄᑦᓄᓂᑦ. ᓴᖑᒥᐊᖅᐱᖃᕆᓐᓇᓯᐊᖅᓯᓂ ᒪᓕᑦᑕᐅᒍᓐᓇᑐᒃ ᐊᒻᒪᓗ ᐅᑐᖅᑕᐅᖁᔭᐅᓚ-ᔭᖑᐊᑐᐃᑦᑐ ᐱᕙᑦᓚᐊᓚᓯᐊᓕᖅᐸᑦ ᐱᓇᓱᐊᖅᑕᐅᕙᖅ ᕿᒥᖅᕈᔭᐅᑦ ᓯᐊᒪᑎᖃᑦ ᑕᑎᐊᖃᖅᓯᓂ ᑲᕙᓯᑎᑕᐅᒥ-ᐊᓕᖓᓕᕈᓂ ᑳᓇ ᐃᓯᒪᖅᓴᓂᐊᑎᔭᐅᒪᕙᖅ ᐱᖓᓯᐃᓕᖓᕙᓂᒃ ᐊᑦᔨᒥᕐᑐᓂᒃ ᐃᓗᐊᓂᑦᑐᑕᓕᒃ ᑲᒪᒥᔭᐅᒥ-ᐊᓕᓐᓂᒃ. ᓯᕗᑦᓕᐸᖅ ᐊᑐᖅᑕᐅᒃᑯᔭᐅᓚᔭᖑᐊᑐᖅ ᓴᐃᒍᓕᐅᖅᑕᐅᑎᑦᓗᒍ ᒥᑉ ᐱᒥᐅᑕᓕᒪᑦᓯᐊᑦ ᒥᑉ ᐱᓗ ᐊᕙᑕᓕᒫᖑᒍᑦ; ᐊᐃᑉ ᐸᖑᓗ ᐊᑐᖅᑕᐅᒃᑯᔭᐅᓚᔭᖅᒥᕙᖅ ᐊᖅᑯᑎᓕᐅᖅᓂᒥ ᒥᑉ ᐱᐅᑉ 08-26 ᓴᓂᕋᓂ ᓯᕿᓂᖑᓂ ᐊᒻᒪᓗ ᓯᕿᓂᖑᑕ ᑕᓕᖅᐱᒥᐊᖑᓂ (Southwest), ᒥᑉ ᐱᓕᑎᕗᑦ ᐃᓯᐊᖅᓴᓂᖅᓴᐅᖃᑕᕋ-ᔭᖅᒪᑕ ᐃᓯᒪᓗᒍᓐᓇᐃᓗᑎᒃ; ᐱᖑᕙᐊᑦᓗ ᑖᓇ ᓄᓇ ᐊᑐᖅᑕᐅᒥᐊᓕᒃ ᐅᑯᓄᖓ ᐊᐅᓚᓂᓕᑎᕗᒃ ᑯᑦ ᑲᓇᑕᒥ ᐱᑕᕐᔭᐅᑎᑦᓗᒍ.

ᐊᓪᓚᑕᐅᓯᒪᕗᑦ ᑐᓴᕋᑦᓴᐃᑦ ᐱᒋᐊᖓᑎᑦᓗᒋᑦ ᖃᐅᔨᓴᖅᓯᑎᑉ ᓱᖅᑲᐃᓚᔭᖅᒪᖓᑦ ᑕᓐᓇ ᐸᓇᓯᑦᑕᐅᒍᒪᕙᖅ, ᑐᓂᔭᐅᓚᐅᕙᕙᖅ ᑕᖅᑭ ᒪᑦᕿ ᓇᓕᖅᑎᓗᒍ, ᐃᓄᐃᑦ ᐊᑐᑦᑕᐅᕙᒪᐅᑎᓕᐅᖓᓚᐅᕙᒻᒪᑕ ᓇᑉᐸᑎᖅᑕᐅᖁᔨᓯᑎᑉ ᓴᐃᒍᖅᓂ ᑕᑦᓚᒪᓂᒃ ᐊᓂᒍᑎᖃᖅ ᐱᖃᖅᑎᓗᒋᑦ ᐃᓯᒪᕆᔭᐅᑦᓯᓂ ᐊᑐᖅᓂᖃᑦᓯᕋ-ᔭᑎᐊᖓ ᐊᒻᒪᓗ ᐊᖅᑯᑎᓕᐅᑎᐊᑦᓯᐊᓗᑎᒃ ᓴᓂᕋᓂ ᑯᑦᕙᐊᒃ ᑯᖓᓂ ᐊᒻᒪᓗ ᐋᓕᒥᐊᖅᓯᒪᓂᖓ ᒥᑉ ᐱᐅᑉ 08-26 ᓴᓕᐊᓂᑦᑐᒃ. ᐃᓕᒥᔭᐅᕆᐊᓪᓚᒥᕙᖅ ᐃᓄᐃ ᐊᖏᕆᓂᑎᓯᒪᔭᕆᑦ ᓄᓇᑕᕈᒪᑎᓪᓗᒋᑦ ᓂᐅᕕᖅᓗᑎᒃ ᐊᐅᓚᓂᓕᑎᕗᒃ ᑯᑦ ᑲᓇᑕᒥ ᑭᓯᐊᓂ ᐊᑭᓕᖅᑐᐃᖃᑦᑕᓯᖓᓇᓂᕋᖅᑕᐅᓯᑎᒃ ᐊᑐᖅᓗᒍ ᓄᓇ ᑲᑎᑯᕗ 1 ᐃᓗᐊᓂ.

ᐊᓪᓚᑕᐅᓯᒪᕗᑦ ᑐᓴᕋᑦᓴᐃᑦ ᐱᒋᐊᖓᑎᑦᓗᒋᑦ ᐊᓪᓚᑕᐅᓯᒪᒻᒥᒪᑕ ᐃᓯᒪᓕᔭᐃᑦ ᐊᑦᕗᒋᕆᓂᕆᑦ ᑖᓯᒪᐅᑉ ᒥᑦᓴᓄᑦ ᐊᐅᓚᓂᓕᑎᕗᒃ ᑯᑦ ᑲᓇᑕᒥ ᐊᕆᖅᑕᐅᓯᒪᕙᑎᓯᒪᒻᒥᒪᑕ ᑕᒪᕆᓐᓄᑦ ᐅᑯᓄᖓ ᓄᓇᓕᑦ ᑲᐸᒪᖑᓄᑦ ᐊᒻᒪᓗ ᓄᓇᒥᒃ ᑎᒍᒥᐊᖅᑎᑯᓐᓄᑦ ᓴᐃᒍᓂᒃ ᓇᑉᐱᑎᒥᐊᒥ, ᑭᓯᐊᓂᓕ ᐃᓄᐃᑦ ᐊᕆᓚᐅᖅᓯ-ᒪᕆᓂᕋᖅᓯᒪᒻᒪᑕ ᑲᕙᓯᑎᑕᐅᒍᑎᒥᒃ ᐊᐅᓚᓂᓕᑎᕗᒃ ᑯᑦ ᑲᓇᑕᒥ ᑲᒪᒥᔭᖃᕈᒪᓯᒪᒻᒪᑕ ᐊᖁᑎᓕᐅᑎᐊᒥᒃ ᒥᐱᐅᑉ 08-26 ᓴᓂᕋᓂ ᑭᓯᐊᓂ, ᐅᑯᐊᓗ ᐃᓄᐃᑦ ᐊᖁᑎᓕᐅᑎᐊᖅᑐᑎᓯᑎᑦᓗᒋᑦ ᐊᖁᑎᓕᒪᒥᒃ ᐱᒋᐊᓗᑎᒃ ᐅᖅᓯᐊᓗᖃᐅᑎᐊᓗᓐᓂᑦ ᒥᑉ ᐱᒧᑦ ᑎᑭᑦᓗᒍ.

ᐊᕿᓯᐊᖁᕈᓘᑦ ᓇᒻᒪᒋᕐᒋᒍᑎᐅᔪᓂᒃ, ᐊᓪᓚᓯᒪᔪᑦ ᑐᓴᕋᑦ ᓴᐃᑦ ᐱᖁᕈᓯᒪᕐᒋᒪᑕ ᑲᑎᖕᒐᓂᖅᒥᒃ ᑯᑦ ᔪᐊᒥ ᐅᑯᓴᖕ ᐋᓪᓚᓂᓕᑎᕈᑉ ᑯᑦ ᑲᓇᑕᒥ ᐊᒻᒪᓗ ᐃᓄᕐᒋᓴᑦ ᓄᓇᓕᐅᑉ ᐊᓯᐃᓚ ᑲᑎᖕᓕᖅᓂᖁᑦ ᐊᐃᕆᓕ 17, 1985-ᖑᑎᓪᓗᒍ ᐅᓐᓴᒃ ᓴᑯᑦ ᒪᖅᑭᕝᒍᑦ ᑎᓗᒍ ᑖᑯᐊᓕᒪᑦ ᑎᒥᐅᔭᐃᑦ ᕿᒻ ᒐᑐᖅᑎᕐᒋᑦ ᐊᐃᓯᒪᑦ ᓱᑎᒃ: ᐋᓪᓚᓂᓕᑎᕈᑉ ᑯᑦ ᑲᓇᑕᒥ, ᓴᐊᑎᐊᑯᑦ, ᔫᓂ ᒦ ᖃᖕᒐᑦ ᑕᔪᒃ ᑯᑦ ᐱᒍᑦᕈᕈᕐᒋᑦ, ᓴᓇᒥᒃ ᑎᒍᒥᐊᖅᑎᑯᑦ ᐊᒻᒪᓗ ᓴᓇᓕᑦ ᑳᒪᐱᖕᒐᑦ.

ᐊᓪᓚᖁᑎᓪᓚᑎᒃ ᑕᓐᓇ ᓴᑕᕝᒍᑎᑦ ᓯᒋᐊᖅᓯᒪᓕᖅᑐᖅ ᓯᕗᓪᓕᓂᑕᖅᓂᒃ ᐊᓪᓚᓯᒪᔪᓂᒃ ᑐᓴᖅᑎᓯᒍᑎᓂᒃ ᐊᒻᒪᓗ ᓴᐃᑎᓯᓱᓂ ᕿᕝᒍᓪᓕᐸᕝᒍᓕᖅᑐᒥᒃ ᐊᓪᓚᓯᒪᔪᒥᒃ ᑐᓴᖅᑎᓯᒍᑎᒥᒃ ᖃᐅᔨᓇᓱᐊᕈᑎᐅᓚᐅᖅᑐᓘᑦ ᓱᖅᑲᐃᒐᔭᖅᒪᖕᒐᑦ ᐃᓄᓐᓂᒃ ᐊᒻᒪᓗ ᓴᓇᒋᔭᐅᔪᒥᒃ ᓇᐸᑎᑎᒍᒪᓂᖅᓘᑦ ᓴᐃᒍᖅᓂᒃ. "ᖃᓄᐃᓗᖅᓂᕐᒋᑦ" ᐃᓚᒋᔭᐅᒥᔪᖅ ᑕᒃ ᑲᓂ ᐊᓪᓚᓯᒪᔪᓂ ᖃᓄᐃᓗᖅᓂᑎᓚᐅᖅᑕᕐᒋᓐᓂᒃ ᑐᑦ ᓯᕋᐅᑎᕐᒋᑦ ᑕ ᓯᕗᓪᓕᐸᒃ ᐊᓪᓚᓯᒪᔫᒃ ᑐᓴᕋᑦ ᓴᐅᑉ ᐊᒻᒪᓗ ᑲᑎᖕᓂᐅᓚᐅᖅᑐᑉ ᖃᓄᐃᓗᖅᓂᑎᓚᐅᖅᑕᕐᒋᓐᓂᒃ ᑯᑦ ᔪᐊᒥ. ᐃᓚᒋᔭᐅᒻᒥᔪᖅ ᑖᓱᒎᖕ ᐃᓪᓚᓯᒪᔪᓘᑦ "ᑲᑎᖕᓂᖅ ᑯᑦ ᔪᐊᒥ" ᐊᓪᓚᑕᐅᓯᒪᒻᒥᔪᑦ ᑲᑎᒪᐅᑎᐅᓂᑦ ᑲᑎᖕᓂᐅᓯᒪᔪᒥ ᐱᖕᔪᐊᓪᓗ ᐊᓪᓚᓯᒪᒻᒥᔪᖅ ᑕᒃ ᑲᓂ ᐊᕿᓯᐃᖃᑎᕆᓐᓂᑎᓚᐅᖅᑕᕐᒋᑦ ᑕ ᐊᒻᒪᓗ ᐊᕐᕆᖃᑎᕆᓐᓂᐅᓂᖕᓂᒃ ᒪᖅᑭᒃ ᑎᒥᐅᔫᒃ ᐊᒻᒪᓗ "ᑐᑭᑕᖅᓂᑎᓯᒪᔭᖕ" ᐃᓗᓐᓇᓕᒪᕐᒋᓐᓂᒃ ᑭᒥᖅᑭᓯᓂ ᖃᓄᐃᓕᖕᓂᖕᓂᒃ ᐊᒻᒪᓗ ᓇᓗᓇᐃᖅᓯᓯᓂ ᐊᕿᒋᐊᖅᑕᐅᒋᐊᖃᕐᓇᑐᓂᒃ.

ᖃᓄᐃᓗᖅᓂᕐᒋᑦ

ᐊᑦᕈᓕᐅᖅᑕᐅᓯᒪᔪᑦ ᓯᕗᓪᓕᐸᒥ ᐊᓪᓚᓯᒪᔪᑦ ᑐᓴᕋᑦ ᓴᐃᑦ ᐊᓪᓚᑎᒍᑦ ᐋᓪᓚᑎᑕᐅᓯᒪᔪᑦ ᑕᒃ ᑯᓴᖕ ᐋᓪᓚᓂᓕᑎᕈᑉ ᑯᑦ ᑲᓇᑕᒥ, ᓴᓇᓕᑦ ᑳᒪᐱᖕ ᐊᒻᒪᓗ ᓴᓇᒥ ᑎᒍᒥᐊᖅᑎᖁᓐᓴᑦ. ᕿᒥᖅᑭᑎᖅᓯᒪᓕᑐᐊᕋᒥᑦ ᐊᒻᒪᓗ ᐅᖁᖃᑎᖃᖃᓚᐅᑲᕐ ᓱᑎᒃ ᖃᐅᔨᒪᑎᑦᓯᔾᔪᓂᒃ, ᐋᓪᓚᓂᓕᑎᕈᑉ ᑯᑦ ᑲᓇᑕᒥ ᖃᐅᔨᑎᑦᓯᓚᐅᖅᒪᑕ ᐅᐸᑦᑎᓂᒃ ᐊᕐᕆᓂᕋᖅᓱᑎᒃ ᐃᓄᐃ ᐱᔪᒪᐅᑎᕐᓂᓂᒃ. ᑕᐃᒪᐃᒻᒪ ᑲᑎᖕᑎᓗᒋᑦ ᑭᓯᐊᓂᐅᓕᓚᐅᕐᒪᑕ ᑎᒥᐅᔪᓕᒪᑦ ᐊᑦᑐᐊᔭᐃᑦ ᑕᑦ ᓱᒎᖕ ᓱᑲᓐᓂᓕᒪᖕᒍᑦ.

ᑲᑎᖕᖄᐅᒐᔭᖅᑐᒥᒃ ᐅᓪᓗᖕᓂᒃ ᐊᖅᑭᓪᓕᐅᔪᔪᑦ ᓴᓇᓕᑦ ᑳᒪᐱᖕᒐᑦ ᐊᒻᒪᓗ ᓴᓇᒥᒃ ᑎᒍᒥᐊᖅᑎᖁᓐᓂᓗ ᕈᐸᑦ ᕗᕋᓐᓯᔅ (Robert Francis) ᐱᓇᓱᑦᑐ ᐅᑯᓇᓂ ᐋᓪᓚᓂᓕᑎᕈᑉ ᑯᑦ ᑲᓇᑕᒥ ᖃᐅᔨᒪᐅᑎᖃᑎᖃᖃᑕᑎᓪᓗᒍ ᖃᐅᔨᒪᑎᑦᓯᔪᓂ ᐊᐃᕆᓕ 17 ᐃᓗᓐᓇᕐᒋᓐᓄᑦ ᐃᓯᐊᕆᔭᐅᓚᐅᖅᒪᑦ ᑲᑎᖕᑎᐊᓕᓐᓄᑦ ᑐᕋᕆᔭᐅᓕᖅᓯᓂᓗ ᐅᓪᓗᒃ ᑲᑎᖕᖄᐅᒐᔭᖅᑐᖅ ᑯᑦ ᔪᐊᒥ.

ᑲᑎᒻᒪᓂᑦ ᓴᒧᑦ ᑎᑭᑕᐅᓚᐅᕋᑎᒃ ᓄᓇᒥᒃ ᑎᒍᒥᐊᕐ ᑎᑯᑦ ᐊᒻᒪᓗ ᓄᓇᓖᑦ ᑲᐸᒫᐱᖕ ᖃᐅᔨᓴᑦ ᓯᐊ-ᑎᐊᓚᐅᑎᕗᑦ ᓯᕗᓪᓕᒥᒃ ᐊᓪᓚᓯᒪᔪᒥᒃ ᑐᓴᕋᓴᒥᒃ ᑭᓯᐊᓂ ᐃᓯᒪᓪᓴᓚᐅᐳᑎᒥ ᓄᐃᑎᑦᓯᓚᐅᕐᓯᑐᑦ.

