BY ORDER OF THE COMMANDER,
85TH GROUP (USAFE)

85 GROUP PAMPHLET 91-1

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Safety

MID-AIR COLLISION AVOIDANCE (MACA)

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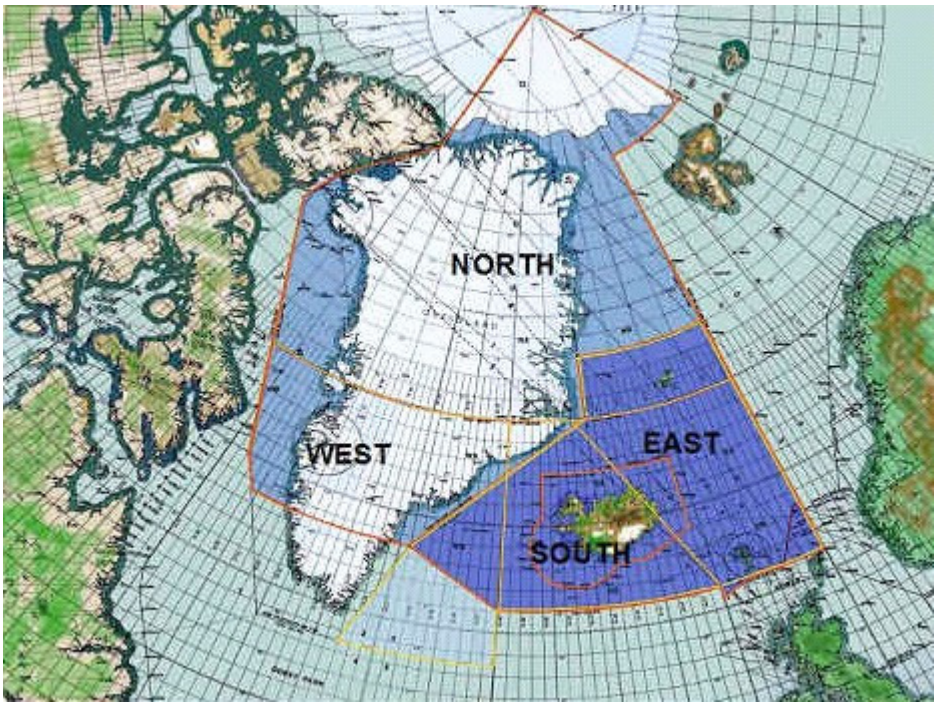
This pamphlet implements AFPD 91-2, *Safety Programs*. This pamphlet outlines the Mid-Air Collision Avoidance (MACA) hazards associated with flight at NAS Keflavik and surrounding areas. The purpose of this pamphlet is to reduce the mid-air collision potential at NAS Keflavik through an aggressive program of information cross-flow between the local military and civilian aviation communities. The MACA program ensures 85th Group aircrews maintain a high level of awareness of the mid-air collision potential inherent in the performance of their worldwide mission. Send comments and suggested improvements to this pamphlet on AF 847, **Recommendation for Change of Publication**, through channels, to 85 GP/SE.

1. THE MID-AIR COLLISION AVOIDANCE (MACA) PROGRAM. The goal of the MACA program is to make the skies in the vicinity of NAS Keflavik (NASKEF) the safest possible flying environment. Prepared jointly by the 85th Group Safety Office and local air traffic control, this pamphlet contains valuable information to help manage flying and increase situational awareness in the airfield area. NASKEF has an extensive use of both military and commercial aviation traffic. As our airspace becomes more congested, the possibility of a mid-air collision increases. Therefore, operation in our local area requires extra vigilance and increased awareness to effectively manage the risk associated with air traffic density. The MACA program provides vital information to both military and civilian aviators to promote an environment of shared expectations and understanding. Communication with air traffic control agencies, aggressive clearing by aviators, use and monitoring of TCAS (Traffic Collision Avoidance Systems), and general knowledge of the airspace in and around the vicinity of NASKEF will help us safely operate together. Within this document, you will find helpful information concerning our airspace, flight patterns, operating procedures, restricted areas, and military aircraft. This pamphlet is intended to serve as a guide only and not as a definitive manual or chart. Always consult current instructions and approved flight information publications before flight. The United States Air Force accepts no liability for any claim arising under or as a result of reliance upon this pamphlet, and reserves protection from liability as afforded under The Federal Tort Claims Act, 28 USC Section 2680.

2. ICELANDIC AIRSPACE. The airspace managed by Reykjavik ACC spans approximately 5.4 million square kilometers, extending from west coast of Greenland to the Greenwich meridian - from the North Pole to just north of Scotland (see **Figure 1.**). Excluded from their area of responsibility are the four main domestic airports, local traffic at which is managed by their own control towers. Lower level airspace in the vicinity of Keflavik (out to 60 nautical miles) is also excluded, being managed from Keflavik. Reykjavik Center serves a great number of clients; in 2001 aircraft from 481 different operators transited the airspace. Although Icelandair operations to and from Iceland easily make it the largest single customer, overall the bulk of the traffic does not land in Iceland.

2.1. Traffic Trends. Over the last 50 years, air traffic in the area under Icelandic jurisdiction has increased from 5,500 flights in 1950 to 92,680 in 2000. Recession, coupled with the events of Sept. 11th, 2001, contributed to a reduction in the numbers for the last years. The total number of crossings in 2003 was 78.642 (which, assuming 250 passengers per aircraft, would translate to more than 19.6 million people). Experts predict that over the next 15 years world air traffic will double in volume.

Figure 1. Reykjavik ACC Area of Responsibility.



3. MILITARY AIRCRAFT OPERATIONS. US and NATO aircraft operate from NASKEF located at latitude 63-59N 022-36W. Field elevation is 171' MSL. All pavement marking and airfield lighting is maintained per ICAO standards. NASKEF is a NATO/International Airfield with military, commercial, and private aviation operations (see **Figure 2.** and **Figure 3.**). Detailed information about NASKEF can be found within the ASRR or electronically at **https://www.afd.scott.af.mil/**.

Figure 2. Keflavik (BIKF) Airfield Diagram.

