

Active Duty Military & Veteran Flyer Cancer Incidence: A Synoptic Analysis

A Synthesis of the Defense Health Agency 2023 & 2024 Aviator Cancer Incidence Studies

How We Got Here

Before the Military Aviator Coalition for Health (MACH Coalition) formed in July 2025, the Red River Valley Association (RRVA) formed an aviator medical issues committee to study aviator cancer. There, among the membership of RRVA, current and former fighter pilots of the Air Force and Navy, there was a sense an unmapped cancer incidence problem existed in the armed services. There was no peer-reviewed evidence to support this claim. This was the inception of an advocacy campaign and its advocacy strategy.

RRVA's advocacy efforts led to the offices of the Air Force Chief of Staff. In 2019 that Chief ordered the Flight Surgeon of the Air Force to conduct a year-long study of cancer incidence among certain Air Force attack and fighter communities. This study, the Air Force 2021 Aviator Cancer Incidence Study, established that an excess of cancer incidence and mortality existed among a longitudinal (1970-2004) cohort of 34,000+ individuals. While such an "n" is modest by epidemiological standards, in the Air Force the study's most immediate effect was to establish beyond doubt at least two things: first, there is an excess of cancer incidence at least among Air Force attack/fighter aircrews; second, the study's findings made an implied case to underwrite further cancer incidence investigation within the Air Force, if not military aviation.

With the Air Force study underway and its preliminary direction understood, RRVA advocates successfully concluded an effort to insert language in the fiscal year 2021 National Defense Authorization Act (Section 750) that directed the Defense Health Agency (DHA) to conduct two cancer incidence studies at scale. These two studies, released respectively in 2023 and 2024, established two facts, one: the cancer incidence challenge ran broader than first thought within military medicine; two: the aviator cancer incidence challenge extended across all of the fixed-wing communities of the Air Force, Navy, Marine Corps, and in much lesser degree, the Army. In other words, elevated fixed-wing flyer cancer incidence was not an Air Force problem, but a vast U.S. military/Veteran flyer health problem, hiding if you will in plain sight.

The DHA's 2023 and 2024 study data gave MACH the evidentiary foundation to document the military aviator cancer problem. Out of this information alignment, a three-phase advocacy strategy emerged. Despite the effects of the pandemic in 2021, RRVA advocates began conversations with Congressman August Pfluger (TX-11) and other lawmakers. Congressman Pfluger read the Air Force 2021 study report and with interest driven by experience sensed the next step in the work was an aviator cancer *causation* study. In working with Congressman Pfluger, RRVA named the proposed legislation the Aviator Cancer Examination Study (ACES) Act. On the RRVA committee performing congressional advocacy work from 2022, was the late Colonel Andrew Shurtleff, USAF. Andrew's death in May 2025 was the second cancer death on RRVA's advocacy committee. Andrew was 43 when as a F-22 pilot he was diagnosed with Stage 4 kidney cancer. He lost his fight at the age of 48. Andy left behind a widow and two high school senior boys. In our advocacy, this outcome among those we know and served with is too common. Meanwhile, we focused and worked harder.

To usher the ACES Act through Congress, RRVA had to broaden the sweep of its advocacy effort and as we learned in our military service, pull in friends and partners. Consequently, in late 2024 RRVA formed a coalition with 10 other nonprofit organizations, each also committed to the emergent aviator cancer story.

MACH attained nonprofit status in August 2025. Days later, President Trump signed the ACES Act into law. The MACH Coalition is working to arrive at the third phase of its aviator cancer advocacy strategy. Phase Three of the aviator cancer strategy becomes the Improved Outcome Strategy (IOS), which this document addresses in its final section. The IOS is itself a standalone effort that must carry on for years if not decades into the future. To read more about the IOS we encourage you to read through this document to the IOS discussion.

Overview: These Charts Say Something Important

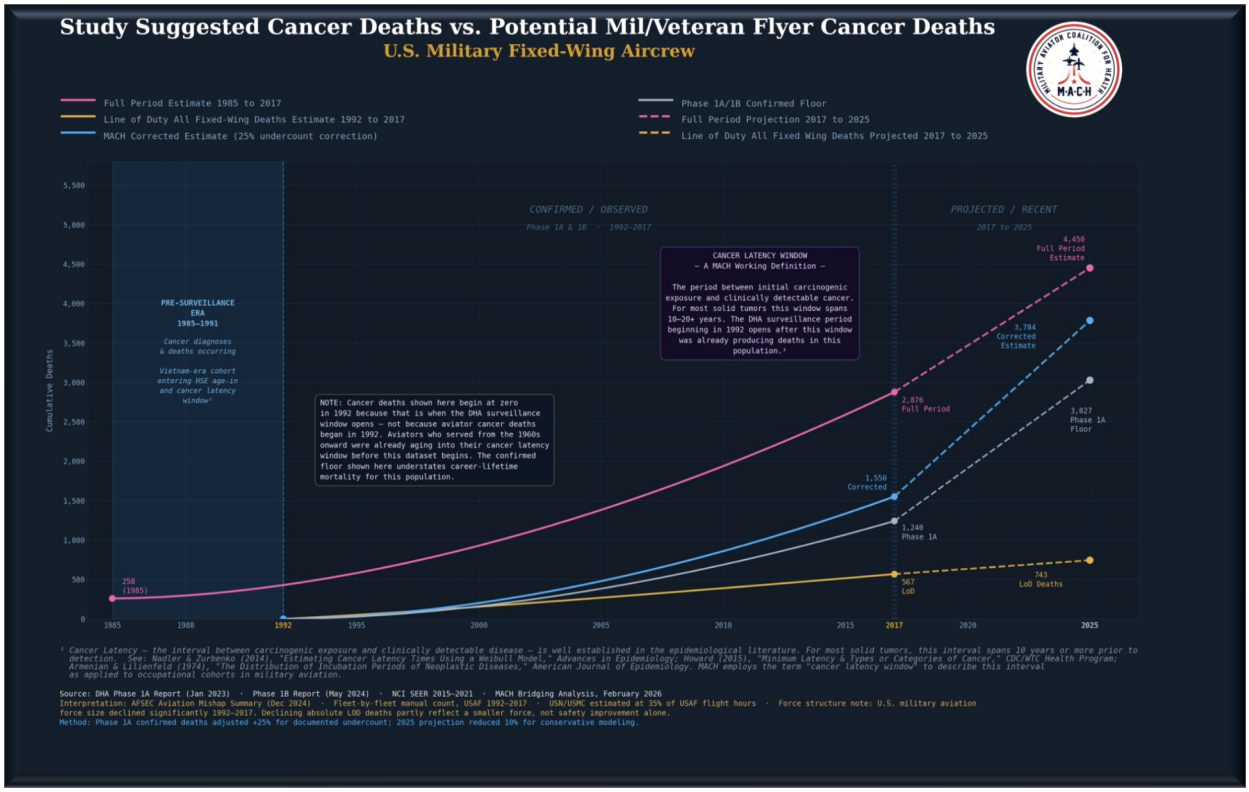
The six charts presented in this document present related aspects of a single story. In other words, each chart illuminates a different dimension of an overarching reality, and together each chart constitutes an argument with an evidentiary basis rooted in the biostatistical data of DHA's 2023 and 2024 studies. This arrangement is put forward at the outset so the reader can perceive it through the pages that follow.

The six charts in this document view the military aviator cancer challenge from various perspectives. The first chart establishes the mortality scale, the foundation on which every subsequent notion rests. The second chart maps the full cancer landscape across both populations and both studies. The third chart parses that landscape into investigative priorities. The fourth chart captures the direction of cancer incidence travel between the 2023 and the 2024 DHA studies. The fifth chart projects the military's fixed-wing flyer cancer incidence trajectory, and its divergence from the U.S. SEER baseline, forward toward 2040. The final chart synthesizes key notions into one concluding image. We hope that each chart effectively supports the next. Our discussion intent is that each chart and its analysis effectively interlock with the previous chart.