ᓇᓗᓇᐃᑎᐊᕈᑎᐅᖃᑦ ᑕᓚᐅᕐ ᑐᖅ ᐊᓪᓚᑕᐅᑦ ᓯᑎᒃ ᑲᑎᒻᒪᔪᓂ ᐊᑐᐃᓇᕈᕐ ᑎᓯᒍᑎᐅᓯᑎᒃ ᑲᑎᒪᐅᑎᕕᓂᑦ ᐊᓪᓚᑕᐅᒥᐊᖃᓕᕐ ᒪᑕ ᓄᐃᑎᓯᒍᑎᐅᑦ ᓯᑎᓪᓗ ᑕᑦ ᓯᒥᕐᒪ ᐊᓚᓯᒪᔪᒥᒃ ᑐᓴᕐ ᑎᓯᒍᑎᒥᒃ ᐱᓇᓱᒐᑦ ᓴᒥᐊᓪᓚᖅ ᓄᐃᑕᐅᓚᐅᕐᒪᑦ ᑯᑦ ᔭᐊᒥ, ᐊᐅᓚᓂᓕᑎᓷᒃ ᑯᑦ ᑲᓇᑕᒥ ᐅᕐᕚᓐᓃᑦ ᐊᓯᐊᓄᑦ ᑲᑎᒻᒪᓂᐅᓚᐅᕐ ᑐᖅ ᐊᐅᓚᑦᔭᓂᖃᕐ ᑐᑐᓚᐅᕐ ᒪᑦ ᓯᕗᓪᓚᐸᖅ ᐊᓪᓚᓯᒪᔪᖅ ᑐᓴᕋᓴᖅ ᓄᐃᑕᑎᑕᐅᓯᒪᓕᕐ ᑎᓗᒍ ᑕᐃᒪᐃᒻᒪᑦ ᐃᓗᓐ ᓇᓕᒪᖕᒪᑕ ᐱᓂᐊᕐ ᓂᐅᓚᐅᕐ ᑐᖅ ᐊᓪᓚᑕᐅᓯᒪᓂᕐᒥᑦ ᐊᑐᕐ ᑕᐅᓯᓚᐅᕐᑯᑦ ᑭᖑᓪᓚᐸᖕᒍᒍᑎᐅᓕᕐ ᑎᓗᒍ ᐊᓪᓚᓯᒪᔪᑦ ᑐᓴᕋᓴᓚᐊᖑᓕᓚᐅᕐᑯᑦ ᖃᐅᔨᓴᕐ ᓂᐅᓚᕐ ᑐᒥ.

ᑲᑎᒻᒪᓂᖅ ᑰᑦᔭᐊᒥ

ᑲᑎᒻᒪᓂᐅᓚᐅᕐ ᑐᖅ ᑲᑎᒃ ᑲᐃᓚᐅᕐ ᑐᑦ 17-ᓂ ᐃᓄᓐᓂᒃ ᑭᒐᑐᕐ ᑎᓂᒃ ᑎᒥᐅᔭᓚᓄᑦ ᐊᑦᑐᐊᔪᓄᑦ: ᐊᓪᓚᕖᒻ ᒥᐅᑕᐃᑦ ᑲᑎᒪᕐᒋᑐ ᒪᕐ ᕿᑐᐃᓇᐅᒐᑎᒃ ᐱᓯᒪᔪᑦ ᐊᐅᓚᓂᓕᑎᓷᒃ ᑯᑦ ᑲᓇᑕᒥ, ᓄᐊᑎᐊᑯᑦ, ᔫᓂ ᒦ ᖃᓪᓗᑦ ᑕᔪᒃ ᑯᑦ ᐱᒍᐹᐹᕐᒥᑦ, ᓄᓇᒥᒃ ᑎᒍᒥᐊᕐ ᑎᑯᑦ ᐊᒻᒪᓗ ᓄᓇᓕ ᑲᐸᒪᐱᖕ ᑲᑎᒻᒪᔪᓂ ᐅᖄᔭᐅᓚᐅᕐ ᑐᑦ ᐊᐃᑦ ᑐᑐᑎᑦ ᓯᑎᒃ ᑐᓴᕋᓴᓂᒃ ᐊᒻᒪᓗ ᐱᓗᐊᖑᐊᑐᒥᒃ ᑐᑭᑖᕿᑎᒦᑲᓯᑦ ᓯᑎᒃ.

ᓯᓚᑕᓄᓕᖕᒐᓚᑦ ᑐᖅ ᐅᖄᔭᐅᒪᓪᒥᔪᖅ, ᐊᐅᓚᓂᓕᑎᓷᒃ ᑯᑦ ᑲᓇᑕᒥ ᐃᑉ ᐱᒍᓯᑦ ᓯᐊᖁᐹᑦ ᓯᑎᒃ ᒥᕐ ᕖᒥ. ᓄᓇᒃ ᑯᔪᑦ ᐊᒥᓯᖑᐸᓕᐊᔪᐸᓗᒻ ᒪᑕ ᐊᑦ ᐹᒥᕐᓯᑐᑦ ᐱᓂᕐ ᓗᖕᐃᑐᐃᓇᑎᐊᖃᓗᐊᖑᑯᐊᓕᕐ ᒥᒪᑕ ᖃᓪᓗᑦ ᑕᔫᓂᒃ. ᓯᓕᓗᐊᖑᑯᐊᓯᓂᓗ ᓇᐅᒃ ᑯᑐᐃᓇᑭᓐᓇᑐᓄᑦ ᓄᓇᒃ ᑯᔪᓄᑦ ᓯᕗᓪᓕᖅ ᐱᓂᕐ ᓗᐃᑐᐃᓐᓇᑎᐊᓕᒃ ᓄᓇᒃ ᑯᔪᑦ ᐊᑐᓯᖑᒻ ᒪᑕ ᒥᕐ ᕖᒥᒃ ᐊᒻᒪᓗ ᐃᑲᕐ ᕖᒥᖄᑦ ᑕᓯᒍ ᓇᐅᒃ ᑯᑐᐃᓐ ᓇᓕᒪᑦ ᓯᐊᖅ: ᑕᓐ ᓇᑕᒐ ᐅᓗᑎᐊᓇᕐ ᑐᒪᑎᐊᓗᒃ ᖃᓪᓗᑦ ᑕᔪᓄᑦ ᐊᐅᓚᑦ ᓯᔪᓄᑦ ᐅᕐ ᕚᓐᓃᑦ ᑎᕐᒥᒐᓯᐊᕐ ᑐᓄᑦ. ᐊᐃᑉ ᐸᖕᒐᓗ ᐊᑐᕐ ᑕᐅᓯᓂ ᖃᓪᓗᑦ ᑕᔪᓄᑦ ᒥᑎᑦ ᓯᒍᑎᐅᓯᖅ ᐊᑐᑦ ᓯᐊᖅᔭᐃᕐ ᑎᑕᐅᒪᓚᐅᕐ ᑐᕆᓐ ᓇᒪᑦ ᓄᓇᒃ ᑯᔪᓄᑦ ᑎᒥᑦ ᓯᒍᑎᑦ ᓴᔭᖅ. ᑕᐸᓇᐃᑦ ᑐᒐᔭᕐ ᒥᒪᑦ ᖃᓪᓗᑦ ᑕᔪᕐ ᑎ ᓯᓚᕐᒥᑐᒥᒃ ᖃᓂᕐᒥᓂᖅ ᑐᑎᑦ ᓯᑐᐃᓐ ᓇᕆᓐ ᓇᒪᑦ ᑲᒪᐅᑎᒥᒍᑦ ᒥᕐ ᕖᒧᑦ ᐊᒻᒪᓗ ᐊᒻ ᒧᐊᐸᑦ ᓚᐊ-ᓚᕆᓂᓗᓐ ᓂᑦ ᑕᐃᒪᑦ ᓯᐊᕐ ᑦ ᑐᑐᐃᓐ ᓇᑎᐊᖅ ᒥᒪᑦ ᐊᐅᓚᓂᓕᑎᓷᒃ ᑯᑦ ᑲᓇᑕᒥ ᑖᑦ ᓯᒎᖅ ᐱᓂᕐ ᓗᑎᐅᔪᓐ ᓇᑐᒧᑦ ᐃᓯᒪᓗᒐᓚᑦ ᑎᑕᐃᑦ

ᑕᐃᒪ ᐱᓂᕐᓗᑐᐃᓐᓇᑎᐊᖅᑲᕐ ᓂᖕᒐᓂ ᖃᐅᔨᓴᐅᑎᑦ ᓯᓚᐅᖅᑯᑦ ᐊᐅᓚᓂᓕᑎᔮᒃᑯᑦ ᑲᓇᑕᒥ ᐊᑐᕐᓱᑎᒃ ᐊᓪᓚᕐᔪᐊᕐᓯᒪᔪᓂᒃ ᐊᒻᒪᓗ ᐊᑦᔨᕐᔪᐊᓄᑦ ᐱᓂᕐᓗᓚᐅᕐᑐᕕᓂᕐᒥ ᑲᕋᓐᐳᕈᒃ, ᐳᕆᑎᔅ ᑲᓚᒻᐱᐊᒥᑦ (Cranbrook, British Columbia) ᕕᕗᐊᕆ 11, 1978-ᖑᑎᓪᓗᒍ ᐳᔪᓕᒃ ᐳᐃᓐᒃ 737 (Boeing) ᐳᔪᓕᖕᒐᑦ Pacific Western Airlines-ᑯᑦ ᐊᐳᑎᔭᐃᒍᑎᒥᒃ ᓄᓇᒃ ᑰᔪᒥᒃ ᐊᐳᖅᑲᑎᖅᑲᕐᓱᓂ; ᑕᐃᒪᑕᒪ ᐱᓂᕐᓗᑐᐃᓐᓇᑎᐊᖅᑲᑎᕗᖅ ᑰᑦᔪᐊᒥ. ᐊᓪᓚᕕᖕᒐᓂᑦ ᕿᒥᕐᕈᔭᐅᑦᓱᓂ ᐱᓂᕐᓗᓂᕕᓂᐅᑉ ᒥᑦᓵᓄᑦ ᑕᑯᑦᓴᐅᕙᖅ ᐊᐳᑏᔭᐃᒍᑎᒃ ᒥᕐᕕᒥᒍᓐᓇᐅᑎᖅᑲᕋᓗᐊᕐᓱᓂ ᐱᓂᕐᓗᐃᑐᐃᓐᓇ-ᑎᐊᖅᑲᑦᓯᐊᒪᑦ. ᐱᓂᕐᓗᖕᒍᐅᑎᓕᑎᐊᓗᒐᔭᕐᑐᓂ ᒥᕐᕕᒥᒍᓐᓇᐅᑎᖅᑲᖕᒥᑐᖅ ᓄᓇᒃ ᑯᔪᖅ ᓈᓚᐅᑎᖅᑲᕋᓂ ᐊᒻᒪᓗ ᐸᓗᐊᖑᐊᑐᒥᒃ ᓄᓇᒃ ᑰᔪᑎᐅᕐᓴᑎᑕᐅᓚᐅᕐᓯᒪᕐᖁᓂ ᐊᐅᓚᓂᓕᑎᔮᒃᑯᓄᑦ ᑲᓇᑕᒥ ᖃᓄᖅ ᒥᕐᕕᒥ ᓄᓇᒃ ᑰᔪᕐ ᑏᑦ ᐱᐅᓯᖅᑲᑎᐊᖅᑲᕐ ᒪᖕᒐᑕ ᒥᕐᕕᒥ.

ᐱᓂᕐᓗᓂᕕᓂᖅ ᑲᕋᓐᐳᕈᒥ (Cranbrook) ᐃᓚᐅᑦᓚᑎᒻᒥᒪᑦ ᐃᑉ ᐱᒍᓯᑦ ᓯᐊᑎᐊᖅᑲᓂᕐᖓᓂᒃ ᒥᕐᕕᒥ ᒪᓕᒐᓕᐊᕐ ᒨᑕᐅᑎᑦ ᓯᓚᕿᑎᑕᐅᑦᓯᓂ, ᐊᒻᒪᓗ ᑕᐃᒪᐃᒻᒪᑦ ᓴᐃᒍᐃᑦ ᓇᐸᑦᔮᕐ ᑎᑕᐅᓚᕿᓯᒪᒻᒪᑕ ᐊᕙᓗᓕᒪᖕᒐᓂ ᒥᕐᕕᐅᐸ ᕖᑦᔫᑎᓯᓗᒍ ᕙᓪᑐᐊᒥ (Val-dor) ᐊᒻᒪᓗ ᐊᓪᒪᒥ (Alma): ᖃᖕᒐᑦ ᑕᔫᒦᑦ ᑐᐃᑦ ᐃᓅᓯᕐᑦ ᐃᓯᒪᕆᔭᐅᓂᕐ ᐸᖑᕆᐊᖅᑲᕐ ᒪᑕ ᐊᓯᓚᒪᕐᖓᓄᑦ ᐃᓯᒪᕆᕆᐊᖅᑲᕐ ᒥᔪᓄᑦ ᓄᓇᓕᒻ ᒥᐅᖑᓚᓗᐊᕐ ᐸᑕ ᐅᕝᕙᓘᓐᓃᑦ ᓄᓇᕐᑯᑎᖕᒐᑦ.

ᑕᐃᒪᐃᑦᓴᒪᑦ ᑕᒐ ᐱᓂᕐᓗᖁᔮᕐᖁᑦ ᖃᖕᒐᑦ ᑕᔫᕐᑐᓂᒃ, ᖃᖕᒐᑦ ᑕᔫᓂᒃ ᐊᒻᒪᓗ ᐊᑐᓯᒐᓚᓐᓄᑦ. ᓵᒃ ᑯᐊ ᐊᐅᓚᓂᓕᑎᔮᒃᑯᑦ ᑲᓇᑕᒥ ᓴᐃᒍᕐᒥᒃ ᐊᕿᒍᒪᓚᕿᔭᑦ ᐃᒻᒥᒎᕐ ᑎᑐᓂᒃ ᐊᓂᒍᕐ ᕕᓂᓐᓂᒃ ᑲᑎᒪᓚᑎ-ᑦᑐᓂᒃ ᐃᓯᐊᕐ ᓂᓴᐅᓂᖁᕐ ᑕᐅᓚᓗᐊᕐ ᐸᑕ ᓄᓇᓕᒥᐅᓄᑦ ᐊᒻᒪᓗ ᓄᓇᒃ ᐱᑦᔪᑎᐅᓚᓗᐊᕐ ᐸᑦ.

ᐊᐅᓚᓂᓕᑎᔮᒃᑯᑦ ᑲᓇᑕᒥ ᖃᐅᔨᒪᑦᓯᐊᔫᓚᓗᐊᑦ ᓴᐃᒍᖅ ᓯᒃ ᑯᐃᒍᓐ ᓇᓯᐊᕐ ᑎᓗᒍ ᐊᖅᑭᒡᒥᓂᒃ ᐊᒻᒪᓗ ᑐᑦᑐᓂᒃ ᐅᖅᑲᕐ ᓯᒪᔭᕐᖓᓂ ᐃᓄᐃᑦ ᓯᕗᓪᓕᒥ ᐊᓪᓚᓯᒪᔪᒥ ᑐᓴᕐᓴᓂ ᓵᒃ ᑯᐊᓗ ᓯᕗᓪᓕᐸᑎᔭᖅᑲᕐ ᒥᓯᑎ ᐱᓂᕐᓗᑎᑦ ᓯᑕᐃᓕᓂᕐᒥᒃ ᐊᐅᓚᓂᓕᑎᔮᒃᑯᑦ ᑲᓇᑕᒥ, ᓴᐃᒍᕐᓂᒃ ᒪᑭᑎᑎᒍᒪᕐᖓᓇᑐᑦ ᑭᓯᐊᓂ ᐊᕿᓯᐃᑦᓯᐊᕈᑎᐅᓚᔭᕐ ᑐᒥᒃ ᐅᖅᑲᕐ ᓯᒪᒥᔪᑦ ᓯᒃ ᑯᐃᒍᑎᐅᓚᔭᕐ ᑐᐸ ᒥᑦᓵᓄᑦ.

ᐊᖅᑭᓱᐃᒋᐊᕈᑏᑦ

ᐅᖄᑎᑦ ᒪᑕ ᐊᐅᓚᓂᓕᑎᕈᑉ ᑯᑦ ᑲᓇᑕᒥ ᒥᕐᕕᒥ ᐱᓂᕐ ᓗᑕᐃᓕᒐᓯᐊᕐ ᓂᒥᒃ, ᐱᓂᕐ ᓗᓂᕕᓂᖓᓂᑦᓗ ᑲᕆᓐ ᐳᕈᒃᒥ (Cranbrook) ᐊᒻᒪᓗ ᐃᓱᒪᕆᔭᒥᓂ ᓴᐃᑯᑉ ᒥᑦᓴᓄ ᐊᕐᕋᑦ ᑕᐅᒪᓐᒥᔭᒥᒃ ᐅᑯᓇᖓ ᖃᐅᔨᒪᑎᑦ ᓯᔨᓄᑦ ᑖᒃ ᑯᐊ ᓄᓇᒥ ᑎᑐᒥᐊᕐ ᑎᑯᑦ ᑭᓐ ᓚᑐᕐ ᑎᕆᑦ ᐊᒻᒪᓗ ᓄᓇᓕ ᑲᕿᒪᐱᖓᓂᒥᐅᑦ ᐊᕐᕆᖃᑎᕆ̊ᓕᓚᐅᕐ ᒥᒪᑕ (ᐅᖃᐅᑎᕆᖃᓚᐅᑲᓐᒥᓯᑎᒃ ᐊᑯᓂᓚᓚᒃ) ᐱᒍᓐ ᓇᐅᑎᒥᒃ ᐊᕐᕆᓕᓚᐅᕐ ᒥᒪᑕ ᓴᐃᑯᕐ ᓂᒃ ᓇᑉᐸᑕᐅᑎᓯᓂᕐ ᒥᒃ. ᐱᒍᓐ ᓇᐅᑎᑕᕐ ᑎᓯᓚᓗᐊᕐ ᓯᑎᒃ ᒪᓕᑦ ᑕᐅᔦᑦ ᓴᓂ ᑕᑯᓇᖓ ᐊᐅᓚᓂᓕᑎᕈᑉ ᑯᑦ ᑲᓇᑕᒥ ᐊᐃᑦ ᑐᐃᓚᐅᕐ ᒥᔦᑦ ᓴᐃᑯᑉ ᒥᑦᓴᓄᐊᓕᖓᔪᓂᒃ, ᐊᕐᑯᓯᐅᕐ ᓂᐅᓗ ᒥᕐ ᕕᓕᐅᓂᒍᑦ ᐊᒻᒪᓗ ᐊᑐᕐ ᑕᐅᓂᖓᓂᒃ ᑲᑎᑯᐱ 1-ᒥ ᓄᓇᖓᓄᑦ.

