U.S. Senator • South Dakota

Tim Johnson

Fax Cover Sheet

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TO: Chairman Pinkapi

DATE: July 29, 2005

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NUMBER OF PAGES TO FOLLOW: 19

MESSAGE:

703 699 2735

Congress of the United States

Washington, DC 20510

July 29, 2005

The Honorable Anthony J. Principi
Chairman
Base Realignment and Closure Commission
2521 Clark Street, Suite 600
Arlington, VA 22202

Dear Chairman Principi:

It has come to our attention the Department of Defense may not have properly evaluated specific risk assessment data when formulating their list of recommended base closures. In light of the proposal to consolidate the entire B-1 fleet at a military installation susceptible to violent weather patterns, we feel it is critical the weather data be properly examined.

On July 12th, the Ellsworth Task Force provided detailed analysis to the Base Realignment and Closure (BRAC) Commission which detailed the effects of violent and destructive weather on a proposed consolidated B-1 fleet at Dyess Air Force Base. This paper, "*Severe Weather Hazard Frequency Comparison Ellsworth AFB vs. Dyess AFB*," was compiled for the Ellsworth Task Force by faculty members at the South Dakota School of Mines and Technology. For your review, we have enclosed a copy of the report. Based on those findings, the Ellsworth Task Force has developed a more exhaustive analysis of severe weather risk assessments titled *"A Comparison of Severe Weather Events in the Proximity of Dyess AFB and Ellsworth AFB,"* which we have also included for your consideration.

Based on data from 1950 to April 2005, the report concludes in part:

> "... It is clear that there is a significantly greater risk of severe weather at Dyess AFB. There is roughly a 6 times greater risk of a tornado at Dyess, the risk of hail 2.5 inches in diameter or greater nearly 5 times greater at Dyess than Ellsworth ...
>
> "The most increasing comparison is the 12 times greater risk of an F2 or greater tornado at Dyess while the overall risk of tornadoes of all strengths is about 6 times greater.
>
> "The conclusion from the analysis of validated severe weather reports is that Dyess AFB has a far greater risk of large hail of all sizes and tornadoes of all types when compared to Ellsworth AFB. The risk of wind gusts of 75mph or greater, while doubled at Dyess, is small in comparison to the substantially greater threat of large hail and tornadoes - particularly significant (F2 and greater) tornadoes. Clearly, the risk of a catastrophic severe thunderstorm is much higher at Dyess, threatening, personnel, equipment and facilities."

As both reports clearly demonstrate, consolidating the entire B-1 fleet at a military installation prone to unpredictable and violent weather would be wrong for our national defense. On numerous occasions fixed and rotary wing assets have been vulnerable to destructive weather – most notably by the tornado that struck Carswell Air Force Base in Texas on September 1, 1952. That catastrophe resulted in the heaviest loss of Air Force bomber aircraft between World War II and Operation Linebacker in Vietnam. The twenty-five B-36 aircraft heavily damaged or destroyed at Carswell were considered to be the backbone of Strategic Air Command – much like the B-1 fleet today.

We strongly believe the Department of Defense substantially deviated from the military value criteria governing this round of base closures. There are considerable risks in basing greater than one-third of our long range bomber fleet at one facility – particularly at a hazardous weather location like Dyess. As a result, we are certain the Commission will concur with the analysis provided by the enclosed research and reject the recommendation to consolidate the B-1B Bomber fleet and close Ellsworth Air Force Base.

Sincerely,

Senator Tim Johnson Senator John Thune Representative Stephanie Herseth

Severe Weather Hazard Frequency Comparison
Ellsworth AFB vs. Dyess AFB

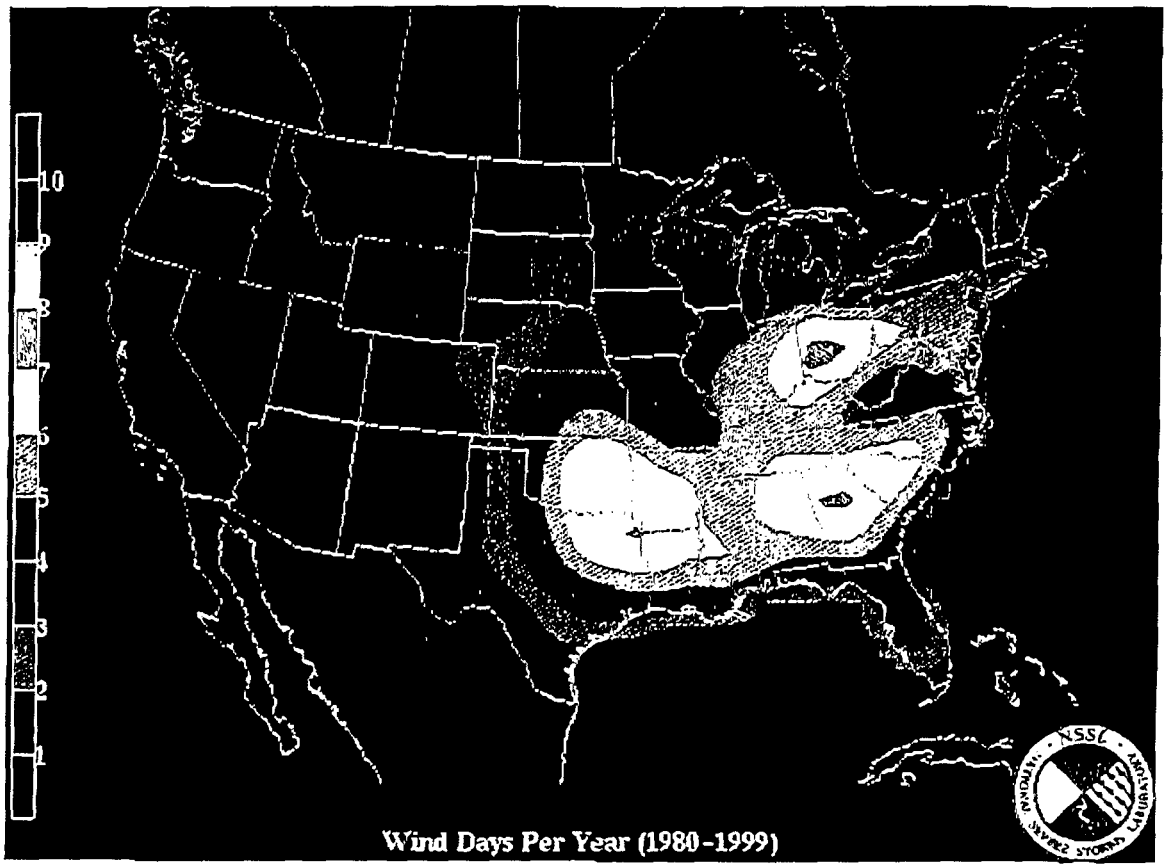
Introduction:

Statistics based on severe weather reports have been compiled into map form at the National Severe Storms Laboratory. See http://www.nssl.noaa.gov/hazard/ . A review of these statistics shows that in spring and summer the Dyess AFB area experiences much more frequent severe weather than the Ellsworth AFB area.