The interpretive structure of this document is that each chart be examined for what it puts forward, organization, data, and interpretations, then for what we perceive this data likely means, a kind of sensemaking exercise. With humility we acknowledge that to highly experienced experts, other views and assessment may emerge. For MACH, our consistent response to peer-reviewed data is that we follow the science where it leads. From this commitment emerges our shared understanding of significance, implications, and layered meaning for individuals who carry MACH's advocacy message into congressional offices, VA proceedings, scientific/medical seminars, and other forums.

A framing note: the DHA studies do not document a uniform cancer signal. So far, DHA's studies (and the Air Force 2021 study) indicate that not all cancers are elevated. Several cancers, for example, lung and bronchus are substantially below the SEER civilian baseline in both populations. That pattern of selective elevation is not a weakness in the overall aviator cancer advocacy strategy. Rather, the lack of elevation in all of the measured 12 cancers of both studies is an assurance of biostatistical and epidemiological investigative credibility within the active military/Veteran fixed-wing flyer cancer case. In fixed-wing flyer communities with demanding entrance selection, unrelenting fitness regimens, alcohol use control, and curtailed tobacco use, the data suggest these practices suppress in degree, cancer incidence most often associated with behavioral risk. However, as the charts within this document assert, this is not the entire aviation cancer incidence and mortality narrative. For the cancers that manifest above the civilian (SEER) baseline, occupational exposure becomes a plausible line of inquiry, not a conclusion established by this document. The grayed or "+" chart features, or lesser incidence data do as much for argumentative work as red or "-" chart data. Given these considerations it seems we stand at the perimeter fence of your study group work.

Section 1: Full Period Cancer Deaths



Study Suggested Cancer Deaths vs. Potential Mil/Veteran Flyer Cancer Deaths · U.S. Military Fixed-Wing Aircrew

Section 1.1 What This Chart Puts Forward

At a basic level, this chart compares cumulative estimated cancer deaths among U.S. military fixed-wing aircrew (and Veterans of same) with cumulative line-of-duty (LoD) fixed-wing only flyer fatalities across a forty-year era placing both in direct relation to each other so the viewer can simultaneously assess the trendlines. This chart design choice is a type of presentation argument but certainly not a judgement of DHA data. Meanwhile the chart's organization is such to make comparisons difficult to misread.

The chart organizes the data across three periods. The shaded zone on the chart's left marks the Pre-Surveillance Era, 1985 to 1991. Here, cancer diagnoses and deaths were occurring in active duty military fixed-wing and Veteran fixed-wing flyer populations, yet no government program existed to count or map them. The chart's center is the period from 1992 to 2017, and it represents the Defense Health Agency's 25-year active surveillance window, the longitudinal heartland of both the 2023 and 2024 studies. The chart's right period covers the recent period from 2017 to 2025, an 8-year time period outside of the DHA studies, nevertheless a time when cancer diagnoses and deaths did not wane. The chart's visual structure puts forward that active military/Veteran

fixed-wing flyer cancer incidence did not begin in 1992, even though the DHA surveillance window did.

The chart displays the cancer lines in three registers of confidence, forming a burden frame. The gray line is the confirmed floor: DHA's 2023 and 2024 surveillance data establish 1,240 deaths from 1992 to 2017, rising to a projected 3,027 by 2025. A common question is why do these trendlines tend to increase? The answer is that while the LoD trendline has been somewhat stable, a massive age cohort has progressively exited its healthy soldier effect (HSE) window. In parallel, the individual cancer latency windows of that cohort, set in motion by career-long occupational exposures, continue to advance. Together these dynamics produce a predictable upward increase in cancer incidence/mortality. However, this is not an "old man" issue. Both DHA studies point out that active military/Veteran diagnoses occur on average 12 years earlier than civilian peers. The combination of a large aging cohort exiting the HSE window and the advancing resolution of career-long cancer latency windows may together be accelerating upward pressure on cancer diagnosis and death rates. Further investigation of this dynamic is warranted.

The chart's blue line corrects for an undercount proportional to the average incidence and mortality data attributable to structural reporting and documentation challenges (this document does not unpack those issues here). DHA acknowledged in the 2023 study an undercount likelihood. Acting on that acknowledgment, the Full Period Cancer Deaths chart adds a nominal 25% undercount figure reaching 1,550 by 2017 and 3,784 by 2025. The magenta line extends back to 1985, though the longitudinal cohort of the 2021 Air Force cancer incidence study (1970 to 2004) would have supported an earlier starting point. In the interests of chart brevity and fidelity to the DHA surveillance data, MACH set the 1985 pre-surveillance window plot at a conservative anchor of 258 cumulative deaths for the entire preceding period, reaching 2,876 by 2017 and 4,450 by 2025.

A word concerning the gold line along the bottom of the chart, the line-of-duty (LoD) fatality trendline. Mapping to Air Force Safety Center, and reported Department of Navy aviation safety data from 1992 to 2017, are confirmed fixed-wing aviation fatalities within the spectrum of reported deaths attributable to causes such as aircraft ground collisions, midair collisions, combat shootdowns, etc. aggregated to an approximate 567 deaths. When extrapolated using the present fatality trends, this figure rises to a projected 743 by 2025. That line, due to concerted military effort, moved slowly upward then flattened after 2017 and likely remains on that trajectory to 2025 and beyond. This is what happens with sustained institutional investment and consistent annual budgetary resourcing. This trend line behavior is not evident in military aviator cancers.

A chart note puts forward a key supposition: cancer deaths begin at zero in 1992 for DHA study purposes not because aviator cancer deaths began at zero in 1992, but because that is when the DHA surveillance window opened. In other words, a figure of zero cancer incidence and death in 1992 does not mean no active military/Veteran fixed-wing flyer was dying. Rather, and to avoid putting too stark a face on the matter, zero in 1992 means no agency was compiling diagnostic/death data. The Cancer Latency Window box explains a mechanism worthy of

consideration: most solid tumors take 10 to 20 years from initial carcinogenic exposure to clinical detection. The DHA surveillance window that opened in 1992 opened after the latency clock was running for decades, this for Veteran fixed-wing flyers with Vietnam and Cold War era service.

Section 1.2 Our Synthesis of The Data

The chart's underlying meaning is not simply that cancer deaths may be higher than aviation LoD deaths, but its larger claim is that the official records likely understate the career-lifetime mortality burden of the military aircrew population. It is a noncontroversial claim to hold that a surveillance boundary must not be mistaken for a biological starting point. The Full Period Cancer Deaths chart is built to assist the viewer in making that distinction.

By 2017, DHA's confirmed data floor when contrasted with data outside of the two DHA studies, shows that military aviator cancer deaths exceeded military LoD deaths by more than two to one. Yet that disparity, as a headline and medical priority to tackle, was absent from discernible service discussion and military medicine budget priorities. When factoring in an intractable undercount challenge, the corrected military aviator cancer diagnoses/death to LoD ratio climbs to nearly three to one. Over time, updated estimates may inflate the aviator cancer death to LoD death ratio to perhaps four or five to one. Across the confirmed floor and the higher modeled estimates presented here, cancer appears to be killing active military/Veteran fixed-wing aircrew at a rate that materially exceeds the toll of LoD deaths across these population(s), certainly since the beginning of the previous decade. This disparity is not incidental. It is a core synthesis of this chart.

