AD NUMBER
ADB013622
LIMITATION CHANGES
TO: **Approved for public release; distribution is unlimited.**
FROM: **Distribution authorized to U.S. Gov't. agencies only; Proprietary Information; 11 JUN 1976. Other requests shall be referred to Army Command and General Staff College, Ft. Leavenswoth, KS 66027.**
AUTHORITY
USACGSC ltr 2 Feb 1999

Army Helicopter
Night/Adverse Weather System (N/AWS)

Ronald S. Michaels, MAJ, USAF
U. S. Army Command and General Staff College
Fort Leavenworth, Kansas 66027

Final Report 11 June 1976

Distribution 11 June 1976 limited to U. S. Government agencies only; proprietary information. Other requests for this document must be referred to U. S. Army Command and General Staff College, ATTN: ATSW-SE, Fort Leavenworth, Kansas 66027.

A Master of Military Art and Science thesis presented to the faculty of the U. S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER (9)

4. TITLE (and Subtitle) (6)

Army Helicopter Night/Adverse Weather System (N/AWS).

5. TYPE OF REPORT & PERIOD COVERED

Final Report, 11 Jun 76

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)

Michaels, Ronald S., MAJ, USAF

8. CONTRACT OR GRANT NUMBER(s)

9. PERFORMING ORGANIZATION NAME AND ADDRESS

Student at the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

(12) 145p.

11. CONTROLLING OFFICE NAME AND ADDRESS (11)

US Army Command and General Staff College ATTN: ATSW-SE

12. REPORT DATE

11 Jun 76

13. NUMBER OF PAGES

~~134~~

14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)* (10)

Ronald [illegible]

15. SECURITY CLASS. *(of this report)*

Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)* 11 June 1976

(Distribution limited to U.S. Government agencies only: Proprietary Information. Other requests for this document must be referred to U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027)

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

Master of Military Art and Science (MMAS) Thesis prepared at CGSC in partial fulfillment of the Masters Program requirements, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This study undertakes an investigation of the feasibility of developing a helicopter night/adverse weather system for the Army by modifying systems currently used in Air Force C-130 and C-141 tactical airlift aircraft. In being systems examined include: Stationkeeping Equipment (SKE), Zone Marker (ZM), and Zone Marker Group (ZMG). For purposes of this study the acronym "N/AWS" specifies the combined capabilities of these three systems.

1B

Those factors investigated in this thesis which were considered to have greatest impact on night/adverse weather operations include: Army doctrinal requirements, weather conditions, anti-helicopter threats, crewmember physiological limitations, and cost effectiveness.

Three significant findings were revealed in the study: A valid requirement exists for developing a helicopter night/adverse weather system; available equipment (described as the N/AWS) provides a feasible solution to satisfy the void stated in the requirement; and state-of-the-art technology can provide a N/AWS for Army Helicopters, through retrofit action.

The study concludes that a N/AWS is feasible and that adoption of it will increase the staying power of Army helicopters in future mid-intensity conflicts.

ARMY HELICOPTER

NIGHT/ADVERSE WEATHER SYSTEM (N/AWS)

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements of the degree

MASTER OF MILITARY ART AND SCIENCE

Fort Leavenworth, Kansas
1976

ARMY HELICOPTER

NIGHT/ADVERSE WEATHER SYSTEM (N/AWS)

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements of the
degree

MASTER OF MILITARY ART AND SCIENCE

by

RONALD S. MICHAELS, MAJ, USAF
B.S., University of Kansas, 1963

Fort Leavenworth, Kansas
1976

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate RONALD S. MICHAELS MAJOR/USAF

Title of thesis ARMY HELICOPTER NIGHT/ADVERSE WEATHER SYSTEM (N/AWS)

Approved by:

Steven S. Price, Research Advisor

Richard O. Bumkovr, Member, Graduate Research Faculty

Don Martin Jr, Member, Consulting Faculty

Accepted this 4th day of June 1976 by [signature], Director, Master of Military Art and Science.

The opinions and conclusions expressed herein are those of the individual student author and do not necessarily represent the views of either the U.S. Army Command and General Staff College or any other governmental agency. (<u>References to this study should include the foregoing statement</u>.)

ABSTRACT

This study undertakes an investigation of the feasibility of developing a helicopter night/adverse weather system for the Army by modifying systems currently used in Air Force C-130 and C-141 tactical airlift aircraft. In being systems examined include: Stationkeeping Equipment (SKE), Zone Marker (ZM), and Zone Marker Group (ZMG). For purposes of this study the acronym "N/AWS" specifies the combined capabilities of these three systems.

Those factors investigated in this thesis which were considered to have greatest impact on night/adverse weather operations include: Army doctrinal requirements, weather conditions, anti-helicopter threats, crewmember physiological limitations, and cost effectiveness.

Three significant findings were revealed in the study: A valid requirement exists for developing a helicopter night/adverse weather system; available equipment (described as the N/AWS) provides a feasible solution to satisfy the void stated in the requirement; and state-of-the-art technology can provide a N/AWS for Army helicopters, through retrofit action.

The study concludes that a N/AWS is feasible and that adoption of it will increase the staying power of Army helicopters in future mid-intensity conflicts.

ACKNOWLEDGEMENTS

The Sierra Research Corporation made available information from its corporate research files that was essential to the progress of this research. Lieutenant Colonel Dick Brunkow, USA, Major Steve Price, USAF, and Major Don Martin, Jr., USAR, contributed suggestions concerning my research and the content of this paper that proved invaluable. My wife, Marty, not only typed the many drafts and the final paper, but she also offered perceptive comments to improve the clarity of my writing. I wish to thank all of these for help that proved vital to my successful completion of this project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF MAPS

CHAPTER I

PRESENTATION OF THE PROBLEM

> The night is a faithful and reliable helper of the soldier. It has never disappointed those who knew how to profit by its advantages and who were familiar with the peculiarities of night. Generally speaking, the darker the night, the worse the weather, the better it is for the brave and proficient soldiers.
>
> Soviet Soldiers Handbook

BACKGROUND

History reveals that even the greatest armies are subject to defeat by weather and its adverse effects. To conduct effective continuous combat, man must develop a means to compensate for the adversities of night and weather. The combatant possessing a night/adverse weather capability has a distinct advantage over adversaries not possessing this capability.

One means of assessing the combat power of opposing forces involves comparing the relative numerical strength of combat assets. A numerical comparison of combat assets, however, does not take into account the aspect of performance. To include performance or combat effectiveness requires a subjective evaluation of a number of variables. An evaluation of these variables is the basis for developing force ratio.

The development process presented in Field Manual 100-5, Operations, concludes that "The defender can win outnumbered 3:1; The attacker should have 6:1 to prevail".[1] However, the formula used in the development of these ratios is not well defined. One definite factor that affects combat force ratio determination is the presence of combat multipliers, which "significantly increase the relative strength of opposing forces while actual force ratios remain constant."[2] These ratios of combat power must be developed through imaginative innovations in deception, mobility, electronic warfare, and massing of fires.[3]

"Throughout the history of warfare, the side enjoying the edge in firepower and mobility...usually have emerged victorious on the battlefield."[4] The helicopter, is a formidable combat weapon system due to its firepower and mobility. Firepower is provided through its aerial artillery, with a stand-off capability. Mobility is provided, primarily, through its multidirectional airborne capability.

Soviet tacticans respect the capabilities of the helicopter, as indicated by the importance they place on organizing air defense to protect their combat units from surprise helicopter attacks. In fact, Soviet doctrine states, "...it should be borne in mind that a small group of helicopters is capable of knocking a tank element out of action...."[5]

The value of the helicopter is manifest in the variety of missions it is capable of performing. In a tactical situation, the helicopter provides firepower, logistics, troop movement, surveillance and reconnaissance.[6] No other combat asset can provide this range of support. Its proven flexibility and mobility make the helicopter a vital part of the combined arms team. Wars of the future necessitate training and equipping units to engage in the contest between mobility and firepower.[7] This plus the fact that helicopters currently constitute an absolute majority of all piloted military vehicles necessitates maximum utilization of them on the battlefields of the future.[8] We must find ways to extend the conditions under which helicopters can provide support for future combat operations.

Post-war evaluations of the 1973 Yom Kippur War have recognized both the stark realities of the ferocity of modern battle, and the demonstrated emphasis in night combat capabilities that the decision-maker can anticipate in the next war, whether it be Middle East or Europe.[9] Since Army forces will be involved, a mid-intensity war against Soviet forces in Europe will be addressed in this research.

The Army defines a mid-intensity conflict as one which is nonnuclear, characterized by national policy limitations, conducted in a sophisticated technological environment, and which involves large armored forces and rapidly changing battlefield conditions.[10]

The U.S. Army is currently developing doctrine to support a continuous, mid-intensity conflict. These changes will influence the tactics, procedures, and techniques, for employing the helicopter in a continuous all-weather role. Pin-pointing operational problems and matching them with technological advances in hardware is of vital importance.[11] Bold and imaginative thinking is necessary to develop a capability to support a doctrine that has a goal of attaining a night fighting capability comparable in effectiveness with that achieved during daylight operations.[12] Accomplishment of this goal represents a monumental task for Army aviation. Developing a capability for conducting the myriad of helicopter combat operations during periods of darkness will necessitate developing a helicopter night/adverse weather capability. The Army cannot allow a combat multiplier, such as the helicopter, to be dependent on fair weather.

STATEMENT OF THE PROBLEM

The Army does not have a Night/Adverse Weather System (N/AWS) for helicopters, yet Army doctrine calls for continuous combat operations for all combined arms weapons systems. This study is devoted to investigating whether the Army should adapt current N/AWS equipment for use in its helicopters. To do this, an analysis of factors relating to current Army Aviation capabilities will be made. Additionally, an analysis of the capabilities and compatibility of a fixed-wing N/AWS will be made to determine if the same increased combat effectiveness available to those weapons systems during night/adverse weather is available to the Army helicopter.

The investigation of conditions impacting on the development of a helicopter N/AWS involves determining if a valid requirement exists; developing a valid and feasible alternative; and evaluating the effectiveness of the alternative as a solution to satisifying the helicopter N/AWS requirement.

Army Aviation must solve the problem of developing a helicopter system and associated capability which will provide the ground forces with those unique and essential support options during night/adverse weather conditions, which only a helicopter can offer.

LIMITATIONS

This investigation is designed to include the salient factors which influence helicopter night operations in general, with emphasis in the specific area of helicopter night/adverse weather operations.

The following limitations to the scope of this investigation were necessary:

1. Only Unclassified Information was Presented. The classified information omitted did not greatly affect the outcome of this investigation.

2. Only the Operational N/AWS System was Investigated. The systems being researched and developed for future use

by the aviation industry were not considered in this study. The Stationkeeping Equipment (SKE)/Zone Marker (ZM) presently in operation in the fixed-wing C-130 and C-141 airlift aircraft was investigated for use in the Army helicopter.

3. The Electromagnetic Pulse Phenomenon (EMP) was not investigated. The effects of the EMP were not studied or considered in the discussion of N/AWS reliability.

4. Weight Limitations for each Type, Series, Model, and Helicopter Mission were not investigated. A general appraisal of the weight of the N/AWS, as a restriction for its use in the helicopter, was the only consideration investigated.

5. Only the Major Components of the N/AWS used by the Helicopter Crewmembers were presented. A detailed description of SKE/ZM operation was not completed in this study.

6. Factors Identified as Bearing on the Employment of Helicopters in Adverse Weather were intentionally dealt with in a superfical manner. A detailed study of these factors has been left to others.

7. The Context of Weather in this study refers to those phenomena which produce restrictions to visibility such as snow, fog, clouds, dust, and rain, or other conditions which deny the use of visual flight references.

8. Only Unclassified Soviet Weapon Systems are Presented in the Threat Discussion. A precise threat assessment would require a presentation of classified

information, (e.g. surface-to-air missiles and radar systems.)

9. Draft Field Manuals were required in some instances, to provide current doctrine. These manuals are considered as valid research material. (i.e., they are awaiting final printing and distribution.)

CHAPTER II

METHODOLOGY

The research structure of this thesis is based on identifying a military problem, searching for a viable alternative, and evaluating the effectiveness of the alternative as a solution to the deficiency.

An investigation of current thinking in the concepts of night combat in Europe identified a deficiency in the current operational capabilities of the helicopter to support Army doctrine. This doctrine calls for continuous (24 hours a day) operations when needed to conduct offensive operations or to react to enemy actions.[1] Yet the Army helicopter, as currently equipped, is unable to operate effectively at night and in adverse weather conditions.

There are three options available to the Army to respond to this problem. The first option is to do nothing; to simply accept the fact that present equipment will not permit implementation of current doctrine. The second option involves changing Army doctrine so that the problem does not exist, e.g., to rewrite doctrine so that it recognizes the fact that helicopters cannot support continuous, all-weather operations. The third option would be to provide a method by which doctrine would be executed. This research rejected the first two options immediately because of the Soviet threat and the projected nature of combat operations in Europe. The Army should keep its goal of 24 hour, all-weather operation. The development of a system that provides the helicopter with a night/adverse weather capability would support the Army's doctrine for continuous warfare. It is this option which is explored in this thesis.

The identification of the problem is followed by an analysis of selected factors which influence the employment of helicopters in adverse weather.

An analysis of the desired operational capabilities and cost limitations insures a measure of feasibility and plausibility in the research process. The helicopter N/AWS must be cost-effective to be a realistic solution.

An operational ready N/AWS system is investigated using the Department of Defense definition of Operationally Ready: "...equipment - available and in condition for serving the functions for which designed."[2]

The operational analysis of this system is conducted by evaluating test data from integrative studies which were part of the acceptance phase testing for the Air Force (C-130/C-141) system. This evaluation follows the Department of Defense definition of Operation Evaluation:

> The test and analysis of a specific end item or system, insofar as practicable under Service operating conditions, in order to determine if quantity production is warranted considering: a. the increase in military effectiveness to be gained; and b. its effectiveness as compared with currently available items or systems, consideration being given to:

1. personnel capabilities to maintain and operate the equipment; 2. size, weight, and location considerations; and 3. enemy capabilities in the field.[3]

A test and analysis of the system selected is evaluated according to the appropriate research and development criteria. This analysis provides validity for a comparative evaluation of the performance parameters of the system.

Next, a comparison of the present capabilities of Army Aviation with the capabilities afforded through the N/AWS yields the tentative hypothesis that adoption of this system would enable helicopter units to support current doctrine.

This hypothesis is examined by evaluating the new capabilities of the helicopter using the three considerations described by the Department of Defense: 1. personnel capabilities to maintain and operate the equipment; 2. size, weight, and location considerations; and 3. enemy capabilities in the field.

Personnel capabilities relate mainly to helicopter crew activity. An investigation of tests conducted to measure human performance in stress situations shows that a major factor affecting the feasibility of a helicopter N/AWS is the added stress of performing in night/adverse weather conditions.[4] Although there is definitely an increase anticipated, it does not appear that human tolerances will be exceeded during helicopter operations in night/adverse weather conditions.

A review of the present state-of-the-art in micro-minaturization produces evidence that the size and weight of the equipment being investigated are not limiting factors for its use in the helicopter.[5]

The factor of location is dependent upon certain idiosyncrasies unique to each series of helicopter. A separate test for each series helicopter cockpit instrumentation configuration is necessary to insure compatibility. The location problem can, however, be solved by present day technology.[6] This conclusion is based on results of research and testing. Interviews with engineers on the subject of cockpit layout and sub-system panel design produced evidence that technology can solve the location problem.

The last consideration, enemy capabilities in the field, is a comparison of susceptibility versus survivability. This comparison is presented in Chapter IV, under a general heading of threat. Those discussions produce evidence supporting the theory that night/adverse weather operations may be required to survive the Soviet anti-helicopter threat and accomplish the mission. Evaluation of mission effectiveness is based on two factors: mission accomplishment and survivability. Accomplishing a mission and not surviving, or aborting the mission due to the threat-environment, are considered unacceptable.

In summary, the structure of this research project is designed to identify a military problem. The problem identified is that current Army helicopter capabilities cannot support Army doctrinal requirements for continuous, all-weather operations. Further investigation reveals that a system designed for use in the fixed-wing segment of aviation is available for solving the identified problem.

Modification of the equipment for use by Army Aviation in conducting night/adverse weather operations will significantly improve helicopter mission effectiveness.

CHAPTER III

REVIEW OF RELATED LITERATURE

This chapter contains source information relating to helicopter operations in general and to the subjects of helicopter night and adverse weather operations in particular.

The review is presented for three purposes: 1) To indicate the search techniques employed; 2) To present a resume of sources which may provide assistance to others involved in similar research; and 3) To evaluate the source materials individually and as to whether they are, as a whole, sufficient and adequate for the research of the problem.

Helicopter night/adverse weather operations is a relatively new concept, as evidenced by source document references to the requirement for developing a method of increasing helicopter staying power on the battlefield. There is very little information available which relates "how" to accomplish this difficult task.

Due to the scarcity of information relating to helicopter night/adverse weather operations, it was necessary to contact those agencies involved in conducting research, relating to this subject. The agencies provided the source documents and related data necessary to complete this research paper. Each agency is evaluated as a source based on the quality and quantity of information obtained and how that information impacts on the overall information search.

The dynamics of changing doctrine makes obtaining current information difficult due to the time lapse between the formulation and finalization phases of new concepts. Concept papers were used to fill the void created by time lapses between the writing, printing, and distribution, of new doctrine.

The first step in the literature search was to insure, with some degree of certainty, that similar research was not already in progress. After a review of information provided by the Defense Documentation Center (DDC), the following agencies were consulted. U.S. Army Training and Doctrine Command (TRADOC), U.S. Army Combined Arms Combat Developments Activity (CACDA), U.S. Army Aviation Center, Modern Army Selected Systems, Test, Evaluation, and Review (MASSTER), and private industry. The search indicated that similar studies were not being conducted.

Private industry proved to be the best source of information concerning developments of stationkeeping equipment and night/adverse weather technology. Sierra Research Corporation, (hereinafter known as Sierra) provided test data not available in the normal research channels.

U.S. Army Field Manuals are generally considered excellent sources for establishing doctrine. However, due to the recent changes in the concepts for employing the helicopter during night/adverse weather, concept papers became the prime source for establishing U.S. Army doctrine.

Field Manuals were used to establish Army Aviation doctrinal concepts for this study. The following FMs, supplied by the U.S. Army Aviation Center, provided most of the aviation concepts in doctrine, tactics, and techniques.

Field Manual 90-1 (DRAFT), Employment of Army Aviation Units In A High Threat Environment, provided the data necessary for establishing the present effectiveness of the Army helicopter in night and adverse weather operations; the unclassified data on the Soviet anti-aircraft threat to the helicopter; and the concept of employing the helicopter in support of combined arms operations.

Field Manual 1-1, Terrain Flying, provided insight into Army Aviation terrain flying in adverse weather. Although very limited in quantity, the information concerning helicopter operations in adverse weather did provide adequate support for determining the intent for developing adverse weather capabilities in the Army helicopter.

Field Manual 1-5, (DRAFT), Instrument Flying and Navigation For Army Aviators, provided information on helicopter operations in general, with an entire chapter on Tactical Navigation and Instrument Flight. The techniques for accomplishing Tactical Instrument Flight are outlined systematically in a step-by-step process. Information concerning helicopter operations in adverse weather was excellent.

Training Circular 1-28 (DRAFT), Rotary Wing Night Flight, described helicopter operations at night. One paragraph mentioned the techniques to be employed in case of inadvertent weather penetration.

All of the previously mentioned publications lack information on Army helicopter operations in night/adverse weather conditions. The fact that both conditions may occur simultaneously is glossed over lightly. However, the need for developing a capability for conducting helicopter operations during night/adverse weather conditions, to increase the staying power of Army Aviation, is emphasized. There is no mention of possible solutions for coping with the adversities of night and weather.

Army Aviation Digest articles, condensed in a report entitled, "Tactics Sampler", served as an indicator for new doctrinal changes. Articles written by Commanders provided excellent material for establishing the current thinking for employing the helicopter in a continuous all-weather role.

The Defense Documentation Center (DDC) On-Line User-Operated Terminal, provided a means of rapid identification and scanning of abstracts relating to the subject of helicopter operations in general and specifically to night/adverse weather operations. Only minimum information was available concerning helicopter night/adverse operations. The DDC provided outstanding sources of material for the other areas investigated in this study. In excess of seven hundred related abstracts and technical reports were scanned.

Technical reports obtained through the DDC provided data from integrative studies in disorientation of Army helicopter pilots, aircraft instrumentation research, factors affecting Army flight crew personnel performance, helicopter cockpit layout and sub-panel designs, findings relating to man/machine interface, helicopter IFR formation flight systems and the helicopter stationkeeping tests. These Technical Reports provided the data required for evaluating the feasibility of incorporating a N/AWS in the Army helicopter. Adequate information concerning each area was available to insure thoroughness.

U.S. Air Force Technical Flight Manual, T.O. 1C-130B-1, served as the source for the operational capabilities of the C-130 SKE along with the brochures produced by Sierra, describing the operation of the SKE, ZM, and ZMG.

The Environmental Technical Applications Center (ETAC), located at Scott AFB, Illinois, provided the weather information used to develop the expected weather conditions in Europe.

A supplemental bibliography relating to the subject of stationkeeping is included in Appendix A.

PROPRIETARY RIGHTS AND PRIVILEGES

The following chapters contain certain data relating to Stationkeeping Equipment (SKE), Zone Marker (ZM), and Zone Marker Group (ZMG) capabilities. The use of that data and information is subject to certain proprietary rights and privileges of SIERRA RESEARCH CORPORATION. Reproductions, disclosures, or use of the data/information, in whole or in part, in any manner whatsoever, to any individual and/or company, other than an employee of the United States Government or an agency thereof, is not permitted without prior approval of SIERRA RESEARCH CORPORATION.

Nothing contained in this notice shall prevent this study from being distributed, reproduced, or used to the extent necessary within the United States Government or an agency thereof.

CHAPTER IV

SELECTED FACTORS BEARING ON THE EMPLOYMENT OF HELICOPTERS IN A NIGHT/ADVERSE WEATHER ROLE

In researching the subject of helicopter flight in night/adverse weather, several factors were identified that relate to the subject and were considered essential for a realistic evaluation of the problem. These factors include weather, helicopter effectiveness, Soviet anti-helicopter threat, physiological, and cost effectiveness considerations.

WEATHER FACTOR

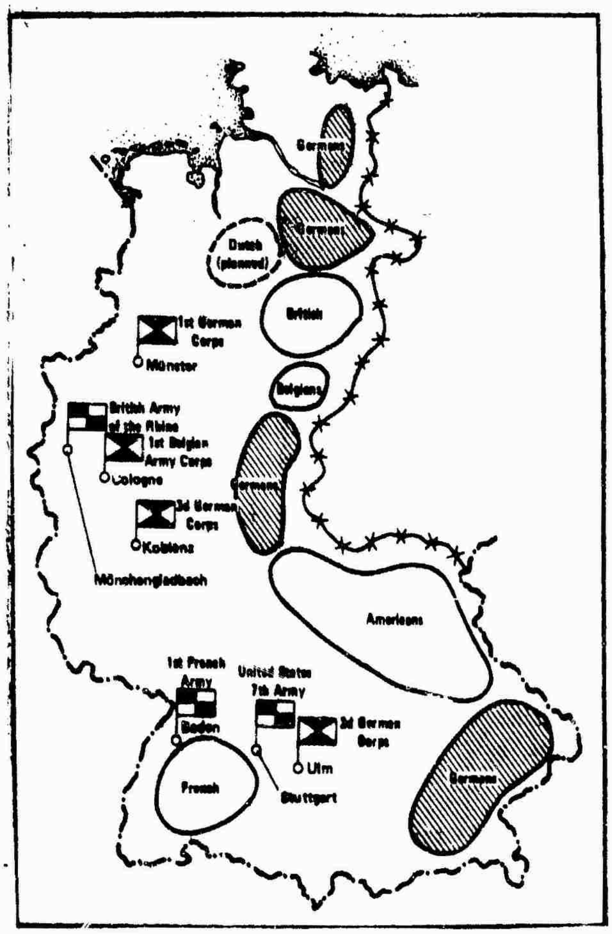
It is essential in this study to establish a probable geographical location for commitment of U.S. Forces and present weather data compiled for that area. This was necessary to determine the impact adverse weather will have on helicopter operations, especially during the hours of darkness.

The United States is committed to the North Atlantic Treaty Organization (NATO), and the defense of Europe. Assuming that we will honor our treaty commitments, there is little doubt that Europe represents a likely location for U.S. troop involvement. In fact,

> US forces in Europe, in their current size composition, perform a vital function in addition to serving as a link to US strategic nuclear forces

> in the event of nuclear war. They help maintain a strong conventional defense in the event of attack from Pact forces, an essential mission which makes detente possible. They also serve as tangible evidence of America's determination to honor our Alliance commitments.[1]

The map below, extracted from Military Review, January 1976, p. 35, shows the current disposition of U.S. forces in Central Europe.



Map 1

This is not to say that U.S. forces will only be committed in this one specific locale. Consequently, they must be capable of responding all along the border.

Army Regulation 95-1, Army Aviation: General

Provisions and Flight Regulations, was used to establish the conditions of ceiling and visibility required to accomplish helicopter operations at night under Visual Flight Rules (VFR). The information in figure 1 was extracted from AR 95-1.

VFR HELICOPTER OPERATIONS

Operation	Feet (above ground level)	Visibility
Night:		
Over flat terrain	500	1 mile
Over mountainous terrain	1,000 above the highest obstacle along the flight route	1 mile

Figure 1

The topography representative of the area of current dispositions of U.S. Forces is considered mountainous. Figure 1 indicates that night helicopter flight over mountainous terrain requires, as a minimum, a 1,000 foot ceiling and a visibility of one mile. These conditions must exist along the entire route of flight.

Environmental Technical Applications Center (ETAC) climatic weather briefs, compiled for a 10 year period from 1960 to 1970, provide ceiling and visibility data for this evaluation. Complete weather information from the twenty-five stations selected for this analysis is included in Appendix B.

The data presented reflects conditions recorded when sky conditions were observed to be less than a 1000 foot ceiling and/or a visibility less than 2 miles; and observed to be greater than a 200 foot ceiling and/or a visibility greater than ½ mile. These conditions represent a realistic condition in which helicopter operations without a N/AWS will be restricted.

WEATHER ANALYSIS

		Annual Average	Worst 5 Month Average
Bad Krevznach	AAF	16	29
Bad Tolz	AAF	16	22
Bitburg	AB	22	35
Coleman	AAF	18	29
Feucht	AAF	26	29
Finthen		17	30
Frankfurt		18	29
Fulda	AAF	19	32
Furth	AAF	16	27
Grafenwoehr	AAF	25	35
Hahn	AB	32	46
Hanau	AB	15	24
Heidelberg	AAF	15	25
Hohenfels	AAF	21	34
Illesheim	AAF	14	22
Kitzingen	AAF	12	19
Ramstein	AB	22	33
Sembach	AB	21	34
Spanglhelm	AB	23	34
Stuttgart		15	25
Schwaebisch Wall	AAF	22	32
Tempehof	AB	19	32
Wertheim	AAF	30	42
Weisbaden	AB	15	27
Zweibracken	AB	26	39
Mean Average		20%	31%

AAF - Army Air Field
AB - Air Base

Figure 2

The first column in figure 2 represents the average percent of time annually, between the hours of 1800-1100, that weather conditions will restrict helicopter operations. The second column represents the average percent of time that helicopter operations would be restricted during the same daily 17 hour time span for the worst 5 month weather period. All values are rounded to the nearest whole percent.

Analysis of the data presented, shows that, on a 12 month average, sky conditions will exist that restrict the use of the helicopter without a N/AWS, 20% of the time between 1800-1100 hours. This percentage translates to approximately 3 hours and 48 minutes of the 17 hour period that the helicopter operation without a N/AWS would be greatly restricted. Analysis also shows that helicopter operations, without a N/AWS, would be greatly restricted an average of 31% of the time between 1800 and 1100 hours during the worst 5 month weather period. This percentage equates to 5 hours and 16 minutes of the 17 hour period.

It must be stressed that flight in a helicopter is not based on averages. If for some reason a helicopter crew enters Instrument Meteorological Conditions (IMC), they must initiate emergency procedures to withdraw from the adverse weather and maintain VFR. The ceiling and visibility criteria selected is very realistic, particularly when flying night/adverse weather helicopter missions in Central Europe. The situation is compounded because weather prognostication cannot guarantee VFR conditions will exist for a flight covering a broad area and time span. In fact, weather conditions, (e.g. ceiling and visibility), reported by a weather station in one locale may differ greatly from actual sky conditions. These circumstances dictate that the Army develop a system which will provide the electronic guidance required during Instrument Meterological Conditions (IMC), if the helicopter is to operate freely on the battlefield during night/adverse weather conditions.

ARMY HELICOPTER NIGHT/ADVERSE WEATHER EFFECTIVENESS FACTOR

OPERATIONS	EFFECTIVENESS				AIRCRAFT CAPABILITIES													AIRCRAFT LIMITING FACTORS									
TYPES OF OPERATIONS FOR ARMY AIRCRAFT PERFORMING MISSIONS IN COMBINED ARMS OPERATIONS	OPTIMUM	EFFECTIVE	MARGINALLY EFFECTIVE	NOT EFFECTIVE	RAPID MOBILITY	HIGH VOLUMES OF FIRE POWER	TANK KILLING AT STANDOFF RANGES	RECONNAISSANCE AND SURVEILLANCE	SECURITY	RESPONSIVE LOGISTICAL SUPPORT	ECONOMY OF FORCE	AIR DEFENSE SUPPRESSION	COMMAND AND CONTROL	DISPERSAL, REORG, AND COVER KEY TERRAIN	BYPASS RESTRICTIVE TERRAIN & OBSTACLES	FIRE ADJUSTMENT	MEDICAL EVACUATION	REQUIRES TAC AIR AND AIR DEFENSE SUPPRESSION	RESTRICTED COMMO BECAUSE OF TERRAIN FLIGHT AND [illegible]	ADVERSE WEATHER	LACK OF NIGHT VISION DEVICES	LACK OF ENDURANCE	AIRCRAFT LOAD RESTRICTIONS	VULNERABILITY OF FORWARD ELEMENTS TO ARTILLERY	HIGH VOLUMES OF LOGISTICS SUPPORT	LACKS AIRCRAFT SURVIVABILITY EQUIPMENT	LACKS TARGET ACQUISITION AND DESIGNATION EQUIP
OFFENSE:																											
MOVEMENT TO CONTACT	X				3	3	3	3	3	3	3	2	3	3	3	3	3	1	0	0	0	0	1	1	0	0	0
RECONNAISSANCE IN FORCE	X				3	3	3	3	3	3	3	2	3	3	3	3	3	1	0	0	0	0	1	1	0	0	0
COORDINATED ATTACK		X			3	3	3	2	2	3	2	2	2	2	3	3	3	0	0	0	0	1	0	0	0	0	0
EXPLOITATION	X				3	3	3	3	3	3	3	2	3	3	3	3	2	1	0	0	0	0	0	1	0	0	0
PURSUIT	X				2	3	3	3	3	3	3	2	3	3	3	3	3	1	0	0	0	0	0	1	0	0	0
NIGHT ATTACK			X		3	2	1	1	1	1	1	1	1	1	3	1	3	0	0	0	0	1	1	0	0	0	0
INFILTRATION		X			3	3	3	2	2	2	3	2	2	3	3	3	3	0	0	1	0	0	0	1	0	0	0
COVERING FORCE		X			3	3	3	3	3	3	3	2	3	3	3	3	3	0	0	0	0	0	0	1	0	0	0
DEFENSE:																											
AREA DEFENSE		X			3	3	3	2	2	3	3	2	3	3	3	3	3	0	1	0	0	1	0	0	0	0	0
MOBILE DEFENSE		X			3	3	3	3	3	3	3	2	3	3	3	3	3	0	1	0	0	1	0	1	0	0	0
RETROGRADE:																											
WITHDRAWAL		X			3	3	3	3	2	3	3	2	3	3	3	3	3	1	1	0	1	2	1	1	1	0	0
DELAY		X			3	3	3	3	2	3	3	2	3	3	3	3	3	0	0	0	0	1	0	1	0	0	0
RETIREMENT	X				3	3	3	3	3	3	3	/	3	3	3	3	3	2	2	1	2	2	1	2	1	2	2
RELIEF OPERATIONS:																											
PASSAGE OF LINES		X			2	2	1	1	2	3	/	2	3	2	3	1	2	0	1	1	1	2	1	0	1	1	0
SPECIAL OPERATIONS:																											
AMPHIBIOUS OPERATIONS		X			3	3	3	2	2	3	3	2	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0
LINK-UP OPERATIONS			X		3	3	3	2	2	3	3	2	3	3	3	3	3	0	0	0	0	0	0	1	0	0	0
RAIDS - SPOILING ATTACKS		X			3	3	3	3	2	2	3	2	2	3	3	3	3	1	1	1	1	2	2	1	1	1	1
DECEPTION, FEINTS, DEMONSTRATIONS AND RUSES		X			3	3	3	3	3	3	3	2	3	3	3	/	3	0	0	0	0	0	0	0	0	0	0
AIR ASSAULT OPERATIONS	X				3	3	3	3	3	3	3	2	3	3	3	3	3	0	0	0	0	1	0	0	0	0	0
COMBAT IN [illegible]		X			3	3	3	3	3	3	3	2	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0
COMBAT AGAINST FORTIFIED AREAS				X	3	3	3	1	1	1	1	1	1	1	3	1	1	2	2	1	1	1	1	2	1	2	2
CIVIL DISTURBANCE/POPULACE CONTROL		X			3	/	/	3	3	3	3	/	3	/	3	/	3	1	1	1	0	1	1	1	1	1	1
STABILITY OPERATIONS		X			3	3	3	3	3	3	3	2	3	3	3	3	3	0	1	0	0	1	1	1	0	0	0
RIVERINE OPERATIONS		X			3	3	/	3	3	3	3	2	3	3	3	3	3	1	1	0	0	1	1	1	1	1	1
UNCONVENTIONAL WARFARE	X				3	3	3	3	3	2	3	2	3	3	3	3	3	1	1	1	0	1	0	2	1	0	1
ANTI-ARMOR OPERATIONS		X			3	3	3	3	3	3	3	2	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0
HELICOPTER VERSUS ARMOR	X				3	3	3	3	3	3	3	2	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0
HELICOPTER VERSUS INFANTRY	X				3	3	/	3	3	3	3	2	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0
HELICOPTER [illegible] AIR DEFENSE		X			3	3	/	3	3	2	3	2	3	3	3	3	2	0	0	0	0	0	0	0	0	0	0
ATTACK OF BUILT-UP AREAS			X		3	3	3	3	3	3	2	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0
OPERATIONS IN NBC ENVIRONMENT		X			3	3	3	3	3	3	3	2	3	3	3	3	2	1	1	0	1	0	1	0	0	0	0
SEARCH AND RESCUE OPERATIONS	X				3	3	3	3	3	/	3	2	3	3	3	3	2	0	0	0	0	0	0	1	2	0	1
PSYCHOLOGICAL OPERATIONS		X			3	3	/	3	3	/	3	2	/	3	3	3	2	1	1		1	1	1	2	1	1	1

(1) AIRCRAFT CAPABILITIES
- 3 - OPTIMUM
- 2 - EFFECTIVE
- 1 - MARGINALLY EFFECTIVE
- 0 - NOT EFFECTIVE

(2) AIRCRAFT LIMITING FACTORS
- 0 - MAJOR
- 1 - MINOR
- 2 - NONE

FIGURE 3

The effectiveness of the helicopter in support of Combined Arms Operations is presented in Figure 3 extracted from Field Manual 90-1, Employment of Army Aviation Units in a High Threat Environment.

The three categories considered are: 1) Effectiveness, 2) Aircraft Capabilities, and 3) Aircraft Limiting Factors. The two conditions highlighted with arrows, indicate adverse weather and night attack. Although adverse weather and night attack are not exactly synomonous with night/adverse weather capabilities, there is a very high degree of similiarity between the two sets of conditions. Obviously night and adverse weather combine to significantly restrict the effectiveness of the helicopter. A helicopter N/AWS would improve Army Aviation's support of Combined Arms Operations during night/adverse weather conditions.

THREAT FACTOR

"As with every other weapon system, the helicopter has a place and role to play in the major combat elements of the Army as long as it is properly used".[2] Proper employment of the helicopter requires an understanding of potential Soviet anti-helicopter threat and the tactics employed on an European battlefield.

Certainly, "Aviation success on the battlefield will be directly proportional to the manner in which we learn to cope with sophisticated enemy capabilities".[3] The following threat investigation is designed to evaluate the restrictions imposed on Soviet anti-helicopter weapons during night/adverse weather conditions. These restrictions, and resulting degradation, results in an increased survivability for U.S. Army aviation.

> Survivability is a function of Hardware, Tactics, and Training.... Our need is to develop new material, doctrine, and techniques, and training if our forces are going to survive the hostile environment in the next war.[4]

The Soviet anti-helicopter threat is presented in the following ways:

Air Defense Artillery
Tactical Fighters
Attack Helicopters
Massive Artillery Fire
Electronic Warfare

A brief examination of each threat category follows:

Air Defense Artillery (ADA) Threat

The Soviet ADA anti-helicopter threat is evaluated by investigating the impact of night/adverse weather conditions on the weapons systems presently in operation. The following information extracted from FM 90-1, *Employment of Army Aviation Units in a High Threat Environment*, represents a cross section of these weapons.

The GUIDANCE capabilities of the weapons presented in the following chart indicates a strong reliance on establishing visual contact for a successful engagement. This conclusion is based on the fact that optical inputs are necessary in every case, as indicated in the GUIDANCE column in figure 4.

Air Defense Artillery Weapons Systems (Table)

WEAPON SYSTEM	RANGE AND CAPABILITY	GUIDANCE	ASSIGNED
S-60, 57mm antiaircraft gun system. Mobility: towed	Range - 6,000M. Gun can be elevated from -2° to +87° vertically and traversed 360°.	Radar and Optical-Mechanical computing.	Antiaircraft regiment of tank division and motorized rifle division.
ZSU-57-2, 57mm antiaircraft. Mobility: Self-propelled with fully tracked chassis.	Range - 4,000M. Gun can be elevated from +2° to +87° vertically and traversed 360°.	Optical-Mechanical computing sight	Air defense units in tank regiment of tank division and motorized rifle division.
ZSU-23-4, 23mm antiaircraft gun system. Mobility: Self-propelled with fully tracked chassis.	Optical range - 2,500M radar range - 3,000M. Gun can be elevated from +8° to +87° vertically and traversed 360°.	Radar-Optical	Air defense units in tank regiment, motorized rifle regiment of tank division and motorized rifle division.
ZU-23, 23mm antiaircraft gun system. Mobility: Towed on two-wheel carriage.	Range - 2,500M. Gun can be elevated from -10° to +90° and can be traversed 360°.	Optical	Air defense units in motorized rifle regiment of tank division and motorized rifle division.
ZPU-4, Quad-mounted 14.5mm antiaircraft machine gun. Mobility: Towed on four-wheel carriage.	Range - 1,400M. Gun can be elevated from -8.5° to +90° vertically and can be traversed 360°.	Optical	Air defense units in motorized rifle regiment of tank division and motorized regiment division.
Machine guns 12.7mm. Mobility: Mounted on combat vehicles.	Range: 1,000M	Optical	Platoon level weapon.

Figure 4

If conditions existed which denied obtaining optical information, the systems would be degraded in engagement effectiveness. This would be the case during night/adverse weather conditions. The technique of "sound shooting", in an attempt to overcome the loss of visual acquisition/guidance, has not been considered an effective alternative.[5]

Operations conducted during periods of night/adverse weather would result in increased survivability for the helicopter, in an ADA environment.

"Among the more serious battlefield threats is that posed by enemy high performance aircraft and armed helicopters".[6] This is true, during daylight and good weather conditions. The following information provides insight into the Soviet capabilities for engaging a low-flying helicopter during night/adverse weather conditions.

Tactical Fighter Threat

The Soviet fighter can fly in adverse weather by utilizing on-board radar. Some Soviet aircraft possess the sophisticated search radar systems required for electronic acquisition of targets, such as a low-flying helicopter. This feature does not necessarily equate to possessing the capability for engaging and destroying a helicopter during night/adverse weather conditions. This is due, in large part, to two factors. First, during the attack, maintaining visual references is critical for proper aircraft attitude and obstacle/terrain clearance. Any distraction diverting pilot attention from the performance of engaging the target, will increase the probability of an unsuccessful engagement. This is especially true when accomplishing a critical diving maneuver while relying on aircraft flight instruments for flight information. The second variable involves the evasive multidirectional capabilities of the helicopter, e.g., a target that changes speed and direction rapidly is extremely difficult to engage. These factors coupled with the first set of variables, combine to complicate the issue for Soviet fighters during night/adverse weather conditions.

Night/adverse weather operation increases helicopter survivability due to the degradation of the Soviet fighter threat.