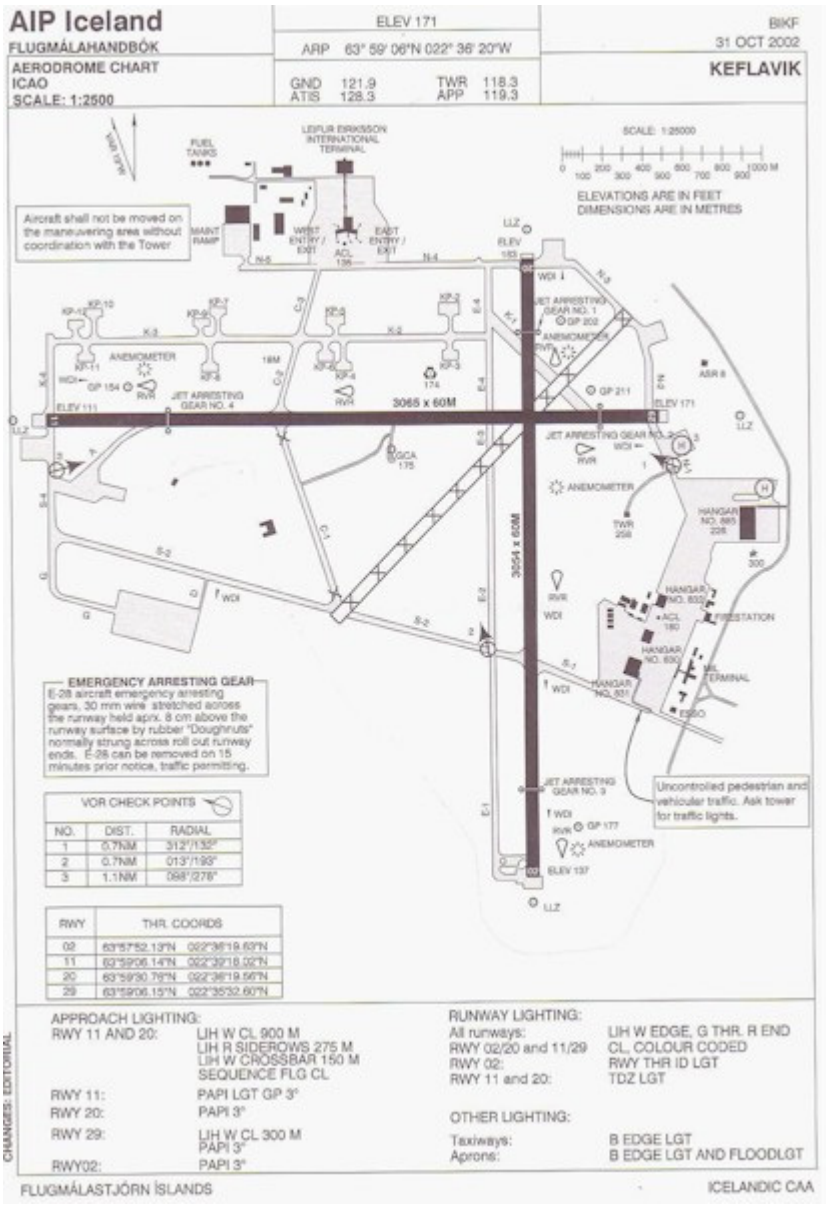


Figure 3. Reykjanesbaer Peninsula Area Diagram.

3.1. Airfield Information and Procedures. NASKEF is comprised of four runways. Specific airfield information and procedures are located in NASKEF Instruction 3710.1P, Air Operations Manual. Aircrew should review this instruction and Flugmálahandbók, Aeronautical Information Publication (AIP) prior to first flight at NASKEF to familiarize themselves with local MACA considerations. Consult DoD flight information publications (FLIP) for specific flight information. Illustrations in this publication should never be used in lieu of approved FLIP.

3.2. F-15, KC-135, and C-130 Operations. NASKEF is a NATO base which hosts USAF F-15, KC-135, C-130, operations. F-15 and KC-135 operations are normally conducted Monday to Friday from 0800 to 1700 in local intercept training areas (ITAs) (see **Figure 4.**). These operations are generally under IFR control with Keflavik Tower, Reykjavik Control, or LOKI (U.S. Military GCI). Operating altitudes while in ITAs range from surface to 50,000’ MSL.

3.2.1. F-15 operations consist of ACT, BFM, air refueling, and low-level training. Aircraft normally depart runway heading and then proceed direct to ITA 1 and 2 during summer months and ITA 1, 2, 10 (LOMA) and 11 during winter months at various altitudes. Aircraft operate under the control of LOKI while in ITA boundaries, but occasionally operate autonomously when control is not available.

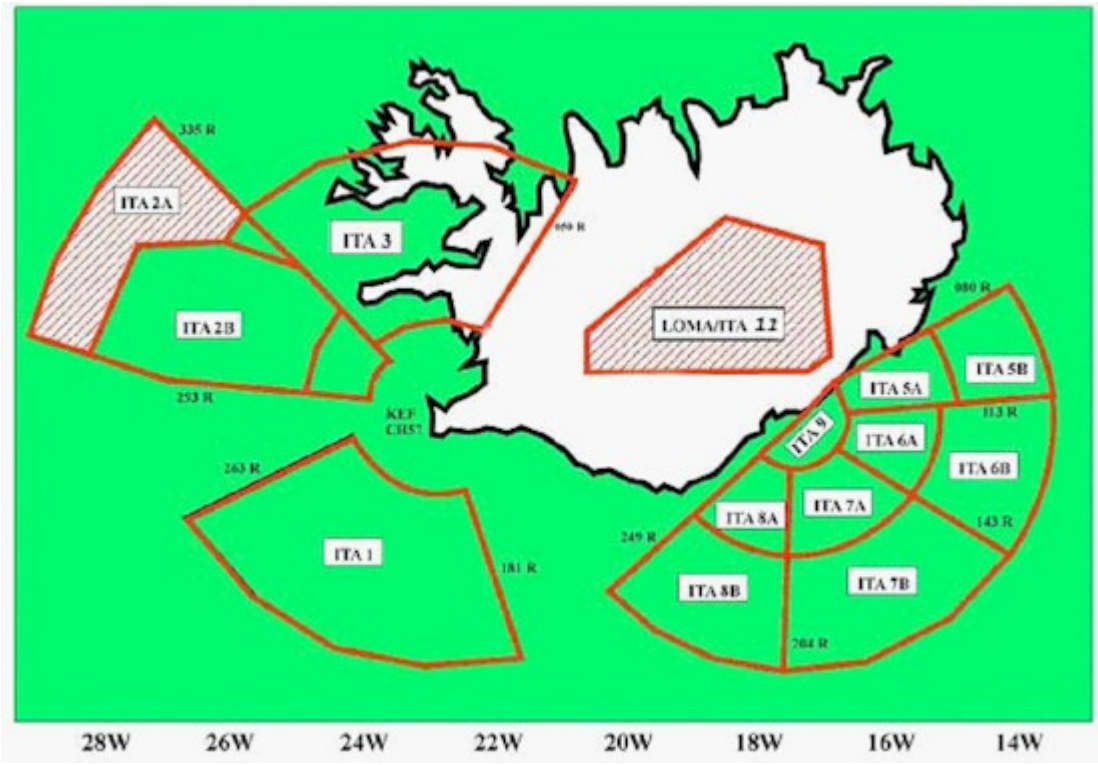
3.2.2. KC-135 aircraft conduct refueling operations with F-15 aircraft. Aircraft normally depart runway heading and then proceed direct ITA 1, 3, and 11 at FL 240. Aircraft operate under the control of LOKI while in ITA boundaries, but occasionally operate autonomously when control is not available.