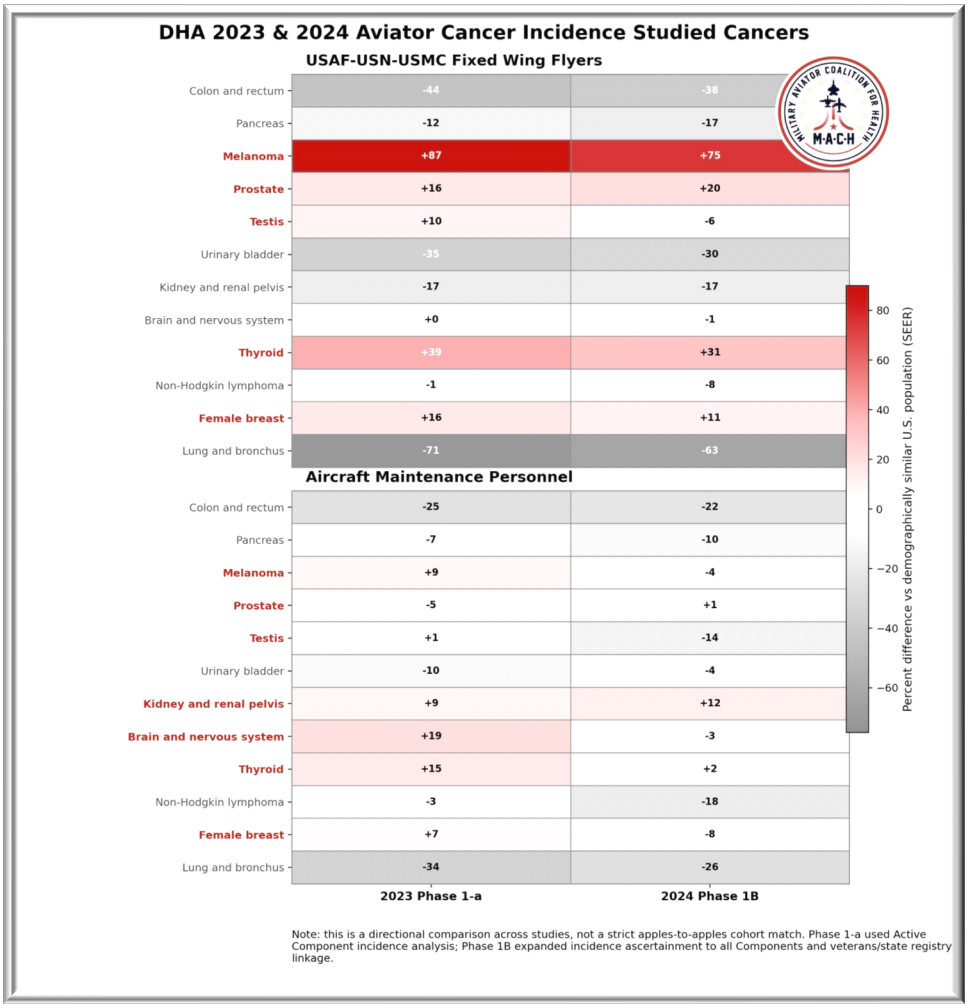
A second synthesis is comparative and strategic. This Full Period Cancer Deaths chart aspires to shift the frame of military aviation risk. Fixed-wing Air Force, Navy, and Marine Corps aviation communities traditionally focused on LoD losses, and rightly so. This chart holds that another category of loss, cancer mortality across the career-lifetime of the force, is in fact materially much larger when measured over the same population and the same period. The military's rigor in counting aviation fatalities makes this point unmistakably clear. The military investigates and documents each aviation crash or fatal mishap. Substantial taxpayer resources are put to work in military aviation safety boards, mishap field investigation, report writing, and consequent aviation policy change enactment. Military aviator cancer deaths do not receive equivalent resource allocation or institutional interest. Why is that? The gold line represents a live culture of accountability. The cancer trend lines represent the structural absence of armed services accountability applied to a different category of military aviator loss.

A third synthesis concerns what the chart cannot visually depict. The chart only addresses fixed-wing aircrew. The chart does not address military/Veteran rotary-wing aviators nor aircraft maintenance personnel whose 2023 study cancer mortality of 5,784 confirmed deaths is larger in absolute terms than the aircrew figure. Importantly, Reserves and Air Guard components are systematically undercounted in both DHA studies. Post-2025 mortality will continue to accumulate as Air Force, Navy, and Marine Corps fixed-wing flyers and Veteran flyers pass out of the healthy soldier effect (HSE) cohort and enter the decades of elevated cancer risk. Their

latency windows, set in motion by exposures that preceded separation by years or decades, will progressively resolve into clinical disease.

The gray, blue, and magenta cancer trend lines do not represent interchangeable estimates. They form a burden ladder: a conservative floor, a corrected estimate, and a broader full-period estimate. This structure allows the chart to make a serious claim while retaining an internal range of humility and caution. Even the most regressive cancer incidence line remains above the LoD line at every point. Even if the total deaths were the same, where is the institutional engagement and resource allocation? This rhetorical question as conclusion does not depend on accepting the most aggressive diagnoses and deaths estimates. Perhaps this is the chart's most important implication.

Section 2: 12 Cancer Incidence Heat Map



DHA 2023 & 2024 Aviator Cancer Incidence Studied Cancers · USAF-USN-USMC Fixed-Wing Flyers & Aircraft Maintenance Personnel

Section 2.1 What This Chart Puts Forward

The 12 Cancer Incidence Heat Map presents the same twelve-cancer, two-population, two-study dataset that drives all the charts in this document, but through a visual grammar suited to a more comprehensive pattern recognition. Where the previous Full Period Cancer Deaths chart speaks in the language of mapped, corrected, and comparative mortality, this 12 Cancer Incidence Heat Map speaks the language of incidence. It asks not how many died, but where the cancer signal is elevated, in which population, and what, if any, consistency exists across the 2023 and 2024 studies.

Each cell in the chart's grid shows the percent difference versus a demographically similar U.S. population, using SEER data as the comparison baseline. Red shading marks positive elevation

above the SEER baseline; gray shading marks negative deviation below SEER. Darker color indicates a greater magnitude in either (+ or -) direction. Cancers in bold red exceeded the SEER baseline in at least one of the two DHA studies. The left column presents 2023 study data while the right column presents 2024 study data. The chart organizes its data into two horizontal panels: Fixed-Wing Flyers above, Aircraft Maintenance Personnel below.

In the Fixed-Wing Flyer panel, the eye is drawn to the melanoma cell(s), the only row in the chart rendered in saturated red. The 2023 study recorded +87 and 2024 study recorded +75 incidence values. The melanoma cells are visually distinct from other panel cells. Next, Thyroid cancers follow at +39 and +31, rendered in positive pink. Prostate cancer is at +16 and +20. Elsewhere, female breast cancer registers at +16 and +11. Testicular cancer presents a split: +10 in Phase 1A, crossing to -6 in Phase 1B. Brain and nervous system cancers sit essentially at parity, shown as +0 and -1. The remaining cancers in the panel dip below the civilian (SEER) baseline. Lung and bronchus cancers are the most extreme at -71 and -63, followed by colon and rectum cancers at -44 and -38, and urinary/bladder cancers at -35 and -30 that plot at a deep discount to non-military peer SEER data.

In the Aircraft Maintenance Personnel panel, the pattern is mixed and generally lower in amplitude. No cell reaches the saturated red of the melanoma row of the Fixed-Wing Flyer panel. Kidney and renal pelvis cancer(s) are positive in both studies at +9 and +12, the only aircraft maintenance personnel cancer that is positive in both studies and is worsening. Thyroid cancer registers at +15 and +2 while brain and nervous system cancers are positive in 2023 at +19 but turn to -3 in the 2024 study. Melanoma, female breast, prostate, and testicular cancer(s) all either weaken materially or cross from positive to negative between the two DHA studies. Lung and bronchus, colon and rectum cancer(s) remain clearly below civilian peer SEER levels.

