THOR Draft Data Dictionary

Error Management

There are several sources for error when dealing with MISREPS. The easiest to deal with are gross errors where the numbers are obviously wrong – weapon weight alone is greater than the maximum takeoff weight of the aircraft, latitude or longitude values that place the attack on an allied country, B-29 attacks against Japan in 1942, etc. These errors tend to be obvious, and closer inspection usually reveals the source of the error (numerical transposition, a missed +/- sign, mistyped character on a punch card, character recognition error in the OCR process, etc.). Other errors are more subtle and require greater levels of effort to find and remove. One of the most common of these is duplicate entries, where the same data may be entered in multiple records. Sources for this include poor database ingest procedures, such that the data is accidentally loaded more than once; normally, this would affect a range of sorties that are all input at the same time, which tends to draw attention as an anomaly during review procedures. Alternatively, initial and follow-up reports of the same sortie may be input as more data becomes available over time. Here the solution is usually to choose the latest report on the grounds it should have the best data. Additionally, when merging data from different databases, the same sortie may appear slightly differently due to slightly different data structures. The key here is to analyze multiple data elements to determine if the sortie is actually a duplicate. If, for example, the date, take-off base, take-off time, aircraft type, unit, mission number, callsign, weapon load, and target struck are all simultaneously identical, then it can be flagged as a duplicate. Criteria used vary slightly depending on the quality and nature of the dataset; but in general, no less than five independent fields were compared to determine the likelihood of duplication. Another source of error and confusion is when dealing with aircraft that carry more than one weapon type and/or strike more than one target. It is possible that they can be counted as multiple sorties instead of multiple strikes by the same sortie. *(See the **Note on Database Design** below)*

The target coordinates are another potential source of error. As the science of geodesy has evolved over time, the underlying shape of the Earth and the resulting coordinate system in use has been refined multiple times since 1914. Moreover, different grid schemes with different reference points have been used (British Purple and Red grids in WWII MTO, Military Grid Reference System (MGRS)) that also require conversion to latitude and longitude values. The database preserves the original coordinates as provided in the original data, and also performs the conversions to the current WGS84 standard. Depending on the accuracy and spatial resolution of the original measurement, and the accuracy of the conversion process, any inherent location error may be magnified as part of the transformation.

In theory, there may be cases where the data is flat-out wrong or false, but this is expected to be highly unlikely overall for a few reasons. First, individual MISREPS were reviewed daily by the unit Operations Officer and/or Commander before being sent up to the higher echelon of command where the data was

again scrutinized.[1,2] These officers had a vested interest in checking and ensuring an accurate report of the day's activities went forward. A number of MISREPS that were manually input into the database demonstrate this and are tattooed with pen and ink changes made by these reviewing officials correcting typos or clarifying details. Secondly, inclusion of these reports into the databases of the time had to make sense. Personnel involved in the process had knowledge of the events and would have (or should have) been able to correct or at least identify those items that did not make sense[3].

There are instances where data may be incorrect, but the resources to correct it are beyond the capabilities of the study. In WW2, there is one data field where this is evident, and it is left unmodified in the database for interest, but without high confidence. That data field is "Number of enemy aircraft destroyed".

Since bombers were flying in formations of hundreds of planes, and multiple gunners from multiple planes were shooting at multiple enemy fighter aircraft, each gunner naturally reported that their bullets were the one that shot down the enemy aircraft. This results in an inflated number of enemy aircraft shot down. This problem was identified by the survey personnel and intelligence personnel at the time, and low confidence was placed on this information. Also, in the IBM punch card data from the Korean War, the documentation advises that the columns for MIA and KIA are initial reports only, and do not represent accurate numbers after the report was filed; i.e., missing airmen found or KIA airmen that were actually only wounded and recovered . Another specific instance during the Vietnam conflict is the "Menu" bombing campaign, where the US was clandestinely bombing Cambodia, and reports were altered at 7th AF to cover up this fact to lower echelons but the correct data was reported to the JCS. The data so far examined in the CACTA and SEADAB databases (originally JCS databases) indicates that the actual, "undoctored" data seems to have made it into the database.

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[1] Fifteenth Air Force HQ procedures: "The target worksheets are normally sent to the Machine Section for processing once a week. After the data has been processed a check listing is made and every item is visually audited against the worksheets. At the month's end a listing by group in date order is made and the totals are checked against the hand totals on the Group Daily History sheets. Non-adding items are sight checked against the original Form 34. Corrections to be made are noted on the listing, then new cards are punched and replace the incorrect cards in the file. A final check listing is then made and checked against the history sheets for balance." *Correspondence from 15th Air Force Headquarters to Commanding General, USSAFE (Attn: Statistical Control Office),* 24 Apr 1945. AFHRA unpublished correspondence of United States Strategic Forces in Europe. IRIS # 00214753. Call # 519.1254-3.

[2] Many early daily mission reports (on RAF forms) by 12th Bomb Group from North Africa in 1942 contain pen or pencil annotations by the squadron ops officer or commander including details initially left out of the report. Over time, these annotations decrease as the desired information is included in subsequent submissions.

[3]For example, the initial 509 Composite Group report from the Nagasaki atomic bombing mission on 9 August 1945 reports a first "bomb release" time and last "bomb release" time. There is an immediate reply by teletype from 20 AF demanding clarification regarding number and type of bombs released, as there was only supposed to be one atomic bomb on board.

Note on Database Design:

There were many potential ways to organize the data. Depending on how it was originally presented, one could either get an accurate count of sorties flown, weapons dropped or targets hit, but not all three. Therefore efforts have been taken in the design of the THOR database to be flexible enough to answer each of these questions, while not falsely inflating the other values. The challenge has been how to account for multiple planes attacking multiple targets with multiple weapons per sortie flown. The solution has been to have each instance of a unique weapon type or engagement of a unique target generates a new record. That is, if plane A drops six 500 pound bombs on target 1, that will generate one record. If the same plane A drops two 250 pound bombs on the same target 1, that generates a second record. If the same plane A then drops three 250 pound bombs on a different target 2, that generates a third record. So the same sortie can generate multiple records. The "Sortie Dupe" field is a flag indicator that will be set to zero for the first weapons use, and will be a "one" when the same sortie employs multiple weapons or attacks multiple targets. A request for a sortie count/summary, etc. will ignore records with a "one" in the "Sortie Dupe" field. That way, the correct accounting can take place whatever the focus of the accrual count (sorties, weapons, targets). This challenge has been encountered before – in the US Strategic Bombing Survey the "Aircraft Attacking" or "Aircraft Dropping Bombs" fields would be left blank, even though the weapons tonnage and types were given. This didn't mean that the weapons magically appeared over the target; rather it meant that the aircraft sorties were already accounted for in relation to another weapon type or target. While appropriate (and elegant) for the punch card technology of the time, the USSBS approach has caused difficulties with the traceability of the aircraft and their associated weapons payload when attempting to interpret the data 70 years later[4]. Hence the adoption of the "Sortie Dupe" field to indicate repeated data.

Terminology

Terms sometimes casually used interchangeably have similar meanings, but can lead to different numerical answers. For consistency, the following terms are used throughout the database and article:

Sortie: One takeoff and landing of one aircraft

Mission: One or several sorties that are grouped together to accomplish a specific purpose[5]

Record: One line of data in the database *(See **Note on Database Design** for more detail on how records are organized in the database)*

Munitions weight: For consistency, all tonnage terms use 1 ton = 2,000 pounds. All munitions weight values in THOR are converted to pounds and fractions of a pound (i.e.: a value of 1.0625 pounds is used, not 1 pound and 1 ounce). All kilograms are converted to pounds using a factor of 2.2 pounds/kilogram. All bullet weights are in pounds. Only the warhead portion of a missile or bullet portion of a cartridge

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[4] This is very evident in the "Incendiary Attacks on Japan" dataset, where up to three different types of incendiary weapons were loaded in multiple B-29 aircraft from multiple Groups, which then flew in formation and all dropped simultaneously on the same target city in Japan.

[5] Refined slightly on the 1946 USSBS definition:"A mission, in the sense in which the term is used in this report, is an attack by any number of aircraft on a single target during the course of a day." US Strategic Bombing Survey. ***Bombing Accuracy, USAAF Heavy and Medium Bombers in the ETO***. Military Analysis Division, Jan 1947. p.2.

round is used in THOR. For example, a notional 100 pound Hellfire missile has a 10 pound explosive head and approximately 90 pounds of booster fuel and structure. Only the 10 pounds of explosive that reaches the target is counted in THOR. Likewise, a nominal 30mm HEI-T cartridge weighs 1.48 pounds[6], of which, only the .79 pound bullet would be recorded in THOR.

Strike: Each attack on a separate target during the same sortie is counted as a separate strike. A separate target is defined as a unique set of latitude and longitude coordinates.

Attacks on a target made by the same striking force within an arbitrary 90 minute window are considered as part of the same strike. The time window is of more interest after the advent of aerial refueling (Vietnam and later) where attacking sorties can make one or multiple passes over the target, break off, refuel, re-acquire and re-attack the same target, thus accounting for the potential situation of one aircraft having accomplished two strikes on one target during the same sortie.

Several WW2-era bomber streams could not accomplish one strike in the 90 minute window due to sheer number of aircraft passing over the target. In such cases, the time limit is ignored by the database.

Geolocation

One of the strengths of the THOR approach is the ability to output the information on a map. The spatial analysis of the information enables graphical analyses that would be next to impossible if the information were left in textual or tabular form. This GIS approach comes with its own inherent limitations and caveats that are exacerbated by the resolution of historical data. In today's location-aware environment, it is unconsciously assumed that a location is exact, to within a meter of the actual person or object. This has not always been the case. Today's precision weapons are a relatively recent phenomenon, and not representative of past bombing capabilities. Where one GPS-guided munition today can destroy a bridge pier, in the past this could require multiple weapons from multiple aircraft saturating a target area in order to have a high probability of success.

The USSBS recorded data in DDMM format (DegreeDegreeMinuteMinute), providing accuracy to one minute of arc on the Earth's surface. That works out to 6702 feet or 1868 meters, or one nautical mile at the equator. While this seems enormous by contemporary standards, bomb fields created by hundreds of aircraft dropping thousands of unguided "dumb" munitions would typically saturate an area where the goal was to get over 50% of the bombs inside a circle 1,000 feet in radius.[7] The targets chosen were for the most part matched against this type of bombing capability; rail marshalling yards,

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[6] http://www.navweaps.com/Weapons/WNUS_30mm_BushmasterII.htm, Accessed 28 Nov 2012.

[7] "a box varied in size from 3 to 18 or more aircraft...all the aircraft in a box bombed as a unit; that is to say each box had a lead bombardier who was primarily responsible for the bombing and the other aircraft in the box simply released their bombs when they observed the leader's bombs fall from his plane. It is therefore the usual technique in bombing analysis to consider the error made in the bombs released from a single box rather than to measure the errors made by each individual bomb...The measurement in question was the percentage of the bombs in the pattern which fell within 1,000 feet of the assigned point." US Strategic Bombing Survey. ***Bombing Accuracy, USAAF Heavy and Medium Bombers in the ETO***. Military Analysis Division, Jan 1947. p.2.

industrial plants, oil refineries, and others represent target sets that can effectively be attacked with this level of precision, best incapacitated by an area bombing approach. Actual results demonstrated this level of accuracy was a challenge to achieve given wartime conditions. For a 4-month period in 1944, under good to fair visibility (and with significant air superiority), 30% of the tonnage fell within 1,000 feet radius, 64% within ½ mile, and 82% within a mile radius of the target[8]. Therefore, a 1 nautical mile uncertainty of geolocation uncertainty seems more than reasonable in these conditions.

The table below lists the inherent accuracy of the geolocation based on the level of granularity in the source target source location.

Location Measurement System	Original Measurement Format	Limit of Geolocation Accuracy (meters)	Limit of Geolocation Accuracy (Feet)
Latitude/Longitude *(where DD represents the value in degrees [equivalent to DDD for Longitude], and M represents Minutes, S represents Seconds, and .DDD represents decimal fractions of a degree)*	DD	112080m	364320 ft.
	DD MM	1868m	6072 ft. (1 nm)
	DD MM SS	31.133m	101.833 ft.
	DD	112080m	364320 ft.
	DD.D	11208.0m	36432.0 ft.
	DD.DD	1120.8m	3643.2 ft.
	DD.DDD	112m	364.32 ft.
	DD.DDDD	11.2m	36.43 ft.
	DD.DDDDD	1.2m	3.643 ft.
MGRS or UTM *(where AA represents the 100,000 m digraph, and X represents Easting, Y represents Northing)*	AAXY	10,000m	32500 ft.
	AAXXYY	1,000m	3250 ft.
	AAXXXYYY	100m	325 ft.
	AAXXXXYYYY	10m	32.5 ft.
	AAXXXXXYYYYY	1m	3.25 ft.

