Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A98H0004

RISK OF COLLISION

BETWEEN
NAV CANADA CANADAIR CL-600-2A12
AND
TRANSPORT CANADA
AIRPORT MAINTENANCE VEHICLE, STAFF 61

TERRACE AIRPORT, BRITISH COLUMBIA
17 DECEMBER 1998

Canada

Aviation Investigation Report

Risk of Collision

Between
NAV CANADA Canadair CL-600-2A12
and
Transport Canada
Airport Maintenance Vehicle, Staff 61
Terrace Airport, British Columbia
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Summary

NAVCAN 200, a Canadair Limited CL-600-2A12 Challenger, reported joining downwind for runway 33 for a full stop and was provided airport advisory information. An airport vehicle, Staff 61, was on the runway at the time; however, this information was not relayed to the pilot. NAVCAN 200 landed and reported a vehicle on the runway to the flight service station specialist. The operator of the vehicle had been performing a runway check and had stopped to pick up a few small pieces of snow that had fallen from a runway sweeper during a previous clean-up. He left the door of the vehicle open, switched his radio to the rear speaker, and was approximately 10 feet from the vehicle when he heard the sound of a jet engine to the south. He ran quickly to the vehicle, put it in reverse, and backed over the edge of the runway. As he got to the runway edge, the aircraft went by. The vehicle operator reported that the occurrence took place at approximately the 3 500-foot point, near runway 33's mid-point. The vehicle operator reported that visibility on the runway was approximately 300 feet in fog and that he had not been able to see the aircraft until it was almost beside him.

Ce rapport est également disponible en français.

Other Factual Information

Air Traffic Services Unit Description

The NAV CANADA-operated flight service station (FSS) at Terrace Airport provides, in part, airport advisory service, vehicle control service, operation of runway, approach, taxi, and other airport lighting in accordance with procedures contained in FSS *Manual of Operations* (MANOPS) and other directives, 24-hour weather observations, notice to airmen (NOTAM) service, visual flight rules alerting service, and equipment monitoring and serviceability reporting in accordance with established agreements. Terrace Airport is an uncontrolled airport; there is no control tower in operation. The Terrace control zone is controlled airspace and consists of a five-nautical-mile circular area centred on the airport and extending up to 3 700 feet above sea level. The control zone is a designated mandatory frequency (MF) area within Class E airspace. Regulations specify that aircraft operating within the MF area, on the ground or in the air, shall be equipped with a functioning radio capable of maintaining two-way communication. The Class E airspace is one of seven designations of Canadian airspace where flights may be conducted under instrument flight rules or under visual flight rules.

Personnel on Duty

The FSS was staffed by two specialists at the time of the occurrence, which was in accordance with local policies and with the workload at the time. A FSS team leader position is staffed on a rotating schedule; however, no team leader was present on this day as it was a scheduled day off. The staffing schedule for the team leader position has been changed to ensure that a stand-back quality assurance role is provided during weekday working hours, Monday to Friday. One specialist position was responsible for the provision of flight services and vehicle control services in and around Terrace Airport, while the other provided en route and advisory services to Sandspit Airport via a remote communications facility. Both specialists provided weather observing and briefing services as required.

Traffic and Weather

Traffic was reportedly moderate for most of the morning and had decreased to the point that, at the time of the occurrence, there were only two active data strips in the strip bay of the specialist responsible for Terrace Airport: NAVCAN 200 in the air and Staff 61 on runway 33. Neither of the two specialists had been provided a relief break between arriving for duty and the time of the occurrence, a span of approximately four hours.

The 1100 Pacific standard time (PST)[1] aviation routine weather report (METAR) indicated the following conditions: wind calm, visibility 20 statute miles, a few clouds at 600 feet above ground level (agl), scattered cloud layers at 2 000 and 12 000 feet agl, temperature minus four degrees Celsius, and dew point minus four degrees Celsius. A correction to the 1100 METAR issued shortly thereafter reported the same weather conditions but in remarks noted the presence of shallow fog.

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[1] All times are PST (coordinated universal time minus eight hours) unless otherwise stated.

Up to the time of the occurrence, all areas of the airport were clearly visible to the FSS specialist except for the northern half of runway 33, where a low fog bank had recently developed. The specialist had had no problems seeing other ground traffic earlier that morning.