Section 2.2 Our Synthesis of The Data

The 12 Cancer Incidence Heat Map is best understood as a pattern-recognition chart rather than a mortality or causal proof chart. The chart does not claim that all active military/Veteran fixed-wing flyer cancers are elevated. Instead, the chart puts forward that certain cancers stand out more than others, and they stand out more coherently among fixed-wing flyers than among aircraft maintenance personnel. That selectivity is not a weakness in the advocacy strategy or the scientific investigative case; rather, it is precisely the kind of exposure-outcome coherence that epidemiologists and regulatory bodies look for when evaluating occupational cancer claims.

For military fixed-wing flyers, a small number of cancers anchor the visual center of gravity: melanoma first, followed by thyroid, with more modest but still persistent positive findings in prostate and female breast. That concentration suggests the flyer cohort has a more distinct pattern of elevated incidence in certain studied cancers than the aircraft maintenance personnel cohort.

For Air Force, Navy, or Marine Corps aircraft maintenance personnel, the chart suggests a less stable and less concentrated profile. Positive findings appear, but they are more scattered and less consistently replicated across both DHA studies. The overall visual impression is gray, with

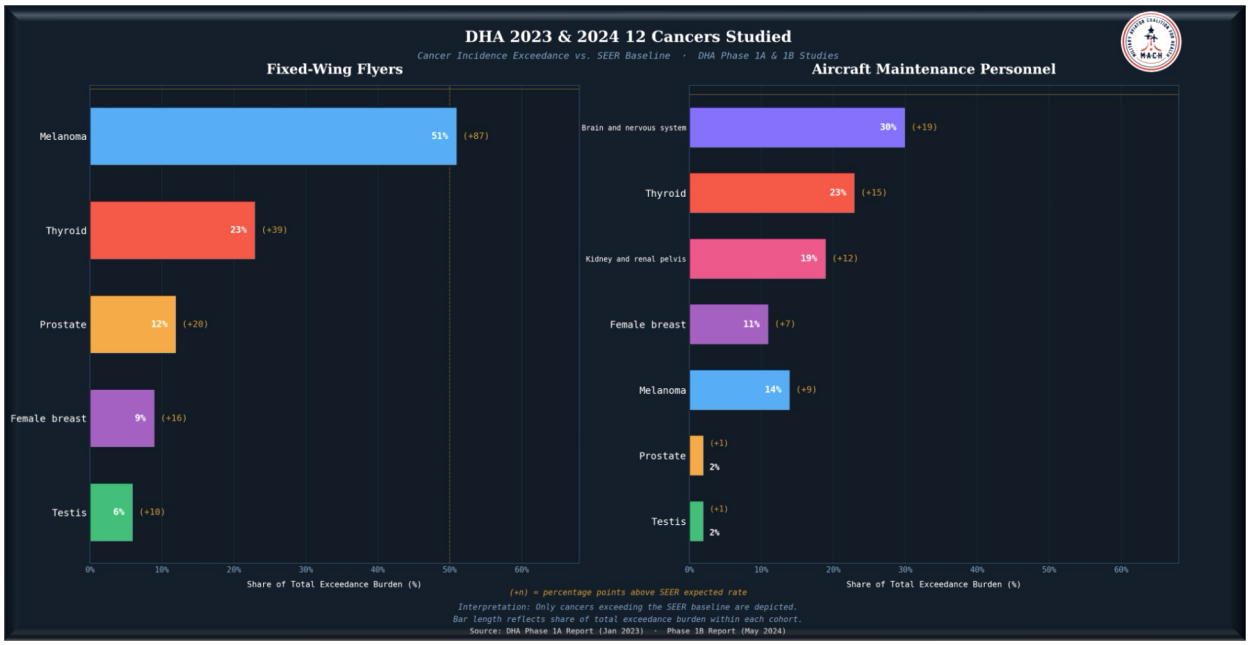
pockets of pink on the left side where the positive signals cluster. That contrast with the Fixed-Wing Flyer panel, where saturated red dominates the melanoma row, is one of the chart's most important messages. The two populations do not share the same cancer profile. The chart makes that visible. Aircraft maintenance personnel are not a true epidemiological control for this analysis, as they share aspects of the broader military aviation environment. Nevertheless, the distinct pattern of exceedance between the two populations, concentrated in melanoma and thyroid among flyers and distributed across brain, kidney, thyroid, and other cancers among maintenance personnel, suggests that aviation-specific exposures contribute a signal distinct from any shared occupational environment. The difference in pattern is itself informative. That the two populations present distinct exceedance profiles, rather than a uniform signal, strengthens rather than weakens the case that occupational exposure within military aviation is driving the findings.

Notably, the DHA 2024 study does not negate the key flyer cancer incidence findings from the 2023 study, even where some values attenuate. Melanoma remains the dominant positive signal in both studies. Thyroid cancer remains elevated in both DHA studies. At the same time, this chart warns against overgeneralization: several cancers are negative, near parity, or inconsistent across DHA studies. The picture is not that all the 12 studied cancers are elevated. It is that certain of the 12 studied cancers stand out more than others, and they stand out more strongly among active military/Veteran fixed-wing flyers.

The gray dominance in both panels is the healthy soldier effect (HSE) made visible. Military institutions select personnel for fitness, subject them to overt behavioral risk management, and maintain institutional climates that effectively, even if indirectly, suppress the cancers most strongly associated with sedentary lifestyle, tobacco use, and inferior diet, the behavioral risks at work in SEER data. In a population where every structural factor should be driving cancer rates downward relative to civilian SEER data, the cancers that still appear above the SEER baseline are the ones that warrant closer evaluation for possible occupational exposure rather than being explained solely by behavioral risk. The gray cells in both DHA studies make the red signal more credible, not less.

One finding the 12 Cancer Incidence Heat Map chart reveals that no other graphic in the six-chart series isolates as clearly: thyroid cancer is the only cancer that registers above the civilian baseline in both populations across both DHA studies. It appears in the flyer panel at +39 and +31, and in the maintenance panel at +15 and +2. Every other elevated cancer is either population-specific or study-specific. The margin in the 2024 maintenance panel is modest at +2, but the directional consistency across four study-population combinations, positive in every instance, is notable. That pattern is suggestive of a shared occupational exposure mechanism and may warrant dedicated research attention.

Section 3: 12 Cancers Exceedance Burden



DHA 2023 & 2024 12 Cancers Studied · Cancer Incidence Exceedance vs. SEER Baseline · Fixed-Wing Flyers & Aircraft Maintenance Personnel

Section 3.1 What This Chart Puts Forward

This chart isolates only those cancers that exceed the civilian SEER baseline and expresses each as a share of the total positive exceedance burden within its cohort. Admittedly, this chart's design is a focus mechanism. Where the 12 Cancer Incidence Heat Map (Section 2 chart) depicted the broader landscape including cancers below the SEER baseline, the 12 Cancers Exceedance Burden chart shows only the signal above the peer SEER baseline. This chart is not attempting to portray the entire aviator cancer profile. Instead, the chart is focused on the positive exceedance side only, and that exceedance is the element worthy of focus.

The chart places its two panels side by side. The left panel covers fixed-wing flyers. The right panel addresses aircraft maintenance personnel. The gold numbers in parentheses are the percentage points above the SEER expected rate from the DHA 2023 study. The bar lengths show each cancer's proportional share of the total exceedance picture within its respective population. The percentages are shares of each cohort's positive burden, not direct cohort-to-cohort totals, a distinction that matters when reading across both panels.

For fixed-wing flyers, melanoma dominates the positive burden: 51 percent of the total positive exceedance burden, at +87 percentage points above the civilian rate. Thyroid cancer follows at 23 percent and +39. Prostate cancer enters at 12 percent at +20 while female breast registers 9 percent at +16. Testicular cancer contributes 6 percent at +10. Cumulatively, these five cancers constitute

the entire excess cancer burden shown above the civilian SEER baseline in the fixed-wing flyer panel. More than 50% of that burden resides in a single cancer.