Table 1: Geolocation uncertainty based on coordinate system precision. THOR converts all original measurement formats to a DD.DDDD format for consistent calculation and reporting.

For internal consistency, THOR converts the original measurement format into a DD.DDDDD format and also translates the source location measurement system into the WGS84 coordinate measurement system. The source measurements are also preserved untouched, to preserve the original information, and to serve as a check for outside parties in case the conversion process was flawed. Additionally, even though the data may be converted into a DD.DDDDD (or greater number of decimal places) format, does not mean that the accuracy has improved by the additional significant figures. The original level of uncertainty stays with the data. Further details on the geolocation challenge for each war are described in that specific conflict's section.

[8] Exhibit R, US Strategic Bombing Survey. ***Bombing Accuracy, USAAF Heavy and Medium Bombers in the ETO***. Military Analysis Division, Jan 1947. p.25.

Conflict-Specific Data Sets

World War 1 (1914-1918)

World War 1 Data Included

Data currently in the collection is digitized from the Daily Raid Reports of the 1st Daylight Bomb Group of the American Air Service in World War 1. This includes records from the 96th, 20th, 11th, and 166th Aero Squadrons. These daily records span dates from June to November 1918, and are the most detailed records found to date. British records of the Royal Naval Air Service/Royal Flying Corps/Royal Air Force (RNAS/RFC/RAF) cover the period from 30 June 1916 to November 1918 for the No. 55, 97, 99, 10, 104, 110, 115, 215, and 216 Sqdns. These British records and French bombing data were provided by Mr. Steven Suddaby, then-President of the World War 1 Historical Society, who personally digitized the data based on French Unit War Diaries available online at:

http://www.memoiredeshommes.sga.defense.gouv.fr/jmo/img-viewer/1_A_286_003/viewer.html

French bombing data covers the period from 8 Aug 1914 to November 1918. Mr. Suddaby also provided data on Italian sorties operating on the Western Front from January to October 1918. Data on Italian sorties on the Italian Front and Americans flying on the Italian front were found in the form of documents from the AFHRA's unpublished Caproni papers. These documents consisted of a mix of US War Department records and reports[9], and documents from the Italian government. Italian War Bulletins in this collection were translated into English by Ms. Iris Moebius. Additional information was gleaned from books[10]

When a detailed description of the bombing location was lacking, and there were no contemporary aerial photographs indicating bomb craters that could be geolocated and matched up with the bombing mission, the coordinates for the named city were used. The coordinates used were those from the US National Geospatial Agency placename gazetteer database available online.

World War 1 Data missing

The records on hand are being evaluated to determine what gaps exist in the bombing record for WW1, a record that now begins within the first seven days of conflict in August of 1914, and continues through November 1918.

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[9] ***Italian Bombardment Activities during 1915-1918, during the World War ar the Italo-Austrian front; List of bombing operations carried out by Italian Airships during the World War, 1914-1918.***

[10] ***Dear Bert: An American Pilot Flying in World War 1 Italy***. Lewis, Edward Davis. Logisma Editore. 2002. ***1918-1958 Nel 40 Anniversario delle Battaglie del Piave e di Vittorio Veneto.*** Magg. Generale A.A. r.s. Vincenzo Lioy. Ufficio Storico Aeronautica Militare

World War 1 Data Sources

A full list of the sources used is included in the bibliography.

A Note on WW1 Geolocation:

Fidelity of geolocation coordinates varies widely in WW1 data, but this is not an isolated case – a similar problem was experienced by the framers of the Gulf War Air Power Survey some eighty years later.[11] Depending on the archival materials available, in some cases, aerial photographs could be cross-referenced with mission reports, and geolocation down to the actual bomb crater location could be determined – a granularity and fidelity comparable to today's GPS-guided munitions. In other cases, significant landmarks were described in sufficient accuracy to place the strike to an accuracy of a few hundred feet. In other cases, the location place name is the only description available, providing an uncertainty circle up to a few kilometers in diameter. Another source of error is the use of identical or similar names in multiple locations. Therefore, it is quite possible that the wrong location was inadvertently selected for geolocation.

When presented with multiple locations having the same appellation, the list was narrowed when possible by additional information ("near Metz", etc.). Failing that, coordinates were selected based on relevance to the battleground (i.e., a location with latitude of 44 N was well south of the WW1 western front battlefields, and excluded from further consideration.) However, when presented with several choices for a location, each equally plausible, the choice was made arbitrarily – resulting in an acceptable accuracy at the macro level, but perhaps unsatisfactory at the detail level. As more people gain exposure to the database, and bring their unique scholarly knowledge to bear, it is desired that corroborating evidence can be provided and applied (via subsequent version updates) to correct any mistakes or errors this process has introduced into the historical record.

Sources used for geolocation data were the National Geospatial Agency's on-line Geonames database, for historical placenames that the NGA site could not resolve, the familysearch database was found to be effective.

http://geonames.nga.mil/ggmagaz/

https://labs.familysearch.org/stdfinder/StdPlaceLookupResults.jsp

[11] "Despite the overall abundance of data there are still significant holes in the records, some of them in critical areas, such as the detailed results of battlefield or tactical-level air operations against Iraqi ground forces in the Kuwait Theater of Operations (KTO). Certainly the ongoing research and data collection process will fill in many of these gaps, but some may never be closed entirely. The quality of information in any archive or database depends on the quality of the original source." ***Gulf War Air Power Survey, Volume V: A Statistical Compendium and Chronology***. Washington DC, 1993, pg.1.

For aircraft launch locations, the following sources were useful to identify shifting unit locations over time and then plug those placenames into the databases above:

http://albindenis.free.fr/Site_escadrille/page_escadrilles_1_a_500.htm (French Sorties)

http://patriot.net/~townsend/WW1AirMap2/ (British Sorties)

World War 1 Data Fields

1) **Master Index Number**
   Unique identifier number used to internally track the record fields
2) **Classification**
   Security Classification of the material. World War 1 data is Unclassified
3) **Date**
   (MM/DD/YYYY Format) Date the operation took place. In the case of night operations that span more than one day, the value will be the date that the plane took off from the launch base
4) **Operation**
   Name of the operation being supported, if given or known
5) **Country**
   Country to which the attacking aircraft belongs (i.e. USA, UK, Australia, etc.)
6) **Service**
   Department or Service to which the attacking aircraft belongs (USAAF, USN, RAF, RAAF, etc.)
7) **Unit**
   Military unit to which the attacking aircraft belongs – depending on the fidelity of the data, this may be a Numbered Air Force, Command, Wing, Group, or Squadron. The default value is Squadron
8) **MDS**
   Mission Delivery System or airframe used to deliver the weapon to target – text name
9) **Mission#**
   Specific mission number if known. Mission numbers may repeat between various levels of command (i.e. different squadrons, groups, wings, and Numbered Air Forces may each have a similarly numbered Mission #35, but each of those may be different missions), hence mission number is not used as a unique identifier, but provided, when known, to correlate with other data that may reference it.
10) **Departure**
    Day or night mission indicator when lacking more detailed information. Otherwise contains the date time stamp in MM/DD/YYYY HH:MM:SS format on a 24 hour clock. Times are assumed to be local time.
11) **Return**
    Return date time stamp in same format as Departure. Blank if no data available.
12) **Duration**
    Duration of flight calculated by subtracting Departure from Return Date/Time. Format is HH:MM:SS of elapsed mission time.
13) **Number of planes launched**
    Number of aircraft that successfully took off in direct support of the bombing mission. Does not include escort aircraft.
14) **Number of planes cancelled**
    Number of aircraft that did not make it to target for whatever reason.
15) **Number of planes attacking**
    Number of aircraft that actually attacked the target.

16) **Callsign**
    Callsign of aircraft or pilot name. For WW1, the airship name
17) **Number of Weapons expended**
    Number of weapons expended.
18) **Weapon type**
    Text description of weapon type
19) **Total Weapon weight in pounds**
    Calculated amount based on "Number of Weapons Expended" and weapon weight indexed by "Weapon Type" on an internal lookup table. Weapon weight is based on the net explosive actually delivered to the target, irrespective of the weight of propellant it took to reach the target. For ammunition, this is the weight of the round, not the weight of the full bullet. Likewise, for a contemporary Hellfire missile, the missile itself weighs 100 pounds, but delivers a 20 pound explosive warhead to the target. The weight used for a Hellfire is 20 pounds.
20) **Bombload per plane**
    Calculated value that divides the total weapon weight by the number of aircraft delivering the weapons load. Used as an internal check to ensure that the nominal bomb load is within the carrying capacity of the aircraft.
21) **TOT**
    Time Over Target. This is a start time in HH:MM:SS format indicating when the bomb drop began. It does not indicate how long the bomb drop took, or the number of passes taken to accomplish the bomb drop.
22) **Latitude**
    Target Latitude in Decimal degrees format (i.e. 30Deg 45 min is 30.75 degrees)
23) **Longitude**
    Target Longitude in Decimal degrees format (i.e. 30Deg 45 min is 30.75 degrees)
24) **Tgt Location**
    Text description of the target location, city name, etc.
25) **Country**
    Text name of target country
26) **Tgt Name Type**
    Text description of target category (Port, Aerodrome, Railyard, etc.)
27) **Altitude in meters**
    Bomb release altitude in meters. Altitude is believed to be height above ground (unsure of how height was determined in 1918). When multiple altitudes are given, the lowest altitude is used
28) **Altitude in feet**
    Bomb release altitude in feet. Altitude is believed to be height above ground (unsure of how height was determined in 1918). When multiple altitudes are given, the lowest altitude is used
29) **Speed in mph**
    Notional speed at altitude for bomb release. Value provided from MDS specs.
30) **TO Base**
    Take off Base place name
31) **TO Base Lat**
    Take off Base Latitude in Decimal Degrees
32) **TO Base Long**
    Take off Base Longitude in Decimal Degrees
33) **Bomb Damage Assessment**
    Text description as provided in daily raid reports
34) **Enemy Action**

Text description as provided in daily raid reports

35) Route Details

Text description as provided in daily raid reports

36) ISR Collected

Text description as provided in daily raid reports

37) Friendly Casualties

Text description as provided in daily raid reports

38) Weather Visibility

Text description as provided in daily raid reports

39) Weather Reanalysis valid time
40) Altitude (ft.)
41) Wind direction (Degrees)
42) Wind Speed (Knots)
43) Temperature at altitude (Degrees Celsius)
44) Relative Humidity at altitude (%)
45) Temperature Dew Point Depression (T-Td) at Altitude (Degrees C)
46) Low Cloud Cover (%)
47) Mid Cloud Cover (%)
48) High Cloud Cover (%)
49) K-Index Thunderstorm Potential Indicator
50) TT-Index Severe Thunderstorm Potential Indicator
51) Icing Potential at Altitude
52) Moon Illumination (%)
53) Wind Direction 10 meters above ground (Degrees)
54) Wind Speed 10 meters above ground (Knots)
55) Surface Temperature (Deg C)
56) Precipitation past 3 hours (inches)
57) Percent of ground covered with snow (%)

58) Sortie Duplicate Count

This column serves as a flag indicator when the same sortie or sorties drop multiple types of weapons on the same target, or strike multiple targets while on the same sortie. The flag is set to "0" by default, and has a value of "1" if the sorties are accounted for in another record. This flag prevents multiple counts of the same sorties while preserving an accurate count of targets hit and weapons expended.

World War 2 (1939-1945)

Data included

Data from World War 2 comes primarily from the files of the US Strategic Bombing Survey. This data included US data in the European, Mediterranean, and Pacific theaters of war from mid-1942 or early 1943(dependent on the dataset) to the respective VE Day (May 1945) or VJ Day (Aug 1945) period. Additionally, the USSBS data included British RAF European bombing data from December 1939 to VE day. Unit-level daily mission reports were used to fill in gaps in coverage from early 1942 for the Mediterranean and Pacific Theaters. Several books and documents were used to fill in the gaps in the RAF record from 1939 to 1945 so that the European bombing record is complete from 3 Sep 1939 to May 1945. By aircraft model, this archive contains heavy and medium bombers, broken out by type (B-17, B-24, B-25, B-26, etc.), which may be more robust than previous studies. Data from fighter aircraft in the MTO and ETO is limited to strafing records, and some records of the A-36, a ground attack model of the P-51 that was used in the Sicilian and Italian campaigns.