The National Weather Service classifies a storm as severe if it produces high winds, hail, or tornadoes. Often the same storm will produce all three of these phenomena. A storm is classified as severe if straight-line winds exceed 50 kts (58 mph), if hail size exceeds ¾", or if a tornado of any severity occurs. Damage to aircraft and facilities on the ground, and in the case of hail, to aircraft in flight, is likely when these criteria are met. At this time, neither the dollar value of property losses, nor statistics on injuries and deaths, are involved in classifying a storm as severe.

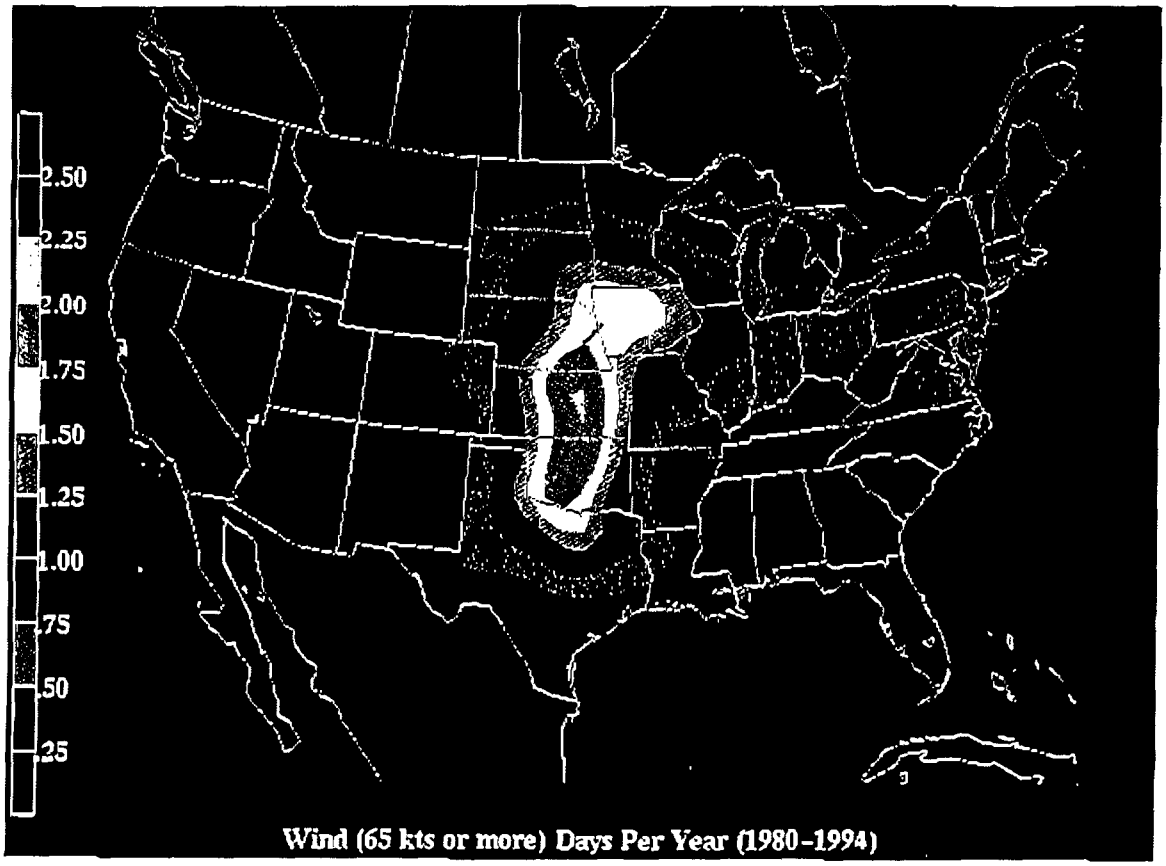
We review here statistics on the frequency of these severe storm phenomena, using charts available at the above-referenced web site. These charts, unless otherwise stated, were compiled using storm reports from 1980-1999.

High Winds



The frequency per year of severe storm magnitude straight-line winds with speed greater than 50 kts (58 mph) within 25 miles of a given point is depicted here. In this type of analysis, the problem of multiple reports of the same event are factored out. The frequencies range from less than one (black) to greater than 7 (deeper shade of orange) wind episodes per year. The red stars indicate the locations of Ellsworth and Dyess Air Force Bases. Around Ellsworth the frequency is fairly uniform and is between once and twice per year, while Dyess is located in a region with a much sharper gradient in frequency. Near Dyess, the frequency is in the 3 to 5 times per year range.

The next chart displays frequency of occurrence of extremely high winds, 65 kts (75 mph) or greater, based on reports from 1980-1994.