The Aircraft

NAVCAN 200, with two pilots and one passenger on board, had departed from Terrace Airport at 1023 to conduct flight inspections on navigational aids located in the vicinity of the airport, which entailed flying routes through and around Terrace Airport's MF area. NAVCAN 200 communicated with the FSS specialist throughout the flight check. At about 1116, above the airport, the pilot of NAVCAN 200 advised the specialist on the MF that he was joining the traffic circuit on a left-hand downwind for landing on runway 33. The specialist responded with a wind advisory (wind calm). About one minute later, the pilot advised turning to final for a full-stop landing on runway 33, and the specialist repeated the wind advisory.

Just prior to landing, the pilot requested that the specialist advise the aircraft refuelling company that the aircraft was landing. The specialist spent the next 35 seconds on the telephone with an employee of the refuelling company. At one point, the specialist commented that he could not see the aircraft after landing because it had disappeared into the fog. At 1117:57, near the end of the telephone conversation with the refueller, the specialist received a radio call from Staff 61, the airport maintenance vehicle that was operating on the runway. At 1118:03 the pilot of NAVCAN 200 reported to the FSS that a vehicle was at the edge of the runway, in the fog. At no time was information regarding the presence of a vehicle on the runway relayed to the pilot of NAVCAN 200 by the FSS specialist.

While overhead, the crew of NAVCAN 200 reported that the airport was visible below, and that a thin layer of fog partially obscured the northern half of runway 33. They had scanned the runway for obstructions but did not spot the vehicle on the runway. The crew made all required radio transmissions on joining the traffic circuit and on turning final for runway 33. After a normal landing, the captain immediately applied brakes and full reverse thrust, as was his normal procedure. The fog bank started at approximately one half the distance down the runway. As the aircraft entered the fog, visibility reduced to approximately one-quarter mile. The crew noted the presence of the vehicle at the side of the runway just after the aircraft entered the fog.

The Vehicle

At 1111:17, the operator of Staff 61, a white airport maintenance vehicle, had called the FSS on the vehicle control frequency and requested access to work area 15/33 to inspect previous snow-clearing work. This area is delineated in local operating procedures and encompasses taxiway A, runway 15/33, and two turn-around areas at the unused runway and at the threshold of runway 03 (see Appendix A). The specialist authorized Staff 61 to proceed onto this work area a few seconds later. Staff 61 was equipped with a functioning strobe light, which had been on while the vehicle was operating on the runway; however, neither the crew of NAVCAN 200 nor the FSS specialist recalled seeing the light.

The operator of the vehicle had stopped a few times to pick up a few small pieces of snow that had fallen from a runway sweeper during a previous clean-up. Each time, while out of the vehicle, he left the door of the vehicle open and switched his radio to the rear, exterior speaker. Just prior to the incident, he was approximately 10 feet away from the vehicle when he heard

the sound of a jet engine to the south. He quickly ran to the vehicle, put it in reverse, and backed over to the edge of the runway. Approximately five seconds had elapsed from the time the operator heard the sound of the jet engines until he saw the aircraft pass by. There had been no communications between the specialist and Staff 61 for the previous 6 minutes and 28 seconds until the call from Staff 61 to the FSS, at 1117:57. The specialist did not immediately answer Staff 61 because he was just completing a telephone conversation with the refuelling agent. Staff 61 was not visible to the specialist at the time because of the fog.

Prompted by the radio calls from Staff 61 at 1117:57 and the pilot of NAVCAN 200 at 1118:03, the specialist immediately instructed Staff 61 to exit the runway (the aircraft had already passed the vehicle) and to report clear. Staff 61 responded that the aircraft was already by his position and that he would follow it to the ramp.

The Transport Canada (TC) publication TP 312, *Aerodrome Standards and Recommended Practices*, specifies as a standard that "all mobile objects to be marked shall be coloured or display flags". This publication also recommends that service vehicles be yellow. A recommended practice is defined in TP 312 as any specification for physical characteristics, configuration, material, performance, personnel or procedure; the uniform application of which is recognized as desirable in the interest of safety, regularity or efficiency of air navigation, and to which operators will endeavour to conform. Recommended practices in TP 312 are identified by the verb "should" and are not mandatory for certification.