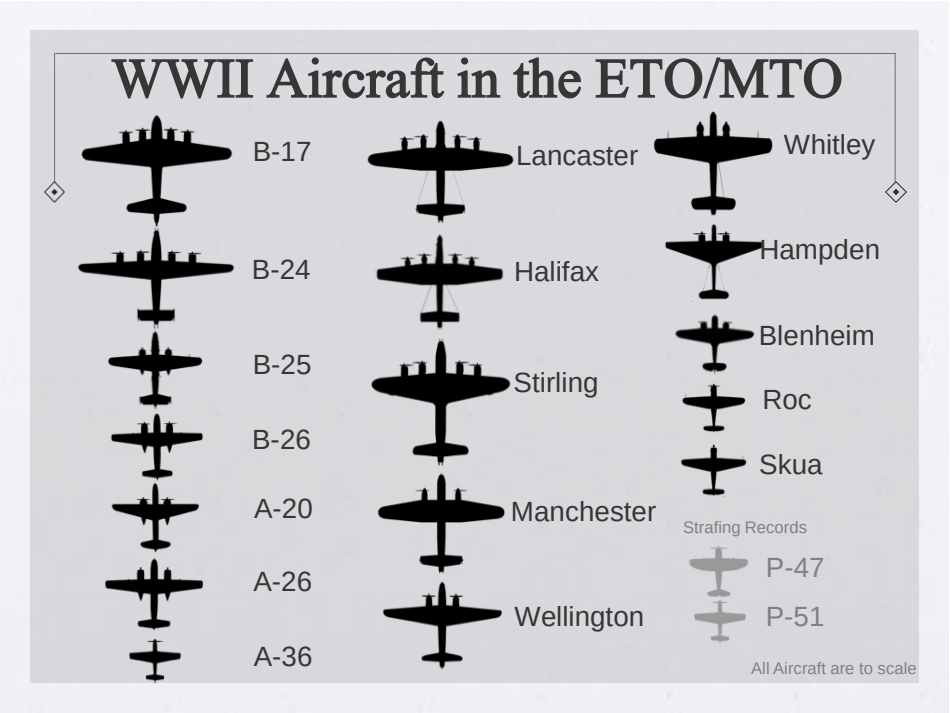

Figure 1: Aircraft types from the European and Mediterranean theaters whose missions are recorded in records collected by the US Strategic Bombing Survey / AAF Evaluation Board

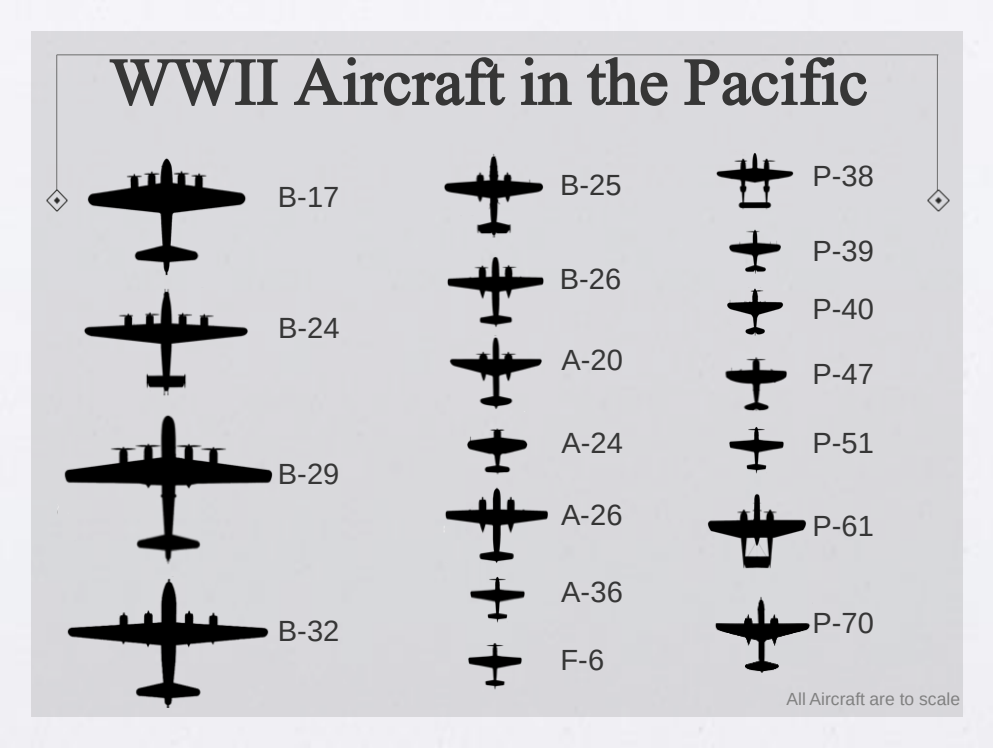

Figure 2: Aircraft types from the Pacific and China-Burma-India theaters whose missions are recorded in records collected by the US Strategic Bombing Survey / AAF Evaluation Board

Data not included (still searching for)

Coverage of RAF bombing in the Mediterranean, African, and Pacific theaters lacks the robustness of the rest of the record. Further research into these theaters may result in more detailed data surfacing at a later date. Missions flown by the Chinese Air Force personnel as part of the 14 AF Chinese American Composite Wing 1943-1945 may be included as missions flown by USAAF personnel in the USSBS data, but further analysis is required to determine which missions are included and which ones might still be missing from the record.

Data Sources

Primary sources for this archive were the surviving documents of the Strategic Bombing Survey and the AAF Evaluation Board. These two concurrent surveys were occurring at the end of WW2, and agreed on using a common data set to simplify and streamline data collection between their studies, but the actual data analysis was done independently by each study, consistent with the study's individual charter. Thus, the USSBS focused on strategic bombing analysis, while the AAFEB looked into the size, scale, and mission apportionment required for a post-war air force.

The common data set used by both studies is what THOR is preserving, without regard to assessing the conclusions of either study. A set of five different IBM punch cards (Target Master Cards, Target Detail Cards, Target Bombing Cards, Mission Data Cards, and Mission Loss Cards) were made to capture the

data recorded in the AAF Form 34 for each unit. These Form 34's were weekly summaries of the missions flown by the units and passed up to their respective higher headquarters for reporting and aggregation. Two identical sets of punch cards were made – one for each study. While a complete record of all of the data from these punch cards does not appear to have survived, a sizable amount has been located in the collections of the AFHRA and the National Archives in the form of initial tabulation printouts from these punch cards. It is these tabulations that have been digitized to allow the examination of bombing at the operational level in World War 2.

A full list of the sources used is included in the bibliography.

USSBS Geolocation

Geolocation for World War 2 data was accomplished using the latitude and longitude values provided by the United States Strategic Bombing Survey. These data are provided in a DDMM (Latitude) or DDDMM (Longitude) format. Data is cross-referenced between bombing data and target books via target ID numbers. Additionally, the MDS volumes also list the target ID and Latitude and Longitude values, so this serves as an additional check on the cross-reference process. There was a shift in the target ID's during the war, as the Joint Targeting process was refined, and new target ID's were issued for past and future targets. Both sets of numbers appear well documented and cross-referenced in the data, so this is not expected to be an issue.

The Target Data volumes were digitized (24,186 records), and then compared against digitized targeting data in the Aircraft Summary volumes(21,562 records), 12 AF Transportation Targets volume (4,828 records), Harvard Statistical Analysis #2 for 8th and 15th Air Forces (TBD records), and Strafing Targets (3,289 records). Duplicates were identified by means of developing a unique data ID string formed by concatenating selected field contents for each record (i.e.: Target Name, Target Description, New Country Code, Old Target Code, New Target Code, Industry ID code, Numbered Air Force). These were then sorted by the database software and duplicate data ID strings were marked for removal. Before the duplicates were removed, the entries were all examined by hand to ensure all possible information was transferred to the records remaining. In particular, some record sets had more information on the old target codes that was transferred to corresponding records being kept. Additionally, latitude and longitude location data were transferred when target name and target codes were identical between the records. There are still duplicate target records in the resulting data. In some cases, the only difference between two records is which Air Force struck the target. Additionally, it was noted that there are significant misspellings and abbreviations of place names that can result in duplicate entries. For the time being, these are being left in the data as a means of matching the target data against other data products that may contain the identical abbreviations and misspellings. Current count places the target list at 38,308 records after all of the consolidation process is complete.

TGT Books	12 AF Trans Tgts	MDS Summaries	Strafing Records	Harvard #2
Location Name	Location Name	Location Name	Location Name	Location Name
Country Code	Country Code	Country Code	Country Code	Country Code
Industry Code	Industry Code	Industry Code	Industry Code	Industry Code
New TGT Code	New TGT Code		New TGT Code	
Old TGT Code	Old TGT Code	Old TGT Code	Old TGT Code	

There are a number of entries in the targeting reference books that have blanks or "9999" as the location. Additionally, there are cases where only the longitude is provided in both the latitude and longitude data columns. In particular, a number of entries for V1 and V2 launch sites were in these categories. NOBALL or CROSSBOW target location data was hand entered for sites identified in the 9 AF "NOBALL TARGET LIST" March –Aug 1944.

For these situations, geolocation was attempted using outside resources to generate latitude and longitude values for these location place names. The following protocol was followed:

1. Search for exact location match via: http://geonames.nga.mil/ggmagaz/
2. If no match found or possible due to information in hand, search via "starts with" or "ends with" or "contains"; Start with search restricted to Country Code provided. Widen search if no answers found. (One town in Europe has changed its nationality four times since WW2, due to shifting national boundaries. During WW2 it was located inside Italy, but is now belongs to Bosnia-Herzegovina, which is where the geonames gazetteer locates it.)
3. If presented with more than one option, look for match based on match with USSBS-provided longitude value (i.e., if USSBS value has a blank or "9999" for latitude but lists longitude as "130E", look for choice that contains a longitude value of "1.5")
4. If USSBS-provided values are blank or "9999", use first exact match NGA Gazetteer option that has the annotation "(Approved)" after the place name
5. If no exact match, but likely match is presented, annotate the place name with the name used.

For example "S Martino" with Country Code of "13" is searched via http://geonames.nga.mil/ggmagaz/ using the parameters "Ends With" MARTINO (as the "S" could stand for San, Santa, Santo, Saint, Sainte, etc.) and restricted to ITALY (Country Code 13=Sicily and Italy). The "Name Type Search" field was set to include Conventional, Approved, Unverified, Provisional, Variant, Anglicized Variant, Historic, and Historic Non-Roman Script nomenclatures in the search.

The NGA geonames website found 97 names identifying 69 locations that meet these criteria, of which 29 are an exact match with San Martino being the "(Approved)" name versus "(Variant)". The first exact match of "San Martino" as the "(Approved)" name was the 17th listed in the responses. In accordance with the protocol described above, the database is updated to reflect the data used: The name is updated to "S MARTINO (San Martino)" and the latitude of 46.783333, Longitude of 11.216667 are entered in place of "9999" and blank values.

An additional logic check is performed by looking at the data and the date of the strike to confirm they are logically consistent. In this case, San Martino is attacked by A-20's on April 17, 1945, so a northern Italian location is consistent with the flow of the war at that point (whereas a San Martino location in Sicily on this date would be an unusual outlier.)

These entered values are identifiable in the database, as they will be the only values with decimal degree format in the "Source Latitude" or "Source Longitude" field. It is possible that the wrong location was chosen by this method, but absent any additional identifying and amplifying records, there doesn't appear to be a better way to geolocate these bombing locations. As better information comes to light, these values can be updated or corrected if they do prove to be in error. The format makes them easily segregable from USSBS-provided values. Additionally, these entered values are in the WGS84 coordinate reference system, whereas the USSBS location data coordinate reference system is not specified in the documentation found to date. Given no identifying or documentary information to the contrary, it is assumed that the International 1924 reference system is used by default, since that was the latest in use prior to post-war mapping efforts.[12] Other than converting DDMMSS format to decimal degree format, the software does not make any geodetic corrections to the USSBS-provided data. Values that are already in decimal degrees are ignored by the software.

Data Structure

There are a multitude of report formats used by the US Strategic Bombing Survey, but the data contained in each remains consistent, so the data fields will be presented once, though different reports used different subsets of the data. Where differences arise, they will be annotated below. A full breakout of all of the data codes used is attached in Appendix A. Brief descriptions will be provided below, highlighting discrepancies between the USSBS-published decode documents[13], and data appearing in the records.

1) **Location Name**
   Target Location place name, although it may also describe a factory name or other feature (e.g. ICARUS describes the Icarus aircraft factory in Belgrade, GUMTREE refers to Gumtree Road in Tunisia)
2) **AC Type**
   Model type of the aircraft flown on the mission. In some cases, this type information is preceded by an "O", "G", or "S". Additionally, some of the records (primarily RAF) list the type as "Light", "Medium", or "Heavy" rather than an actual model designator.
3) **Latitude**
   As given by the USSBS target books in DDMM format. In situations where the latitude was listed as blank or "9999", NGA geolocated values have been substituted, identifiable by the DD.DDDD format. See **USSBS Geolocation** for more details.