ᓴᐃᑯᖅ

ᐊᓪᓚᑕᐅᓯᒪᓐᒥᒪᑦ ᓯᑯᓪᓕᒥ ᑐᓴᕋᑦᓴᓕᐊᑎᓯᒪᔦᒥ ᐊᓪᓚᓯᒪᔦᓂ, ᐃᓱᒪᓗᑎᒋᔭᕆᓐᓂᒃ ᐃᓄᐃᑦ ᓴᐃᑯᖃᕐ ᓂᐅᑉ ᒥᑦᓴᓄᑦ ᑐᑦᑐᓄᓗᐊᖑᐊᖅ, ᐊᕿᓪ ᕆᓄᓪᓗ ᐊᒻᒪᓗ ᐸᐅᖓᑕᕐ ᕕᐅᓯᒥ. ᐃᓱᒪᑦᓴ-ᓕᐅᕈᑎᓕᐅᓚᐅᕐ ᒥᒪᑕ ᐃᓄᐃᑦ ᐊᒻᒪᓗ ᐊᕐᕆᑦ ᑕᐅᓴᐅᑎᕆᑦ ᓯᑎᒃ ᑖᑯᓇᖓ ᐊᐅᓚᓂᓕᑎᕈᑉ ᑯᓄᑦ ᑲᓇᑕᒥ ᐊᐃᑦ ᑐᑎᒥᓂᒃ ᐃᓱᒪᖃᕐ ᓯᑎᒃ ᐅᒪᔦᐃᑦ ᓴᐳᒻᒥᔭᐅᕆᐊᖃᕐ ᓂᕆᓐᓄᑦ:

1. ᓴᐃᑯᖅ ᐊᓂᒍᑎᕕᐅᒍᓐ ᓇᑎᓪᓗᒍ ᐊᕿᓪ ᕆᓄᑦ 6"x 6"-ᖑᑎᓪᓗᒍ ᑭᓪᓚᕚᕆᑦ, ᐊᒻᒪᓗ

2. ᐊᐅᓚᒍᓐ ᓇᑐᓂᒃ ᐊᒻᒪᓗ ᓯᒃ ᑯᑕᐅᓯᑎᑦ ᑐᓴᔪᓂᒃ ᓯᓚᒎᑦ ᐊᑕᓯᒪᑦ ᓯᐊᓗᑎᓪᓗ ᓴᐃᑯᕐ ᒎᑦ ᑕᑯᔭᐅᒍᓐ ᓇᓯᐊᕐ ᑯᓪᓗᕆᑦ ᐆᒪᔦᓄᑦ ᐅᓪᓗᑯᓪᓗ ᐊᒻᒪᓗ ᑕᕐ ᑑᓚᓗᐊᕐ ᐸᑦ ᐆᒪᔦᓄᑦ ᑕᑯᔭᐅᒍᓐ ᓇᑐᓂᒃ.

ᐃᓄᐃᑦ ᐃᓱᒪᕆᔭᖃᕐ ᒪᑕ, ᑖᒃ ᑯᐊ ᐊᖅᑭᓱᐃᒋᐊᕈᑎᐅᔦᑦ ᒪᓕᑦ ᑕᐅᓯᐊᕐ ᐸᑕ ᐊᐅᓚᓂᓕᑎᕈᑉ ᑯᑦ ᑲᓇᑕᒥ ᓇᑉᐸᐃᒍᓐ ᓇᒪᑕ ᓴᐃᑯᕐ ᓂᒃ ᒥᕐ ᕕᐅᑉ ᐊᕙᓗᓕᒫᖓᓄᑦ ᓯᒃ ᑯᑕᐅᑕᐃᓕᒍᑎᐅᓂᐊᓕᕐ ᒪᑦ ᐆᒪᔦᓄᑦ.

ᐊᖅᑯᑎ

ᖃᐅᔨᓇᓱᐊᕐ ᑕᐅᕆᐊᖅᑲᓱᒪᒻ ᒥᕙᖅ ᑭᓇᒃ ᑯᑦ ᐊᖁᑎᓕᐅᑎᐊᖅᑲᕐ ᒪᖕᑕ ᐊᕐᖅᑲᑎᖨ ᒍᑎᐅᕆᐊᖅᑲᓚᐅᕐ ᒥᒪᑦ. ᓯᑰᑦᓕᒥ ᐊᑦᓚᓯᒪᕙᓂ ᑐᓴᖅᑦ ᓴᓂ ᐅᖅᑲᕐ ᓯᒪᒻ ᒥᒪᑦ ᐊᕐᖅᑲᑎᖨᕐᓂᕐᓐ ᓂᒃ ᑖᑦ ᓯᒪᐅᑉ ᒥᑦᓵᓄᑦ. ᐅᑯᐊᓗ ᓄᓇᓕ ᑲᕙᒪᕐᑦ ᐊᖁᑎᓕᐅᑎᐊᖅᑲᓂᖄᐃᑎᓪᓗᕆᑦ ᐅᕐ ᓯᐊᓗᖅᑲᐅᑎᐊᓗᑉ ᓴᓂᐊᓂ ᐱᕆᐊᕐ ᓗᑎᒃ ᑎᑭᑦᑎᓗᒍ ᒥᕐ ᕿᒡᑦ.

ᑲᑎᖕᒐᓂᕐ ᒥ ᑐᑭᓯᔭᐅᑦ ᓯᐊᓕᓚᐅᕐ ᒥᒪᑦ ᐊᕐᕆᑦ ᑕᐅᓯᓂᓗ ᐃᓄᓐ ᓇᕐᓐ ᓄᑦ ᑎᒥᐅᕙᓄᑦ ᑖᒃ ᑯᐊ ᐊᐅᓚᓂᓕᑎᒌᒃ ᑯᑦ ᑲᓇᑕᒥ ᐊᖅᑯᑎᓕᐅᕐ ᓂᐊᓕᕐ ᑎᓗᕆᑦ ᐅᕐ ᓯᐊᓗᖅᑲᐅᑎᐅᑉ ᓴᓂᐊᓂ ᐱᕆᐊᕐ ᓗᑎᒃ ᑎᑭᓪᓗᒍ ᒥᕐ ᕿᒡᑦ. ᐊᖁᓯᐅᕐ ᓂᖅ ᐱᕆᐊᓚᓕᕐ ᑐᖅ ᐅᐱᓐᖑᓚᖕᕙᒥ ᑭᓇᐅᔭᐃᑦ ᐊᑐᐃᓐ ᓇᐅᐸᑕ ᑭᓯᐊᓂᑦ ᑕᐅᖅ ᓴᐃᒍᐃᑦ ᓇᕐ ᐸᑎᕐ ᑕᐅᓚᐅᕐ ᑎᓇᕆᑦ ᐊᖁᑎᓕᐅᑎᐊᖅᑲᕐ ᒪᑕ. ᓯᑰᑦᓕᐸᒥᓗ ᐊᖁᑎᓕᐅᓕᕉᑎᒃ ᒥᑭᓂᕐ ᓴᓄᑦ ᑭᓯᐊᓂ ᐊᖁᑎᓕᐅᓚᕐ ᑐᑦ ᓄᓇᒃ ᑯᕙᓐ ᓄᑦ. ᐊᕐᓕᕆᐊᖅᑲᑦ ᑕᓚᕐ ᑎᓗᒍ ᓯᐊᕆᕆᐊᕐᒍᓕᕐ ᐸᑦ ᒪᓐ ᓇᐅᓂᖕᓂᓕ ᓯᐅᕆᕐ ᑕᐅᑏᑦ ᐊᖁᑎᒥᒃ ᒥᕐ ᕿᐅᕐ ᓴᓂᕆᓂᑦ ᑐᒥᒃ ᐊᑐᑲᐃᓐ ᓇᖅᑲᑦ ᑕᓚᖕᕙᑦ.

ᐃᓚᐅᔪᑎᒥᓂᒃ ᐃᓄᐃᑦ ᑲᒪᕆᔭᖅᑲᑎᐊᖅᑲᓕᕐ ᑎᓗᕆᑦ ᐊᖁᑎᒥᒃ ᐅᐱᕐ ᖑᖑᔪᓂᖕᒪ ᑭᓯᐊᓂ. ᐅᑭᐅᒃ ᑯ ᐊᐳᑎᔭᑎᐊᖅᑲᕐᒥᒪᑦ ᐊᖁᑎ ᐊᑐᕐ ᑕᐆᖑᔪᕐᓇᒥ ᓯᑭᑐᑦ ᑯᑦ ᑭᓯᐊᓂ. ᐱᑦ ᕙᑎᑕᑲᓪ ᓚᐸᓪᓕ ᒥᕐ ᕿᓕᐊᑎᐊᒥᒃ ᐅᑭᐅᖑᑎᓪᓗᒍ ᐊᐅᓚᓂᓕᑎᒌᒃ ᑯᑦ ᑲᓇᑕᒥ ᐱᑐᓐ ᓇᕿᖅᑲᕐ ᑎᓯᒪᔭᕐ ᒪᑕ ᐊᑐᕐ ᑕᐅᕆᐊᖅᑲᕐ ᑲᓗᐊᕐ ᑎᓗᒍ ᓄᓇᒃ ᑯᕙᒻ ᒪᑎᓐ ᓄᑦ ᑖᑦ ᓯᓘᖕ ᒫᓐ ᓇ ᐊᖁᑎᕆᔭᐅᕙᓘᑦ.

ᑲᑎᑯᕗ 1 ᓄᓇᖕ

ᑲᑎᒪᓂᖅᑲᕐ ᓯᑎᒃ ᑰᑦ ᔭᐊᒥ ᐃᓄᐃᑦ ᐊᕐᓚᐅᕐᒪᑕ ᓂᐅᕿᑦ ᑕᐅᔪᒪᓚᓯᐊᕐ ᑎᓗᒍ ᓄᓇ ᑲᑎᑯᕗ 1 ᐃᓗᐊᓂᑦ ᑐᖅ ᐅᑯᓄᖕ ᐊᐅᓚᓂᓕᑎᒌᒃ ᑯᓄᑦ ᑲᓇᑕᒥ. ᑕᐃᒪᐃᓕᖕᒐᓗᐊᕐ ᑎᓗᒍ ᓄᓇᓖᑦ ᑲᕙᒫᐱᖕ ᐊᕐᕆᑦ ᓯᒪᓕᑎᕐ ᒪᑦ ᓴᐃᒍᕐ ᓂᒃ ᓇᕐ ᐸᐃᒍᒪᔭᓄᑦ, ᓄᓇᒥᒃ ᑎᒍᒥᐊᕐ ᑎᑯᑦ ᐊᕐᓂᖅᑲᕐ ᓯᒪᒍᒪᔭᑦ ᓂᐅᖁᓯᕆᐊᒥᒃ ᓄᓇᒥᒃ. ᒪᓐ ᓇᐅᓂᖕᓂᓕ ᓇᒍᑦ ᓇᕐ ᐸᔭᕐ ᑕᐅᖁᐳᓪ ᒪᖕᕐ ᒥᒃ ᖃᐅᔨᒪᕐᑐᑦ.

ᑕᐃᒪᐃᑦᓴᒪᑦ ᑕᒪ ᓄᓇᒥᒃ ᑎᒍᒥᐊᕐ ᑎᑯᑦ ᐃᓯᒪᑦ ᓴᓂᐊᑎᓯᒪᔪᕐᑦ ᓇᑉᐸᐃᖅᑯᐸᑦ ᓯᑎᒃ ᓴᐃᒍᕐ ᓂᒃ ᓄᓇᖅᑯᑎᒥᓂ ᐊᑉᑕᓕᒫᖕᒐᓂ ᐃᓚᐅᑎᓪᓗᒍ ᓄᓇᖅᑯᑎᑕᑎᓚᕐ ᑕᖕᒐ ᑖᒃ ᑯᐊ ᐊᐅᓚᓂᓕᑎᕙᒃ ᑯᑦ ᑲᓇᑕᒥ ᐊᖏᓯᕐ ᑕᐅᓚᕐ ᒪᑦ ᐊᖏᖅᑲᑎᒌᒪᓯᖅᑲᓕᕈᑎᒃ ᑖᒃ ᑯᐊ ᐊᐅᓚᓂᓕᑎᕙᒃ ᑯᑦ ᑲᓇᑕᒥ, ᑯᐸᐃᒃ ᑲᐸᒪᖕᒐᑦ ᐊᒻᒪᓗ ᓄᓇᒥᒃ ᑎᒍᒥᐊᕐ ᑎᑯᓐ ᓄᑦ. ᐊᖏᑦ ᓴᐅᑎᒋᓚᐅᕐ ᑐᑦ ᐊᐅᓚᓂᓕᑎᕙᒃ ᑯᑦ ᑲᓇᑕᒥ ᑖᑦ ᓯᒥᖕᒐ ᐃᓯᒪᑦ ᓴᓂᐊᑎᓯᒪᕙᒥᒃ.

ᑐᑭᑖᕐ ᓂᑎᓯᒪᔪᖕᒐ

ᑲᑎᒪᓂᖅᑳᕐ ᑎᓗᒍ ᑰᑦ ᕙᐊᒥ ᐃᓯᒪᖅᑲᑎᒋᖕᒋᓂᖕᒐᑦ ᑕᑯᑦ ᓴᐅᓚᐅᕐ ᒪᑦ. ᐊᐅᓚᓂᓕᑎᕙᒃ ᑯᑦ ᑲᓇᑕᒥ ᓇᑉᐸᐃᒍᒪᓂᑎᓚᐅᕐ ᑕᖕᒐ ᓴᐃᒍᕐ ᓂᒃ ᒥᑉ ᐱᐅᑉ ᐊᑉᐳᓕᒫᖕᒐᓄᑦ, ᐊᖅᑯᑎᓕᐅᕚᒪᑦ ᓯᑎᓪᓗ ᒥᑉ ᐱᐅᑉ 08-26 ᓴᓂᕙᓂ ᓯᖅᑭᓂᖕᒐᓂᑦᑐᒥ ᐊᒻᒪᓗ ᓯᖅᑭᓂᖕᒐᑕ ᑕᓕᕐ ᐱᐊᓂ (Southeast) ᐊᒻᒪᓗ ᓂᐅᐱᕚᒪᒋᐊᒥᒃ ᑲᑎᑯᕗ 1 ᐃᓗᐊᓂ.

ᐃᓄᐃᑦᑐ ᓇᑉᐸᑎᕐ ᑕᐅᖅᑯᕚᑎᓪᓗᒋᑦ ᓴᐃᒍᕐ ᓂᒃ ᑕᑦᓕᒪᐅᓕᖕᒐᑎᓪᓗᒋᑦ ᐊᓂᒍᑎᐱᑦᓴᕐᓐ ᓄᑦ ᐊᒻᒪᓗ ᒫᓐᓇ ᐊᖅᑯᑎᑦ ᓴᓇᒋᐊᕐ ᑕᐅᖅᑯᑦ ᓯᒍ ᑎᑭᒍᓇᐅᓗᓂ ᒥᑉ ᐱᐅᑉ ᓴᓂᕋᓄᕐ ᑐᓴᒥᒃ. ᐊᖏᕋᑎᓪᓗ ᓂᐅᐱᕐ ᑕᐅᒍ-ᒪᑎᓪᓗᒍ ᑲᑎᑯᕗ 1 ᓄᓇᖅᑯᑎᖕᒐᑦ ᐅᑯᓄᖕᒐ ᐊᐅᓚᓂᓕᑎᕙᒃ ᑯᓄᑦ ᑲᓇᑕᒥ.

ᐊᖏᑦ ᑕᐅᓯᒪᕙᑎᓚᐅᕐ ᒥᒪᑕ ᐊᐅᓚᓂᓕᑎᕙᒃ ᑯᑦ ᑲᓇᑕᒥ ᓇᑉᐸᑎᑎᒋᐊᒥᒃ ᓴᐃᒍᕐ ᓂᒃ ᐅᑯᓄᖕᒐ ᓄᓇᓖᑦ ᑲᐸᒪᐱᖕᒐᓄᑦ ᐊᒻᒪᓗ ᓄᓇᒥᒃ ᑎᒍᒥᐊᕐ ᑎᑯᓐ ᓄᑦ, ᓯᓇᐅᑉ ᐊᖏᑦ ᑕᐅᓯᒪᒪᑎ ᓯᓕ ᐃᓄᓐ ᓄᑦ. ᐃᓚᐅᒻ ᒥᑎᓪᓗᒍ ᑖᒃ ᑯᐊ ᐊᐅᓚᓂᓕᑎᕙᒃ ᑯᑦ ᑲᓇᑕᒥ ᑲᒪᒋᔭᖅᑲᕈᒪᑦ ᓯᑎᒃ ᒥᑉ ᐱᐅᑉ ᓴᓂᕋᓂ ᑭᓯᐊᓂ ᐅᑯᓄᖕᒐᓗ ᐃᓄᓐ ᓄᑦ ᐊᖅᑯᓯᐅᑎᐊᖅᑲᕐ ᓂᕋᕐ ᑕᐅᓯᑎᒃ ᐊᖅᑯᑎᓕᒪᒥᒃ ᐅᕐ ᓯᐊᓗᖅᑲᐅᑎᐊᓗᓐ ᓂᑦ ᐱᒋᐊᕐ ᓗᑎᒃ ᑎᑭᑦ ᓗᒍ ᒥᑉ ᐱᓗᑦ ᑲᒪᒋᔭᖅᑎᐊᖅᑲᕐ ᓂᕋᕐ ᑕᐅᓯᑎᒃ.