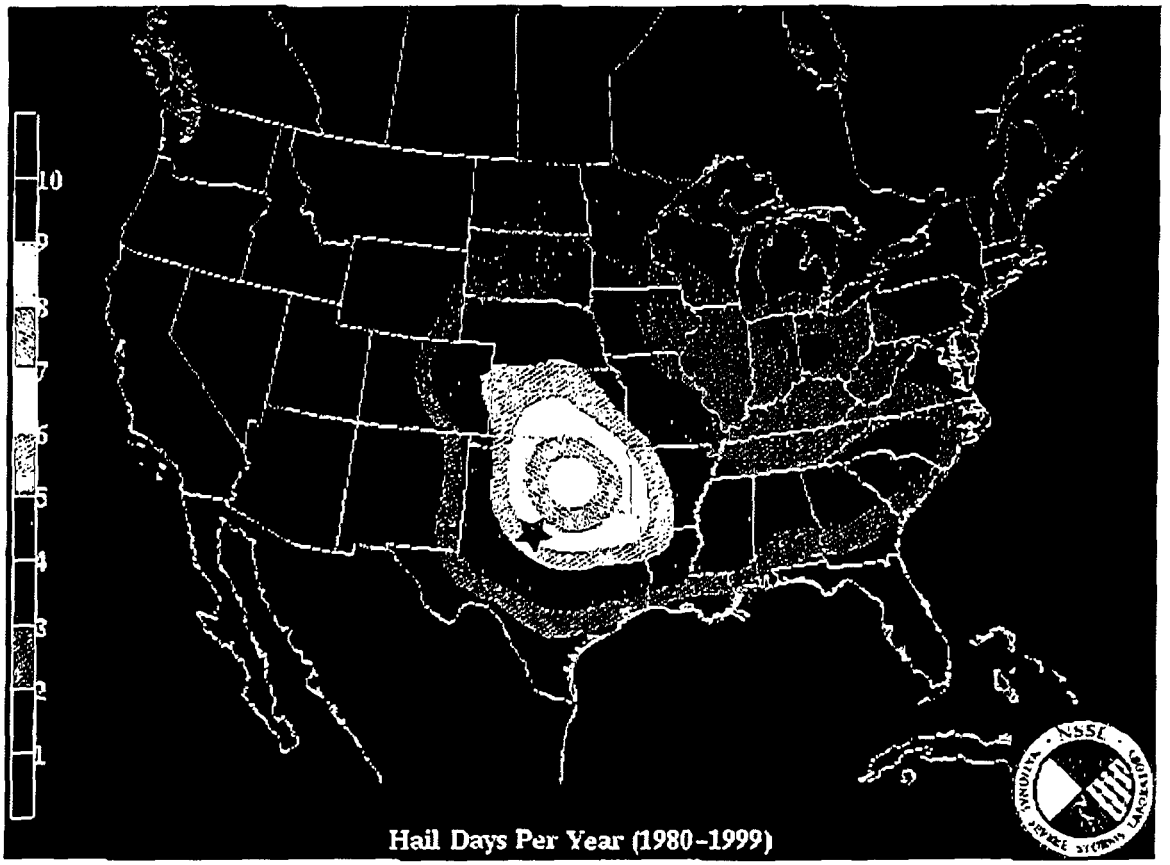


Ellsworth is in a region experiencing this kind of wind between .5 and .75 times per year, while Dyess is in the 1 to 1.25 times per year regime.

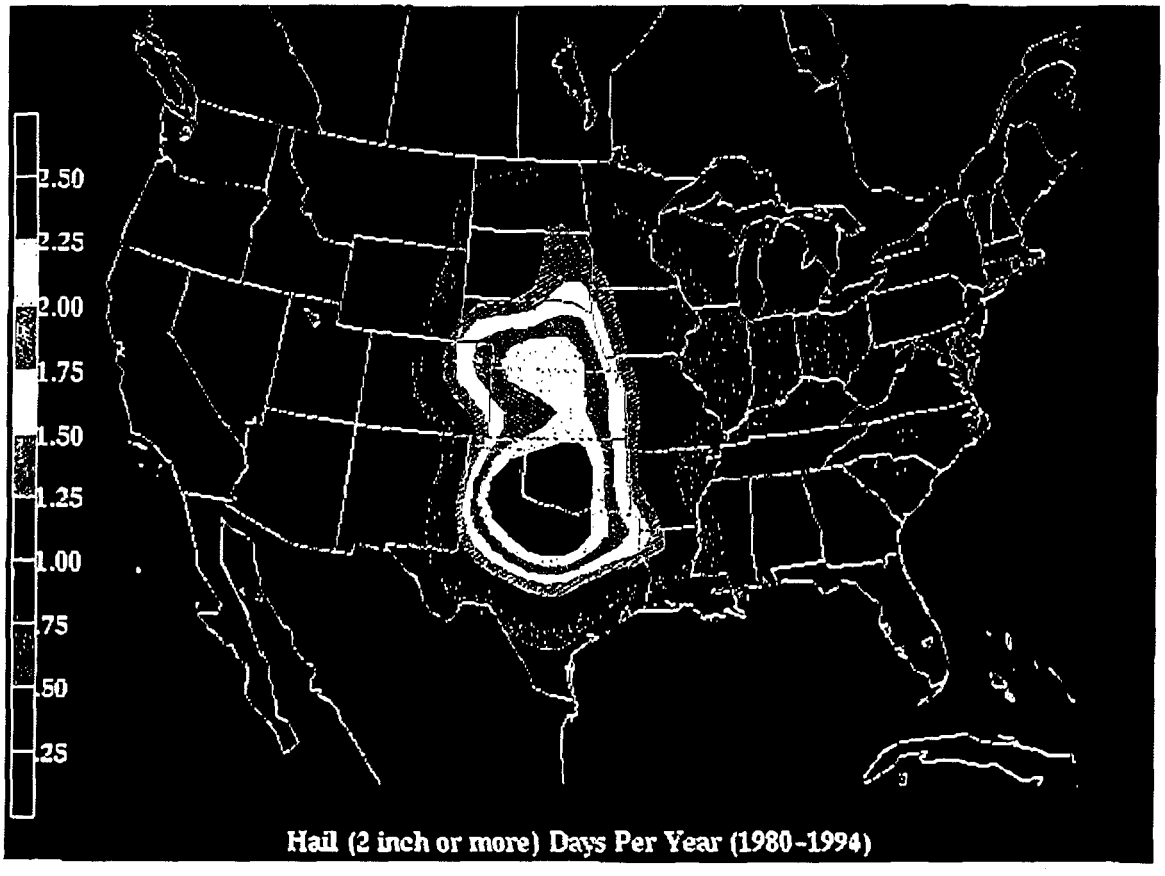
Thus, with respect to high and extremely high straight-line winds, the Dyess area experiences both categories of winds about twice as often as the Ellsworth area.

Hail

The panel below shows the frequency of occurrence of damaging hail (diameters greater than ¾").