3.2.3. C-130 aircraft conduct refueling operations with HH-60 aircraft and normally depart runway heading and then proceed direct to operate at low-level altitudes with HH-60 aircraft along the northern and southern refueling tracks during summer months and in ITA 10 (LOMA) during winter months.

3.2.4. Intercept Training Areas. Air defense training operations conducted under instrument flight rules and under CRC radar surveillance within the Domestic Sector of the Reykjavík Control Area (excluding an area of 40 NM radius around the Keflavík VORTAC, and the busiest ATS air routes)

is accomplished within Intercept Training Areas 1-11. Consult Joint ICAA/IDF Agreement 2-2 for local training airspace information.

Figure 4. Intercept Training Areas.



3.2.5. Bailout and Jettison Areas. In the event an aircraft emergency requires the jettison of external stores, it will be accomplished at the KEF 330/12 or over water. In the event of controlled bailout, ejection will be accomplished at the KEF 120/50 (see **Figure 5.**).

Figure 5. Bailout and Jettison Areas.

3.3. HH-60 Operations. A squadron of HH-60 aircraft is permanently stationed at NASKEF. HH-60s normally operate under VFR throughout the local area and Iceland. HH-60 parking is located at Hangar 885 and takeoffs and landings occur in close proximity to this area at Helipads 1, 2, and 3. Special attention is required for mid-air collision avoidance especially when runway 11/29 is in use since Hanger 885 is just southeast of that runway. Multiple remote landing sites are used across the Reykjanesbaer Peninsula.

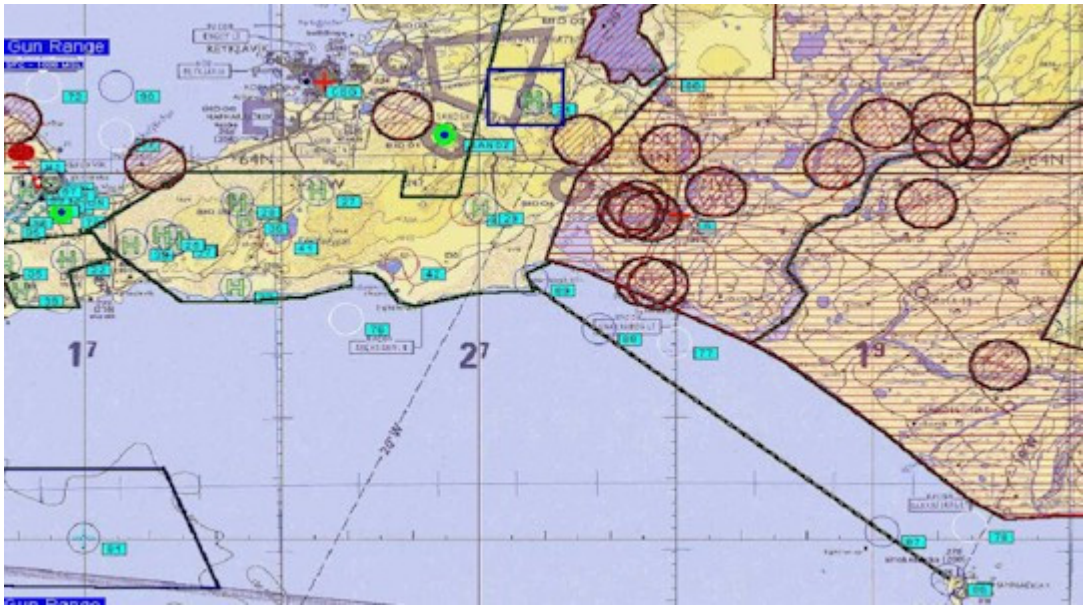
3.3.1. Departures. Predominately HH-60 aircraft depart VFR, omni directional as cleared by Keflavik Tower, 100-150 knots. IFR departures are also omni directional via radar vector with tower and approach 80-110 knots.

3.3.2. Arrivals. HH-60 arrivals are also VFR with Keflavik Tower-omni directional 100-150 knots. IFR arrivals are conducted with Approach Control, 80-150 knots. Hafnir Bay Minimal Weather Arrival at 50’ to 100’ AGL to runway 02 threshold 60 knots ground speed (marginal weather approach).

3.3.3. Air Refueling. HH-60s conduct air refueling operations with C-130 aircraft between 700’-3000’ MSL at 115 knots (see **Figure 6.** and **Figure 7.**). The North Refueling Track is located at KEF VORTAC 340/20-50 DME below 3000’. The Southeast Refueling Track is over water between Thorlakshofin and Vestmannaeyjar, VFR below 3000’ MSL. The South Refueling Track is south of KEF between 63-36N 022-00W to 62-24N 022-40W.