ᐊᑦ ᐹᒋᖕᒋᓗᑐᓚᐅᕐ ᒪᑕ ᑕᒪ ᐃᓯᒪᒋᔭᐃᑦ ᑲᑎᖕᒋᐊᖅᑯᕐ ᓂᖅ ᐊᑦᓚᑕᐅᓯᒪᓕᓕᓚᐅᑎᑦᓯᖅ ᓯᑦᑕᓕᒥ ᑐᓴᕋᑦ ᓴᓂ ᐱᐱᓕᒪᖕᒐᒍᑦ ᑐᐊᐱᕐ ᓗᓂ ᐊᖅᑭᓯᑎᑦ ᓯᐊᕿᐹᒧᑦ. ᐅᖅᑲᖅᑲᑎᒥᖅᑲᑎᕋᖅᑲᓚᐅᑲᑦ ᓯᑎᒃ ᖃᐅᐱᒪᑎᑦ ᓯᐹᓂᒃ ᐊᐅᓚᓂᓕᑎᕙᒃ ᑯᑦ ᑲᓇᑕᒥ ᐃᓄᐃᑦ ᐱᔭᐅᖅᑯᒐᔭᕐ ᑕᖕᒐᓂᒃ ᐊᖏᖅᑲᔭᓚᐅᖕᒋᑲᑦ ᐊᒻᒪᓗ ᑲᑎᒪᐅᑎᒥᒍᒪᓕᕐ ᓯᒍ. ᑲᑎᒪᓂᕐ ᒥ ᐊᖏᖅᑲᑎᒌᓕᓕᐅᑎᖅᑦ ᓇᑉᐸᐃᒥᐊᒥᒃ ᓴᐃᒍᕐ ᓂᒃ ᐊᒻᒪᓗ ᐊᐅᓚᓂᓕᑎᕙᒃ ᑯᑦ ᑲᓇᑕᒥ ᐊᖏᕐ ᓯᑎᒃ ᐊᖅᑯᑎᓕᐅᕆᐊᖅᑲᓕᕐ ᓯᑎᒃ. ᐊᕿᒋᐊᒍᑎᐅᔪᓂᑦᑐ ᐊᖏᕐ ᒥᓯᑎᒃ: ᐊᖅᑯᑎᓕᐅᖅᑲᓕᑎᒋᐊᖅᑲᕋᒥᒃ ᓇᑉᐸᑎᑎᓕᐅᕋᑎᒃ ᓴᐃᒍᕐ ᓂᒃ; ᓴᐃᒍᐃᑦᑐ ᑭᑦᓚᒌᖏᑦ 6" x 6" -ᖑᒥᐊᖅᑲᓕᕐ ᑎᓗᒥᑦ ᐃᓚᖅᑲᕐ ᓗᑎᒃ ᓂᒪᒌᓯᓂᒃ ᑕᑯᔭᐅᒍᓐ ᓇᑐᓂᒃ ᐆᒪᕙᓄᑦ: ᓇᑉᐸᑎᑎᓕᓕᕐ ᓯᑎᑦᑐ ᓴᐃᒍᕐ ᓂᒃ ᓄᓇᑦ ᓴᖕᒐᑦ ᐊᖏᖅᑲᑎᒌᒍᑎᐅᓚᐅᑲᑦ ᑎᓗᒍ ᐊᖏᓂᑎᒥᐊᓕᖕᒐ ᐅᑯᓄᖕᒐ ᐊᐅᓚᓂᓕᑎᕙᒃ ᑯᑦ ᑲᓇᑕᒥ, ᑯᐸᐃᒃ ᑲᐸᒪᖕᒐ ᐊᒻᒪᓗ ᓄᓇᒥᒃ ᑎᒍᒥᐊᕐ ᑎᑯᓐ ᓄᑦ.

ᐱᑦᔪᑎᐅᒍᑎᓕᒪᒐᓐᓄᑦ ᐊᖏᖅᑲᑎᒋᓚᐅᖅᑐᑦ ᑎᒥᐅᔪᓕᒪᑦ ᐃᓚᐅᔪᑦ. ᐊᖅᑭᓱᖅ ᑕᐅᔪᑦ ᓴᑐᓂᖅᑐᖅ ᓄᓇᑕᑎᔭᐅᒐᔭᖅᑐᖅ ᐊᖏᓂᑎᒋᐊᓕᖕᖓ ᑖᒃ ᑯᓄᖕᖓ ᐊᐅᓚᓂᓕᑎᑦᓯᒃ ᑯᓄᑦ ᑲᓇᑕᒥ ᓄᓇᑎᔭᐅᓗᓂ.

ᓄᖅᑎᐊᕈᑎᐅᓕᖅ ᑎᓗᒍ ᐅᖅᑲᖅ ᑕᐅᒋᐊᖅᑲᖅ ᒥᒪ ᓄᓇᐅᑉ ᐃᒻ ᒧᐊ ᖅᑲᓄᐃᑦ ᑐᓯᐊᕐᔪᒻ ᒪᖕᖓᑦ. ᑕᐃᒪᐃᓕᖕᖓᓴᒪ ᑕᒐ ᐊᑦᓚᓯᒪᔪᑦ ᑐᓴᕋᑦᓴᐃᑦ ᐊᑦᓚᓯᒪᔭᖕᖓᑦ ᐅᑯᐊ ᐊᖅᑭᐊᒃ (Archèos) ᑎᒥᐅᔪᑉ ᐃᓯᒪᑦᓴᓕᐊᑎᓯ-ᒪᔭᕐᒋᑦ ᑕ ᖅᑭᒥᖅ ᕿᔭᐅᒋᐊᖅᑲᖅ ᓂᖕᖓᓂᒃ ᓄᓇᐅᑉ ᐃᒻ ᒧᐊ ᐊᐳᑎᖅᑲᕿᓐ ᓇᐃᓴᑐᐊᖅ ᐸᑦ ᑲᒪᒋᔭᐅᒋᐊᓕᖅ ᑎᓗᒍ. ᐅᑯᐊᓗ ᐊᐅᓚᓂᓕᑎᑦᓯᒃ ᑯᑦ ᑲᓇᑕᒥ ᐊᖏᓕᐅᖅ ᒥᒪᑕ ᐱᔭᐅᑎᑦ ᓯᓯᐊᓕᖅ ᓂᕋᖅ ᓯᑎᒃ ᖅᑭᒥᖅ ᕿᔭᐅᑦ ᓚᑎᑦ ᓯᓗᑎᒃ ᐅᐱᖕᖓᓴᐅᓕᑐᐊᖅ ᐸᑦ.

"This accident was investigated to provide guidance toward the prevention of a recurrence. The content of this report is confined to relevant circumstances and is published for accident prevention purposes only."

TP 1991

REPORT # H80001

Aircraft Accident

Pacific Western Airlines

Boeing 737, C-FPWC

Cranbrook, B.C.

11 February, 1978

Following an instrument approach and touchdown with reverse selection, the pilot immediately elected to go-around due to an obstruction on the runway. The engine thrust reversers did not fully re-stow because hydraulic power was automatically cut off at lift-off. After clearing the obstruction and climbing briefly, the aircraft crashed to the left of the runway. The accident was due to a complex set of circumstances.

This accident was investigated and this report was prepared by the Aviation Safety Investigation Division, Aviation Safety Bureau, Transport Canada.

This accident investigation and this report have been audited by the Aircraft Accident Review Board. The Board has considered all information available, including that from involved parties. The Board agrees with the content of this report for release as public information.

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1.16 8 PARA: ROBERT FRANCIS

1. FACTUAL INFORMATION

1.1 History of the Flight

Pacific Western Airlines flight 314 was a scheduled Boeing 737 service from Edmonton, Alberta to Castlegar with stops at Fort McMurray, Edmonton, Calgary and Cranbrook, B.C. The flight departed Calgary at 1932Z,[1] 11 February 1978, for Cranbrook with a Company estimated time enroute of 23 minutes. This estimate was passed to the Company Agent in Cranbrook.

Flight 314 was cleared by Calgary Air Traffic Control to Cranbrook via high level airway 505, and reached the assigned altitude of 20,000 feet at 1938Z. Air Traffic Control in Calgary transmitted an ETA (estimated time of arrival) of 2005Z to Cranbrook Aeradio, via the land line.

Cranbrook is an "uncontrolled" airport without a control tower, but within controlled airspace, with an "Aeradio" station providing communications, weather, and advisory service. At Cranbrook it was snowing with the visibility reported as 3/4 of a mile, and a radio equipped snow removal vehicle was sweeping the runway. The Aeradio operator at Cranbrook alerted the vehicle operator about the incoming aircraft at 1935Z and gave him the ETA of 2005Z; they both expected the flight would report by the "Skookum Beacon" on a straight-in approach to runway 16, thus giving the vehicle operator about seven minutes to get off the runway.

At 1942Z Flight 314 called Calgary and requested and received descent clearance; it was also given clearance for the approach to Cranbrook. At 1944Z, the flight called out of 18000 feet in the descent, and Calgary ATC advised the flight to contact Aeradio. At 1945Z, Flight 314 made initial contact with Cranbrook Aeradio and at 1946Z Cranbrook passed the latest weather, altimeter and runway information. At 1947Z Cranbrook Aeradio advised the

1 *All times in this report are Greenwich mean time (Z); for mountain standard time subtract 7 hours.*

flight that snow removal was in progress and gave the latest visibility; Flight 314 acknowledged. No further transmissions were received from the flight by Aeradio or ATC.

Evidence indicates the aircraft passed the Skookum beacon inbound on a straight-in instrument approach, and flew the ILS for runway 16 to touchdown.[1] According to witnesses and estimates partially derived from flight data recorder information, the aircraft touched down at 1955Z approximately 800 feet from the threshold and reverse thrust was selected. Reverse thrust was cancelled immediately after touchdown and a go-around was initiated. The aircraft became airborne prior to the 2000 foot mark, and flew down the runway at a height of 50 to 70 feet, flying over a snow removal vehicle which was still on the runway, 2050 feet from the threshold and 20 feet from the right edge. About this time the left engine thrust reverser doors deployed. A few seconds later, the flap was selected up from 40° to 15°. The landing gear remained down and locked. Six seconds before impact and just over 4,000 feet from the runway threshold, the flight recorder data indicates that a large amount of left rudder was momentarily applied.[2] The aircraft climbed to 300 to 400 feet above the airfield, banked steeply to the left, lost height and side-slipped into the ground to the left of the runway. Fire broke out on impact.

2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	4	38	
Serious		5	
Minor/None	1	1	

Damage to Aircraft

The aircraft was destroyed by impact and fire.

1 *See Figure 4, "Depiction of flight path from Calgary to Cranbrook as verified by simulated studies."*

2 *The validity of this FDR indication is in question. See subsequent text and also appendix "C".*

1.4 Other Damage

None

1.5 Personnel Information

(a) The pilot-in-command (Captain) was 30 years of age and had been flying for eleven years. He held an Airline Transport licence valid until July, 1978 with no limitations. The licence was endorsed for Convair 640, Lockheed 382 and Boeing 737. The Captain had flown a line check 14 April, 1977, a simulator check 26 September 1977 and a pilot proficiency check on 14 December, 1977. He had a total of 5173 hrs, of which 2780 were flown on the Boeing 737. The day prior to the accident flight was a day of rest and he had been on duty for 8 hours at the time of the accident.

The First Officer was 25 years of age and had been flying for five years. He held a Senior Commercial Licence valid until November, 1978 with no limitations. The licence was endorsed for Lockheed 382 and Boeing 737. He held a Class I Instrument Rating, valid to January 1979. The First Officer had completed the company training programme in December, 1977 and had accomplished the required checks at that time. He had flown 1316 hrs of which 81 were on the Boeing 737. The day prior to the accident flight was a day of rest and he had been on duty for 8 hrs at the time of the accident.

(b) The Flight Attendants had been with the company approximately three years, and had received the company Flight Attendants course. Recurrency training including emergency procedures had been provided in accordance with company policy.

The Aeradio Operator on duty at Cranbrook was qualified for his position and had been employed in this capacity for 5 years. Prior to this employment, he had been a military Air Traffic Controller for about 20 years.

The Air Traffic Controllers in Calgary who were involved with the control of Flight 314 were properly licensed and experienced.

The Runway Maintenance Equipment Operator at Cranbrook was qualified and had been employed in this position for five years.

1.6 Aircraft Information

The aircraft, a Boeing 737-275, was manufactured in 1970, bearing Boeing serial number 20142, Company fleet number 734. Two Model JT8D-9A Pratt and Whitney power plants were installed. The aircraft was maintained in accordance with the approved Company maintenance manual and was within the required check cycle.

Part II of the Journey Log used for maintenance purposes made reference to a previous fault in the thrust reverser. Log sheet 46419 "Snag #3" concerned thrust reversers. The reversers would not deploy or restow; the fault was corrected by replacing the engine accessory module. Log sheet 46420 indicates that the reversers operated properly on the next five landings. Investigation was continued to determine if the snag had in fact been cleared effectively. The engine accessory unit module S/N M00398, which had been removed, was bench tested and it was determined that the number 1 engine thrust reverser unlocked light flickered when the thrust reverser door sensors were activated. Replacement engine accessory unit module S/N M00162 was also bench tested and no faults were found. From these tests and the absence of thrust reverser snags from subsequent flights it appears that the thrust reverser system operation was normal for both engines, at the time of the accident. Module S/N M00162 was recovered from the wreckage.

Boeing Service Bulletin S/B 737-78-1023 had been incorporated. This modification removes the nose gear squat switch from the thrust reverser logic system and permits the use of reverse thrust earlier in the landing sequence.

The weight and balance data was up-to-date and the aircraft loading was within limits.

The aircraft was fuelled with JP-4. Samples of this fuel, along with samples of the oil and hydraulic fluid were analyzed and appeared to be of the types specified (Report LP 60/78 refers).

1.7 <u>Meteorological Information</u>

The Cranbrook terminal forecast issued at 1630 GMT, 11 Feb 78 was as follows:

> "Ceiling 4500 ft broken, 10,000 feet broken variable to overcast, occasionally 4500 ft scattered cumulus, 10,000 ft broken, high broken."

The actual conditions at Cranbrook at 1600 GMT were:

> "Estimated ceiling 2500 overcast, visibility 10 miles in very light snow, temp -6^{o}, dew point -10", wind 160" at 11, altimeter 29.73 inches with visibility to the south reported at 6 miles."

At 1900 GMT the amended terminal forecast for Cranbrook was issued as:

> "Ceiling 1500 ft broken, 4000 ft overcast, light snow, variable 1500 ft obscured, visibility 1 mile in light snow."

This forecast compares favourably to the actuals issued at 1900 GMT and 2000 GMT:

"1900Z Precipitation ceiling 1500 ft obscured, visibility 1 mile in light snow."

"2000Z Precipitation ceiling 1200 ft obscured, visibility 3/4 mile in light snow."

Eyewitnesses at the airport provided information confirming that the surface visibility was about 3/4 mile at the time of the accident (1955Z).

A document recovered from the wreckage established that the crew had received and recorded the amended forecast as well as the latest observations.

The possibility of wind shear was investigated and considered to be remote.

.8 Aids to Navigation (Figure 3 relates to sections 1.8, 1.9 and 1.10)

Cranbrook airport is equipped with the following navigational and approach aids:

a) VOR/DME YXC freq. 112.1 MHz, channel 58 with scheduled weather broadcasts, situated 12.4 n.m. west of the airport;

b) NDB "X", freq. 219 kHz, situated 0.8 n.m. from the threshold of and aligned with runway 16;

c) NDB "XC", freq. 242 kHz, with scheduled weather broadcasts, situated 3.8 n.m. from the threshold of runway 16 and aligned with that runway;

d) NDB "SX", freq. 368 kHz, situated 20.1 n.m. from the threshold and aligned with runway 16;

e) ILS "IXC", freq. 110.3 MHz serving runway 16.

All navigational and approach aids were serviceable at the time of the accident. They were flight checked after the accident and determined to be within tolerance.

1.9 Communications

Cranbrook Aeradio operates on VHF frequencies 122.2, 126.7, 122.1(R) and 121.5 MHz, UHF frequencies 262.7, and 243 MHz, and can transmit on the NDB frequency of 242 kHz and VOR frequency 112.1 MHz. There is a land line between the Aeradio and other stations. Cranbrook is also able to monitor the peripheral Calgary frequency of 125.2 MHz. The Aeradio operator has two-way communication with the vehicle traffic that is allowed on the manoeuvring area of the airport, on frequency 122.6 MHz.

Pertinent to the accident are the ATC tape recordings from Calgary and the Aeradio recordings from Cranbrook.

The Cranbrook tape was a 4 track type. One channel recorded a number of Aeradio stations linked by a land line as well as aircraft communications. These recordings were found to have been made at a very low level and presented considerable difficulty in interpretation.

A preliminary transcript of the Cranbrook tape was made shortly after the accident. Considerable effort was then necessary to refine this transcript and to extract the maximum amount of relevant information. In order to identify the voices and to separate transmissions made from ground stations from those emanating from aircraft, spectral analysis and "voice-print" techniques were employed.

The pertinent conversations between ground stations and Flight 314 are detailed in Appendix "A"; additional information is on Figure 2.

1.10 Aerodrome Information

Cranbrook Airport, operated by the City of Cranbrook under a lease agreement with Transport Canada, has one runway, 16/34 6000 ft long, 3082 ft above sea level. The aerodrome has:

runway lights;

taxiway and ramp lighting;

approach lighting on runway 16 with centre row category 1 high intensity lead in lights with threshold and runway end high intensity lights variable to 5 settings; approach lighting on runway 34 with centre row low intensity lead in lights with high intensity runway identification strobe lights;

2 bar VASIS on runway 34;

rotating beacon.

The runway was covered in light snow and snow removal was in progress at the time of the accident. All lighting was serviceable.

1.11 Flight Recorders

The aircraft was fitted with a Collins 642C-1 Cockpit Voice Recorder Serial No 657, and a Leigh Instruments FDRS-38 Flight Data Recorder System utilizing an RTD-1 Digital Recorder Serial No. 0041. The recorders were situated in the rear part of the pressurized cabin, an area that was extensively damaged by fire.

The tail section broke away during the crash and remained essentially intact. The accident occurred at 12:55 local time but the recorders were not identified and recovered until the next morning.

The cockpit voice and flight data recorders were almost totally destroyed by excessive heat. The damage was most probably due to the prolonged period of immersion in the hot surroundings rather than to the extreme temperature of the fire. A limited amount of information was recovered visually from the charred Flight Data Recorder tape with extreme difficulty. The usefulness of the recovered data was substantially reduced due to a number of malfunctions in the recording system as follows:

- The Synchro Converter in the Recorder Electronics Unit was faulty. This seriously affected eight of the sixteen measured parameters.

- There were intermittent faults in the monitoring of the normal acceleration together with a bias error of 0.24g.

- Both the fine synchro parameters monitoring small variations in the magnetic heading and control wheel position were inoperative.

- Engine 1 fuel flow monitoring was inoperative.

- The digital signal fed to three or four of the eight sequential tracks on the tape was abnormal due to an unidentified fault that prevented recovery of any data on those tracks. In particular, this prevented any study of the information from the track preceding that on which the accident occurred.

- The lack of monitoring of the roll angle (not specified by current Canadian requirements), prevented detailed analysis of the motions of the aircraft following initiation of the overshoot.