Ellsworth is in a region experiencing damaging hail between 2 and 3 times per year, while Dyess is in a region where the frequency is 5 to 7 times per year. Although ¾" hail is the size at which significant damage to metallic vehicles, and roofs, siding and windows of structures begins to occur, larger hail causes more severe damage. A database spanning 1925-1999 was analyzed for the occurrence of very large hail (2" diameter or greater. The figure below shows the results of this analysis.



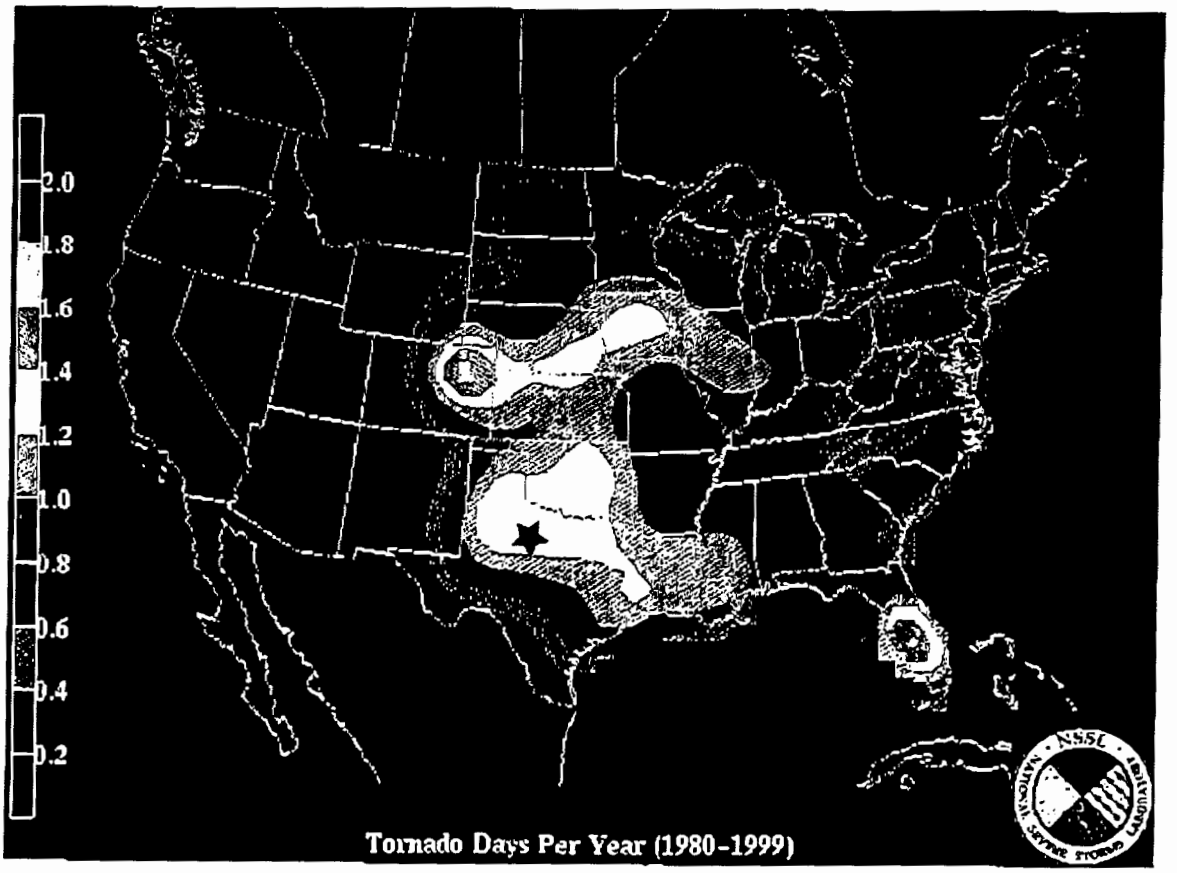
Near Ellsworth, hail this large occurs once per year or less, while near Dyess, such large hail is expected twice per year or more.

Thus hail large enough to begin to result in significant damage falls more than twice as often around Dyess as around Ellsworth, when one looks at even larger hail, the Dyess area experiences it more than 3 times as frequently as the Ellsworth area according to these analyses.

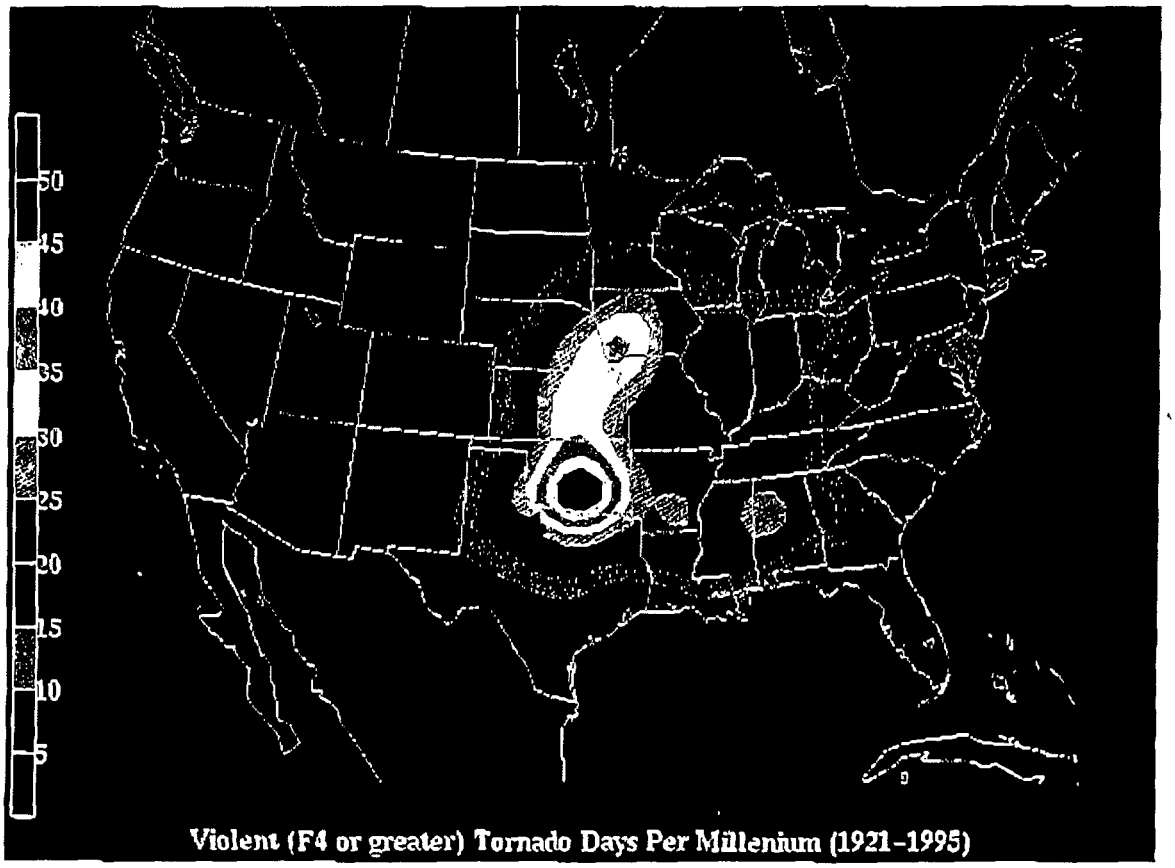
An independent analysis, published by certified consulting meteorologist Chris Orr in the Rapid City Journal on 19 June 2005 looked at the number of reports of hail 2" diameter or greater from the two counties surrounding Dyess and two surrounding Ellsworth, from 1950 – spring 2005. There were 71 reports of such hail around Dyess, and 88 around Ellsworth. In this analysis, multiple reports of the same storm often occurred, so the ratio of reports in the two regions does not truly reflect the ratio of events.