The minimum recommended lighting requirement for a vehicle being operated at night, as stated in TP 312, is a flashing yellow light. The vehicle was equipped with a flashing white strobe light, flashing orange hazard lights, and white headlights. The flashing white strobe light was reportedly much brighter than the older rotating yellow lights used on the service vehicles previously. All vehicle lights were operating at the time of the occurrence.

Vehicle Control and Advisory Service

The objective of the vehicle control service provided by the FSS is to control the movement of ground traffic on the airport manoeuvring area. Ground traffic does not include aircraft; it includes all other traffic, such as vehicles, pedestrians, and construction equipment. A separate frequency is established for the control of ground traffic entering the manoeuvring surfaces of the airport. Vehicle operators are required to receive authorization from the FSS prior to entering and to report on and off the manoeuvring area. The FSS MANOPS specifies that specialists do not normally transmit simultaneously on more than one frequency. Vehicles required to operate on the manoeuvring surfaces of the airport are required to be equipped with a radio capable of receiving and transmitting on the vehicle control frequency or be escorted by a vehicle so equipped. At airports where a vehicle control service is provided, vehicles do not normally monitor the MF. As a result, the FSS specialist is the focal point and exclusive repository for all the available information on air and ground traffic. The FSS has the responsibility to ensure that operators are apprised of essential information as required.

At Terrace Airport, the term "work area 15/33" is reserved exclusively for snow-clearing operations. Snow-clearing vehicles are permitted unrestricted access by the FSS specialist to the entire area; while in the area, vehicles are not required to provide position reports to the FSS. This procedure was instituted because of the extensive amount of snow-removal operations conducted at Terrace Airport and the number of vehicles normally involved, often up to eight.

The reduction in radio transmissions and workload between the FSS and vehicle operators was seen as a significant benefit.

On the other hand, a vehicle advisory service may be provided at uncontrolled airports where there is no FSS. The objective of the vehicle advisory service is to coordinate (as opposed to control) the movement of ground traffic on airport manoeuvring areas at designated remote uncontrolled airports served by a remote communications outlet. All radio communications between the FSS and vehicles are normally conducted on the MF, that is, the same frequency used for aircraft communications. In these situations, the vehicles and the aircraft would hear transmissions directed to the other or to the FSS.

Data Strips

At Terrace Airport, flight and vehicle data strips are used to assist the FSS specialist in controlling and coordinating the movement of aircraft and vehicles on and around the airport. Such strips serve as reminders of that traffic. The data strips are placed into a data strip board located on the console. These strips are below the level of the normal visual scan when the specialist is looking out the window. The aircraft flight data strips are buff-coloured and the vehicle data strips are rose-coloured, which makes it easier to distinguish between the two types of strips. As well, the edges of the vehicle data strips holders are painted bright red to enhance the visibility of the strips. However, studies have shown that peripheral vision has low colour sensitivity (buff versus rose strip colour) and low resolution (red strip holder edges), so differentiating between vehicle and aircraft strips is not effective unless the specialist looks directly at the strips.

The specialist had used data strips for all ground traffic and NAVCAN 200 that morning and had kept the information updated as required.

Visual Scanning

Studies have shown that visual scanning may take precedence over other available information because it takes less mental manipulation to integrate it into the required mental model. In this occurrence, processing of information would only continue until the expected answer is generated to the question "What is the state of the runway for the incoming aircraft?" Visual scanning of the airport appeared to be the fastest technique to provide that answer.

FSS MANOPS provides guidance for specialists on how to conduct a visual scan of the manoeuvring surfaces for greatest effect. Similarly, air traffic control MANOPS provides guidance for airport and ground controllers. What is not covered in this material is guidance for effective scanning of the specialists' or ground and airport controllers' entire work area, including data strip boards, other displays, and the external environment, to ensure the available cues trigger the appropriate memory items.

During qualification training, trainees must demonstrate an ability to determine traffic situations using the strip board and visual scanning in the delivery of the airport advisory service. Trainees must reach a skill level such that they can do this satisfactorily without assistance from the on-the-job-instructor before being considered for qualification. In this case, the specialist's scan of his entire work area was not effective in gathering all the information he required.