Information recovered from the tape is given in detail in Figure 1. Vertical lines in shaded areas on that diagram are associated with the synchro converter fault referred to above and each indicates a range within which that parameter must have been at the time indicated. Relevant portions of the data are summarized in Figure 2.

1.12 Wreckage and Impact Information

Physical evidence shows that the airplane had rolled to the left about 90 degrees when the left side of the nose contacted the ground with a nose down angle of about 30 degrees. The left wing tip impacted while the aircraft was at 90° of bank and was progressively broken up. The fuselage centre section was broken up and the wing centre section broke diagonally across from the left rear spar to the right wing front spar as the fuselage crashed into the ground.

The surface impacted was level frozen ground covered by about two feet of snow.

The flap selector lever was at 15°. The landing gear selector handle was down. On the overhead panel in the cockpit, the guard for the left thrust reverser override switch had been moved to the open position. The guard was undamaged. The witness wire on the guard had been broken and the switch was exposed but had not been moved from the "normal" position. The right switch was in the guarded, witness wired "normal" position.

At impact the thrust reverser on the left engine was fully deployed. The right engine thrust reverser was in an intermediate, but nearly stowed forward thrust position. Both reverser unlock lights were illuminated. Power on the left engine was at or near idle; power on the right engine was at less than maximum thrust (see Flight Data Recorder Information). The application of full right rudder and aileron was evident.

The flaps were at approximately 20° and retracting. The ground spoilers were retracted (due to power lever advancement beyond 25°). The landing gear was extended. Electrical and hydraulic power were available.

1.13 Medical and Pathological Information

1.13.1 The Captain

Autopsy revealed a number of pertinent findings. There was a large irregularly shaped wound over the anterior chest wall. An open fracture was noted at the mid section of the right tibia and fibula. A distinct pressure mark was seen over the sole of the right boot which also left an imprint on the corresponding foot. A linear laceration and comminuted fracture was present at the base of the right thumb and there were numerous lacerations on the palmar surface of the right hand.

There are indications that the fracture of the Captain's right thumb may have occurred in flight rather than at impact. (The power levers were found spread apart far enough that they would have avulsed his thumb on impact.) The lacerations on the palmar surface of his right hand appear to have been produced by the plastic knob of the power lever breaking during the crash. The injury pattern in his right leg is consistent with this pilot applying hard right rudder at the moment of first impact with the ground. The injuries in his left arm and hand were consistent with application of full right aileron. The chest injury was produced by the left horn of the control column being held back while the body was thrown toward the left side of the cockpit. Since he was not wearing a shoulder harness but only a lap belt his body jackknifed on impact allowing the left horn of the control column to penetrate his chest. After the first impact the nose section bounced throwing this pilot toward the right side of the cockpit so that his head came to lie near the First Officer's control column with his chest over the centre console.

There was no evidence of disease which might have impaired his flying performance. Biochemical determinations did not show the presence of any alcohol, carbon monoxide or cyanide.

The post mortem tissue lactate profile indicated that this pilot had an acute stress reaction for approximately the last 20 seconds before impact.

1.13.2 The First Officer

The following injuries are of particular interest. There was a fracture of the left humerus and compound fractures of the distal aspects of the left ulna and radius. Multiple fractures were seen in the right tibia and fibula. There was evidence of an imprint upon the sole of the right foot corresponding to the pattern of the rudder pedal. There were fewer lacerations on the palmar surface of the left hand than observed on the other pilot.

The injury pattern is consistent with this pilot also applying hard right rudder at impact. At the same time he was apparently pushing with his left hand over the Captain's right hand on the power levers. The fractures in his left upper extremity were likely produced at the time of the first impact. The injuries on his right arm and hand were consistent with application of full right aileron. There were no shoulder harness or lap belt related injuries; he was not wearing either of these.[1] On the second impact his body was thrown toward the front right hand corner of the cockpit.

Internal examination did not show any evidence of pre-existing disease. Biochemical determinations did not reveal the presence of any alcohol, carbon monoxide, or cyanide.

1 *See also Section 1.12 - the harness being undone may have been due to an attempt to reach the left engine thrust reverser override switch.*

The post mortem tissue lactate profile indicated an acute stress reaction for the last 10 to 11 seconds before impact.

1.13.3 The Cabin Occupants

The two forward cabin attendants and two passengers were found in the cockpit section having died of crushing and penetrating injuries. Seven passengers remained in the front section of the aircraft when the latter came to rest. Six of these were found dead of crushing injuries, mostly to the head. One had survived but died eleven days later, also as a result of head injuries.

Sixteen passengers were found widely scattered outside the aircraft on the left side of the front and centre section. They apparently fell out of the aircraft as the left side of the fuselage broke open. Passengers near the centre section and along the wreckage trail had minimal injuries but died of smoke inhalation and/or burns. There were thirteen passengers found on the right side of the centre section and between it and the rear section. These suffered from flailing injuries and burns of which many died.

1.14 Fire

1.14.1 Response

The equipment operator on the runway observed the aircraft crash approximately 10 seconds after it passed over him. He immediately alerted the Aeradio operator and then drove hastily to the fire hall where he was met by the Fire Chief who had responded to the siren. Both men departed with the crash truck and arrived near the crash site within five minutes after the aircraft crashed. The City of Cranbrook fire department responded with a 4 wheel drive main pumper carrying 730 gallons of water and 20 gallons of chemical plus a smaller 4 wheel drive mini pumper using water only.

Kimberley Fire Department responded with one pumper. These units arrived at the site approximately 25 minutes after the alarm was sounded. Because of snow banks and deep snow bordering the side of the runway, none of the units was able to approach within effective fire fighting range. Approximately one hour after the crash a roadway was opened by a snow blower and the two units from the City of Cranbrook were then used to extinguish the spot fires.

1.14.2 Initiation

The fire was initiated either by the #1 engine which came off as the left wing was being progressively broken up, spilling out large quantities of JP-4 fuel, probably in both liquid and mist form, and/or by broken electrical wiring in the fuselage. The fire spread farther down the wreckage trail to other parts of the airplane and to the right wing fuel tanks. The #1 engine did not show fire damage; neither did the #2 engine. It was reported that the tail section did not catch fire until a little later. The flight attendant who was seated in the rear and survived the crash, reported that the rear fuselage was drenched with fuel.

The fire would probably have started in much the same way regardless of what type of aviation fuel was used since there is little difference in the flammability when it is in the form of a mist. Once the fire propagates back to the source of the fuel and ignites the fuel as it is released from the system, then the rate of fire development depends primarily on the spillage rate, with fuel volatility being of secondary importance. (Ref. Technical Report AFAPL-TR-66-9, March 1966, *A Review and Analysis of the Safety of Jet Fuel.*)

15 Survival Aspects

15.1 Evacuation

Two survivors escaped through the right rear emergency door. Some difficulty was encountered opening the door because of refuse blocking access to the exit. Because of the catastrophic break-up, the other exits were not required; survivors were able to evacuate through breaks in the fuselage; one passenger was thrown clear still in a seat.

1.15.2 Rescue

The snow sweeper driver notified the Aeradio operator within 10 seconds of the crash. The Aeradio operator activated the crash siren and then telephoned the Airport Manager, the Cranbrook and Kimberley Fire Depts as well as the hospitals. These actions were completed within 10 minutes of the crash.

Rescue of survivors was commenced within about five minutes. The injured were carried out by rescuers on foot since the vehicles were hindered by deep snow (See also Sec 1.14). Medical attention was provided at both hospitals in accordance with local emergency procedures.

Arrangements to transport the injured to local hospitals were adequate and medical services and accommodations were satisfactory. Because of fuselage deformation the search for victims was not completed until 36 hours after the accident.

1.15.3 Fire Fighting

The fire was started either by the left engine as it was torn from the wing or by electrical wiring as it broke during fuselage disintegration. The fuel sprayed from the wing tanks as the wing broke up and it was reported that there were three separate fire sites.

The airport crash truck arrived near the site within 5 minutes. The fire fighting equipment from Cranbrook received notification within 10 minutes of the crash and were on the way less than 2 minutes after notification. They arrived within 25 minutes of the crash. No vehicles were able initially to get within range of the fire because of snow conditions. Fire fighters and other rescuers went in on foot to rescue survivors while a snow blower cleared an access road. Fire fighting equipment was able to get close to the site approximately 30 minutes after arrival, and the fire was extinguished about 2.5 hours after the crash.

One of the fire fighting vehicles carried water and dry chemicals while others were water pumpers only. Another unit dispenses foam. A Hurst "Jaws of Life" rescue tool was available.

1.15.4 Crashworthiness

The fuselage breakup destroyed much of the occupiable area of the airplane giving conditions recognized as generally non-survivable; the seats, which were fastened to the floor tracks attached to the floor beams, came loose with their occupants as the floor beams broke. The rear fuselage was provided with a larger stopping distance by the centre fuselage breakup and impact forces were less on persons seated in that area.

All the survivors were seated from row 18 to the back row 21, except one from seat 16A who was thrown out. The fracture of the rear fuselage occurred between stations 727 and 757; seat 16A was at about station 756. Other survivors were in seats 18C, 18F, 19A, 20F, and 21B. A seventh survivor who was seated somewhere up front died in hospital. The two at 18C and 19A were seriously injured. Two passengers, who had been sitting on the left side of the rear section, were thrown outside the aircraft, still attached to their seats; one of these survived. Another passenger on the left side of the rear section managed to escape through the open fuselage in spite of a broken leg and extensive burns. One survivor sitting on the right side, just at the point where the aircraft broke, escaped through the open fuselage. One passenger in the last seat on the right side, and the cabin attendant who sat in the last aisle seat on the left side, escaped through the right rear galley door. This door was opened with difficulty because of waste paper and galley equipment on the floor. The left rear door was twisted and could not be moved.

1.16 Tests and Research

1.16.1 Compulsory Aircraft Position Reporting - Related Regulations

A study was made of related Canadian regulations and of other documents issued to pilots concerning position reporting, to determine their applicability to the Cranbrook instrument approach procedures. The documents examined were the Air Regulations, The Designated Airspace Handbook, Air Navigation Order, Series V, No. 2, Radio Navigation Charts - ICAO Flight Information Publications ENROUTE LOW ALTITUDE and ENROUTE HIGH ALTITUDE, Transport Canada Aeronautical Information Publication FLIGHT PLANNING AND PROCEDURES CANADA AND NORTH ATLANTIC, Transport Canada NOTAM 1/77.

All the foregoing documents relate to instrument flight and reporting procedures. None of the documents obliged a pilot to report on final approach. It was concluded an intent of FLIGHT PLANNING AND PROCEDURES CANADA AND NORTH ATLANTIC was that a pilot should report by a fix on final approach, but because that publication did not have appropriate status in relation to the Air Regulations there was no obligation to do so, in a legal sense.

1.16.2 Flight Tests and Engineering Simulator Studies

The Boeing Airplane Co. conducted flight tests to (study thrust reverser extension and aircraft controllability) during a duplicated accident sequence. The flight tests involved a Boeing 737 modified to enable the crew to move the thrust reversers on one side to any desired position and then to free them by relieving the actuator hydraulic pressure. It was found that the air loads on the reversers were insufficient to deploy them further if they were freed with the leading edges 1 inch out from the closed position. If the initial deflection was increased to 2 inches, they invariably deployed fully under the air loads. At intermediate settings, deployments only occasionally occurred. Due to restrictions in the hydraulic lines, the deployment time was 7 to 8 seconds. The associated thrust lever was moved to the flight idle position over 2.5 seconds, beginning to retard when the reversers were open 7 inches and reaching the flight idle position when they were open 23 inches. By the time that the reversers had reached their fully open deflection of 56 inches, the low speed compressor had spooled down to 46% RPM. The flight tests also showed that the aircraft was controllable with one engine in idle reverse and the other at or near full forward thrust, with the gear up and flaps at 15^{o}. The Boeing studies determined that with flap 25, gear down and one reverser deployed, the sink rate is 50 feet per minute at 126 KEAS. The rate of sink can be overcome by .1 Kt/sec deceleration at a constant altitude. With flap 40 there is insufficient thrust to maintain level flight at a constant air speed in any configuration examined, however, at 126 KEAS gear down with one thrust reverser deployed, it is possible to overcome the rate of sink by decelerating at .85 Kt/sec. The flight test information was studied and amplified in a Boeing 737 engineering simulator.

1.16.2.1 Pacific Western Airlines performed a number of demonstrations in a Boeing 737 aircraft suitably configured to simulate conditions existing on the accident flight. These demonstrations, which were observed by aviation safety investigators, involved both high speed taxi runs and demonstration flights. The ground runs showed that partially opened thrust reversers deployed at various speeds during taxi tests with manually controlled air/ground logic. The rate of deployment varied with the amount of the initial open condition of the reverser doors and also varied with speed. In all cases partially opened doors deployed fully before 130 Kts.

The flight demonstrations were conducted to simulate the accident flight conditions, but without deploying the left thrust reverser. No correction was applied for density altitude difference.

The aircraft was flown at 125 knots with gear down, flaps at 20°, the left engine at flight idle, and the right engine at approximately full power. Right rudder was held to keep the aircraft straight. Height was maintained but the airspeed was gradually decreasing. At a given moment the pilot allowed the rudder to go back to neutral. The aircraft immediately yawed to the left and started a left roll. The pilot then applied partial left rudder whereupon the nose yawed sharply to the left, the left roll increased violently to about 60° and the nose went down giving a high rate of descent and a heading change to the left. This exercise was repeated with the same results. Synchronized movie cameras and a flight data recorder were operated throughout the demonstration.

The flights illustrated that any left rudder application at low speeds with left engine at idle, gear down, and flaps at 20°, produced an immediate yaw to the left, accompanied by a violent roll to the left and a marked nose down attitude.

1.16.3 Pilot Survey

Pilots from PWA and from other organizations were interviewed to ascertain what communications procedures were used for landing at uncontrolled airports such as Cranbrook. Cockpit procedures were observed during a number of flights in the area and communications procedures were monitored. Aeradio tapes covering flights into Cranbrook during the three days prior to the accident were studied to determine accepted practices.

1.16.4 The consensus among pilots interviewed was that once an ATC clearance for the approach had been given, there was no obligation to pass a further position report (px) unless requested to do so. These pilots were unanimous: it would be good airmanship to px on every approach regardless of the "legal" requirements; all PWA pilots observed made position reports "inbound". The Cranbrook Aeradio tapes studied confirmed that each PWA crew px'd to Cranbrook when inbound during the three days prior to the accident.

1.16.5 Video Simulation

A video camera was used to "duplicate" the final approach and accident sequence and to examine the operation of the engine thrust reverser mechanism. These flight and ground mock-up studies aided in the reconstruction of the events of the flight, provided timing of the thrust reverser operation, and confirmed that it was possible to obtain forward thrust with the reverser doors in other than the fully stowed and locked position (see also Section 1.17).

1.16.6 Search for Previous Incidents

An attempt was made to obtain information on previous incidents involving go-arounds due to obstructions on runways, and of any previous incidents of an unplanned go-around after thrust reverser deployment. The means employed were searches of computer data, literature, enquiries in the aviation industry and in other elements of the civil aeronautics system.

Although there appeared to be many incidents of go-arounds due to obstructions on runways, or to related communications problems at uncontrolled airports, only five had been formally investigated and documented. It was apparent that there was no effective system for reporting, investigating and documenting such incidents, and collating the resulting information in a suitable location.

One accident report involving an unplanned attempt to go-around after thrust reverser deployment was studied. This was a Boeing 727 at Ketchikan, Alaska April 5, 1976 (NTSB Report #AAR 76-20). The 727 has a reverser mechanism similar to that of the 737, although pneumatically operated. Of particular interest was the comment of the NTSB in that report *"The intent of these regulations*[1] *is to cause the designer to develop an interlock system*

[1] *Referring to the standards under which the aircraft was constructed.*

that will prevent the application of forward thrust with the power levers if the reversing system is not completely stowed and locked, and, conversely, prevent the application of reverse thrust with the power lever if the reversing system is not completely deployed. There is no requirement to override these features or to stow or deploy the reversing system and apply the desired level of thrust in a minimum time interval." There were no other documented reports of accidents or incidents concerning unplanned thrust reverser deployment.

There were two reports to investigators from PWA pilots of successful go-arounds after reverse thrust selection. These go-arounds were made because of slippery runway conditions, and had not been reported to the Company.

1.16.7 Review of Standards Applicable to the Thrust Reverser System

The Canadian airworthiness authorities were provided with appropriate information arising from the accident investigation and were requested to answer the question *"In what way does the Boeing 737 thrust reverser system meet the standards under which it was certificated?"*

The Canadian airworthiness authorities:

considered that the B737 thrust reverser system satisfied the requirements that formed the basis for Type Certification;

also considered that the intent of the applicable requirements would be met with an interlock system such as described in the documentation (see Section 1.17.1);

pointed out that if the B737 were submitted for approval today, the thrust reverser system would have to meet revised U.S. standards.

1.16.8 Review of ATC, Aeradio, and Airports interface

Appendix "B" contains excerpts from the operating manuals of the ATC, Aeradio and Airports organizations. These are the only references in these manuals showing the interrelationship between the three organizations related to providing an advisory service at Cranbrook suitable for preventing conflict between landing aircraft and authorized vehicles on the runway.

The ATC manual MANOPS (para 2356.6) provides that the ATC centre concerned will notify the Aeradio station of the estimated time of arrival of an aircraft at least fifteen minutes prior to the ETA.

The only explanation of how the ETA is constructed is given in para 392.1 "estimated time of arrival over the approach aid to be used".

The Telecommunications Maintenance and Operations Manual used by Aeradio avoids the use of the term "Control" but obligates the Aeradio operator (para 8.6.2) to advise vehicles by radio or alternate means to leave a runway 5 minutes prior to an estimated aircraft arrival.

The Airports manual "Recommended Vehicle Operating Procedures at Airports" instructs vehicle operators to monitor the appropriate radio frequency and to respond to communications from Aeradio as though they were from a control tower.

Interviews with air traffic controllers revealed a considerable difference in methods of developing the ETA ranging from a relatively simple one conforming to the MANOPS "over the approach aid to be used" to a more complicated formula involving allowances for destination weather and probable approach procedures to be used. Controllers emphasized the estimates were for ATC purposes only.

From Company records, the average flight time for Flight 314 from off Calgary to on at Cranbrook, over a 14 month period was 25 minutes, with very little variance.