Tornadoes

Tornado frequency is much higher at Dyess than at Ellsworth, as shown below.



While the Ellsworth area experiences tornadoes about once every other year, on average, the Dyess area experiences tornadoes more than once per year. When looking just at very violent tornadoes the contrast in frequency is even more striking, as the next figure shows.



Here is shown the frequency of tornadoes classified as F4 or F5 on the 5-level Fujita scale, based on data from 1921-1995.The Dyess area expects to experience such violent tornadoes 20-30 times per millennium, while the Ellsworth area expects such tornadoes less than 5 times per millennium. Thus the frequency of violent tornadoes is low in both areas, but is 5 to 6 times more likely around Dyess than around Ellsworth.

Historically, neither base has had any tornado pass directly over it, in the 50+year lifetimes of these bases. Orr, in the article cited above, points out that between 1950 and 2002, two strong tornadoes passed within 40 miles of Ellsworth, while 10 strong tornadoes passed within 40 miles of Dyess. Using this view, the frequency of strong tornadoes 5 times higher at Dyess than Ellsworth.

Looking at these statistics another way, the climatological chance of seeing a violent tornado near Dyess, over a 20 year period, is 46%. At Ellsworth, the probability is less than 10%. The chance of a violent tornado intercepting either base perimeter while on the ground will be small fractions of these percentages, and at Ellsworth at least such a probability is negligible.

Summary

Severe weather in general is more than twice as probable around Dyess AFB compared to Ellsworth AFB. The two areas differ proportionally the most in tornado frequency, by more than a factor of two for all tornadoes, and a factor of 5 to 6 for violent tornadoes. Damaging straight-line winds and damaging hail each occur on the average every year at both bases, at least once at Ellsworth and more than twice at Dyess. Very high winds occur on the average once every other year at Ellsworth, and once per year at Dyess. Very large hail occurs a little more often than once per year at Ellsworth and about 2 ½ times per year at Dyess.

Addendum

It would be useful to provide information on damage experience during actual cases of severe weather near or at Air Force bases. However, we don't know how to reliably and quickly find damage statistics. By chance, we found information on one relatively famous case.

The following damage account refers to an Oklahoma base, and comes from Galway (1992):

> 20 March 1948 – A tornado struck Tinker AFB near Oklahoma City, destroying 32 military aircraft and damaging many structures on the base.

Bomar (1995), pg 237, provides a list of "most memorable tornado" events in Texas. From among them, events near towns with air bases at the time were selected. Perhaps someone with access to military records, or possibly through a search of local newspaper accounts, can find information on damage at the affected bases.

> 11 May 1953 – There was a very damaging tornado outbreak around Waco, TX and nearby Connally AFB.
>
> 3 April 1964 – Large tornado outbreak near Wichita Falls and Sheppard AFB
>
> 10 April 1979 – Another large tornado outbreak near Wichita Falls and Sheppard AFB.

From a web posting by Luchtzak Aviation (http://www.luchtzak.be/postt10079.html) :

Hail caused moderate to severe damage to 96 of 121 TH-57 helicopters and 50 of 151 T-24's at Whiting Naval Air Station in Florida. In addition, buildings were damaged. Total damage was estimated to be at least $2.1 M.

The point is that weather hazards are going to cause damage and that weather damage losses are part of the cost of doing business at these bases. Were weather-related damage costs included in the Air Force analysis of the costs of doing business at Dyess and Ellsworth?

References

Bomar, G. W., 1995. Texas Weather. U. of Texas Press, Austin, TX. 275 pp.

Galway, J. G., 1992: Early severe thunderstorm forecasting and research by the United States Weather Bureau. Weather and Forecasting, 7, 564-587.

Luchtzak Aviation. Accessed 5 July 2005 at http://www.luchtzak.be/postt10079.html)

National Severe Storms Laboratory Severe Thunderstorm Climatology. Accessed 5 July 2005 at http://www.nssl.noaa.gov/hazard/.

A Comparison of Severe Weather Events in the Proximity of Dyess AFB and Ellsworth AFB

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Rapid Weather/Meteorology Training Center, Rapid City, South Dakota 57701

July 19, 2005

I. Introduction.

Severe thunderstorms affect every state but are most common across the central and southern plains. Large hail, damaging wind and tornadoes do significant damage - often irreparable damage - to such an extent that the primary function of government weather services is to forecast and warn of these events.

The 2005 Base Realignment and Closure (BRAC 2005) commission is considering the U.S. Department of Defense recommendation to consolidate B1 bombers at one Air Force base. This study was undertaken to determine if there is an appreciable difference between the number of severe weather events at and near Dyess AFB (Texas) and Ellsworth AFB (South Dakota). The current BRAC 2005 recommendation is to move Ellsworth's operations to Dyess.