Memory

Working memory (or conscious awareness) is defined as that memory which contains information gathered through an individual's senses for immediate use and is considered to be capacity limited. To reduce mental processing requirements, information about a persistent condition, such as the presence of a vehicle on the active runway, is unlikely to remain in the capacity-limited working memory, but would normally be retrieved intermittently from long-term memory. If another process, such as visual scanning or data strip scanning, is needed in parallel, the interval between retrievals from long-term memory into working memory is likely to be increased. This memory recall process may also be interrupted completely in the presence of other factors such as distractions. If the processes are related to safety, as in this occurrence, the interval between recalls could increase to the extent that safety would be jeopardized.

Studies have shown that memory is subject to frequent lapses, so other defences or barriers must be put in place to prevent unwanted outcomes. The FSS specialist had encoded the presence and location of the ground vehicle into memory. This was confirmed by his response to the pilot's communication after landing, that is to immediately instruct the vehicle to get off the runway.

Technical Assists to Memory

A technical aid, termed SONALERT, installed at various FSSs is connected to the FSS communications system and serves to assist FSS specialists in preventing conflicts between vehicles and aircraft on an active runway. When a specialist authorizes a vehicle to proceed onto a runway, the specialist manually activates the SONALERT with a switch on the console. When the specialist subsequently transmits to an aircraft on the MF while the SONALERT is activated, a distinct sound is produced to alert the specialist that a vehicle is on the runway. This serves as an active reminder to the specialist. Local procedures require specialists to use this system every time a vehicle is allowed to proceed onto the runway. It is deactivated as soon as the vehicle reports off the runway. Terrace FSS and technical staff have started developing another type of active reminder system which would be activated when a vehicle strip is placed into the data strip board and would alert the specialist in a similar manner. These systems do not alleviate the specialist's responsibility to follow a disciplined approach to the provision of air traffic services.

Other Reported Occurrences

In the previous month, there had been two other risk of collision incidents involving vehicles and aircraft at Pacific region airports where FSS specialists were providing vehicle control services. One occurred at Fort St. John on 24 November 1998, when the specialist did not relay information about a snow blower operating on a runway from which a Gulfstream executive jet was about to depart. The pilot of the Gulfstream commenced the take-off then rejected it when advised a snowblower was on the runway. The on-the-job-instructor had seen the impending conflict developing, took over the position from the trainee, and advised the pilot of the presence of the snowblower. The trainee had forgotten about the snowblower. On 4 December 1998 at Smithers, a Beech 200 aircraft departed runway 33 after having received a departure advisory from the FSS; the advisory did not include information about a sweeper operating at the other end of the runway. The aircraft overflew the sweeper at an altitude of approximately 500 feet on the climb-out.

In 1993, the TSB sent an information letter (Aviation Safety Information 2149—*Use of Mandatory Frequency by Airport Vehicles*) to TC following two occurrences in southern Ontario in which vehicles were on the runway when aircraft were landing. The letter stated that "the capability to monitor the MF [by the vehicle operators] has the potential to improve the situational awareness of the vehicle operators". In its 15 February 1994 response, TC stated that "It has been found impractical for vehicle operators to monitor two frequencies for the purpose of maintaining situational awareness", and considered it "the responsibility of the controlling agency to separate vehicles from aircraft and/or advise pilots of vehicle operations on the manoeuvring area". As has been demonstrated at Terrace, and in other recent incidents, the risk of collision between vehicles and aircraft is still present.

Analysis

General Concept of Safety

Safety in the aviation system is rooted in the concept of defences in depth, or redundancy, and the timely and accurate dissemination of information to reduce the likelihood of a single failure leading to an accident. Safeguards have been built into many air traffic services, procedures, and systems to ensure that operations can be conducted safely, such as the use of checklists during position handover and reliable dual channel radar, communications, and electrical systems. Whenever information is compartmentalized to the extent that a single individual or system is the exclusive conduit for that information, a lapse in memory, a deviation from standard procedures, or a technical failure has the potential to result in an accident.

In the absence of a sufficient depth of defence, a single lapse resulted in this occurrence. It did not become an accident due only to an unanticipated and unplanned defence, in that the operator of Staff 61 received information about a landing aircraft from the sound of the approaching jet engines. The vehicle operator showed great presence of mind to react so quickly and move the vehicle to the edge of the runway in the few seconds available. This action most likely prevented an accident.