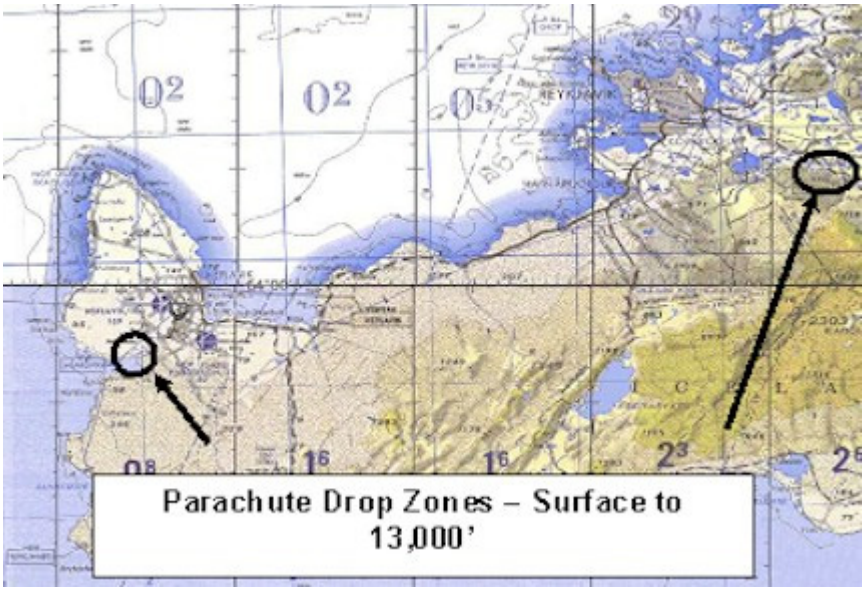
Figure 6. HH-60 North Refueling Track.

Figure 7. HH-60 South Refueling Track.



3.3.4. Parachute Training Drop Zone. The parachute training area known as "McKenna Drop Zone" is located on the KEF VORTAC 167R at 3.0 DME (63-56N 022-33W) (see **Figure 8.**). Normal parachute training operations conducted by para-rescue teams are scheduled two times a week for approximately two hours each up to 13,000' MSL in close proximity to departing/arriving traffic when runway 20/02 is in use. HH-60 aircraft will be in direct communications with Keflavik control tower when using McKenna Drop Zone. Sandskeið Drop Zone is 28 NM east of Keflavik up to 13,000' MSL. HH-60 aircraft are not in communication with Reykjavik Control when using Sandskeið Drop Zone.

Figure 8. Parachute Drop Zones.



3.4. Transient Aircraft. Numerous NATO and AMC aircraft traffic use NASKEF as a remain-overnight (RON) location. AMC C-5, C-17, KC-10, and KC-135 aircraft are common. NATO countries also use NASKEF as an RON location.

4. COMMERCIAL CARRIER OPERATIONS. NASKEF serves as Iceland's international commercial airfield. Civilian airline operations are conducted at the North end of the airfield (Leifur Eiriksson International Terminal). Military aircraft should avoid using November and Kilo taxiways. Iceland Air and Iceland Express are the two main commercial carriers utilizing the airfield. The other main airport in Iceland is located at Reykjavik. Domestic carriers, such as Air Iceland, operate scheduled air services from Reykjavík to Ísafjörður, Akureyri, and Egilsstaðir as well as from Akureyri to Ísafjörður, Grímsey, Þórshöfn, Vopnafjörður and Egilsstaðir.

4.1. Commercial Carriers. Numerous commercial carriers operate from Leifur Eiriksson International Terminal (BIKF) including; Air Atlanta, Air Iceland, Bluebird, Iceland Express, Icebird Airlines, Icelandair. With the exception of Icelandair, most of these carriers operate a small Boeing 737 fleet (1-2 aircraft) or lease aircraft for passenger and cargo transport. Flight path of these aircraft is predictable, usually following standard instrument departures and arrivals under air traffic control. At Reykjavik (BIAR), carriers operate a mixed fleet of Fokker 50 and Fairchild Metros on domestic and regional international services.

4.1.1. The Iceland Air fleet consists solely of Boeing 757 aircraft. Predominantly, outgoing traffic is scheduled for the morning at 0800 for Europe and between 1100 and 1700 for North America. Incoming traffic is scheduled continuously during the day until 2200. Aircraft operate under IFR rules and are contact with ATC.

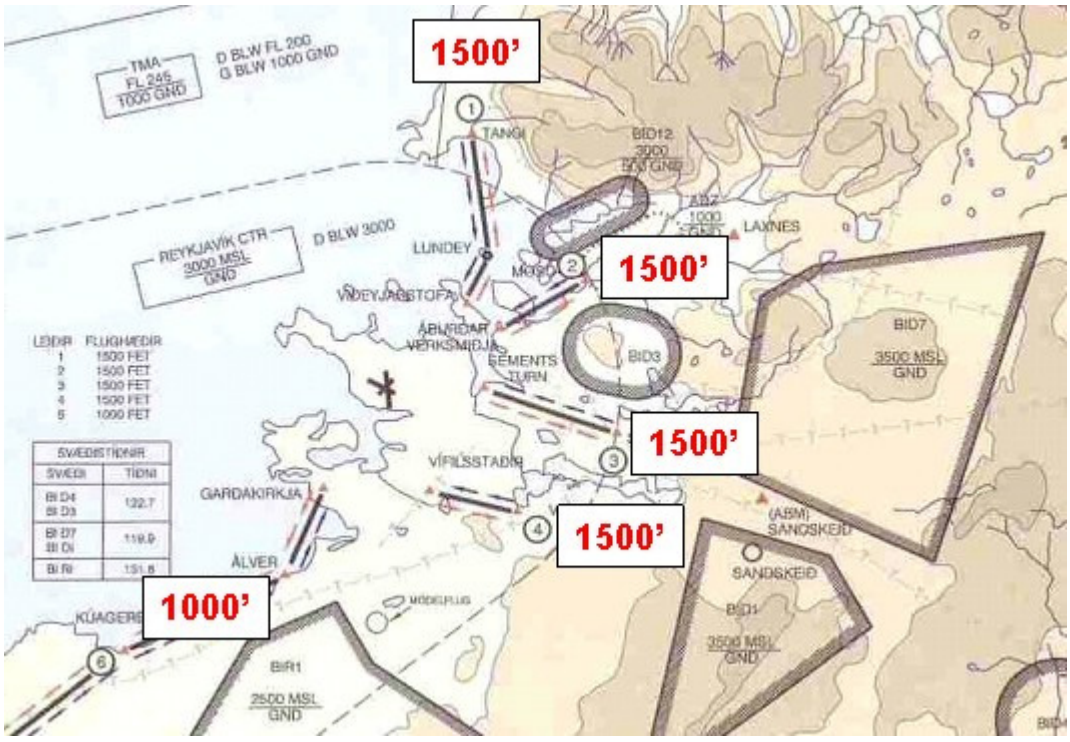
4.2. Helicopter Carriers. There are two helicopter operators in Iceland; The Icelandic Coast Guard and Helicopter Service Iceland. Helicopter Service operates two helicopters; Bell 206L Long Ranger, TF-HHG, which takes six passengers, and Schweizer Hughes 269C, TF-HHX, which takes two passengers. Helicopter Service operates from Hangar 14 on the Southwestern side of Reykjavík Airport.