Pivoting to aircraft maintenance personnel, seven cancers appear, each reflecting a more distributed exceedance profile. Brain and nervous system cancers lead at 30 percent of the total positive burden at +19 above SEER. Thyroid cancer accounts for 23 percent at +15 while kidney and renal pelvis cancers hold 19 percent at +12. Melanoma cancer contributes 14 percent at +9. Female breast registers 11 percent at +7 while prostate and testicular cancers each account for 2 percent with +1 exceedance, small in relative share but meaningful in their presence above the civilian SEER baseline.

Section 3.2 Our Synthesis of The Data

The 12 Cancer Exceedance Burden chart is an important chart in this six-chart series. The previous section's 12 Cancer Incidence Heat Map chart is evidence in a more comprehensive form. The chart in this section is evidence organized for decision purposes. This chart's design to depict the cancers above the civilian baseline ranked by share of total burden highlights potential follow-on analytic attention. The chart focuses attention on which cancers may matter first and removes the noise that would allow a skeptic to point at the negative bars of the 12 Cancer Incidence Heat Map chart to argue that the fixed-wing flyer population(s) represented here are healthy overall, hence no cancer problem.

The positive cancer signal is not spread evenly across all 12 studied cancers. The signal is concentrated in relatively few cancers, and the concentration pattern differs sharply by cohort. This chart communicates comparative shape rather than raw incidence volume. The 12 Cancer Exceedance Burden chart does not say which cohort has a greater total cancer burden. Instead, this chart depicts how the positive exceedance burden is internally apportioned within each cohort.

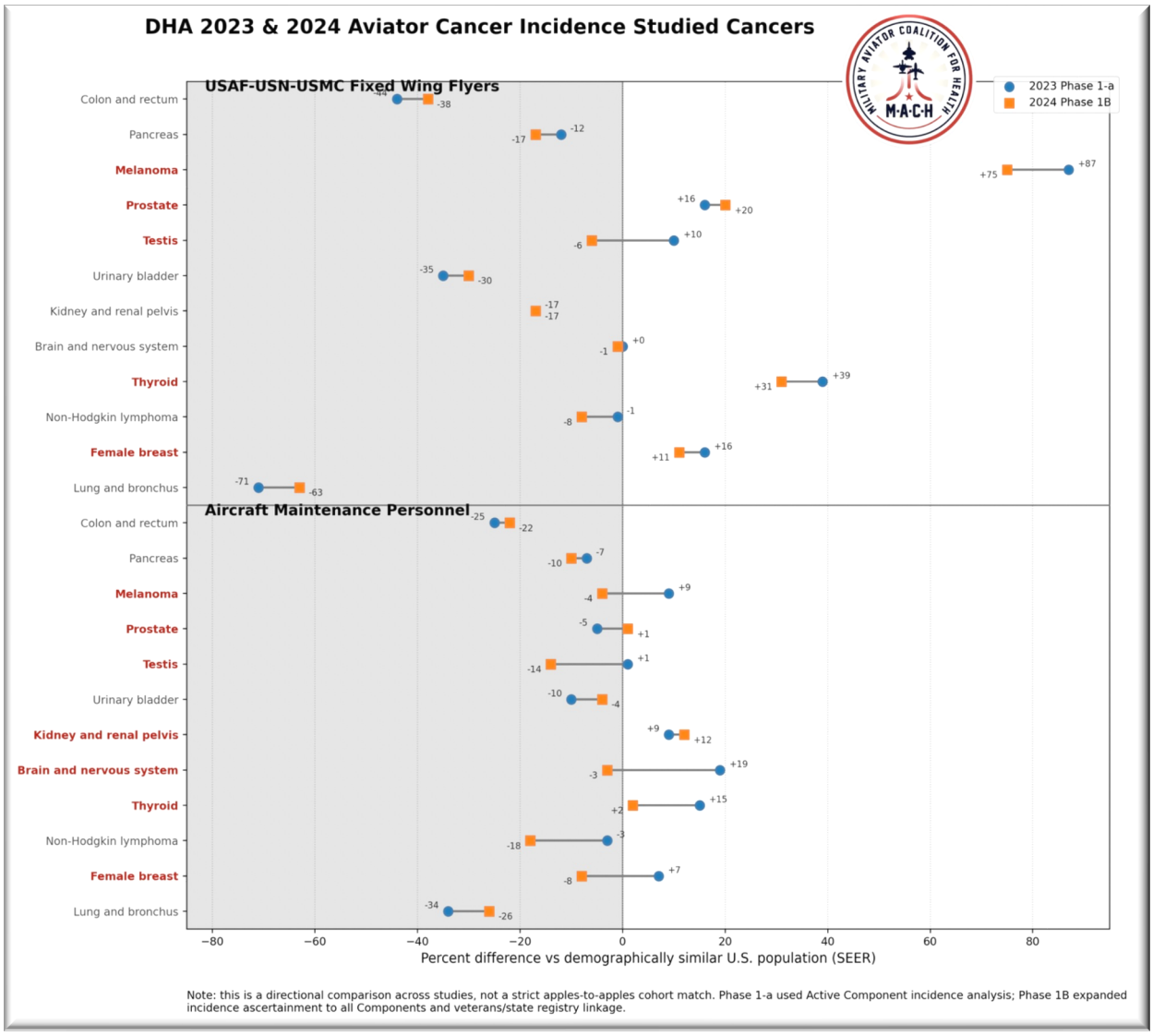
The 51 percent melanoma bar is the single most powerful number. It does not mean that any individual military fixed-wing flyer who develops cancer has a better than one in two chance of developing melanoma. It means that, within this chart's modeled positive exceedance burden, melanoma accounts for just over half of the above-baseline burden in the fixed-wing flyer panel. The (+87) figure illustrates the magnitude. The 51 percent bar points to the concentration. For one evaluating a service connection query, the incidence data at least permit two questions to be seriously asked: first, is this cancer prevalent enough among the population to justify a policy change; second, once causation is established, will the mechanism be plausible enough to survive legal and scientific scrutiny. The data do not answer those questions here. Of those questions, the melanoma finding provides the most immediate analytical weight. Melanoma is not an edge case in the fixed-wing flyer population represented here. Melanoma is the dominant excess cancer. What drives that dominance is a question the data can point toward but not yet answer. The causation question, including the role of UV radiation exposure at altitude, belongs properly to the NASEM committee's work. What the incidence data establish at this stage is the pattern and

magnitude of the signal. That pattern makes altitude-related UV exposure a plausible mechanism for future evaluation, not a conclusion for this document to assert.

The aircraft maintenance personnel panel reveals an underappreciated constituency. The right panel tells a more distributed story, and that distribution is itself significant. Seven cancers contribute to the exceedance burden, compared to five in the military flyers. No single cancer dominates the way melanoma dominates in the fixed-wing flyer panel. This distribution may be consistent with a chemically complex occupational exposure environment with multiple potential carcinogens operating through multiple potential pathways. The implication may be that the fixed-wing flyer inquiry could best be formed around melanoma as a flagship cancer. The aircraft maintenance personnel analytic effort may take shape as a portfolio argument in which the breadth of the distributed exceedance pattern across seven cancer types is itself evidence of systemic, not yet fully understood, occupational harms.

The (+n) exceedance figures are incidence numbers, not mortality numbers. They measure how many more cases of each cancer develop in these populations per 100,000 compared to demographically similar civilians; however, incidence precedes mortality. The connection between this chart and the Section 1 Full Period Cancer Deaths chart is a bridge that policymakers must cross. The incidence exceedances shown in this chart are a plausible upstream contributor to the mortality divergence shown in the Section 1 Full Period Cancer Deaths chart. More melanoma cases in 1995 can, over time, contribute to more melanoma deaths in 2005, 2015, 2025, and so on. These are not two separate stories. They are two related chapters within the same military/Veteran flyer cancer story.