Use of Visual Scan

Visual scanning assists a person's memory retrieval process to recall information into conscious or working memory so that that individual can make safe and effective decisions. Although it was the specialist's habit to scan the entire length of the runway prior to an aircraft landing, as he did in this instance after NAVCAN 200 advised joining downwind, it was ineffective because the fog was not perceived to be an obstruction to vision sufficient to hide the vehicle from view. As recently as a few minutes before the occurrence, the specialist's routine visual scan of another part of the airport had been sufficient to confirm that there was no conflict between an arriving helicopter and a vehicle transiting along Bravo taxiway.

Seeing that the runway was clear based on his visual scan (although the observation was inaccurate), the specialist would not have felt a need to search other displayed information, such as the data strip board, to confirm what he saw out the window. This subtle shift to relying on one source of information, the visual scan, would not normally be detected by an individual. Only a disciplined, practised scan of his entire work area, including the manoeuvring areas and all displayed information, and/or an active technology-based reminder system might have been sufficient for the specialist to recall the fact that he had authorized a vehicle to operate on an

area that included runway 33. The specialist's techniques for scanning the entire work area, learned during qualification training, were not effective, and, as a result, he did not recall the presence of the vehicle on the runway.

Although the FSS MANOPS provides guidance for conducting efficient and effective visual scans of the manoeuvring surfaces, no guidance or techniques are provided for the overall scanning of the specialist's entire work area in order to integrate information into a complete mental picture: situational awareness. A lack of effective integration of internal and external cues by the individual providing air traffic services results in an incomplete mental picture being used to make decisions. As in this occurrence, using only the visual scan to provide situational awareness while inadvertently disregarding other displayed information increases the risk that critical information will be missed.

Data Strips

The defence that should have been provided by the data strips was not effective in this occurrence. Although the specialist remembered updating the strips after the initial call from NAVCAN 200, the process of conflict detection was not engaged. Studies have also shown that a person's peripheral vision is not designed to differentiate between different colours. The differently coloured data strips were ineffective in drawing the specialist's attention to the fact that a vehicle was on the runway.

The data strips serve well as repositories of information, but in themselves may not act as a sufficient stimulus to cause an individual to recall specific information from memory. Additional stimuli would, therefore, be required to cause the specialist to consciously look to the data strips for additional information so that his or her own mental picture would be continuously updated.

Work Areas

Work areas established at Terrace Airport to facilitate snow-clearing operations reduce the coordination and communications workload for the FSS and vehicle operators. This procedure allows unrestricted travel within the work area, and no additional communications contact was required between the vehicle operator and the FSS. The absence of radio communications to and from the vehicle may have prevented the specialist from recalling the presence of the vehicle at a critical time. Routine communications requirements, such as position reports in the work areas, could have served as a reminder for the specialist that a vehicle was on the runway, when NAVCAN 200 initially reported above the airport.

System Defences

A more positive intervention is required to change a specialist's established routine for gathering information to ensure that the pertinent facts are recalled into working memory at the correct time. For example, NAV CANADA has installed a SONALERT system at some of its FSS facilities, which serves to actively remind specialists that they have authorized a vehicle to operate on a runway. Terrace FSS and technical staff are also developing another system that would activate as soon as a vehicle strip is placed into the data strip board. This type of active warning could provide the positive intervention required to ensure the specialists do not overlook other sources of critical information. However, technological systems alone will not be effective unless

the FSS specialist consistently follows a disciplined approach in the provision of air traffic services, that is, scanning the immediate work area as well as the outside environment to gather all available and required information.

Under the current procedures at FSS facilities, when a vehicle control service is being provided, vehicles and aircraft monitor different frequencies; only the FSS specialist has all the information required to maintain complete traffic awareness. The redundancy that would be achieved by providing more than one person/agency access to the information necessary for safe operations is lost when the information is restricted to only the FSS. The capability to listen to the other active frequency by the aircrew or the vehicle operator would have reduced the likelihood of this occurrence happening.