ATC records showed that over 29 similar flights from Calgary to Cranbrook the average error in ETA's was 5 minutes, with particular errors as much as 13 minutes.

It was concluded that the ETA's were produced by ATC for one purpose and were used by Aeradio and Airports for another purpose. There was no standard method of calculating the ETA's, this rendering them unsuitable for either use. The interface between the three agencies, as expressed in their published manuals of operation was unsatisfactory for the purpose of avoiding conflict between landing aircraft and authorized vehicles on the runway.

1.17. Additional Information

1.17.1 Thrust Reverser System - B737 Aircraft

The thrust reverser system provides means of decelerating the aircraft during the landing roll. The system comprises (a) two thrust reverser assemblies, (b) a thrust reverser control system, and (c) a thrust reverser position indicating system. The thrust reverser assembly consists of two hydraulically operated deflector doors mounted on the engine exhaust. During reverse thrust operation these doors reverse the direction of engine exhaust gas flow. The control system consists of a reverse thrust lever mounted "piggy back" on the forward thrust lever, and engine drum and shaft control assembly on the wing front spar above the engine, hydraulic plumbing and a push-pull follow-up cable between the control assembly and the deflector door carriage.

A pawl lock-out mechanism prevents simultaneous action of the forward and reverse thrust levers. The forward thrust lever must be at idle in order to select reverse power. Conversely, the reverse thrust lever must be in the stowed (full forward) position in order to advance the forward thrust lever. Initial movement of the reverse thrust lever selects the directional control valve porting hydraulic fluid pressure to deploy the doors. Thrust drum rotation is opposite to forward thrust motion. Further aft movement of the R/T lever (if permitted by the lock-out cam and follow-up system) increases reverse thrust power. To cancel reverse the reverse thrust lever is moved forward, reducing engine power to idle. The last movement of the lever selects the directional control valve to port hydraulic fluid pressure to stow the deflector doors.

A follow-up mechanism, consisting of a push-pull cable with a quick disconnect and a feedback control lever, connects the door guide carriage to a cam lock-out mechanism on the thrust drum. This system provides two functions (1) it limits engine power application by the forward or reverse thrust levers until the thrust reverser deflector doors have almost reached their selected positions; (2) if a thrust reverser door moves to a position inconsistent with the lever selection the push-pull control drives the follow-up cam at the control shaft, forcing the throttle to a reduced thrust position. Because the follow-up lock-out system is a cam function power lever movement to deflector door position is progressive. Tests on a similar B-737 showed that power lever movement progressively follows the doors. The doors do not have to be in the fully stowed or fully deployed position in order to apply maximum engine power.

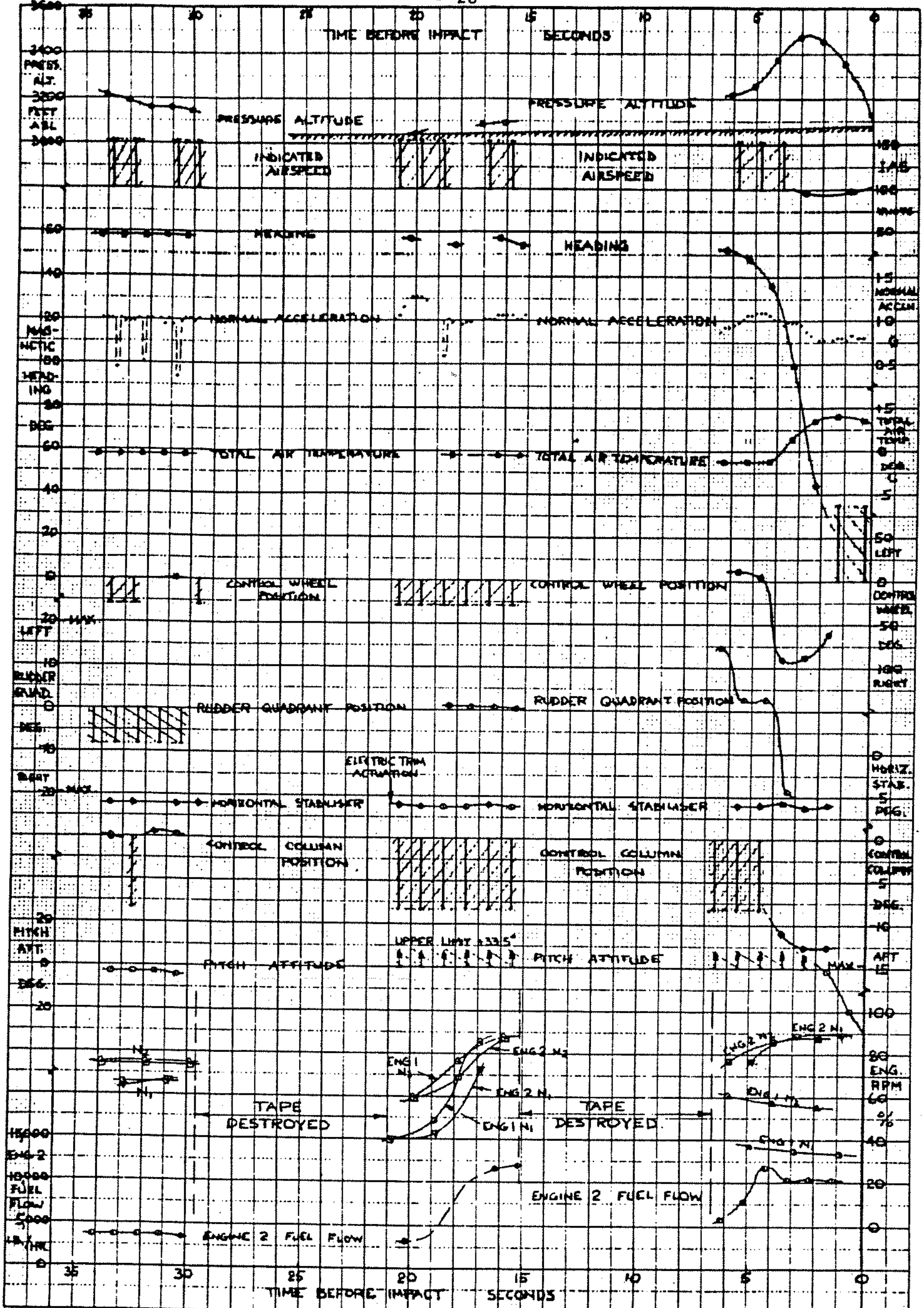
The basic B-737 airplane design required that all landing gear be on the ground prior to deployment of the thrust reversers, however, this airplane had incorporated Boeing S/B 737-78-1023, a modification which removed the nose gear squat switch from the T/R logic system, and permits earlier thrust reverse. The squat switch controls the isolation valves (one for each reverser) which are located on the forward bulkhead of the air conditioning bay. Power, 28 VDC from the #1 DC Buss, energizes the isolation valve only when all of the following occur: (1) the appropriate engine fire switch is closed; (2) the engine running switch is closed (oil pressure above 35 psi); (3) the air-ground squat switch is closed (weight on the main gear). If any one of these switches is open, the affected isolation valve or valves are de-energized (spring loaded) depressurizing the thrust reverser system. When the air-ground squat switch opens both reversers become inoperable, remaining at their last achieved position unless caused to deploy by aerodynamic loads. The only way to subvert trapped thrust reverser doors from the cockpit is to position the appropriate thrust reverser override switch to "override". These switches, located on the aft overhead panel, are guarded and witness wired in the "normal" position. As these switches are provided for maintenance purposes only, their use in the air would be an "emergency procedure".

1.17.2 Witnesses

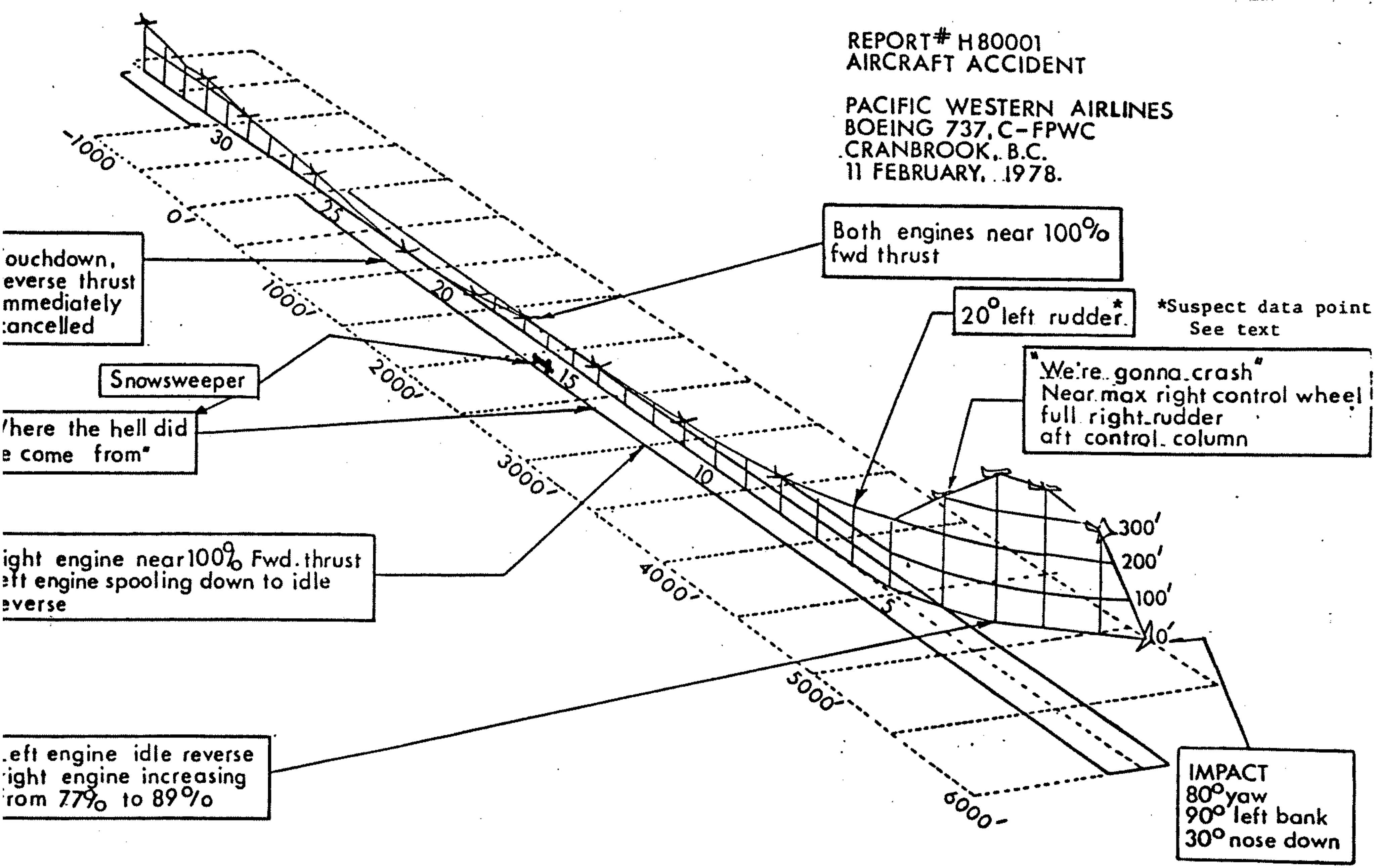
Witness information is incorporated in this report.

Persons interviewed included eyewitnesses, survivors, operating and supervisory personnel of the various agencies, flight crews, and individual pilots.

In addition to the above, crews of other aircraft operating in the area during the period of the accident flight were interviewed. Pilots on two different aircraft reported hearing the Captain of the accident flight conversing with another flight on company frequency. The time of this conversation was established as being about 1948Z, the time the information respecting the runway condition was transmitted by Cranbrook Aeradio.

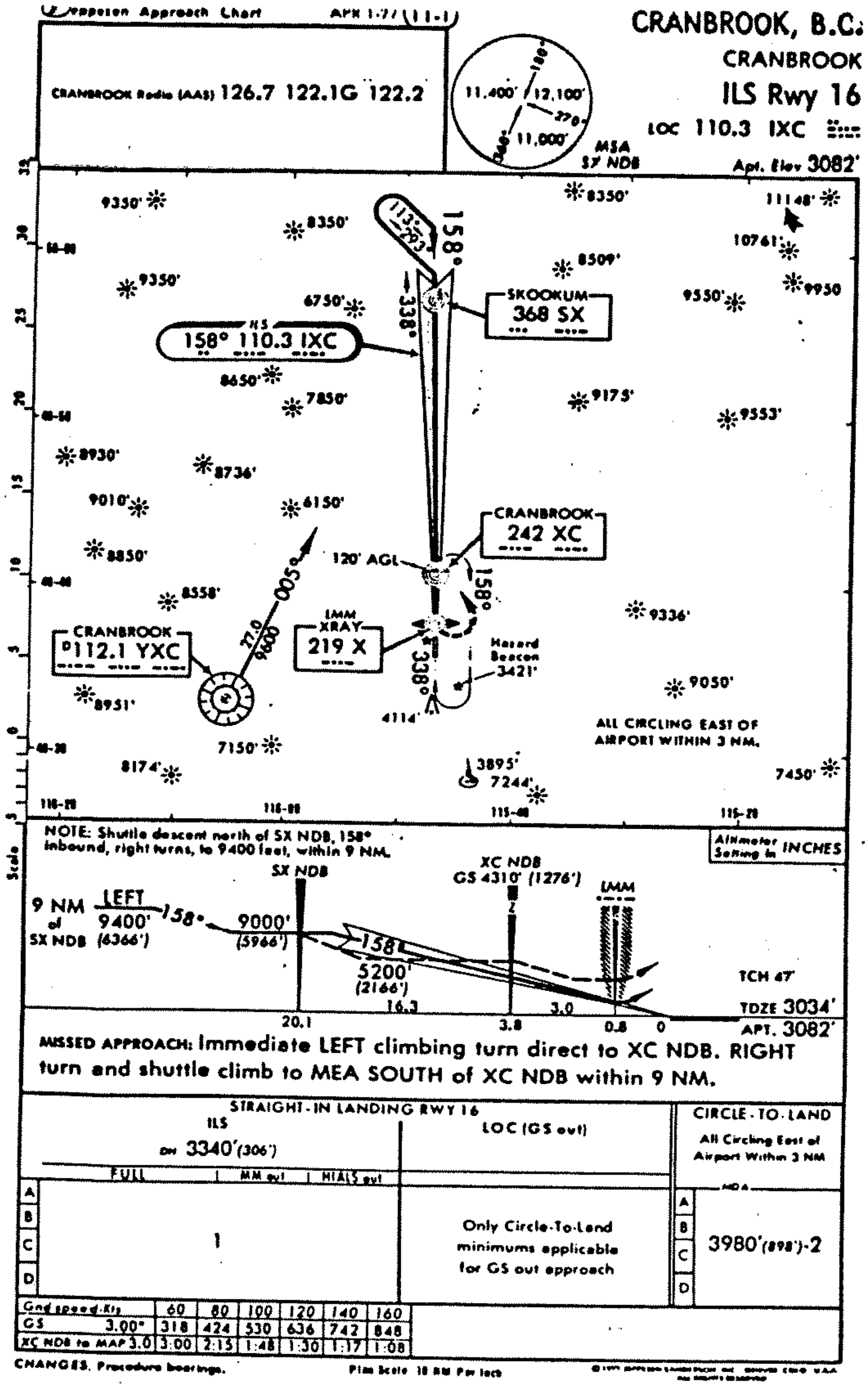


PWA BOEING 737 C-FPWC OVERSHOOT ACCIDENT CRANBROOK B.C. 11 FEB 1978 FLIGHT RECORDER DATA



COMPOSITE DIAGRAM INCORPORATING INFORMATION FROM THE FLIGHT DATA RECORDER, WITNESSES, ENGINEERING AND FLIGHT SIMULATOR

FIGURE 2



Gnd speed-Kts	60	80	100	120	140	160
GS 3.00°	318	424	530	636	742	848
XC NDB to MAP 3.0	3:00	2:15	1:48	1:30	1:17	1:08

PACIFIC WESTERN AIRLINES
BOEING 737, C-FPWC
CRANBROOK, B.C.
11 FEBRUARY, 1978

REPORT * H80001
AIRCRAFT ACCIDENT

FLIGHT SIMULATOR STUDY

T/O 95,000 AUW FLAP 5,
V1, VR 127 KIAS, -5C
CLIMB - 280 KIAS
ENROUTE - 320 KIAS
DESCENT - 320 KIAS
ISA. TEMP - 10 AT 20,000
LANDING - 91,000 AUW, FLAP 40,
V REF. 122 KIAS, -6C.
TIME IN BRACKETS IS ELAPSED TIME.
* CRANBROOK TOUCHDOWN OF SIMULATOR

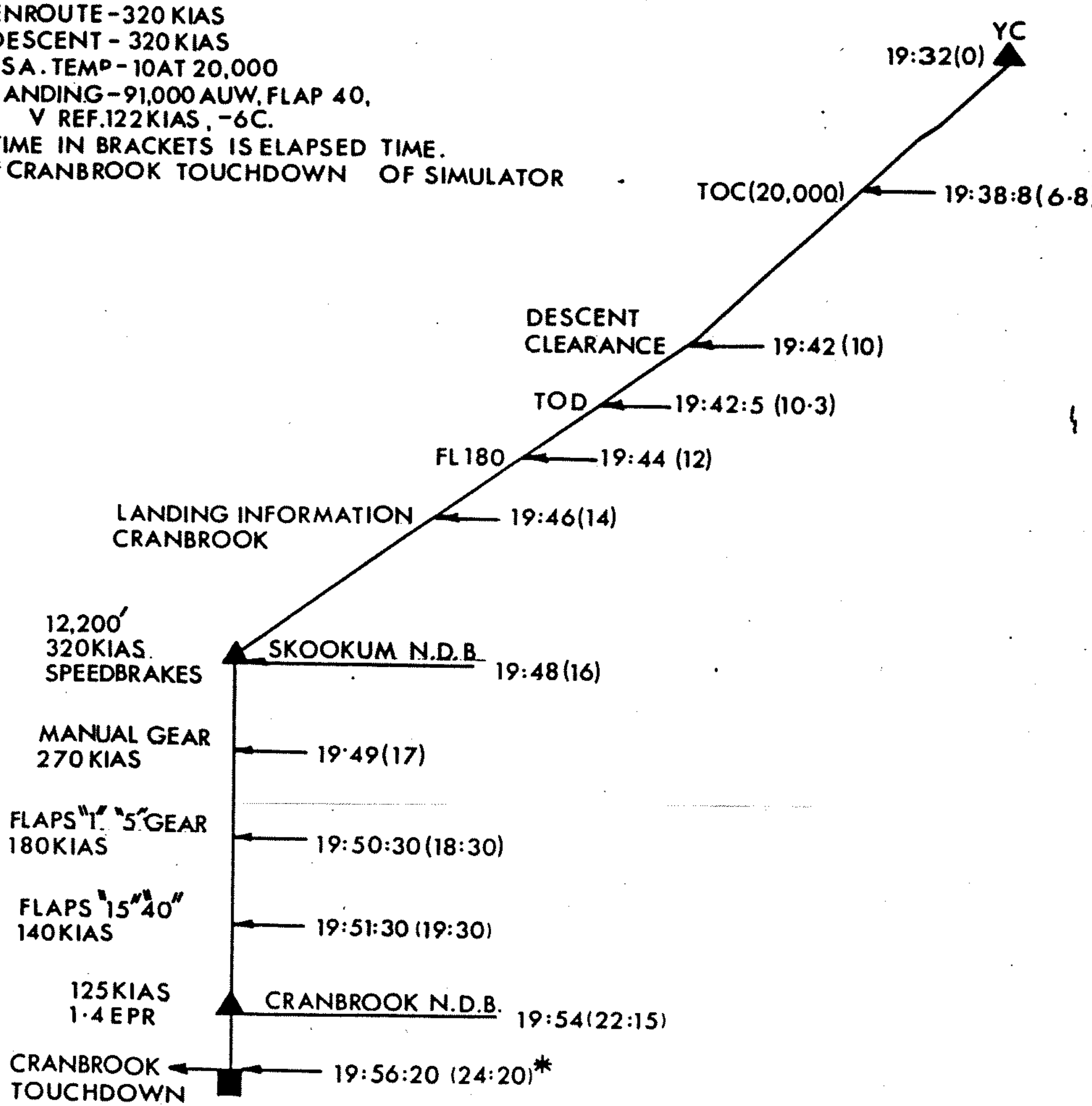


FIGURE 4.