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[12] Conversations with the USGS Coordinate Research Branch have failed to identify any documentation identifying the coordinate reference system used by the USSBS, or what systems were widely in use prior to the post-war US-led worldwide geodetic surveys conducted beginning in 1949.

[13] Specifically, ***Index of Codes***, pp. 157-161, ***Statistical Appendix to the United States Strategic Bombing Survey***. Washington DC. 1946.

4) **Direction**
   Number believed to indicate North or South. "5" = North
5) **Longitude**
   As given by the USSBS target books in DDMM format. In situations where the longitude was listed as blank or "99999", NGA geolocated values have been substituted, identifiable by the DDD.DDDD format. See **USSBS Geolocation** for more details.
6) **Direction**
   Number believed to indicate East or West. "5" = East, "6" = West
7) **Country Code**
   Two different code systems were used to identify countries where the Location Name was located. Full details given in Appendix A. The database performs the code substitution and tracks by country name. Importantly, this is the country where the location was located during the war, not the one where it might be currently located due to shifting post-war political boundaries.
8) **Target ID Code**
   An ID code used to uniquely identify targets.
9) **Day**
   Self-explanatory, values from 1-31
10) **Month**
    Self-explanatory, values from 1-12
11) **Year**
    Single digit provided for the year (i.e. "3" = 1943). Not documented in the decode documents: blank values indicate 1940, and "9" indicates 1939
12) **Industry Code**
    Used to identify the target group the attack was intended against. Full listing provided in Appendix A.
13) **AC Attacking**
    Number of aircraft attacking the target. Inclusion or calculation of this number varied by Numbered Air Force and over time. It may be lower than the dispatched number to account for generation losses, and higher than the number of aircraft dropping bombs.
14) **AC Dispatched**
    Number of aircraft launched to perform a mission
15) **Weather Abort**
    Number of aircraft that turned back without attacking due to weather
16) **Mechanical Abort**
    Number of aircraft that turned back without attacking due to mechanical fault
17) **Miscellaneous Abort**
    Number of aircraft that turned back without attacking due to miscellaneous reasons. Seven categories of miscellaneous reasons are provided in Table C of Appendix A. No further breakout of the distribution of these reasons is available at this time.
18) **Other Abort**

Number of aircraft that turned back without attacking due to other reasons. Again, difficult to pin down what was thrown in the "Other" category that wasn't "Miscellaneous", it appears this category tracked crew issues – airmen getting ill in flight, failure of the oxygen system, etc.

19) **Spares Returning**
Number of spare aircraft launched that did not continue toward the target

20) **AC Dropping Bombs**
Number of aircraft actually dropping bombs on target

21) **Msn Type**
16 different mission categories are listed in the USSBS Statistical Appendix, full listing in Appendix A.

22) **TGT Priority**
5 Different target priorities indicating whether this was a primary target, secondary, target of opportunity, target of last resort, or not indicated.

23) **Organization Type:**
W= Wing; G=Group; S=Squadron; F=Flight; D=Detachment; C=Command (as in Bomber Command). The use of "C" is not documented in the USSBS Statistical Appendix, but is deduced from context of the USSBS Pacific records.

24) **NAF**
When provided, the numbered Air Force responsible for that mission; "R" = RAF. Other numerical codes were used when single digit: 5,6,7,8,9 for 5 AF, 6 AF, 7 AF, 8 AF, and 9 AF. For double digit NAF's , letters were used: J, K, L, M, N, A, B, C, D, E for 11 AF, 12 AF, 13 AF, 14 AF, 15 AF, 20 AF. 10 AF appears to use a blank or null character for the code. Codes B, C, D, E are still in work.

25) **Unit**
When provided, the number designation for the unit (i.e. 96 BS would be "96" with corresponding Org Type above being "S")

26) **Tgt Description**
Identifying detail of the target. The industry code may be "78" indicating "Airfield", but the Target Description field would amplify this by adding "Seaplane Base"

27) **Altitude**
Given in hundreds of feet; i.e. "100" = 10,000 feet

28) **Sighting Method**
One of 13 different methods of finding the target. Full details provided in Appendix A.

29) **# AC lost to AAA**
Self-explanatory

30) **# AC lost to EA**
Self-explanatory

31) **# AC lost to Accident**
Self-explanatory

32) **# AC Lost Total**
Self-explanatory

33) **# AC damaged by AAA**

Self-explanatory

34) **# AC damaged by EA**
Self-explanatory

35) **# AC damaged by Accident**
Self-explanatory

36) **# AC damaged Total**
Self-explanatory

37) **# of HE Bombs**
Self-explanatory. Number of High explosive bombs dropped on the target

38) **Type of HE Bombs**
Specific explosive weight or size of each bomb and nomenclature (250 lb. (GP-M37), 500 lb. (GP-M43 or M64), etc.)

39) **Tons HE**
Self-explanatory

40) **# of Fragmentation Bombs**
Self-explanatory

41) **Type of Fragmentation Bombs**
Specific explosive weight or size of each bomb and nomenclature (260 lb. (FS-M81), 540 lb. (FS-TS or FS-M27), etc.)

42) **Tons Fragmentation**
Self-explanatory

43) **# of Incendiary Bombs**
Self-explanatory

44) **Type of Incendiary Bombs**
Specific explosive weight or size of each bomb and nomenclature (100 lb. (I-M47A1 or I-M47A2), 500 lb. (I-M76), etc.)

45) **Tons Incendiary**
Self-explanatory

46) **Total Tons**
Total Tons of munitions dropped on target

47) **Tons Lost or Jettisoned**
Includes bombs on aircraft shot down before they dropped bombs on target as well as aircraft that had to jettison their bomb load due to an in-flight problem.

48) **Enemy AC Destroyed**
Number of aircraft claimed as destroyed by aircrews. Multiple aircrews in formation pooling their defensive firepower to shoot at the same enemy aircraft would each claim the kill, so the number destroyed is inflated, a condition recognized at the time

The following data fields are still in work:

49) **JTG Country**

50) **JTG Area**

51) **JTG Number**

52) **TC Country**
53) **TC Location**
54) **TC Industry**
55) **TC Sub**
56) **Total KIA/MIA**
57) **Total Wounded**
58) **EAC Kill**
59) **EAC Probable**
60) **EAC Damaged**
61) **EAC Ground Kill**
62) **EAC Ground Probable**
63) **EAC Ground Damage**
64) **Fighters Encountered**
65) **Bombers Encountered**
66) **Machine gun**
67) **Rocket**
68) **Card Count**
69) **Bullets**
70) **Caliber**
71) **Rockets**
72) **Caliber**

Korean War (1950-1953)

Data included

The Korean War data set consists of date from the B-29 mission reports, and data from a punch card archive from start of the conflict through April 1951. The B-29 mission reports were hand-transcribed from the typed, multipage reports compiled after each mission. Where provided, lat/long values were recorded, though often MGRS values were used. Of note, the MGRS grid in use during the Korean War is referenced to the "Japan B" grid, and differs from today's MGRS grid. Luckily, there is a rather involved but straightforward transformation that allows the conversion from the JAPAN B MGRS grid to current latitude and longitude values. Both values are presented in the database.

The punch card database is a record of every sortie taking off under 5 AF control during the reported time period, and includes 22 distinct data elements, such as unit Identification and mission information, to include the amount of ordnance employed. The only data not present in this database is the target location data.

Data not included (still searching for)

Navy and USMC data.

Data Sources

Data Structure

1) **Group Designation**
   Alphanumeric abbreviation of Group; also indicates if sorties are coalition forces; e.g. RHAF (Royal Hellenic Air Force for Greek aircraft, RAAF for Royal Australian AF aircraft, SAAF for South African AF aircraft)
2) **Squadron Designation**
   Alphanumeric abbreviation of Squadron flying the sortie.
3) **Operating Location**
   Alphanumeric code for takeoff location. No decode document has been found to match up with these codes. However, given the Squadron and Group designations, these can be deduced using data provided in unit histories.
4) **Type and Model of aircraft**
   Self-explanatory (Example: B-26)
5) **Sorties Airborne**
   Total number of aircraft launched
6) **Sorties Effective**
   Total number of aircraft conducting the mission
7) **Sorties abortive**
   Self-explanatory

8) **Number of aircraft lost on mission to enemy aircraft**
   Self-explanatory
9) **Number of aircraft lost on mission to enemy ground fire**
   Self-explanatory
10) **Number of aircraft lost on mission to enemy action, causes unknown**
   Self-explanatory
11) **Number of aircraft lost on mission to other causes**
   Self-explanatory
12) **Number of aircraft receiving major damage**
   Self-explanatory
13) **Number of personnel KIA**
   Flash reporting data from units at time of report. Not to be used as authoritative for historical purposes. Personnel may have been mistakenly reported as KIA when they were in fact just WIA or missing. Likewise, personnel reported as MIA and later determined to be KIA were not corrected on subsequent reports.[14]
14) **Number of personnel WIA**
   Flash reporting data from units at time of report. Not to be used as authoritative for historical purposes. Personnel may have been mistakenly reported as KIA when they were in fact just WIA or missing. Likewise, personnel reported as MIA and later determined to be KIA were not corrected on subsequent reports.
15) **Number of personnel MIA**
   Flash reporting data from units at time of report. Not to be used as authoritative for historical purposes. Personnel may have been mistakenly reported as KIA when they were in fact just WIA or missing. Likewise, personnel reported as MIA and later determined to be KIA were not corrected on subsequent reports.
16) **Number of Enemy aircraft destroyed (confirmed)**
   Self-explanatory
17) **Number of Enemy aircraft destroyed (probable)**
   Self-explanatory
18) **Tons of bombs expended**
   Self-explanatory
19) **Number of rockets expended**
   Self-explanatory
20) **Total rounds of ammunition expended (nearest hundred rounds)**
   Self-explanatory
21) **Day**
   Values 1-31
22) **Month**

[14] Letter from HQ Far East Air Forces to USAF Historical Division. ***Subject: Daily Combat Operations Report, RCS: AF-SC-C6A.*** 13 Dec 1950

Values 6-4 (corresponds to June 1950 through April 1951, thus, the month also indicates the year of the activity.)

Vietnam War (1964*-1975)

Data included

Data not included (still searching for)

Data prior to September 30, 1965 are not currently included in the database, as these records predate the CACTA database.

Data Sources

CACTA, SEADAB, and SACCOACT

Data Structure

Still In Work

Appendix A

World War 2 US Strategic Bombing Survey Codes

A. Industry Code Table

Two-digit codes are provided in the USSBS Statistical Appendix[15]. Three digit are codes found in the data itself, indications are that the third digit (1-9) was used to distinguish between similar individual targets in the same target area. Thus, code "78" or "780" indicates Airfield or Aerodrome, and specific Aerodromes are listed with codes 780, 781, and 782 indicating aerodromes or airfields all geographically co-located in the same target area (This explains why oil refineries would have up to 9 targets clustered together, while explosives manufacturing plants, on the whole, rarely have more than 1 co-located target).

01 Unidentified Targets
02 Cities Towns and Urban Areas
03 Public Utilities - Electric Light and Power Companies, Gas Companies, Telephone Companies, Water Companies.
04 Government Buildings
09 Manufacturing Installations (not specifically identified below from Class 11 through 59)
11 Aircraft Factories and Assembly Plants
12 Propeller Plants
13 Engine Plants
14 Airframe Plants
15 A/C Component Plants
16 V-Weapon Factories
20 Armament and Ordnance Plants
21 Tank Factories
22 Vehicle Mfg. Plants
23 Explosives Mfg. Plants
30 Machinery & Equipment Mfg. Plants
31 Abrasives
32 Bearings Mfg. Plants
33 Electrical Products Mfg. Plants
34 Machine Tools Mfg. Plants
35 Optical Products Mfg. Plants
36 Precision Instrument Mfg. Plants
38 Mining, Coal, etc.
39 Iron and Steel Production Facilities, Blast Furnaces, Boiler Shops, Forges, Foundries Steel Works, Rolling-Mills
40 Light Metal Plants
41 Aluminum Production Facilities
42 Magnesium Production Facilities
43 Chemical Plants
44 Radio and Radar Manufacturing Plants
45 R.R. Manufacturing Works and Roundhouses

[15] Specifically, ***Index of Codes***, pp. 158-159, ***Statistical Appendix to the United States Strategic Bombing Survey***. Washington DC. 1946.