5. CIVIL AIRCRAFT OPERATIONS. Civilian aircraft operating in the vicinity of NASKEF is not uncommon, however the density of air traffic is very low. The majority of civilian traffic originates from the vicinity of Reykjavik and transits to the numerous small airports and unimproved runways that exist in Iceland. In the local area, the most frequented airport other than Reykjavik is Vestmannaeyjar Island (BIVM), southeast of NASKEF. Other airports include Akureyri (BIAR) in northern Iceland and Egilsstaðir (BIEG) in eastern Iceland.

5.1. Flight Schools. The largest school is the Icelandic Flight Academy and offers flight and ground instruction at all levels from Reykjavik airport. The SouthAir Flight Training Academy is arguably the second largest flight training facility in Iceland and offers sight-seeing and domestic charter service all year round from Reykjavik airport. Both operate small Beech, Piper, and Cessna aircraft.

5.1.1. VFR traffic flying to exercise areas or airports to conduct touch and go training follow established VFR routes. These routes range from 1000'-1500' MSL and generally follow roads and obvious landmarks. Aircraft must be in contact with ATC. Generally these aircraft will not fly above 3000' MSL unless on cross-country routes over mountainous terrain (see **Figure 9.**). Civil aircraft both operate at and fly to NASKEF from Reykjavik to utilize the precision approaches for training. These aircraft will transit along VFR Route 6 at 1000' MSL. When utilizing NASKEF approaches, aircraft are required to be in contact with Tower.

Figure 9. Reykjavik VFR Routes.



5.2. Navy Flying Club. NAVPERSCOM (PERS-658F) is responsible for administering the Navy Flying Club program. IAW BUPERS Instruction 1710.22, the Commanding Officer has appointed the Aviation Safety Officer to manage and monitor Flying Club safety programs. The Navy operates a flying club with one (1) Piper Cherokee aircraft. This aircraft practices touch and gos at NASKEF and accomplishes air work in the practice area depicted in **Figure 8.** from surface to 2500' MSL. Aircraft

do not normally climb into controlled airspace. Aircraft fly under visual flight rules, normally following roadways for navigation between 1000'-3000' MSL while under Reykjavik Control. Cross country training is usually conducted from 3000'-6000' MSL following roadways. Common destinations are Vestmannaeyjar Island (BIVM) and Akureyri (BIAR).

5.3. Gliders. There are two gliding clubs in Iceland: The Gliding Club of Iceland (Reykjavik) and The Gliding Club of Akureyri. The prime areas for soaring are at Sandskeið near Reykjavík, at Melgerðismelar in Eyjafjörður, south of Akureyri, and in the area of Rangárvellir, near Hella in the south of Iceland. There are over 33 Icelandic aircraft registered in the glider category including one motor glider. Of these there are 16 club owned aircraft and 17 that are privately owned. The gliding season in Iceland starts in May and ends in September. The high season is during the months June and July. In the springtime the thermals are usually too weak for cross-country flight so most of the flights are local.

5.4. Ultralights. A small number of ultralight aircraft operate in the vicinity of Keflavik and Reykjavik. Flights are to flight at or below 700' MSL and must be in contact with Tower.

6. SPECIAL USE AIRSPACE. Several special use airspace areas exist in the local area (See **Figure 10.** and **Figure 11.**). Coordinates for these areas are located in AP/2A Area Planning/Special Use Airspace. These areas are active only when in use under the control of Reykjavik and Keflavik Control. To inquire about the status of these areas, monitor Reykjavik or Keflavik ATIS or contact Tower.

6.1. BID 1 to 3500' MSL is used primarily by gliders. The Sandskeið airfield, a glider operating base, is located within the boundaries of BID 1. During active periods pilots flying near Sandskeið should contact Sandskeið Radio on 119.9 MHz for further information. The gliding season in Iceland starts in May and ends in September. The high season is during the months June and July. In the springtime the thermals are usually too weak for cross-country flight so most of the flights are local.

6.2. BID 3 and 4 to 3000' MSL are used by hang gliders. These areas are rarely active.

6.3. BID 7 to 3500' MSL located North of BID 1 is an exercise/training area used by light aircraft traffic. Aircraft should be in contact with Sandskeið Radio if practicing landings at that location. The area is under the control of Reykjavik Tower.

6.4. BID 12 to 500' AGL to 3000' MSL is used for aerobatic flights.

Figure 10. Special Use Airspace - Reykjavik Vicinity.