2.0 ANALYSIS

2.1 Resume of Events

The ETA generated by Calgary ATC proved to be ten minutes later than the actual arrival time of the aircraft. A chance to update this ETA was lost when the Flight did not report by the Skookum beacon.

A vehicle on the runway, in addition to being partially obscured by reduced visibility in falling snow was further hidden by snow thrown up by its rotating brush.

The decision to go around after touchdown required fast action in the cockpit - cancelling the reverse selection, advancing the power levers, moving the flap selector lever from the full landing flap position to the 15^{o} position, and raising the landing gear after lift-off. Evidence established that the flap reselection was delayed until about seven seconds before impact; the landing gear was not raised.

After passing over the snow sweeper the aircraft flew level for a few seconds; the left thrust reverser slowly deployed. The aircraft was flown straight down the runway for a few seconds, indicating that right rudder had been applied to correct the assymetry (not shown on damaged FDR record), then, either the corrective right rudder pressure was removed, or momentary left rudder was applied. The aircraft yawed and rolled to the left climbing slightly and then dived into the ground.

Fire started quickly in the central part of the wreckage and eventually spread to the tail section. Fire fighting and rescue vehicles were unable to get close to the aircraft for a considerable time due to deep snow. Rescuers reached the wreckage on foot. There were survivors but some passengers who survived the impact died later from effects of the fire.

2.2 Communications

Upon takeoff of Flight 314 from Calgary two ETA's were sent to Cranbrook - each had its particular purpose.

Calgary ATC sent an ETA "2005" which was acknowledged by the Cranbrook Aeradio operator on duty; viewed as an element to control vehicular traffic on the runway, this estimate was in error by ten minutes, since the aircraft touched down at 1955. However, from the point of view of ATC, the estimate was for air traffic control purposes only. The ATC procedures manual MANOPS makes no reference to any other purpose for the ETA other than for traffic separation. The same manual (sec. 392.1) refers to the ETA as "estimated time of arrival over the approach aid to be used". In this sense the ETA generated by Calgary ATC was even further in error.

The airline agent in Calgary also sent an ETA to Cranbrook - to the company agent there. This estimate proved to be accurate. The purpose was to alert the agent in Cranbrook for facilitation of passenger handling. The company ETA had no bearing on the system for controlling ground vehicles on the runway.

The change-over to Cranbrook Aeradio frequency was done well back in the flight, giving adequate time for the transmission of necessary landing information. The message from Aeradio to the Flight at 1947:18 gave multiple intelligence: there was not much change in the weather; the visibility was about 3/4 mile in snow; there was a sweeper on the runway; snow removal was in progress; an update on the runway condition would be given.

The response from the First Officer was simply "three fourteen checks". This provides no assurance that he had received the entire message (although the transmission from Cranbrook was loud and clear on the Aeradio tape recording).

There were no other calls either to or from the aircraft during the approach. This indicates that the Cranbrook Aeradio operator was depending on the ETA of 2005 and saw no urgency to give an update on the runway condition, and that he was expecting a call from the aircraft by the Skookum beacon. It would seem logical for a pilot to request an update on the runway state, to determine whether the equipment was clear of the runway, and finally, to report by the Skookum beacon as was the common practice - whether this report was mandatory or not. This would be particularly important at an uncontrolled airport with only an "Advisory" service.

During an instrument approach it is usual for the Captain to monitor all flight deck activities including radio communications made by the First Officer. Evidence indicates that one VHF transceiver was on a Company frequency during the time the Cranbrook landing information was transmitted. The other transceiver was on an Aeradio frequency and the First Officer's voice was identified on the Aeradio tape. It is possible to monitor both VHF transceivers simultaneously, but it appears that the Captain was not aware of the snow sweeper advisory. The Captain had been communicating on Company frequency and the First Officer might not have passed the runway information to him; the First Officer might not have assimilated all the advisory information. A transceiver malfunction seems unlikely since the equipment was operating before and after the time in question.

The failure to report on final approach and the unnecessary talk on company frequency represent an unacceptable standard of cockpit practice and discipline.

2.3 Cranbrook Vehicle Control Procedures

The obligation of the Airport Manager and his staff to maintain the runway in serviceable condition for aircraft operations required that maintenance vehicles have access to the runway as long as possible between flight arrivals or departures, particularly during falling snow conditions. The method of controlling those vehicles by radio through the Aeradio operator was as described in the publications summarized in Appendix "B" - MANOPS, Telecommunications Maintenance and Operations Standards, and Recommended Vehicle Operating Procedures at Airports. At Cranbrook, as elsewhere, this procedure obviously depended upon accurate ETA's. The estimate produced at Calgary upon departure of the flight, being subject to a number of enroute variables, could not be accurate enough for vehicle control purposes. The system therefore depended on an update on the progress of the flight which would have to come from the pilot. There was no radar surveillance in that area at lower altitudes.

2.4 Regulatory Aspects

The ATS MANOPS manual which sets forth air traffic control procedures deals primarily with air traffic separation. The activity appears to be well supported by Air Regulations 505, 600, and 601. There is only brief mention of "Aeradio" in this publication, and no mention of an "Advisory" function being ascribed to Aeradio. The provisions of MANOPS do not constitute a satisfactory interface with Aeradio for the purpose of providing an effective flight information service.[1] The advisory function assumed by Aeradio is not defined or mentioned in the Air Regulations. The provisions of the Aeradio manual "Telecommunications Maintenance and Operations Standards" therefore do not have a formal basis. This has the effect of further weakening the interface with Air Traffic Control.

There is no "legal" requirement for a pilot to make position reports during an instrument approach unless requested by ATC. The lack of effective regulation weakens the advisory system.

Annex 11 to the ICAO Convention defines Flight Information Service as: "A service provided for the purpose of giving advice and information for the safe and efficient conduct of flights".

2.5 Flight Crew Actions

It is obvious that the pilots were taken by surprise when they saw the obstruction on the runway, otherwise they would neither have touched down nor selected reverse if a go-around had been foreseen. Surface visibility was approximately 3/4 mile; visibility from the cockpit to the runway environment was probably better than that. It is most likely that, as reported by the vehicle operator, the snow sweeper was obscured by the snow thrown up by its rotating brush, against the general snow background.

The selection of reverse was confirmed by the unlocking of the reverser doors, possible only on the ground, when the squat switch is activated. The aircraft was on the runway for only about 2.5 seconds, indicating that the pilot elected to go around while he was still physically going through the motion of landing and selecting reverse.

The different stress reaction times of the pilots (20 seconds for the Captain vs 10 to 11 seconds for the First Officer) indicate that the First Officer did not immediately appreciate the gravity of the situation. The gear was left down throughout the go-around sequence and the flap selection to 15° was delayed until about 7 seconds prior to impact. The "gear up" would await a command from the Captain, but in most circumstances in the Company procedures the First Officer would be expected to raise the flaps to 15° without a command.

If the corrective right rudder was released and/or left rudder was applied about 6 seconds before impact as indicated by the FDR, this would start a yaw and roll to the left at a critical phase of the flight. The motivation for releasing corrective right rudder pressure and, or briefly applying left rudder is difficult to explain. It may have been an inadvertent action associated with an attempt to reach the thrust reverser override switch. Another possibility is that the Captain's thumb was broken in the air. Flight tests established that a power lever comes back relatively slowly when a thrust reverser deploys. However, medical opinion arising from autopsy findings suggests that this injury was caused by both pilots exerting heavy pressure against the power lever with the First Officer bracing his hand over the Captain's. This may have provided the necessary reaction to produce the thumb injury.

A number of other stress inducing factors may have affected the performance of the Captain:

- the surprise at seeing the obstruction on the runway;
- the uncertainty as to whether the aircraft would clear the obstruction;
- concern about the caution in the Boeing 737 Operations Manual "do not attempt a go-around after reverse thrust has been initiated" (App. "B");
- seeing the thrust reverser indicator lights illuminated;
- confusion due to interpretation of information in the Boeing 737 Operations Manual (App. "B");
- the unexpected deployment of the left thrust reverser;
- realization that full approach flap was still selected;
- possible lack of positive assistance from the less experienced First Officer;
- probable extreme annoyance about the equipment being on the runway;
- the urgent need to analyse the deteriorating situation and an attempt to have the First Officer operate the thrust reverser override switch.

Some of these stress inducing factors would also apply to the First Officer.

When considering the adequacy of the flight crew performance it must be remembered that they were faced with an unusual set of circumstances. The go-around after touchdown and reverse thrust initiation, being an abnormal manoeuvre against which a caution had been issued, was not provided for in the Airplane Operating Manual or in training. The pilots had possibly heard about other successful go-arounds and could have been mislead by the information in the manual regarding the significance of the reverse unlock lights. They could not have realized it was possible for a reverser to deploy in flight. The time available for decision making was very short indeed, and they were faced with a situation which to them was without precedent.

2.6 The Loss of Control

The go-around would no doubt have been successful if the left engine thrust reverser doors had not deployed. This occurred because the retraction cycle was interrupted at lift-off by a feature of the design which caused hydraulic power to be removed from the thrust reverser door mechanism. It was determined by the Boeing flight tests that, once they started to open from their nearly stowed position, it took about 8 seconds for the doors to deploy and about 2.5 seconds for the left thrust lever to retard under the influence of the mechanical interlock.

The flight data recorder trace indicates that as the left thrust lever came back, the right thrust lever also came back, probably because the pilot was holding both levers. It is of course possible that the Captain was attempting to land on the remaining portion of the runway, but this seems unlikely.

There was an apparent attempt to operate the left engine thrust reverser override switch, located above and behind the pilots. This would have restored hydraulic power to the thrust reverser retraction mechanism, providing the landing gear was extended. It is possible that the gear was left extended to permit operation of the override switch. This would assume a detailed knowledge of the thrust reverser system and seems unlikely. It is far more likely that the action of raising the gear was simply overlooked in the same manner as the flap selection from the full landing position to 15^{o} was delayed.

The flight data recorder record indicates that left rudder was applied 6 seconds before impact, about the time that the flap lever was moved to "15". Such a rudder application would start a yaw and roll to the left at a critical phase of the flight. The validity of this data point showing a heavy, brief application of left rudder must be called into question by the information gained in the PWA flight demonstrations. The reaction of the aircraft to left yaw was so immediate, coupled with a large heading change and loss of altitude, that if the 20^{o} of left rudder had been applied as indicated by the FDR, the aircraft, which was at only 100 ft above ground at that moment, would have struck the ground within two or three seconds.

Control of the aircraft with the gear down, flap in transit from "40" to "15", left engine in idle reverse, and right engine at almost full forward thrust was, as indicated by engineering simulator tests, possible but marginal.

Full details of the actions in the cockpit and the reactions of the aircraft in those final six seconds will probably never be known, due to loss of recorded data. There is however no doubt that a considerable yaw to the left occurred about 6 seconds before impact and caused a roll to the left. The pilots attempted to counter this yaw and roll at 4 seconds before impact with full right aileron and rudder at the same time pulling back on the control column. The aircraft, then being below minimum control speed went out of control and rolled 90^{o} to the left.

Given the surprise and other factors affecting the pilots the aircraft had become uncontrollable once the left thrust reverser doors deployed. The possibility that the actions of the Captain were adversely affected by the severe pain of a broken thumb cannot be discounted.

2.7 Thrust Reverser Design

The interlock system is designed to prevent disagreement between the reverse thrust door position and the thrust lever and will retard the thrust lever to flight idle in case of inadvertent reverser door deployment in flight. The design also prevents application of reverse thrust unless the doors are deployed, but is apparently not intended to cover the case of a baulked landing after reverse thrust has been initiated. There may be some doubt about this intent however since a "caution" regarding go-arounds did not appear as an amendment to the 737 manual until September 20, 1977, eight years after the introduction of the aircraft into airline service.

The Boeing 737 Operations Manual[1] after the above date contains a caution "Do not attempt a go-around after reverse thrust has been initiated. Failure of a thrust reverser to return to the forward thrust position may prevent a successful go-around".

The same manual states - with reference to the Reverser Unlocked Light(s) becoming illuminated in flight - "If the forward thrust lever has not moved to idle, and movement of the lever is unrestricted, the engine is in forward thrust".

In this case, both thrust levers were in the forward thrust position after lift-off and were unrestricted, however the left engine did not remain in forward thrust.

Although technically correct, the provisions of the Boeing 737 Operations Manual relating to the thrust reversers could be misleading to a pilot.

1 *All references in this report to the Boeing 737 Operations Manual relate to the Manual supplied by the airplane manufacturer to Pacific Western Airlines.*

It is accepted that the 737 thrust reverser design was in compliance with the applicable FAA standards under which the aircraft was constructed. Considering that the aircraft was intended for use at smaller, "uncontrolled" airports, as well as at main line airports, the ability to abort a landing even after touchdown and reverse selection would seem to be a desirable, if not essential, feature. In this sense the FAA standards must be considered either inadequate or ill-defined.

2.8 Survival Aspects

The rescue operation was hampered because the airport fire-fighting vehicle was not capable of operating in deep snow.

According to medical opinion, a number of passengers survived the crash but succumbed to toxic fumes and fire. Some of these might have been saved if proper equipment and sufficient personnel with appropriate training had been available.

.9 Incident Reporting

During the attempts to collect information on previous incidents it was clear that pilots had not in all cases reported operating irregularities to their companies, or through their companies to the manufacturer or to Transport Canada. In addition pilots and other personnel had been lax in reporting traffic conflicts at uncontrolled airports, and there was no well defined system or procedure for them to do so. (These statements do not refer specifically to PWA pilots.) This situation, combined with the lack of a formal investigation and collation procedure, allowed problems to persist.

3.0 Conclusions (Findings)

3.1 *The estimated time of arrival of the aircraft at Cranbrook, calculated by Calgary ATC, and used by Aeradio for advisory purposes was considerably in error and resulted in a traffic conflict between the arriving aircraft and a vehicle working on the runway.*

3.2 *The flight crew did not report by the Skookum beacon on final approach, as was the normal practice at Cranbrook, thereby allowing the incorrect ETA to remain undetected.*

3.3 *Regulatory provisions concerning mandatory pilot position reporting during instrument approaches were inadequate.*

3.4 *The interfaces between the organizations providing Air Traffic Services, Telecommunications (Aeradio) and Airports Services were not well enough developed to provide a reliable fail safe flight information service.*

3.5 *The pilots lost control of the aircraft consequent upon the left engine thrust reverser deploying in flight when the aircraft was at low speed, and in a high drag configuration.*

3.6 *The FAA design standards under which the Boeing 737 was constructed did not adequately provide for the possibility of an aborted landing after touchdown and thrust reverser initiation.*

3.7 *The lack of a suitable national system of incident reporting, investigation, and follow-up corrective action allowed operational problems to remain uncorrected.*

3.8 *Rescue efforts at the accident scene were hampered due to lack of a fire fighting vehicle capable of negotiating deep snow and shortage of trained rescue personnel.*

PACIFIC WESTERN AIRLINES
BOEING 737, C-FPWC
CRANBROOK, B.C.
11 FEBRUARY, 1978

APPENDIX "A"
REPORT #H80001
AIRCRAFT ACCIDENT

TRANSCRIPT OF PERTINENT AIR/GROUND COMMUNICATIONS

1918	314	Calgary Clearance Delivery it's Pacific Westerns three fourteen.
	D	Three fourteen to the Cranbrook Airport centre stored flight level two zero zero. Depart runway one six, runway heading until through ten thousand, turn right squawk one three zero zero.
	314	OK, three fourteen, the Cranbrook Airport, centre stored, flight level two zero zero runway one six to ten thousand before turning right squawking thirteen.
	D	That's correct three one four, time one nine one nine and advise push back this frequency.
1929	314	Three fourteen's ready in sequence.
	T	Three fourteen to position and hold sixteen.
	314	Three fourteen.
1930	T	PW three one four you're cleared for take-off runway sixteen, departure frequency one nineteen eight when airborne.
	314	Three one four roger.
1931	314	Calgary Departure it's Pacific Western three one four, runway heading out of forty-two hundred.
	D	Three one four is in contact you can proceed on course.
	314	Three one four on course.
1933	L	Cranbrook radio-Calgary.
	L	Cranbrook's on.
	L	I've got an inbound three one four from Calgary at two zero zero five.
	L	Roger, Echo Hotel.
34:05	A	Are you out there, my friend.
34:08	G	Yes sir.