46 Rubber and Tire Manufacturing Facilities
47 Natural Rubber Mfg.
48 Synthetic Rubber Mfg.
50 Oil Refineries
51 Natural Oil Refineries
52 Synthetic Oil Refineries
53 Oil Storage Facilities and other Oil Installations
60 Transportation Facilities (not specifically identified below)
61 Bridges
62 Tunnels
63 RR Installations, Tracks, Marshalling Yards, and Stations
64 Moving Trains & Rolling Stock
65 Highways a t Vehicles
66 Waterways and Boats
70 Naval Installations
71 Ports and Harbors
72 Submarine Pens and Yards
73 Ships
74 Tugs, Barges, and Sampans
75 Ship building
78 Air Fields and Airdromes
80 Tactical Targets: (Unidentified or not listed below)
81 Troop Concentrations
82 Gun Emplacements
83 Supply Dumps and Warehouses
84 Radio & Radar Installations
85 V - Weapon Launching Sites
86 Direct Cooperation with Ground Forces

B. Country Code Table

1 Albania
2 Austria
3 Belgium
4 Bulgaria
5 Czechoslovakia
6 Denmark
7 France
8 Germany
9 Great Britain
10 Greece
11 Holland or Netherlands
12 Hungary
13 Italy and Sicily
14 Yugoslavia
15 Luxembourg
16 Norway
17 Poland

18 Rumania
19 Russia
20 Spain
21 Sweden
22 Switzerland
23 Turkey
24 Abyssinia
25 Algeria
26 Egypt
27 Eritrea
28 French West Africa
29 Libya
30 Morocco
31 Nigeria
32 Tunisia
33 Italy
22 Corsica
34 Crete
35 Cyprus
36 Malta
37 Pantellerina
38 Sardinia
39 Sicily
40 Italy
41 Italy
42 France
43 France
44 France
45 France
46 Germany / Poland?
47 Germany / Bulgaria?
48 Germany
49 Germany
50 Italy
51 Italy
52 Unidentified Target
53 France
54 France
55
56 Germany
57 Germany
58 Germany
59
60 Italy
61 Italy
62
63
64 Japan

65
67 Germany
68 Germany
69
70 Italy
71 Italy

99 Unknown or Not Indicated

C. Non-effective Aircraft – Miscellaneous Reasons

1 Intercepted
2 Antiaircraft
3 Fuel Shortage
4 Navigational error
5 Target reached but obscured
6 Destroyed or missing before reaching target
7 Personnel failure

D. Sighting Method

1 Visual
2 Instrument, general
3 P.F.F.
4 H2X
5 GEE
6 M. H. or Micro HH.
8 SHORAN
9 Not indicated
R AZON or RAZON
D Dive Bombing
S Skip Bombing
G Glide Bombing
L Low Altitude Bombing

E. Target Priority

1 Primary Target
2 Secondary Target
3 Target of Opportunity
4 Target of Last Resort
9 Not indicated

F. Mission Type

1 Objective Bombing
2 Patrol

3 Escort or Cover
4 Interception or Intruder
5 Strafing
6 Reconnaissance or Search
7 Diversionary
9 Fighter Sweep
10 Bombing and Strafing (Combined)
11 Transport, non-combat
12 Sea Search or attack or patrol (Over water only)
13 Leaflet Dropping
14 Transport, combat
16, Staging
99 Other or not indicated

G. Visibility

G .1 or 1/10 to .3 or 3/10 or **Good**
C .4 or 4/10 to .7 or 7/10 or intervening **Clouds**
P .8 or 8/10 to 1.0 or 10/10 or **Poor** or undercast
9 Not indicated

H. Caliber of Cannon or Rocket Ammunition

2 20mm
3 37mm
7 75mm
40 4 ½ - inch rocket (M-8)
50 5 – inch rocket (AR & HVAR)

I. Caliber of Machine Gun Ammunition

3 .30 or .303
5 .50

J. Size of High Explosive Bombs

Code	Weight	Designation
1	100 pounds GP or RDX or HE	GP-M30
2	250 pounds GP or RDX or HE	GP-M57
2	300 pounds GP or RDX or HE	GP-31
3	500 pounds GP or RDX or HE	GP-M43 or GP-M64
3	600 pounds GP or RDX or HE	GP-M32
4	1,000 pounds GP or RDX or HE	GP-M44 or GP-M65
4	1,100 pounds GP or RDX or HE	GP-M33
5	2,000 pounds GP or RDX or HE	GP-M34 or GP-M66
6	4,000 pounds GP or RDX or HE	GP-M56

7	500 pounds Semi-armor piercing	SA-M58
8	1,000 pounds Semi-armor piercing	SA-M59
9	1,000 pounds Armor piercing	AP-Mk 33
10	1,600 pounds Armor piercing	AP-Mk 1
11	325 pounds Depth Bombs or Charges	DB-Mk 17
11	350 pounds Depth Bombs or Charges	DB-Mk 47
12	1,000 pounds Mines	M-Mk 26, 13, 19
13	1,660 pounds Mines	M-Mk 17
14	2,000 pounds Mines	M-Mk 12
15	Flares Pyrotechnics	Py-M26
15	Photo Flash (PF) Pyrotechnics	Py-M46 OR Py-M23A1
15	Parachute Flares Pyrotechnics	Py-M9A1
16	Torpedoes Miscellaneous	
C	Chaff Miscellaneous	
21	8,000 pounds Additional RAF Code	
22	12,000 pounds Additional RAF Code	Tallboy
23	22,000 pounds Additional RAF Code	Grand Slam "Earthquake Bomb"

K. Size of Incendiary Bombs

Code	Weight	Designation
1	2 pounds (Individual)	I-M52
2	4 pounds (Individual)	I-M50A2
3	6 pounds (Individual)	I-M69
4	10 pounds (Individual)	I-M74
5	100 pounds (Individual)	I-M47A1 or I-M47A2
6	500 pounds (Individual)	I-M76
7	84 pounds or 100 pounds or (14x6 pounds) Clusters	I-M12
8	228 pounds or (38x6 pounds) Clusters	I-M18
9	360 pounds or (60x6 pounds) Clusters	I-M13
10	136 pounds or 100 pounds or (34x4 pounds) Clusters	I-M6
11	440 pounds or (110x4 pounds) Clusters	I-M17
12	500 pounds or 512 pounds or (128x4 pounds) Clusters	I-M7
13	100 pounds WP (White Phosphorous)	WP-M47A2
14	332 pounds (USSBS Japan codes)	
15	400 pounds (USSBS Japan codes)	
16	501 pounds or 545 pounds (USSBS Japan codes)	
18	334 pounds (USSBS Japan codes)	
21	300 pounds Auxiliary fuel tank used as fire bombs	50 gallons
22	500 pounds Auxiliary fuel tank used as fire bombs	75 gallons
23	660 pounds Auxiliary fuel tank used as fire bombs	110 gallons
24	1,000 pounds Auxiliary fuel tank used as fire bombs	150 or 165 gallons
25	2,000 pounds Auxiliary fuel tank used as fire bombs	300 gallons
30	111 pounds (USSBS Japan codes)	
31	30 pounds Additional RAF Code	

32	250 pounds Additional RAF Code	
33	1,000 pounds Additional RAF Code	
34	2,000 pounds Additional RAF Code	
35	4,000 pounds Additional RAF Code	
36	25 pounds Additional RAF Code	
37	50 pounds Additional RAF Code	

L. Size of Fragmentation Bombs

Code	Weight	Designation
1	4 pounds Individual Bombs	BF-M83
2	20 pounds Individual Bombs	FS-M41
3	23 pounds Individual Bombs	FP-M40 or FP-M72
4	90 pounds Individual Bombs	FS-M82
5	260 pounds Individual Bombs	FS-M81
6	69 pounds or 100 pounds (3x23 pounds) Clusters (regular)	FP-M4
7	100 pounds or 120 pounds (6x20 pounds) Clusters (regular)	FS-M1A1
8	400 pounds or (20x20 pounds) Clusters (regular)	FS-T4E4 or FS-M26
9	540 pounds or (6x90 pounds) Clusters (regular)	FS-T8 or FS-M27
10	96 pounds or (24x4 pounds) Clusters (butterfly)	BF-T10 or BF-M28
11	360 pounds or (90x4 pounds) Clusters (butterfly)	BF-T11 or BT-M29
41	40 pounds Additional RAF Code	

M. Numbered Air Force Codes

Code	Air Force
1	1st Tactical Air Force
5	5th Air Force
6	6th Air Force (Caribbean Air Command/ Panama Canal Zone)
7	7th Air Force
8	8th Air Force
9	9th Air Force
	10th Air Force
J	11th Air Force
K	12th Air Force
L	13th Air Force
M	14th Air Force
N	15th Air Force
R	Royal Air Force
A	20th Air Force
B	**Antilles Air Command (?) 11/42-9/44 A20, P39,B17, B24, B25**
C	**Bermuda Base Command (?) 1/43-10/43 B25**
D	**1/43-11/44 P38, P39, P40, P47**
E	**AAF Anti-Submarine Command (?) 12/42-2/43 A20, B17**

Appendix B

Consolidated THOR data field listing – ACTIVELY IN WORK

Column #	Field	Format
1	**Date**	MMDDYYYY Display as MM/DD/YYYY
2	**Conflict**	WW1, WW2, Korean War, Vietnam War
3	**Theater**	Western Front, Italian Front, MTO, ETO, PTO, CBI, Korea, SEA
4	**Country**	Country flying mission (USA, UK, France, Italy)
5	**Service**	Abbreviation (USAF/USMC/RAF) of Service flying mission
6	**Numbered AF**	If applicable
7	**Group**	If Known
8	**Unit**	If Known
9	**Callsign**	Name+number
10	**Aircraft MDS**	Type/number, no hyphen, model as available: F15, F15E, B24
11	**Mission #**	Assigned mission
12	**Mission Type**	Function of mission: Strike, Armed Recce, CAS, etc.
13	**Service Supported**	SAC, USMC, etc.
14	**Operation Supported**	Operation name
15	**TO Location**	Launch base or ship
16	**TO Lat**	Launch Latitude
17	**TO Long**	Launch Longitude
18	**Flying Hours/Duration**	in hours & tenths of hours
19	**# Dispatched**	Total AC launching in support of mission
20	**# Attacking**	Total AC reaching Tgt; may be same as # Dropping bombs
21	**# Dropping Bombs**	Total AC Dropping Bombs
22	**TGT Priority**	Primary, Secondary, Target of Opportunity, Target of Last Resort, NA
23	**Tgt Location**	Location Name
24	**TGT Province**	Political region
25	**Tgt Country**	Target Country
26	**Tgt Description**	Text description of target
27	**Tgt ID Code/ Number, etc.**	Target #, BE Entry, etc.
28	**TGT Industry/ID Code**	Target system Classification
29	**Tgt Lat**	Target Latitude
30	**Tgt Long**	Target Longitude
31	**# Weapons**	# of weapons
32	**Weapon Type**	Nomenclature/Description: M64 500 lb. HE
33	**# Weapons Jettisoned/Lost**	# of weapons
34	**Weight of Weapons jettisoned/Lost**	Total pounds
35	**# Weapons Delivered**	# of weapons
36	**Total Weapon employed wt**	Total pounds on tgt
37	**Delivery Tactic**	Level, Dive bomb, loft, etc.