Given the right set of circumstances, any statistically rare event such as a runway incursion will eventually occur. This has been demonstrated by the continuing reports of aircraft-vehicle conflicts at airports. Given the potentially catastrophic consequences of these occurrences, barriers independent of the specialist's function ought to be considered. For instance, the addition of another observer (or set of observers) to the conflict avoidance team certainly increases the resources for error detection and reduces the chance of this type of occurrence from happening again.

Findings

1. The FSS specialist did not inform the pilot of NAVCAN 200 that a vehicle was operating on the runway at the time the airport advisory information was relayed to the pilot.

2. Fog covered part of the infield and runway 15/33, obscuring the vehicle from the view of the FSS specialist and the crew of NAVCAN 200.

3. The pilot of NAVCAN 200 was not aware a vehicle was on the runway, and the vehicle operator did not know that an aircraft was inbound for landing.

4. The aircraft and the vehicle were operating on different radio frequencies, which was in accordance with established procedures.

5. No active warning system that would serve as a reminder for the FSS specialist that a vehicle is operating on a runway is in place at the Terrace FSS.

6. Vehicles operating on work area 15/33 or work area Bravo are not required to make routine position reports to the FSS specialist while operating within the bounds of the work area.

7. Just prior to the occurrence, the FSS specialist may have been distracted by a request from the pilot of NAVCAN 200 to advise the refuelling company of the aircraft's arrival at the airport just prior to the aircraft landing on runway 33.

8. There was a risk of collision between the landing aircraft and the vehicle operating on the runway.

9. Staffing at the Terrace FSS met unit standards.

10. All necessary equipment was serviceable and being used.

11. Workload at the time of the occurrence was reported as light with no complexity, although the workload was reportedly moderate for most of the morning prior to the occurrence.

12. The vehicle, Staff 61, was equipped with a functioning strobe light that had been on while the vehicle was operating on the runway.

13. All active data strips were properly completed and updated by the FSS specialist.

14. Due to the workload during the four hours prior to the occurrence, neither FSS specialist on duty was afforded the opportunity for a relief break.

Causes and Contributing Factors

The FSS specialist did not recall that a vehicle was operating on the active runway. As a result, he did not advise the incoming aircraft pilot of the vehicle's presence. The aircraft and the vehicle were on different frequencies, contributing to the lack of situational awareness that led to the occurrence. The absence of an active technological system to alert FSS specialists and the lack of routine movement reports by vehicle operators also contributed to this occurrence.

Safety Action

The staffing schedule for the team leader position has been changed to ensure that a stand-back quality assurance role is provided during weekday working hours, Monday to Friday.

Under a local initiative, a reminder system for FSS specialists has been developed and is awaiting testing and approval. It provides for a flashing warning light whenever a vehicle is operating on the runway surface. The system is activated as soon as a vehicle strip is inserted into the data strip board by the specialist and provides for an automatic, periodic alert to the specialist until deactivated after the vehicle strip is removed from the data strip board.

Through the Canadian Aviation Regulation Advisory Council (CARAC) Part III Technical Committee, Transport Canada is examining the extent to which vehicles should be allowed to use aircraft manoeuvring surfaces when transiting from one aerodrome location to another, with a view to reducing the potential for aircraft/vehicle conflicts. Additionally, the committee will determine whether vehicles at uncontrolled airports should be operating on the same or different frequency as that used by aircraft.