Section 4: 12 Cancer Direction of Travel



DHA 2023 & 2024 Aviator Cancer Incidence Studied Cancers · USAF-USN-USMC Fixed-Wing Flyers & Aircraft Maintenance Personnel · Percent Difference vs. SEER

Section 4.1 What This Chart Puts Forward

The 12 Cancer Direction of Travel chart is a two-panel dumbbell chart which compares DHA's 2023 and 2024 studies that both studied the same 12 cancers. The horizontal axis shows percent difference versus a demographically similar U.S. population benchmark derived from SEER data. Values left of zero are below parity. Values right of zero exceed the benchmark. The blue dots represent the 2023 study findings while the orange squares represent the DHA 2024 findings. The

connecting lines between them show the direction and magnitude of change between the two DHA studies.

A critical methodological note anchors at the bottom of the chart: the DHA 2023 (Phase 1A) study used active component incidence analysis, while the DHA 2024 (Phase 1B) study expanded ascertainment to all components and Veterans through state registry linkages. The visual comparison is therefore directional and interpretive rather than a literal year-over-year (Section 1 chart) trend line. This chart is a directional comparison across both studies, not a strict apples-to-apples cohort(s) match.

For the military/Veteran fixed-wing flyer cohorts, the chart shows a selective rather than universal elevation pattern. Melanoma is the dominant positive signal in both DHA studies, at +87 in 2023 and +75 in 2024. Thyroid cancer is clearly elevated at +39 and +31. Prostate and female breast cancers respectively remain positive in both DHA studies. Testicular cancer is positive in the 2023 study but turns negative in the 2024 study. Several other cancers remain below parity in both DHA studies such as colon and rectum, urinary bladder, kidney and renal pelvis cancers with lung and bronchus cancers most prominently.

For aircraft maintenance personnel, the 12 Cancer Direction of Travel chart shows a more mixed and lower-amplitude pattern. Thyroid, kidney, renal pelvis, and brain and nervous system cancer(s) show positive results in at least one study while kidney and renal pelvis cancers remain positive in both studies. For maintenance personnel, melanoma is positive in the 2023 study but turns negative in the 2024 study. Prostate cancer moves from slightly negative to slightly positive. Testicular and female breast cancer(s) move in the opposite direction. Lung and bronchus, colon and rectum cancer(s) remain clearly negative in both DHA studies.

Section 4.2 Our Synthesis of The Data

The geometry of this chart requires careful reading. For cancers already above the SEER baseline, the orange squares in several cases sit to the left of the blue dots, indicating that the rate of exceedance moderated between 2023 and 2024. This reflects in part the broader ascertainment methodology of the 2024 study, which captured more of the population and more of the cancer burden, producing a larger absolute case count even where the percentage exceedance above the SEER baseline appears reduced. For cancers below the SEER baseline, the orange squares frequently sit to the right of the blue dots, moving toward parity. Across both directions, the movement is consistent: the military and Veteran flyer cohort is converging toward the civilian baseline in suppressed cancers while remaining elevated above it in the cancers that matter most. These geometries are not random noise. They point toward a single underlying dynamic: the progressive erosion of the healthy soldier effect (HSE) as cohort members age and enter their individual cancer latency windows accumulated over careers of occupational exposure begin to resolve.

The HSE is the well-documented phenomenon in which military populations, because of the physical and medical fitness standards required for service entry and annual continuation yield

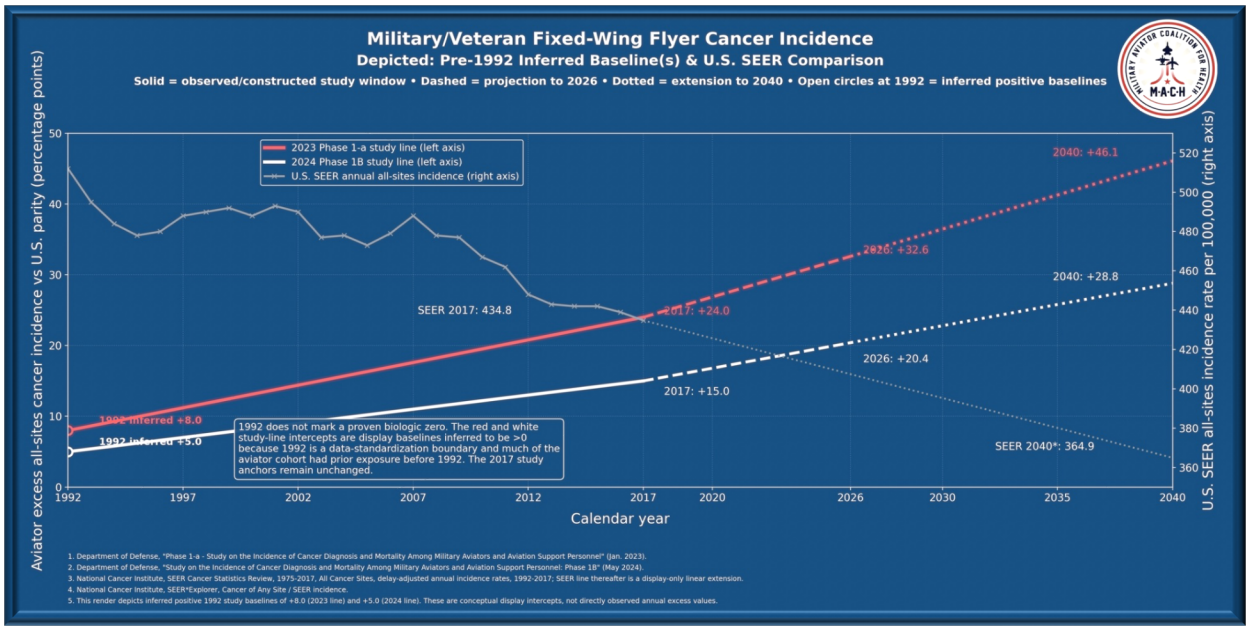
lower rates of some diseases than the U.S. general population. This creates a statistical depression in military health outcomes that is real, but it is temporary not lifelong. As the cohort ages, separates from service, and enters the decades of life when cancer risk climbs steeply, the HSE depression has eroded, perhaps over a handful of years. The two DHA studies therefore capture overlapping populations through two different methodological windows during that erosive upward movement. The rightward shift is that erosion made visible. The most important sentence derivable from this chart may be: in absolute case volume, the 2024 study found more cancer than the 2023 study in almost every category for both populations, and the 2023 study found more cancer than anyone expected.

The 12 Cancer Direction of Travel chart also means that consistency across the DHA studies matters. Cancers that remain positive in both studies carry more interpretive weight than cancers that flip from positive to negative or from negative to positive. In that sense, the graphic encourages one to distinguish between persistent signals and more fragile signals that may depend on how the cohort was assembled or how incidence was ascertained. For the military active/Veteran flyer cohort(s), melanoma and thyroid are persistent. For the aircraft maintenance personnel cohort, kidney and renal pelvis cancer(s) are the most consistent positive finding.

The shifts between the two DHA studies reveal a structural problem in how DHA conducted them. The 2023 study used a narrower active-component incidence approach, while the 2024 study expanded ascertainment to all components and Veterans through state cancer registries. The broader ascertainment of the 2024 study is therefore partly methodological: it found more cancer partly because it looked in more places. This is simultaneously an argument for the quality of the DHA 2024 methodology and a biostatistical critique of the adequacy of the 2023 study. Any policy, presumptive determination, or advocacy position that rested on the 2023 numbers alone rested on a floor that may have been too low.

The red labels on the chart, the cancer names in bolded red that exceeded the SEER baseline in at least one study, are a threshold, not a ceiling. Several cancers that currently sit below the SEER baseline are moving rightward with each iterative study. If the statistical trajectory continues and as the epidemiological logic of cohort aging suggests, the number of red-labeled cancers will expand in another at-scale (large “n”) study. Then, the next, etc. until the full burden of occupational exposure becomes visible and reveals itself within the inquiry data.