38	**Sighting/Nav Method**	Visual, H2X, Radar, Skyspot, SHORAN, etc.
39	**Target Control**	JTAC, FAC, CAS Type 1,2,or 3
40	**Speed**	in mph (True Airspeed?)
41	**Release Altitude**	in feet (MSL?)
42	**Period of Day**	Day(D) or Night(N) at TGT location
43	**TOT Start**	HH:MM 24 hour Time (Time at target)
44	**TOT End**	HH:MM 24 hour Time (Time at target)
45	**Weapon impact**	Text Description
46	**BDA/Results**	Text Description
47	**Comments**	Text Description
48	**Sortie Dupe**	Multitarget/multiweapon flag
49	**Visibility**	
50	**Target Weather**	
51	**Cloud Cover**	
52	**Cloud Base**	
53	***A/C Status***	Lost, Damaged, Divert, Abort
54	***# Lost***	Total Lost/destroyed AC
55	***Lost AC Serial Number***	YYNNNN
56	***Lost Reason: AAA/Ground Fire***	
57	***Lost Reason: Enemy Aircraft***	
58	***Lost Reason: Missile***	
59	***Lost Reason: Accident***	
60	***Lost Reason: Ops Non-Hostile***	
61	***Lost Reason: Malfunction***	
62	***Lost Reason: Unknown***	
63	***Lost Lat***	Latitude last seen
64	***Lost Long***	Longitude last seen
65	***Crew Status: Recovered***	# of Crewmembers
66	***Crew Status: Killed***	# of Crewmembers
67	***Crew Status: Missing***	# of Crewmembers
68	***Crew Status: Captured***	# of Crewmembers
69	***# Damaged***	Total Damaged AC
70	***Damaged Reason: AAA/Ground Fire***	
71	***Damaged Reason: Enemy Aircraft***	
72	***Damaged Reason: Missile***	
73	***Damaged Reason: Accident***	
74	***Damaged Reason: Ops Non-Hostile***	
75	***Damaged Reason: Malfunction***	
76	***Damaged Reason: Unknown***	
77	***#Divert***	
78	***Divert Reason: Intercepted***	

79	***Divert Reason: Antiaircraft***	
80	***Divert Reason: Fuel Shortage***	
81	***Divert Reason: Navigation Error***	
82	***Divert Reason: Weather***	
83	***Divert Reason: Personnel Failure***	
84	***Divert Reason: Malfunction***	
85	***# Aborts***	Total non-effective AC
86	***Abort Reason: Intercepted***	
87	***Abort Reason: Antiaircraft***	
88	***Abort Reason: Fuel Shortage***	
89	***Abort Reason: Navigation Error***	
90	***Abort Reason: Weather***	
91	***Abort Reason: Personnel Failure***	
92	***Abort Reason: Malfunction***	
93	**Raw Data Line**	Original data line as applicable
94	***Wind direction (Degrees)***	
95	***Wind Speed (Knots)***	
96	***Temperature at altitude (Degrees Celsius)***	
97	***Relative Humidity at altitude (%)***	
98	***Temperature Dew Point Depression (T-Td) at Altitude (Degrees C)***	
99	***Low Cloud Cover (%)***	
100	***Mid Cloud Cover (%)***	
101	***High Cloud Cover (%)***	
102	***K-Index Thunderstorm Potential Indicator***	
103	***TT-Index Severe Thunderstorm Potential Indicator***	
104	***Icing Potential at Altitude***	
105	***Moon Illumination (%)***	
106	***Wind Direction 10 meters above ground (Degrees)***	
107	***Wind Speed 10 meters above ground (Knots)***	
108	***Surface Temperature (Deg C)***	
109	***Precipitation past 3 hours (inches)***	
110	***Percent of ground covered with snow (%)***	
111	*Weather Reanalysis valid time*	TOT

112	*Altitude (ft.)*	See **Release Altitude** (Column 39)

Bibliography

Selected Finding Aids for Records used in creation of the THOR Database

World War 1

Call#	Title	Author
168.7239-32	**Operations of Air Service, First Army from August 10 to Nov 11, 1918**	Office First Army Air Service Commander, AEF (Mitchell, Wm, Colonel)
168.7239-32	**AMERICAN AIR SERVICE GREW FROM THREE SQUADRONS AT ENTRY INTO WORLD WAR I TO 28 BY 11 NOV 18. UNITS OF AMERICAN AIR SERVICE PARTICIPATED IN BOTH SAINT MIHIEL AND MEUSE ARGONNE OPERATIONS. INCLUDES AIR SERVICE ORGANIZATION, TRANSLATION OF CAPTURED GERMAN DOCUMENT ON NIGHT RANGING BY AEROPLANE, AND OPERATION REPORTS.**	Office First Army Air Service Commander, AEF (Mitchell, Wm, Colonel)
168.7239-26	**History of 20th Aero Squadron, 1st Army**	Gorrel's History of the American Expeditionary Forces Air Service 1917-1919, Series N, Vol 16
168.7239-26	**History of 11th Aero Squadron, 1st Army**	Gorrel's History of the American Expeditionary Forces Air Service 1917-1919, Series N, Vol 16
168.7239-26	**History of 96th Aero Squadron, 1st Army**	Gorrel's History of the American Expeditionary Forces Air Service 1917-1919, Series N, Vol 16
168.7239-26	**History of 166th Aero Squadron, 1st Army**	Gorrel's History of the American Expeditionary Forces Air Service 1917-1919, Series N, Vol 16
168.7239-24	**1st Day Bombardment Group History, Orders, Reports**	*No author given, reference individual documents*

167.41-8	**1st Day Bombardment Group History, Orders, Reports**	*No author given, reference individual documents*
167.4131-5	**The AEF Day Bombers**	Edwin Boyd Fitzpatrick, West Point, NY
168.7239-17	**History of the First Pursuit Wing: The St Mihiel Operation**	*No author given, reference individual documents*
K239.0512-1011 C.1	**Oral History interview of George C. Kenney.**	B Gen George W. Goddard, 6 May 1966.
167.601-2	**Bombardment Material World War 1**	1st Army Air Corps - Col. Frank P. Lahm
167.601-2	**MAP: St Mihiel**	General Pershing, USA
167.601-2	**MAP: Argonne Meuse - Metz**	1st Army Air Corps
167.601-2	**Aerial Photographs WW1**	1st Army Air Corps
248.501-64	**Italian Bombardment Activities during 1915-1918, during the World War at the Italo-Austrian front**	M.I.D. Italy
248.501-64	**List of bombing operations carried out by Italian Airships during the World War, 1914-1918.**	US War Dept.
Book	***The US Air Service in World War 1 Volume III the Battle of St Mihiel***	Maurer Maurer, 1979
Book	***The World War 1 Diary of Col. Frank P. Lahm, Air Service, A.E. F.***	Historical Research Division, Aerospace Studies Institute, Air University, Dec 1970.
Book	***Biplanes and Bombsights: British Bombing in World War 1***	George K. Williams, AU Press, May 1999.
Book	***Hostile Skies: A Combat History of the American Air Service in World War 1***	James J. Hudson, Syracuse University Press, © 1968.
Book	***French Strategic and Tactical Bombardment Forces of World War 1***	Rene Martel, Translated by Allen Suddaby, edited by Steven Suddaby, © 2007.
Book	***Skyfighters of France***	Henry Farre, © 2009 Oakpast Ltd.

Book ***The West Point Atlas of War: World War 1*** USMA © 1995

World War II

IRIS # or Call #	Dates	Title	Author
113002		B-17	
113003		B-24	
113004		B-25	
113005		B-26	
113006		A-20	
113007		A-26	
113008		A-36	
113176		UNIDENTIFIED TARGETS	
113177		UNIDENTIFIED TARGETS	
113178		UNIDENTIFIED TARGETS Lt Med Bombers)	
113180		CITIES, TOWNS AND URBAN AREAS	
113181		CITIES, TOWNS AND URBAN AREAS	
113182		CITIES, TOWNS AND URBAN AREAS	
113183		CITIES, TOWNS AND URBAN AREAS	
113184		PUBLIC UTILITIES	
113185		PUBLIC UTILITIES	
113186		TARGETS INCLUDE LIGHT METALS PLANTS, ALUMINUM PRODUCTION FACILITIES, MAGNESIUM PRODUCTION FACILITIES, CHEMICAL PLANTS, RADIO AND RADAR MANUFACTURING PLANTS, RAILROAD MANUFACTURING WORKS AND ROUNDHOUSES, RUBBER AND TIRE MANUFACTURING FACILITIES, NATURAL RUBBER MANUFACTURING, AND SYNTHETIC RUBBER MANUFACTURING.	
113187		INDUSTRIAL AREA AND MANUFACTURING	

113188	INDUSTRIAL AREA AND MANUFACTURING
113189	AIRCRAFT INDUSTRIES
113190	AIRCRAFT INDUSTRIES
113191	ARMAMENT AND ORDNANCE PLANTS, TANK FACTORIES, VEHICLE MANUFACTURING, EXPLOSIVES MANUFACTURING PLANTS
113192	ARMAMENT AND ORDNANCE PLANTS, TANK FACTORIES, VEHICLE MANUFACTURING, EXPLOSIVES MANUFACTURING PLANTS
113193	TARGETS INCLUDE MACHINERY AND EQUIPMENT MANUFACTURING PLANTS; ABRASIVES; BEARINGS MANUFACTURING PLANTS; ELECTRICAL PRODUCTS MANUFACTURING PLANTS; MACHINE TOOLS MANUFACTURING PLANTS; OPTICAL PRODUCTS MANUFACTURING PLANTS; PRECISION INSTRUMENTS MANUFACTURING PLANTS; AND IRON AND STEEL PRODUCTION FACILITIES: BLAST FURNACES, BOILER SHOPS, FORGES, FOUNDRIES, STEEL WORKS, AND ROLLING MILLS.
113195	TARGETS INCLUDE LIGHT METALS PLANTS, ALUMINUM PRODUCTION FACILITIES, MAGNESIUM PRODUCTION FACILITIES, CHEMICAL PLANTS, RADIO AND RADAR MANUFACTURING PLANTS, RAILROAD MANUFACTURING WORKS AND ROUNDHOUSES, RUBBER AND TIRE MANUFACTURING FACILITIES, NATURAL RUBBER MANUFACTURING, AND SYNTHETIC RUBBER MANUFACTURING.
113196	TARGETS INCLUDE OIL REFINERIES, NATURAL OIL REFINERIES, SYNTHETIC OIL REFINERIES, OIL STORAGE FACILITIES, AND OTHER INSTALLATIONS.
113198	TARGETS INCLUDE OIL REFINERIES, NATURAL OIL REFINERIES, SYNTHETIC OIL REFINERIES, OIL STORAGE FACILITIES, AND OTHER OIL INSTALLATIONS.
113199	TARGETS INCLUDE COMM FACILITIES, BRIDGES, TUNNELS,RAIL INSTALLATIONS, MOVING TRAINS, HIGHWAYS AND VEHICLES,WATERWAYS AND BOATS

113200	TARGETS INCLUDE COMM FACILITIES, BRIDGES, TUNNELS,RAIL INSTALLATIONS, MOVING TRAINS, HIGHWAYS AND VEHICLES,WATERWAYS AND BOATS
113201	TARGETS INCLUDE NAVAL INSTALATIONS, PORTS, SUB PENS, SHIPS, TUGS, SHIPYARDS
113202	TARGETS INCLUDE NAVAL INSTALATIONS, PORTS, SUB PENS, SHIPS, TUGS, SHIPYARDS
113203	TARGETS INCLUDE NAVAL INSTALATIONS, PORTS, SUB PENS, SHIPS, TUGS, SHIPYARDS
113204	AIRFIELDS
113205	AIRFIELDS
113206	TARGETS INCLUDE TACTICAL TARGETS, TROOP CONCENTRATIONS, GUN EMPLACEMENTS, SUPPLY DUMPS, RADIO, V-WEAPON LAUNCHING SITES, DIRECT COOPERATION WITH GROUND FORCES
113207	TARGETS INCLUDE TACTICAL TARGETS, TROOP CONCENTRATIONS, GUN EMPLACEMENTS, SUPPLY DUMPS, RADIO, V-WEAPON LAUNCHING SITES, DIRECT COOPERATION WITH GROUND FORCES
113208	TARGETS INCLUDE TACTICAL TARGETS, TROOP CONCENTRATIONS, GUN EMPLACEMENTS, SUPPLY DUMPS, RADIO, V-WEAPON LAUNCHING SITES, DIRECT COOPERATION WITH GROUND FORCES
113209	TARGETS INCLUDE TACTICAL TARGETS, TROOP CONCENTRATIONS, GUN EMPLACEMENTS, SUPPLY DUMPS, RADIO, V-WEAPON LAUNCHING SITES, DIRECT COOPERATION WITH GROUND FORCES
113210	AIRFIELDS
113179	RAF UNIDENTIFIED TARGETS
113194	RAF TARGETS INCLUDE MACHINERY AND EQUIPMENT MANUFACTURING PLANTS; ABRASIVES; BEARINGS MANUFACTURING PLANTS; ELECTRICAL PRODUCTS MANUFACTURING PLANTS; MACHINE TOOLS MANUFACTURING PLANTS; OPTICAL PRODUCTS

	MANUFACTURING PLANTS; PRECISION INSTRUMENTS MANUFACTURING PLANTS; AND IRON AND STEEL PRODUCTION FACILITIES: BLAST FURNACES, BOILER SHOPS, FORGES, FOUNDRIES, STEEL WORKS, AND ROLLING MILLS.
113197	**RAF TARGETS INCLUDE LIGHT METALS PLANTS, ALUMINUM PRODUCTION FACILITIES, MAGNESIUM PRODUCTION FACILITIES, CHEMICAL PLANTS, RADIO AND RADAR MANUFACTURING PLANTS, RAILROAD MANUFACTURING WORKS AND ROUNDHOUSES, RUBBER AND TIRE MANUFACTURING FACILITIES, NATURAL RUBBER MANUFACTURING, AND SYNTHETIC RUBBER MANUFACTURING.**
113211	**RAF TGT CODES 1-11? Looks like A-20, A-26, B-25, B-26 sorties**
113212	**RAF TGT CODE 2 CITIES AND TOWNS**
113213	**RAF TGT CODE 3 PUBLIC UTILITES**
113214	**RAF TGT CODES 4 AND 9**
113215	**RAF TGT CODES 11-16 - "*2" cards since Total Tons was too much in "*1" cards**
113216	**RAF TGT CODES 20-23 - "*2" cards since Total Tons was too much in "*1" cards**
113217	**RAF TGT CODES 50-53**
113218	**RAF TGT CODES 60-66**
113219	**RAF TGT CODES 70-75**
113220	**RAF TGT CODE 78 AIRFIELDS**
113221	**RAF TGT CODES 80-86**
113895	**TABULATING SERVICE SECTION REPORT AIR ATTACKS IN THE PACIFIC, 5 AIR FORCE**
113896	**TABULATING SERVICE SECTION REPORT AIR ATTACKS IN THE PACIFIC, 5 AIR FORCE**