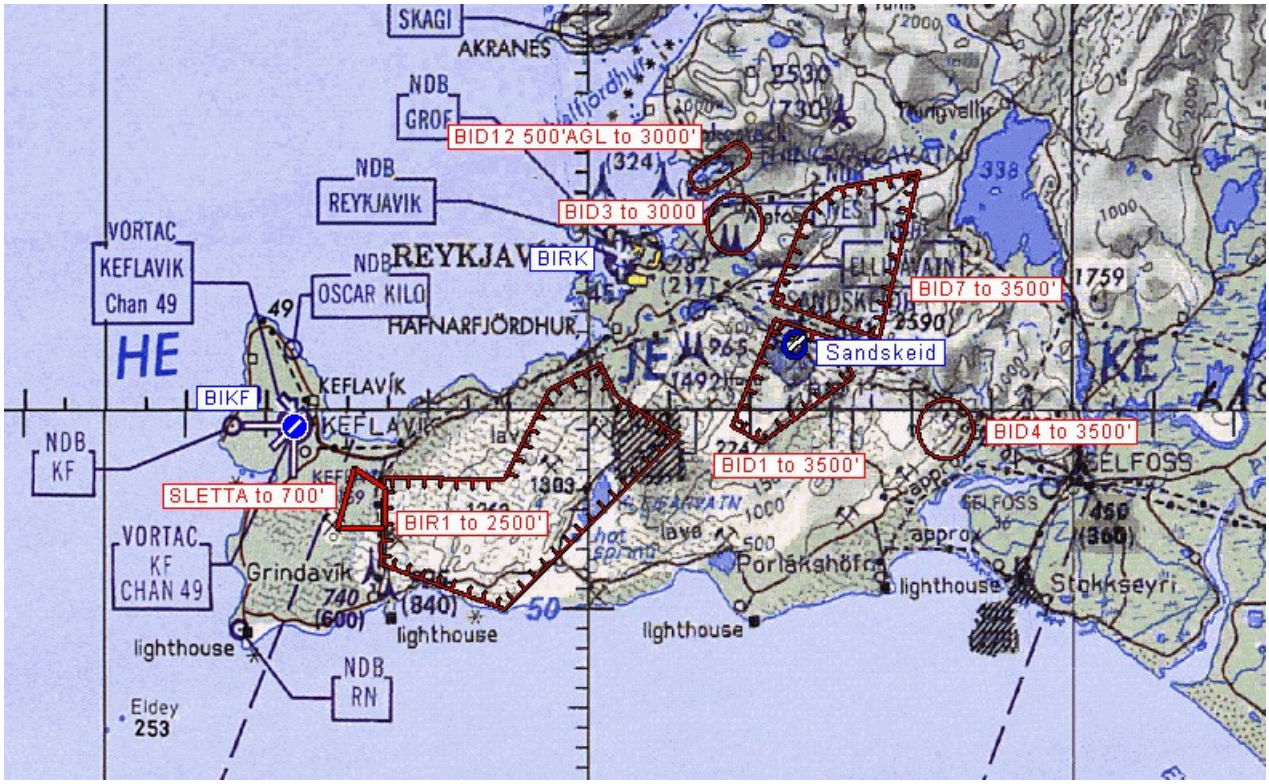


Figure 11. Special Use Airspace - Keflavik Vicinity.

6.5. BIR 1 to 2500’ MSL is an exercise/training area for light aircraft. It does not constitute restricted or danger area, it is a VFR advisory area. Its western boundary begins six (6) NM southeast of Keflavik. The control Tower may direct light aircraft to remain within the area or instruct other aircraft to avoid it. The largest flight school in Iceland is based in Reykjavik. The second largest flight school is based at Keflavik. The Navy Aero Club operates from Hangar 885. These light aircraft organizations operate Piper and Cessna aircraft, both in BIR1 and in the local VFR pattern.

6.6. SLETTA to 700’ MSL is an aerial sporting and recreational area that has been established on a trial basis until 15 Oct 04. It is used by ultralight aircraft. Aircrew will be notified via Keflavik Tower and ATIS if the area is active. Ultralight aircraft do not fly above 700’ and must be in contact with Keflavik Tower to operate. Note that ultralight aircraft can be large enough to carry two passengers.

7. SCANNING FOR OTHER AIRCRAFT. Despite numerous advances in air traffic rules and separation devices, the potential for a mid-air will always be present. Research has proven that the most critical times for mid-air collisions are the first three minutes after take-off and the last eight minutes before landing. Mid-airs usually occur on clear days (more people flying) and near airports (higher density traffic at similar altitudes). The most reliable means of preventing mid-air collisions is to "see and avoid". Pilots must divide their attention between the aircraft instrumentation and outside clearing. They should also encourage other occupants of the aircraft to assist with looking out for conflicting air traffic. The geometry of a collision course can occur quickly in the fast moving arena of flight (see **Attachment 4**).

7.1. One of the best ways to prevent mid-air collisions is to refine your scanning technique. How you scan for traffic is important, so here are a few tips to help you improve your scanning skills.

7.1.1. First, when scanning, do not rapidly move your eyes from side to side. To illustrate, try moving your eyes rapidly from side to side; you don’t recognize much, especially small objects in the distance. Now try breaking your scan pattern into sections 10-15 degrees wide. This gives you 9-12 "blocks" in your scan area Allow a minimum of one to two seconds for focusing and detection within each block. By fixating every 10-15 degrees, you should be able to detect any contrasting or moving objects in each block.

7.1.2. Second, keep your scan moving. Against a clear blue sky, your eyes have a tendency to focus on a point just a few feet ahead of you. To assist you, focus on a point on the ground, or a cloud in the distance, then back to your scanning block. This pulls your focal point out to the horizon. Repeat this process for each block within your viewing area.

7.1.3. Third, scan with a purpose. You’re looking for something important--another guy who’s not scanning.

7.1.4. Finally, use your whole crew. Brief passengers on how to scan correctly, and more importantly, how to identify traffic using the clock and horizon method of describing another aircraft’s position. A poorly trained scanner may distract you by pointing out an aircraft that is not a hazard, causing you to not see the one that really is.

7.2. Being a good scanner is part of being a good pilot. Remember the old saying "You can’t hit what you don’t see". Without good scanning techniques, you just might "Hit what you don’t see".

8. COLLISION AVOIDANCE TIPS.

8.1. Check yourself. Make sure you're ready to fly both physically and mentally. Wear glasses if you need them.

8.2. Avoid areas of high-density traffic. If you can't avoid them, use those good scanning techniques to help you see other traffic.

8.3. Fly as high as practical. Stay above 3000' MSL.

8.4. Obtain an IFR clearance or participate in radar flight following whenever possible, and continue to practice "*see and avoid*" at all times.

8.5. Use landing lights at lower altitudes, especially when near airports.

8.6. Announce (talk and listen) your intentions on unicom and use standard traffic pattern procedures at uncontrolled fields. Try to present a "*predictable target*" when operating near airports.