Armed Helicopter Threat

Armed enemy helicopters present a unique and potentially more hazardous threat to Army Aviation than the tactical fighter. The increased threat is due to the multidirectional capabilities unique to rotor-wing aviation and ..."because weather often precludes the use of high performance fighters; but if weather permits us to use our helicopters, the enemy can employ his".[7] A N/AWS for Army helicopters would provide a system for operating in conditions that presently prohibit Soviet helicopter operations.

Artillery Threat

Soviet artillery poses a threat to Army Aviation during all phases of operation due to its massive coverage and great range.

Marginal weather and the resulting decrease in flight activity compound the problem of security for the helicopter. The grouping of grounded helicopters presents lucrative targets for indirect fires from Soviet ground-to-ground mortars, guns, rockets, and missiles. Proper concealment, dispersal, and camouflage, of the facilities required for support of helicopter operations is essential for survival. A N/AWS for helicopters would enable operations to continue during those conditions which now cause grounding. When airborne, helicopters are less vulnerable due to the reduced probability of sustaining a direct hit from enemy artillery. Therefore, a decrease in ground time increases the survivability of the Army helicopter.

Electronic Warfare Threat

"Electronic warfare encompasses signal collection, intercept, direction-finding, jamming, and deception of communication and non-communication devices".[8] The Soviet doctrine emphasizes "disrupting and disorganizing their opponents use of navigation aids, command and control, and fire control systems".[9]

The demonstrated emphasis and proven capabilities of the Soviet electronic deception and meaconing capabilities requires developing a system that will provide electronic security for helicopters operating in an austere battlefield environment. The system must have the capability for providing navigational guidance in an austere environment; command and control capabilities which are not dependent on voice transmissions; and airspace management procedures that will provide maximum airspace utilization with minimum control.

These factors will be discussed separately in Chapter V. For purposes of this section it should be stated that an improvement in electronic security and decreased dependence in voice transmissions will result in increased helicopter survival.

PHYSIOLOGICAL FACTORS

Because a system is only as good as its operator, an investigation must be made to determine if the physical requirements to operate a helicopter in night/adverse weather, during combat, exceed human performance tolerances. If so, then the N/AWS is not feasible for use in the Army helicopter. To begin with, it must be kept in mind that the level of stressors for a helicopter crewmember is already very high due to noise, vibration, and cockpit environment conditions associated with rotor-winged aviation.[10] This fact alone makes the addition of night/adverse weather stresses critical to human tolerance. The following data was extracted from studies which tested the stress levels anticipated during night/adverse weather combat conditions.

The Study of Factors that Affect the Performance of Army Flight Crew Personnel, defines three variables that affect the capabilities of helicopter crewmembers:

performance, fatigue, and stress. The following exerpts relate the significance of the problems encountered when incorporating night/adverse weather operations in the helicopter.

> Performance denotes a measurable activity that requires expenditures of energy in attempted completion of tasks that normally involve both physical and mental effort. Neuromuscular activity involves performance of tasks which can be measured ergometrically and subsequently compared to other similar data. Mental activity alone is usually measured by task performance against a scale of pre-established or hypothetical norms. Performance can be influenced by complex and poorly understood factors such as fear, motivation, emotional response to environment, and interaction of sequential subtasks.
>
> The word Fatigue has been appropriated by many branches of science as the designation for various regressive phenomena. With respect to human activity, fatigue is a subjective term generally employed to cover a variety of processes in many different physiological and psychological mechanisms. Fatigue is but one natural consequence of sustained endeavor. When fatigue affects performance, its effect is usually detrimental. However, as a natural consequence of activity, it can be viewed as a subjective awareness of the approach to a point where bodily resources are overtaxed. The term fatigue can not be used without further modification.
>
> Stress is equally difficult to define, but suggests significant selective alternation in the balance of phychological and physiological processes. Stress may often be characterized by heightened but more selective attention and motivation. Although stress suggests the general occurrence of regressive changes in performance, it may temporarily enhance certain elements of task performance. Situations which are likely to induce stress include, (a) conditions of uncertainty which produce anxiety, (b) natural hazards of the environment, (c) sensory and perceptual saturation or overloading, and (d) sustained maximal energy output.

These three variables serve to measure the magnitude of the problems the helicopter flight crew will confront in preparing for combat in night/adverse weather conditions.

Factors which affect performance levels are: diet, sleep, tobacco, age, proficency, inner ear, training, and drugs. These factors are measurable and controllable.

The effects of adverse weather on helicopter operations impacts on the crewmember tolerances. The "Factors Study" indicated that although the level of stress is increased significantly, there is no precise measurement technique to measure it. Therefore, performance during high stress conditions is not predictable. Although there are no precise answers, there are certain identified areas that will require increased attention in order to increase tolerance levels. Three possible solutions to increasing tolerance are: proper training and physical conditioning; proper rest and diet; and improved cockpit instrument configuration.

The study concludes, "There is a need to recognize the interdependence of the Army's requirements for human performance in the helicopter and the performance capacity of the man."[11] Although the results of these tests indicate an increase in stressors during helicopter night/adverse weather operations, there is no conclusive evidence that man's capacity has been exceeded.

COST FACTOR COMPARISON

Cost considerations involve more than a feasibility check. Budgetary constraints demand that a system be affordable, as well as feasible. Therefore, the cost involved in developing a system impacts significantly on its feasibility.

This cost factor comparison is designed to determine the most cost-effective solution for developing N/AWS equipment for Army helicopters. The two options considered are: 1) retrofitting existing equipment in operation in the Air Force C-130 and C-141 aircraft for use in the helicopter, or 2) develop new equipment for a helicopter N/AWS. The vehicle used in this comparison is the... "Life Cycle System Management Model (LCSMM), which is designed to provide effective and continuous development of Army materiel".[12] There are four phases in this model: Conceptual, Validation, Full-scale development, and Production and deployment.

The conceptual phase involves developing an idea or concept to determine its feasibility for continued development.[13] The validation phase verifies the concept to insure that continued development is still valid.[14] The full-scale development phase provides the technology and testing required to determine if the original requirement is being satisfied.[15] "The production and deployment phase provides for manufacture, issue and inventory management until eventual disposal of the item".[16]

The LCSMM is a methodical step by step process that is time consuming, very expensive, and yet, necessary for developing a new system.

The N/AWS system offers proven data for the majority of unknown variables that must be answered in developing a new system and therefore represents a significant savings in time and resources.

The Test and Evaluation of a concept is still required with the N/AWS. "Budgetary constraints and the concern of governmental leaders have magnified the importance of properly planned and thoroughly conducted testing.[17]

"Testing is conducted to demonstrate how well the materiel system meets its technical and operational requirements; to provide data to assess developmental and operational risk and aid in decision making...."[18]

For the purpose of this study, two testing categories are discussed: Development Testing (DT) and Operational Testing (OT). These two types of testing represent the major areas for testing the feasibility of the N/AWS. The following DT and OT definitions are extracted from the U.S. Army Command and General Staff College Reference Book (RB), 101-3, p. 3-6.

Developmental Testing

> It includes engineering design tests and human factors testing to demonstrate a satisfactory technical man (soldier)/machine interface using qualified and experienced operators and support maintenance personnel. During the full-scale development phase and prior to the first major production decision, the DT accomplished shall be adequate to insure that engineering is reasonably complete; that all significant design problems (including compatibility; interoperability; reliability, availability, and maintainability (RAM); and supportability considerations....

Operational Testing

> That test and evaluation conducted to estimate the prospective system's military utility, operational effectiveness, operational suitability (including compatibility; interoperability; reliability, availability, and maintainability (RAM); and logistic and training requirements), and need for any modifications. In addition, it provides information on organization, personnel requirements, doctrine, and tactics. Also, it may provide data to support or verify operating instructions, publications, and handbooks. OT personnel of the type and qualifications of those expected to use and maintain the system when it is deployed; it will be conducted in as realistic an operational environment as possible. OT must examine the operational man-machine interface.

The N/AWS offers proven data acquired from both integrative studies and operational fixed-wing capabilities. These factors provide an ample amount of data on which to make the necessary decisions concerning development of a system for the helicopter. The savings in time and money are significant when the LCSMM is entered in the production and deployment phase. This eliminates the first three phases: conceptual, validation, and full-scale development. The majority of time consuming research and development is already completed.

OPERATIONAL TESTING is the area where major emphasis will be required for developing a helicopter night/adverse weather capability. The data derived from this testing will serve as an update for determining the doctrine for employing the helicopter in a night/adverse weather role. The results of realistic testing will provide additional insight in the area of "operational man/machine interface".[19] This information will be invaluable in developing a realistic training program for helicopter N/AWS operation.

The development of doctrine and tactics represents a major task. The initial formulation of doctrine for employing the helicopter in a night/adverse weather role, will evolve from data obtained during operational testing.

The training of the cadre of personnel in the field will constitute the final step in developing the systems.

> Aviation units must spend a considerable amount of time conducting night and adverse weather training. The benefits of this training are twofold. First, it increases aviation staying power and, secondly, night and adverse weather operations reduce somewhat the threat posed by previously discussed air defense systems.[20]

The product of this process will then give Army Aviation a night/adverse weather capability.

The reduced life cycle cost realized when using a fully developed system, makes the N/AWS for helicopters, an attractive cost-effective proposition.

CHAPTER V

AN OPERATIONAL N/AWS

The N/AWS is essentially composed of two systems which operate on the principle of time/frequency sharing. The two systems are: The Stationkeeping-intraformation positioning equipment (SKE), designated the AN/APN-169; and, the Zone Marker (ZM), designated the AN/TPN-27.

Credit for the invention of the time/frequency technique is difficult to assign to any one individual or company. The reason being, many individuals from several different companies and often from more than one country, have contributed to the research of time/frequency techniques.[1] "STATIONKEEPING is a comparatively new term in the aviation industry".[2]

The use of systems incorporating time/frequency sharing, on airborne platforms, has been prohibited due to the size, weight, and power required for operation.[3] Micro-minaturization of solid-state devices has decreased the power, weight, and size, requirements of the system.[4] This advance in technology, specifically in solid-state research, solved the size, weight, and power supply problem, and opened the door for developing new systems for use by aviation,

BACKGROUND

A history of time/frequency technology, the development of Stationkeeping-intraformation positioning, and the description of the concept of operation was contained in the Sierra Research Corporation History of Time/ Frequency Technology.

"Certain techniques of 'one-way' ranging have been in use for hundreds of years".[5] This technique is the basis for developing the capability to maintain specific relationships by utilizing transmitted energy of a specific type and measuring the time for propagation.[6] Establishing a "one-way" ranging time provides for precise measuring techniques. "The distance to an emanating source of energy, ...can always be determined by 'one-way' techniques."[7] The important factor is precise determination of transmitting time by the source and reception time by the receiver.[8] A familiar application of this measuring technique is the determination of the distance of an approaching thunderstorm.[9] The lightning is the emanating source, transmission time and the arrival of its sound (the thunder) is the arrival time at the receiver. The timed delay between the lightning and the arrival of sound, can be multiplied by the velocity of sound to determine the storms' distance.[10] "This method involves the use of one-way delay for measuring range, since light propogation time can be neglected".[11]

Establishing a system for synchronizing the time of all receiving stations becomes an important task. A system which would electronically synchronize a series of clocks will provide for a stabilized reference point. All receivers with precisely aligned clocks could determine the distance to the enemy emitter, by determining the time interval between a predetermined and known time of transmission.[12]

Stationkeeping equipment originated as a system specifically designed to allow helicopters to fly in close formation under reduced visibility conditions.[13]

An extension to the 1956 system mentioned earlier was developed by Sierra in 1957 and presented to the Navy in 1958 as a stationkeeping system and radar combination.[14] In 1959, Sierra successfully flight tested a stationkeeping system for the Navy. The Navy agencies recommended eight evaluation units be manufactured in 1960 for use in Naval helicopters conducting anti-submarine warfare. Successful testing was conducted in Pacific waters in 1961. Following testing, a production program began in December 1962. One hundred and four units were produced.[15]

In 1961, Sierra proposed a "one-way" ranging concept to the U.S. Air Force.[16] The proposal paved the way for development of the first practical one-way system for air-to-air stationkeeping and collision avoidance.[17] This important development permitted inflight use, for the first time, of "one-way" transit time ranging early in 1964.[18]

In 1965, Sierra produced an advanced version of the SKE. The U.S. Air Force procured four sets of this advanced version to provide a low-level, in-trail, five-second aircraft interval for delivery of troops and supplies.[19]

The Tactical Air Command recommended a retrofit of the C-130 "Hercules" fleet. The stationkeeping system was procured under the military designation AN/APN-169. A suffix "A" and "B" indicates revisions to the basic 169 equipment.[20] This system provided the Tactical Air Command with a night/adverse weather capability.

PRINCIPLE OF STATIONKEEPING OPERATION

The following schematic representing three clocks is presented to explain electronically stabilized/synchronized time keeping. The clocks shown in figure 5 are not in a stabilized/synchronized status.

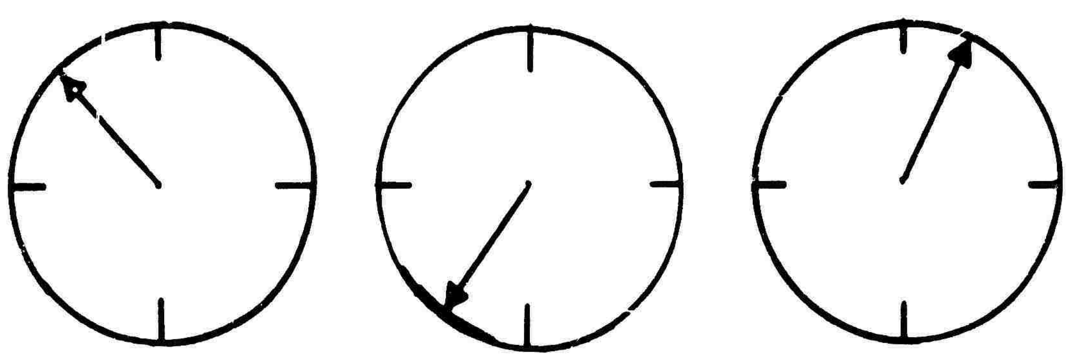


Figure 5

When the system is energized and operating properly, synchronization takes place and the clocks will indicate the same position at the same time. The movement of the clocks is now under control of the SKE system designated as the "Master" clock.[21] "Master" clock operation will be discussed later. The clocks in figure 6 indicate stabilized/synchronized clock operation.

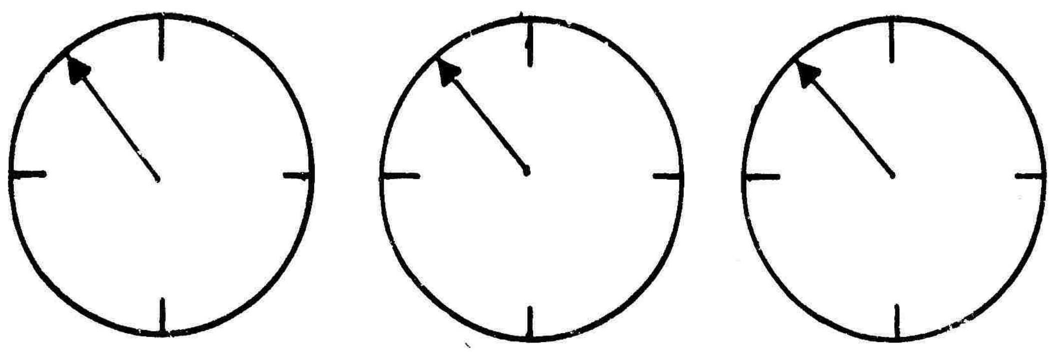


Figure 6

Each clock remains precisely aligned with the "Master" clock in rate of movement and position. This is the principle of electronically stabilized synchronization of time clocks, which is the basis for interference-free transmission and reception of data in the SKE/ZM system.[22]

One-way ranging is possible through the use of precisely synchronized local clocks in each aircraft as a common time reference for extracting range information from the arrival time of pulsed Radio Frequency (RF) energy.[23] "If all local clocks are in precise alignment, then all receiving stations know both the assigned transmission time, and, of course, the measured arrival time of pulsed RF energy."[24] The SKE/ZM operates on these principles.

DESCRIPTION OF N/AWS OPERATION

SKE/ZM operation utilizes one SKE system to act as a "Master" clock. This "Master" slaves all other clocks, designed as "followers".[25] Any clock operating on the same frequency may operate as "Master", however, only one clock may operate as "Master" at any <u>one</u> time.[26] This obvious restriction prevents inadvertent disruption of the synchronization process.

The synchronized time and stabilized movement of the clock allows for assignment of designated positions on the clock.[27] The SKE/ZM operates a clock which is divided in forty separate segments.[28] Each complete 360 degrees travel of the clock traverses the forty segments of the clock. Each segment is designated as a "slot" and is given a numerical value. The segment of time represented by each "slot" is 160 microseconds in duration.[29] As each SKE system sweeps its designated "slot" position, it acts as a transmitter and transmits coded information. All other properly configured SKE/ZM clocks receive this coded information during this "slot" time.[30] The coded information is then decoded and relayed electrically to the respective cockpit instruments in each SKE/ZM configured aircraft. This process is repeated by each SKE/ZM system as the clock sweeps their respective "slot" position. The SKE/ZM systems function as a receiver at all times other than during the sweep of its respective "slot" position, when it acts as a transmitter. The system operating as "Master" has an additional "slot" for the synchronization and stabilization of the clocks operating on one frequency. Two frequencies are available in the present SKE/ZM configuration. They are designated "Freq A" and "FreqB".[31] Frequency A "Master", utilizes the zero slot and Frequency B "Master" uses the twenty slot. Slots ten and thirty are inert.[32] This arrangement of the clock is shown in Appendix C.. Of the forty total slots available, two are for "Masters", two are inert, and thirty-six are for SKE users. The present system configuration allows for a total of seventy-two aircraft operating simultaneously; thirty-six each on "FreqA" and "Freq B".[33]

The previous operation is the process referred to as the synchronized time slot technique. All information is transmitted and received during the process, thus providing air-to-air, ground-to-air, and air-to-ground capabilities. It is believed that Sierra was first to demonstrate the reduction to practice of a synchronized time slot technique involving local clocks in 1956.[34]

An extension of the SKE system was made possible through technological advances. The SKE/ZM was developed by incorporating a Zone Marker, the AN/TPN-27, as an accurate electronic reference point on the ground.[35] The Zone Marker operates on the same principles as the SKE. There are some unique features in the ZM which will be discussed later.

MAJOR N/AWS COMPONENTS

The three major components of equipment used by flight crewmembers are discussed to analyze the increased capabilities for performing flight operations in night/adverse weather conditions.

The Plan Position Indicator (PPI) is the single most important component.[36] It provides the crewmember with a plan view of the position of his aircraft in relation to another SKE aircraft or a ground stationed ZM. The Flight Command Indicator (FCI) and Zone Marker/Zone Marker Group (ZM/ZMG) are presented to relate the increased capabilities provided the U.S. Air Force C-130 and C-141 airlift aircraft.

Plan Position Indicator (PPI)

This cathode ray direct view storage tube presents a plan view of returns produced by other SKE/ZM systems operating on the same SKE frequency.[37] (see Appendix D-2) The user aircraft is always represented by a solid ring on the scope which, under normal operations, is the center of the scope. This solid ring indicates the "zero range" area.[38]

There are four concentric rings of electrically generated dots displayed on the inner surface of this five inch diameter scope. The operator may select scope range coverage, measured in thousands of feet: 4, 8, 16, 32, and 64 thousand feet, respectively.[39] With a selection of "1" on the Range Knob, the distance between each ring is 1000 feet for a total scope coverage of 4000 feet. At "2" the distance between each ring is 2000 feet for a total scope coverage of 8000 feet. At "4" each ring is 4000/total 16,000 feet. At "8" each ring is 8000/total 32,000 feet. At " 6" each ring is 16,000/total 64,000 feet.[40] An indicator light will illuminate on the right edge of the PPI to indicate which selection is being presented on the scope. A SKE formation with the interval of 2,000 feet would be indicated on the PPI as shown in Appendix D-2. The intensity of the scope background illumination is adjustable to accomodate levels of intensity compatible with an outside illumination from darkness to bright sunlight.[41]

The electronic return of another SKE/ZM set on the scope, is called a "blip". The ZM has a characteristic "blip" which is different from other SKE system returns. All aircraft in the formation can simultaneously 'see' each other and also 'see' the Zone Marker.[43]

An identification feature allows for identifying a "blip" by "slot" number.[43] When the ID button, on the secondary control panel is depressed, all returns will disappear from the PPI leaving only the "blip" of the aircraft selected for identification.[44] The PPI provides for determining the relationship of other SKE/ZM systems in the plan view. Maintenance of specified intervals or navigation can be accomplished during night/adverse weather conditions by simply maintaining position electronically. Heavy precipitation degrades, but does not debilitate, the transmission/reception of SKE information.

The operational capabilities of the PPI are dependent upon three conditions:

1) All aircraft must be SKE/ZM equipped.
2) All systems must be on the same SKE frequency.
3) All systems must have an operational SKE "Master" operating within ten nautical miles, for synchronization.[45]

SKE/ZM information can be passed electronically air-to-air, ground-to-air, and air-to-ground.[46]

<u>Flight Command Indicator (FCI)</u>

This silent signalling device allows for both input and output of discrete maneuver commands electronically. (see Appendix D-3) This signal is included as part of the "slot" encoded information.[47] In order to receive silent signalling from another SKE system, that system's "slot" number must be known and inserted as secondary control data. Maneuvering commands may be sent by depressing one of the command transient pushbuttons which illuminates, thereby indicating a command being sent.[48] A signal is received when the upper legend labelled "REC" is lit. All SKE systems must be properly configured with the operational settings to insure information is transmitted and received according to mission requirements.

<u>Zone Marker (ZM) AN/TPN-27</u>

This ground based marker was designed and tested to meet the following Required Operational Capabilities:* (see Appendix D-5)

1) Must be air droppable and transportable by one man. (23 pounds)
2) Must remain passive until interrogated by a properly configured SKE system. Full power must be generated within 30 seconds of interrogation.
3) Must be capable of operating on standard 24 volt direct current (VDC) power.
4) Must have provisions for alignment within ± 2 degrees of inbound/outbound axis.
5) Must be weatherproofed so as to be functional in adverse weather conditions (i.e., water, dust, and mud) and have an anchoring device to prevent upset by wind gusts or rotor blast.
6) Time to set up for operation not to exceed .3 hours and not to exceed .2 hours for converting to travel status.
7) Operation must be simple and not require special or extensive training to set-up.
8) Not possess tell-tale lights of an intensity to be readily detectable by an enemy.

The Zone Marker provides a SKE equipped aircraft with departure, enroute, point-to-point, and approach navigation, in night/adverse weather conditions.

An additional feature incorporated into the ZM operation includes a "listening" mode of operation. In this mode, the ZM remains passive until automatically activated by a properly configured SKE "Master" within a twenty nautical mile range. Thirty seconds after interrogation by a SKE "Master", the ZM must be at maximum power. It then reverts to a passive "listen" mode one minute after the "Master" synchronization signal is lost.[49]

*The preceding ZM information was extracted from Tactical Air Forces Required Operational Capability (ROC), IMC Aerial Delivery System for Non-awads C-130 Aircraft 307-74 March 1974.

Zone Marker Group (ZMG)

The ZMG (see Appendix D-7) is a combination of SKE/ZM equipment, and is used as a ground based SKE. The ZMG ground operator has all the capabilities an airborne SKE operator possesses. An ideal use for this equipment would be in Forward Area Refueling and Rearming Point (FARRP) operations. Ground personnel would be capable of directing identified aircraft silently, to the FARRP location. Knowledge of the geographical location of the FARRP is not a required item for a helicopter crew. Additionally, relocation of the FARRP would not affect operations. The normal procedures would be used for locating it. Silent electronically-secure, differentiated navigation would improve helicopter operations.

SUMMARY

The SKE/ZM discussed above provides specific line-of-sight differentiated navigation, intraformation positioning, collision avoidance, selective identification, low electronic signatures, secure reception, and silent signalling. (This writer refers to these capabilities inclusively, in the acronym, N/AWS).

The SKE/ZM has greatly increased the combat capabilities of the Air Force C-130 and C-141 airlift aircraft. It has provided the capability for operating in night/adverse weather conditions.[50]

CHAPTER VI

INCORPORATION OF THE N/AWS IN THE ARMY HELICOPTER

Retrofit Action

Adding a new system to a weapon system not specifically designed for post-development modification, requires "retrofit action". This process is complicated and could be more time consuming than installations which are part of the original design. Such is the case for the incorporation of SKE in the Army helicopter. Retrofit action does not represent a major obstacle.[1] However, due to the variety of different types of helicopters in the Army inventory, it does represent a considerable task.

To install the SKE three problems must be solved: equipment location, weight reduction, and antenna location.[2] These retrofit problems are examined below to determine their impact on the feasibility of incorporating SKE in the helicopter.

Two alternatives exist in the retrofit action: first, modify the helicopter to accomodate the SKE; second, modify the SKE to fit the existing helicopter design. The latter appears to be the more cost-effective alternative. It is for this reason, that only the SKE modifications will be presented, however, there are minor modifications required in the helicopter that are common to both alternatives.

Equipment location actually involves several factors: cockpit/sub-panel design, space/arrangement of helicopter interior, and inflight access to equipment. The cockpit/sub-panel design evaluation is critical because it determines proper placement of cockpit components (FCI, PPI, and control panels) to maximize the "operational man/machine interface" concept. These cockpit components are used continuously by the aircrew during N/AWS operations and are most critical. The installation of the receiver-transmitter and coder-decoder in the helicopter are more dependent on space available. However, the coder-decoder positioning must allow the crew to change clock and slot number settings while airborne.

Weight reduction experimentation and testing has been in progress since the Sierra tests in 1970 and at the present time does not present a major problem. The system has been reduced to thirty pounds, a weight which does not significantly degrade the lift capabilities of the majority of the helicopters. The feasibility of incorporating the SKE in those helicopters not capable of operating with the additional weight requires a prioritizing of equipment to determine which system should be removed or replaced by the SKE. In summary, the problem of weight is not beyond the technical capabilities of SKE technology.[3]

Antenna location is a problem that affects the entire SKE system operation. Each type helicopter must be evaluated to determine the proper antenna location, primarily to insure that the fuselage does not blank out reception in all flight attitudes. The reduction in antenna size and weight may allow placing a top and bottom antenna. This would insure maximum transmission and reception.[4] This modification can be accomplished on a two for one trade of antennas with no weight increase.*

Normal SKE system operation is not dependent on the type airborne or ground platform in which it is installed. The SKE will function essentially the same way in the Army helicopter as it does in the Air Force C-130 and C-141 aircraft. This fact is borne out by the fact that the functional capabilities of the SKE were successfully tested in the Army UH-19D helicopter in 1965.[5]

The ZM and ZMG are capable of functioning in cooperation with a properly configured SKE system. Their operation will be the same regardless of the type of vehicle transporting the operating SKE system, therefore, it can be concluded that the N/AWS, which is a combination of the SKE, ZM, and ZMG capabilities, will operate satisfactorily in Army helicopters.

CURRENT ARMY AVIATION NIGHT/ADVERSE WEATHER CAPABILITIES

Chapter V has stated the point that Army Aviation

* The HELO SKE report presented in Appendix D, confirms that the three identified problem areas in the retrofit action process have been engineered and do not represent restrictions to considering SKE installation in the Army helicopter.

has recognized the need for developing a system and supporting tactics that will enhance the capabilities of the Army helicopter during night/adverse weather operations, particularily when Instrument Meteorological Conditions (IMC) are encountered. Tactical Instrument Flight Procedures which are employed in IMC conditions are designed to cope with the adversities of vision obscuring phenomena.[6] Although these instrument procedures are still in the early stages of development, they represent an effort to improve Army Aviation by providing, the combined arms team, with an important segment of firepower, mobility, and staying power.[7]

In addition, to instrument conditions, aircraft are expected to operate on a routine basis with minumum air traffic advisories and control, minimum NAVAIDS, and at lower altitudes.[8] Therefore, "training is the key" to developing a capability for conducting helicopter operations utilizing tactical instrument flight procedures.[9] Thoroughness in preflight planning and flight crew proficiency are essential to the success of tactical instrument flight and mission accomplishment.

The hypothetical mission presented in FM 1-5 and FM 1-60 provides a framework for comparing the theoretical effectiveness of helicopter tactical instrument flight and theoretical helicopter effectiveness utilizing the N/AWS. A brief summary of the salient points in that mission is presented in the following exerpt.

An emergency exists in the forward area of the battlefield unless the personnel are extracted soon, an overrun of the outposts is expected. The mission assigned is to extract and relocate the outposts. To complete the mission, you must fly low-level to a location just short of the forward edge of the ... battle area (FEBA).

The weather is forecast to remain marginal until your intended departure time. You plan your mission accordingly. Shortly after takeoff from the basefield, you encounter '0-0' conditions due to heavy fog which precludes even NOE flight. However, you have radio contact with the unit at the FEBA and it reports that the ceiling there has lifted to 200 to 400 feet overcast - acceptable visual flight condition. The problem that faces you now, is how to get from your present location to the forward area where visibility exists that will allow mission completion and then return to the basefield. Will you cancel the mission due to the weather? Will you wait for conditions to improve and risk the outposts being overrun in the meantime? Neither of these courses of action are suitable solutions. How can you proceed with the mission even in the adverse weather condition? How can you return to the basefield or a refuel or rearm point after completing the mission?

Since you knew while planning the mission that the weather was marginal and forecast to remain the same, you were able to plan ahead and develop a tactical instrument flight plan at an altitude which was commensurate with intelligence indications of enemy air defense threat capabilities within your area intended flightpath and at the destination and arranged pre-planned locations. Confirmation to their placement and operation was received. You then coordinated instructions for their activation and deactivation (upon request only, or activation at a preselected time). As a standard operating procedure, you planned your tactical instrument flight as a backup for visual flight in the event weather prohibited using visual flight. You were able to plan the flight, using the lowest possible safe altitude, to the vicinity of the FEBA where adequate ceiling and visibility conditions existed and to execute a letdown approach to VFR conditions. Upon completing your mission, your plan provided for return to the rear area or to an alternate or subsequent location to perform other missions as needed.[10]

To add a touch of realism to that scenario, several questions are posed. <u>Can this mission be performed</u>

on an immediate basis? Would failure to contact the pathfinder beacon teams result in mission failure? Can a Forward Area Arming and Refueling Point (FARRP) be found? Can a mission other than planned be flown? Can multi-aircraft operations be performed? Can this mission be performed in radio silence in a single aircraft, multi-aircraft, or multi-mission profile? Last of all, can this mission be performed at NIGHT in the described weather conditions?

SCENARIO COMPARISON (N/AWS VS NON-N/AWS)

Can this mission be performed on an immediate basis? The detailed planning suggested indicates a considerable preflight planning requirement. Immediate response capabilities without a N/AWS are not possible. The N/AWS would provide the capability for flying an instrument departure, a specific route, and the approach for landing at the specific location of the unit being supported in night/adverse weather conditions with a significantly reduced preplanning requirement.

Would failure to contact a pathfinder beacon team result in mission failure? If the beacon is not located properly and manned for operation, that portion of the mission will not be supported by NAVAIDS. If adverse weather is encountered, navigation would be highly improbable in the absence of visual references (dead reckoning). With a N/AWS, coordination for turn-on is not necessary, since the ZM operates on a passive "listening mode" concept. It will provide guidance automatically when activated by a SKE equipped aircraft during night/adverse weather conditions, thus providing timely, precise, and relatively secure navigational guidance.

Can a Forward Area Arming and Refueling Point (FARRP) be found? Present helicopter capabilities provide for FARRP operation only if navigational aids are present for enroute navigation and visual conditions exist for establishing its location. Night/adverse weather conditions would prohibit use of FARRP operations. The helicopter N/AWS allows for a silent electronic differentiated identification of the FARRP. This feature provides the necessary guidance for accomplishing a successful mission in night/adverse weather conditions.

Can a mission, other than preplanned, be flown? The detailed mission planning required for and described in the exerpt from FM 1-60 and FM 1-5 indicates that a recovery is necessary to flight plan a changed mission. The N/AWS provides for an immediate launch response capability. The procedures u[illegible] would be identical to any N/AWS mission. The only change would be reflected in the data the crew is required to insert in the SKE control panels. Accomplishing this mission would be no more difficult than flying instruments in night/adverse weather conditions.

Can multi-aircraft missions be performed? Without a N/AWS? NO! Visual contact cannot be maintained. With a N/AWS, up to 68 aircraft can fly interference free, multi-aircraft operations during night/adverse weather conditions. (34 "FreqA", 34 "Freq B")[11]

Can the mission be performed in radio silence? Single aircraft? Multi-aircraft? Multi-mission? The present procedures do not provide for radio silence, unless visual contact can be made at destination. With the N/AWS silent signalling capabilities, single aircraft, multi-aircraft, and multi-missions can be performed during night/adverse weather conditions. The multi-mission information must be provided to the flight crews inflight if mission changes occur after takeoff.

Can the previous operations be performed at night in the described weather conditions? Without a N/AWS, and in the weather conditions presented, the mission could not be performed. With a N/AWS, the mission could be performed at night in adverse weather conditions, provided the Army helicopter could accomplish the takeoff and landing phases of flight. The success of the first and last seconds of flight are not enhanced by the N/AWS.

SUMMARY

Retrofit action required for incorporating the N/AWS in Army helicopters does not represent a restriction to technology. In addition, anticipated reductions in size and weight are within existing state-of-the-art stationkeeping technology. However, weight limitations testing and analysis is required to lend validity to the feasibility of using the N/AWS in all types of Army helicopters, regardless of their respective sizes.

Finally, a review of the present helicopters' capabilities indicates a great need to support combined arms operations during night/adverse weather conditions. The N/AWS will dramatically improve mission effectiveness. Eventually it will emerge as a helicopter operational capability when doctrinal and tactical employment procedures are developed to support this new system and when training programs are initiated for employing the helicopter in a night/adverse weather role.

CHAPTER VII

FINDINGS, CONCLUSIONS, & RECOMMENDATIONS

FINDINGS

Revisions in Army doctrine to support continuous warfare include developing the requirement for helicopter operations during night/adverse weather conditions.

Germany is a logical area for commitment of U.S. Army forces in support of NATO. The weather conditions in this area indicate a definite need for an Army helicopter N/AWS in order to provide the necessary support required for ground units fighting in that area.

There are distinct advantages to operating helicopters in night/adverse weather conditions, including providing firepower, movement of troops, logistical support, surveillance and reconnaissance. However, each of these require development of tactics which provide the least exposure to Soviet anti-helicopter threats. Because enemy ADA, tactical fighter and armed helicopter capabilities are degraded considerably during night/adverse weather conditions, operating the helicopter during those times will enhance survivability. An increase in survivability certainly enhances mission accomplishment.

A N/AWS presently in operation in the U.S. Air Force C-130 and C-141 provides these fixed-wing tactical airlift aircraft with an increased mission effectiveness during night/adverse weather conditions.

Advances in stationkeeping technology provide an air-to-air, air-to-ground, and ground-to-air capability for navigation, intraformation positioning, collision avoidance, selective identification, minimal electronic signatures, secure reception, and silent signalling. The Army helicopter does not presently possess these capabilities.

Technology can provide a N/AWS for the helicopter with only minor installation modifications. The retrofit action required is considered manageable and within budgetary constraint feasibility.

Operating helicopters at night in adverse weather conditions requires increased training to maintain proficiency in both day and night tactics, techniques, and procedures; development of increased physiological stressor levels; an examination of the cost in manpower, money, and time required to retrofit Army helicopters with N/AWS; and making revisions in doctrinal/procedural publications as needed to incorporate the N/AWS in Army helicopter operations.

CONCLUSIONS

Army Aviation's support of continuous warfare necessitates developing a night/adverse weather capability.

Equipment in use in C-130 and C-141 aircraft, is available to satisfy the requirement for a helicopter

N/AWS. The N/AWS presented possesses the desired operational capabilities, availability, and cost effectiveness which combine to make it a feasible solution to the problem.

The N/AWS will provide Army Aviation with the improved staying power required to support ground forces during night/adverse weather conditions, thereby increasing mission effectiveness.

RECOMMENDATIONS

Providing equipment with the desired operational capabilities is by no means to be construed as providing the Army with a night/adverse weather CAPABILITY for the helicopter. Now the major problems arise in how to employ this weapon system in order to achieve the maximum mission effectiveness within the capabilities of the system. The major areas requiring further research and development are: tactics, techniques, procedures, Standing Operating Procedures, training, and weight limitation analyses. Each of these areas represents a major undertaking. Each solution represents a major contribution toward providing the Army helicopter with a night/adverse weather capability. When solutions are provided to the previously mentioned problem areas; then, and only then, can it be said that the Army has a night/adverse weather capability for the helicopter.

ENDNOTES

ENDNOTES

CHAPTER I

[1]U.S. Army, FM 100-5, Operations (Washington, D.C.: Headquarters, Department of the Army, December 1975), p. 3-15.

[2]U.S. Army Command and General Staff College, Reference Book (RB) 100-7, The Common Language of Tactics (Fort Leavenworth, Kansas, July 1975), p. 22.

[3]RB 100-7, p. 22.

[4]U.S. Army, FM 90-1, Employment of Army Aviation Units in a High Threat Environment, (Draft), (Washington D.C.: Headquarters, Department of the Army, October 1975), p. 1-7.

[5]U.S. Army Aviation, "Tactics Sampler", (Quote from Military Herald) reprints from Aviation Digest, (Fort Rucker, Alabama, 1974-75), p. 116.

[6]U.S. Army, FM 1-5, Instrument Flying and Navigation For Army Aviators, (Draft), (Washington D.C.: Headquarters, Department of the Army, August 1975), p. 22-1.

[7]FM 90-1, p. 1-7.

[8]Tactics Sampler, p. 109.

[9]Tactics Sampler, p. 62.

[10]Tactics Sampler, p. 53.

[11]Letter, ATSW-TA-1, Headquarters Combined Arms Center (CAC) and Ft. Leavenworth, Subject: Concept Paper on Night Operations (U), August 1975, Para. 1, Part II, 1, "The Army's Goal in Night Operations."

[12]Letter, ATSW-TA-1.

CHAPTER II

[1]U.S. Army Concept Paper on Night Operations. (no date)

[2]U.S. Air Force Manual, AFM 11-1, Vol. I, US Air Force Glossary of Standardized Terms, (Headquarters: U.S. Air Force, Washington D.C., January 1973), p. 151.

[3]U.S. Air Force Manual, AFM 11-1

[4]Life Sciences Division, Army Research Office, Office of the Chief of Research and Development, A Study of Factors that Affect the Performance of Army Flight Crew Personnel, Interim Report, (Department of the Army, Washington, D.C., January 1969), p. 23.

[5]Sierra Research Corporation, HELO SKE, (Buffalo: December 1975), p. 3.

[6]HELO SKE, p.3.

CHAPTER IV

[1]U.S. Army Command and General Staff College, Course 5 Syllabus, Strategy Formulation, Vol. III, Academic Year 1975-76, p. 244.

[2]FM 90-1, p. 1-10.

[3]FM 90-1, p. 2-1.

[4]FM 90-1, p. 2-34.

[5]Joint Army-Navy Aircraft Instrumentation Research (JANAIR), Display Requirement Study for Helicopter IFR Formation Flight, (Technical Report No., NR 213-054, February, 1968), p. 174.

[6]FM 90-1, p. 2-17.

[7]FM 90-1, p. 2-23.

[8]FM 90-1, p. 2-33.

[9]FM 90-1, p. 2-33.

[10]Stress Study, p. 3.

[11]Stress Study, p. 26.

[12]U.S. Army Command and General Staff College, Reference Book (RB) 101-3, Logistic Management in Conus, (Ft. Leavenworth, October 1975), p. 3-2.

[13]RB 101-3, p. 3-3.

[14]RB 101-3, p. 3-3.

[15]RB 101-3, p. 3-3.

[16]RB 101-3, p. 3-3.

[17]RB 101-3, p. 3-5.

[18]RB 101-3, p. 3-6.

[19]Stress Study, p. 19, 20, 27.

[20]FM 90-1, p. 4-10.

CHAPTER V

[1]R. Martin, K. Fletcher, Lewis Michnick and Johannes Prast, History of Time Frequency/Technology, Sierra Research Corporation, Report No. TR-0647A, August 1967, p. 10.

[2]SKE/ZM Air Delivery System, Sierra Research Corporation Marketing Literature (ML) 155, January 1975, p. 2.

[3]JANAIR, p. 3.

[4]JANAIR, p.174.

[5]Martin, Fletcher, Michnick, and Prast, p. 10.

[6]Martin, Fletcher, Michnick, and Prast, p. 10.

[7]Martin, Fletcher, Michnick, and Prast, p. 10.

[8]Martin, Fletcher, Michnick, and Prast, p. 10.

[9]Martin, Fletcher, Michnick, and Prast, p. 10.

[10]Martin, Fletcher, Michnick, and Prast, p. 10.

[11]Martin, Fletcher, Michnick, and Prast, p. 10.

[12]Martin, Fletcher, Michnick, and Prast, p. 10.