113898	TABULATING SERVICE SECTION REPORT AIR ATTACKS IN THE PACIFIC
113899	TABULATING SERVICE SECTION REPORT AIR ATTACKS IN THE PACIFIC, 7 AIR FORCE
113901	TABULATING SERVICE SECTION REPORT AIR ATTACKS IN THE PACIFIC, 10 AIR FORCE REPORT NO. 1
113904	AIR ATTACKS IN PACIFIC, 11 AIR FORCE
113906	AIR ATTACKS IN PACIFIC, 13 AIR FORCE
113908	AIR ATTACK IN THE PACIFIC
113910	AIR ATTACK IN THE PACIFIC
113632	CONTAINS SUMMARY REPORT BY DATE OF ATTACK OF BOMBING DIRECTED AGAINST EUROPEAN AND NORTH AFRICAN TRANSPORTATION TARGETS BY 12 AIR FORCE FROM FIRST ATTACK TO V-E DAY.
113643	CONCERNS EUROPEAN TARGETS ONLY. CONTAINS NO NARRATIVE.
113644	CONCERNS EUROPEAN TARGETS ONLY. CONTAINS NO NARRATIVE.
113645	CONCERNS EUROPEAN TARGETS ONLY. CONTAINS NO NARRATIVE.
113646	CONCERNS EUROPEAN TARGETS ONLY. CONTAINS NO NARRATIVE.
113647	CONCERNS EUROPEAN TARGETS ONLY. CONTAINS NO NARRATIVE.
113648	CONCERNS EUROPEAN TARGETS ONLY. CONTAINS NO NARRATIVE.
113649	CONCERNS EUROPEAN TARGETS ONLY. CONTAINS NO NARRATIVE.
113650	CONCERNS EUROPEAN TARGETS ONLY. CONTAINS NO NARRATIVE.

113651		**CONCERNS EUROPEAN TARGETS ONLY. CONTAINS NO NARRATIVE.**
113652		**CONCERNS EUROPEAN TARGETS ONLY. CONTAINS NO NARRATIVE.**
113655		**AIR ATTACKS IN EUROPE, 15 AIR FORCE**
113662		**TARGET BOMBING IN EUROPE, ROYAL AIR FORCE**
113673		**CONTAINS TARGET DATA; MISSION LOSS AND TARGET MASTER CARD LISTING.**
113672		**CONTAINS TARGET DATA; MISSION LOSS AND TARGET MASTER CARD LISTING.**
113653		**TARGET BOMBING IN EUROPE, 9 AIR FORCE**
113654		**AIR ATTACKS IN EUROPE, 12 AIR FORCE**
113660		**CONTAINS MISSION and MISSION LOSS STATISTICS.**
113661		**CONTAINS MISSION and MISSION LOSS STATISTICS.**
113674		**CONTAINS MISSION and MISSION LOSS STATISTICS.**
113664		**CONTROL BOOK, 8, 9, 12, 15 ARMY AIR FORCES, 1 TACTICAL AIR FORCE, AND ROYAL AIR FORCE**
113894		**Msn Loss, Tgt Card, Msn Card data summarized by Numbered AF (5, 7, 10,11,13,14,20) Month and AC MDS**
113888		**Navy Summary by country and industry by month**
1140075		**Summarized by city and target area by NAF and Navy - # of Planes, Tones of HE or Other bombs**
113868		**Japan Target Book - Provides Lat/Long clarity to above book**
113893		**Incendiary Attacks on Japan Cities - AAF and Navy attacks summarized by day**
480.302 A-3	Aug 40-Jun 44	**A-3 History of 11 AF**

480.302	15 Mar - 31 May 1943	**Air Operations in the Alaskan Theater SC-SP-14 Auth J.O.W. 3 Aug 1943 Statistical Control Division Office of Management Control**	
480.245	9/1/1942-5/1943	**11 AAF Combat Activities Mission Reports**	
480.308	1942-1945	**11 AF Narrative Summaries of Operations**	To be Read
863.305	12/2/41-2/24/42	**First American Volunteer Group Diary, CBI 1941-1942 (Dr Lee Bowen's Material)**	
862.3081-2	8/1/1942	**DAILY WORKSHEETS ON OPERATIONS**	STATISTICAL CONTROL UNITS.
862.3081-2	9/1/1942	**DAILY WORKSHEETS ON OPERATIONS**	STATISTICAL CONTROL UNITS.
862.3081-2	10/1/1942	**DAILY WORKSHEETS ON OPERATIONS**	STATISTICAL CONTROL UNITS.
862.3081-2	11/1/1942	**DAILY WORKSHEETS ON OPERATIONS**	STATISTICAL CONTROL UNITS.
830.305-1	6/1/1942-6/1/1943	**10 AF Operational Diary**	
830.306-1	Apr-Sep 42	**10 AF G-2 Files**	
700.61	4/1/1944	**Gazeteer to maps of Burma**	Army/Corps of Engineers
827.308-1	11/1/1942 -9/1/1943	**India Air Task Force Statistical Charts**	
830.3061-3	7/1942-4/28/1943	**Missions from Dinjan**	
830.306-1	10/29/42-4/27/43	**Missions in India - 10 AF B-24/B-25**	
830.306	2/12/1942 -1/1/1943	**Operations of the 10 United States Air Force**	

740.306-525C	Jun-42	**7th AF and the Battle of Midway**	
742.308		**Summary of Enemy and US Aircraft Losses Through the Action of VII Bomber Command**	
740.306-1	7-Jun-42	**Combat Operations, Midway Area, 3-4 June 1942**	431 BS(H)
		VII Bomber Command Raid on Wake Island	
742.3083		**7 Bomber Command Monthly Combat Data**	
742.308		**Missions against Wake and Gilbert Islands**	
742.01 V.9	5/31-7/44	**Reports of missions flown against Islands in Central Pacific by units of 7 Bomber Command**	
742.01 V.4	5/31-7/44	**Liaison Journal on Battle of Midway, Report on Command Participation in Gilbert Islands Offensive**	
GP-376-SU-OP(BOMB)	Dec 1942-Aug 1943	**Mission Summaries of 376 Bomb Group, 1st Provisional Group, HALPRO, and 98 Bomb Group**	
533.1621	10/1/1942 - 12/1/1942	**9 AF Incoming and Outgoing Messages**	
138.5-13 V.7	12/1/1944	**Successes and Failures of Operations: Operation Corkscrew, Capture of Island of Pantelleria**	
612.430E-1	5/1/1943-6/1/1943	**Operation Corkscrew**	Northwest African Air Forces
612.430E-1	5/1/1943-6/1/1943	**Chart on Bombing of Pantelleria**	Northwest African Air Forces
622.430-9	6/1/1943-2/1/1944	**Operation Pantelleria**	Northwest African Air Forces
101-52	5/8/1943-6/14/1943	**Reduction of Pantelleria and Adjacent Islands**	AAF Historical Study #52
		12 BG History - includes Daily Tgt List	

Gazetteer of Italy

RAF in Desert 1941-1942

RAF in Desert May-Jun 1942

RAF Air Support Handbook

NZ in Egypt

9 AF Lessons Learned in El Alamein

Italian Tgts 1943

Operation Avalanche

Op Avalanche 2

Op Avalanche prep

Foggia MY Attack

Op Avalanche 3

Op Husky

Appendix B Op Husky

12 AF Merchant Shipping

AFD-090522-041

AFD-090522-051

AFD-090602-067

9 AF in Western Desert

Africa, Atlantic and Indian Ocean Islands

Air Phase of N African invasion

Cyrenaica - Landing Ground List

French Equatorial Africa - Landing Ground List

History Air Attack Review UK

		History 12 BG	
		Middle East Command - Landing Field Location	
		Middle East Command - Landing grounds Location	
		Mission Report - 15 AF Fiume	
		Mission Report - 15 AF Vienna	
		Mission Report No. 208	
		Mission Reports - 14 AF (2)	
		Mission Reports - 15 AF Linz	
		Mission Report - MTO	
		Mission Report - UK Analysis of MTO Bombing	Zuckerman
		Narrative Mission Reports 15 AF	
		Narrative Reports 15 AF	
		Newspaper - British account of N. Africa	
		Ploesti Mission Report	
		Preliminary Study of Coordinated Attacks 12 AF 1944	
		Preliminary Study of Coordinated Attacks - Big Week	
		The Ploesti Mission of 1 Aug 1943 Study # 103	
		Tripolitania - Libya Landing Ground List	
		War Diary - U-Boats	
		War Diary - U-Boats Pt 2	
		Weekly intelligence Summary No. 166	
520.3083-2	8/1/1942-6/1/1943	**Summary, Heavy Bomber Operations**	8 AF
520.384-1	8/17/1942	**Target Summary**	8 AF
523.303A	8/17/1942 - 1/13/1943	**Statistical Analysis of Operations**	8 AF

		Area Bombing on Berlin, Bochum, Liepzic, Hagen, Dortmund, Oberhausen, Schweinfurt, and Bremen	USSBS
		WW II POW Camp Locations	
		CBO Plan	
		8 AF Battle Damage Section History	
		8 AF Statistical Summary	
		8 AF Form 34	
		8 AF Form 34	
		8 AF Form 34	
		8 AF Form 34	
		8 AF Form 34	
		History - Incendiary Bombing	
		Information GAF - Tgts in Germany by UK	
		Operations - Air Ministry Tgts in Germany	
		Operations	
		Target and Bombing Data	
	19440301-19441101	**Types of Aircraft used by Certain Fighter Groups Fighter Command**	
		Eaker I C 0627v0	
		Effectiveness of Bombing at D-Day	
		Overlord D+30	
		Cobra Breakout 9 Bom Com	
830.8613-1	**5/1/1942-6/1/1952**	**10 AF Report on B-25 Aircraft from members of Doolittle Mission**	
		Doolittle Oral History	

		Doolittle Project Vol 3 Part 3	
		Intelligence Report on Doolittle Raid Vol 2	
		Messages relating to Doolittle raid Vol 3 Part 2	
		Summary of Targets Japanese Raid Vol 1 Doolittle	
		Tokyo Raid - Photographs Vol 3 Part 1	
519.1259-1	Feb 1944-Oct 1944	**Correspondence on variability in Statistical data from the field**	
519.1259-3	Sep 1942-Feb 1944	**Correspondence on variability in Statistical data from the field**	
650.30811		**Operations and Statistics of Twelfth Air Force**	HQ 12 AF
520.308A	17 Aug 42 - 8 May 45	**Statistical Summary of Eighth Air Force Operations: European Theater 17 Aug 1942 - 8 May 1945**	HQ 8 AF
134.11-11	Dec 1942-Sep 1942	**Synopsis of US Army Aircraft Horizontal Bombing Attacks on Enemy Ships**	
		2331 Ordnance Ballistics Data Vol 1	
		2365 - Ordnance Ballistic Data Vol III	
		Great Britain Gazetteer	
		Monthly Stats 1944-1945	
		USSBS Startup and Codes	
		Spaatz Correspondence	
		Spaatz Med Allied Air Force Conf Papers	
		Incoming Messages Strat Forces in Europe	
		AAFEB Correspondence	
		Documents on Ball Bearing Raids	
		Albert Speer Interviews	

		USSBS Ball Bearing Report	
		WW2 Statistical Digest	
		Correspondence - USSBS in Russia	
		Incoming Messages - NOBALL / CROSSBOW	
		Monthly Airfield Return - RAF Landing Fields	
		Order of Aerodromes - RAAF	
		review of Statistical Services	
		Statistical Control in the AAF Studies No. 57	
		Table of 332 FG Mission for 15 AF 1944-1945	
		Target Berlin 1944-1945	
		Tuskegee Airmen Escorted Bombers lost to Enemy Aircraft	
	17-Jun-46	**Naval Aviation Combat Statistics**	OPNAV -P-23V No. A129 ONI
750.3811-1	1/1/1942-1/1/1945	**Statistical Data on Missions**	
750.375-2	Jul 42-May 44	**Enemy Aircraft destroyed by SOPAC Forces and Shipping attacked by SOPAC planes (SOPAC= USN South Pacific)**	To be Read
720.310-64	1/1/1944-12/31/1944	**Attacks on Heavy Enemy Warships**	To be Read
134.67-1486	31 Dec 42-14 Aug 45	**Status of USN Air Units 31 Dec 42-14 Aug 45**	
		10 AF Study No. 117 Burma	
		13 AF Study No. 120	
		509 Gp Records Jul 1945	
		5 AF History	