Analysis of significant severe weather reports shows that the incident of large hail, damaging wind and tornadoes is much greater at Dyess than at Ellsworth.

II. Selection of Data.

Severe thunderstorms are defined as those thunderstorms producing 0.75 inch diameter hail or larger, wind in excess of 58 mph, a tornado, or any combination thereof. The likelihood of damage and casualties increases as the diameter of hail, wind velocity and the strength of tornadoes increases. This paper narrows the definition of a severe thunderstorm to include F2 or stronger tornadoes, wind greater than 75 mph and hail at least 2.5 inches in diameter, events that cause significant - if not catastrophic - damage.

Ellsworth AFB is located in south central Meade County (South Dakota), near the border of Pennington County. Dyess AFB is located in northeast Taylor County (Texas), near Jones, Callahan and Shackelford counties.

Since both bases are located near the borders of their respective counties, we decided to include data for adjacent counties. Thus, data for Meade and Pennington counties are used for Ellsworth while data for Taylor and Jones counties are used for Dyess. The incident of severe weather increases east of Taylor and Jones counties, so the inclusion of data for Callahan and Shackelford would enhance the threat of severe weather in and near Dyess. Our use of Jones County instead of Callahan or Shackelford only serves to skew the data toward a smaller risk of severe weather when paired with Taylor County.

III. Raw Data.

The National Climatic Data Center storm database was queried for official, validated severe weather reports meeting our criteria. The following table shows the raw number of hail, tornado and wind gust reports for each county from January 1, 1950 to April 30, 2005.

County	County area in square miles	All tornado reports	F2 or greater tornado reports	Reports of Wind 65 knots (75 mph) or greater	Reports of Hail 2.5 inches in diameter or greater
Pennington SD	2,776	39	3	34	30
Meade SD	3,471	38	5	21	18
Taylor TX	916	59	11	12	20
Jones TX	931	71	18	15	32

Figure 1. Raw severe weather reports for Pennington and Meade counties (SD) and Taylor and Jones counties (TX). Data from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville NC.

The raw numbers appear to show a higher number of tornadoes and large hail in the Texas counties but a lower number of high wind events. However, when the data is normalized to incident per square mile, Taylor and Jones counties clearly have a higher incidence across the board.

IV. Normalized Data

As can be seen in Figure 1, the size of the selected counties is not equal. To make more sense of the information, each category has been normalized to the size of the counties. The following table shows the data normalized to the area of the counties.

		Normalized incidents per square mile			
County	County area in square miles	All tornado reports	F2 or greater tornado reports	Reports of Wind 65 knots (75 mph) or greater	Reports of Hail 2.5 inches in diameter or greater
Pennington SD	2,776	0.014	0.001	0.012	0.011
Meade SD	3,471	0.012	0.001	0.006	0.005
Taylor TX	916	0.064	0.012	0.013	0.022
Jones TX	931	0.076	0.019	0.016	0.034

Figure 2. Normalized severe weather reports for Pennington and Meade counties (SD) and Taylor and Jones counties (TX). Data from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville NC.

We can then compare the area of the two Air Force bases to the incidents in each county. Dyess AFB includes 9.56 square miles and Ellsworth covers 8.46 square miles.

County	Air Force base	All tornado reports	F2 or greater tornado reports	Reports of Wind 65 knots (75 mph) or greater	Reports of Hail 2.5 inches in diameter or greater
Pennington SD	Ellsworth	0.118	0.008	0.101	0.093
Meade SD	Ellsworth	0.101	0.008	0.051	0.042
Taylor TX	Dyess	0.612	0.101	0.124	0.210
Jones TX	Dyess	0.727	0.182	0.153	0.325

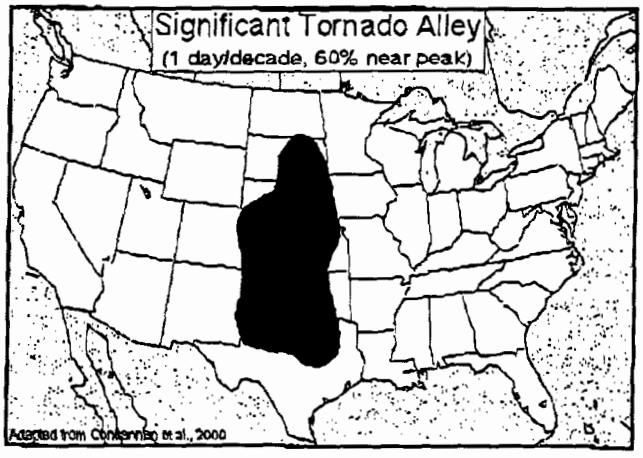
Figure 3. Normalized severe weather reports for Pennington and Meade counties (SD) and Taylor and Jones counties (TX) converted to the area of Ellsworth AFB and Dyess AFB, respectively. Data from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville NC.

V. Analysis and Conclusion

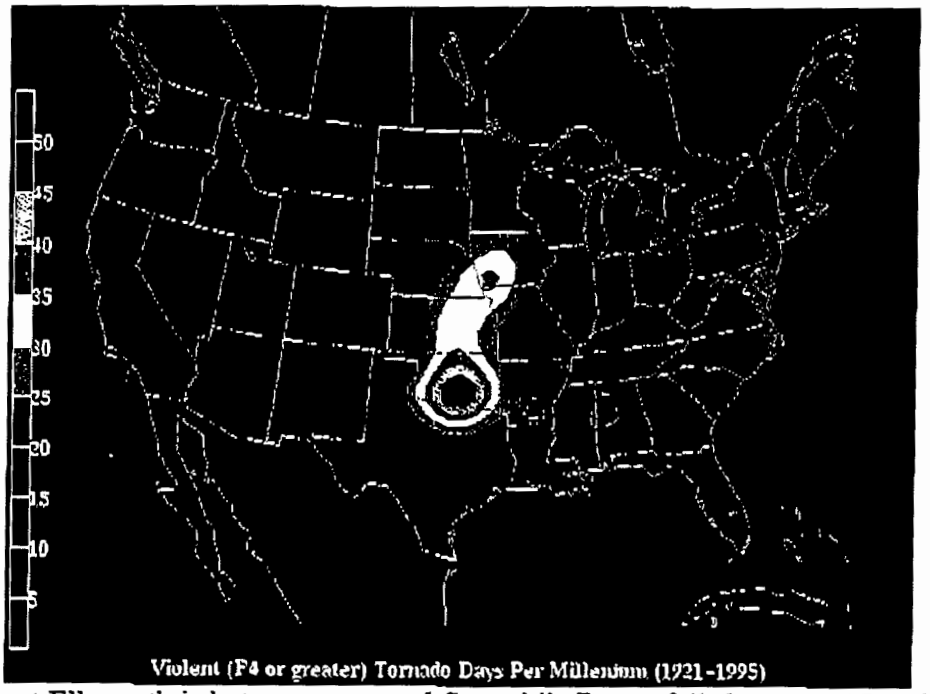
Once the data is normalized it is clear that there is a significantly greater risk of severe weather at Dyess AFB. There is roughly a 6 times greater risk of a tornado at Dyess, the risk of hail 2.5 inches in diameter or greater nearly 5 times greater at Dyess than Ellsworth, but the risk of winds of 75mph or greater is only twice as much at Dyess than Ellsworth.