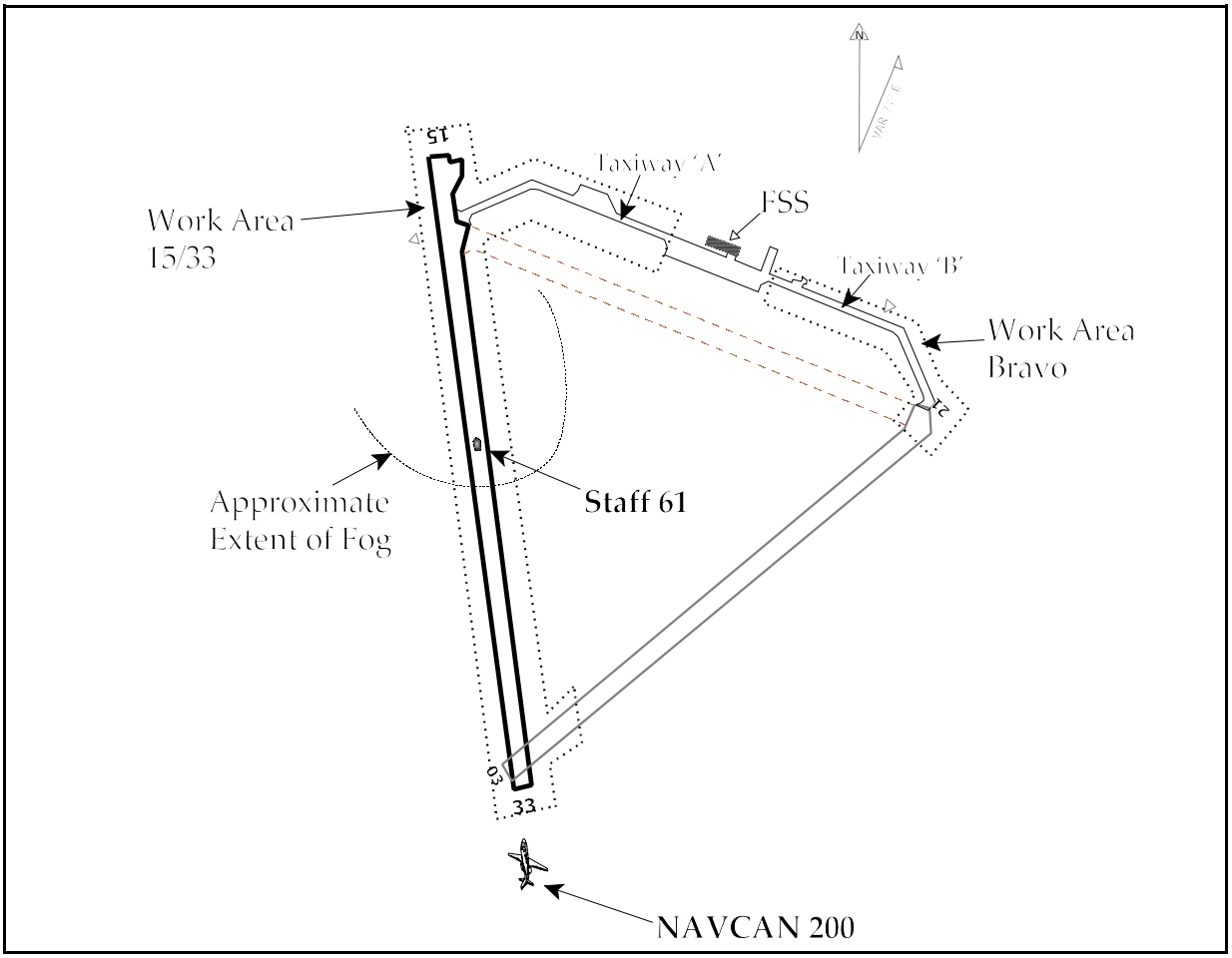
Runway incursions have received significant publicity in the United States (USA) as a result of several spectacular accidents and incidents and a rapid climb in the number of reported occurrences over the last several years. NAV CANADA data show an increase in the incursion rate, which is consistent with that experienced in the USA. The rise in the number of runway incursions over the last five years at large and small airports in Canada is a concern. NAV CANADA launched a study into the problem late 1999, with the preliminary step of collecting data. NAV CANADA staff, with a panel of experts, are to review the data and define some

strategies for reducing the number of runway incursion occurrences across the country. A report on the study is expected in summer 2000. Transport Canada has also established a safety review group to examine the problem of runway incursion.

The Terrace-Kitimat Airport Society, the present operator of Terrace Airport, has initiated staff action to procure extra radios (receive only) for installation on all its vehicles that operate on the movement areas of Terrace Airport. The radios will be tuned to receive the MF. The MF is the frequency used by aircraft to communicate with the FSS and with each other while in the MF area surrounding the airport. The new radios will allow vehicle operators to hear communication from and to aircraft flying into or out of Terrace Airport, thereby increasing their situational awareness. This project was completed in April 2000.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 16 February 2000.

Appendix A—Terrace Airport Diagram



Positions of NAVCAN 200 and Staff 61 (at approximately 1119 PST)