Mr. Chairman and Members of the Subcommittee:

I am pleased to appear before the Subcommittee to discuss the kinds of air carrier navigation systems in use today. With me today is Neal Blake, FAA's Deputy Associate Administrator for Engineering.

In the North Pacific (NOPAC) for operations within the Anchorage and Tokyo Flight Information Regions airspace in the area transited by Korean Air Lines Flight 007, U.S. air carriers who will fly at Flight Levels 280 through 450 are required by the FAA to have one of the following types of navigation systems: an approved dual Inertial navigation system (INS); an approved dual OMEGA navigation system; an approved system comprised of an Inertial navigation system and an OMEGA navigation system; or an approved Doppler radar navigation system and an Inertial navigation system or OMEGA navigation system. International standards contained in ICAO Annex 2 require an aircraft, which is not under VFR rules, to have "navigation equipment which will enable it to proceed: a) in accordance with its operational flight plan; and b) in accordance with the requirements of air traffic services...."
While the U.S. operations procedures permit the use of different types of navigation systems for oceanic use, and ICAO rules are not specific on equipment, a survey of NOPAC traffic between January 10-23, 1982, showed that all aircraft flying the composite routes (R-20, R-80, A-90, R-91, and G-44) were equipped with at least INS, and, for that matter, all traffic in NOPAC was equipped with INS except for one carrier which has now equipped its oceanic aircraft with INS. It is now common international practice for oceanic aircraft to use INS, a combination of INS and OMEGA, or OMEGA.

Joint U.S./Japanese monitoring of navigation accuracy at the end points of the NOPAC composite route system between March and September 1982, found only one aircraft with a lateral position error greater than 10 nautical miles. That aircraft was 17 nautical miles from centerline, well within the accuracy required for the safety of aircraft using the composite routes. The demonstrated navigation performance of both INS and OMEGA is adequate to meet the demands for safe flight in the NOPAC composite route system where aircraft at the same altitude are separated by 100 nautical miles. The maximum permissible error for INS is 2 nautical miles per hour. Actual demonstrated performance on over 500,000 flights has shown that the average INS drift rate is, in fact, about one nautical mile per hour. The average time in the NOPAC composite route system
is approximately 5 hours; consequently the maximum permissible navigation error for INS is about 10 nautical miles at the end point. OMEGA in the NOPAC has a demonstrated accuracy of better than 4 nautical miles.

The operation of both INS and OMEGA is similar except for the INS alignment prior to use. For either system to be useful, the operator must insert the desired navigation information. The information consists of trip origin, destination, and, if required, intermediate "way points." This data is most commonly entered as latitude and longitude out to tenths of minutes.

Both INS and OMEGA have good operational histories. Nevertheless, the FAA requires U.S. air carriers to have dual systems so that redundancy is provided. Since both systems must be operating at departure, many carriers have installed three INS units or a dual INS with an OMEGA as back-up.

In addition to prescribed types of navigation equipment, all U.S. air carriers operating large turbojet aircraft are equipped with airborne weather radar for the detection of thunderstorms and other potentially hazardous weather conditions considered detectable with such equipment. The airborne weather radar must be operational prior to departing
under IFR or night VFR over a route when current weather reports indicate that thunderstorms, or other detectable weather conditions, may reasonably be expected along the route to be flown. ICAO recommended practices are comparable to these FAA requirements.

When operating over the NOPAC composite route structure, the airborne weather radar required of U.S. air carriers must be capable of day and night ground mapping. This radar must be operational prior to departing over these routes, and must be used continuously by the flight crew to monitor flight progress over these routes.

With respect to the KAL tragedy, the Members of this Subcommittee are aware that the United States is participating in the investigation being conducted by the South Korean Government. To date no formal conclusions have been reached concerning the reason or reasons why Flight 007 would have been off course. Accordingly, I can't shed any additional light on this topic nor am I in a position to speculate about the reasons given the pendency of the investigation. I can say we have gone over the communications between our controllers and Flight 007 and have found nothing which would have provided our controllers with any indication that the plane was off course. All communications up to and including the last transmission
received by the FAA were of a normal, routine nature. For your information, I am appending to my prepared statement a transcript of those communications.

Mr. Chairman, that completes my prepared statement. I will be pleased to respond to questions you may have at this time.
Memorandum

Subject: Consolidated transcription on Korean flight 007 on 8-31-83 from Anchorage Tower, Anchorage Center and Anchorage International Flight Service Station

Date: September 11, 1983

Reply to

From: Joseph A. Beaudoin
Accident/Incident Analysis Branch

To:

Agencies making transmissions

Anchorage Tower
Anchorage Air Route Traffic Control Center:
Sector RD 5/6
Sector D 2/3
Sector D 10/11
Anchorage International Flight Service Stn.
Tokyo Air Route Traffic Control Center
Korean Air Lines Flight 007
Korean Air Lines Flight 015
United Air Lines Flight 18
Unknown Source

Abbreviations

ANC APCH
D 5/6
D 2/3
D 10/11
IFSS or E459
TKY CTR
KE007
KE015
UA18
UNK

This transcription is in a sequential order and will identify the source from whence it was derived from at the beginning of each different segment. Duplications have been eliminated. All times indicated will be in GMT (Greenwich mean time).