[13]USAF Stationkeeping, p. 1.

[14]Martin, Fletcher, Michnick, and Prast, p. 13.

[15]Martin, Fletcher, Michnick, and Prast, p. 13.

[16]Martin, Fletcher, Michnick, and Prast, p. 13.

[17]Martin, Fletcher, Michnick, and Prast, p. 13.

[18]Martin, Fletcher, Michnick, and Prast, p. 13.

[19]Martin, Fletcher, Michnick, and Prast, p. 13.

[20]SKE/ZM Air Delivery System ML 155, p. 1.

[21]Martin, Fletcher, Michnick, and Prast, p. 13.

[22]Martin, Fletcher, Michnick, and Prast, p. 17.

[23]Martin, Fletcher, Michnick, and Prast, p. 1.

[24]Martin, Fletcher, Michnick, and Prast. p. 1.

[25]USAF Flight Manual, Technical Order (TO), 1C-130B-1, March, 1974, p. 4-166.

[26]USAF Flight Manual TO 1C-130B-1, p. 4-167.

[27]United States Air Force Stationkeeping, Sierra Research Corporation Marketing Literature, ML 153A, (no date), p. 562.

[28]USAF Stationkeeping, p. 562.

[29]USAF Stationkeeping, p. 562.

[30]USAF Stationkeeping, p. 22.

[31]USAF Stationkeeping, p. 562.

[32]USAF Stationkeeping, p. 562.

[33]USAF Stationkeeping, p. 558.

[34]Martin, Fletcher, Michnick, and Prast, p. 13.

[35]SKE/ZM Air Delivery System ML 155, p. 1.

[36]USAF Flight Manual, p. 4-166.

[37]USAF Flight Manual, p. 4-166.

[38]SKE/ZM Air Delivery System, p. 15.

[39]SKE/ZM Air Delivery System, p. 4.

[40]SKE/ZM Air Delivery System, p. 4.

[41]USAF Flight Manual, p. 4-166.

[42]USAF Stationkeeping, p. 4.

[43]USAF Stationkeeping, p. 4.

44 *USAF Stationkeeping*, p. 4.

45 *USAF Stationkeeping*, p. 9.

46 *USAF Stationkeeping*, p. 2.

47 *USAF Stationkeeping*, p. 3

48 USAF Flight Manual, p. 4-169.

49 *SKE/ZM Air Delivery System*, p. 16.

50 *SKE/ZM Air Delivery System*, p. 2.

CHAPTER VI

1 *HELO SKE* p. 3.

2 *HELO SKE* p. 3.

3 *HELO SKE* p. 3.

4 *HELO SKE* p. 6.

5 W.T. Lennon, Jr., *Helicopter Stationkeeping System* SNS-64/2-A, (Sierra Research Corporation, Technical Report ECOM-01408-F, December 1966), p. 50.

6 U.S. Army, FM 1-5, *Instrument Flying and Navigation for Army Aviators* (Draft) (Washington D.C.: Headquarters, Department of the Army, August 1975), p. 22-1.

7 "Tactical Instrument Flying - Why?" *United States Army Aviation Digest*, December 1975, p. 22-23.

8 *Army Aviation Digest*, December 1975, p. 22-23.

9 *Army Aviation Digest*, December 1975, p. 22-23.

10 FM 1-5, p. 22-1 - 22-3.

11 *USAF Stationkeeping*, p. 558.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. Books

Army Regulation. 310-25, Dictionary of United States Army Terms (Short title: AD). Department of the Army, June 1972.

This regulation is designed to assist in reaching a more common understanding of the meaning of terminology used extensively by the Army in Uniservice, Department of Defense (DOD), and International Standardization usage.

U.S. Air Force. Manual 11-1, US Air Force Glossary of Standardized Terms. Department of the Air Force, 1 January 1973.

This manual in four volumes provides an authorative source for terms and definitions which have been standardized for use within the US Air Force, as well as within Joint and International military structures.

U.S. Air Force. Flight Manual, Technical Order 1C-130B-1. Department of the Air Force, 1 March 1974.

This document provided some of the equipment capabilities and descriptions for the stationkeeping system AN/APN-169A.

U.S. Army. Field Manual 90-1, Employment of Army Aviation Units in a High Threat Environment. (Draft). Department of the Army, 15 October 1975.

A description of how Army Aviation units can make a major contribution to land combat in a high threat environment. In addition, it is designed to provide a broad doctrinal foundation for future publications.

U.S. Army. Field Manual 1-5, Instrument Flying and Navigation for Army Aviators. (Draft). Department of the Army, August 1975.

U.S. Army. Field Manual 1-1, Terrain Flying. Department of the Army, 1 October 1975.

This manual provides the doctrine for employing the Army helicopter. It addresses terrain flying techniques in adverse weather along with all the training objectives for terrain flying.

U.S. Army. Field Manual 100-5, Operations. Department of the Army, 15 December 1975.
This publication provided the insight for determining the combat ratios for conduct of the defense and offense.

U.S. Army. Regulation 95-1, Army Aviation: General Provisions and Flight Regulations. Department of the Army, 1 December 1973.
This regulation prescribes general flight regulations and requirements, air traffic rules, visual and instrument flight rules, and the operating procedures governing the command, control, and operation of Army aircraft.

B. DOCUMENTS

Army Research and Development. Interium Report, A Study of Factors that Affect the Performance of Army Flight Crew Personnel. Contract # DAHC 19-68-C-0001. January 1969.
(The findings in this report are not to be construed as an offical Department of the Army position.) This technical report identifies and reviews the factors that influence the performance proficiency of Army helicopter flight crew personnel. This report served to equate the requirements for human performance in the helicopter and the performance capacity for man.

Bates, Fletcher, Michnick, and Prast. Sierra Research Corporation Report No. TR-0647A, "History of Time-Frequency Technology". Sierra Research Corporation. Buffalo, New York, 1967.
This twenty page report presents the history of the development of time/frequency technology which has led to the present day stationkeeping-intraformation positioning equipment.

Joint Army-Navy Aircraft Instrumentation Research Evaluation of the Research Helicopter Number 2 (RH-2) Cockpit Mock-up. Technical Report, D228-410-001. August 1965.
This study represents one in a series of evaluations to determine the feasibility of the cockpit layout and sub-panel design in terms of accessibility.

Joint Army-Navy Aircraft Instrumentation Research. Technical Report, No. NR 213-054, "Display Requirements Study for Helicopter IFR Formation Flight". July 1967.
This report provided insight for the importance of the definition and demonstration of display formats appropriate for helicopter IFR formation flight. A display feasibility analysis was performed which indicated that the technology required to develop the selected display format is within the present state-of-the-art.

Lennon, W.T.,Jr. Technical Report, ECOM-01408-F. "Helicopter Stationkeeping System, SNS-64/2-A", Final Report. 1December 1966. Acquired through the Defense Documentation Center.

The results of this testing served as a basis for evaluating the stationkeeping capabilities for helicopters. The UH-19 test bed helicopters were used in this Military Potential Test.

Sierra Research Corporation Marketing Literature, ML-128. This brochure explains the SKE operation.

Sierra Research Corporation Marketing Literature, ML-152 SKE/DZM Air Delivery, System Growth Potential. September 1974.

Presents the N/AWS operation in C-130 and C-141 aircraft.

Sierra Research Corporation Marketing Literature, ML-155. January 1975.

This brochure presents the components of the Zone Marker and the SKE procedures for utilizing the Zone Marker.

Sierra Research Corporation Technical Proposal TP-1074. A Stationkeeping/Zone Marker Air Delivery System for C-130E SKE Aircraft. June 1973.

Based on these test results, it was concluded that the SKE/ZM technique is feasible for accomplishing IFR Air drop operations.

Stich, Ken and John Palmer. Research and Development Technical Report ECOM 7030. "Investigation of Night Vision Equipment Operations with ILLTV and FLIR Systems". November 1973.

This report presents the results of a series of helicopter flight experiments conducted by the Night Vision Laboratory.

U.S. Army. Concept Paper on Night Operations. S-30 Department of the Army, June 1975.

This series of concept papers provided the changing doctrine and new approach to night operations. The Army goal was derived from these concept papers. Only the unclassified information was presented.

U.S. Army. Training Circular, (TC) 1-28, "Rotary Wing Night Flight". Department of the Army, July 1975.

This publication provides the fundamental principles required for night transition. It explains the techniques and procedures of night rotary wing flight to train aviators for night, low-level-contour, and Nap-of-the-Earth (NOE) flight.

"Professional Journal of the US Army". Military Review.

U.S. Army Command and General Staff College, Fort Leavenworth, Kansas. January 1976.

This periodical presents a myriad of views, and has for the past fifty-four years. The views presented are those of individual authors and not necessarily those of the Department of Defense. Excellent source of new trends in doctrine.

"Tactics Sampler", reprints from Aviation Digest. U.S. Army Aviation Center, Fort Rucker, Alabama, 1974-75.

This is a reprint of articles assembled from the U.S. Army Aviation Digest Magazine and represents the doctrine and concepts of senior commanders, school commandants and Army aviators, and how they plan to provide support for the ground commander.

APPENDIX A

SUPPLEMENTAL BIBLIOGRAPHY

SUPPLEMENTAL BIBLIOGRAPHY

ADTC -TC-69-106, "AN/APN-169 Intraformation Positioning Radar Evaluation", Unclassified report, August 1969.

"Air-to-Air Stationkeeping/Air Delivery System Validation Tests for C-130 and C-141 Aircraft" Sierra Research Corporation, Technical Report No. TR-1038, 9 February 1973.

Air Tramsport Association of America: "Airborne Collision Avoidance System", An Airline Industry Document to provide the Statement of Airline Policy and Requirements and a Technical Description of the System. June 30, 1967.

APGC-TR-65-27, "Evaluation of SNS-64/2 Stationkeeping System in C-130E Aircraft", Unclasified report, April 1965.

Bagnall, James J., Jr., Fenton, Lawrence F., "Collision Avoidance System", U.S. Patent No. 3,167,772, filed 7/23/62.

Bates, M.R., "On Synchronization of Collision Avoidance Systems", Attachment D to Minutes of Fourth Meeting of the Air Transport Association of America; Collision Avoidance System Technical Working Group, Sierra Research Corporation TR-0622, April 1967.

Borrok, M.J., "EROS in Operation" Presentation at the Institute of Navigation National Air Meeting on Collision Advoidance, Dayton, Ohio, 23-24 February 1967.

"Design Feasibility Study of Helicopter and Stationkeeping Equipment (HUDAT), Final Report", Report No. NADC-EL-6011; 4 April 1960, U.S. Naval Air Development Center, Johnsville, Pa.

Graham, Walton, "Compatible Airborne Navigation-Air Traffic Control and Collision Avoidance System", U.S. Patent 3,255,900 filed 7/14/60.

______________, "Synchronization Communications System", U.S. Patent No. 3,262,111, filed 12/6/63.

"Helicopter Orientation and Stationkeeping Equipment (HUDAT), Tactical Service and Electronic Evaluation of", Report No. 1, Final Report; WEPTASK No. RUDC-e-B-201; 13 July 1961; Naval Air Test Center, U.S. Naval Air Station, Patuxent River, Maryland.

LaRochelle, P.J. "Technical Feasibility of Collision Avoidance Systems" Pages 9-15 in "Potential of Airborne Collision Prevention Devices" Report of the Proceedings of the Collision Prevention Advisory Group Symposium, 12-13 July 1962, Published by the Federal Aviation Agency, Washington, D.C.

Michnik, L., Frederick G. Reinagel. "One-way Range and Azimuth System for Stationkeeping" U.S. Patent No. 3,336,591 filed 12/21/64.

Minneman, Milton J., Arthur S. Westneat, Jr. "Synchronization System" U.S. Patent No. 2,869,121 filed 9/18/50.

O'Brien, W.J., D.E. Bridges. "Radio Range-Indicating Systems" U.S. Patent No. 2,838,753 filed 8/27/51.

Perkinson, Robert E., Wilbur H. Von Fange, Martin J. Borrok. "Synchronizing Means for Remotely Positioned Timing Devices" U.S. Patent No. 3,250,896 filed 4/16/62.

Prast, J.W., H.K. Fletcher, L. Michnik. "Discussion of Empirical Stationkeeping Performance Data of Interest for Airline Collision Avoidance Systems" Attachment G to Minutes of Second Meeting of the Air Transport Association of America, Collision Avoidance System Technical Working Group; Sierra Research Corporation TR-0615 Feburary 1967.

Prast, J.W., L. Michnik, S.H. Calhoun. "A Stationkeeping System for IFR Formation Flying" Journal of the American Helicopter Society Vol. 10, No. 1 Pages 5-12 January 1965.

______________. "One-way Ranging and Direction Finding for IFR Formation Stationkeeping" 1965 IEEE International Convention Record, Part 4, Pages 1-7.

Prast, J.W. "World-Wide Time, Drift Time, and Local Fine Synchronization in Collision Avoidance Systems" Attachment to Minutes of Sixth Meeting of the Air Transport Association of America. Collision Avoidance System Technical Working Group; Sierra Research Corporation TR-0629 May 1967.

Sierra Research Corporation. "All-Weather Formation Flight Through the AN/APN-169 Stationkeeper" Brochure No. ML-040.

______________. "Final Engineering Report, Intraformation Positioning Se[illegible] AN/APN-169" TP-0500, 15 March, 1965 Buffalo, New York.

Sikorsky Aircraft. "AN/APN-150 HUDAT Evaluation on SH-3A" Report No. SER-61886. 30 September 1963, Under Contract now 61-0931C.

TAC Test 66-161, Final Report. "Air-to-Air Stationkeeping in Tactical Airlift Operations" March 1969.

TAC Test 70A-037A, Test Order. "Adverse Weather Aerial Delivery System (AWADS)" August 1970.

TAC-TR-64-78. "Air-to-Air Stationkeeping in Tactical Assault Airlift Operations" Unclasified report. April 1965.

APPENDIX B

WEATHER DATA

PREPARED BY	USAFETAC	STATION NAME	NAVAL AAF GERMANY	PERIOD	MAY 46-DEC 72 B	STN LTRS	EDIO
NOVEMBER	1974	LOCATION	50C 10 E008 57	ELEV	367	WBAN NO	35009
						WMO NO.	10642

AWS CLIMATIC BRIEF

MONTH	TEMPERATURE (°F) MEAN DAILY MAX	MEAN DAILY MIN	MEAN MONTHLY	EXTREME MAX	EXTREME MIN	PRECIPITATION (IN) MONTHLY MEAN	MONTHLY MAX	MONTHLY MIN	MAX 24 HRS	SNOWFALL (IN) MONTHLY MEAN	MONTHLY MAX	MAX 24 HRS	MEAN RELATIVE HUMIDITY (%) LST 04	LST 13	MEAN VAPOR PRESSURE (IN Hg)	MEAN DEW PT (°F)	PRESSURE ALTITUDE (FT) 99.95%	SURFACE WINDS PVLG DRCTN (16 PT)	SPEED MEAN (KT)	SPEED MAX (KT) **	MEAN CLOUD COVER (tenths)	MEAN NUMBER OF DAYS: PRECIP ≥ 0.01	PRECIP ≥ 0.5	SNOWFALL ≥ 0.1	SNOWFALL ≥ 1.5	THUNDERSTORMS	FOG VSBY < 7 MI	TEMP MAX ≥ 90	TEMP MAX ≥ 80	TEMP MIN ≤ 32	TEMP MIN ≤ 00
JAN	37	29	33	57∂	-4∂	1.6	[illegible]	.8	.6	5	8	4	86	81	.16	29	1250	$ SW	4	33	8	15	#	6	1	#	21	0	0	18	#
FEB	42	32	37	64∂	0	1.8	2.8	.3	.4	5	18	5	85	76	.17	31	1450	$ SW	5	44	8	14	0	4	1	#	18	0	0	13	#
MAR	49	35	43	77	9∂	1.6	1.9	.7	.7	2	6	3	83	67	.20	34	1200	$ SW	6	50	7	16	#	2	#	1	17	0	0	11	0
APR	58	41	50	87	23∂	2.6	4.1	2.0	1.2	#	1	1	82	60	.25	40	1150	$ SW	5	42	7	15	1	#	0	2	15	0	1	3	0
MAY	66	48	57	90	32	2.6	3.1	1.6	.8	0	0	0∂	86	58	.32	47	900	$ W	5	41	7	14	1	0	0	4	16	#	2	#	0
JUN	72	53	63	94	38∂	3.1	5.1	.0	2.2	0	0	0	88	58	.39	52	800	$ W	4	36	7	14	2	0	0	5	[illegible]	#	6	0	0
JUL	75	56	66	97∂	43∂	2.3	4.8	.7	1.4	0	0	0	89	59	.45	56	750	$ W	4	42	7	11	1	0	0	4	17	2	10	0	0
AUG	74	55	65	96	42∂	2.6	4.9	.3	1.1∂	0	0	0∂	89	62	.44	55	800	$ SW	4	31	7	16	1	0	0	4	19	1	7	0	0
SEP	68	50	59	87∂	35∂	2.1	4.1	.6	1.7	0	0	0∂	91	66	.38	51	900	$ SW	3	30	6	10	1	0	0	2	22	0	2	0	0
OCT	58	43	51	79∂	27∂	1.5	3.6	.2	1.5	#	#	#	90	72	.30	45	1000	$ SW	3	32	7	9	#	0	0	#	24	0	0	2	0
NOV	46	37	42	69∂	16	2.4	4.3	.8	1.8	2	8	5	88	79	.22	37	1300	$ SW	4	42	8	14	1	3	1	0	22	0	0	7	0
DEC	39	32	36	61∂	0	2.2	5.5	.5	1.7	5	9	6	87	82	.17	31	1400	$ SW	4	36	8	14	1	5	1	0	23	0	0	15	#
ANN	57	43	50	97∂	-4∂	25.8	5.5	.0	2.2	19	18	6	87	68	.28	43	1100	$ SW	4	50	7	158	9	20	4	22	230	3	28	69	#
YRS	16	16	16	16	16	8	8	8	8	10	10	10	14	17	17	17	17	17	17	6	15	8	8	10	10	10	10	16	16	16	16

REMARKS RUSSWO FOR:
HRLY OBS: MAY-AUG 46, APR 56, OCT 56-DEC 72
DAILY OBS: MAY-AUG 46, APR 56, OCT 56-FEB 64, JUN 64, AUG 64-DEC 72

NOTE: * DATA NOT AVAILABLE # AMTS < UNITS SHOWN IN HEADING ** INSTANTANEOUS PEAK WINDS $ % CALM GRTR % PLVG DRCTR ∂ BASED ON < FULL MONTHS

CAV FREQ (%)	HRS LST	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	YRS
CEILING LESS THAN 3000 FT AND/OR VISIBILITY LESS THAN 3 MI	00-02	55	37	26	18	13	15	13	16	27	42	49	51	30	10
	03-05	58	44	35	31	25	24	24	29	39	52	53	56	39	14
	06-08	59	54	46	37	28	26	25	32	46	59	60	62	45	17
	09-11	63	54	44	34	23	21	19	25	33	53	61	69	42	17
	12-14	56	48	34	24	18	16	13	14	19	37	54	61	33	17
	15-17	54	41	25	17	9	10	9	8	10	28	48	59	27	17
	18-20	55	35	21	12	6	[illegible]	6	6	12	35	50	58	25	16
	21-23	55	31	18	13	8	[illegible]	9	8	16	38	48	56	26	12
	ALL HRS	57	43	31	23	16	17	15	17	25	43	53	59	33	
CEILING LESS THAN 1500 FT AND/OR VISIBILITY LESS THAN 3 MI	00-02	43	30	14	11	10	10	11	12	25	34	39	37	23	10
	03-05	46	34	21	23	19	20	21	26	37	43	42	42	31	14
	06-08	44	41	33	30	21	20	21	20	42	50	45	47	35	17
	09-11	50	44	31	21	11	10	9	14	26	43	45	53	30	17
	12-14	42	33	16	7	4	6	3	5	10	25	36	45	19	17
	15-17	39	27	11	3	3	3	2	3	5	19	32	43	16	17
	18-20	44	24	10	4	4	3	2	3	8	28	37	42	17	16
	21-23	42	23	9	8	6	7	6	4	14	31	37	40	19	12
	ALL HRS	44	32	18	13	10	10	9	12	21	34	39	44	24	
CEILING LESS THAN 1000 FT AND/OR VISIBILITY LESS THAN 2 MI	00-02	23	15	4	4	3	6	5	7	15	23	20	22	12	10
	03-05	27	20	10	10	10	11	12	14	23	31	23	24	18	14
	06-08	28	29	18	15	10	11	12	15	28	39	28	29	22	17
	09-11	35	30	16	8	5	4	3	6	15	29	31	34	18	17
	12-14	29	22	7	2	1	3	1	2	4	15	20	26	11	17
	15-17	25	17	5	1	1	1	1	1	2	11	19	27	9	17
	18-20	27	14	5	1	1	1	1	2	4	17	21	27	10	16
	21-23	23	12	3	2	2	3	2	3	7	19	21	25	10	12
	ALL HRS	27	20	9	5	4	5	5	6	12	23	23	27	14	
CEILING LESS THAN 300 FT AND/OR VISIBILITY LESS THAN 1/2 MI	00-02	2	2	1	1	1	1	1	2	2	10	3	3	2	10
	03-05	3	2	1	2	2	3	2	4	7	12	4	4	4	14
	06-08	3	6	3	3	2	2	3	4	10	18	5	4	5	17
	09-11	5	8	2	1	#	#	#	#	2	11	5	6	3	17
	12-14	4	3	#	0	0	0	0	0	#	2	2	4	1	17
	15-17	4	2	0	0	0	0	0	#	0	1	2	5	1	17
	18-20	4	2	#	0	0	0	0	0	#	5	3	4	2	16
	21-23	2	1	0	#	#	#	1	1	#	7	3	3	2	12
	ALL HRS	3	3	1	1	1	1	1	1	3	8	3	4	3	

PREPARED BY USAFETAC NOVEMBER 1974	STATION NAME LOCATION	ZWEIBRUCKEN AB GERMANY N49 13 E007 24	PERIOD ELEV	OCT 54-DEC 72 B 1132	STN LTRS WBAN NO WMO NO	EDAR 34058 10714

AWS CLIMATIC BRIEF

MONTH	TEMPERATURE (°F) MEAN DAILY MAX	MEAN DAILY MIN	MEAN MONTHLY	EXTREME MAX	EXTREME MIN	PRECIPITATION (IN) MONTHLY MEAN	MONTHLY MAX	MONTHLY MIN	MAX 24 HRS	SNOWFALL (IN) MONTHLY MEAN	MONTHLY MAX	MAX 24 HRS	MEAN RELATIVE HUMIDITY (%) LST 03	LST 12	MEAN VAPOR PRESSURE (IN Hg)	MEAN DEW PT (°F)	PRESSURE ALTITUDE (FT) 99.95%	SURFACE WINDS PVLG DRCTN (16 PT)	SPEED MEAN (KT)	SPEED MAX (KT) **	MEAN CLOUD COVER (tenths)	PRECIP ≥ 0.01	PRECIP ≥ 0.5	SNOWFALL ≥ 0.1	SNOWFALL ≥ 1.5	THUNDERSTORMS	FOG VSBY < 7 MI	TEMP MAX ≥ 90	TEMP MAX ≥ 80	TEMP MIN ≤ 32	TEMP MIN ≤ 0
JAN	36	25	33	55	0	1.5	2.3	.8	.5	3	6	2	88	84	.16	29	2050	SW	8	51	8	12	0	5	*	*	24	0	0	21	*
FEB	40	30	35	67	0∂	1.7	3.9	.7	1.1∂	3	8	3∂	87	78	.17	30	2150	SW	8	36	7	11	1	3	1	0	19	0	0	17	*
MAR	47	34	41	76	6	1.3	1.8	.9	.4	[illegible]	6	2	85	68	.19	33	1900	SW	7	38	7	12	0	4	1	0	14	0	0	13	0
APR	59	40	48	81	25	1.8	2.3	.8	.5∂	2	5	2∂	84	61	.23	38	1800	SW	7	36	7	13	*	1	*	1	14	0	*	4	0
MAY	63	46	55	86	30	4.9	6.8	2.9	3.4∂	0	0	0∂	86	59	.29	44	1600	SW	6	42	7	15	3	0	0	4	15	0	1	*	0
JUN	68	52	60	88	36	3.4	4.6	2.3	1.2	0	0	0∂	88	61	.38	51	1500	SW	6	46	6	15	2	0	0	5	16	0	3	[illegible]	[illegible]
JUL	72	55	64	94	40∂	1.8	2.6	.8	.6∂	0	0	0∂	88	60	.42	54	1450	SW	6	46	6	10	*	0	0	7	13	1	6	[illegible]	0
AUG	70	54	62	92	41	2.0	2.8	1.3	.6	0	0	0∂	91	63	.42	54	1500	SW	6	58	6	11	*	0	0	6	17	*	4	[illegible]	[illegible]
SEP	66	50	58	87	34	1.0	1.2	.6	.6	0	0	0∂	90	65	.36	50	1500	SW	6	34	6	7	*	0	0	2	19	0	1	[illegible]	[illegible]
OCT	56	43	50	78	25	1.1	1.5	.5	.8	0	0	0∂	91	74	.29	44	1750	SW	6	37∂	7	10	*	0	0	*	19	0	0	2	0
NOV	44	36	40	68	17	3.6	6.7	1.9	1.6	5	11	4	90	82	.21	36	1950	SW	7	50	8	15	2	3	2	0	19	0	0	12	0
DEC	38	32	35	74	7	1.3	2.1	.6	.9	5	11	6	90	85	.17	31	2150	SW	8	41	8	10	1	3	1	0	24	0	0	19	[illegible]
ANN	55	41	48	94	0	25.4	6.8	.5	3.4∂	20	11	6	88	70	.26	41	1800	SW	7	58	7	141	9	19	5	25	215	1	15	95	[illegible]
EYR	18	18	18	18	18	3	3	3	3	3	3	3	17	18	18	18	19	18	18	2	16	3	3	3	3	3	3	18	18	18	1[illegible]

REMARKS

HRLY OBS
AND OCT 54-JUN 66, OCT 66-MAY 69
DAILY OBS OCT 69-DEC 72

NOTE * DATA NOT AVAILABLE = AMTS < UNITS SHOWN IN HEADING ** INSTANTANEOUS PEAK WINDS $ % CALM GRTR % PVLG DRCTN ∂ BASED ON < FULL MONTHS

CAV FREQ (%)	HRS LST	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CEILING LESS THAN 3000 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	69	56	40	27	17	23	20	25	36	51	55	72	42	17
	03-05	72	61	50	37	30	37	32	39	49	60	70	76	51	17
	06-08	75	68	58	47	40	42	37	46	55	67	73	77	57	18
	09-11	75	71	59	48	37	37	32	40	46	64	74	77	55	18
	12-14	71	64	49	37	26	25	24	30	32	48	64	74	45	18
	15-17	66	53	37	24	15	17	13	15	19	33	56	69	35	18
	18-20	66	48	32	20	10	14	11	12	16	33	56	70	32	17
	21-23	67	49	32	20	12	15	13	15	23	40	59	71	35	17
	ALL HRS	70	59	45	33	23	26	23	28	35	50	65	73	44	
CEILING LESS THAN 1500 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	57	47	29	20	12	18	16	22	31	45	57	62	35	17
	03-05	62	49	39	29	24	31	28	35	44	53	62	65	43	17
	06-08	65	56	49	39	33	36	32	41	50	61	64	67	49	18
	09-11	66	61	45	34	20	24	18	28	37	56	65	69	44	18
	12-14	60	49	28	18	8	12	9	11	18	32	51	63	30	18
	15-17	54	39	20	12	5	8	5	7	10	21	42	56	23	18
	18-20	54	37	19	11	5	8	5	7	11	25	45	55	24	17
	21-23	54	40	22	14	6	11	9	11	18	33	49	57	27	17
	ALL HRS	59	47	31	22	14	19	15	20	27	41	54	62	34	
CEILING LESS THAN 1000 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	43	35	18	10	7	11	11	15	21	31	40	47	24	17
	03-05	48	38	26	19	14	21	18	26	31	39	45	49	31	17
	06-08	48	44	35	28	21	24	22	32	40	49	48	52	37	18
	09-11	51	47	30	21	11	14	10	16	25	42	47	55	31	18
	12-14	46	36	16	9	5	5	4	6	9	21	34	50	20	18
	15-17	40	28	11	6	2	4	3	4	7	13	28	40	16	18
	18-20	40	27	12	6	3	5	3	4	6	16	32	39	16	17
	21-23	41	29	13	7	4	6	5	6	11	22	34	40	16	17
	ALL HRS	45	35	20	13	8	11	10	14	19	29	39	47	24	
CEILING LESS THAN 200 FT AND OR VISIBILITY LESS THAN 1/2 MI	00-02	8	4	1	1	1	1	1	2	3	8	9	12	4	17
	03-05	10	6	2	2	2	5	2	4	6	11	12	14	6	17
	06-08	13	10	4	4	3	4	2	5	8	17	13	15	8	18
	09-11	12	9	3	1	*	1	*	1	4	12	11	14	6	18
	12-14	6	5	1	0	*	*	*	*	*	2	5	8	2	18
	15-17	6	3	1	*	0	0	*	0	0	*	4	8	2	18
	18-20	6	4	1	*	0	*	*	*	*	1	6	8	2	17
	21-23	6	3	1	*	*	*	*	*	1	4	8	10	3	17
	ALL HRS	8	6	2	1	1	1	1	2	3	7	9	11	4	

AWS CLIMATIC BRIEF

Prepared by ETAC (JAN 1971)

BAD TÖLZ AAF, GERMANY

N 47 46 E 11 36

PERIOD: 1934-67B

ELEVATION: 2360 ft

WBAN # 34197

WMO # 10971

STN LTRS: EDOV

MONTH	TEMPERATURE (°F) Extreme Maximum[1]	Mean	Mean Daily Minimum	Extreme Minimum[1]	PRECIPITATION (in) Mean Total	Maximum in 24 Hours	Mean Snowfall	Max Snowfall in 24 Hours	WIND (KT) Prevailing Direction	Mean Speed	Extreme Speed (Max Wind)[2]	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (In Hg)	Pressure Altitude[3] 99.95% (Feet)	MEAN NUMBER OF DAYS Precip ≥ 0.8[4]	Precip ≥ 2.0[4]	Snowfall ≥ [5]	Snowfall ≥ [5]	Thunderstorms	Fog	TEMPERATURE (°F) Maximum ≥	Maximum ≥	Minimum ≤	Minimum ≤	Mean Clouds (Tenths)
JAN	56	28		-13					W	4	21	89	75	23	.12	3450	1	#									7
FEB	66	35		-5					W	5	33	81	67	27	.15	3450	1	0									7
MAR	64	37		1					W	5	27	89	63	27	.15	3300	1	#									7
APR	70	47		27					W	5	27	88	60	37	.22	3000	1	0									7
MAY	76	53		33					W	5	21	87	62	43	.28	2800	2	#									7
JUN	90	63		33					W	5	21	85	58	50	.36	2700	3	#									7
JUL	88	62		43					W	4	16	86	63	51	.38	2700	2	#									8
AUG	94	60		37					W	4	21	88	66	51	.38	2750	3	#									7
SEP	84	57		31					ENE	4	21	90	68	50	.36	2800	2	#									6
OCT	78	50		25					ENE	4	21	90	70	42	.27	3000	1	#									6
NOV	72	36		9					W	5	27	89	75	30	.17	3100	1	0									8
DEC	48	32		3					W	5	21	89	77	27	.15	3400	1	0									8
ANN	94	45	*	-13	*	*	*	*	W	5	33	88	67	37	.22	3050	19	#	*	*	*	*	*	*	*	*	7
EYR	3	3		3					3	3	3	3	3	3	3	10	14	14									2

REMARKS

[1] Refers to highest and lowest hourly temperature class interval

[2] Refers to highest hourly wind speed class interval

[3] Munich pressure data base used (1951-60)

[4] 2WWg, Feb 1955, Spl Sumry Num 2, Intense PCPN Data, Germany (POR: 1934-41, 1949-54)

RUSSWO POR: Hrly Obs: Sep 64 - Feb 67, Daily Obs: None

NOTE; *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and / or VSBY less than 3 miles	00 - 02	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	03 - 05	48	23	53	41	48	34	30	34	43	50	51	44	42	2
	06 - 08	46	30	47	43	44	32	25	32	42	51	56	48	41	3
	09 - 11	42	40	42	44	43	28	25	37	27	39	55	51	39	3
	12 - 14	38	43	47	42	45	29	27	37	24	34	53	46	39	3
	15 - 17	46	40	45	31	38	24	29	28	24	36	53	48	37	2
	18 - 20	52	21	43	32	30	28	23	28	28	36	47	48	35	2
	21 - 23	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	MEAN OF LISTED HOURS	45	33	46	39	41	29	26	33	31	41	53	48	39	
CIG less than 1500 feet and / or VSBY less than 3 miles	00 - 02	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	03 - 05	35	14	37	21	29	20	14	16	31	46	47	33	29	2
	06 - 08	35	22	31	25	27	19	8	21	24	46	48	34	28	3
	09 - 11	31	31	26	27	21	14	9	19	17	36	46	35	26	3
	12 - 14	29	28	24	15	16	7	7	17	12	30	42	29	21	3
	15 - 17	27	25	23	16	15	6	8	11	7	29	39	28	20	2
	18 - 20	32	11	25	17	12	10	9	19	10	33	37	20	20	2
	21 - 23	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	MEAN OF LISTED HOURS	32	22	28	20	20	13	9	17	17	37	43	30	24	
CIG less than 1000 feet and / or VSBY less than 2 miles	00 - 02	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	03 - 05	22	11	30	14	13	14	9	13	24	39	33	23	20	2
	06 - 08	25	18	22	18	11	12	3	13	19	41	38	19	20	3
	09 - 11	21	23	18	14	8	9	4	12	11	28	31	24	17	3
	12 - 14	18	15	17	9	7	4	3	8	9	19	29	18	13	3
	15 - 17	16	13	16	9	8	2	5	5	4	18	31	21	12	2
	18 - 20	18	4	16	15	7	3	5	7	4	22	33	9	12	2
	21 - 23	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	MEAN OF LISTED HOURS	20	14	20	13	9	7	5	10	12	28	32	19	16	
CIG less than 200 feet and / or VSBY less than ½ mile	00 - 02	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	03 - 05	2	3	10	3	2	2	4	5	10	19	9	2	6	2
	06 - 08	4	3	4	4	1	0	1	4	8	15	5	4	4	3
	09 - 11	2	3	2	2	0	0	0	0	1	3	4	2	2	3
	12 - 14	0	1	3	0	0	0	0	0	0	0	2	2	1	3
	15 - 17	#	2	4	0	0	0	0	0	0	1	3	3	1	2
	18 - 20	2	0	3	1	0	0	2	0	2	2	7	0	2	2

AWS CLIMATIC BRIEF

Prepared by ETAC (MAR 1972)

BAD KREUZNACH AAF, GERMANY — PERIOD: 1959-70[1] — WBAN # 34070 — WMO #

N 49 51 E 07 53 — FIELD ELEVATION: 345 ft — STN LTRS: EDEH

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM[2]	MEAN DAILY MAXIMUM[3]	MEAN DAILY MINIMUM[3]	EXTREME MINIMUM[2]	PRECIPITATION (in) MEAN TOTAL[3]	MAXIMUM IN 24 HOURS	MEAN SNOWFALL[3]	MAX SNOWFALL IN 24 HOURS[3]	WIND (KT) PREVAILING DIRECTION	MEAN SPEED	EXTREME (MAX) SPEED (WIND)[4]	MEAN RELATIVE HUMIDITY (%) 0400	1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE (Feet) 99.95%	MEAN NUMBER OF DAYS PRECIP ≥ 0.01[3]	PRECIP ≥ 0.5[3]	SNOWFALL ≥ [3]	SNOWFALL ≥ [3]	THUNDERSTORMS	FOG	TEMPERATURE (°F) MAXIMUM ≥	MAXIMUM ≥	MINIMUM ≤	MINIMUM ≤	MEAN CLDNS (TENTHS)
JAN	58	37	28	-3	1.8	0.6	4	5	WSW	5	27	85	80	29	.16	1250	13	#									8
FEB	66[3]	40	27	-3	1.1	0.9	4	3	WSW	5	33	85	76	30	.17	1400	10	#									8
MAR	74	50	32	5	1.6	0.4	3	2	W	6	33	86	66	34	.20	1200	10	0									7
APR	86	61	38	25	1.7	0.8	#	2	WSW	6	27	86	60	40	.25	1100	11	#									7
MAY	90	66	43	31	2.1	0.7	#	#	W	6	21	87	56	46	.31	850	11	1									7
JUN	92	72	49	35	2.4	1.4	0	0	WSW	5	27	88	56	52	.39	750	11	1									7
JUL	96	74	53	41	2.3	0.6	0	0	W	5	27	88	55	54	.42	750	12	#									7
AUG	96	73	52	41	2.9	2.4	0	0	WSW	5	27	89	57	54	.42	800	13	2									7
SEP	88[3]	68	47	30	2.8	1.5	0	0	WSW	4	21	91	63	52	.39	850	12	1									6
OCT	80	58	42	23	1.3	1.4	#	#	WSW	4	27	92	73	46	.31	1000	10	1									7
NOV	66	47	36	17	2.8	0.8	#	1	SW	5	33	87	80	37	.22	1300	13	2									8
DEC	62	41	29	7	1.6	0.4	2	3	WSW	5	33	86	81	30	.17	1400	14	0									8
ANN	96	57	40	-3	24.4	2.4	13	5	WSW	5	33	88	67	42	.27	1100	140	8									7
EYR	11	11	11	11	3	5	3	2	11	11	11	11	11	11	11	10	3	3									11

REMARKS

[1] Station took hourly obsns, but generally: 0500-1800 hours, Mon-Fri.
[2] Extreme limit of 2°F class interval.
[3] Estimates from surrounding stations.
[4] Highest hourly wind speed class interval.