		5 AF History	
		5 AF Periodic History	
		5 AF Periodic History	
		10 AF CBI Data 1944	
		10 AF Stats and Charts 1942-1943	
		CBI	
		14 AF AVG	
		13 AF Losses	
815.278	Oct-43	**Air Command Southeast Asia: Air Facilities in the Western Pacific**	
SQ-Bomb-2-HI-(XIV)	Oct 1943-Dec 1943	**History of the 2nd Bombardment Sq, CACW, 14 AF**	
GP-19-HI(Bomb)	8 Dec 1941-24 Feb 1942	**War Diary of 19th Bomb Group**	
512.014-27 V2.	Sep 1939-May 1941	**The RAF in the Bombing Offensive Against Germany Volume II Restricted Bombing September 1939 - May 1941**	RAF Narrative (First Draft) Ministry of Defence Air Historical Branch (RAF)
512.3061C	1 Jul 1942-12 Mar 1943	**RAF Operations Overseas**	
512.3061A	Dec 16, 1941-Jun 30, 1942	**Bomber Operations**	
512.041-22 V3.	9/1/1939 - 11/1/1943	**Far East Campaigns, India Command , Vol III of VI**	
533.431-1 VOL 10	Mar-Aug 1944	**NOBALL TARGET LIST**	9 AF
512.308A	1939-1945	**War Room Manual of Bomber Command Operations 1939-1945**	Air Ministry War Room

			(Statistical Section)
512.308B	1/14/1943	**War Room Manual of Bomber Command Operations 1942**	Air Ministry War Room
512.312	1943-1944	**RAF Sorties in CBI Theater June 1943-March 1944**	
512.4311-2 Vol 1	May 1944	**War Cabinet Crossbow Committee British Countermeasures May to May 1944 (Maps of NOBALL launch sites)**	
705.331	Jan 43-Feb 45	**United States Army Forces South Pacific Area – Principal Target Forms 13 AF**	
512.431J		**British Air Ministry – RHUBARB Operations Appendix XI: NOBALL Targets**	
512.4289B	1 Jun 1942-31 Dec 1943	**Allied Claims against Shipping in the Mediterranean**	
520.056-165 - 520.056.172	8/17/1942 -5/1/1945	**8 Bomber Command Narrative of Operations**	
134.11-28A	1-31 Jan 1943	**Summary and interpretation of cables: Combat Air Operations , Middle East January 1-January 31, 1943**	Air Staff, Office, Chief of Statistical Control
523.303A	17 AUG 42-13 JAN 43	**VIII BOMBER COMMAND STATISTICAL ANALYSIS OF OPERATIONS (Form 34 for first 8 AF Missions)**	War Dept.
512.6742-1	10-20-1944	**GERMAN V-1 AND V-2 GUIDED MISSILE INCIDENTS IN GREAT BRITAIN**	
512.888-1	1/1/42-1/1/1943	**Gazetteer of Decoys**	Great Britain/ Bomber Command

670.716-1	5/29/1945	**TECHNICAL MANUAL OF PROCEDURE FOR RECORDING AND PROCESSING ON IBM MACHINES OF 15AF FORM 34**	28TH Statistical Control Unit, Bari, Italy
142.052	Feb 20, 1943	**Current Intelligence Section A-2 Interview with Lt Colonel P.W. Tibbets Aircraft Commander**	
512.4289A	1 Nov 42-May 1943	**Italian Merchant Shipping sunk by Allied Aircraft**	
512.429B	1 June 19420-31 Dec 1943	**Allied Air Force Claims of Damage to Enemy Shipping in the Mediterranean**	
628.308-1	Nov 1943-April 1945	**Operations by RAF Units of MASAF**	
142.052	11 May, 3 July 1942	**Interview with Col Demas T. Craw, Special Observer Assigned by Gen Arnold to HALPRO Mission, returned from Cairo June 24, 1942.**	
628.3071	Sep 26 1943-April 1945	**MASAF INTOPS Summaries – Daily Summaries of Ops and Intelligence (Grouped by Month)**	MASAF/ 15 AF/ RAF 205 Group
512.077-160	11/04/1942-12/31/1942	**Operational Summaries of RAF 160 Sqdn**	
512.077-178	8/1/1943-9/1/1943	**History of RAF 178 Sqdn (Actually covers RAF MASAF Forces 1 Jan – Sep 1943)**	
		159 Squadron RAF 1942 (Transcription of records from the UK Public Records Office, Kew. Air 27, by Robert Quick, Winnipeg Canada Draft April 2005) From the website:	
		160 Squadron RAF 1942 (Transcription of records from the UK Public Records Office, Kew. Air 27, by Robert Quick, Winnipeg Canada Draft April 2005) From the website:	
		160 Squadron RAF 1943 (Transcription of records from the UK Public Records Office, Kew. Air 27, by Robert Quick, Winnipeg Canada Draft April 2005) From the website:	
137.716-73		**The Campaigns of the Pacific War. Naval Analysis Division. USSBS.**	USSBS

180.024-2	1943-June 1944	**Navy Organization Charts, Pacific**	
137.715-71A	Dec 41-Aug 45	**Air Campaigns of the Pacific War. Military Analysis Division. USSBS.**	USSBS
615.8613-2	June 1943	**NASAF Wellington Bombers**	
706.306		**Allied Air Forces Operations Reports (Daily) April 4, 1942 to July 31, 1942**	**(5 AF, USN, RAAF)**
706.331	1942	**Bomber Reports 1942**	RNZAF
180.602A	Jan 1945	**Representative Enemy and Allied Aircraft: Comparative Performance and Characteristics TAIC Manual #2 Third Edition**	
00210029		**RAF Mission Reports June 1943-Mar 1944 (CBI)**	
512.3061B		**Royal Air Force Home Operations (Incomplete) 7/7/1942 to 3/21/1943**	
700.610	Aug 1943	**Gazetteer (No.1) H.O. MISC No. 10,881 Solomon Islands, Bismarck Archipelago, and Islands off the Southeastern end of New Guinea**	
700.610	Sep 1943	**First Supplement (September 1943) to Gazetteer (No.1) H.O. MISC No. 10,881 Solomon Islands, Bismarck Archipelago, and Islands off the Southeastern end of New Guinea**	
700.610	Nov 1943	**Gazetteer (No.2) H.O. MISC No. 10,882 New Guinea and Nearby Islands**	
700.610	Dec 1942	**Gazetteer of South-East New Guinea and New Britain**	
732.288	Jan-Mar 1942	**Tables – To be placed within Jan–Mar Narration: 19 BG Mission reports Jan-Mar 1942**	
706.331	Feb 44-Aug 1945	**Mission Reports Bomber Reconnaissance Squadrons (RNZAF)**	

706.3083	Aug- Dec 1942	**Summary of Operations Allied Air Forces, SW Pacific Area**	
180.308	Jan, Mar 1944	**Central Pacific Command Task Force 57 Air Strike Data**	
145.81-192	1943	**Danube River File**	
512.041-15	1940-1941	**Vol 6: RAF Narrative The Middle East Campaigns The Campaign in Greece 1940-41**	RAF
512.041-16	May 1941	**Vol 7: The Campaign in Crete**	RAF
512.041-17	May 1941	**Vol 8: The Middle East Campaigns Operations in Iraq**	RAF
512.041-18	June 1941	**Vol 9: The Middle East Campaigns Campaign in Syria June 1941**	RAF
512.3072	Jan-July 1942	**Great Britain/ Ministry of Defence Air Operations Daily Summaries**	RAF
138.4-33	Aug 1945	**Tactics and Techniques Developed by the United States Tactical Air Commands in the European Theater of Operations**	AAFEB in ETO
138.4-37	June 1945	**Effectiveness of Air Attacks Against Rail Transportation in the Battle of France**	AAFEB in ETO
138.4-36	Aug 1945	**The Effectiveness of Third Phase Tactical Air Operations in the European Theater 5 May 1944 – 8 May 1945**	AAFEB in ETO
732.305-1	13 Jan -19 Mar 1942	**Journal 5th Bomber Command**	19 BG
821.3083	Apr 1944	**Strategic Air Force, Eastern Air Command: Statistical Summary**	
821.3083	May 1944	**Strategic Air Force, Eastern Air Command: Statistical Summary**	

Korean War

Call	Date	title	Author
K134.01	1 Jul-31 Dec 1950	**Historical Summary Directorate of Statistical Services**	DCS/Comptroller USAF
K134.01	1 Jan 1951-30 June 1951	**Historical Summary Directorate of Statistical Services**	DCS/Comptroller USAF
K134.01	13-Dec-50	**Daily Combat Operations Report RCS: AF-SC-C6A**	
K720.3081	June-Sep 1950	**FEAF IBM Listing of the Daily Combat Operations Statistical Report**	
K720.3081	Oct-50	**FEAF IBM Listing of the Daily Combat Operations Statistical Report**	
K720.3081	Nov-50	**FEAF IBM Listing of the Daily Combat Operations Statistical Report**	
K720.3081	Dec-50	**FEAF IBM Listing of the Daily Combat Operations Statistical Report**	
K720.3081	Jan-51	**FEAF IBM Listing of the Daily Combat Operations Statistical Report**	
K720.3081	Feb-51	**FEAF IBM Listing of the Daily Combat Operations Statistical Report**	
K720.3081	Mar-51	**FEAF IBM Listing of the Daily Combat Operations Statistical Report**	
K720.3081	Apr-51	**FEAF IBM Listing of the Daily Combat Operations Statistical Report**	
K168.041-1 V.31	11 Sep-5 Oct 1950	**Kenney Report**	
720.310-38		**2D and 3D Operations Analysis Sections Table of Lethal Radii**	HQ FEAF
K713.197	13 July 1950 thru 27 July 1953	**FEAF Bomber Command Digest: Combat Review 13 July 1950 thru 27 July 1953**	FEAF BOMCOM
K713.197	7/13 - 10/31/1950	**FEAF Bomber Command Digest**	FEAF BOMCOM

K713.197	Nov-Dec 1950	**FEAF Bomber Command Digest**	FEAF BOMCOM
K720.302 A	25 Jun 1950-31 Oct 1950	**FEAF Operations History Volume 1**	Combat Operations Division, Directorate of Operations, HQ FEAF
K720.302 A	1 Nov 50 - 28 Feb 1951	**FEAF Operations History Volume 2**	Combat Operations Division, Directorate of Operations, HQ FEAF
	Jun 1950-July 1953	**FEAF ECM History During Korean Conflict**	D/O Comm-E-HQ FEAF
?	7 Jul 1950-14 Jul 1950	**FEAF Correspondence - Daily Mission reports/Recaps**	
K168.041-V.16	2-Sep-50	**Bomber Command Transportation Interdiction Plan**	Air Targets Research and Analysis
	19500701-19510630	**AF Statistical Digest 1951**	
		AFD-090529-031 USAF Operations in the Korean Conflict Part 1	
		AFD-090529-033 USAF Operations in the Korean Conflict Part 2	
		AFD-090529-034 USAF Operations in the Korean Conflict Part 3	
		AFD-090529-035 USAF Operations in the Korean Conflict Part 4	
		AFD-090601-061 USAF Operations in the Korean Conflict 25 Jun-1 Nov 50	
		AFD-090601-064 USAF Operations in the Korean Conflict 1 Nov 50-30 Jun 52	
		AFD-090601-099 USAF Credits for the Destruction of Enemy Aircraft Korean War	
		AFD-090601-128 The Employment of Strategic Bombers in a Tactical Role 1941-1951	

AFD-101004-027 The USAF in Korea: A Chronology 1950-1953	A. Timothy Warnock, Ed. AFHRA, 2000.
Down in the Weeds: CAS in Korea	William T. Y'Blood, AF History and Museums Program, 2002
The USAF in Korea: Campaigns, Units, and Stations 1950-1953	Judy G. Endicott,Ed. AFHRA, 2001
Coalition Warfare in the Korean War 1950-1953: Proceedings AF Historical Foundation Symposium May 7-8 2002 Andrews AFB, MD	Jacob Neufeld & George M. Watson, Jr., Ed.
The Evolution of Airborne Forward Air Controller: An analysis of Mosquito Operations in Korea.	J. Farmer and M.J. Strumwasser, Rand, Santa Monica, 1967.
Steadfast and Courageous: FEAF Bomber Command and the Air War in Korea 1950-1953	AF History and Museums Program, 2002

Vietnam War

CACTA Electronic database version preserved by JCS	National Archives
SEADAB Electronic database version preserved by JCS	National Archives
SACCOACT Electronic Database version preserved by JCS	National Archives
CACTA Electronic database version preserved by MAC-V	National Archives