The most increasing comparison is the 12 times greater risk of an F2 or greater tornado at Dyess while the overall risk of tornadoes of all strengths is about 6 times greater.

The greater risk of tornadoes is borne out in this illustration of what is typically thought of as "tornado alley".

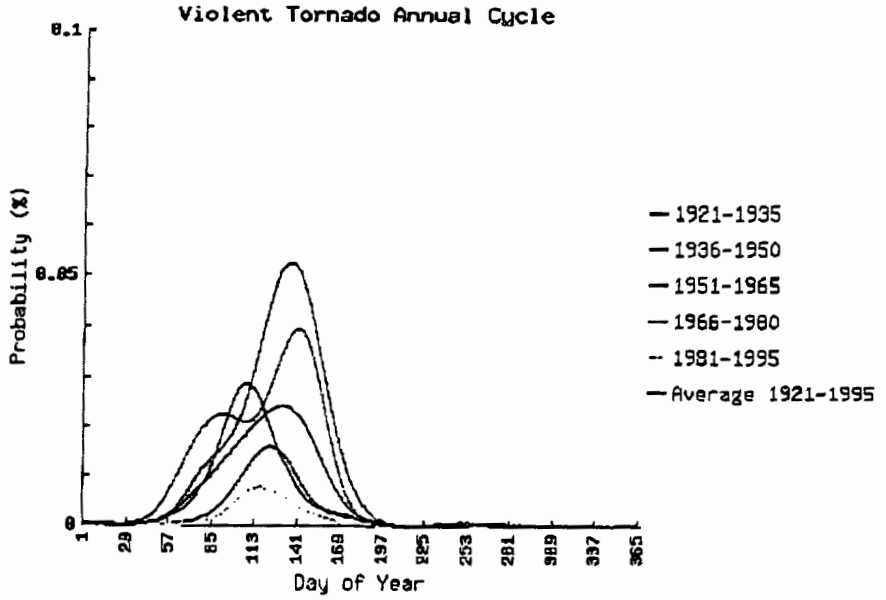


The map below indicates the number of days per millennium with a F4 or greater violent tornado. Note that the region around Dyess has a far greater risk than the region around Ellsworth.

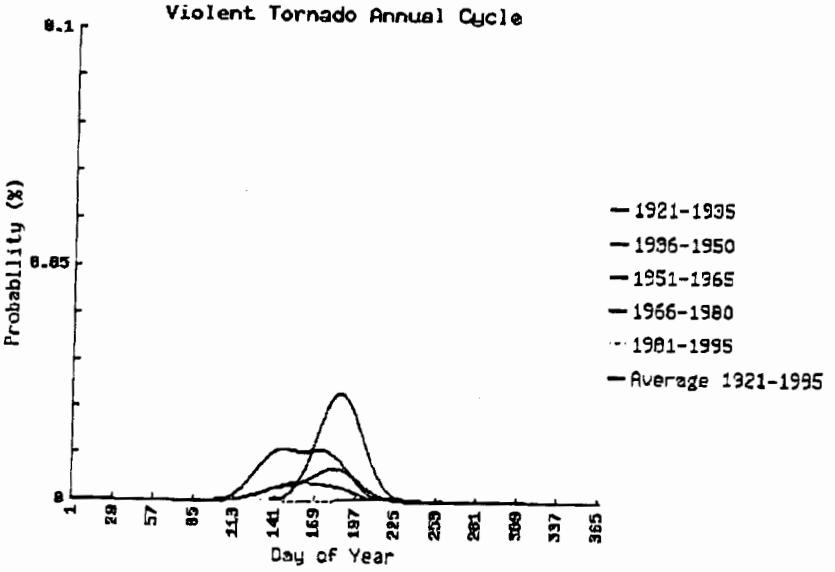


The value at Ellsworth is between zero and five while Dyess falls between 15 and 25. These numbers appear to be meaningless at face value, but remember that it is possible to have a "500-year flood" in back to back years or even in the same year.

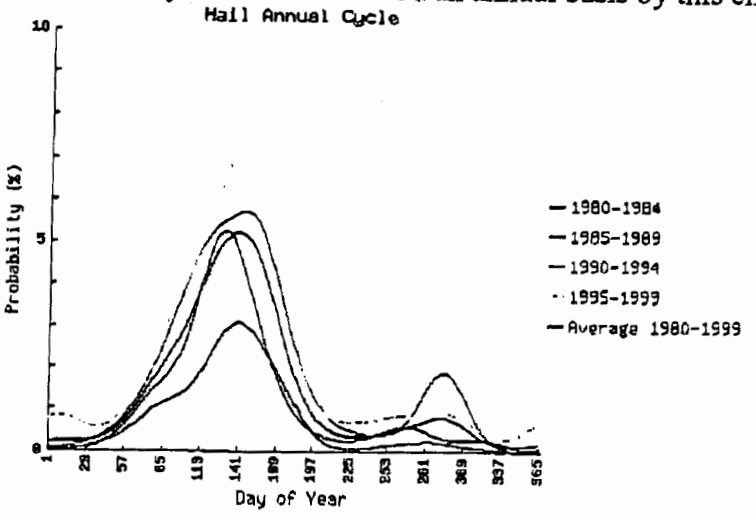
Graphically, the probability of a violent tornado at Dyess during the course of a year is:



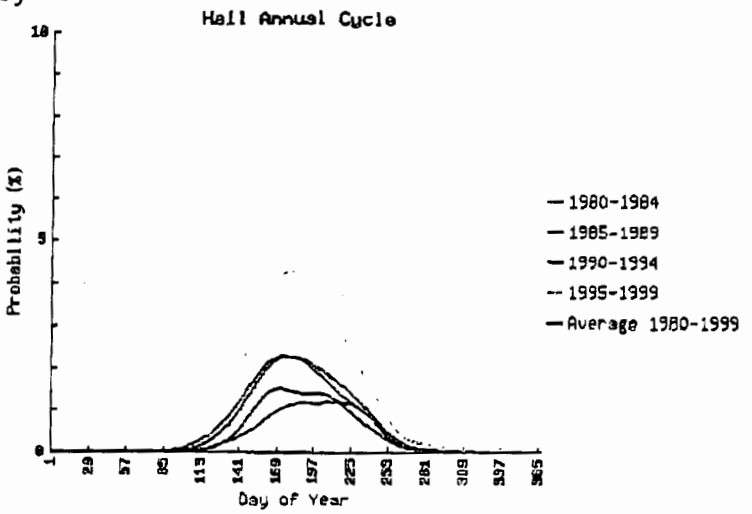
While at Ellsworth:



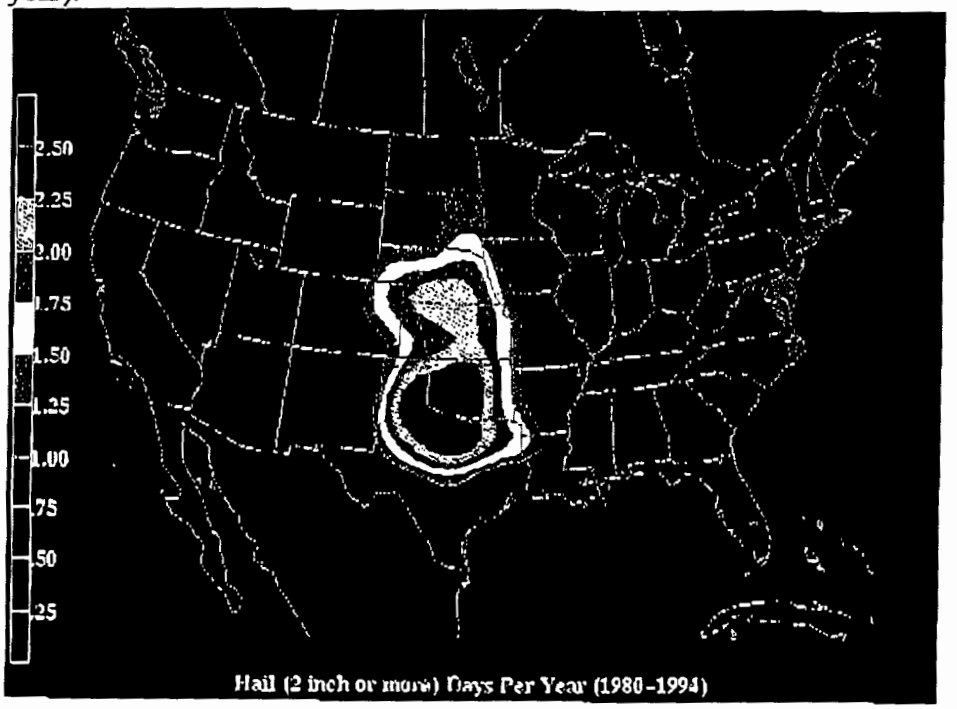
The probability of hail at Dyess is illustrated on an annual basis by this chart



and Ellsworth by



and the risk of hail 2 inches in diameter or greater is approximately doubled at Dyess (2 to 3 days per year with hail meeting the criteria) when compared to Ellsworth (less than 1 day per year).



The conclusion from the analysis of validated severe weather reports is that Dyess AFB has a far greater risk of large hail of all sizes and tornadoes of all types when compared to Ellsworth AFB. The risk of wind gusts of 75mph or greater, while doubled at Dyess, is small in comparison to the substantially greater threat of large hail and tornadoes - particularly significant (F2 and greater) tornadoes. Clearly, the risk of a catastrophic severe thunderstorm is much higher at Dyess, threatening, personnel, equipment and facilities.

VI. Acknowledgements

Bob Riggio, chief meteorologists at KNBN-TV, Rapid City, contributed the statistical data for this paper. He is one of the two Certified Consulting Meteorologists working in the state of South Dakota. He also serves on Air Quality Board of the City of Rapid City and is a professional member of the American Meteorological Society.

Dr. Harold Brooks, National Severe Storms Laboratory (NSSL), steered the author to the additional statistics maintained by NSSL that were used in this paper.

VI. Sources.

Hail, tornado and hail reports from January 1, 1950 through April 30, 2005 are from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center online database at http://www.ncdc.noaa.gov

The map of "tornado alley" is courtesy of the National Oceanic and Atmospheric Administration, Storm Prediction Center, online at http://www.spc.noaa.gov

Graphical tornado and hail probabilities are courtesy of the National Oceanic and Atmospheric Administration, National Severe Storms Laboratory, online at http://www.nssl.noaa.gov/hazard

VII. About the author.

Chris S. Orr is one of two Certified Consulting Meteorologists working in the state of South Dakota, earning the designation in 1997. Fewer than 600 meteorologists hold the CCM. He has been working in operational meteorology, including aviation meteorology, since 1979. From 1996 to 2000 he was the liaison between DTN/Kavouras and the FAA/NWS' Collaborative Convection Forecast Product development as well as with the MIT/FAA Integrated Terminal Weather System Situation Display. He was also been invited to write opinions on reorganization of the National Weather Service (1987) and the National Weather Service's budget (1993). He currently does training programs for meteorologists through his company, Rapid Weather, in Rapid City, South Dakota. He also serves on the City of Rapid City's Water Task Force. He is a professional member of the American Meteorological Society and the National weather Association.