RUSSWO POR: HRLY OBS: 5911-7012; DAILY OBS: 6004-09, 6401-12, 6501-02, 6504-11, 6603-12, 6702-12, 6801-7012

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02														
	03-05	49	58	56	38	18	14	15	26	44	63	51	57	41	5
	06-08	64	54	50	29	21	18	19	26	49	64	58	62	43	11
	09-11	64	56	49	27	18	15	13	18	41	59	64	64	41	11
	12-14	60	50	40	24	16	14	12	13	24	44	55	66	35	11
	15-17	58	43	31	18	11	13	10	8	13	35	48	63	29	11
	18-20	63	39	29	15	7	9	8	7	14	40	55	67	29	9
	21-23														
	MEAN OF LISTED HOURS	58	50	43	25	15	14	13	16	31	51	55	63	36	
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02														
	03-05	34	41	35	27	11	8	10	17	40	53	33	38	29	5
	06-08	49	42	34	20	14	12	13	21	44	55	43	45	33	11
	09-11	49	44	33	15	7	6	6	9	35	50	48	48	29	11
	12-14	46	37	20	5	2	2	3	3	14	33	37	45	21	11
	15-17	44	29	13	3	1	1	2	2	6	24	32	44	17	11
	18-20	52	28	18	5	2	2	1	2	10	34	44	51	21	9
	21-23														
	MEAN OF LISTED HOURS	46	37	26	13	7	5	6	9	25	42	40	45	25	
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02														
	03-05	23	25	26	12	7	2	2	5	30	45	25	25	19	5
	06-08	34	28	21	8	6	5	6	11	31	42	30	30	21	11
	09-11	36	31	21	5	2	2	2	4	20	37	33	34	19	11
	12-14	31	23	9	2	#	1	1	1	6	20	24	29	12	11
	15-17	29	20	5	1	#	1	0	#	2	13	21	26	10	11
	18-20	33	17	10	#	#	1	0	1	5	21	26	31	12	9
	21-23														
	MEAN OF LISTED HOURS	31	24	15	5	3	2	2	4	16	30	27	29	16	
CIG less than 200 feet and/or VSBY	00-02														
	03-05	5	2	4	3	1	1	1	1	10	18	8	10	5	5
	06-08	9	8	4	3	1	1	1	1	12	24	10	6	7	11
	09-11	11	8	2	#	0	#	0	#	4	17	10	7	5	11
	12-14	8	3	#	0	0	0	#	0	#	2	5	5	2	11
	15-17	7	5	#	0	0	0	0	0	#	2	5	6	2	[illegible]

CB DATED APR 70 OBSOLETE

PREPARED BY: USAFETAC JUNE 1974	STATION NAME: BITBURG AB GERMANY	LOCATION: N49 57 E006 34	PERIOD: APR 52–JUL 72	ELEV: 1228	STN LTRS: EDAB	WBAN NO: 34049	WMO NO: 10610

AWS CLIMATIC BRIEF

MONTH	TEMPERATURE (°F) MEAN DAILY MAX	MEAN DAILY MIN	MEAN MONTHLY	EXTREME MAX	EXTREME MIN	PRECIPITATION (IN) MONTHLY MEAN	MONTHLY MAX	MONTHLY MIN	MAX 24 HRS	SNOWFALL (IN) MONTHLY MEAN	MONTHLY MAX	MAX 24 HRS	MEAN RELATIVE HUMIDITY (%) LST 03	LST 12	MEAN VAPOR PRESSURE (IN Hg)	MEAN DEW PT (°F)	PRESSURE ALTITUDE (FT) 99.95	SURFACE WINDS PVLG DRCTN (16 PT)	SPEED MEAN (KT)	SPEED MAX (KT) **	MEAN CLOUD COVER (tenths)	MEAN NUMBER OF DAYS OCCURRENCE OF: PRECIP (IN) ≥ 0.01	PRECIP ≥ 0.5	SNOWFALL (IN) ≥ 0.1	SNOWFALL ≥ 1.5	THUNDERSTORMS	FOG VSBY < 7 MI	TEMPERATURE (°F) MAX ≥ 90	MAX ≥ 80	MIN ≤ 32	MIN ≤ 0
JAN	35	28	32	51	-3	2.3	5.3	.7	1.0	7	19	5	88	83	.15	28	2200	E	8	56	8	17	#	8	2	#	23	0	0	22	#
FEB	39	29	34	63	-3	2.2	5.4	.1	1.1	7	21	8	85	76	.15	28	2350	E	8	60	8	14	1	7	1	#	19	0	0	17	#
MAR	46	33	40	72	7	1.8	3.6	.1	1.0	3	17	6	83	65	.18	32	2100	E	8	58	7	13	1	6	1	#	18	0	0	14	0
APR	56	39	47	82	22	1.7	3.1	.3	.9	1	5	3	83	60	.22	37	1950	SW	8	50	7	13	#	1	#	1	14	0	#	5	0
MAY	61	45	53	85	28	2.3	5.7	1.0	1.2	#	1	1	85	58	.28	43	1700	W	7	47	7	13	1	#	0	3	15	0	1	1	0
JUN	[illegible]	[illegible]	[illegible]	91	35	[illegible]	[illegible]	[illegible]	2.0	#	#	#	85	60	.35	49	[illegible]	W	6	50	7	13	2	0	0	4	16	#	2	0	0
JUL	70	54	62	96	40	2.8	5.3	1.3	3.3	0	0	0	88	60	.39	52	1650	W	6	54	7	12	2	0	0	5	17	1	4	0	0
AUG	69	53	61	88	39	2.6	4.3	1.1	1.6	0	0	0	90	63	.40	53	1700	SW	6	46	7	14	1	0	0	4	20	0	3	0	0
SEP	66	49	57	86	34	2.0	3.9	.1	2.5	#	#	#	90	67	.35	49	1700	W	6	45	6	12	1	0	0	1	22	0	1	0	0
OCT	55	42	49	76	26	1.9	4.3	.1	1.6	#	#	#	91	74	.29	44	1900	SW	7	48	7	12	1	0	0	#	25	0	0	2	0
NOV	44	35	40	65	15	2.7	6.5	.6	2.1	2	11	5	90	81	.21	36	2150	E	8	49	8	17	1	3	#	#	24	0	0	11	0
DEC	37	30	34	58	8	2.6	7.4	.3	1.2	9	15	8	89	85	.17	31	2350	SW	8	56	8	16	1	6	1	#	24	0	0	18	0
ANN	56	40	47	96	-3	27.4	7.4	.1	[illegible]	[illegible]	21	8	87	[illegible]	.25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7	166	12	29	[illegible]	18	[illegible]	[illegible]	[illegible]	90	[illegible]
EYR	19	19	19	19	19	20	20	20	20	20	20	20	20	20	20	20	[illegible]	20	20	13	19	20	20	20	20	19	19	19	19	19	19

REMARKS: RUSSWO POR:
HRLY OBS: APR 52–JUL 72
AND (12 OBS/DAY: SEP-NOV 58, 10 OBS/DAY: AUG-OCT 68,
DAILY OBS: 16 OBS/DAY: APR-JUN 71)

NOTE: *DATA NOT AVAILABLE #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT AS APPLICABLE ** INSTANTANEOUS PEAK WINDS [illegible]

CAV FREQ (%)	HRS LST	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CEILING LESS THAN 3000 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	68	59	39	26	20	19	16	24	32	51	66	73	41	
	03-05	70	63	48	35	32	31	34	39	45	61	72	74	50	
	06-08	74	68	58	41	39	36	39	49	57	71	76	77	57	
	09-11	73	67	52	41	33	32	34	39	44	64	74	77	53	
	12-14	68	57	40	31	21	22	23	25	28	46	62	74	41	
	15-17	64	50	31	22	13	16	13	15	18	34	57	68	33	
	18-20	62	49	29	19	11	13	11	12	17	34	54	69	32	
	21-23	61	50	32	20	16	12	12	15	22	39	59	71	34	
	ALL HRS	68	58	41	29	23	23	23	27	33	50	65	73	43	20
CEILING LESS THAN 1500 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	54	45	26	16	12	13	11	17	24	42	51	59	31	
	03-05	56	49	34	25	23	26	27	31	36	52	57	62	40	
	06-08	60	53	44	30	27	26	28	40	49	62	64	64	46	
	09-11	61	54	34	20	13	12	12	19	28	49	59	65	36	
	12-14	53	42	19	11	5	8	5	8	12	26	44	58	26	
	15-17	49	36	16	9	4	6	4	5	9	21	40	54	21	
	18-20	47	34	16	10	5	7	5	6	10	23	39	53	21	
	21-23	49	37	18	12	6	8	6	10	15	29	46	56	26	
	ALL HRS	54	44	26	17	12	13	12	17	23	38	50	59	30	20
CEILING LESS THAN 1000 FT AND OR VISIBILITY LESS THAN 2 MI	00-02	41	30	15	9	6	8	5	12	16	30	35	46	21	
	03-05	42	37	22	14	15	16	16	22	26	39	41	50	28	
	06-08	44	40	28	17	16	15	16	25	31	47	47	51	31	
	09-11	44	38	17	10	6	6	5	9	15	34	42	50	23	
	12-14	37	27	9	5	3	4	3	3	6	16	28	42	15	
	15-17	36	21	7	5	2	3	2	3	5	12	26	38	13	
	18-20	34	21	9	5	2	3	3	3	6	13	26	38	14	
	21-23	37	22	11	7	3	4	3	6	9	19	30	42	16	
	ALL HRS	39	30	15	9	7	7	7	10	14	26	34	45	20	20
CEILING LESS THAN 200 FT AND/OR VISIBILITY LESS THAN 1/2 MI	00-02	11	5	1	1	1	1	#	2	3	10	10	13	5	
	03-05	11	7	3	2	4	3	4	6	6	15	12	14	7	
	06-08	12	9	6	3	3	2	2	5	8	20	15	15	8	
	09-11	11	8	1	#	#	#	0	#	1	10	12	13	5	
	12-14	8	3	1	#	#	#	0	#	#	1	5	10	2	
	15-17	7	3	1	0	#	0	0	#	#	1	4	9	2	
	18-20	8	3	1	#	#	0	0	0	#	2	6	10	3	
	21-23	8	3	1	#	#	#	#	1	1	5	7	11	3	
	ALL HRS	10	5	2	1	1	1	1	2	2	6	9	12	5	20

AWS CLIMATIC BRIEF

Prepared by ETAC (APR 1972)

COLEMAN AAF/MANNHEIM-SANDHOFEN, GERMANY — PERIOD: 1959-70[1]

N 49 34 E 08 28 — FIELD ELEVATION: 314 ft

WBAN # 34068 — WMO # — STN LTRS: EDOP

MONTH	Temp (°F) Extreme Maximum	Mean Daily Maximum	Mean Daily Minimum	Extreme Minimum	Precip (in) Mean Total	Maximum in 24 Hours	Mean Snowfall	Max Snowfall in 24 Hours	Wind (KT) Prevailing Direction	Mean Speed	Extreme Speed (Peak) (Gust)	Mean Relative Humidity (%) 0400	Mean Relative Humidity (%) 1300	Mean Dew Point (°F)	Mean Vapor Pressure (in Hg)	Pressure Altitude 99.95% (Feet)	Mean No. of Days Precip ≥ 0.01	Precip ≥ 0.5	Snowfall ≥ 0.1	Snowfall ≥ 1.5	Thunderstorms	Fog	Temp Max ≥ 86	Temp Max ≥ 77	Temp Min ≤ 32	Temp Min ≤ 0	Mean Clouds (Tenths)
JAN	58	38	29	-1	1.9	0.8	1	1	S	6	23	86	80	29	.16	1150	14	#	2	0	0		0	0	18	#	8
FEB	64	42	31	5	1.8	0.6	1	1	S	6	41	87	74	31	.17	1350	17	1	2	0	#		0	0	14	0	8
MAR	80	49	35	15	1.4	0.5	#	#	S	7	27	87	65	35	.20	1150	12	#	1	0	1		0	#	9	0	7
APR	88	58	41	27	2.0	0.8	#	#	S	7	38	84	59	41	.26	1000	18	#	0	0	1		#	#	2	0	8
MAY	92	67	49	31	3.2	1.4	0	0	S	6	27	87	55	47	.32	800	15	2	0	0	4		#	5	#	0	8
JUN	94	72	54	39	3.1	1.7	0	0	W	6	27	86	54	53	.40	700	13	2	0	0	6		1	9	0	0	7
JUL	98	75	58	45	2.1	0.8	0	0	W	6	37	87	53	55	.44	750	10	1	0	0	5		4	13	0	0	8
AUG	96	74	57	45	2.0	1.0	0	0	WSW	6	26	87	57	55	.44	700	11	1	0	0	4		2	10	0	0	7
SEP	88	67	51	37	1.6	1.6	0	0	S	5	30	90	60	52	.39	800	8	1	0	0	1		#	4	0	0	7
OCT	84	56	44	27	0.6	0.7	0	0	S	5	32	91	70	46	.31	950	7	#	0	0	#		0	#	1	0	7
NOV	72	45	36	21	2.3	0.9	1	1	S	6	44	89	78	38	.23	1200	17	1	1	0	#		0	0	8	0	8
DEC	64	39	31	7	2.1	0.5	1	3	S	6	35	87	80	31	.17	1350	22	#	2	#	0		0	0	14	0	9
ANN	98	57	43	-1	24.1	1.7	3	3	S	6	44	87	65	43	.28	1050	164	9	8	#	22		7	41	66	#	8
EYR	11	50	50	11	4	4	2	2	11	11	2	11	11	11	11	10	4	4	2	2	11		38	38	38	11	11

REMARKS

1. Less than full time operation.
2. Extremes of 2°F class intervals.
3. Estimated from nearby station.

RUSSWO POR: Hrly Obs: 5908-7012; Daily Obs: 6401-6502, 6509-11, 6601-05, 6611-7012.

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02														
	03-05	39	56	45	30	36	37	44	34	52	60	58	53	45	4
	06-08	60	54	49	36	28	30	30	33	56	65	57	58	46	11
	09-11	68	59	47	35	20	23	20	25	37	57	62	64	43	11
	12-14	57	46	34	25	11	13	8	13	18	40	51	57	31	11
	15-17	55	39	23	16	7	8	5	6	10	30	48	55	25	11
	18-20	54	38	23	13	6	7	5	5	10	36	43	55	25	11
	21-23														
	MEAN OF LISTED HOURS	56	49	37	26	18	20	19	19	31	48	53	57	36	
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02														
	03-05	43	35	34	27	34	33	40	31	48	52	43	36	38	4
	06-08	48	40	[illegible]	29	23	24	26	30	52	57	44	36	37	11
	09-11	58	48	36	20	13	16	13	20	34	51	51	49	34	11
	12-14	46	35	18	7	4	6	4	6	15	30	37	42	21	11
	15-17	46	27	12	4	2	3	2	2	6	23	36	41	17	11
	18-20	44	26	15	5	3	4	2	3	7	32	32	40	18	11
	21-23														
	MEAN OF LISTED HOURS	48	35	26	15	13	14	15	15	27	41	41	41	28	
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02														
	03-05	32	29	24	12	17	17	19	16	29	38	26	27	24	4
	06-08	32	31	25	17	12	12	12	16	38	45	31	22	24	11
	09-11	44	35	24	10	6	8	6	10	22	39	36	34	23	11
	12-14	34	24	12	3	2	3	1	4	8	23	25	27	14	11
	15-17	31	20	6	1	1	1	1	1	3	15	22	26	11	11
	18-20	28	15	9	2	1	1	1	2	3	21	19	23	10	11
	21-23														
	MEAN OF LISTED HOURS	34	26	17	8	7	7	7	8	17	30	27	27	18	
CIG less than 200 feet and/or VSBY less than ½ mile	00-02														
	03-05	4	4	4	3	2	2	3	2	13	13	11	8	6	4
	06-08	6	7	3	3	1	1	2	3	16	21	11	6	7	11
	09-11	9	7	2	1	0	#	#	1	4	14	10	8	5	11
	12-14	5	5	#	0	0	0	0	#	1	4	7	5	2	11
	15-17	7	4	#	0	#	0	0	0	#	3	7	5	2	11
	18-20	5	2	#	0	0	0	0	0	#	6	8	3	2	11
	21-23														
	MEAN OF LISTED HOURS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]	[illegible]	[illegible]	

AWS CLIMATIC BRIEF

Prepared by ETAC (APR 1972)

FEUCHT AAF/NÜRNBERG, GERMANY — PERIOD 1968-70[1] — WBAN # 34198 — WMO #

N 49 23 E 11 10 — FIELD ELEVATION: 1240 ft — STN LTRS: EDIG

MONTH	TEMPERATURE (°F) Extreme Maximum[a]	Mean Daily Maximum[a]	Mean Daily Minimum[a]	Extreme Minimum[a]	PRECIPITATION (in) Mean Total[a]	Maximum in 24 Hours	Mean Snowfall[a]	Max Snowfall in 24 Hours	WIND (KT) Prevailing Direction	Mean Speed	Extreme (Peak) (Gust) Speed	MEAN Relative Humidity (%) 0700	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (in Hg)	Pressure Altitude 99.95% (Feet)
JAN	50	34	25	11	1.5	0.[illegible]	3	6	SE	5	29	91	85	28	.15	2150
FEB	50	38	2[illegible]	5	1.[illegible]	0.[illegible]	4	3	SSE	6	41	90	82	28	.15	2050
MAR	74	46	31	9	1.3	0.[illegible]	3	4	W	7	36	86	69	31	.17	2000
APR	86	55	37	25	1.7	0.[illegible]	1	4	W	6	37	84	64	37	.22	1950
MAY	86	65	45	31	2.[illegible]	1.[illegible]	#	1	W	6	30	83	59	45	.30	1800
JUN	86	70	51	41	2.5	1.[illegible]	0	0	W	6	30	82	58	51	.38	1600
JUL	90	73	54	39	3.1	1.[illegible]	0	0	W	5	36	82	56	53	.40	1550
AUG	90	71	53	41	3.[illegible]	3.[illegible]	0	0	W	4	38	89	64	54	.42	1700
SEP	86	65	47	31	2.1	1.[illegible]	0	#	W	4	32	91	62	50	.36	1750
OCT	72	54	40	29	2.1	1.[illegible]	#	#	W	4	42	94	71	45	.30	1650
NOV	66	43	33	23	1.9	0.[illegible]	1	6	S	5	46	91	79	37	.22	2100
DEC	50	36	28	-3	1.7	0.[illegible]	3	3	SSE	4	48	91	85	25	.14	2150
ANN	90	54	39	-3	24.5	3.[illegible]	15	6	W	5	48	88	70	40	.25	1950
EYR	3	10	10	3	40	2	3	3	3	3	1	3	3	3	3	3

MONTH	MEAN NUMBER OF DAYS Precip ≥ 0.01 in[a]	Precip ≥ 0.5 in[a]	Snowfall ≥ 0.1 in[a]	Snowfall ≥ 1.5 in[a]	Thunderstorms[a]	Fog	TEMPERATURE (°F) Maximum ≥ 86[a]	Maximum ≥ 77[a]	Minimum ≤ 32[a]	Minimum ≤ 0	MEAN CLOUDS (TENTHS)
JAN	16	#	9	1	#		0	0	23	0	9
FEB	14	#	7	1	0		0	0	19	0	9
MAR	14	1	6	1	#		0	0	15	0	8
APR	15	0	3	#	1		#	#	5	0	7
MAY	15	1	#	0	3		#	4	#	0	8
JUN	15	2	0	0	6		1	8	0	0	8
JUL	15	2	0	0	[illegible]		3	11	0	0	7
AUG	15	2	0	0	4		2	8	0	0	7
SEP	13	1	0	0	2		#	3	#	0	6
OCT	13	1	1	0	#		0	0	4	0	7
NOV	14	#	4	1	#		0	0	12	0	9
DEC	17	0	8	1	0		0	0	19	#	8
ANN	176	10	38	5	21		6	34	97	#	8
EYR	40	2	40	2	3		80	80	80	3	3

REMARKS

[1]LESS THAN FULL TIME OPERATION.
[a]EXTREMES OF 2°F CLASS INTERVALS.
[a]ESTIMATED FROM NEARBY STATION.

RUSSWO POR: HRLY AND DAILY OBS: 6801-7012. LCTD APRX 8 NM SSE OF NÜRNBERG APRT.

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02														
	03-05														
	06-08	74	67	45	43	32	30	30	50	44	74	56	71	51	
	09-11	65	69	44	43	26	26	18	38	23	52	54	68	44	
	12-14	59	52	43	41	26	23	13	30	20	37	45	58	37	
	15-17	53	51	39	28	16	15	8	18	12	29	45	62	31	
	18-20	60	57	34	2[illegible]	9	9	7	11	11	29	48	68	30	
	21-23														
	MEAN OF LISTED HOURS	62	59	41	35	22	21	15	29	22	44	50	65	39	3
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02														
	03-05														
	06-08	67	53	34	31	23	28	24	45	41	64	44	59	43	
	09-11	64	57	31	19	12	12	8	27	16	44	43	60	33	
	12-14	49	34	26	12	7	8	2	12	8	18	33	50	22	
	15-17	45	35	15	9	6	5	0	8	5	14	28	52	19	
	18-20	53	40	19	13	3	5	0	5	6	15	30	55	20	
	21-23														
	MEAN OF LISTED HOURS	56	44	25	17	10	12	7	19	15	31	36	55	27	3
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02														
	03-05														
	06-08	40	34	24	19	12	14	14	36	30	49	29	42	29	
	09-11	38	32	21	10	4	6	3	20	11	30	30	43	21	
	12-14	32	19	13	7	4	4	#	8	5	8	22	35	13	
	15-17	30	20	9	5	2	3	0	4	4	4	20	36	11	
	18-20	30	22	13	5	0	4	0	4	4	7	23	42	13	
	21-23														
	MEAN OF LISTED HOURS	34	25	16	9	4	6	3	14	11	20	25	40	17	3
CIG less than 200 feet and/or VSBY less than ½ mile	00-02														
	03-05														
	06-08	4	4	2	1	1	2	3	7	9	20	5	2	5	
	09-11	5	3	#	1	0	0	0	1	1	7	5	3	2	
	12-14	4	1	0	0	0	0	0	0	0	#	2	2	1	
	15-17	5	0	0	0	0	0	0	0	0	#	1	3	1	
	18-20	5	0	0	0	0	0	0	0	0	2	4	3	1	
	21-23														
	MEAN OF LISTED HOURS	5	2	#	#	#	#	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AWS CLIMATIC BRIEF	FINTHEN AAF/MAINZ/OBER-OLM, GERMANY	PERIOD: 1962-70	WBAN # 34075 WMO #
Prepared by ETAC (MAR 1972)	N 49 58 E 08 09	FIELD ELEVATION: 759 ft	STN LTRS: EDOT

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM [1]	MEAN DAILY MAXIMUM	MEAN DAILY MINIMUM	EXTREME MINIMUM [1]	PRECIPITATION (in) MEAN TOTAL	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	WIND (KT) PREVAILING DIRECTION	MEAN SPEED	EXTREME (PEAK) (GUST) SPEED	MEAN RELATIVE HUMIDITY (%) 0400	1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE (Feet) 99.95%	MEAN NUMBER OF DAYS PRECIP ≥ 0.01 [a]	PRECIP ≥ 0.5 [a]	SNOWFALL ≥ 0.1 [a]	SNOWFALL ≥ 1.5 [a]	THUNDERSTORMS [a]	FOG (< 7 MILES)	TEMPERATURE (°F) MAXIMUM ≥ 90	≥ 80	MINIMUM ≤ 32	≤ 0	MEAN CLDNS (TENTHS)
JAN	54	36	29	-1	1.4	1.9	11	6	E	6	40	90	84	28	.15	1650	15	#	10	3	#	22	0	0	18	#	8
FEB	58	42	34	1	1.6	0.4	8	5	WSW	7	37	88	79	30	.17	1750	14	0	6	2	#	12	0	0	12	0	8
MAR	74	48	35	15	1.7	1.6	3	4	WSW	7	40	86	70	33	.19	1550	14	1	4	1	#	14	0	0	12	0	7
APR	84	57	43	27	2.1	0.9	#	1	WSW	7	47	84	63	40	.25	1550	15	1	1	0	1	20	0	#	#	0	7
MAY	86	66	49	33	2.7	1.1	0	0	WSW	6	37	84	59	46	.31	1300	16	1	0	0	3	9	0	1	0	0	7
JUN	90	74	55	41	2.2	0.6	0	0	WSW	6	31	85	58	52	.39	1100	13	#	0	0	4	13	1	4	0	0	6
JUL	96	69	54	41	2.7	1.8	0	0	WSW	5	43	87	59	54	.42	1100	13	1	0	0	3	18	2	6	0	0	7
AUG	94	71	54	45	3.1	1.4	0	0	WSW	5	39	89	61	54	.42	1200	15	2	0	0	3	20	1	4	0	0	7
SEP	86	66	50	37	1.9	1.5	0	0	WSW	5	28	91	66	51	.38	1300	12	1	0	0	1	24	0	1	0	0	6
OCT	78	58	45	29	1.4	1.4	#	#	WSW	5	52	92	76	46	.31	1350	12	#	0	0	#	25	0	0	1	0	7
NOV	66	44	36	17	1.8	0.9	2	3	WSW	6	44	91	84	37	.22	1750	15	1	3	#	#	19	0	0	13	0	8
DEC	54	40	33	5	2.1	0.9	5	3	WSW	7	33	91	85	30	.17	1850	18	1	5	1	#	18	0	0	14	0	8
ANN	96	56	43	-1	24.7	1.9	29	6	WSW	6	47	88	70	42	.27	1500	172	9	29	7	15	214	1	16	70	#	7
EYR	9	3	3	9	7	7	7	5	9	9	4	9	9	9	9	8	7	7	7	7	20	2	3	3	3	3	9

REMARKS

[1] EXTREMES OF 2°F CLASS INTERVALS.

[a] 2 WWG CLIM DATA FOR MAINZ, GERMANY (POR: UNKN).

RUSSWO POR: HRLY OBS: 6202-7012; DAILY OBS 6401-7012.

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02	65	42	37	25	8	15	15	11	18	43	58	66	34	3
	03-05	69	45	44	28	22	23	20	24	32	48	56	61	39	9
	06-08	69	53	51	35	25	23	17	28	42	55	61	63	44	9
	09-11	72	51	50	36	25	26	18	23	38	56	64	67	44	9
	12-14	68	50	47	29	19	18	15	16	26	47	64	66	39	9
	15-17	66	48	41	24	12	13	9	10	16	38	58	68	34	9
	18-20	63	42	33	18	9	11	7	7	13	36	54	66	30	9
	21-23	57	41	35	25	12	17	12	10	14	34	64	66	32	3
	ALL HOURS	67	48	44	29	18	19	14	17	27	46	60	65	38	
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02	42	23	18	14	4	8	10	7	11	33	34	41	20	3
	03-05	50	29	23	16	13	15	13	18	24	39	38	43	27	9
	06-08	50	46	33	22	15	16	13	22	37	45	44	45	32	9
	09-11	56	39	34	20	12	11	9	13	28	47	49	51	31	9
	12-14	53	38	25	11	4	4	4	5	15	36	46	50	24	9
	15-17	53	35	19	7	3	4	3	3	11	29	46	52	22	9
	18-20	48	29	17	4	3	3	3	3	10	31	42	46	20	9
	21-23	38	19	18	9	1	7	6	2	11	29	37	46	19	3
	ALL HOURS	51	34	25	14	8	9	7	10	20	37	44	48	25	
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02	24	14	6	5	2	1	6	4	5	21	21	15	10	3
	03-05	34	19	13	7	8	10	9	13	15	30	25	30	18	9
	06-08	34	26	23	14	8	9	8	15	29	38	30	34	22	9
	09-11	42	30	23	9	5	4	3	6	19	26	35	41	20	9
	12-14	37	27	15	5	2	1	1	2	7	25	35	37	16	9
	15-17	38	23	10	2	1	1	1	1	4	21	34	37	14	9
	18-20	35	17	7	2	1	1	1	2	7	21	31	31	13	9
	21-23	19	9	4	3	0	2	2	1	5	15	22	20	9	3
	ALL HOURS	36	23	15	7	4	4	3	6	13	28	31	34	17	
CIG less than 200 feet and/or VSBY less than ½ mile	00-02	9	8	0	0	0	1	2	1	4	11	7	6	4	3
	03-05	13	5	1	1	2	2	1	1	5	17	10	11	6	9
	06-08	15	7	4	3	2	2	2	2	9	24	12	13	8	9
	09-11	15	8	5	3	1	#	#	#	4	18	16	14	7	9
	12-14	10	6	2	0	0	0	0	0	1	[illegible]	11	9	[illegible]	9
	15-17	10	7	1	0	#	0	0	#	#	5	11	11	4	9
	18-20	8	5	1	#	#	0	0	0	#	6	11	9	3	9
	21-23	6	[illegible]	[illegible]	0	0	0	[illegible]	0	[illegible]	5	[illegible]	[illegible]	[illegible]	[illegible]

AWS CLIMATIC BRIEF

FRANKFURT MAIN/RHEIN MAIN APT, GERMANY — PERIOD: 1946-63 — WBAN # 35032 — WMO # 10637

Prepared by ETAC (JUN 70) — N 50 02 E 08 34 — ELEVATION: 378 ft — STN LTRS: EDAF

MONTH	TEMPERATURE (°F) Extreme Maximum	Mean Daily Maximum	Mean Daily Minimum	Extreme Minimum	PRECIPITATION (In) Mean Total	Maximum in 24 Hours	Mean Snowfall	Max Snowfall in 24 Hours	WIND (KT) Prevailing Direction	Mean Speed	Extreme (Max Wind) Speed	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (In Hg)	Pressure Altitude 99.95% (Feet)	MEAN NUMBER OF DAYS Precip ≥ 0.01 In	Precip ≥ 0.5 In	Snowfall ≥ 0.1 In	Snowfall ≥ 1.5 In	Thunderstorms	Fog (< Miles)	TEMPERATURE (°F) Maximum ≥	Maximum ≥	Minimum ≤	Minimum ≤	Mean Clouds (Tenths)
JAN	60	37	28	-1	1.7	0.7	5	9	SW	8	48	88	80	28	.15	1300	14	#	4	1	1	19	0	0	20	#	8
FEB	64	39	28	-4	1.4	1.3	3	4	NE	7	40	88	74	28	.15	1400	12	#	3	1	2	18	0	0	19	#	7
MAR	74	51	33	9	1.4	0.9	1	4	NE	7	35	87	62	33	.19	1250	10	#	1	#	1	17	0	0	15	0	6
APR	87	60	40	20	1.6	1.0	#	2	NE	7	26	86	55	39	.24	1050	12	1	#	#	2	11	0	#	5	0	6
MAY	89	67	46	27	2.5	1.8	#	#	NNE	7	36	87	54	45	.30	800	13	1	0	0	4	13	0	2	1	0	6
JUN	97	73	52	32	2.9	4.2	#	#	SW	6	25	89	54	52	.39	800	12	2	0	0	6	13	1	6	#	0	6
JUL	100	76	56	38	2.5	2.0	0	0	SW	6	35	89	54	55	.43	750	12	1	0	0	5	12	2	10	0	0	6
AUG	96	75	55	38	3.4	5.4	0	0	SW	6	35	91	56	54	.42	800	13	1	0	0	6	14	1	8	0	0	6
SEP	93	69	50	32	1.9	1.2	0	0	SW	6	30	92	61	51	.37	800	11	1	0	0	4	17	1	3	#	0	6
OCT	80	58	41	21	1.8	1.6	#	#	SW	6	28	93	69	44	.29	950	10	1	0	0	3	22	0	#	4	0	6
NOV	63	46	36	11	2.0	0.9	1	4	SW	6	30	92	79	37	.22	1250	14	1	1	#	2	21	0	0	9	0	8
DEC	60	38	30	1	2.1	1.1	3	10	SW	7	44	91	83	31	.17	1400	13	1	2	#	2	22	0	0	18	#	8
ANN	100	57	41	-4	25.0	5.4	13	10	SW	7	48	89	65	42	.27	1100	146	10	11	2	38	199	5	29	91	#	7
EYR	17	17	17	17	16	16	17	17	17	17	10	17	17	17	17	17	16	16	17	17	17	17	17	17	17	17	17

REMARKS:

RUSSWO POR: Hourly Obs: Sep 46 - Dec 63
Daily Obs: Sep 46 - Dec 63

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG Less Than 3000 Feet and/or VSBY Less Than 3 Miles	00-02	52	53	14	16	10	12	11	14	27	48	59	66	34	
	03-05	56	54	38	27	26	25	26	28	42	57	61	68	42	
	06-08	65	64	54	31	21	22	24	29	50	70	69	75	48	
	09-11	66	61	41	23	16	15	15	17	31	53	64	74	40	
	12-14	57	51	27	16	10	9	8	7	16	34	53	65	29	
	15-17	56	47	20	9	6	6	5	5	10	28	52	63	26	
	18-20	52	47	22	10	5	7	6	7	12	32	50	61	26	
	21-23	52	50	24	11	6	8	7	8	17	40	56	65	29	
	ALL HOURS	57	53	33	18	12	13	13	14	26	45	58	67	34	17
CIG Less Than 1500 Feet and/or VSBY Less Than 3 Miles	00-02	35	39	23	8	6	8	6	9	22	42	42	45	24	
	03-05	36	39	27	17	19	20	20	22	36	48	44	46	31	
	06-08	45	52	44	23	15	14	16	21	44	62	53	54	[illegible]	
	09-11	49	50	29	10	5	5	5	8	20	43	49	57	28	
	12-14	39	38	15	3	2	3	2	2	7	24	35	47	18	
	15-17	38	36	11	2	1	2	1	2	6	21	35	48	17	
	18-20	35	35	15	4	2	3	2	3	8	25	33	45	18	
	21-23	37	37	18	5	3	5	4	4	14	33	39	46	20	
	ALL HOURS	39	41	23	9	7	7	7	9	20	37	41	48	24	17
CIG Less Than 1000 Feet and/or VSBY Less Than 2 Miles	00-02	24	26	12	4	3	5	3	5	15	30	28	33	16	
	03-05	24	26	17	11	11	12	12	15	26	37	31	34	21	
	06-08	33	38	31	13	7	8	8	13	32	51	30	40	[illegible]	
	09-11	36	38	17	4	3	2	2	4	11	30	36	44	19	
	12-14	29	27	7	1	1	1	1	1	3	16	24	35	12	
	15-17	26	25	7	1	#	1	1	1	2	14	24	35	12	
	18-20	22	25	8	1	1	1	1	1	5	17	23	30	11	
	21-23	24	26	10	2	1	3	2	2	7	23	26	32	13	
	ALL HOURS	27	29	14	5	3	4	4	5	13	27	29	35	16	17
CIG Less Than 200 Feet and/or VSBY Less Than 1/2 Mile	00-02	4	6	2	1	1	1	#	1	3	10	6	9	4	
	03-05	5	7	4	2	2	1	2	2	7	14	8	10	5	
	06-08	5	8	5	2	1	1	1	2	8	18	9	11	6	
	09-11	6	7	2	#	0	0	#	#	1	8	6	9	3	
	12-14	4	3	#	0	0	0	0	0	0	1	2	6	1	
	15-17	4	3	1	0	0	#	0	0	0	1	2	7	2	
	18-20	3	4	1	#	0	0	0	#	#	3	3	6	2	
	21-23	4	[illegible]	1	#	#	0	#	#	#	7	5	7	3	

AWS CLIMATIC BRIEF

Prepared by ETAC (APR 1972) | FULDA AAF, GERMANY | PERIOD: 1960-70[1] | WBAN # 35053 | WMO #

N 50 33 E 09 39 | FIELD ELEVATION: 1000 ft | STN LTRS: EDEX

MONTH	TEMPERATURE (°F): EXTREME MAXIMUM[2]	MEAN DAILY MAXIMUM	MEAN DAILY MINIMUM	EXTREME MINIMUM[2]	PRECIPITATION (in): MEAN TOTAL	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	WIND (KT): PREVAILING DIRECTION	MEAN SPEED	EXTREME (PEAK) (GUST) SPEED	MEAN: RELATIVE HUMIDITY (%) 0400	RELATIVE HUMIDITY (%) 1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE 99.95% (Feet)	MEAN NUMBER OF DAYS: PRECIP ≥ 0.01 in	PRECIP ≥ 0.5 in	SNOWFALL ≥ 0.1 in	SNOWFALL ≥ 1.5 in	THUNDERSTORMS	FOG (< 7 MILES)	TEMPERATURE (°F) MAXIMUM ≥ 90	MAXIMUM ≥ 80	MINIMUM ≤ 32[3]	MINIMUM ≤ 0	MEAN CLDNS (TENTHS)
JAN	54	37	31	-9	1.3	0.6	11	4	SSW	6	36	90	84	27	.15	1900	18	1	12	2	1	22	0	0	20	1	9
FEB	60	38	28	-5	2.5	1.2	4	6	SSW	6	50	88	79	28	.15	2000	13	2	3	1	2	14	0	0	17	#	8
MAR	74	48	36	1	2.2	0.6	2	3	SW	7	44	87	71	31	.17	1850	17	#	3	#	2	15	0	0	12	0	7
APR	86	53	36	23	2.5	1.2	1	1	SW	6	44	88	63	38	.23	1750	17	#	3	0	#	17	0	#	6	0	8
MAY	84	64	45	29	2.6	0.8	#	#	SW	6	42	89	59	44	.29	1500	15	1	#	0	4	13	0	1	1	0	7
JUN	88	68	50	31	3.3	2.3	0	0	SW	5	38	92	58	51	.38	1350	16	2	0	0	6	16	0	[illegible]	#	0	7
JUL	92	72	53	37	3.4	1.2	0	0	SW	5	42	92	58	53	.40	1400	14	2	0	0	6	18	#	8	0	0	7
AUG	94	70	50	37	2.9	1.5	0	0	SW	5	60	94	61	53	.40	1400	15	2	0	[illegible]	[illegible]	[illegible]	#	2	0	0	7
SEP	88	64	47	29	1.6	1.1	0	0	SSW	5	32	94	66	50	.36	1550	12	#	0	0	2	22	0	1	1	0	7
OCT	80	58	41	23	1.3	0.3	0	0	SSW	5	52	94	75	45	.30	1650	12	#	0	0	#	23	0	#	7	0	7
NOV	66	40	31	11	2.6	1.1	8	5	SSW	6	39	91	83	35	.20	2000	17	1	6	2	2	21	0	0	10	0	9
DEC	58	38	31	-7	4.7	1.4	6	4	SSW	6	40	89	85	28	.15	2100	21	4	9	2	#	25	0	0	18	#	9
ANN	94	54	40	-9	30.9	2.3	32	6	SSW	6	60	91	70	40	.25	1750	187	15	36	7	31	226	#	14	92	1	8
EYR	10	4	4	10	6	6	6	5	10	10	5	10	10	10	10	9	6	6	6	6	3	3	10	4	4	10	10

REMARKS:

1 Less than full time operation.

2 Extremes of 2°F class interval.

3 Estimated from nearby station.

RUSSWO POR: HRLY OBS: 6009-7012; DAILY OBS: 6009-10, 6101-03, 6307-6502, 6505-11, 6601-7012.

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02	61	46	41	27	10	11	14	12	26	33	66	55	34	3
	03-05	68	54	52	43	32	37	38	43	57	60	66	56	51	9
	06-08	69	64	62	53	40	38	37	51	64	67	65	70	57	10
	09-11	75	69	58	48	34	27	26	35	55	61	65	74	52	10
	12-14	70	59	47	40	23	19	18	19	25	40	60	70	41	10
	15-17	62	52	37	29	14	12	12	11	12	30	52	69	33	10
	18-20	63	51	32	23	7	10	7	5	10	27	53	70	30	10
	21-23	54	41	27	19	6	7	8	5	12	20	59	64	27	3
	ALL HOURS	63	58	48	39	24	22	22	26	36	46	60	70	43	
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02	40	23	19	12	3	7	7	10	22	24	51	35	21	3
	03-05	54	38	35	31	21	27	30	36	51	49	52	50	40	9
	06-08	56	50	45	41	29	29	30	42	57	56	51	54	45	10
	09-11	63	55	43	28	14	11	12	19	40	49	50	60	37	10
	12-14	55	42	26	13	8	5	5	6	12	25	42	56	25	10
	15-17	43	35	18	9	3	3	4	3	5	17	38	54	19	10
	18-20	45	33	18	9	2	3	3	2	6	17	40	55	19	10
	21-23	42	23	9	12	2	2	4	1	9	13	46	40	17	3
	ALL HOURS	52	42	30	21	12	12	13	17	27	34	46	54	30	
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02	26	10	11	7	2	4	5	5	17	19	41	18	14	3
	03-05	38	28	21	21	16	20	25	27	43	41	40	33	29	9
	06-08	40	36	29	20	21	18	21	32	47	47	37	41	33	10
	09-11	43	39	26	15	7	6	6	12	28	37	36	44	25	10
	12-14	35	28	13	6	4	2	1	2	4	14	26	40	15	10
	15-17	29	20	8	3	2	1	1	1	2	10	26	38	12	10
	18-20	30	21	9	3	1	#	1	1	3	9	26	40	12	10
	21-23	19	11	5	2	0	0	2	0	4	11	30	19	9	3
	ALL HOURS	35	28	17	12	7	7	8	11	20	25	32	38	20	
CIG less than 200 feet and/or VSBY less than ½ mile	00-02	3	2	2	1	1	2	3	2	8	12	14	3	4	3
	03-05	7	4	3	6	7	8	7	3	28	27	13	4	10	9
	06-08	8	9	6	11	7	6	6	14	32	31	13	6	12	10
	09-11	7	9	3	3	#	0	#	2	10	18	10	7	6	10
	12-14	4	2	#	0	0	0	#	0	0	2	4	5	1	10
	15-17	3	3	#	#	0	0	0	0	0	1	5	4	1	10
	18-20	3	1	0	#	#	0	0	0	1	2	7	4	2	10
	21-23	2	1	0	0	0	0	0	0	2	4	11	1	2	3
	ALL HOURS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

AWS CLIMATIC BRIEF

Prepared by ETAC (JAN 1971)

FURTH AAF/MONTEITH BARRACKS, GERMANY — PERIOD: 1946-65B — WBAN # 34176 — WMO #

N 49 30 — E 10 58 — ELEVATION: 1000 ft — STN LTRS: EDEW

MONTH	TEMPERATURE (°F) Extreme Maximum[1]	Mean Daily Maximum	Mean Daily Minimum	Extreme Minimum[1]	PRECIPITATION (in) Mean Total	Maximum in 24 Hours	Mean Snowfall	Max Snowfall in 24 Hours	WIND (KT) Prevailing Direction	Mean Speed	Extreme (Max) Speed[2]	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (in Hg)	Pressure Altitude 99.95% (feet)	MEAN NUMBER OF DAYS Precip ≥ 0.01	Precip ≥ 0.5	Snowfall ≥ 0.1	Snowfall ≥ 1.5	Thunderstorms	Fog	Temperature (°F) Maximum ≥ 90	Maximum ≥ 80	Minimum ≤ 32	Minimum ≤ 0	Mean Clouds (Tenths)
JAN	48	30	19	-3	0.4	0.2	1	#	WSW	4	27	92	84	25	.14	1500	8	0	3	0			0	0	26	2	7
FEB	52	29	15	3	1.0	0.2	9	2	W	5	40	*	74	27	.15	1850	14	0	12	1			0	0	28	0	7
MAR	68	49	33	11	0.4	0.3	#	#	W	5	33	92	73	35	.20	2050	6	0	2	0			0	0	14	0	7
APR	78	64	38	25	0.4	0.1	0	0	W	6	>55	91	56	39	.24	1600	7	0	0	0			0	0	6	0	5
MAY	86	70	48	35	1.7	1.1	0	0	W	5	33	94	59	48	.34	1450	9	1	0	0			0	5	0	0	6
JUN	90	68	52	43	7.1	2.1	0	0	W	7	33	95	58	53	.40	1350	16	5	0	0			#	4	0	0	7
JUL	96	77	56	47	3.4	0.6	0	0	W	6	27	92	55	55	.44	1250	11	3	0	0			2	11	0	0	6
AUG	94	72	54	45	3.2	1.2	0	0	W	5	40	91	60	54	.42	1250	8	2	0	0			#	6	0	0	7
SEP	86	70	48	[illegible]	1.1	0.4	0	0	WSW	5	47	96	64	52	.39	1300	7	0	0	0			0	#	0	0	6
OCT	74	53	37	23	2.5	1.3	0	0	W	5	27	93	67	41	.26	1500	12	1	0	0			0	0	9	0	6
NOV	64	43	32	25	0.7	0.2	1	1	W	5	27	96	78	37	.22	1900	8	0	2	0			0	0	15	0	8
DEC	50	33	24	5	0.2	#	2	1	SSE	4	40	91	82	26	.14	1800	10	0	3	0			0	0	23	0	7
ANN	96	56	38	-3	22.1	2.1	13	2	W	5	>55	93[3]	68	42	.27	1700	116	12	22	1	*	*	2	26	121	2	7
EYR	4	1	1	4	1	1	1	1	3	3	3	3	3	3	3	2	1	1	1	1			1	1	1	1	4

REMARKS:
[1] REFERS TO HIGHEST AND LOWEST HOURLY TEMPERATURE CLASS INTERVAL.
[2] REFERS TO HIGHEST HOURLY WIND SPEED CLASS INTERVAL.
[3] ANN RH IS MEAN OF LISTED MO MEANS.
HRLY OBS: MAR 46-MAY 47, AUG 63-OCT 65.
DAILY OBS: MAR 46-MAY 47.