Section 5: Av Cancers vs. SEER Trajectory



Military/Veteran Fixed-Wing Flyer Cancer Incidence · Pre-1992 Inferred Baseline(s) & U.S. SEER Comparison · 1992–2040

Section 5.1 What This Chart Puts Forward

The Av Cancers vs. SEER Trajectory chart is analytically distinct from every other graphic in this six-chart series. Where the preceding four charts measured what has happened, i.e., confirmed deaths, confirmed incidence exceedances, between-study directional drift, etc., this chart measures trajectory. The Av Cancers vs. SEER Trajectory answers a different question: not where has the military aviator population been, but where is it going…and how fast?

The left vertical axis measures military flyer excess all-sites cancer incidence versus U.S. parity, expressed in percentage points. Zero on that axis means the active military/Veteran population has the same all-sites cancer incidence as demographically comparable Americans. Any positive number means aviators have more cancer than the civilian baseline. The right vertical axis measures the U.S. SEER all-sites cancer incidence rate per 100,000, the civilian baseline itself depicted as a descending gray line. The horizontal axis runs from 1992 through a projected 2040.

Two DHA study lines span the chronology of the chart. The red line represents the DHA 2023 study trajectory. The white line represents the DHA 2024 study trajectory. Both begin above zero in 1992 as inferred positive baselines rise through the observed period ending in 2017 then extend forward as dashed projections to 2026 and dotted extensions on to 2040. The chart's note is direct: 1992 is not a proven biological zero. The lines start above zero because the active military/Veteran flyer cohort(s) already had prior occupational exposure before 1992 and was already on the

backside of their HSE window and well within their respective cancer latency windows when the military flyer cancer surveillance era opened.

Numerically: the 2023 study line rises from an inferred +8.0 in 1992 to +24.0 in 2017, then to a projected +32.6 in 2026, and +46.1 in 2040. The 2024 study line rises from an inferred +5.0 in 1992 to +15.0 in 2017, then to a projected +20.4 in 2026, and +28.8 in 2040. Over the same period, SEER continues its decline, reaching an estimated 364.9 per 100,000 by 2040. The 2023 study line is consistently higher. The DHA 2024 study line reflects a lower exceedance rate, in part because its broader ascertainment methodology distributed the cancer count across a larger population. However, both are climbing. The SEER line has been falling continuously since 2007. To emphasize, the SEER trajectory is in sharp contrast to military active/Veteran fixed-wing flyer cancer incidence. This chart offers another rebuttal for the skeptic who asserts there is no substantive cancer problem among military/Veteran flyers and/or active military/Veteran cancer rates are tracking with SEER data hence there is no problem.

Section 5.2 Our Synthesis of The Data

A compelling visual element in the Av Cancers vs. SEER Trajectory chart is the relationship between two trend directions: the aviator excess lines are rising, and the civilian SEER baseline is falling. This creates a scissors pattern, two sets of lines moving in opposite directions over the same timeframe. The chart does not only say that cancer exists in the active military/Veteran population(s). The chart says those population(s) are clearly diverging from the broader American pattern rather than tracking with it. Moreover, that divergence is projected to become more pronounced as time goes forward, if the chart's linear extension holds.

In 1992, the gap between what the aviator cohort experienced and what comparable Americans experienced was measured in single digits of percentage points. By 2017 it was 15 to 24 points depending on the study. By 2040 the projections suggest 29 to 46 points. This is not what one would expect from random or incidental health variation alone. Random variation produces noise around a common trend. What this chart illustrates, under the document's linear model, is systematic and sustained directional divergence.

The AV Cancers vs. SEER Trajectory chart makes a case about burden, timing, and under-recognition. Cancer incidence among active military/Veteran fixed-wing flyers should not be interpreted as if it began in 1992 simply because formal surveillance began in that year. In this chart, meaningful excess cancer burden is modeled as already present when the official observation window opened, because much of the population already had prior exposure histories and were already outside their HSE eras and well into their respective personal cancer latency windows. The implied cancer burden is therefore modeled as larger, earlier, and more persistent than a narrow reading of the official observation period might suggest.

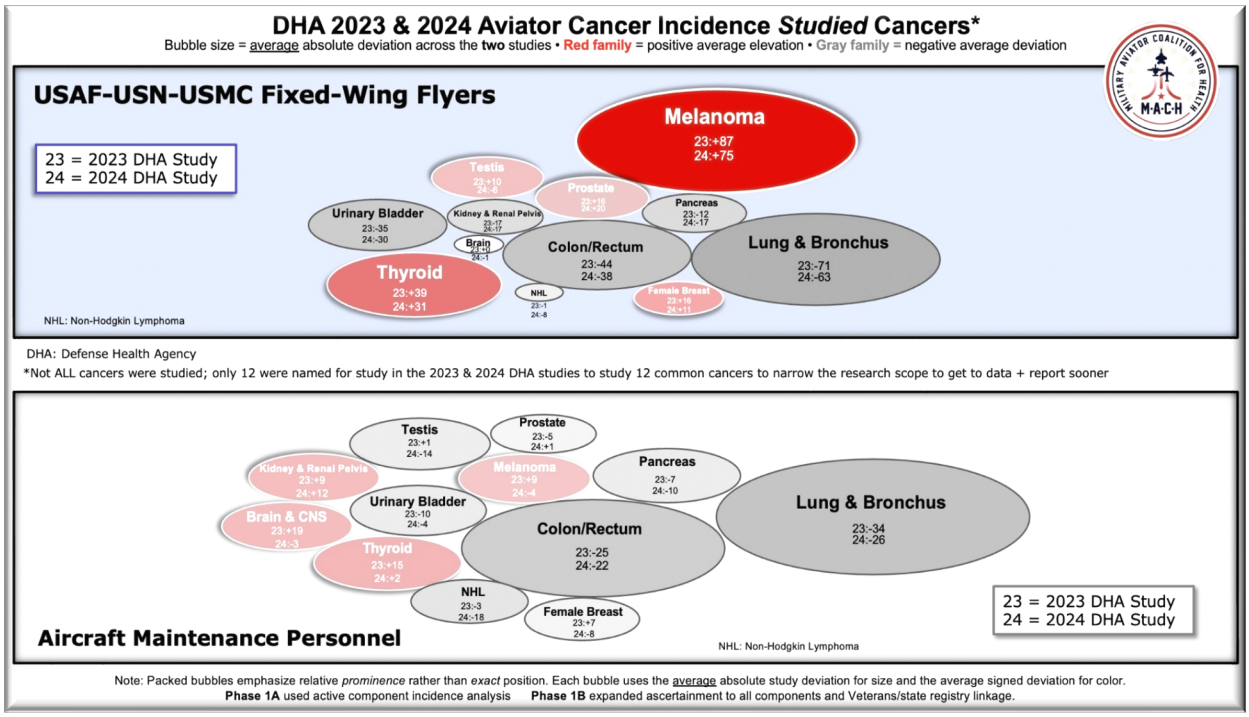
At first glance, a declining civilian cancer rate might appear to be good news for this analysis. If the SEER baseline is declining, perhaps the absolute cancer burden in the military/Veteran flyer cohort is not actually growing. That reading would miss what this chart is designed to show. The

left axis measures excess above parity; that is, the gap between the active military/Veteran flyer population(s) and their respective civilian benchmarks. When SEER falls and the military flyer excess simultaneously rises, the gap widens regardless of what is happening in absolute terms. The civilian population is benefiting from improvements in cancer prevention, screening, and treatment. The active military/Veteran flyer cohort(s) are not tracking those improvements at the same rate nor in the same direction. The result is a population potentially being left behind by the broader improvements in American cancer outcomes. The correct response to the argument that falling civilian cancer rates make military flyer cancer concerns less urgent is this: yes, civilian rates are falling, and that is precisely what makes the widening excess in military and Veteran flyers more concerning, not less.