Anchorage Tower

1250:12 KE007
Uh clearance Korean zero zero seven uh have information sierra Seoul at three one zero

1250:18 ANC APCH
Korean Air zero zero seven heavy is cleared to Seoul via the Anchorage eight departure then as filed climb and maintain flight level three one zero departure frequency one one eight point six squawk six zero seven two

1250:34 KE007
Korean zero zero seven cleared to Seoul Anchorage eight departure climb and maintain three one zero one one eight six six zero seven two

1250:43 ANC APCH
Korean zero zero seven heavy read back was correct
1250:59  KE007  Ground Korean zero zero seven request push gate two
1251:04  ANC APCH  Korean Air zero zero seven heavy push at your discretion plan runway three two
1251:08  KE007  Roger
1255:40  KE007  Uh-ground Korean Air zero zero seven taxi
1255:45  ANC APCH  Korean Air zero zero seven heavy taxi to runway three two
1255:50  KE007  Runway three two roger
1258:33  KE007  Korean zero zero seven ready for takeoff
1258:36  ANC APCH  Korean Air zero zero seven heavy roger departure frequency will be one one eight point three same as tower cleared for takeoff runway three two
1258:45  KE007  Roger one one eight three
1301:12  ANC APCH  Korean Air zero zero seven heavy Anchorage departure radar contact climb and maintain flight level three one zero turn left heading two two zero
1301:22  KE007  Roger two two zero climb and maintain three one zero roger
1302:40  ANC APCH  Korean Air zero zero seven heavy proceed direct Bethel when able
1302:45  KE007  Roger uh proceed direct to Bethel roger
1304:39  ANC APCH  Handoff forty seven line
1304:45  D 5/6  Go ahead
1304:47  ANC APCH  About seven west of the VOR Korean Air zero zero seven heavy going direct Bethel
1304:51  D 5/6  He's radar
1304:54  ANC APCH  He's off on the hour (unintelligible) TD
1305:13  ANC APCH  Korean Air zero zero seven heavy contact Anchorage Center one two five point seven good day
1305:18  KE007  (unintelligible) good day
1305:23  Anchorage ARTCC Sector RD 5/6
1305:03  KE007  Anchorage Korean Air zero zero seven leaving five thousand for three one zero good morning
1305:09  D 5/6  Good morning Korean Air zero zero seven seven  roger
1327:50  D 5/6  Korean Air zero zero seven seven radar service is terminated contact Center one two five point two good morning
1327:53  KE007  two five two seven good morning

Anchorage ARTCC Sector D 2/3

1328:01  KE007  Anchorage Center Korean Air zero zero seven seven good morning now leaving three zero zero for three one zero
1328:06  D 2/3  Korean Air zero zero seven seven roger report Bethel
1328:11  KE007  Report Bethel roger
1350:09  KE007  Anchorage Korean Air zero zero seven
1350:12  D 2/3  Korean Air zero zero seven seven go ahead
1350:14  KE007  Zero zero seven Bethel at four niner flight level three one zero estimate NABIE at one four three zero two one niner decimal zero minus four niner two niner five diagonal two five
1350:28  D 2/3  Korean Air zero zero seven seven roger report NABIE to Anchorage on one two seven eight
1350:33  KE007  one two seven eight roger
1350:42  D 10/11  Go ahead
1350:43  D 2/3  Korean Air zero zero seven says NABIE one four three zero TJ
1350:47  D 10/11  KD

Anchorage ARTCC Sector D 10/11

1432:21  D 10/11  Korean Air zero zero seven seven Anchorage Center
1432:32  D 10/11  Korean Air zero zero seven seven Anchorage Center
1433:37  D 10/11  Korean Air zero zero seven seven Anchorage Center
1433:47  UNK  (unintelligible)
1433:52  D 10/11  Korean Air zero zero seven seven Anchorage Center how do you read
1434:18  UNK  *(Well wait a minute call again please)

*(best interpretation)

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1434:37  D 10/11  Korean Air zero zero seven Anchorage Center
1434:50  UNK  *(Three three zero I can't wait a minute)*
1434:54  UNK  *(Three three zero okay I got it hello)  *(best interpretation)*
1435:02  KE015  Anchorage Korean Air zero one five
1435:08  D 10/11  Korean Air zero one five Anchorage Center  go ahead
1435:11  KE015  Roger Korean Air zero one five ah forwarding report ah Korean zero zero seven position NABIE one four three two flight level three one zero estimating ah NEEVA one five four nine fuel remaining two zero zero decimal zero minus four nine spot two five zero diagonal six zero go ahead
1435:38  D 10/11  Korean Air zero one five roger ah have Korean Air zero zero seven report NEEVA to Anchorage Center one two eight decimal two
1435:52  KE015  Roger NEEVA one two eight decimal two  good day
1436:00  KE015  Zero zero seven
1436:12  E459  Four five nine
1436:14  D 10/11  Four five nine Center channel eleven reference ah Korean Air zero zero seven
1436:19  E459  Go ahead
1436:21  D 10/11  Ah you can cancel it
1436:22  E459  GB
1436:23  D 10/11  KD