Legend

314 - PWA 314
D - Calgary Departure
T - Calgary Tower
G - Snow Sweeper
E - Calgary Enroute
A - Cranbrook Aeradio
L - Aeradio Landline

34:09	A	Er - Five past the hour, Terry.
34:11	G	OK. What's the time now, Ernie?
34:13	A	Er - Half an hour from now. Thirty just coming up to thirty five.
34:16	G	OK. Thank you. Everything's working good out here.
34:20	A	That's good.
34:23	G	Can't see you from here, so I don't know whether you're good looking or not.
34:27	A	Oh - take my word for it - I'm good looking.
34:29	G	O.K.
1936	D	PW three one four can call enroute one thirty three three, good day.
	314	Calgary Enroute, it's Pacific Western three one four on one thirty three three out of sixteen thousand for two zero zero.
	E	Three one four's radar.
1938	314	Three fourteen's level two zero zero.
	E	Roger three fourteen you can come up on one twenty-five two.
1942	314	Calgary, it's Pacific Western three fourteen request descent.
	E	Three fourteen cleared to the Cranbrook Airport for the approach, the altimeter at Cranbrook two nine seven seven, advise leaving one eight oh.
	314	OK, cleared to the Cranbrook Airport for an approach, nine seven seven and, ah, will call at one eight.
1943	E	Three fourteen.
1944	314	Three fourteen's out of one eight thousand.
	E	Roger advise time down this frequency.

Legend

314 - PWA 314
D - Calgary Departure
T - Calgary Tower

G - Snow Sweeper
E - Calgary Enroute
A - Cranbrook Aeradio
L - Aeradio Landline

1946	314	Cranbrook Radio. Pacific Western three one four-er-your frequency.
	A	Three one four, Cranbrook, go ahead.
	314	Yes, sir. We have the approach. You can go ahead with your numbers.
	A	OK - I'll give you the numbers - the wind at one five zero degrees magnetic at six Cranbrook altimeter two nine - two nine seven six and there's no reported traffic.
1947	314	OK. We check-two nine seven six.
	A	And three one four. The-er-sweeper on the runway-er-has been for some time trying to keep the snow back for you. I'll let you know what it's like as soon as I get a progress from him. And the visibility - not much change in the weather - maybe visibility about three quarters of a mile in snow.
	314	Three fourteen checks.
1955	G	Where the hell did he come from?
	314	We're gonna crash -
	A	I don't know Terry, but he sure didn't call after his first call.
	L	Cranbrook radio, Calgary.
	L	Cranbrook.
	L	I've got an inbound for you.
	L	Standby a second please, I got an emergency.
	L	Oh. OK.
2004	L	Cranbrook Radio, Calgary, are you still busy?
	L	Aoah, OK go ahead now Calgary.
	L	OK, first off, where's PW three thirt, three fourteen now, have you any idea.
	L	Yeah, he's the emergency he's crashed and is burning off the end of the runway.

Legend

314 - PWA 314
D - Calgary Departure
T - Calgary Tower
G - Snow sweeper
E - Calgary Enroute
A - Cranbrook Aeradio
L - Aeradio Landline

Extracts from Pertinent Manuals and Regulations

(1) "MANOPS" Air Traffic Services manual of operations

(2) "Telecommunications Maintenance and Operations Standards" (section on Aeradio Vehicle Advisory Service)

(3) "Recommended Vehicle Operating Procedures at Airports"

(4) "Boeing 737 Operations Manual"

APPENDIX "B"
SECTION (1)

"MANOPS" (Extracts)

(2214) New sub-section covering Tower Aeradio coordination procedures at locations that do not operate on a 24 hour basis. Cancels ATC Circular Letter 6-3-P313-73.

2214 TOWER/AERADIO COORDINATION

2214.1 At locations where there is an aeradio station which operates on a 24 hour basis and a tower which does not, unit chiefs shall prepare, in coordination with the appropriate aeradio supervisory personnel, procedure to be followed when ceasing or starting daily opeations in accordance with the following:

A. When ceasing daily operation, tower shall advise aeradio of:
   1. All aircraft traffic in the vicinity.
   2. Any valid flight plan data.
   3. Information on runway in use and runway conditions for all runways.
   4. Any information on the location and activity of vehicles on the manoeuvring area.
   5. The time to standby for a radio check.
   6. Any other information which may be required.

B. When beginning daily operation, tower shall obtain from aeradio the information in 2214.1 A-1, 2,3,4 and 6.

(2356.2) When the destination airport is served by a control tower or aeradio station, the centre concerned will notify such stations of the estimated time of arrival at least fifteen minutes prior to the ETA. Upon arrival of the aircraft, the tower or aeradio station shall report the arrival to the centre within whose FIR the aircraft has landed.

392 IFR UNIT - TOWER

392.1 Forward the following data 15 minutes or more before an IFR aircraft will establish communication with a tower: (N)

A Arriving IFR aircraft:

1. Aircraft identification.
2. Type of aircraft, prefixed by:
   a. the number of aircraft if more than one; and
   b. the symbol "H/" if a heavy aircraft.
3. point of departure; and
4. estimated time of arrival over the approach aid to be used.

B Departing IFR aircraft:

1. flight plan data if other than a scheduled air carrier flight; and
2. anticipated delay to a departing aircraft.

392.2 Inform the tower of any condition that necessitates revision of an ATIS message.

APPENDIX "B"
SECTION (2)

"TELECOMMUNICATIONS MAINTENANCE AND OPERATIONS MANUAL" (Extracts)

(8) AERADIO VEHICLE ADVISORY SERVICE

(8.1) General

(8.1.1) Instructions to vehicle operators concerning the operation of motor vehicles in the aircraft manoeuvring areas at controlled and non-controlled airports are published in a manual entitled "Recommended Vehicle Operating Procedures at Airports". This manual is issued by the Airports and Field Operations Branch.

(8.1.5) Aeradio operators in the course of their duties are required to provide information to vehicle operators in an advisory capacity with a view towards enhancing the safe use of the airport. It must be emphasized, however, that the Aeradio Operator is not a Ground Controller. At a number of airports the aeradio office is not strategically located so as to afford a complete view of the airport manoeuvring area. In such cases, the vehicle operator has a clearer view of the runways than the aeradio operator. These circumstances do not relieve the vehicle operator of his obligation to call the aeradio operator and receive aircraft traffic information before proceeding to the manoeuvring area. While in the manoeuvring area it is the vehicle operator's responsibility to remain clear of all runways and taxiways where aircraft are manoeuvring.

(8.4) Use of Vehicular Radio at Non-Controlled Airports

(8.4.1) Vehicle operators and aeradio operators at non-controlled airports and at controlled airports during hours the tower is closed will adopt the procedures outlined below:

(1) Vehicle operator will not proceed to the manoeuvring area on his own initiative but will hold short of this area, contact the aeradio operator, advise where he wants to go, and ask for aircraft traffic information.

(2) Aeradio operator will provide traffic information on arrivals, departures, as appropriate, and other information such as runway in use. When applicable vehicle will hold until an arriving or departing aircraft is clear of the runway.

(3) While in the manoeuvring area vehicle operator shall monitor the vehicular radio at all times and acknowledge and conform to any further advice or information received from the aeradio operator.

(4) When a vehicle operator has completed a task in one area of the field and wishes to move to another he will not do so without first contacting the aeradio operator to make known his intentions.

(5) Vehicle operator contacts and advises aeradio operator when clear of the manoeuvring area.

(8.6) Vehicle Advisory Procedures Applicable at All Non-Controlled Airports

(8.6.1) At airports where the aeradio operator does not have a complete view of the aerodrome a suitable notation shall be maintained on the location of all vehicles on the manoeuvring area of the airport.

(1) A fabricated panel board equipped with appropriate lights and switches is in use at a number of stations and is a highly recommended method of keeping track of vehicles on runways at those airports where the aeradio office is not afforded a good view of the aerodrome.

(8.6.2) Vehicles shall be advised by radio or by alternate means to leave a runway 5 minutes prior to an estimated aircraft arrival and immediately prior to the time a departing aircraft is ready to commence taxiing to the point of takeoff.

(8.6.3) The presence of vehicles in the manoeuvring area of an airport shall be transmitted to incoming aircraft in the text of Airport Advisory messages even when these vehicles are not located on the runway in use.

---------WIND TWO NINE FIVE DEGREES AT ONE EIGHT FAVOURING RUNWAY TWO EIGHT - ALTIMETER TWO NINE NINE EIGHT - VEHICLE ON RUNWAY TWO ONE ENGAGED IN RUNWAY MAINTENANCE OVER.

(8.6.4) Where the aeradio operator does not have a complete view of the runway and it is not certain that all vehicles have cleared the runway in use, the information shall be included in the text of Airport Advisory messages to incoming aircraft as in the following example:

----------WATCH FOR VEHICLE ON RUNWAY TWO EIGHT INSPECTING RUNWAY LIGHTING.

APPENDIX "B"
SECTION (3)

"RECOMMENDED VEHICLE OPERATING PROCEDURES AT AIRPORTS" (Extracts)

Procedures Non-Controlled Airports

Before proceeding onto the manoeuvring area (taxiways, runways, etc.) a vehicle operator will inform the Aeradio operator of his intended operation and obtain information concerning aircraft activities, the runways in use, and any other information necessary to safe operating practices.

Vehicle operators are required to remain clear of all runways and taxiways where aircraft are manoeuvring.

At non-controlled airports provided with utility radio service, the vehicle operator will monitor this frequency at all times when in the aircraft manoeuvring area for advice concerning aircraft activities provided by the Aeradio Station. Such communication shall be responded to as though it were from a control tower.

ENGINE CAUTION LIGHT(S)

Reverser Unlocked Light (Inflight)

Forward Thrust Lever. . . . . .CHECK
If forward thrust lever is not restricted, operate engine normally.

CAUTION: DO NOT ACTUATE THE REVERSE THRUST LEVER.

Illumination of the thrust reverser unlocked light indicates that either of the two deflector door locks has mechanically unlocked or that the thrust reverser unlocked light is giving a false indication.

If the forward thrust lever has not moved toward idle, and movement of the lever is unrestricted, the engine is in forward thrust.

Movement of the deflector doors to reverse thrust position will mechanically retard the forward thrust lever to the idle thrust position, and the interlock will limit movement of the thrust lever as long as the engine is in reverse thrust.

Only multiple failures could allow the engine to go into reverse thrust. Such failures may preclude returning the engine to forward thrust. Thrust reversal above 250 knots may fail the actuating linkage, preventing retraction. The doors, if not retracted, will produce buffet and increased airplane drag.

The airplane will climb in clean configuration with one engine in idle reverse and one engine at maximum continuous thrust. For approach and landing use 1 engine inoperative landing procedure.

If the engine is in reverse thrust due to inadvertent actuation of the reverse thrust lever, at pilot's discretion the reverser may be returned to the forward thrust position by the following procedure:

Altitude - MINIMUM 5000 FEET ABOVE TERRAIN
Flaps - 5
Airspeed - 170 KNOTS
Good Engine - MAXIMUM CONTINUOUS THRUST
Reverser Override Switch - OVERRIDE
Landing Gear Lever - DOWN
Reverse Thrust Lever - CHECK FORWARD AND DOWN

Until engine returns to forward thrust the airplane will descend at 700-800 feet per minute while maintaining 170-180 knots airspeed with flaps 5 and gear down.

Forward thrust may be confirmed by the reverser unlocked light being extinguished and unrestricted forward thrust lever movement.

If the engine cannot be returned to forward thrust, the pilot may elect to shut down the engine. Electrical and hydraulic requirements should be evaluated before engine shut down.

LANDING PROCEDURES

As the airplane approaches the touchdown point, reduce descent rate, smoothly retard thrust to idle and maintain the flight profile to touchdown. Use speed brakes, brakes, and reverse thrust normally after touchdown. On gravel runways do not use reverse unless required. The aileron and rudder controls are effective down to approximately 50 knots.

In the event of a bounced landing, hold or re-establish normal landing attitude. Add thrust as necessary to control the sink rate. Do not push over, as this may cause a second bounce and possibly damage the nose gear.

GO-AROUND PROCEDURE

Apply go-around thrust and rotate to go-around attitude.

Retract flaps to 15.

Retract the landing gear when a positive rate of climb is indicated.

At V2 +15 knots, select flaps 5.
Climb thrust

At 170 knots, select flaps 1.

At 190 knots, select flaps UP.

Check leading edge lights OUT.

Crosswind

The crab, sideslip, or a combination of both are accepted methods for correcting for a crosswind during approach and landing. Regardless of which method is used, there is sufficient rudder and aileron control available to execute crosswind landings.

Use rudder and rudder pedal steering to hold the airplane on centerline. Displacing the aileron into the wind will assist on directional control. Nose wheel steering will be improved with a slight forward pressure on the control column which increases weight on the nose gear.

Flap Extension

The following procedures, configuration, and normal maneuvering speeds are used when flying normal traffic patterns.

Initial pattern entry: at 210 knots select flaps 1

At 190 knots, select flaps 5.

Reduce speed to 170 knots.

Lower landing gear passing abeam of end of runway. Select flaps 15.

At 150 knots, select flaps 25.

At 140, select landing flap.

Reduce speed to Vref speed + 5 (no wind) or reduce speed to bug + 1/2 wind + gust.

Complete LANDING checklist.

Speed Brakes

With the speed brake lever in the armed position, all spoilers will rise automatically when the thrust levers are retarded to IDLE and the right main gear touches down and the wheels spin up. The spoilers destroy lift and place most of the weight of the airplane on the wheels for effective braking during initial landing roll.

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Speed Brakes (Cont).

At touchdown, if the spoilers do not extend automatically, immediately move the speed brake lever to the up position and simultaneously apply the brakes and reverse thrust.

CAUTION: DO NOT ATTEMPT A GO-AROUND AFTER REVERSE THRUST HAS BEEN INITIATED. FAILURE OF A THRUST REVERSER TO RETURN TO THE FORWARD THRUST POSITION MAY PREVENT A SUCCESSFULL GO-AROUND.

Reverse Thrust

Brake and tire wear can be reduced by proper use of reverse thrust. On airports known to have dirty runways reverse thrust should be used with caution. Reverse thrust is not used on Gravel Runways unless required. On snow or ice covered gravel runways use of idle reverse is normal procedure at touchdown. The thrust levers must be in IDLE before the reverse thrust operation can be initiated.

Reverse thrust is most effective when used at the start of the landing roll while the airplane is moving at high speed. The reverse thrust levers should be pulled back until their movement is limited by the force build-up at the reverse detent, and then moved slightly to approximately 1.5 EPR (normally recommended) for passenger comfort.

NOTE: When using reverse thrust on gravel, use approximately idle reverse, not to exceed 1.8 EPR. Modulate to reverse idle at 80 kts, and stow reversers by approximately 60 knots.

The maximum allowable go-around EPR should not be exceeded as the same engine operating limits apply for forward or reverse thrust. At 50 knots, EPR should be reduced from 1.5 to 1.2. Just prior to runway turn off return the reversers to forward thrust for taxi.

Flaps

Operation on contaminated runways may result in foreign object damage to the flaps. In order to minimize damage to the flaps the pilot not flying the airplane will place the flap handle to 15 immediately after touchdown. The effect on stopping distance using this procedure is negligible.

PACIFIC WESTERN AIRLINES
BOEING 737, C-FPWC
CRANBROOK, B.C.
11 FEBRUARY, 1978

REPORT #H80001
AIRCRAFT ACCIDENT

Notes on the flight data recorder characteristics related to consideration of the validity of the apparent large left rudder application 6 to 7 seconds before impact.

The data recovered from the flight data recorder tape indicates a single measurement of rudder quadrant position between 6 to 7 seconds before impact showing application of a large amount of left rudder. The reliability of this one synchro measurement is a subject of considerable concern.

The technique used to convert the normal three wire synchro signal to a digital number involves initial conversion of the signal to a DC voltage that is a linear function of the synchro angle. Unfortunately, this linear relationship must obviously have a discontinuity at some point. With the Leigh FDRS 38 system, this nominally occurs at the $0^{\circ}/360^{\circ}$ reference point of the synchro. In reality, the measured discontinuity is not abrupt and can occur anywhere within approximately $\pm 1^{\circ}$ of synchro angle either side of the reference point. The digital data format in the recorder is a sequence of discrete samples. If a synchro DC output is sampled whilst the synchro is in the discontinuous region the observed voltage can vary in an almost random manner. This voltage, when translated into a digital number would erroneously be interpreted as indication of a random variation in synchro angle instead of a constant zero position.

Conversely, in principal, any observed digital measurement from a synchro may correspond to either the linearly-related synchro angle or to the zero angle. The probability of the latter occurrence is low but depends on many factors and would be very difficult to quantify. The validity of the linearly-related synchro angle must be assessed by comparing it with those derived from samples that preceded and followed it and/or by cross-reference to other related parameters. In view of the almost random nature of the output in the discontinuous region, if a number of sequential measurements show a sensible time history, the alternate possibility that all the synchro angles were zero becomes extremely remote.

Unfortunately, the installation of the DFRS 38 synchros on the pilot's control system is such that the zero angle of the synchro corresponds to the neutral position of the control. The actual control positions will usually be close to this neutral position. Thus, it becomes more difficult to differentiate between the linearly-related values and the alternative neutral setting.

Considering the data derived from C-FPWC, all synchro measurement points outside of the indeterminate range indicated in Figure 1 appear reasonably consistent either in terms of the time-history of their relation to other parameters, with the exception of the one rudder quadrant position in question. The defect found in the synchro converter (ref. Sec. 1.11) was considered in detail and it was decided that this would not materially affect the presence of the discontinuous range though it did mask some of the evidence that might have been used to assess the problem.

In the case of the rudder quadrant monitoring, the discontinuous range of $\pm 1^{\circ}$ synchro angle corresponds to $\pm 0.3^{\circ}$ of quadrant movement.

Validation of the one questionable rudder measurement must depend primarily on correlation with the remaining parameters since there are no measurements immediately preceding it, and those following it might even be considered more consistent with the alternative neutral setting.