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02	53	57	32	8	7	20	20	9	24	38	60	74	34	1
	03-05	52	54	37	10	14	28	24	27	41	52	61	70	39	1
	06-08	75	73	64	35	25	34	18	33	53	80	65	80	53	3
	09-11	87	73	65	35	31	30	19	27	42	69	62	83	52	3
	12-14	70	61	51	26	25	26	19	22	22	49	53	78	42	3
	15-17	66	53	44	19	13	23	12	19	18	29	46	71	34	3
	18-20	53	64	38	10	9	23	13	7	9	28	53	71	32	1
	21-23	51	67	34	4	5	20	14	11	11	34	63	79	33	1
	ALL HOURS	68	64	48	21	18	27	17	22	30	52	57	77	39	
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02	40	54	10	4	5	7	11	2	12	19	33	58	21	1
	03-05	40	50	12	4	11	16	14	11	28	26	34	55	25	1
	06-08	64	64	50	27	18	24	11	25	44	68	47	71	43	3
	09-11	78	65	52	22	13	14	6	12	32	58	46	77	40	3
	12-14	62	45	34	9	7	12	4	4	12	29	27	67	26	3
	15-17	51	37	25	4	3	8	3	4	1	14	29	56	20	3
	18-20	33	60	22	3	2	7	5	1	3	18	40	63	21	1
	21-23	38	63	17	3	2	7	10	0	3	19	44	65	23	1
	ALL HOURS	56	54	31	11	8	13	7	[illegible]	20	37	38	66	26	
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02	19	26	8	4	2	7	2	1	6	9	23	33	12	1
	03-05	26	21	9	3	5	9	5	7	18	15	23	34	15	1
	06-08	47	31	30	11	6	10	7	10	29	46	25	45	25	3
	09-11	52	31	25	8	3	5	1	4	18	33	23	53	21	3
	12-14	41	19	14	2	1	3	0	2	5	10	10	30	11	3
	15-17	32	18	11	1	1	4	0	2	2	4	12	23	9	3
	18-20	25	29	8	1	1	7	1	1	0	5	20	36	11	1
	21-23	27	38	8	3	0	7	1	0	0	11	23	32	13	1
	ALL HOURS	37	26	16	4	3	6	2	4	11	19	19	37	14	
CIG less than 200 feet and/or VSBY less than ½ mile	00-02	3	5	4	2	1	0	0	0	0	0	0	8	2	1
	03-05	3	4	5	2	1	2	3	4	9	1	0	0	[illegible]	1
	06-08	7	4	6	2	2	0	2	5	14	11	3	2	5	3
	09-11	5	2	3	#	#	0	0	1	4	7	2	7	3	3
	12-14	4	1	0	0	0	0	0	0	0	0	0	1	1	3
	15-17	1	2	0	0	0	0	0	0	0	0	0	3	1	3
	18-20	0	6	0	0	0	0	0	0	0	0	0	[illegible]	1	1
	21-23	[illegible]	6	1	1	0	0	0	0	0	0	0	[illegible]	2	1
	ALL HOURS	4	3	[illegible]	1	1	[illegible]	1	1	[illegible]	3	1	[illegible]	2	

AWS CLIMATIC BRIEF

Prepared by ETAC (AUG 1971)

GRAFENWOEHR AAF, GERMANY — PERIOD: 1959-67B — WBAN # 34189 — WMO # 10687

N 49 42 E 11 57 — FIELD ELEVATION: 1360 ft — STN LTRS: EDIC

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM	MEAN DAILY MAXIMUM	MEAN DAILY MINIMUM	EXTREME MINIMUM	PRECIPITATION (in) MEAN TOTAL	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	WIND (KT) PREVAILING DIRECTION	MEAN SPEED	EXTREME (PEAK GUST) SPEED	MEAN RELATIVE HUMIDITY (%) 0400	1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE 99.95% (Feet)	MEAN NUMBER OF DAYS PRECIP ≥ 0.01 in	PRECIP ≥ 0.5 in	SNOWFALL ≥ 0.1 in	SNOWFALL ≥ 1.5 in	THUNDERSTORMS	FOG (< 7 MILES)	TEMPERATURE (°F) MAXIMUM ≥ 90	MAXIMUM ≥ 80	MINIMUM ≤ 32	MINIMUM ≤ 0	MEAN CLOUDS (TENTHS)
JAN	48	29	18	-18	1.7	0.7	11	7	W	5	46	89	82	22	.12	2200	14	1	10	2	0	25	0	0	28	5	8
FEB	60	36	21	-18	1.3	0.7	8	4	W	6	45	88	79	26	.14	2500	12	1	7	2	0	19	0	0	22	3	8
MAR	60	42	24	-7	2.2	0.9	7	6	W	6	31	90	72	30	.17	2250	13	#	4	1	#	25	0	0	23	2	8
APR	75	55	35	25	1.8	0.8	#	1	W	5	35	91	61	38	.23	2050	12	#	#	0	2	23	0	0	10	0	7
MAY	80	63	43	29	2.1	0.7	#	#	W	5	50	92	58	44	.29	1750	14	1	0	0	5	24	0	1	2	0	7
JUN	89	71	48	33	4.1	1.4	0	0	W	5	43	92	56	[illegible]	.36	1750	17	2	0	0	8	18	0	6	0	0	7
JUL	91	74	50	34	2.6	1.8	0	0	W	5	35	92	56	52	.39	1750	10	1	0	0	7	25	#	8	0	0	7
AUG	91	70	49	34	1.7	0.6	0	0	W	5	32	93	61	52	.39	1700	12	1	0	0	3	23	1	5	0	0	7
SEP	84	65	44	27	2.4	1.1	0	0	W	4	41	94	62	48	.34	1850	14	1	0	0	2	24	0	2	2	0	6
OCT	76	55	35	22	0.9	0.5	#	#	E	5	37	94	69	41	.26	1950	8	#	#	0	0	27	0	0	12	0	6
NOV	61	43	33	8	2.6	0.9	3	2	E	5	46	[illegible]	80	34	.20	2250	17	1	6	#	0	26	0	0	14	0	9
DEC	54	32	22	-15	2.6	1.0	9	5	W	5	56	89	85	[illegible]	[illegible]	2550	14	1	9	2	0	24	0	0	25	2	8
ANN	91	52	35	-18	26.0	1.8	38	7	W	5	56	91	68	39	.24	2100	157	10	36	7	27	283	1	22	138	12	7
EYR	4	[illegible]	4	4	4	4	4	4	9	9	4	9	9	9	9	7	4	4	4	4	4	4	4	4	4	4	9

REMARKS

RUSSWO POR: Hrly Obs: 5901-6708. Daily Obs: 6206-6505, 6508-6602.

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00 - 02	81	62	55	36	26	20	18	20	38	56	66	74	46	6
	03 - 05	81	66	69	51	42	39	44	38	57	65	71	73	58	7
	06 - 08	79	72	77	57	46	[illegible]	45	49	65	74	77	77	63	9
	09 - 11	78	70	68	47	35	29	33	38	47	60	71	79	55	9
	12 - 14	67	62	55	37	31	26	27	33	29	41	61	76	45	9
	15 - 17	65	51	48	28	20	20	17	18	18	29	54	72	37	9
	18 - 20	71	57	47	22	16	16	11	12	16	33	57	74	36	9
	21 - 23	78	61	48	21	17	14	10	11	20	46	61	73	38	6
	ALL HOURS	74	63	59	39	30	26	26	28	37	51	65	75	47	
CIG less than 1500 feet and/or VSBY less than 3 miles	00 - 02	74	50	46	26	17	16	15	15	35	49	52	59	38	6
	03 - 05	72	55	56	42	35	34	37	33	53	60	61	61	50	7
	06 - 08	70	71	66	49	37	29	37	43	60	67	66	64	55	9
	09 - 11	71	60	55	27	17	12	15	21	37	51	59	70	41	9
	12 - 14	56	44	32	12	7	8	6	10	13	28	44	62	27	9
	15 - 17	54	36	25	8	5	5	4	7	7	21	41	58	23	9
	18 - 20	63	47	32	10	7	6	4	4	11	26	45	60	26	9
	21 - 23	69	50	38	14	9	10	5	7	17	37	47	61	30	6
	ALL HOURS	65	50	44	24	17	15	16	18	29	42	52	62	35	
CIG less than 1000 feet and/or VSBY less than 2 miles	00 - 02	49	28	27	12	10	10	8	7	24	33	35	36	23	6
	03 - 05	43	33	33	24	23	24	23	22	41	41	40	37	32	7
	06 - 08	44	42	40	30	22	18	18	27	45	51	43	40	35	9
	09 - 11	49	42	30	12	6	5	5	9	17	35	40	47	25	9
	12 - 14	36	29	15	3	3	4	3	4	6	14	26	38	15	9
	15 - 17	32	21	12	2	2	2	2	3	4	9	25	37	13	9
	18 - 20	41	23	16	2	3	3	2	2	6	15	26	39	15	9
	21 - 23	47	25	19	6	4	5	3	2	9	23	29	38	18	6
	ALL HOURS	42	31	24	12	9	9	8	10	19	28	33	39	21	
CIG less than 200 feet and/or VSBY less than ½ mile	00 - 02	3	5	6	3	4	2	2	2	13	16	7	6	6	6
	03 - 05	6	5	8	7	11	10	8	9	24	21	9	8	11	7
	06 - 08	6	13	12	7	8	7	5	11	24	25	9	8	11	9
	09 - 11	6	10	5	1	#	#	#	#	6	11	7	7	4	9
	12 - 14	2	4	#	0	0	#	0	0	0	1	2	3	1	9
	15 - 17	3	2	#	0	0	0	0	0	#	0	2	2	1	9
	18 - 20	3	3	1	0	0	0	0	0	1	2	5	4	2	9
	21 - 23	[illegible]	5	3	1	1	1	#	#	4	8	6	6	3	6
	ALL HOURS	[illegible]	6	4	2	3	2	2	3	9	10	6	5	5	

AWS CLIMATIC BRIEF

Prepared by ETAC (APR 1970)

[illegible] AB, HUNSRUCK, GERMANY — N 49 57 E 07 16

PERIOD: 1953-66 — ELEVATION: 1659 ft

WBAN # 34055 — WMO # 10616 — STN LTRS: EDAH

MONTH	TEMPERATURE (°F) Extreme Maximum	Mean Daily Maximum	Mean Daily Minimum	Extreme Minimum	PRECIPITATION (in) Mean Total	Maximum in 24 Hours	Mean Snowfall	Max Snowfall in 24 Hours	WIND (KT) Prevailing Direction	Mean Speed	Extreme (Peak) (Gust) Speed	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (in Hg)	Pressure Altitude 99.95% (Feet)	MEAN NUMBER OF DAYS Precip ≥ 0.01 in	Precip ≥ 0.5 in	Snowfall ≥ 0.1 in	Snowfall ≥ 1.5 in	Thunderstorms	Fog (<7 Miles)	Temperature (°F) Maximum ≥ 90	Maximum ≥ 80	Minimum ≤ 32	Minimum ≤ 0	Mean Clouds (Tenths)
JAN	51	34	26	-3	2.8	1.0	9	6	W	9	44	88	84	26	.14	2650	18	1	10	2	#	26	0	0	24	#	8
FEB	59	36	26	-11	2.2	1.1	10	6	W	8	44	86	78	27	.14	2850	14	1	9	2	#	22	0	0	20	1	8
MAR	68	44	32	12	1.9	1.5	4	7	W	8	37	85	70	31	.17	2550	13	1	4	1	#	21	0	0	15	0	7
APR	78	52	38	21	1.7	0.9	1	2	W	7	43	84	66	37	.22	2350	14	#	2	#	1	17	0	0	6	0	7
MAY	80	59	44	28	2.7	0.9	#	1	W	7	33	84	62	42	.27	2100	15	1	#	0	4	16	0	#	1	0	7
JUN	90	65	50	34	2.6	2.4	0	0	W	6	68	84	63	49	.35	2150	12	1	0	0	4	16	#	1	0	0	7
JUL	93	68	53	40	3.0	2.4	0	0	W	7	35	86	64	51	.37	2100	14	2	0	0	5	17	#	3	0	0	7
AUG	86	67	52	43	3.2	1.3	0	0	W	7	42	88	65	51	.37	2150	15	2	0	0	3	19	0	2	0	0	7
SEP	83	63	49	34	1.9	0.9	0	0	W	7	35	88	68	48	.33	2100	12	1	0	0	1	20	0	1	0	0	6
OCT	72	53	42	26	2.0	1.1	#	6	W	7	51	91	76	43	.28	2350	13	1	#	#	1	25	0	0	2	0	7
NOV	59	42	35	18	2.0	2.3	2	6	W	8	46	91	[illegible]	35	.20	2450	14	1	2	#	#	26	0	0	11	0	9
DEC	60	36	29	5	2.5	1.0	5	9	W	9	53	90	87	30	.16	2800	15	1	5	1	#	27	0	0	19	0	8
ANN	93	52	40	-11	28.5	2.4	31	9	W	8	68	87	72	39	.24	2450	169	13	32	6	19	252	#	7	98	1	7
EYR	12	12	12	12	11	11	12	12	14	14	6	14	14	14	14	11	11	11	12	12	12	12	12	12	12	12	14

REMARKS:

RUSSWO POR: HRLY OBS: Jul 53 - Dec 66
DAILY OBS: Jul 53 - Jun 65

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and / or VSBY less than 3 miles	00 - 02	69	65	48	36	28	25	28	27	35	54	73	79	47	
	03 - 05	71	67	56	42	38	34	39	40	48	62	77	80	55	
	06 - 08	73	74	60	47	43	37	44	47	53	65	80	81	59	
	09 - 11	73	70	56	50	41	35	42	42	45	59	77	78	56	
	12 - 14	73	63	49	43	31	29	30	29	36	46	68	79	48	
	15 - 17	71	59	40	34	22	21	21	19	26	40	69	76	42	
	18 - 20	68	60	39	31	19	17	19	18	25	38	69	74	40	
	21 - 23	68	61	40	31	19	19	21	17	27	44	69	75	41	
	ALL HOURS	71	65	48	39	30	27	30	30	37	51	73	78	48	14
CIG less than 1500 feet and / or VSBY less than 3 miles	00 - 02	61	55	39	30	21	20	22	22	29	49	65	70	40	
	03 - 05	63	58	47	36	31	29	33	33	42	55	70	72	47	
	06 - 08	65	66	54	42	36	31	34	40	46	59	74	73	52	
	09 - 11	66	61	43	33	22	18	21	24	32	50	68	72	43	
	12 - 14	62	50	28	29	12	13	12	12	18	33	57	70	32	
	15 - 17	61	49	23	18	9	10	9	9	15	29	58	67	30	
	18 - 20	58	51	25	19	11	12	10	10	17	30	59	66	31	
	21 - 23	59	50	28	23	15	14	14	14	21	38	61	67	34	
	ALL HOURS	62	55	36	28	20	18	19	20	28	43	64	70	39	14
CIG less than 1000 feet and / or VSBY less than 2 miles	00 - 02	50	42	28	23	15	14	15	16	21	37	55	60	31	
	03 - 05	51	47	36	30	23	21	25	26	32	45	58	72	38	
	06 - 08	52	53	41	34	26	23	25	30	38	49	60	63	41	
	09 - 11	52	48	29	22	12	13	12	14	21	38	56	60	31	
	12 - 14	48	38	18	13	7	9	6	7	12	21	43	59	23	
	15 - 17	47	37	15	12	6	7	6	6	10	19	43	56	22	
	18 - 20	45	36	17	13	6	8	6	8	11	21	46	54	23	
	21 - 23	47	37	18	16	7	10	10	10	14	28	51	55	25	
	ALL HOURS	49	42	26	20	13	13	13	15	20	32	51	58	29	14
CIG less than 200 feet and / or VSBY less than ½ mile	00 - 02	18	13	8	8	4	4	3	5	7	14	24	25	11	
	03 - 05	19	16	10	12	7	7	7	9	13	20	28	26	15	
	06 - 08	19	20	11	10	4	3	4	7	11	23	29	26	14	
	09 - 11	18	14	6	3	1	2	1	1	3	12	20	22	9	
	12 - 14	15	10	3	2	#	1	1	#	1	5	14	20	6	
	15 - 17	17	9	3	2	#	1	1	1	1	5	15	19	6	
	18 - 20	17	9	4	3	1	2	1	1	2	6	18	20	7	
	21 - 23	16	10	6	5	1	3	2	2	4	9	19	21	8	
	ALL HOURS	17	11	6	6	2	3	3	3	5	12	21	22	9	14

AWS CLIMATIC BRIEF

HANAU AAF/LANGENDIEBACH, GERMANY — PERIOD: 1946-67B — WBAN # 35009 — WMO # 10642

Prepared by ETAC (JAN 1971) — N 50 10 E 08 58 — ELEVATION: 377 ft — STN LTRS: EDID

MONTH	TEMPERATURE (°F) Extreme Maximum[1]	Mean Daily Maximum[3]	Mean Daily Minimum[3]	Extreme Minimum[1]	PRECIPITATION (In) Mean Total[3]	Maximum in 24 Hours[3]	Mean Snowfall[3]	Max Snowfall in 24 Hours[3]	WIND (KT) Prevailing Direction	Mean Speed	Extreme (Max Wind) Speed[2]	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (In Hg)	Pressure Altitude 99.95% (Feet)	MEAN NUMBER OF DAYS Precip ≥ 0.01[3]	Precip ≥ 0.5[3]	Snowfall ≥ 0.1[3]	Snowfall ≥ 1.5[3]	Thunderstorms	Fog (< 7 Miles)	Temperature (°F) Maximum ≥ 90	Maximum ≥ 80	Minimum ≤ 32	Minimum ≤ 0	Mean Cldns (Tenths)
JAN	58	37	30	-5	*	*	3	1	SW	5	33	86	79	29	.16	1250	*	*	6	0	1	22	0	0	15	#	8
FEB	6.	43	34	1	1.7	0.3	*	*	SW	5	33	84	75	32	.18	1500	14	0	*	*	0	16	0	0	13	0	8
MAR	72	48	35	9	1.5	0.4	3	3	SW	6	27	84	67	35	.20	1150	16	0	3	1	2	21	0	0	12	0	7
APR	80	58	42	23	3.0	0.5	#	#	SW	5	27	85	60	41	.26	1150	21	#	0	0	4	26	0	#	1	0	7
MAY	84	67	48	31	2.4	0.5	0	0	E	5	40	86	58	47	.32	850	15	#	0	0	6	17	0	2	#	0	7
JUN	94	71	54	37	5.0	2.2	0	0	SW	5	27	89	58	52	.39	800	14	3	0	0	7	17	#	7	0	0	7
JUL	98	72	55	39	3.4	1.4	0	0	SW	4	33	89	59	56	.45	750	16	2	0	0	6	19	1	6	0	0	7
AUG	96	74	54	41	1.6	0.5	0	0	SW	4	27	90	61	55	.44	800	11	#	0	0	4	18	2	8	0	0	7
SEP	88	66	49	35	2.1	0.8	0	0	SW	4	33	90	63	51	.38	900	11	1	0	0	3	27	0	2	0	0	7
OCT	80	58	42	27	1.7	1.5	0	0	SW	4	33	91	72	45	.30	1050	9	1	0	0	1	28	0	#	3	0	7
NOV	70	44	36	15	3.7	1.8	4	3	SW	4	33	88	79	37	.22	1300	17	1	5	1	0	25	0	0	11	0	8
DEC	62	42	34	5	5.0	1.6	3	3	SW	5	33	86	81	32	.18	1500	23	2	4	1	0	23	0	0	10	0	8
ANN	98	57	43	-5	*	*	*	*	SW	5	40	87	68	43	.28	1100	*	*	*	*	34	259	3	25	65	#	7
EYR	11	2	2	11	2	2	2	2	12	12	12	12	12	12	12	11	2	2	2	2	2	2	2	2	2	2	11

REMARKS
[1] Refers to highest and lowest hourly temperatures class interval.
[2] Refers to highest hourly wind speed class interval.
[3] Daily Obs POR differs from EYR because of incomplete months

POR: Hourly Obs: May - Aug 46, Oct 56 - Dec 67
Daily Obs: Feb - Aug 46, Oct 56 - Feb 64, Jun 64, Aug 64 - Dec 66

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and / or VSBY less than 3 miles	00-02	60	37	31	22	14	19	16	10	38	43	60	53	34	5
	03-05	58	45	43	36	26	26	20	31	46	57	62	58	43	10
	06-08	58	56	50	38	29	27	27	33	48	61	63	65	46	12
	09-11	64	56	48	36	25	23	22	27	35	56	63	71	44	12
	12-14	56	50	37	26	19	18	16	17	21	39	58	64	35	12
	15-17	55	43	28	18	11	12	10	9	12	30	53	61	29	12
	18-20	57	36	23	15	8	11	7	6	16	36	58	62	23	11
	21-23	61	32	22	17	11	13	10	9	19	39	57	59	29	7
	ALL HOURS	58	47	38	27	19	19	17	19	29	46	59	63	37	
CIG less than 1500 feet and / or VSBY less than 3 miles	00-02	49	30	23	16	11	12	14	9	35	35	49	38	27	5
	03-05	48	35	29	27	20	21	22	27	44	48	52	43	35	10
	06-08	43	43	39	31	21	22	22	27	45	52	48	49	37	12
	09-11	51	46	36	23	12	12	11	14	27	46	48	55	32	12
	12-14	42	36	19	8	4	7	3	5	11	26	40	46	21	12
	15-17	41	28	13	3	3	4	2	3	6	20	37	46	17	12
	18-20	47	24	14	5	4	3	3	3	10	30	43	46	19	11
	21-23	48	21	15	12	6	8	6	6	17	31	46	42	22	7
	ALL HOURS	45	35	25	16	10	11	10	12	22	36	44	47	26	
CIG less than 1000 feet and / or VSBY less than 2 miles	00-02	19	15	6	5	2	7	6	6	20	19	25	22	13	5
	03-05	24	22	13	12	10	12	13	14	[illegible]	34	28	24	20	10
	06-08	27	31	22	15	10	11	12	14	29	40	30	30	23	12
	09-11	35	32	19	9	5	5	4	6	14	30	34	36	19	12
	12-14	29	22	9	2	2	4	1	2	4	14	23	28	12	12
	15-17	24	17	6	1	1	2	1	1	2	11	21	30	10	12
	18-20	28	14	7	1	1	1	1	2	5	18	24	31	11	11
	21-23	23	9	5	3	2	5	2	4	5	16	26	28	11	7
	ALL HOURS	28	23	12	6	4	6	5	6	13	23	26	30	15	
CIG less than 200 feet and / or VSBY ½ mile	00-02	0	3	1	1	1	1	1	2	2	5	3	3	2	5
	03-05	2	3	2	3	2	3	1	3	9	11	4	4	4	10
	06-08	3	8	4	4	2	2	2	3	10	17	6	5	6	12
	09-11	5	9	2	1	#	#	#	#	2	10	6	8	4	12
	12-14	5	4	#	0	0	0	0	0	0	2	2	5	2	12
	15-17	4	2	0	0	0	0	0	0	0	1	2	6	1	12
	18-20	3	2	0	0	0	0	0	0	#	4	3	6	2	11
	21-23	1	1	0	0	1	#	1	1	0	5	3	5	2	7
	ALL HOURS	3	5	1	1	1	1	1	1	3	7	4	5	3	

CB DATED JUN 71 OBSOLETE

PREPARED BY: USAFETAC JUNE 1974	STATION NAME: HEIDELBERG AAF GERMANY	LOCATION: N49 24 E008 39	PERIOD: APR 51-JUL 72	ELEV: 359	STN LTRS: EDIE	WBAN NO: 34046	WMO NO: 10734

AWS CLIMATIC BRIEF

MONTH	TEMP (°F) MEAN DAILY MAX	TEMP MEAN DAILY MIN	TEMP MEAN MONTHLY	TEMP EXTREME MAX	TEMP EXTREME MIN	PRECIP (IN) MONTHLY MEAN	PRECIP MONTHLY MAX	PRECIP MONTHLY MIN	PRECIP MAX 24 HRS	SNOWFALL (IN) MONTHLY MEAN	SNOWFALL MONTHLY MAX	SNOWFALL MAX 24 HRS	MEAN RELATIVE HUMIDITY (%) LST 03	MEAN RH LST 12	MEAN VAPOR PRESSURE (IN HG)	MEAN DEW PT (°F)	PRESSURE ALTITUDE (FT) 99.95%	SURFACE WINDS PVLG DRCTN (16 PT)	SPEED MEAN (KT)	SPEED MAX (KT) **	MEAN CLOUD COVER (tenths)	DAYS PRECIP (IN) ≥ 0.01	PRECIP ≥ 0.5	SNOWFALL (IN) ≥ 0.1	SNOWFALL ≥ 1.5	THUNDERSTORMS	FOG VSBY < 7 MI	TEMP MAX ≥ 90	TEMP MAX ≥ 80	TEMP MIN ≤ 32	TEMP MIN ≤ 0
JAN	38	29	36	58	0	1.8	6.3	.8	1.0	5	11	7	88	81	.18	29	1250	SS	5	48	8	15	1	5	1	#	20	0	0	19	#
FEB	41	30	36	67	-6	1.8	5.3	#	1.2	5	15	8	86	76	.17	30	1400	SS	5	45	8	13	1	5	1	#	17	0	0	16	#
MAR	51	35	43	77	16	1.6	3.9	.3	1.0	2	10	7	84	63	.20	35	1150	SS	5	52	7	11	1	2	1	1	16	0	0	11	0
APR	60	42	51	88	23	2.0	3.9	.8	1.7	#	4	4	83	58	.26	41	1050	SN	5	39	7	13	1	#	#	2	13	0	1	2	0
MAY	67	49	58	91	30	2.6	4.6	.9	1.4	#	#	#	85	55	.32	47	850	SN	5	44	7	14	1	0	0	5	13	#	3	#	0
JUN	73	55	64	93	37	3.2	6.2	.9	1.8	0	0	0	87	57	.42	54	800	SS	4	48	7	13	2	0	0	6	12	#	#	0	0
JUL	77	57	67	100	40	2.7	5.7	.3	2.0	0	0	0	87	55	.45	56	700	SS	4	32	6	12	1	0	0	6	12	3	11	0	0
AUG	75	57	66	97	43	3.2	7.1	1.3	2.7	0	0	0	89	58	.45	56	750	SS	4	50	7	14	1	0	0	5	14	2	9	0	0
SEP	70	52	61	90	32	2.1	5.2	.1	1.6	0	0	0	90	62	.39	52	800	SS	4	37	6	11	1	0	0	2	19	#	3	#	0
OCT	59	44	52	82	26	1.9	5.9	#	1.5	#	#	#	91	69	.31	46	950	SS	4	37	7	11	1	0	0	#	22	0	#	2	0
NOV	47	37	42	72	19	1.9	4.5	.2	1.1	1	6	3	88	78	.23	38	1250	SS	5	44	8	14	#	1	#	#	20	0	0	7	0
DEC	40	32	36	63	7	2.0	4.6	.1	1.4	3	14	4	88	82	.18	32	1400	SS	5	44	8	14	1	3	1	0	21	0	0	16	0
ANN	58	43	51	100	-6	26.8	7.1	#	2.7	18	15	8	87	66	.28	43	1050	SS	5	52	7	155	12	16	4	27	197	5	35	75	#
EYR	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	15	21	21	8	20	21	21	21	21	21	21	21	21	21	21

REMARKS: RUSSWO POR:
HRLY OBS: APR 51-JUL 72
AND
DAILY OBS:

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT AS APPLICABLE. ** INSTANTANEOUS PEAK WINDS. $= % CALM GREATER THAN % PVLG DRCTN.

CAV FREQ (%)	HRS LST	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CEILING LESS THAN 3000 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	49	46	20	16	11	10	11	12	17	36	48	58	28	
	03-05	51	47	27	23	18	22	19	21	30	45	52	58	34	
	06-08	56	55	43	33	25	28	23	28	42	58	60	63	43	
	09-11	60	57	44	33	20	23	17	22	32	51	58	64	40	
	12-14	56	52	32	26	14	16	12	13	17	35	52	61	32	
	15-17	53	47	22	14	10	11	7	8	11	28	48	58	26	
	18-20	51	44	19	11	8	9	7	6	10	28	46	55	25	
	21-23	49	46	18	11	8	9	9	8	11	28	47	56	25	
	ALL HRS	53	49	28	21	14	16	13	15	21	39	51	59	32	21
CEILING LESS THAN 1500 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	35	36	13	9	5	7	6	8	12	27	34	39	19	
	03-05	36	37	18	15	12	17	14	15	24	37	36	41	25	
	06-08	41	43	34	24	18	21	16	22	37	50	43	46	33	
	09-11	46	45	33	15	10	11	8	11	22	41	44	47	28	
	12-14	40	38	20	8	4	5	3	5	9	25	36	41	20	
	15-17	39	34	13	4	3	6	2	3	6	20	33	40	17	
	18-20	36	34	12	6	3	5	3	3	6	21	31	38	16	
	21-23	36	33	10	6	4	5	5	4	8	21	32	38	17	
	ALL HRS	39	38	19	11	7	9	7	9	16	30	36	41	22	21
CEILING LESS THAN 1000 FT AND OR VISIBILITY LESS THAN 2 MI	00-02	22	23	6	4	3	3	3	4	7	19	23	24	12	
	03-05	24	24	8	8	6	9	7	7	16	26	24	25	15	
	06-08	29	33	21	13	8	10	8	12	24	38	32	30	22	
	09-11	33	34	18	8	3	4	3	5	12	28	29	33	18	
	12-14	27	25	10	3	1	2	1	2	4	19	23	27	12	
	15-17	25	22	6	2	1	2	1	1	3	12	21	27	10	
	18-20	23	23	5	2	1	2	1	1	3	14	20	25	10	
	21-23	23	21	5	3	1	2	2	2	3	15	21	24	10	
	ALL HRS	26	26	10	5	3	4	3	4	9	21	24	27	14	21
CEILING LESS THAN 200 FT AND/OR VISIBILITY LESS THAN 1/2 MI	00-02	7	8	1	1	#	#	#	#	1	10	8	8	4	
	03-05	6	8	2	1	1	1	2	1	6	13	9	8	5	
	06-08	7	11	4	2	#	1	1	1	8	16	11	8	6	
	09-11	8	9	2	#	0	#	0	0	1	8	7	9	4	
	12-14	6	4	1	#	0	0	0	#	#	1	4	6	2	
	15-17	6	4	#	#	0	#	0	0	#	2	5	6	2	
	18-20	5	4	#	0	0	#	0	0	0	4	6	6	2	
	21-23	7	6	1	#	0	0	#	#	#	6	7	7	3	
	ALL HRS	7	7	1	1	#	#	#	#	2	8	7	7	3	21

AWS CLIMATIC BRIEF

Prepared by ETAC (MAR 1972)

HOHENFELS AAF, GERMANY[1] PERIOD: 1961-70[a] WBAN # 34195 WMO #

N 49 13 E 11 50 FIELD ELEVATION: 1450 ft STN LTRS: EDIH

MONTH	TEMPERATURE (°F) Extreme Maximum [a,4]	Mean Daily Maximum [4]	Mean Daily Minimum [4]	Extreme Minimum [a,4]	PRECIPITATION (In) Mean Total [4]	Maximum in 24 Hours [4]	Mean Snowfall [4]	Max Snowfall in 24 Hours [4]	WIND (KT) Prevailing Direction	Mean Speed	Extreme (Max) Speed (Wind)[b]	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (in Hg)	Pressure Altitude [a] 99.95% (Feet)	MEAN NUMBER OF DAYS Precip ≥ 0.01 [4,a]	Precip ≥ 0.5 [4,a]	Snowfall ≥ 0.1 [4,a]	Snowfall ≥ 1.5 [4,a]	Thunderstorms	Fog	TEMPERATURE (°F) Maximum ≥	Maximum ≥	Minimum ≤	Minimum ≤	Mean Clouds (Tenths)
JAN	56	32	21	-15	2.4	0.9	10	6	W	5	27	85	81	23	.12	2250	14	#	8	3							8
FEB	58	36	23	-11	2.1	2.4	7	5	W	6	40	83	77	26	.14	2450	12	1	7	#							7
MAR	74	43	27	-3	2.2	0.[illegible]	5	4	W	6	40	86	70	30	.17	2300	14	1	7	1							7
APR	82	55	36	19	2.0	0.[illegible]	2	1	W	6	33	85	62	38	.23	2200	15	#	4	0							7
MAY	86	63	43	27	2.1	1.[illegible]	#	#	W	6	21	86	59	44	.29	1900	14	#	#	0							7
JUN	90	70	50	31	2.8	1.5	#	#	W	6	27	83	58	51	.38	1800	13	1	#	0							7
JUL	92	73	51	37	2.4	1.5	#	#	W	6	40	86	57	52	.39	1800	14	1	0	0							6
AUG	92	70	50	37	3.2	1.2	0	0	W	5	27	87	60	53	.40	1800	14	2	0	0							6
SEP	84	65	46	29	2.2	0.[illegible]	0	0	W	5	33	89	62	50	.36	1900	13	1	0	0							6
OCT	76	58	38	21	2.2	0.[illegible]	#	#	W	4	21	90	69	44	.29	2000	11	2	0	0							6
NOV	66	43	33	9	2.0	0.[illegible]	4	5	W	5	27	88	78	35	.20	2350	12	#	4	#							8
DEC	60	32	23	-13	2.3	1.2	10	3	W	5	33	87	83	26	.14	2500	14	1	10	2							8
ANN	92	53	36	-18	27.9	2.4	38	6	W	5	40	86	68	40	.25	2150	162	10	40	6							7
EYR	9	9	9	9	3	5	3	3	9	9	9	12	12	9	9	8	3	3	3	3							9

REMARKS

[1] LOCATED 33 NM SE OF NURNBERG.
[a] LESS THAN FULL TIME OPERATION.
[a] EXTREME LIMIT OF 2°F CLASS INTERVALS.
[4] ESTIMATED FROM SURROUNDING STATIONS. [b] HIGHEST HOURLY WIND SPEED CLASS INTERVAL.
RUSSWO POR: HRLY OBS: 6109-7012; DAILY OBS: 6401-6502, 6508-09, 6601-7012.

NOTE: *DATA NOT AVAILABLE #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02														
	03-05	80	71	61	51	39	20	22	41	52	76	73	84	56	4
	06-08	77	72	66	47	34	25	23	33	58	78	70	74	55	9
	09-11	75	67	62	45	35	28	25	31	37	59	64	74	50	9
	12-14	67	58	57	47	35	25	20	30	29	40	58	66	44	9
	15-17	65	54	48	37	27	18	15	19	21	28	55	66	38	9
	18-20	68	48	42	28	17	18	8	11	15	29	62	67	34	9
	21-23														
	MEAN OF LISTED HOURS	72	62	56	43	31	22	19	28	35	52	64	72	46	
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02														
	03-05	72	60	49	36	35	17	20	38	45	65	59	80	48	4
	06-08	69	62	56	36	30	18	17	27	50	67	58	64	46	9
	09-11	67	56	51	27	20	14	11	22	28	49	52	64	38	9
	12-14	57	43	40	17	10	7	4	13	13	25	42	56	27	9
	15-17	54	38	32	12	7	5	2	6	8	14	39	55	23	9
	18-20	57	33	32	12	6	5	2	3	11	21	45	56	24	9
	21-23														
	MEAN OF LISTED HOURS	63	49	43	23	18	11	9	18	26	40	49	63	34	
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02														
	03-05	54	43	30	20	24	9	4	17	33	54	44	45	31	4
	06-08	50	38	33	18	15	8	8	17	36	54	41	44	30	9
	09-11	47	30	24	10	8	5	3	8	14	32	35	40	21	9
	12-14	37	22	15	4	2	2	1	3	5	13	24	34	14	9
	15-17	33	19	12	2	2	2	#	2	2	8	22	31	11	9
	18-20	36	18	10	4	3	1	0	1	2	11	27	30	12	9
	21-23														
	MEAN OF LISTED HOURS	43	28	21	10	9	5	3	8	15	29	32	37	20	
CIG less than 200 feet and/or VSBY less than ½ mile	00-02														
	03-05	6	7	3	4	7	5	0	7	17	28	4	5	8	4
	06-08	7	6	6	4	3	2	2	5	40	31	13	6	9	9
	09-11	7	3	3	#	#	#	#	1	5	12	10	5	4	9
	12-14	4	1	1	0	0	0	0	0	1	2	3	4	1	9
	15-17	4	1	#	0	0	0	0	0	#	1	3	3	1	9
	18-20	4	2	1	0	0	0	0	0	1	2	6	3	1	9
	21-23														

AWS CLIMATIC BRIEF	ILLESHEIM AAF/STORK BARRACKS, GERMANY[1]	PERIOD: 1959-70[2]	WBAN # 34190
Prepared by ETAC (APR 1972)	N 49 28 E 10 23	FIELD ELEVATION: 1065 ft	WMO # 10752 STN LTRS: EDIK

MONTH	TEMPERATURE (°F) Extreme Maximum[3]	Mean Daily Maximum[4]	Mean Daily Minimum[4]	Extreme Minimum[3]	PRECIPITATION (in) Mean Total[4]	Maximum in 24 Hours	Mean Snowfall[4]	Max Snowfall in 24 Hours	WIND (KT) Prevailing Direction	Mean Speed	Extreme (Peak) (Gust) Speed	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (in Hg)	Pressure Altitude 99.95% (Feet)	MEAN NUMBER OF DAYS Precip ≥ 0.01 in[4]	Precip ≥ 0.5 in[4]	Snowfall ≥ 0.1 in[4]	Snowfall ≥ 1.5 in[4]	Thunderstorms[4]	Fog	TEMPERATURE (°F) Maximum ≥ 86	Maximum ≥ 76	Minimum ≤ 32	Minimum ≤ 0	Mean Clouds (Tenths)
JAN	56	35	26	-11	1.2	0.5	5	3	WSW	8	42	89	82	25	.14	1950	16	#	9	1	#		0	0	23	2	6
FEB	68	39	27	-5	1.0	0.4	4	3	W	8	54	87	76	27	.15	2100	14	0	7	1	0		0	0	19	1	7
MAR	76	47	32	1	1.1	0.5	5	2	W	9	60	88	70	32	.18	1900	14	#	6	1	#		0	#	15	0	7
APR	86	56	38	23	1.3	0.8	2	2	W	8	50	90	62	39	.24	1850	17	1	3	#	1		#	#	5	0	8
MAY	88	66	46	29	1.9	0.7	0	0	W	8	42	92	59	45	.30	1550	11	1	#	0	7		#	4	#	0	8
JUN	90	71	52	33	2.1	1.3	0	0	W	7	46	90	58	51	.38	1450	11	1	0	0	10		1	8	0	0	7
JUL	94	74	55	41	2.5	0.9	0	0	W	7	60	90	55	53	.40	1450	9	2	0	0	9		3	11	0	0	7
AUG	94	72	54	41	2.6	1.3	0	0	W	7	36	95	61	53	.40	1500	15	2	0	0	7		2	8	0	0	7
SEP	88	66	48	29	1.8	0.6	0	0	W	7	46	94	65	50	.36	1550	9	1	0	0	2		#	3	#	0	6
OCT	86	51	41	21	1.6	0.7	#	#	W	7	47	95	71	44	.29	1750	8	#	1	0	#		#	#	4	0	7
NOV	68	44	34	13	1.4	0.4	2	3	W	8	55	92	81	[illegible]	.21	2000	13	0	4	#	#		0	0	12	0	7
DEC	61	37	29	-7	1.3	0.5	5	3	W	8	54	90	83	28	.15	2150	16	#	8	1	0		0	0	19	1	8
ANN	94	55	40	-11	19.8	1.3	23	3	W	8	60	91	69	41	.26	1800	153	8	38	4	36		5	34	97	4	7
EYR	12	10	10	12	3	4	3	3	12	12	4	9	9	12	12	11	3	3	3	3	15		80	80	80	12	12

REMARKS

[1] 26 NM W OF NÜRNBERG ALRT.
[2] LESS THAN FULL TIME OPERATION.
[3] EXTREMES OF 2°F CLASS INTERVALS.
[4] ESTIMATED FROM SURROUNDING STATIONS.