8.7. Always use your Mode C transponder, and cross-check its accuracy with ATC whenever possible.

8.8. Use the hemispheric altitudes appropriate for your direction of flight, and don't let your altimeter "*wander*".

8.9. Clear constantly for other aircraft, both visually and over the radio.

8.10. Keep your windows and windscreen clean and clear. A bug on the windscreen can obstruct a large object even at a short distance.

8.11. Learn proper task management in the air. A cockpit can really get busy. Learn the proper methods to help you reduce workload demands and prepare ahead for high workload phases of flight. This will give you more time to scan when near the airport.

8.12. Complete checklists as early as practical. Early inflight preparation allows time to scan during descent.

8.13. Don't get complacent during instruction! Instructors make mistakes, too. Many mid-air collisions occur during periods of instruction or supervision when no one is looking outside.

8.14. When flying at night, don't use white light. White light disrupts your night vision, even if used momentarily. Use a green or red light when necessary, and ensure cockpit lighting doesn't wash out your night vision by being set too bright.

8.15. Beware of wake turbulence. It's an invisible killer--the best way to avoid it is to watch for the large aircraft which cause it. Remember "heavy, clean, and slow" are the aircraft configurations which produce the worst wake turbulence.

8.16. Understand the limitations of your eyes and use proper visual scanning techniques. Remember, if another aircraft appears to have no relative motion, but is increasing in size, it is on a direct collision course with you.

8.17. Execute appropriate clearing procedures before and during all climbs, descents, turns, abnormal maneuvers, or aerobatics. And avoid doing unpredictable things in the traffic pattern.

8.18. Plan ahead. Preparation before you take off will give you time to scan when you reach your destination.

8.19. Brief and use the entire crew. Brief crew and passengers on proper scanning techniques. Encourage them to speak up if they see a hazard. Confirm you understand and identify the hazards in question.

8.20. Obey the rules. Many accident sequences begin when somebody doesn't follow the rules.

8.21. Above all, Avoid Complacency! Remember, there is no guarantee that everyone else is flying by the rules, or that anyone is where they are supposed to be. Keep track of traffic with your eyes and ears, and let others know your intentions as well.

STEVEN F. DREYER, Colonel, USAF
Duty Commander

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFPD 91-2, Safety Programs

AFI 91-202, The Air Force Mishap Prevention Program

BUPERS Instruction 1710.22

COMICEDEFORINST 4540.1-P, Noise Sensitive Low Altitude Flight Restrictions

Flugmálahandbók, Aeronautical Information Publication (AIP), Iceland

Joint ICAA/IDF Agreement 2-2, Air Traffic Services

Joint ICAA/IDF Agreement 4-1, Air Traffic Control/Search and Rescue Aircraft Procedures

NASKEF Instruction 3710.1P, Air Operations Manual

Abbreviations and Acronyms

ACT—Air Combat Training

AGL—Above Ground Level

ATC—Air Traffic Control

BFM—Basic Fighter Maneuvers

FLIP—Flight Information Publication

ICAO—International Civilian Aviation Organization

IFR—Instrument Flight Rules

ITA—Intercept Training Area

MACA—Mid-Air Collision Avoidance

MSL—Mean Sea Level

NASKEF—Naval Air Station Keflavik

TCAS—Traffic Collision Avoidance Systems

VFR—Visual Flight Rules

Attachment 2

NASKEF COMMON AIRCRAFT

Figure A2.1. HH-60G Pave Hawk.

Table A2.1. HH-60G Information.

Primary Function:	Combat search and rescue and military operations other than war in day, night or marginal weather conditions.
Builder:	United Technologies/Sikorsky Aircraft Company
Power Plant:	Two General Electric T700-GE-700 or T700-GE-701C engines
Thrust:	1,560-1,940 shaft horsepower, each engine
Length:	64 feet, 8 inches (17.1 meters)
Height:	16 feet, 8 inches (4.4 meters)
Rotor Diameter:	53 feet, 7 inches (14.1 meters)
Speed:	184 mph (294.4 kph)

Figure A2.2. KC-135 Stratotanker.

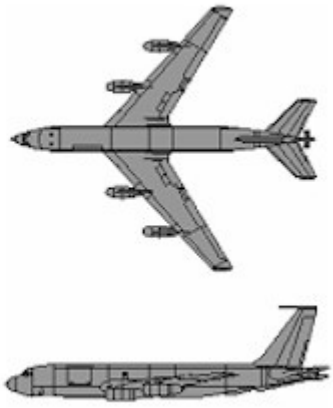


Table A2.2. KC-135 Information.

Primary Function:	Aerial refueling and airlift
Builder:	Boeing Company
Power Plant:	CFM International CFM-56 turbofan engines; **KC-135E**, Pratt and Whitney TF-33-PW-102 turbofan engines
Thrust:	21,634 pounds each engine; **KC-135E**, 18,000 pounds each engine
Length:	136 feet, 3 inches (41.53 meters)
Height:	41 feet, 8 inches (12.7 meters)
Wingspan:	130 feet, 10 inches (39.88 meters)
Speed:	530 miles per hour at 30,000 feet (9,144 meters)

Figure A2.3. F-15 Eagle.

Table A2.3. F-15 Information.

Primary Function:	Tactical fighter
Builder:	McDonnell Douglas Corp.
Power Plant:	Two Pratt & Whitney F100-PW-100, 220 or 229 turbofan engines with afterburners
Thrust:	(C/D models) 23,450 pounds each engine
Length:	63.8 feet (19.44 meters)
Height:	18.5 feet (5.6 meters)
Wingspan:	42.8 feet (13 meters)
Speed:	1,875 mph (Mach 2.5 plus)

Figure A2.4. MC-130P Combat Shadow.

Table A2.4. MC-130P Information.

Primary Function:	Air refueling for special operations forces helicopters
Builder:	Lockheed Aircraft Corp.
Power Plant:	Four Allison T56-A-15 turboprop engines
Thrust:	4,910 shaft horsepower each engine
Length:	98 feet, 9 inches (30.09 meters)
Height:	38 feet, 6 inches (11.7 meters)
Wingspan:	132 feet, 7 inches (40.4 meters)
Speed:	289 miles per hour (464 kilometers per hour) at sea level

Figure A2.5. Boeing 757.

Table A2.5. 757 Information.