Anchorage International Flight Service Station

1444:10  KE007  Anchorage Radio Korean Air zero zero seven
1444:15  IFSS  Korean Air zero zero seven Anchorage
1444:20  KE007  Roger Korean Air zero zero seven position NABIE one four three two three one zero estimating NEEVE one five five three remaining fuel two zero zero decimal zero minus four nine wind two five zero diagonal five ah diagonal six five ah selcal code golf kilo foxtrot hotel requesting level three three zero when available

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1444:50 IFSS Korean zero zero seven Anchorage understand NABIE one four three two three one zero NEEVE one five five three is that correct
1445:00 KE007 Affirmative Korean Air zero zero seven thats affirmative
1445:20 IFSS Korean zero zero seven Anchorage roger progress standby for sel check
1445:30 KE007 Korean zero zero seven selcal ok thank you
1445:40 IFSS Korean zero zero seven Anchorage roger and ah contact Anchorage Center now one two seven decimal eight make your request with them
1445:40 KE007 Roger one two seven eight roger

Anchorage ARTCC Sector D 10/11

1600:39 KE015 Anchorage Center Korean Air zero one five
1600:43 D 10/11 Korean Air zero one five Anchorage Center go ahead
1600:46 KE015 (unintelligible) relay NEEVA report for zero zero seven their position NEEVA one five five eight flight level three one zero estimate NIPPI one seven zero eight fuel remaining one six one decimal zero minus four eight spot two seven zero diagonal five five go ahead
1601:20 D 10/11 An Korean Air zero one five understand this is a position report for Korean Air zero zero seven and advise Korean Air zero zero seven to ah report NIPPI to enroute radio thank you very much
1601:32 KE015 Roger

Anchorage International Flight Service Station

1603:55 KE007 Anchorage Radio Korean Air zero zero seven
1604:05 KE007 Anchorage Korean Air zero zero seven
1604:12 IFSS United one eight Anchorage radio
1604:21 KE007 Anchorage radio Korean Air zero zero seven
1604:31 IFSS Aircraft calling Anchorage on two niner one zero I'm unable to copy you would you give me a radio check on five six two eight now
1604:49 UA18 Anchorage radio United one eight
United one eight I have you loud and clear this frequency go ahead sir

(unintelligible - sounds like KE007 & UA18 both talking)

United one eight ATC is requesting you forward one five zero west progress and say again your request

Ok we're requesting flight level three seven zero we crossed ah (KE007---Anchorage radio Korean Air zero zero seven) four eight north one five zero west one five zero three five zero four seven north one four zero west one five five one (unintelligible) minus four six (KE007---Korean Air zero zero seven) go ahead

United one eight roger I copied that earlier my mistake sir thank you I have your request and will give it back to ATC standby

Thank you

Anchorage ARTCC Sector D 10/11

Anchorage Center Korean Air zero one five now reaching flight level three five zero

Korean Air zero one five roger flight level three five zero and would you ask Korean Air zero zero seven if he would like higher altitude prior to NIPPI

Ah yes zero zero seven requested three three zero

And ATC clears Korean Air zero zero seven climb and maintain flight level three three zero report reaching through you or through enroute radio

Roger they are now leaving three one zero for three three zero and (unintelligible) Korean Air zero zero seven

Roger

Anchorage Center Korean Air zero one five

Korean Air zero one five go ahead sir

(unintelligible) three three zero Korean Air zero zero seven we talk on one two three four point zero

Korean Air zero one five thank you and report NIPPI to enroute radio have a good flight

Good morning

This is Tokyo Center

Anchorage Center two transfers first Korean Air zero zero seven
1612:44 TKY CTR  Go ahead

1612:45 D 10/11  Korean Air zero zero seven flight level three three zero NIPPI one seven zero eight the next Korean Air zero one five

1612:55 TKY CTR  (unintelligible)

1612:56 D 10/11  Korean Air zero one five three five zero NIPPI one seven one four  go ahead

1613:04 TKY CTR  Roger Korean Air zero zero seven NIPPI ah ah Korean zero zero seven flight level three three zero NIPPI one seven zero eight and the Korean Air one five flight level three five zero  NIPPI one seven one four  India Alpha

1613:19 D 10/11  Thank you Tango Alpha

Anchorage International Flight Service Station

1623:00 IFSS  Calling Anchorage on five six say again your call sign and go ahead sir

1623:06 KE007  Korean Air zero zero seven on five six radio check

1623:11 IFSS  Korean Air zero zero seven Anchorage three by three

1623:16 KE007  Thank you

END OF TRANSCRIPT