RUSSWO POR: HRLY OBS: 5903-7012; DAILY OBS: 6208-6502, 6608-11, 6703-7012.

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02														
	03-05	56	59	47	38	28	13	21	25	46	56	48	53	41	5
	06-08	63	53	49	35	25	24	21	24	42	55	50	59	42	12
	09-11	64	53	50	36	29	25	21	28	30	46	54	61	41	12
	12-14	58	53	50	39	33	26	23	27	24	35	51	58	40	12
	15-17	54	48	44	29	26	19	20	18	15	26	47	58	34	12
	18-20	63	48	42	23	20	17	12	6	12	26	51	64	32	8
	21-23														
	MEAN OF LISTED HOURS	60	52	47	33	27	21	20	21	28	41	50	59	38	
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02														
	03-05	39	39	33	27	19	8	9	13	39	45	29	37	28	5
	06-08	49	37	33	25	17	16	13	23	36	45	34	39	31	12
	09-11	50	39	34	18	13	12	6	15	22	36	37	45	24	12
	12-14	46	36	27	13	8	7	3	6	9	17	32	41	20	12
	15-17	42	32	20	7	5	5	3	3	4	12	30	40	17	12
	18-20	53	34	24	6	4	4	4	2	4	14	34	44	19	8
	21-23														
	MEAN OF LISTED HOURS	42	36	29	16	11	9	6	10	19	28	33	41	23	
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02														
	03-05	27	18	24	20	11	5	3	5	26	34	17	21	18	5
	06-08	28	22	20	13	9	10	6	13	27	32	24	23	19	12
	09-11	32	24	20	9	4	5	3	6	12	22	24	28	16	12
	12-14	25	21	12	5	3	2	2	3	3	8	18	25	11	12
	15-17	23	17	8	2	1	2	1	2	1	5	19	23	9	12
	18-20	25	19	9	2	1	2	2	1	2	6	22	23	10	8
	21-23														
	MEAN OF LISTED HOURS	27	20	16	9	5	4	3	5	12	18	21	24	14	
CIG less than 200 feet and/or VSBY less than ½ mile	00-02														
	03-05	5	4	5	6	3	4	0	0	11	15	4	1	5	5
	06-08	4	5	5	3	2	2	1	3	12	14	6	4	5	12
	09-11	4	4	1	1	#	0	0	#	2	5	4	3	2	12
	12-14	2	1	0	0	0	0	0	0	0	#	1	[illegible]	[illegible]	12
	15-17	2	1	#	0	#	0	0	0	0	#	1	1	#	12
	18-20	3	1	0	0	0	0	0	0	0	0	1	3	1	8
	21-23														

PREPARED BY: USAFETAC JUNE 1974	STATION NAME: KITZINGEN AAF GERMANY LOCATION: N49 45 E010 12	PERIOD: FEB 46-JUL 72 8 ELEV: 689	STN LTRS: EDIN WBAN NO.: 34191 WMO NO.: 10659

AWS CLIMATIC BRIEF

MONTH	Temp (°F) Mean Daily Max	Mean Daily Min	Mean Monthly	Extreme Max	Extreme Min	Precip (in) Monthly Mean	Monthly Max	Monthly Min	Max 24 Hrs	Snowfall (in) Monthly Mean	Monthly Max	Max 24 Hrs	Mean Rel Humidity (%) LST 04	13	Mean Vapor Pressure (in Hg)	Mean Dew Pt (°F)	Mean Pressure Altitude (FT)	Surface Winds Pvlg Dir	Speed Mean (KT)	Speed Max (KT)	Mean Cloud Cover (eighths)	Precip ≥ 0.01	≥ 0.5	Snowfall ≥ 0.1	≥ 1.5	Thunderstorms	Fog Vsby < 7 mi	Temp Max ≥ 90	Max ≥ 80	Min ≤ 32	Min ≤ 00
JAN	33	26	31	56	-5	1.5	2.9	.6	.6	7	17	6	88	81	.16	26	1650	SW	5	40	8	16	*	8	1	0	23	0	0	23	1
FEB	42	30	36	50	1	1.6	3.7	.1	.7	6	13	4	86	75	.16	29	1650	SW	5	41	8	14	1	6	1	*	19	0	0	15	0
MAR	48	33	41	77	10	1.6	3.6	.5	1.1	2	5	3	84	66	.19	33	1550	SW	6	49	7	12	*	1	1	*	17	0	0	16	0
APR	58	40	49	86	24	2.1	3.5	1.4	1.0	*	2	2	83	57	.24	39	1400	SW	6	35	7	13	1	1	*	1	15	0	1	3	0
MAY	67	48	57	88	31	2.6	5.6	.6	1.7	*	*	*	83	54	.31	46	1150	SW	5	37	7	11	1	0	0	4	15	0	3	*	0
JUN	72	53	63	91	39	2.6	4.9	.5	1.8	0	0	0	87	55	.39	53	1050	SW	4	40	7	12	1	0	0	5	14	1	7	0	0
JUL	76	55	66	97	40	2.1	4.1	.3	1.5	0	0	0	87	56	.42	54	1050	SW	4	40	6	9	1	0	0	5	16	3	10	0	0
AUG	74	55	65	93	42	3.1	3.1	1.4	1.2	0	0	0	88	58	.42	54	1030	SW	4	39	7	14	2	0	0	5	18	2	8	0	0
SEP	68	49	59	87	31	1.7	3.6	.6	.8	0	0	0	91	61	.36	50	1100	SW	4	35	6	11	1	0	0	2	22	0	2	0	0
OCT	59	42	51	80	28	1.1	1.9	.1	.8	*	*	*	91	68	.29	44	1250	SW	4	42	7	8	*	0	0	*	24	0	*	5	0
NOV	46	36	41	67	18	1.3	1.8	.7	.9	2	5	4	88	76	.21	36	1600	SW	4	40	8	13	*	2	*	*	22	0	0	11	0
DEC	37	28	33	56	-6	1.2	1.8	.7	.9	3	6	4	88	82	.16	29	1650	SW	5	36	8	11	*	7	1	0	24	0	0	21	*
ANN	57	41	49	97	-6	21.9	5.5	.0	1.8	22	17	6	87	68	.25	[illegible]	[illegible]	SW	5	59	7	142	8	27	4	22	239	6	31	92	1
EYR	9	9	9	9	9	9	9	9	9	10	10	10	13	14	14	14	-	14	14	5	13	9	9	10	10	9	9	9	9	9	9

REMARKS: RUSSWC POR:
HRLY OBS: FEB, APR-JUN, AUG-SEP 46, DEC 46-JUL 47, (34163)
AND AUG 59-JUL 72 (34191) (12 OBS/DAY: FEB, APR 46,
DAILY OBS: 11-16 OBS/DAY: AUG 59-JUL 63, APR 72)

NOTE: - DATA NOT AVAILABLE * LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT AS APPLICABLE ** INSTANTANEOUS PEAK WINDS [illegible]

CAV FREQ (%)	HRS LST	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CEILING LESS THAN 3000 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	37	42	26	13	9	10	6	8	12	39	46	38	27	10
	03-05	57	43	32	19	14	17	13	16	28	51	49	58	33	13
	06-08	39	51	44	26	21	22	18	26	40	38	53	39	40	14
	09-11	39	30	44	30	24	22	17	24	30	30	33	59	39	14
	12-14	33	47	39	27	20	20	13	17	14	31	48	53	32	14
	15-17	52	42	29	19	14	12	10	10	8	22	42	56	26	14
	18-20	53	39	26	13	9	9	6	6	6	22	47	58	25	13
	21-23	54	40	24	11	8	8	6	6	8	23	46	57	24	12
	ALL HRS	56	45	33	20	15	13	11	14	19	37	48	57	31	
CEILING LESS THAN 1500 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	43	32	13	7	6	5	3	6	8	30	32	43	13	10
	03-05	43	33	22	11	10	10	9	11	22	42	36	42	24	13
	06-08	43	36	31	18	14	13	13	19	36	49	38	42	30	14
	09-11	48	37	28	13	7	6	3	12	23	38	38	44	25	14
	12-14	40	27	17	6	4	4	3	3	7	16	31	37	16	14
	15-17	36	23	10	6	2	2	2	2	3	10	26	36	13	14
	18-20	40	28	11	3	1	2	1	1	3	15	31	38	15	13
	21-23	41	29	11	4	2	2	2	2	5	18	31	40	16	12
	ALL HRS	42	31	18	8	6	6	5	7	13	27	33	40	20	
CEILING LESS THAN 1000 FT AND OR VISIBILITY LESS THAN 2 MI	00-02	22	17	6	*	1	2	1	1	4	17	16	21	9	10
	03-05	24	19	10	3	6	5	4	5	13	29	19	22	13	13
	06-08	26	21	17	8	7	8	8	10	28	37	21	24	18	14
	09-11	29	23	14	4	3	3	2	4	12	24	23	[illegible]	14	14
	12-14	24	15	8	1	1	1	2	1	2	9	16	[illegible]	8	14
	15-17	21	12	3	1	1	1	1	1	1	5	14	19	7	14
	18-20	23	14	4	1	*	1	1	1	1	6	16	21	8	13
	21-23	22	14	4	1	1	1	1	1	1	9	17	21	8	12
	ALL HRS	24	17	8	3	2	3	2	3	8	17	18	22	11	
CEILING LESS THAN 300 FT AND OR VISIBILITY LESS THAN 1/2 MI	00-02	3	4	1	0	0	*	0	0	2	7	4	3	2	10
	03-05	3	3	1	1	1	1	1	2	7	14	5	3	4	13
	06-08	3	4	4	2	2	1	1	4	15	22	7	4	6	14
	09-11	3	3	1	*	*	*	0	*	4	11	5	3	3	14
	12-14	2	1	1	0	0	0	0	0	*	1	1	3	1	14
	15-17	2	1	*	0	0	0	0	0	0	*	2	2	1	14
	18-20	2	1	*	*	0	0	0	0	0	1	1	2	1	13
	21-23	2	2	*	0	0	0	0	0	*	2	4	2	1	12
	ALL HRS	3	2	1	*	*	*	0	1	4	8	4	3	2	

AWS CLIMATIC BRIEF

Prepared by ETAC (APR 1970)

RAMSTEIN AB/LANDSTUHL, GERMANY — PERIOD: 1952-66 — WBAN # 34050 — WMO # 10614

N 49 25 — E 07 35 — ELEVATION: 799 ft — STN LTRS: EDAR

MONTH	TEMPERATURE (°F) Extreme Maximum	Mean Daily Maximum	Mean Daily Minimum	Extreme Minimum	PRECIPITATION (In) Mean Total	Maximum in 24 Hours	Mean Snowfall	Max Snowfall in 24 Hours	WIND (KT) Prevailing Direction	Mean Speed	Extreme (Peak) (Gusts) Speed	MEAN Relative Humidity (%) 0400	Relative Humidity (%) 1300	Dew Point (°F)	Vapor Pressure (in Hg)	Pressure Altitude (Feet) 99.95%	MEAN NUMBER OF DAYS Precip ≥ 0.01	Precip ≥ 0.5	Snowfall ≥ 0.1	Snowfall ≥ 1.5	Thunderstorms	Fog (< 7 Miles)	Temperature (°F) Maximum ≥ 90	Maximum ≥ 80	Minimum ≤ 32	Minimum ≤ 0	Mean Clds (Tenths)
JAN	55	36	26	-7	2.1	1.4	5	6	SW	6	48	87	81	27	.14	1700	15	1	5	1	#	20	0	0	22	1	8
FEB	67	39	25	-9	1.7	1.4	4	5	WSW	6	43	87	75	28	.15	1900	13	#	5	1	#	18	0	0	20	1	7
MAR	73	49	31	4	1.5	0.8	4	6	W	5	36	88	67	33	.19	1650	11	#	3	1	1	21	0	0	18	0	7
APR	82	58	36	19	1.6	1.7	1	6	W	5	38	89	60	39	.24	1400	12	1	1	#	2	20	0	#	10	0	7
MAY	89	65	42	24	1.9	0.8	#	#	W	5	35	91	57	45	.30	1200	12	1	0	0	4	22	0	2	3	0	7
JUN	94	71	49	31	2.6	1.6	0	0	W	4	46	92	59	51	.37	1250	11	1	0	0	5	21	#	5	#	0	7
JUL	100	74	52	37	2.3	1.6	0	0	W	5	35	91	58	53	.40	1150	12	1	0	0	5	19	2	7	0	0	7
AUG	94	72	51	36	2.8	1.4	0	0	WSW	5	44	92	60	53	.40	1200	14	1	0	0	4	22	1	6	0	0	7
SEP	88	67	46	30	2.0	1.3	0	0	SW	4	36	92	64	50	.36	1200	12	1	0	0	3	24	0	2	1	0	6
OCT	77	57	39	21	1.7	0.8	#	#	SW	4	39	92	73	43	.28	1400	12	1	0	0	1	26	0	0	6	0	7
NOV	65	46	35	12	1.8	1.4	1	5	SW	5	50	90	80	36	.21	1600	13	1	1	#	#	24	0	0	12	0	9
DEC	66	39	29	0	2.3	1.4	3	4	SW	6	51	89	83	31	.17	1850	15	1	3	#	#	23	0	0	19	#	8
ANN	100	56	39	-9	24.3	1.7	18	6	WSW	5	51	90	68	41	.26	1500	152	10	18	3	25	260	3	22	111	2	7
EYR	13	13	13	13	13	13	13	13	15	15	4	15	15	15	15	12	13	13	13	13	13	13	13	13	13	13	15

REMARKS

RUSSWO POR: Hourly Obs - Mar 52-Dec 66
Daily Obs - Mar 52-Jun 65

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02	68	59	42	29	18	20	21	27	45	67	72	73	45	
	03-05	69	66	53	45	37	40	38	43	57	72	75	74	56	
	06-08	71	70	64	52	38	39	38	48	64	77	78	76	60	
	09-11	73	73	60	41	27	27	28	33	46	70	78	77	53	
	12-14	68	61	36	26	18	20	20	17	26	42	64	72	39	
	15-17	60	49	25	19	11	14	12	10	17	25	54	66	30	
	18-20	60	50	26	16	6	10	8	8	17	31	60	66	30	
	21-23	65	51	29	17	10	12	13	12	28	50	65	69	35	
	ALL HOURS	67	60	42	31	20	23	22	25	38	54	68	71	43	15
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02	54	48	35	21	13	15	15	22	37	58	59	59	36	
	03-05	55	54	45	36	28	33	30	36	47	63	59	59	45	
	06-08	54	56	52	40	26	30	27	37	53	67	62	58	47	
	09-11	59	61	45	21	9	10	9	16	30	57	61	61	37	
	12-14	52	44	19	8	3	5	4	4	10	24	45	53	23	
	15-17	46	32	13	6	2	5	2	1	5	15	36	47	18	
	18-20	48	37	16	7	2	4	3	3	10	25	44	48	21	
	21-23	52	41	22	10	4	8	8	7	21	43	52	54	27	
	ALL HOURS	53	47	31	19	11	14	12	16	27	44	52	55	32	15
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02	35	31	18	11	6	8	7	11	25	43	39	37	23	
	03-05	36	33	26	18	16	20	17	24	33	49	42	39	29	
	06-08	35	38	35	24	14	15	13	24	40	54	43	38	31	
	09-11	41	42	27	9	2	3	3	5	15	39	41	44	23	
	12-14	34	25	8	3	#	1	1	#	3	13	26	33	12	
	15-17	30	17	5	2	#	2	1	#	2	8	20	29	10	
	18-20	31	20	7	2	#	1	1	1	4	14	25	31	11	
	21-23	32	24	9	4	2	3	2	2	11	28	33	33	15	
	ALL HOURS	34	29	17	9	5	7	6	9	17	31	34	36	20	15
CIG less than 200 feet and/or VSBY less than ½ mile	00-02	5	5	4	3	2	2	2	3	10	21	10	8	6	
	03-05	6	6	6	4	5	7	1	10	18	20	12	8	10	
	06-08	6	8	8	5	3	3	4	10	17	26	11	8	9	
	09-11	7	7	3	#	0	0	0	#	3	11	9	7	4	
	12-14	3	2	0	0	#	0	0	0	0	1	2	3	1	
	15-17	2	1	1	#	0	#	0	0	0	#	1	3	1	
	18-20	2	2	1	0	0	0	0	0	#	3	4	4	1	
	21-23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

AWS CLIMATIC BRIEF

Prepared by ETAC (Sep 1970)

SEMBACH AB/GERMANY — N 49 30 E 07 52

PERIOD: 1953-67 — ELEVATION: 1062 ft

WBAN # 34056 — WMO # 10712 — STN LTRS: EDAS

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM	MEAN DAILY MAXIMUM	MEAN DAILY MINIMUM	EXTREME MINIMUM	PRECIPITATION (in) MEAN TOTAL	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	WIND (KT) PREVAILING DIRECTION	MEAN SPEED	EXTREME (Peak Gust) SPEED	MEAN RELATIVE HUMIDITY (%) 0400	1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE 99.95% (Feet)	MEAN NUMBER OF DAYS PRECIP ≥ 0.01 in	PRECIP ≥ 0.5 in	SNOWFALL ≥ 0.1 in	SNOWFALL ≥ 1.5 in	THUNDERSTORMS	FOG (< 7 Miles)	TEMPERATURE (°F) MAXIMUM ≥ 90	MAXIMUM ≥ 80	MINIMUM ≤ 32	MINIMUM ≤ 0	MEAN CLOUDS (Tenths)
JAN	55	35	26	-2	2.4	1.0	6	6	SW	8	48	88	83	27	.14	1950	17	1	7	2	#	22	0	0	22	#	8
FEB	67	38	27	-6	2.0	1.1	5	6	NE	8	60	86	76	28	.15	2150	13	1	6	1	#	18	0	0	18	1	7
MAR	69	46	32	9	1.8	0.8	3	4	NE	7	48	85	68	32	.18	1850	12	1	3	1	1	20	0	0	15	0	7
APR	80	55	39	23	1.8	0.7	#	2	WSW	6	37	85	62	38	.23	1750	14	#	#	#	2	17	0	#	6	0	7
MAY	84	62	45	28	2.0	0.9	#	0	W	6	39	87	59	44	.29	1500	13	1	0	0	4	17	0	#	1	0	7
JUN	90	69	51	35	2.8	1.7	0	0	W	6	40	88	60	50	.36	1450	12	2	0	0	5	16	#	3	0	0	7
JUL	97	71	54	41	2.4	1.9	0	0	W	6	44	87	60	53	.40	1450	12	1	0	0	5	17	1	5	0	0	7
AUG	92	70	53	38	3.0	2.1	0	0	WSW	6	42	90	63	53	.40	1500	14	2	0	0	4	19	#	4	0	0	7
SEP	90	66	49	32	2.3	1.8	0	0	SW	6	40	90	66	50	.36	1450	11	1	0	0	2	22	#	2	#	0	6
OCT	77	56	42	25	1.8	1.2	#	#	SW	5	45	92	74	44	.29	1700	11	1	0	0	#	27	0	0	4	0	7
NOV	66	44	35	15	2.1	1.3	2	5	SW	6	49	90	81	36	.21	1900	13	1	2	#	#	25	0	0	11	0	8
DEC	64	38	30	5	2.5	1.6	2	3	SW	8	46	90	85	31	.17	2150	16	1	4	#	#	24	0	0	18	0	9
ANN	97	54	40	-6	26.9	2.1	18	6	SW	6	60	88	69	41	.26	1800	158	13	22	4	23	244	1	14	95	1	7
EYR	14	14	14	14	14	[illegible]	14	14	15	15	5	15	15	15	15	14	14	14	14	14	14	14	14	14	14	14	15

REMARKS

RUSSWO FOR: Hourly Obs: Jul 53 - Dec 67
Daily Obs: Jul 53 - Dec 66

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or Visibility less than 3 miles	00 - 02	64	55	35	24	14	17	16	19	30	49	68	71	39	
	03 - 05	66	61	47	33	27	29	25	31	42	58	71	73	47	
	06 - 08	68	66	54	40	30	31	31	39	52	66	72	75	52	
	09 - 11	72	67	53	40	30	27	30	33	38	58	72	78	50	
	12 - 14	69	59	41	32	21	19	21	23	26	43	62	72	41	
	15 - 17	61	48	28	21	14	12	15	12	15	29	56	70	32	
	18 - 20	63	50	29	18	9	9	9	8	16	32	61	69	31	
	21 - 23	64	49	28	17	9	12	11	10	19	39	63	70	33	
	ALL HOURS	66	57	39	28	19	19	20	22	30	47	66	72	40	
CIG less than 1500 feet and/or Visibility less than 3 miles	00 - 02	54	46	26	18	10	13	12	15	26	44	56	62	31	
	03 - 05	54	50	35	24	20	23	21	26	37	51	59	64	39	
	06 - 08	56	54	43	32	23	24	24	32	44	59	61	64	41	
	09 - 11	61	56	41	24	12	12	12	18	24	44	59	66	36	
	12 - 14	54	42	20	12	5	7	5	6	9	25	46	57	24	
	15 - 17	48	37	15	8	3	5	4	4	6	18	41	54	20	
	18 - 20	51	38	17	8	3	5	4	4	9	24	48	53	22	
	21 - 23	52	40	21	11	4	7	7	6	14	33	52	58	25	
	ALL HOURS	54	45	27	17	10	12	11	14	21	38	53	60	30	15
CIG less than 1000 feet and/or Visibility less than 2 miles	00 - 02	36	29	12	9	5	8	6	8	12	28	38	44	20	
	03 - 05	37	31	17	14	11	14	13	17	22	34	40	47	25	
	06 - 08	38	37	27	20	12	13	13	20	29	44	44	45	29	
	09 - 11	45	41	22	11	4	4	5	8	11	33	44	50	23	
	12 - 14	37	26	11	4	1	3	2	2	4	14	30	41	15	
	15 - 17	34	21	8	3	1	2	2	1	3	10	27	38	13	
	18 - 20	32	24	9	3	1	2	2	2	4	13	28	37	13	
	21 - 23	33	25	9	4	1	4	3	3	7	18	32	39	15	
	ALL HOURS	37	29	14	9	5	6	6	8	12	24	36	43	17	15
CIG less than 200 feet and/or Visibility less than ...	00 - 02	6	5	2	1	2	1	1	1	4	11	10	12	5	
	03 - 05	7	5	3	3	3	4	3	4	8	16	13	10	7	
	06 - 08	6	8	3	3	2	2	2	4	12	21	13	12	7	
	09 - 11	7	8	2	1	#	#	#	#	2	9	11	11	4	
	12 - 14	5	2	1	#	0	0	0	0	0	2	5	7	2	
	15 - 17	4	2	1	#	0	0	0	0	0	1	4	6	2	
	18 - 20	7	2	1	0	0	0	0	0	#	2	6	7	2	

CS DATED SEP 70 OBSOLETE

PREPARED BY USAFETAC JUNE 1974	STATION NAME SPANGDAHLEM AB GERMANY	LOCATION N49 59 E006 42	PERIOD MAY 53-JUL 72	ELEV 1195	STN LTRS EDAO	WBAN NO 34054	WMO NO 10607

AWS CLIMATIC BRIEF

MONTH	Temp °F Mean Daily Max	Mean Daily Min	Mean Monthly	Extreme Max	Extreme Min	Precip In Monthly Mean	Monthly Max	Monthly Min	Max 24 Hrs	Snowfall In Monthly Mean	Monthly Max	Max 24 Hrs	Mean Relative Humidity 03 LST	12 LST	Vapor Pressure In Hg	Dew Pt °F	Pressure Altitude Ft	Surface Winds Prevailing Direction	Mean Speed Kt	Max Speed Kt	Cloud Cover Tenths	Mean No. of Days: Precip ≥	Precip ≥	Snowfall ≥	Snowfall ≥	Thunderstorms	Fog Vsby < ½	Temp Max ≥ 90	Temp Max ≥ 80	Temp Min ≤ 32	Temp Min ≤ 0
JAN	35	28	32	52	-3	2.4	4.9	.8	.9	7	24	7	87	82	.15	28	2150	E	8	62	8	17	1	8	1	*	23	0	0	21	*
FEB	39	29	34	61	-3	2.2	6.4	.2	2.5	7	25	7	86	76	.15	28	2300	[illegible]	7	48	8	14	*	6	1	*	19	0	0	18	*
MAR	46	33	40	72	9	1.7	3.3	.9	1.2	3	15	4	85	67	.19	32	2050	E	7	45	7	13	*	4	1	*	18	0	0	14	0
APR	56	39	47	81	24	1.5	3.4	.4	1.1	*	2	1	83	60	.22	37	1950	E	7	40	7	12	*	1	0	1	15	0	*	5	0
MAY	62	45	54	86	28	2.5	6.5	.7	1.2	*	1	1	84	57	.28	43	1700	E	6	38	7	14	1	*	0	4	15	0	1	1	0
JUN	67	50	59	90	35	2.5	4.2	.1	1.7	0	0	0	86	61	.36	50	1600	E	6	37	7	13	1	0	0	5	16	*	2	0	0
JUL	7[illegible]	54	62	94	4[illegible]	2.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	86	61	.40	53	1600	[illegible]	6	50	7	13	1	0	0	5	17	*	4	0	0
AUG	68	53	61	88	38	2.6	6.2	1.4	1.6	0	0	0	90	63	.40	53	1650	[illegible]	6	36	7	15	1	0	0	4	20	0	3	0	0
SEP	64	49	57	85	34	2.1	5.5	.1	1.3	*	*	*	89	65	.35	49	1650	[illegible]	5	39	6	12	1	0	0	2	21	0	1	0	0
OCT	55	43	49	74	27	1.8	3.5	.4	1.3	*	*	*	91	74	.29	44	1850	E	6	47	7	12	1	*	0	1	25	0	0	2	0
NOV	44	35	40	66	17	2.3	3.6	.2	1.3	2	10	5	90	81	.21	36	2150	E	7	51	8	15	1	2	*	*	24	0	0	10	0
DEC	38	31	36	58	7	2.4	5.8	.2	1.3	4	14	12	89	85	.17	31	2300	[illegible]	8	43	8	16	1	5	1	*	26	0	0	18	0
ANN	53	41	47	94	-3	26.9	6.5	.1	2.5	23	25	12	87	69	.25	42	1925	[illegible]	7	62	7	166	10	26	4	22	237	*	11	89	*
YRS	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	17	19	19	11	18	19	19	17	19	19	19	19	19	19	19

REMARKS RUNWAY PSN:
HRLY OBS: MAY 53-JUL 72 (12 OBS/DAY: NOV-DEC 6[illegible],
AND 13-14 OBS/DAY APR-JUN 69, 12-21 OBS/DAY: AUG-NOV 69,
DAILY OBS: 10 OBS/DAY: JUL-OCT 71)

NOTE *DATA NOT AVAILABLE #LESS THAN [illegible] ... PERCENT AS APPLICABLE ... ** INSTANTANEOUS PEAK WINDS [illegible]

CAV FREQ (%)	HRS LST	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CEILING LESS THAN 3000 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	66	53	38	24	20	19	18	26	33	52	62	71	40	
	03-05	67	60	47	33	33	32	36	41	46	61	68	73	50	
	06-08	70	65	55	41	39	35	41	48	54	68	73	75	55	
	09-11	70	63	50	41	33	30	32	38	41	61	70	73	50	
	12-14	66	54	40	32	20	20	19	23	25	42	58	69	39	
	15-17	62	45	30	20	11	14	12	15	15	32	53	67	31	
	18-20	60	45	27	18	11	12	10	13	14	34	51	67	30	
	21-23	61	45	31	19	14	15	13	17	21	40	56	68	33	
	ALL HRS	65	54	40	29	23	22	23	28	31	49	61	70	41	19
CEILING LESS THAN 1500 FT AND OR VISIBILITY LESS THAN 3 MI	00-02	55	40	27	18	13	14	13	21	25	43	48	56	31	
	03-05	55	46	35	25	24	26	30	34	38	52	54	60	40	
	06-08	58	53	44	30	29	26	31	40	45	59	50	62	45	
	09-11	59	50	32	21	13	13	14	19	26	47	55	62	34	
	12-14	49	38	18	12	6	8	6	7	12	25	40	55	23	
	15-17	47	32	14	9	5	7	5	5	9	20	38	50	20	
	18-20	46	31	16	10	5	6	6	8	10	24	38	52	21	
	21-23	50	33	18	12	8	9	8	12	15	32	42	56	26	
	ALL HRS	52	40	26	17	13	14	14	18	23	38	47	56	30	19
CEILING LESS THAN 1000 FT AND OR VISIBILITY LESS THAN 2 MI	00-02	42	28	15	10	8	9	7	14	17	32	36	43	22	
	03-05	42	35	23	16	16	18	20	25	27	40	40	48	29	
	06-08	43	40	28	20	17	17	19	28	34	47	46	50	32	
	09-11	43	38	18	11	6	6	7	10	16	34	40	48	23	
	12-14	36	26	10	6	2	4	3	3	7	16	27	40	15	
	15-17	34	21	9	4	2	3	3	3	5	12	25	37	13	
	18-20	33	20	9	5	3	3	3	5	5	14	26	38	14	
	21-23	37	22	11	6	4	5	4	7	9	21	31	40	16	
	ALL HRS	39	29	15	10	7	8	8	12	15	27	34	43	21	19
CEILING LESS THAN 200 FT AND OR VISIBILITY LESS THAN 1/2 MI	00-02	11	6	2	1	2	2	1	3	2	11	10	14	5	
	03-05	10	8	3	3	3	4	5	6	7	15	13	16	8	
	06-08	11	10	5	3	3	2	2	5	7	18	14	17	8	
	09-11	11	7	1	#	#	#	0	#	1	8	10	14	4	
	12-14	8	3	#	0	#	0	#	0	0	1	5	11	2	
	15-17	8	3	1	#	#	0	#	0	#	1	[illegible]	11	2	
	18-20	8	3	1	#	1	#	#	#	#	2	5	[illegible]	3	
	21-23	8	5	1	1	#	1	#	1	1	5	8	11	4	
	ALL HRS	9	6	2	1	1	1	1	2	2	8	9	13	5	19

AWS CLIMATIC BRIEF	STUTTGART/ECHTERDINGEN, GERMANY	PERIOD: 1946-63	WBAN # 34041 WMO # 10738
Prepared by ETAC (AUG 1971)	N 48 41 E 09 13	FIELD ELEVATION: 1300 ft	STN LTRS: EDDS[1] EDAT

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM	MEAN DAILY MAXIMUM	MEAN DAILY MINIMUM	EXTREME MINIMUM	PRECIPITATION (in) MEAN TOTAL	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	WIND (KT) PREVAILING DIRECTION[2]	MEAN SPEED	EXTREME (MAX) SPEED (JTHD)[3]	MEAN RELATIVE HUMIDITY (%) 0400	1300	DEW POINT (°F)	VAPOR PRESSURE (" Hg)	PRESSURE ALTITUDE 99.95% (Feet)	MEAN NUMBER OF DAYS PRECIP ≥ 0.01	PRECIP ≥ 0.5	SNOWFALL ≥ 0.1	SNOWFALL ≥ 1.5	THUNDERSTORMS	FOG (< 7 MILES)	TEMPERATURE (°F) MAXIMUM ≥ 90	MAXIMUM ≥ 80	MINIMUM ≤ 32	MINIMUM ≤ 0	MEAN CLDNS (TENTHS)
JAN	58	36	27	-2	1.8	1.6	5	6	SW	7	40	87	77	26	.14	2150	14	1	5	1	1	19	0	0	22	#	8
FEB	66	39	27	-14	1.5	1.5	7	18	SW	6	40	86	72	27	.15	2350	13	#	5	1	1	16	0	0	19	1	7
MAR	72	49	33	7	1.4	1.2	1	3	WSW	6	40	84	60	32	.18	2150	11	1	1	#	1	15	0	0	15	0	6
APR	80	57	40	22	1.8	1.4	1	5	WSW	7	40	82	55	37	.22	1950	13	1	#	#	3	9	0	#	5	0	7
MAY	87	64	46	27	2.7	1.9	#	#	WSW	5	27	84	56	44	.29	1750	14	1	#	0	5	11	0	1	1	0	7
JUN	95	70	52	36	3.1	1.2	0	0	WSW	5	33	86	59	51	.38	1700	15	1	0	0	7	9	#	4	0	0	6
JUL	97	73	55	39	2.9	1.8	0	0	WSW	5	27	86	57	54	.42	1600	13	2	0	0	7	6	1	8	0	0	6
AUG	94	73	54	39	3.0	1.4	0	0	WSW	5	33	86	57	53	.40	1700	14	2	0	0	5	8	1	7	0	0	6
SEP	89	68	50	34	2.3	2.9	0	0	SW	5	33	88	59	50	.36	1650	12	1	0	0	4	14	0	3	0	0	6
OCT	78	58	41	21	1.5	0.9	#	1	SW	4	33	90	65	42	.27	1850	10	1	#	0	3	19	0	0	4	0	6
NOV	71	45	35	9	1.8	1.5	1	4	SW	5	33	89	76	35	.20	2100	14	#	1	#	3	17	0	0	11	0	8
DEC	62	38	29	-3	1.8	1.1	4	5	SW	5	40	89	81	29	.16	2300	14	1	4	1	2	19	0	0	20	#	7
ANN	97	56	41	-14	25.6	2.9	19	18	SW	5	40	86	65	40	.25	2000	157	12	16	3	42	162	2	23	97	1	7
EYR	17	17	17	17	17	16	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17

REMARKS [1]Civ: (EDDS)
Mil: (EDAT)
Old: (EDOC)

[2]ENE is significant as a secondary prevailing direction because of its high rate of occurrence during afternoons.

[3]Highest hourly wind speed class interval. RUSSWO POR: Hrly and Daily Obs: 4610-6312.

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00 - 02	53	49	25	19	17	14	10	9	18	36	48	55	29	
	03 - 05	54	53	33	27	21	19	16	15	28	46	50	58	35	
	06 - 08	60	59	45	32	25	18	18	15	33	51	56	61	39	
	09 - 11	59	58	39	33	28	23	21	18	22	39	51	62	38	
	12 - 14	54	50	31	30	23	19	16	13	17	27	45	58	32	
	15 - 17	55	47	27	20	15	14	9	7	13	25	46	59	28	
	18 - 20	55	49	25	17	13	10	8	7	11	25	43	58	27	
	21 - 23	54	47	20	15	12	12	9	5	12	29	45	57	26	
	ALL HOURS	55	51	31	24	20	16	13	11	19	35	48	58	32	17
CIG less than 1500 feet and/or VSBY less than 3 miles	00 - 02	36	37	13	10	9	6	5	4	13	26	34	40	19	
	03 - 05	37	37	19	18	17	10	11	10	24	37	37	42	25	
	06 - 08	42	44	34	22	16	10	10	9	26	43	43	46	29	
	09 - 11	44	46	24	15	10	7	5	4	12	27	37	47	23	
	12 - 14	35	31	13	10	[illegible]	5	4	2	6	14	28	42	16	
	15 - 17	37	33	14	7	5	3	3	2	6	16	32	43	17	
	18 - 20	38	35	13	6	5	3	3	2	6	16	30	41	17	
	21 - 23	38	34	10	6	5	3	3	2	7	19	32	41	17	
	ALL HOURS	38	37	18	12	9	6	5	5	12	25	34	43	20	17
CIG less than 1000 feet and/or VSBY less than 2 miles	00 - 02	26	25	6	6	5	3	3	3	10	20	24	30	13	
	03 - 05	26	27	12	12	11	6	8	6	20	29	26	32	16	
	06 - 08	32	35	25	15	10	6	6	6	21	36	32	34	22	
	09 - 11	39	34	15	10	5	4	3	2	7	18	26	36	17	
	12 - 14	23	19	7	6	3	2	2	1	3	8	18	29	10	
	15 - 17	24	21	7	4	2	2	1	1	3	9	21	31	11	
	18 - 20	25	24	7	4	3	1	[illegible]	2	3	9	20	29	11	
	21 - 23	26	23	6	4	3	1	1	1	5	13	22	30	11	
	ALL HOURS	27	26	10	8	5	3	3	3	9	18	24	31	14	17
CIG less than 200 feet and/or VSBY less than ½ mile	00 - 02	5	4	1	1	1	1	1	1	4	8	6	7	3	
	03 - 05	5	6	3	2	3	1	2	2	10	14	8	9	5	
	06 - 08	5	7	4	2	1	1	1	1	7	13	8	9	5	
	09 - 11	3	4	1	#	0	0	#	0	#	2	3	7	2	
	12 - 14	2	1	#	#	0	0	0	0	0	#	2	4	1	
	15 - 17	2	1	#	0	0	0	0	0	0	#	2	4	1	
	18 - 20	3	1	1	#	0	0	0	0	#	#	3	5	1	
	21 - 23	4	2	1	#	#	0	0	0	1	2	4	6	2	

AWS CLIMATIC BRIEF

SCHWAEBISCH HALL AAF/HESSENTAL, GERMANY[1] PERIOD: 1962-70B[2] WBAN # 34074 WMO # 10745

Prepared by ETAC (MAR 1972) N 49 07 E 09 47 FIELD ELEVATION: 1308 ft STN LTRS: EDOP

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM	MEAN DAILY MAXIMUM[3]	MEAN DAILY MINIMUM[3]	EXTREME MINIMUM	PRECIPITATION (in) MEAN TOTAL	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	WIND (KT) PREVAILING DIRECTION	MEAN SPEED	EXTREME (MAX WIND) SPEED[4]	MEAN RELATIVE HUMIDITY (%) 0400	1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE 99.95% (Feet)	MEAN NUMBER OF DAYS PRECIP ≥ 0.01 in	PRECIP ≥ 0.5 in	SNOWFALL ≥ 0.1 in	SNOWFALL ≥ 1.5 in	THUNDERSTORMS	FOG	TEMPERATURE (°F) MAXIMUM ≥	MAXIMUM ≥	MINIMUM ≤	MINIMUM ≤	MEAN CLOUDS (TENTHS)
JAN	50	31	24	-5	2.7	0.5	15	4	E	7	33	89	82	25	.14	2250	20	1	14	2							8
FEB	54	36	23	-3	4.3	1.1	15	4	WSW	8	40	87	80	26	.14	2250	22	2	13	3							8
MAR	76	43	28	9	2.1	0.5	10	4	WSW	7	33	88	71	30	.17	2150	17	#	8	2							8
APR	86	52	35	23	4.0	1.4	7	6	WSW	7	27	86	63	38	.23	2000	18	2	5	1							8
MAY	86	60	42	29	5.7	1.5	1	1	W	7	33	89	61	44	.29	1800	21	4	1	0							8
JUN	90	69	47	35	3.1	1.1	#	#	W	6	21	88	60	51	.38	1650	16	1	0	0							7
JUL	94	70	51	41	2.9	1.2	0	0	W	6	27	87	58	53	.40	1600	14	2	0	0							6
AUG	92	69	49	41	4.6	1.5	0	0	WSW	6	27	91	63	53	.40	1650	17	3	0	0							7
SEP	82	63	45	33	1.1	0.7	#	#	WSW	6	27	93	64	50	.36	1700	11	#	0	0							6
OCT	80	52	37	27	2.2	1.0	#	#	WSW	6	33	95	72	44	.29	1750	12	1	0	0							7
NOV	70	42	32	15	3.2	0.6	5	6	SW	8	33	88	79	36	.21	2200	21	2	2	1							8
DEC	52	35	26	5	2.2	0.6	16	5	E	6	27	90	84	25	.14	2250	18	#	12	4							8
ANN	94	52	37	-5	38.1	1.5	69	6	WSW	7	40	89	70	40	.25	20000	207	18	55	13							7
EYR	7	7	7	7	4	4	4	3	7	7	7	7	7	7	7	7	4	4	4	4							7

REMARKS
[1] Located 40 NM NE of Stuttgart
[2] Less than full time operation
[3] Estimated from surrounding stations
[4] Highest hourly wind speed class interval.