Primary Function:	Commercial transport
Builder:	Boeing Company
Power Plant:	Two Pratt and Whitney 2040 engines
Thrust:	41,700 pounds static thrust each engine
Length:	155 feet, 3 inches (47.32 meters)
Height:	44 feet, 6 inches (11.02 meters)
Wingspan:	124 feet, 8 inches (37.99 meters)
Speed:	530 miles per hour (Mach 0.8)

Figure A2.6. Boeing 737.

Table A2.6. 737 Information.

Primary Function:	Commercial transport
Builder:	Boeing Company
Power Plant:	Two Pratt & Whitney JT8D-9A engines
Thrust:	14,500 pounds each engine
Length:	100 feet (30.3 meters)
Height:	37 feet (11.2 meters)
Wingspan:	93 feet (28.2 meters)
Speed:	535 mph (Mach 0.72) at 35,000 feet

Attachment 3

AIRCRAFT CLOSURE RATES

Table A3.1. F-15 Closure Rate.

SPEED →	600 MPH	360 MPH
DISTANCE	SECONDS	
10 Miles	60	100
6 Miles	36	60
5 Miles	30	50
4 Miles	24	40
3 Miles	18	30
2 Miles	12	20
1 Mile	06	10
1/2 Mile	03	05
0 Mile	0	0

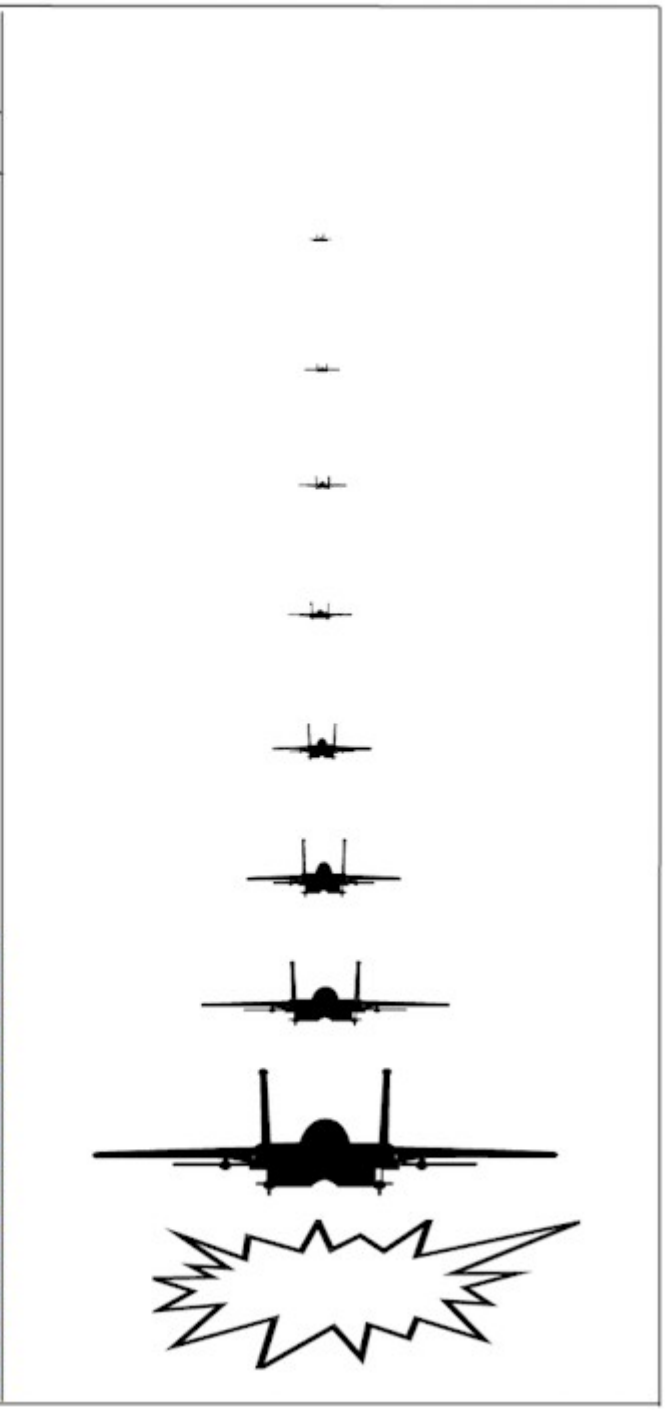
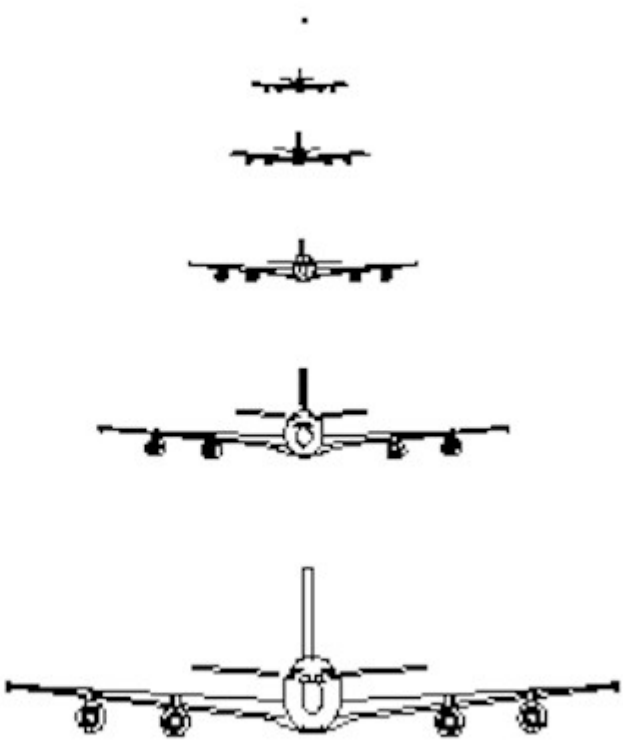


Table A3.2. KC-135 Closure Rate.

DISTANCE SECONDS

	AT 600 MPH	AT 210 MPH
10 MILES	60	170
5 MILES	30	85
3 MILES	18	56
2 MILES	12	38
1 MILE	6	18
0.5 MILE	3	9



The areas in the gray box are the danger areas.
This is based on recognition and reaction times.

Attachment 4

GEOMETRY OF A COLLISION COURSE

Table A4.1. F-15 Collision