RUSSWO POR: HR ; OBS: 6201-6506, 6705-7012; DAILY OBS: 6201-6502, 6705-7012.
NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02														
	03-05	74	69	52	50	36	26	27	36	54	70	49	74	51	4
	06-08	76	68	59	43	31	31	27	39	48	65	56	73	51	7
	09-11	75	66	56	48	30	26	21	37	32	56	54	71	48	7
	12-14	67	63	50	40	29	22	13	25	22	34	46	66	40	7
	15-17	63	57	42	28	22	16	7	14	12	23	45	65	33	7
	18-20	69	54	35	23	16	12	5	13	10	27	38	67	31	7
	21-23														
	MEAN OF LISTED HOURS	71	63	49	39	27	22	17	27	30	46	48	69	42	
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02														
	03-05	66	51	37	29	28	24	21	29	47	62	35	65	41	4
	06-08	66	54	46	31	22	28	24	34	44	55	45	61	43	7
	09-11	67	56	45	31	15	16	12	25	25	47	44	65	37	7
	12-14	58	51	31	18	10	8	4	12	10	21	34	57	26	7
	15-17	56	43	23	13	9	7	2	6	6	14	30	54	22	7
	18-20	65	41	19	11	8	7	1	8	6	18	26	54	22	7
	21-23														
	MEAN OF LISTED HOURS	63	49	34	22	15	15	11	19	23	36	36	59	32	
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02														
	03-05	47	33	26	18	15	17	10	19	34	48	22	44	28	4
	06-08	46	37	29	25	14	20	11	25	33	43	32	41	30	7
	09-11	49	39	28	18	10	8	4	15	14	32	30	41	24	7
	12-14	38	29	17	10	5	5	1	5	4	12	21	35	15	7
	15-17	36	22	14	7	4	5	1	4	3	8	21	33	13	7
	18-20	44	23	11	7	4	4	1	3	2	12	14	33	13	7
	21-23														
	MEAN OF LISTED HOURS	43	31	21	14	9	10	5	12	15	26	23	38	21	
CIG less than 200 feet and/or VSBY less than ½ mile	00-02														
	03-05	7	2	6	2	1	6	5	7	10	25	5	6	7	4
	06-08	7	3	4	4	3	3	3	7	12	19	7	6	7	7
	09-11	5	3	1	1	#	#	0	1	2	8	5	3	2	7
	12-14	2	1	0	0	#	0	0	0	0	#	3	2	1	7
	15-17	2	1	1	0	0	0	0	#	0	0	3	3	1	7
	18-20	5	0	1	0	0	0	0	0	0	#	3	3	1	7
	21-23														
	MEAN OF LISTED HOURS	5	2	2	1	1	2	1	3	4	9	4	4	3	

AWS CLIMATIC BRIEF

Prepared by ETAC (JUNE 1970)

TEMPELHOF AB/BERLIN, GERMANY — PERIOD: 1946-63 — WBAN # 35104 — WMO # 10384

N 52 29 — E 13 24 — ELEVATION 173 ft — STN LTRS: EDBB

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM	MEAN DAILY MAXIMUM	MEAN DAILY MINIMUM	EXTREME MINIMUM	PRECIPITATION (in) MEAN TOTAL	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	WIND (KT) PREVAILING DIRECTION	MEAN SPEED	EXTREME (MAX) SPEED (WINDS)	MEAN RELATIVE HUMIDITY (%) 0400	1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE 99.95% (Feet)	MEAN NUMBER OF DAYS PRECIP ≥ 0.01 in	PRECIP ≥ 0.5 in	SNOWFALL ≥ 0.1 in	SNOWFALL ≥ 1.5 in	THUNDERSTORMS	FOG (< 7 MILES)	TEMPERATURE (°F) MAXIMUM ≥ 90	MAXIMUM ≥ 80	MINIMUM ≤ 32	MINIMUM ≤ 0	MEAN CLDNS (TENTHS)
JAN	54	35	27	-1	1.7	1.1	6	3	W	9	36	86	79	27	.14	1250	16	#	5	2	1	19	0	0	20	#	6
FEB	61	36	27	-7	1.4	0.8	6	6	W	8	32	86	75	26	.14	1350	13	#	4	1	2	18	0	0	18	#	7
MAR	68	46	33	10	1.2	0.9	2	3	E	8	36	83	63	30	.16	1100	10	#	1	#	1	17	0	0	15	0	6
APR	85	57	41	25	1.6	1.1	#	1	W	8	28	80	54	37	.22	900	12	#	#	0	2	10	0	#	3	0	6
MAY	89	66	49	31	2.0	2.3	0	0	W	7	30	79	52	44	.29	650	13	1	0	0	4	7	0	2	#	0	6
JUN	97	72	55	38	2.5	1.3	0	0	W	7	27	79	52	50	.36	700	11	1	0	0	5	6	1	5	0	0	6
JUL	101	74	58	42	2.6	2.4	0	0	W	7	25	81	56	54	.42	650	13	1	0	0	6	7	1	7	0	0	6
AUG	96	73	58	45	2.5	2.4	0	0	W	7	32	83	56	54	.42	700	14	1	0	0	4	10	#	6	0	0	6
SEP	92	68	52	36	1.8	1.5	0	0	W	7	29	85	58	50	.36	700	11	1	0	0	3	12	#	2	0	0	6
OCT	76	56	44	26	1.4	1.2	#	#	W	7	26	87	67	43	.28	850	12	#	#	0	3	16	0	0	1	0	6
NOV	61	45	37	20	1.8	1.0	1	4	W	7	34	89	80	37	.22	1100	14	1	#	#	3	18	0	0	7	0	8
DEC	60	37	31	1	1.6	0.7	2	5	W	8	31	88	83	30	.16	1350	14	#	2	#	3	20	0	0	17	0	8
ANN	101	56	43	-7	22.1	2.8	17	6	W	8	36	84	65	40	.25	1000	153	6	12	3	37	160	2	22	81	#	7
EYR	18	18	18	18	18	18	18	18	18	18	10	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18

REMARKS

USSWO POR: Hourly Obs: Apr 46-Dec 63
Daily Obs: Apr 46-Dec 63

NOTE; *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02	59	55	39	23	16	13	13	12	18	39	61	66	35	
	03-05	61	60	48	30	22	21	20	23	29	48	67	67	41	
	06-08	70	74	60	40	27	25	26	27	37	60	76	75	50	
	09-11	67	71	52	33	24	24	25	24	30	49	72	77	46	
	12-14	59	58	40	23	17	15	16	12	19	32	61	69	35	
	15-17	59	55	31	16	11	11	10	8	11	28	61	70	31	
	18-20	59	57	34	16	9	9	8	7	10	31	61	66	31	
	21-23	57	55	35	17	10	10	9	8	12	35	59	66	31	
	ALL HOURS	61	61	42	25	17	16	16	15	21	40	65	70	37	18
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02	44	41	27	14	10	9	9	8	12	30	49	55	26	
	03-05	45	47	37	21	16	16	15	17	23	39	54	56	32	
	06-08	57	64	51	31	17	17	16	20	30	53	67	64	41	
	09-11	57	60	39	17	8	10	9	10	14	38	65	68	33	
	12-14	45	41	22	7	4	5	5	3	6	19	48	58	22	
	15-17	43	38	17	6	3	5	4	2	4	19	50	58	21	
	18-20	45	43	23	8	4	4	4	3	5	22	47	55	22	
	21-23	44	40	25	11	5	6	5	5	7	26	47	54	23	
	ALL HOURS	48	47	30	14	8	9	8	9	13	31	53	59	27	18
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02	28	28	16	9	7	5	6	4	7	19	34	39	17	
	03-05	30	31	23	14	9	9	9	10	14	25	41	40	21	
	06-08	39	46	32	19	8	10	9	11	17	35	51	49	27	
	09-11	38	41	24	9	4	5	5	5	8	24	48	50	22	
	12-14	27	24	14	3	2	2	3	1	3	11	33	41	14	
	15-17	26	20	9	3	1	2	2	1	2	11	31	39	12	
	18-20	27	24	13	5	2	2	2	2	1	14	31	37	13	
	21-23	27	25	14	7	3	4	3	3	4	16	31	38	15	
	ALL HOURS	30	30	18	8	4	5	5	5	7	19	37	42	18	18
CIG less than 200 feet and/or VSBY less than ½ mile	00-02	2	3	2	#	#	#	#	#	1	4	6	5	2	
	03-05	3	4	4	1	#	#	#	1	3	5	6	6	3	
	06-08	3	5	4	1	#	0	#	#	2	7	7	7	3	
	09-11	3	4	2	0	0	0	0	#	#	3	5	7	2	
	12-14	1	1	#	0	0	0	0	0	0	#	2	4	1	
	15-17	1	1	1	0	0	0	0	0	0	#	2	3	1	
	18-20	1	1	1	#	0	0	0	0	0	1	3	4	1	
	21-23	[illegible]	2	2	#	#	0		#	#	2	4	4	1	
	ALL HOURS	2	3	2	#	#	#	#	#	1	3	4	5	2	18

AWS CLIMATIC BRIEF

Prepared by ETAC (APR 1972)

WERTHEIM AAF/REINHARDSHOF, GERMANY [1] PERIOD: 1964-70 [2]

N 49 45 E 09 30 FIELD ELEVATION: 1110 ft

WBAN # 34076
WMO # 10657
STN LTRS: EDOF

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM [3]	TEMPERATURE (°F) MEAN DAILY MAXIMUM [4]	TEMPERATURE (°F) MEAN DAILY MINIMUM [4]	TEMPERATURE (°F) EXTREME MINIMUM [3]	PRECIPITATION (in) MEAN TOTAL [4]	PRECIPITATION (in) MAXIMUM IN 24 HOURS	PRECIPITATION (in) MEAN SNOWFALL	PRECIPITATION (in) MAX SNOWFALL IN 24 HOURS	WIND (KT) PREVAILING DIRECTION	WIND (KT) MEAN SPEED	WIND (KT) EXTREME (MAX) SPEED (WIND) [5]	MEAN RELATIVE HUMIDITY (%) 0700	MEAN RELATIVE HUMIDITY (%) 1300	MEAN DEW POINT (°F)	MEAN VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE 99.95% (Feet)	MEAN NUMBER OF DAYS PRECIP ≥ 0.01 in	PRECIP ≥ 0.5 in	SNOWFALL ≥ 0.1 in	SNOWFALL ≥ [illegible]	THUNDERSTORMS	FOG	TEMPERATURE (°F) MAXIMUM ≥ 86	MAXIMUM ≥ 77	MINIMUM ≤ 32	MINIMUM ≤ 0	MEAN CLDNS (TENTHS)
JAN	56	36	27	-3	1.3	0.8		6	WSW	6	27	91	86	28	.15	1950	15	#	7		#		0	0	20	#	9
FEB	60	40	28	5	1.9	0.6		3	WSW	7	33	90	81	30	.17	2050	9	2	6		#		0	0	16	0	8
MAR	72	49	33	15	1.6	0.8		4	W	8	27	87	70	32	.18	1900	15	#	4		#		0	0	13	0	8
APR	84	58	39	25	2.0	0.8		#	W	7	33	84	63	38	.23	1900	15	1	2		2		0	#	4	0	8
MAY	86	67	47	32	1.7	0.8		#	W	7	27	83	59	45	.30	1600	14	1	#		5		#	4	#	0	8
JUN	92	72	52	41	3.0	2.0		0	W	6	27	83	62	52	.39	1400	13	1	0		6		1	8	0	0	7
JUL	92	75	56	47	2.9	0.9		0	W	6	27	[illegible]	[illegible]	54	.42	1500	14	2	0		6		3	12	0	0	7
AUG	96	73	54	43	2.6	1.0		0	W	6	21	[illegible]	[illegible]	54	.42	1500	13	2	0		5		1	9	0	0	7
SEP	82	66	49	35	2.3	1.2		0	WSW	5	33	93	[illegible]	51	.38	1600	11	1	0		2		0	3	0	0	7
OCT	76	55	41	27	1.3	0.7		#	WSW	6	27	[illegible]	76	46	.31	1650	8	1	#		#		0	0	3	0	8
NOV	62	45	35	17	2.5	0.7		1	WSW	7	33	91	[illegible]	36	.21	2050	18	1	2		0		0	0	9	0	9
DEC	56	39	30	1	1.9	0.5		3	WSW	7	40	91	76	29	.16	2100	16	#	5		#		0	0	16	0	9
ANN	96	56	41	-3	25.0	2.0	*	6	W	6	40	88	72	41	.26	1800	161	12	26	*	26		5	36	81	#	8
EYR	6	50	50	6	3	5		3	6	6	6	6	6	6	6	6	3	3	50		10		50	50	50	6	6

REMARKS

[1] 17 NM W of Würzburg. [2] Less than full time operation. [3] Extremes of 2°F Class Intervals.

[4] Estimated from Nearby Station. [5] Highest Hourly Wind Speed Class Interval.

RUSSWO POR: HRLY OBS: 6411-7012; DAILY OBS: 6411-6502, 6504-05, 6507-11, 6601-7012.

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02														
	03-05														
	06-08	76	58	65	52	42	45	39	55	63	71	69	75	59	
	09-11	76	59	62	50	35	34	27	40	50	66	74	74	54	
	12-14	74	57	56	46	30	30	23	19	30	46	68	69	46	
	15-17	71	52	47	36	21	23	14	10	16	36	62	73	38	
	18-20	72	57	43	32	14	17	13	8	15	34	65	73	37	
	21-23														
	ALL HOURS	74	57	55	43	28	30	23	26	35	51	68	73	47	6
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02														
	03-05														
	06-08	68	49	54	41	32	40	34	51	57	65	59	61	51	
	09-11	67	51	51	37	21	23	15	31	45	61	63	62	44	
	12-14	63	46	37	24	11	14	6	10	17	39	56	58	32	
	15-17	61	41	31	15	7	7	5	5	8	28	47	59	26	
	18-20	65	45	31	12	5	8	6	4	9	29	54	55	27	
	21-23														
	ALL HOURS	65	46	41	26	15	18	13	20	27	44	56	59	36	6
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02														
	03-05														
	06-08	52	41	39	29	21	27	23	43	49	58	45	48	40	
	09-11	54	43	37	23	10	11	9	19	33	52	48	47	32	
	12-14	50	34	22	11	6	6	4	6	9	32	40	43	22	
	15-17	46	26	15	9	4	3	4	3	4	20	34	43	18	
	18-20	49	30	17	7	3	3	4	2	3	22	37	42	18	
	21-23														
	ALL HOURS	50	35	26	16	9	10	9	15	20	37	41	45	26	6
CIG less than 200 feet and/or VSBY less than ½ mile	00-02														
	03-05														
	06-08	21	12	7	7	6	7	7	16	30	37	19	13	15	
	09-11	20	11	6	3	1	#	#	4	13	26	16	17	10	
	12-14	14	6	2	0	0	0	#	0	2	8	10	12	5	
	15-17	9	4	1	#	0	0	#	0	#	3	9	10	3	
	18-20	10	4	1	0	0	0	0	0	0	4	9	9	3	
	21-23														

AWS CLIMATIC BRIEF

Prepared by ETAC (AUG 1971)

WIESBADEN AB/ERBENHEIM, GERMANY — PERIOD: 1946-65 — WBAN # 35010 — WMO # 10633

N 50 03 E 08 20 — FIELD ELEVATION: 460 ft — STN LTRS: EDAW

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM	MEAN DAILY MAXIMUM	MEAN DAILY MINIMUM	EXTREME MINIMUM	PRECIPITATION (in) MEAN TOTAL	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	WIND (KT) PREVAILING DIRECTION [1]	MEAN SPEED	EXTREME (PEAK) SPEED (GUST)	MEAN RELATIVE HUMIDITY (%) 0400	RELATIVE HUMIDITY (%) 1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE 99.95% (Feet)	MEAN NUMBER OF DAYS PRECIP ≥ 0.01 in	PRECIP ≥ 0.5 in	SNOWFALL ≥ 0.1 in	SNOWFALL ≥ 1.5 in	THUNDERSTORMS	FOG (< 7 MILES)	TEMPERATURE (°F) MAXIMUM ≥ 90	MAXIMUM ≥ 80	MINIMUM ≤ 32	MINIMUM ≤ 0	MEAN CLDNS (TENTHS)
JAN	57	37	29	3	1.5	1.3	4	4	WSW	6	50	85	79	28	.15	1400	13	#	5	1	#	19	0	0	20	0	8
FEB	63	40	29	-3	1.2	0.6	3	5	ENE	6	38	84	74	28	.15	1500	11	#	4	1	#	17	0	0	17	#	7
MAR	71	50	35	9	1.2	0.9	1	2	ENE	7	32	82	65	33	.19	1350	9	#	1	#	#	14	0	0	11	0	6
APR	86	60	42	28	1.0	0.7	#	1	NNE	7	38	79	56	39	.24	1150	11	#	#	0	1	8	0	#	2	0	6
MAY	89	67	49	33	1.6	0.9	#	#	NNE	6	28	80	54	45	.30	900	11	1	0	0	4	7	0	2	0	0	6
JUN	96	72	54	38	1.9	2.3	0	0	W	6	31	83	55	51	.38	900	11	1	0	0	5	10	1	6	0	0	6
JUL	99	76	57	41	2.0	1.4	0	0	W	5	34	84	56	54	.42	850	11	1	0	0	5	10	2	9	0	0	6
AUG	95	74	56	42	2.3	1.5	0	0	W	5	45	85	57	54	.42	900	12	1	0	0	4	13	1	7	0	0	6
SEP	93	69	52	35	1.6	1.1	0	0	WSW	5	35	86	63	51	.38	850	10	#	0	0	1	18	#	3	0	0	6
OCT	79	57	43	24	1.4	1.6	#	#	ENE	5	39	88	70	43	.28	1050	10	#	#	0	#	21	0	0	2	0	6
NOV	62	46	37	15	1.8	1.3	1	4	ENE	5	29	88	80	37	.22	1350	13	1	1	#	#	21	0	0	7	0	8
DEC	60	39	31	7	1.8	1.4	3	5	ENE	5	39	87	83	31	.17	1500	13	1	3	1	#	22	0	0	16	0	8
ANN	99	57	43	-3	19.3	2.3	12	5	ENE	6	50	84	66	42	.27	1200	135	6	14	3	20	180	4	27	75	#	7
EYR	19	19	19	19	19	18	19	19	20	20	3	20	20	20	20	18	19	19	19	19	19	19	19	19	19	19	20

REMARKS

[1] SIGNIFICANT AS SECONDARY PREVAILING DIRECTION:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ENE	WSW	WSW	WSW	W	NNE	-	-	ENE	WSW	WSW	WSW	WSW

RUSSWO POR: HRLY OBS: 4603-6510. DAILY OBS: 4603-6410.

NOTE: *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 mile	00-02	54	51	27	13	7	9	8	9	16	34	55	65	29	
	03-05	57	55	35	19	12	15	14	16	24	45	58	65	35	
	06-08	61	57	46	31	20	24	23	28	41	55	64	68	43	
	09-11	67	63	51	30	20	21	22	25	42	57	68	71	45	
	12-14	65	51	40	19	13	12	11	13	25	47	63	70	36	
	15-17	60	50	28	12	9	9	7	6	14	34	58	67	30	
	18-20	56	49	25	11	5	7	6	5	12	31	51	62	27	
	21-23	53	45	22	9	5	7	7	6	12	29	51	64	26	
	ALL HOURS	59	53	34	18	11	13	12	13	23	42	59	67	34	20
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02	36	35	17	6	3	5	3	5	11	27	37	45	19	
	03-05	38	39	22	9	7	9	8	11	18	35	40	46	24	
	06-08	41	43	33	19	14	16	17	21	35	46	47	49	32	
	09-11	50	49	37	17	9	10	9	15	32	47	53	55	32	
	12-14	45	41	24	7	3	2	3	5	16	34	43	51	23	
	15-17	41	34	16	3	2	2	2	2	8	26	39	49	19	
	18-20	39	35	16	4	2	2	2	2	9	25	34	44	18	
	21-23	36	32	14	4	2	4	2	3	8	23	34	44	17	
	ALL HOURS	41	39	22	9	5	6	6	8	17	33	41	48	23	20
CIG less than 1000 feet and/or VSBY less than 2 mile	00-02	24	21	8	2	1	3	1	3	5	17	23	30	12	
	03-05	26	24	11	4	3	5	3	6	10	25	27	32	15	
	06-08	27	28	20	9	6	7	7	11	23	36	32	35	20	
	09-11	30	34	22	8	3	3	3	6	18	36	38	41	21	
	12-14	30	26	14	2	1	1	1	1	6	23	30	37	14	
	15-17	25	23	8	1	1	1	#	1	3	16	26	36	12	
	18-20	25	22	7	1	#	1	1	1	4	14	22	30	11	
	21-23	24	19	6	2	1	1	1	1	3	14	21	28	10	
	ALL HOURS	28	25	12	3	2	3	2	4	9	22	27	34	14	20
CIG less than 200 feet and/or VSBY less than ½ mile	00-02	7	5	1	0	0	#	0	#	1	7	5	10	3	
	03-05	6	7	2	#	#	1	#	1	2	12	9	11	4	
	06-08	9	9	4	1	1	1	1	2	7	19	11	12	6	
	09-11	10	9	4	1	#	#	0	#	3	13	10	12	5	
	12-14	7	5	1	#	#	#	0	0	1	4	4	10	3	
	15-17	6	5	#	0	0	#	#	0	#	2	5	9	2	
	18-20	4	4	#	#	0	0	0	0	0	3	4	8	2	
	12-23	[illegible]	4	1	0	0	0	#	0	0	4	6	8	2	
	ALL HOURS	[illegible]	5	2	#	#	#	#	#	2	8	7	10	4	20

AWS CLIMATIC BRIEF	ZWEIBRÜCKEN AB, GERMANY	PERIOD: 1891-69B	WBAN # 34053
Prepared by ETAC (JAN 1971)	N 49 13 E 07 24	ELEVATION: 1135 ft	WMO # 10714 / STN LTRS: [illegible]

MONTH	TEMPERATURE (°F) EXTREME MAXIMUM	MEAN DAILY MAXIMUM	MEAN DAILY MINIMUM	EXTREME MINIMUM	PRECIPITATION (in) MEAN TOTAL [1]	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	WIND (KT) PREVAILING DIRECTION	MEAN SPEED	EXTREME SPEED [3]	MEAN RELATIVE HUMIDITY (%) 0400	1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	PRESSURE ALTITUDE 99.95%	MEAN NUMBER OF DAYS PRECIP ≥ 0.004	PRECIP ≥ 0.04 in	SNOWFALL ≥ in	SNOWFALL ≥ in	THUNDERSTORMS	FOG	TEMPERATURE (°F) MAXIMUM ≥ 90	MAXIMUM ≥ 80	MINIMUM ≤ 32	MINIMUM ≤ 0	MEAN CLOUDS (Tenths)
JAN	55	36	28	0	2.6				SW	8	40	89	84	29	.16	2000	13	12					0	0	21	#	8
FEB	67	40	29	0	2.2				SW	7	47	87	78	29	.16	2150	15	10					0	0	17	#	7
MAR	76	47	34	12	2.6				SW	7	55	85	69	33	.19	1900	16	11					0	0	12	0	7
APR	81	55	40	25	2.3				SW	7	33	83	61	38	.23	1800	17	12					0	#	4	0	7
MAY	84	63	46	30	2.4				SW	6	[illegible]	86	59	44	.29	1550	15	10					0	1	#	0	7
JUN	88	68	52	36	2.6				WSW	6	33	88	61	51	.33	1500	15	9					0	3	0	0	6
JUL	94	72	55	42	2.9				SW	6	33	88	60	53	.40	1450	15	10					1	6	0	0	6
AUG	90	69	54	41	2.9				SW	6	33	91	64	54	.42	1500	16	11					#	3	0	0	7
SEP	87	66	50	35	2.6				SW	6	27	91	67	51	.38	1550	14	9					0	1	0	0	6
OCT	78	56	43	25	2.9				SW	6	40	92	76	45	.30	1750	16	10					0	0	2	0	7
NOV	68	44	36	17	2.7				SW	7	47	91	82	36	.21	1900	17	11					0	0	10	0	8
DEC	74	38	31	7	3.4				SW	8	55	90	86	31	.17	2150	19	14					0	0	19	0	8
ANN	94	55	42	0	32.1	*	*	*	SW	7	55	88	71	41	.26	1900	193	129	*	*	*	*	1	14	[illegible]	#	7
EYR	15	15	15	15	40				15	15	15	15	15	15	15	15	40	40					15	15	15	15	16

REMARKS

[1] Klimakunde des Deutschen Reiches, Band II/Tabellen, Berlin 1939. (POR: 1891-1930)

[3] Refers to highest wind speed class interval

RUSSWO POR: Hrly Obs: Oct 54 - Jun 66, Oct 66 - May 69
Daily Obs: Oct 54 - Jun 66, Oct 66 - May 69

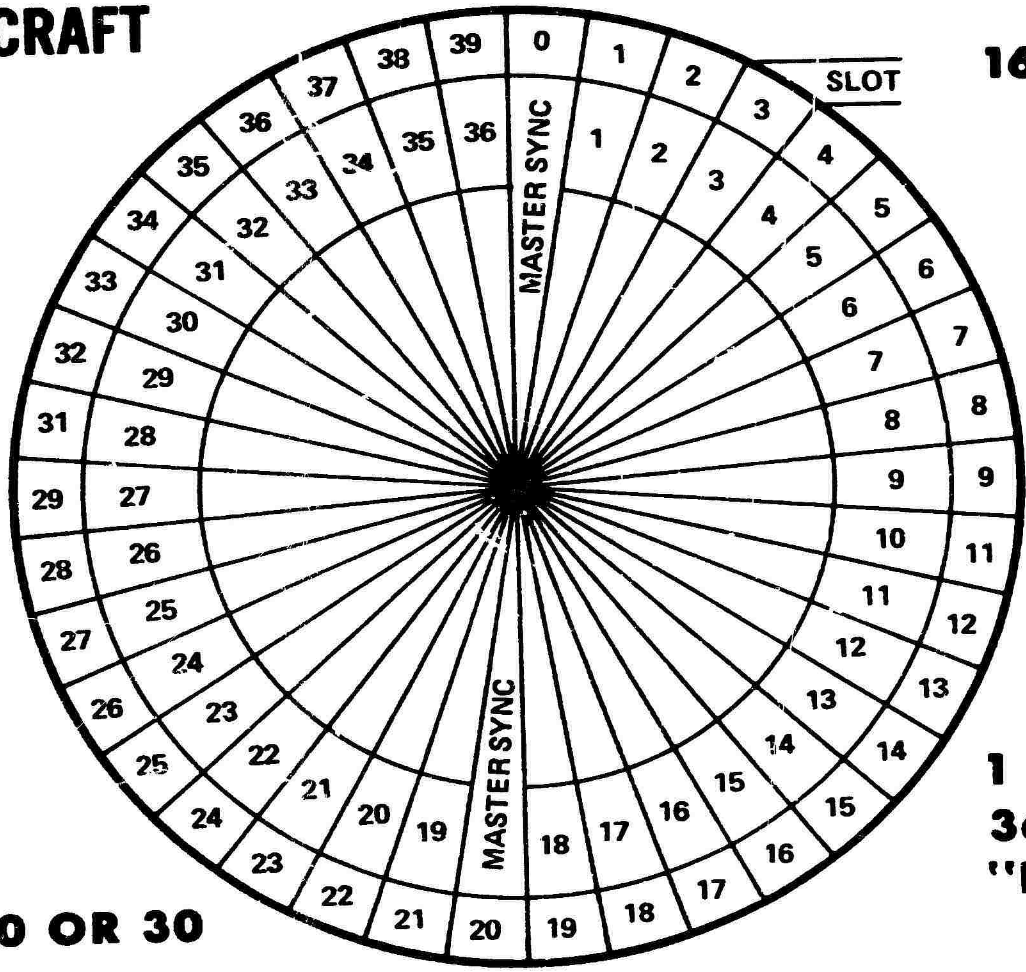
NOTE; *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

FLYING WEATHER (% FREQ)	HOURS (LST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	EYR
CIG less than 3000 feet and/or VSBY less than 3 miles	00-02	70	57	42	28	18	23	21	27	37	53	67	73	43	
	03-05	73	61	51	37	32	36	34	41	50	62	74	[illegible]	52	
	06-08	75	63	60	48	42	42	39	48	57	69	76	[illegible]	52	
	09-11	75	71	60	49	40	38	34	43	50	66	77	79	57	
	12-14	72	64	50	38	28	26	25	32	35	51	67	76	47	
	15-17	67	52	38	24	15	18	14	17	21	35	59	72	36	
	18-20	66	48	34	20	11	14	11	12	19	34	59	73	34	
	21-23	69	50	34	21	13	15	14	16	24	43	61	73	36	
	ALL HOURS	71	59	46	33	25	26	24	30	36	52	68	[illegible]	[illegible]	15
CIG less than 1500 feet and/or VSBY less than 3 miles	00-02	53	43	31	21	12	13	17	23	31	47	59	[illegible]	3[illegible]	
	03-05	62	49	40	29	25	31	29	36	45	56	65	[illegible]	45	
	06-08	65	56	50	40	35	37	35	43	52	63	66	68	51	
	09-11	67	62	47	36	22	26	19	30	40	59	69	79	46	
	12-14	61	49	30	18	8	12	9	12	20	34	54	64	32	
	15-17	54	39	22	12	5	9	5	8	12	22	45	58	24	
	18-20	55	37	21	12	5	8	6	7	12	26	48	58	25	
	21-23	56	41	23	15	6	11	9	12	19	35	51	59	28	
	ALL HOURS	60	47	33	23	15	19	16	21	29	43	57	63	36	15
CIG less than 1000 feet and/or VSBY less than 2 miles	00-02	44	35	19	10	7	11	11	15	21	33	42	47	25	
	03-05	49	38	26	19	14	21	19	27	32	41	47	51	32	
	06-08	48	43	36	29	22	25	24	34	42	50	50	52	33	
	09-11	52	48	31	22	12	14	11	18	27	43	50	56	32	
	12-14	47	36	17	9	5	5	4	6	10	22	37	51	21	
	15-17	40	28	12	6	2	5	3	4	7	13	30	42	16	
	18-20	41	27	13	6	2	4	3	5	7	17	34	41	17	
	21-23	42	30	13	8	4	6	5	7	11	23	36	43	19	
	ALL HOURS	45	36	21	14	9	11	10	15	20	30	41	48	25	15
CIG less than 200 feet and/or VSBY less than ¼ mile	00-02	8	4	2	1	1	1	1	2	3	8	9	12	4	
	03-05	10	6	2	2	1	4	2	4	6	12	13	14	6	
	06-08	13	10	3	4	3	4	3	6	9	18	14	15	9	
	09-11	12	10	2	1	#	1	#	1	4	13	12	15	6	
	12-14	7	5	1	0	#	#	0	0	#	2	5	[illegible]	[illegible]	
	15-17	6	3	1	#	0	0	#	0	0	1	[illegible]	[illegible]	2	
	18-20	7	4	1	#	0	#	0	#	#	1	7	[illegible]	2	
	21-23	[illegible]	3	1	#	#	#	#	#	1	4	[illegible]	10	3	
	ALL HOURS	[illegible]	6	2	1	1	1	1	2	3	7	9	11	4	15

APPENDIX C

STATIONKEEPING CLOCK SCHEMATIC

SKE SLOT ASSIGNMENTS FOR 36 AIRCRAFT



160 MICRO SEC

38 SLOTS
1 FRAME

1 FRAME
6080 MICRO SEC

1 FRAME
36 AIRCRAFT
"ROUNDROBIN"

NOTE:

NO SLOT 10 OR 30

SLOTS 0 & 20 : MASTER GENERATES TIME REFERENCE CODES
ANY AIRCRAFT CAN BE MASTER

1637-015

APPENDIX D

HELO SKE REPORT

HELO SKE FOREWORD

The following HELO SKE report was compiled by representatives of Sierra Research Corporation in response to inquiries concerning Helicopter Stationkeeping development since 1966. The report is presented in its original form to insure authenticity and context of meaning. The future capabilities of N/AWS technology is included.

The information contained in the HELO SKE report is subject to the provisions setforth in the Proprietary Rights and Privileges statement on page 18 of this study.

17 December 1975

HELO SKE

The application of stationkeeping (SKE) to helicopters has been examined and evaluated by Sierra Research since the mid 1950s. The concept of SKE denotes operating in one particular formation with a time-ordered system, in which a separate time slot is associated with each aircraft for the purpose of time-shared multiplex operation. This is accomplished by providing synchronized stable local clocks in each SKE.

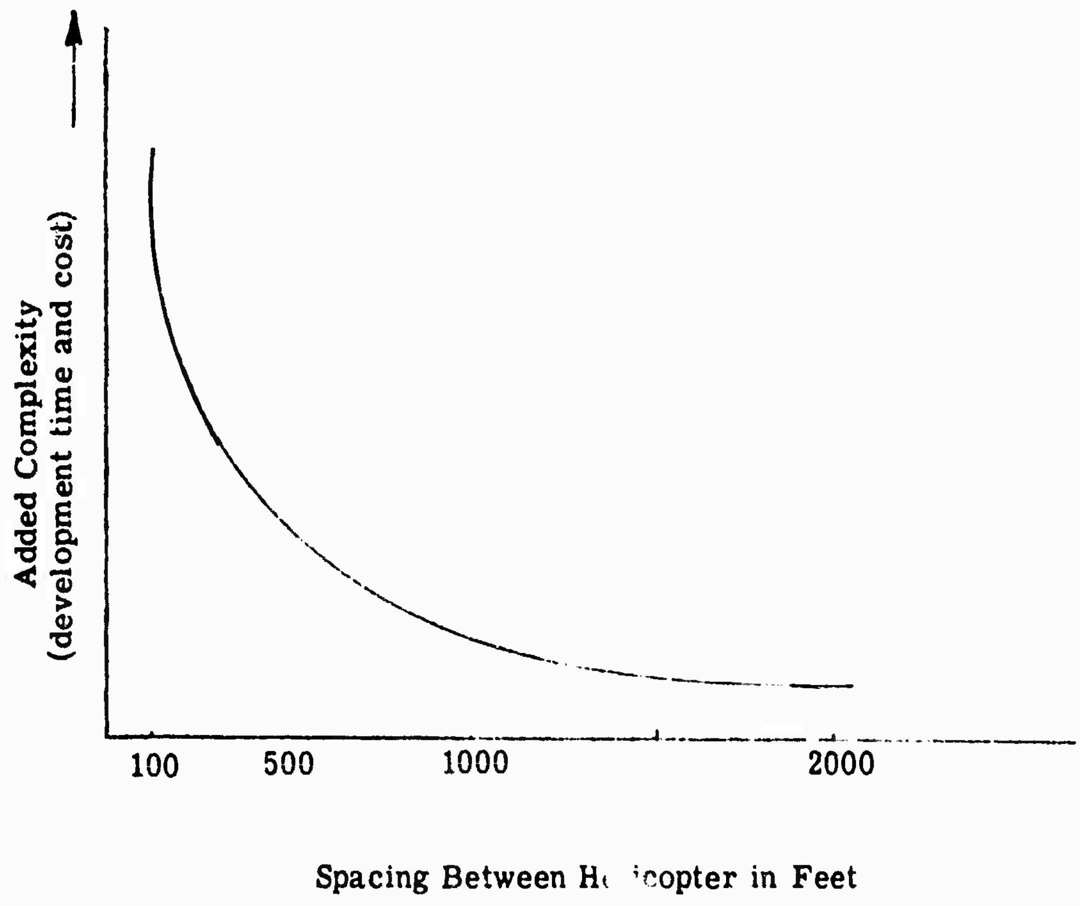
The first Sierra SKE system was the AN/APA-161. This was a combination of search radar and two way, L Band SKE for the Navy HS-1 and HS-2 helicopter. The two-way connotation refers to the fact that time-ordering was utilized only to prevent mutual interference. Range formation was obtained in the classic beacon interrogate/respond manner.

In the mid 1960's Sierra developed the first one-way stationkeeper, the SNS-64. This system has clocks with very good stability, and accomplishes automatic synchronization to the order of 3 parts in 10^9. The result is a system in which synchronization is required infrequently and each member can compute range from all other members by measuring the time of arrival of a known transmission. Without the need for many interrogations and frequent synchronization, it is possible to determine accurate range (±200 foot) free of multipath. Moreover, because of the high stability clock, short term loss of the synchronizer (Master) can be tolerated. This one-way system became the AN/APN-169A, AN/APN-169B Intraformation Positioning Set (stationkeeping) and the AN/TPN-27 Zone Marker.

The early SNS-64 system was also tested (1965) in the Army's UH-19 helicopter. This system was designed for the C-130 airlift aircraft flight characteristics with an update period of 1.5 seconds. This data rate proved too low for the flight profiles utilized in the UH-19 tests. Sierra recognized this situation before the tests began but with the press of Southeast Asia, agreed to demonstrate the equipment. Since the Army was not able to modify the helicopter flight requirements, the system was deemed unacceptable.

Sierra developed the SNS-64 into the production configuration APN-169A, B for the C-130 and C-141, adding along the way the Track-While-Scan, altitude data transfer and data transfer features. Sierra also began and has continued a study of the technical problems associated with flying helicopters in close formation.

The complexity of SKEs for helicopters is related to the required spacing between the vehicles. The following figure, which is not quantitatively derived, can provide a simplified picture of the problem.



The figure shows that with spacings of 2000 feet, for which the existing APN-169B/TPN-27 equipment has been designed, the system can be made to do the helicopter stationkeeping job with very little effort. Indeed it may be that spacings down to 1000 feet can be obtained for the same effort. As the spacing decreases to about 100 feet, the problem complexity increases manifold.

At the longer spacings (1000 to 2000 feet) the 169B type equipment will accomplish the Helo SKE Mission. There are certain installation problems to consider - equipment location, weight reduction, and antenna location. In addition, certain growth features may be of interest, such as multiple channel operation, and spread spectrum waveform. The spread spectrum technique permits low level of rf radiation thereby reducing the probability of detection. The technique can also be employed to provide a more secure, less jammable system. Both of these growth features have been engineered at Sierra for future applications. Neither the installation or growth modifications present a serious technical or budget impact.

As the spacing decreases the complexity increases to the point where a 169 type SKE will not suffice. In the following, the requirements for a minimum spacing (100 feet) SKE shall be discussed. Between the two spacing extremes a blend of the existing 169 type SKE and minimum spacing SKE can be made. For the sake of brevity, we will not go into those combinations at this time.

To analyze the close formation problem, Sierra in 1970, spent considerable time researching the then existing helicopter formation techniques. Directives such as the U.S. Army Helicopter Flying Special Text, ST1-105-1 from Fort Rucker were studied. A portion of an internal Sierra Research technical memo dated 16 April 1970 is attached as an appendix. Let us assume for a moment that although procedures may have changed, the basic SKE requirements as distilled from the 1970 techniques are still adequate.

From this study the following table was derived:

OVERALL EXTENSION OF TWO-COMPANY-FORMATION OF
32 UH-1 HELICOPTERS
(All dimensions in feet)

SPACING	100	300	500
Roto Diameter (approx.)	40	40	40
Flight diameter (1)	300	900	1,500
Diagonal length of one company(1)	1,950	5,850	9,750
Spacing between companies (1-1/2 flight diameter)	450	1,350	2,250
Length of second company	1,950	5,850	9,750
Diagonal length of two companies in echelon formation	4,350	13,050	21,750

(1)Computations are based on figures 2 and 3 of the Appendix.

The SKE functional requirements were analyzed for all spacings. The following is a compilation of the requirements derived for the 100 foot spacing SKE case which presents the most difficult situation.

SYSTEM REQUIREMENTS

1. Each helicopter shall determine the position of all the other helicopters of the formation in relation to own ship and shall transmit his compass heading to all the other helicopters.
2. The stationkeeping equipment shall be capable of handling a formation of 32 helicopters (two companies).
3. The updating rate shall be 5 samples/second.
4. The coordinate system for the formation display shall be oriented to own ship's heading.
5. The coordinate system for the tracking display shall be oriented to the leader's heading.

6. The compass heading data must adequately be filtered to provide stable display of position data during turbulence.

7. A selector for leader identification number and command position coordinates shall be provided.

8. Using leader position and compass heading data and command position coordinates, follower position (in relation to command position), heading error, and relative bearing, with respect to leader shall be computed.

9. From present follower position, the predicted position, shall be computed, based on the tracker equations.

10. Smoothing time shall be 1 second, prediction interval shall be 5 seconds.

11. The follower's closing rate shall be computed.

12. Proximity helicopters entering own ship's collision warning sphere shall be detected.

13. The radius of the collision warning sphere shall be variable. The values shall correspond to the desired spacing.

14. The stationkeeping system shall be capable of transferring preparatory and execute flight commands from leader to follower. The following commands shall be transferred:

(1) left turn (standard rate)
(2) right turn (standard rate)
(3) minus (slow)
(4) plus (fast)
(5) pop-up
(6) let down
(7) formation break-up
(8) landing
(9) execute

15. Roll and pitch data stabilization is required if the measured location data depend on own ship's attitude.

16. The stationkeeper design shall minimize the probability of enemy interception and vulnerability to false signals (jamming).

17. The weight of the system, installed in the aircraft, shall be approximately 30 pounds.

18. The effects of aircraft structure shadowing shall be considered.

DISPLAY REQUIREMENTS

1. Range and bearing of all helicopters of the formation in relation to own ship shall be displayed on own-ship-centered CRT indicator (formation display, PPI mode).

2. Present smoothed position and predicted position of follower shall be displayed on command-position-centered CRT indicator (tracking display, command mode). Displayed on the same indicator shall be the position of the leader (which is fixed in relation to the center of the CRT) and the positions of any proximity helicopters within the proximity sphere. Maximum range of the tracking display shall be 800 feet.

3. Altitude separation, heading error, and closing rate of the follower. shall be displayed.

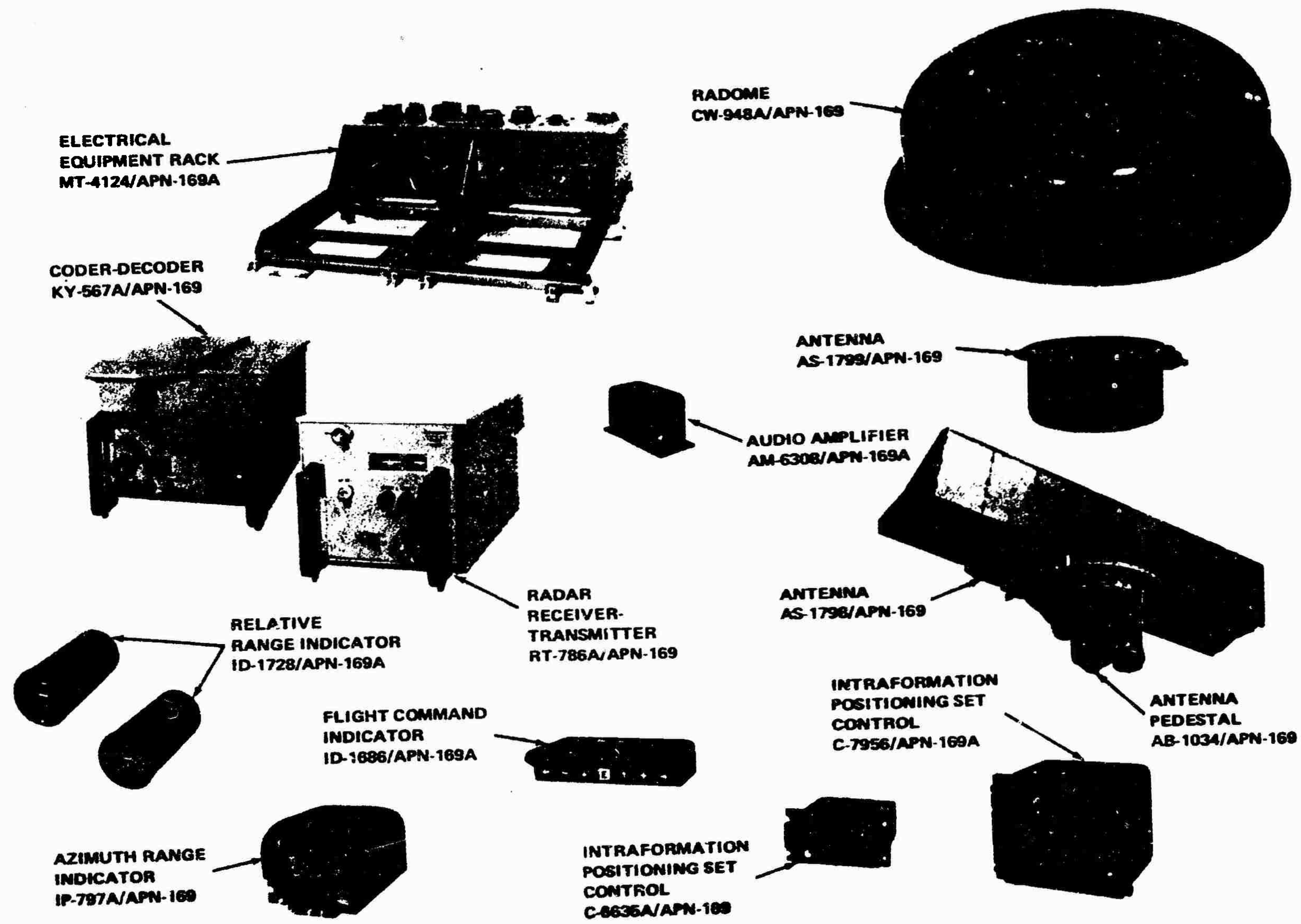
4. Symbols indicating transmittal and receipt of flight commands shall be displayed.

5. A warning signal shall be generated when proximity helicopters are entering own ship's collision warning sphere.

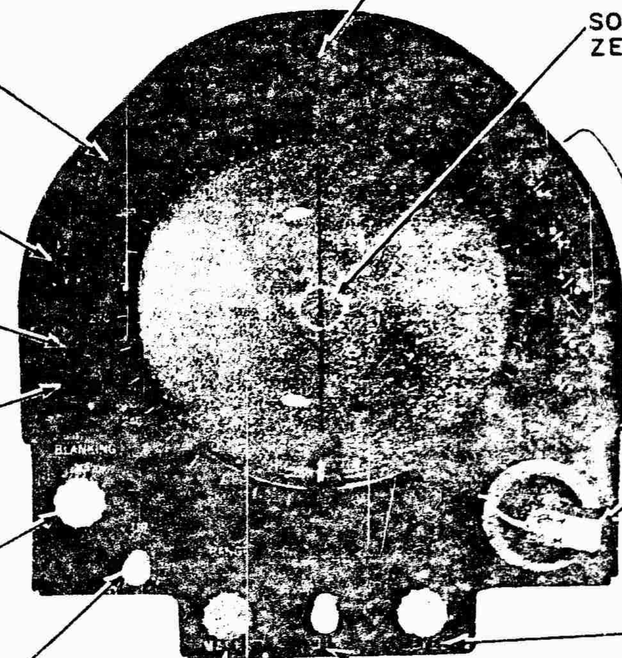
6. The collision warning sphere shall be displayed in the form of a circle around own ship.

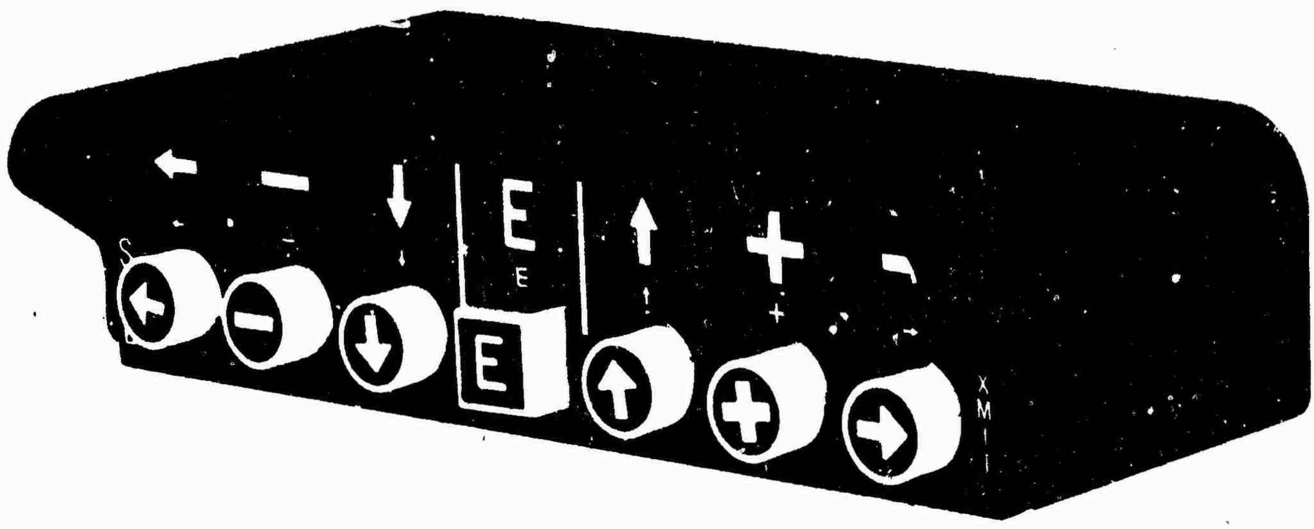
This list although long and impressive is not beyond the state of the art. Indeed several of the required features are in the 169B design. It should also be noted that the list refers to Sierra's minimum spacing case interpretation, which would require refinement with the Army. In any case it is obvious that 100 foot separation is more difficult than 2000 foot separation. Indeed the 2000 foot spacing system is available with only installation modifications required.

APPENDIX D1-D8


ELECTRICAL EQUIPMENT RACK MT-4124/APN-169A
RADOME CW-948A/APN-169
CODER-DECODER KY-567A/APN-169
ANTENNA AS-1799/APN-169
AUDIO AMPLIFIER AM-6308/APN-169A
RADAR RECEIVER-TRANSMITTER RT-786A/APN-169
ANTENNA AS-1798/APN-169
RELATIVE RANGE INDICATOR ID-1728/APN-169A
INTRAFORMATION POSITIONING SET CONTROL C-7956/APN-169A
ANTENNA PEDESTAL AB-1034/APN-169
FLIGHT COMMAND INDICATOR ID-1686/APN-169A
AZIMUTH RANGE INDICATOR IP-797A/APN-169
INTRAFORMATION POSITIONING SET CONTROL C-8635A/APN-169

PILOT/COPILOT PPI DISPLAY





NOTE: USED WITH AN/APN-169A SYSTEM PART NO. 6803-0001-4 AND SUBSEQUENT

Figure 1-11A. Flight Command Indicator Part No. 6803-7000-3

STATIONKEEPER

- SILENT SIGNALING SYSTEM

  FLIGHT COMMAND INDICATOR FOR MANEUVERING
  7 DISCRETE ORDERS

←	L TURN
−	DECREASE SPEED
↓	DESCENT
E	EXECUTE
↑	CLIMB
+	INCREASE SPEED
→	R TURN

1637-014

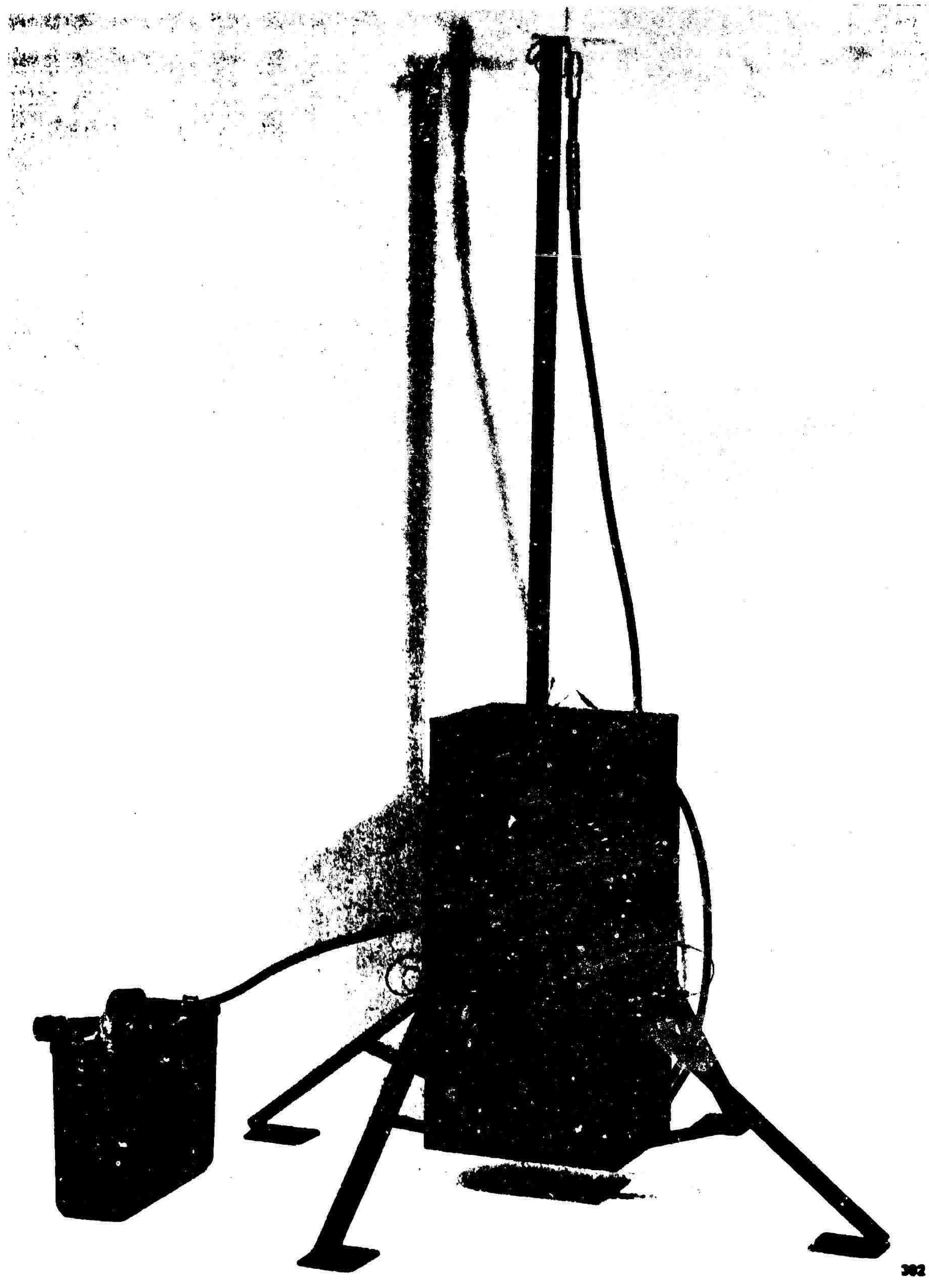
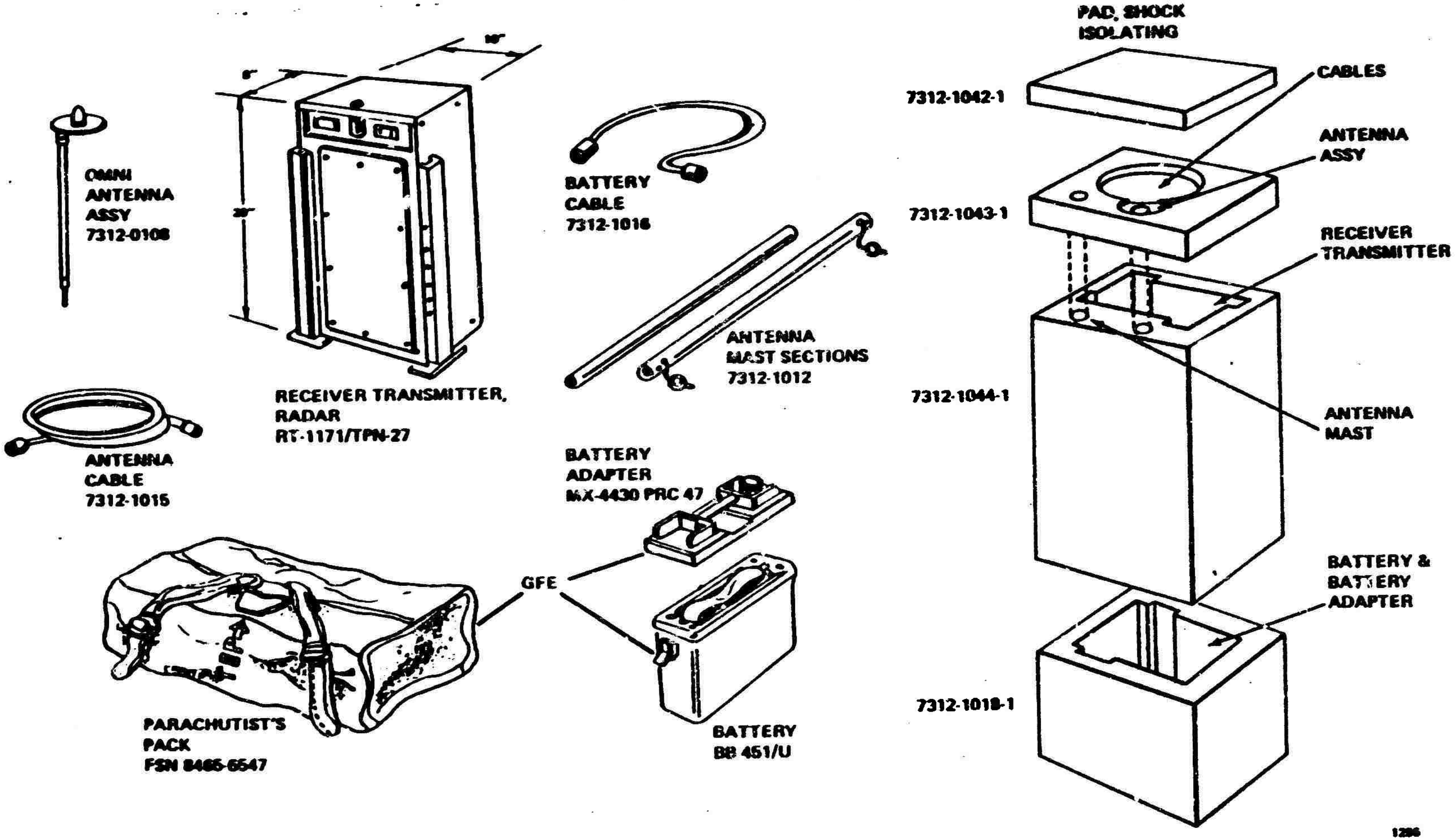


Figure 1-1. Drop Zone Marker Prototype, Deployed

RADAR SET, ZONE MARKER | AN/TPN-27 - COMPONENTS



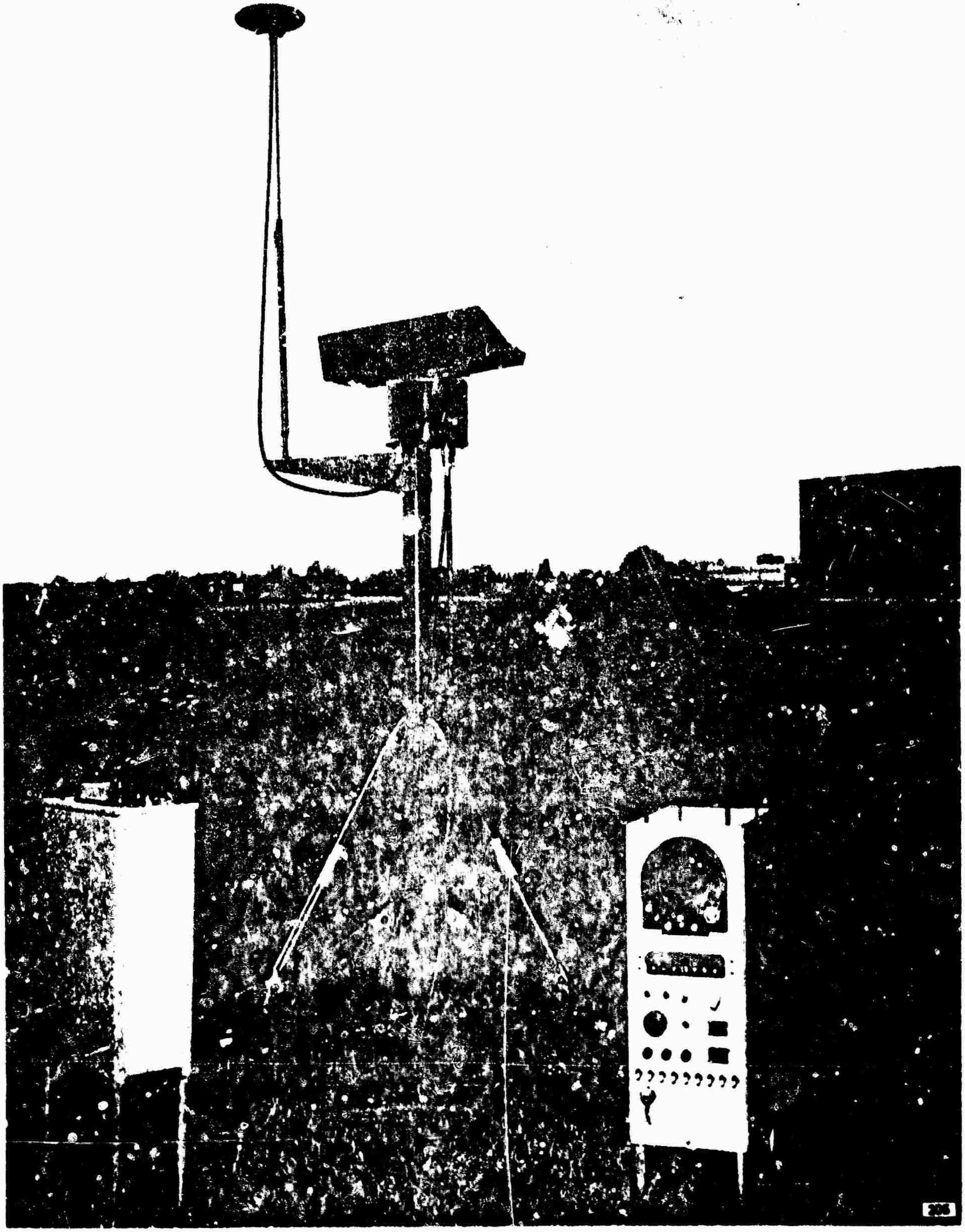


Figure 4-2. Deployment of Zone Marker Group

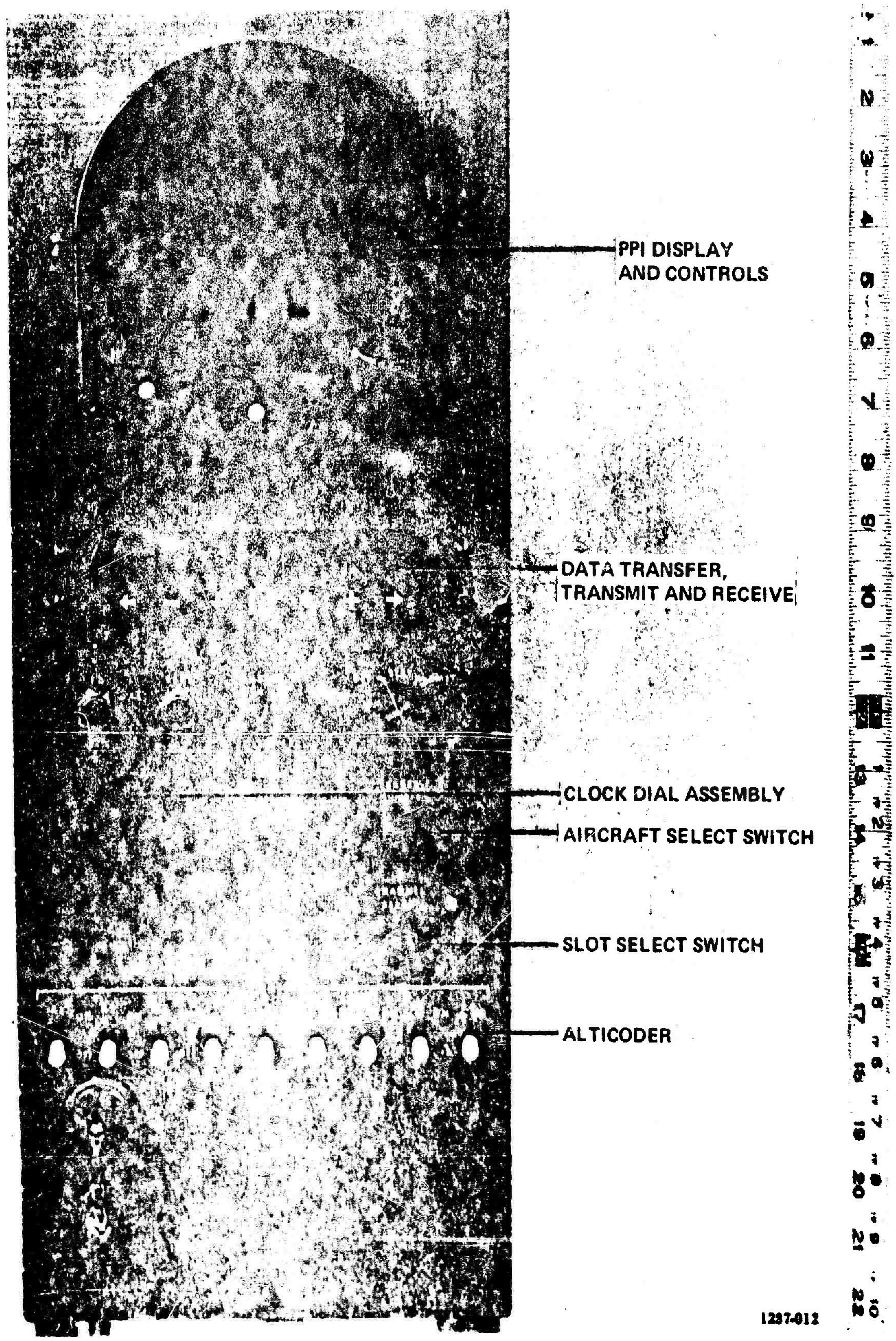


Figure 4-1. Display Assembly Control Panel

GLOSSARY OF TERMS AND DEFINITIONS

ADVERSE WEATHER (D)D)

Weather in which military operations are generally restricted or impeded.

U.S. Air Force Glossary of Standardized Terms P.4 (Here after known as AFM 11-1)

ADVERSE WEATHER AERIAL DELIVERY SYSTEM (AF)

The precise delivery of personnel, equipment, and supplies during adverse weather, utilizing a self-contained aircraft instrumentation system without artificial ground assistance, or use of ground navigational aids.

AFM 11-1 Pg. 4

AIRBORNE STATIONKEEPING (AF)

The use of air in-plane radar capability to maintain a specific position in close formation during night and instrument flight conditions.

AFM 11-1 Pg. 8

AIRBORNE STATIONKEEPING APPROACH - ASA

An airborne radar approach (ARA) using airbrone radar stationkeeping equipment (SKE) and a SKE equipped aircraft or a Zone Marker (ZM) prepositioned on the destination airfield.

Sierra Research Corporation Marketing Literature

ARMY AVIATION

A term used interchangeable with Army helicopter and helicopter. It identifies the rotor-wing segment of Army aviation.

Author Interpretation

CEILING (DOD)

The height above the earth's surface of the lowest layer of clouds or obscuration phenomena that is reported as "broken", "overcast", or "obscured" and not classified as "thin" or "partial".

AFM 11-1 Pg. 41

COLLISION AVOIDANCE SYSTEM - CAS

A system designed to warn when an intruder aircraft has entered a prescribed safety zone surrounding the user aircraft. The system incorporates a

warning to advise the pilot of an impending collision.
Sierra Research Corporation
Marketing Literature

COMBAT MULTIPLIER (A)
Supporting and subsidiary means that significantly increase the relative combat strength of opposing forces while actual force ratios remain constant; e.g., economizing in one area to mass in another, surprise, deception, electronic warfare, psychological operations, and obstacles.
Reading Bulletin (RB) 100-7
Pg. 21 Army Command and General Staff College

COMBINES ARMS TEAM (A)
Two or more arms, each providing a mutual shielding of vulnerabilities, supplementing each other's capabilities through the systematic employment of its own special capabilities and weapon systems; usually consisting of tanks, infantry, field artillery, air defense artillery, engineers, and tactical air support.
Dictionary of United States Army Terms; Short Title: AD (Here after known as AR 310-25) Pg. 126

COMMAND AND CONTROL (DOD)
The excercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of his mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures which are employed by a commandor in planning, directing, coordinating, and controlling forces and operations in the accomplishment of his mission.
AFM 11-1 Pg. 49

COMMONALITY (AF)
A term applied to equipment or systems which possess like and interchangeable characteristics. Equipment and systems are common when: they possess compatibility; each can be operated and maintained by personnel trained on the others without additional specialized training; repair parts (components and/or subassemblies) are interchangeable between them.
AFM 11-1 Pg. 50

COMMUNICATION DECEPTION (DOD)
Use of devices, operations, and techniques with the intent of confusing or misleading the user of a

communications link or a navigation system.
AFM 11-1 Pg. 51

CONCEPTUAL PHASE (AF)
The initial period when the technical, military, and economic bases for acquisition programs are established through comprehensive studies and experimental hardware development and evaluation. The out-puts are alternative concepts and their characteristics (estimated operational, schedule, procurement, costs, and support parameters) which serve as inputs to the Development Concept Paper on major systems, memoranda on smaller systems/equipment, and to HQ, USAF decision documents (Program Management Directives) for programs that do not require OSD decisions.
AFM 11-1 Pg. 54

COST EFFECTIVENESS (AF)
A comparative evaluation derived from analyses of alternatives (actions, methods, approaches, equipment, weapon systems, support systems, force combinations, etc.) in terms of the interrelated influences of cost and effectiveness in accomplishing a specific mission.
AFM 11-1 Pg. 59

CRITICAL POINT (DOD, IADB)
A key geographical point or position important to the success of an operation.
AFM 11-1 Pg. 62

DEAD RECKONING (ASCC)
Finding one's position by means of a compass and calculations based on speed, time elapsed, effect of wind, and direction from a known position.
AFM 11-1 Pg. 66

DEAD SPACE (DOD, NATO, SEATO, IADB)
An area within the maximum range of a weapon, radar, or observer, which cannot be covered by fire or observation from a particular position because of intervening obstacles, the nature of the ground, or the characteristics of the trajectory, or the limitations of the pointing capabilities of the weapon.
An area or zone which is within range of a radio transmitter, but in which a signal is not received.
The volume of space about and around a gun or guided missile system into which it cannot fire because of mechanical or electronic limitations.
AFM 11-1 Pg. 66

DEFENSE RESEARCH, DEVELOPMENT, TEST AND EVALUATION (RDT&E) ON-LINE SYSTEM

Searches and documents a wide range of R&D background studies with little time and effort.
Gives projects a head start and enables researchers to avoid areas of duplication.
Answers questions that evolve from new discoveries.

A direct connection to data banks located the the Defense Documentation Center (DDC), Alexandria, Virginia, that contains approximately one million records. There are sixty-five remote terminal sites as of January 1976. The Terminal has an electronic computer type video which displays abstracts for viewing. Saving techniques involve automatic printing of the information contained in the abstract. If an entire document is desired, a request is made and a copy of the document is received in approximately one week.

Defense Documentation Center
Information Brochure

DUAL (MULTI-PURPOSE) WEAPONS (DOD,IADB)

Weapons which possess the capabilities for effective application in two or more basically different military function and/or levels of conflict.

AFM 11-1 Pg. 78

ELECTRONIC JAMMING (NATO, CENTO, IADB)

The deliberate radiation, reradiation, or reflection of electromagnetic signals with the object of impairing the use of electronic devices by the enemy.

AFM 11-1 Pg. 79

ELECTRONICS SECURITY (DOD, IADB)

The protection resulting from all measures designed to deny unauthorized persons information of value which might be derived from their interception and study of noncommunications electromagnetic radiations, e.g., radar.

AFM 11-1 Pg. 80

ENVIRONMENTAL TECHNICAL APPLICATIONS CENTER - ETAC

A USAF Agency whose mission is to provide quantitative advice and studies on the effect of the natural environment on military plans, weapons systems, facilities and intelligence activities in support of the USAF, US Army, and other agencies as directed by the commander USAF Global Weather Central. ETAC has a centralized capability to collect, store, retrieve, and process those aerospace environmental data necessary for customer requirements.

FORWARD EDGE OF BATTLE AREA - FEBA (DOD, NATO, CENTO, IADB)
The foremost limits of a series of areas in which ground combat units are deployed, excluding the areas in which the covering or screening forces are operating, designated to coordinate fire support, the positioning of forces, or the maneuver of units.
AFM 11-1 Pg. 93
AR 310-25 Pg. 232

HIGH THREAT ENVIRONMENT
An enemy combat posture wherein modern sophisticated weapons and techniques create a highly lethal situation.... Such a posture could include armor, field, and antiaircraft artillery, surface to air missiles, radar, infrared, optical, electro-optical, and visual means, and might be supplemented by electronic warfare methods to include interception, jamming, and deception.
FM 90-1 Employment of Army Units in a High Threat Environment (Draft) Glossary

INSTRUMENT FLIGHT (DOD, NATO, SEATO, CENTO, IADB)
Flight in which the path and altitude of the aircraft are controlled solely by reference to instruments.
AFM 11-1 Pg. 112

LIFE CYCLE COST (AF)
The total cost of an item or system over its full life. It includes the cost of development, acquisition, ownership, (operation, maintenance, support, etc.), and, where applicable, disposal.
AFM 11-1 Pg. 122

MARGINAL WEATHER (DOD)
Weather which is sufficiently adverse to a military operation so as to require the imposition of procedural limitations. (See also Adverse Weather)
AFM 11-1 Pg. 128

MEACONING (NATO, SEATO, CENTO, IADB)
A system of receiving radio beacon signals and rebroadcasting them on the same frequency to confuse navigation. The meaconing stations cause inaccurate bearings to be obtained by aircraft or ground stations.
AFM 11-1 Pg. 131

MOBILITY (DOD, NATO, CENTO, IADB)
A quality or capability of military forces which permits them to move from place to place while retaining the ability to fulfill their primary mission.
AFM 11-1 Pg. 137

NAP-OF-THE-EARTH FLIGHT - NOE

Flight as close to the earth's surface as vegetation or obstacles will permit, while generally following the contours of the earth. The pilot pre-plans a broad corridor of operation based on known terrain features which has a longitudinal axis pointing toward his objective. In flight, the pilot uses a weaving and devious route within his preplanned corridor while remaining oriented along his general axis of movement in order to take maximum advantage of the cover and concealment afforded by terrain, vegetation and man-made features. By gaining maximum cover and concealment from enemy detection, observation, and firepower, nap-of-the-earth flight exploits surprise and allows for evasive actions.

AR 310-25 Pg. 343

NAVIGATIONAL AIDS - NAVAIDS

Electronic/mechanical devices designed to enhance air navigation.

NIGHT/ADVERSE WEATHER SYSTEM - N/AWS

A system, when incorporated, that would provide the Army helicopter with a night/adverse weather capability. An acronym that represents a capability rather than any one specific aircraft subsystem.

Author Interpretation

OPERATIONAL ENVIRONMENT (DOD, IADB)

As pertains to the military, it is a composite of the conditions, circumstances, and influences which affect the employment of military forces and which bear on the decisions of the commander.

AFM 11-1 Pg. 150

OPERATIONALLY READY (DOD)

1. As applied to a unit, ship, or weapon system - Capable of performing the missions or functions for which organized or designed. Incorporates both equipment readiness and personnel readiness.

2. As applied to equipment - Available and in condition for serving the functions for which designed.

3. As applied to personnel - Available and qualified to perform assigned missions or functions.

AFM 11-1 Pg. 151

PATHFINDERS (DOD, IADB)

A radar device used for navigating or homing to an objective when visibility precludes accurate visual navigation.

Terms, air delivered into enemy territory, for the purpose of determining the best approach and withdrawal lanes, landing zones, and sites for helicopter-borne forces.

AFM 11-1 Pg. 156

PENETRATION AIDS (AF)

Techniques and/or devices employed by aerospace systems to increase the probability of weapon system penetration of an enemy defense. Examples are: low altitude flight profiles, trajectory adjustment, reduced radar cross-sections of attack vehicles, improved vehicle hardness to effects of defense engagements, terrain avoidance radar, bomber defense missiles, decoys, chaff, electronic countermeasures, etc. Penetration aids are used by an offensive system to penetrate more effectively enemy defenses.

AFM 11-1 Pg. 157

PLAN POSITION INDICATOR (NESN, NFSN)

A cathode ray tube on which radar returns are so displayed as to bear the same relationship to the transmitter as the objects giving rise to them.

AFM 11-1 Pg. 160

PREVAILING VISIBILITY (AF)

The horizontal distance at which targets of known distance are visible over at least half of the horizon. It is determined by an observer viewing selected dark objects against the horizon sky during the day and moderate intensity unfocused lights at night. It is reported in statute miles and fractions thereof and does not necessarily represent the visibility along the runway.

AFM 11-1 Pg. 163

PROXIMITY WARNING (AF)

(SKE equipment) Signal light and horn advises the pilot that another aircraft has penetrated a selectable range airspace about his aircraft.

Sierra Research Corporation

RADIO NAVIGATION (NATO, SEATO, CENTO, IADB)

Radio location intended for the determination of position or direction or for obstruction warning in navigation.

AFM 11-1 Pg. 172

REQUIRED OPERATIONAL CAPABILITY - ROC (AF)

A formal serially-numbered document giving a general description of operational capabilities deemed necessary at a specific time in the future; outlining the capability desired rather than the means of accomplishment; describing the objective, operational concept, expected operational environment and other pertinent factors to be considered.

AFM 11-1 Pg. 178

REQUIRED OPERATIONAL CAPABILITY - ROC (A)

The ROC ia a formal requirement, with an implicit commitment to an eventual production decision and normally will not be established until a thorough advanced development program has been conducted under an LOA. The advanced development program will include testing of components and/or prototypes to demonstrate adequately both its technical feasibility and its operational feasibility.

RB 101-3 Pg. 3-5

RESEARCH AND DEVELOPMENT TEST (AF)

An experiment or operation designed to measure, verify, assess, and provide data for evaluation of: research investigations or experiments carried on beyond the laboratory bench; progress in attainment of accomplishment of development objectives; and performance capability and/or operational suitability or systems, subsystems, components, and equipment items.

AFM 11-1 Pg. 179

SPATIAL DISORIENTATION (AF)

During flight, illusions result from false information or misinterpreted sensory impressions created by inflight forces acting upon the organs of equilibrium and balance. When a pilot cannot determine the location of the surface of the earth, he is said to be suffering from spatial disorientation, also commonly called vertigo.

Air Force Manual 51-37
Instrument Flight

STATE-OF-THE-ART (AF)

The level to which technology and science have at any designated cutoff time been developed in a given industry or group of industries, as in "the missile's capabilities were determined by the state of the art at the time it went into production".

AFM 11-1 Pg. 197

STATIONKEEPING EQUIPMENT - SKE AN/APN 169A

Designated the AN/APN 169A, airborne avionics equipment which permits maintenance of accurate spatial relationship between aircraft. SKE designation is as follows:

A - nomenclature will be assigned to complete
N   sets of equipment and major components of
/   military design.
A - Airborne installed and operated in aircraft.
P - Radar
N - Navigational aids
1 - Specific
6 -   Numerical
9 -   Identifier
A - Modification letter: component modification suffix letters will be assigned for each modification of a component when details, parts, and subassemblies used therein are no longer interchangeable, but the component itself is interchangeable physically, electrically, and mechanically.

Sierra Research Corporation

SURVIVABILITY (AF)

The capability of a system to withstand a man-made hostile invironment without suffering an abortive impairment of its ability to accomplish its designated mission.

AFM 11-1 Pg. 204

SUSCEPTIBILITY (DOD)

The degree to which a device, equipment or weapons system is open to effective attack due to one or more inherent weaknessess.

AFM11-1 Pg. 204

TACTICAL INSTRUMENT FLIGHT (A)

Tactical instrument flight is defined as flight under instrument meteorological conditions in an area directly affected by the threat. It is used as a normal means to complete assigned missions when ceiling or visibility conditions preclude visual flight or normal regulated IFR flight.

F. 1-5 Pg. 22-3

TECHNICAL PROPOSAL - TP

A technical proposal is industry's reply to a ROC or SOR. This is a prototype of equipment which meets the specifications set forth. The equipment is tested with conclusive data supporting the testing.

Training Circular Pg. 543
AR 310-25

WEAPON SYSTEM (DOD, NATO, CENTO, IADB)

A weapon and those components required for its operation. (The term is not precise unless specific parameters are established.)

(Note: The Air Force definition indicates that the Air Force parameters are: a composite of equipment, skills, and techniques that form an instrument of combat which usually, but not necessarily, has an aerospace vehicle as its major operational element. The complete weapon system includes all related facilities, equipment, material, services, and personnel required solely for the operation of the aerospace vehicle, or other major elements of the system, so that the instrument of combat becomes a self-sufficient unit of striking power in its intended operational environment.)

AFM 11-1 Pg. 226

WEATHER

The conditions of the atmosphere, such as temperature, windiness, wetness, or dryness, and clearness, or cloudiness, which affect man's environment.

Encyclopedia Americana

ZONE MARKER - ZM AN/TPN 27

Avionics equipment which operates on the same principle as SKE. It is capable of independent battery operation in a portable ground mode or air mode.

Designation is as follows:

A - Nomenclature will be assigned to complete
N sets of equipment and major components of
/ military design.
T - Ground, transportable.
P - Radar.
N - Navigational aids.
2 - Specific numeric
7 - identifier.

Sierra Research Corporation

ZONE MARKER GROUP - ZMG

A combination of SKE and ZM equipment operating in a ground mode.

Sierra Research Corporation

PARENTHETICAL SYMBOLS EXPLAINED:

(A) Army Source
(AF) Standardized for use within the U.S. Air Force only.
(DOD) Standardized for use within the Joint Services and Department of Defense.
(I) U.S. Government interdepartmental approval has been achieved for national usuage.

(NESN) Standardized for use with the English-speaking nations of NATO.

(NFSN) Standardized for use within the French-speaking nations of NATO.

(NATO) Standardized for use by all NATO nations.

(ASCC) Standardized for use by the American, Australian, British, Canadian, and New Zealand Air Forces.

(SEATO) Standardized for use within the Southeast Asia Treaty Organization.

(CENTO) Standardized for use within the Central Treaty Organization.

(IADB) Adopted for use by the Inter-American Defense Board.

\- Denotes acronym