The 2040 projections are conservative by design. The dotted lines represent the document's linear continuation of the trends the study data display. Linear extension is a conservative display choice within this document because it assumes no acceleration, no additional cohort effects, and no worsening of the trajectory beyond the implied existing trend slope. More sophisticated cohort aging models could produce steeper acceleration as Vietnam-era and Cold War-era cohorts move fully into their seventies and eighties, but that is not modeled here. Even on this linear assumption, the 2023 study line reaches +46.1 percentage points above parity by 2040. Under that linear extension, military and veteran fixed-wing aviators would be developing all-sites cancer at a rate nearly half again as high as demographically comparable Americans. Not for a specific cancer type but for all cancers combined.

The Av Cancers vs. SEER Trajectory chart makes the case for prospective surveillance more powerfully than any argument from principle. No one could see this trajectory while it was developing. It emerged only in retrospect, through studies that DHA conducted decades after the exposures occurred. Prospective surveillance would have seen this trajectory in real time. It would have detected the rising excess in the 1990s, when the cohort was younger and the excess was smaller, when interventions might have been earlier and more effective. The chart's x-axis runs from 1992 to 2040. The years from 1992 to today represent what happens when you watch a population without measuring it systematically. The years from today to 2040 represent the window in which the policy choice, to measure or not to measure, to intervene or not to intervene, likely has the power to change outcomes, and disrupt history.

Section 6: 12 Cancer Bubble Chart



DHA 2023 & 2024 Aviator Cancer Incidence Studied Cancers · USAF-USN-USMC Fixed-Wing Flyers & Aircraft Maintenance Personnel · Bubble Size = Average Absolute Deviation

Section 6.1 What This Chart Puts Forward

The 12 Cancer Bubble Chart presents the 12 studied cancers for both populations through a visual language that uses packed bubbles rather than axes that prioritize intuitive salience over numerical precision. Each bubble simultaneously encodes three variables. Size reflects the average absolute deviation across the two DHA studies: how far from the civilian baseline that cancer sits, regardless of direction. Color reflects direction: red family for positive average elevation above the SEER baseline, gray family for negative average deviation below it. Position within the packed layout reflects relative grouping without carrying precise spatial meaning. The 12 Cancer Bubble Chart is explicit on this point: packed bubbles emphasize relative salience rather than exact position.

The result is a chart that communicates differently from the preceding five charts in this document. Numbers are present, each bubble carries a DHA 2023 study and adjacent 2024 study factor. However, the numbers are secondary to the visual impression. The relative size and color of the bubbles deliver the primary message before the viewer processes any numerical label. However, to disarm skeptics, this chart is not an alarm graphic. It is a salience chart that shows both magnitude and direction simultaneously.

In the Fixed-Wing Flyer panel, the chart says that melanoma is the dominant positive signal by a wide margin. Melanoma's average absolute deviation of 81 percentage points across the two DHA studies produces the largest bubble in the chart by a factor of two. Thyroid cancer is the next clearest positive signal. Prostate, testis, and female breast cancer(s) remain positive but much smaller. At the same time, lung and bronchus, colon and rectum cancer(s) appear as large negative gray bubbles, showing that some of the largest deviations in the military active/Veteran flyer cohort(s) are below the SEER baseline rather than above it.

In the aircraft maintenance personnel panel, the pattern is mixed and less concentrated. Brain and nervous system, thyroid, and kidney and renal pelvis cancer(s) stand out as notable positive signals, but no single maintenance cancer has the same visual dominance that melanoma has among military flyers. Lung and bronchus, colon and rectum cancer(s) again occupy large negative gray positions.

Section 6.2 Our Synthesis of The Data

The 12 Cancer Bubble Chart is not an evidence document; it is an information instrument, and it ought to be restricted to such use. We hope every graphic in the six-chart series in this document rewards attentive reading. The Full Period Cancer Deaths chart, the 12 Cancer Direction of Travel chart, the 12 Cancer Incidence Heat Map, the Av Cancers vs. SEER Trajectory chart, and the 12 Cancers Exceedance Burden chart all repay the time a viewer invests in unpacking the data and following the trend lines. The 12 Cancer Bubble Chart makes no such demand. This chart, the sixth in document order, is formed to be understood in seconds by one who may be encountering this data for the first time and has no obligation to spend time with it.

The melanoma bubble's dominance is not accidental; the study data physically encode it. The bubble is that size because the number is that large. When a skeptic questions whether the visual emphasis on melanoma is advocacy bias, the correct answer is direct: the visual is the math. The 12 Cancer Bubble Chart is not choosing to make melanoma look dominant because MACH wants it to be dominant. It is making melanoma look dominant because melanoma is dominant, by a factor of two, measured against the second-largest exceedance in the same population(s).

Visual prominence is not the same as positive elevation, and this distinction must be explained clearly in any briefing context. Some of the largest bubbles are gray, not red. The lung and bronchus bubble in the Fixed-Wing Flyer panel is -71 and -63. The colon and rectum bubble in both panels is large and deeply gray. A viewer not prepared for this may mistake visual dominance for alarm. The gray bubbles are the HSE at its most visible. Active military/Veteran flyers and aircraft maintenance personnel are systematically screened for the behavioral risk factors, diet composition, alcohol consumption control, tobacco use above all, workout adherence, etc., that drive the cancers most common in the civilian population. The gray bubbles are what one might expect from a tobacco-screened and/or fitness-selected population. The red bubbles are what one would not expect: cancers that exceeded the civilian baseline despite every structural advantage working against active military/Veteran flyers.

The size differential between the two panels encodes a strategic argument that no other chart in the six-chart series immediately makes. The Fixed-Wing Flyer panel has one massive red bubble and one massive gray bubble. The Aircraft Maintenance Personnel panel has no massive bubbles of either color. This is not evidence that aircraft maintenance personnel face lower cancer risk or none at all. Rather, it is evidence that their risk is more distributed; that is, spread across more cancer types at lower individual magnitudes. The fixed-wing flyer panel depicts a concentrated above-baseline signal dominated by a single cancer at extraordinary elevation. The strategic implication is direct: flyers need a flagship cancer argument built around melanoma; maintenance personnel need a portfolio argument built around the distributed exceedance across brain, kidney, thyroid, and emerging cancers. The melanoma flagship is the most visible entry point for the broader argument, not a substitute for it. The full case encompasses all elevated cancers across both populations; the melanoma signal is where the argument begins, not where it ends.

The small pink bubbles in the aircraft maintenance personnel panel, brain and nervous system, kidney and renal pelvis, thyroid, melanoma cancer(s) are modest in size relative to the gray bubbles around them. Size reflects average absolute deviation across both DHA studies, which means that cancers with split readings between DHA studies appear smaller than their maximum exceedance value would suggest. Brain and nervous system cancers reached +19 in the 2023 study but reversed to -3 in the 2024 study, producing an average that partially cancels the 2023 signal. That bubble's modest size is a methodological artifact. The +19 is the biological signal.

The 12 Cancer Bubble Chart functions as a useful visual summary of relative prominence. It helps a viewer grasp that melanoma is the dominant positive cancer signal in fixed-wing flyers, that thyroid cancer is a meaningful secondary signal, and that the aircraft maintenance personnel cohort presents a different and less concentrated pattern. However, readers should avoid drawing the wrong insight that there are only two or three cancers at work and should be mitigated within active military/Veteran flyer population(s). Rather, the red and gray should recruit researchers to investigate further and deeper.

Synthesis: What We Believe These Charts Establish

When the six graphics in this document are read as an inter-connected narrative rather than as isolated exhibits, they establish something stronger than any single chart. The six charts converge on the same core conclusion but from six different analytic and visual vector lines. However, their convergence is the main point.

The series bifurcates into two analytic levels. The first is the site-specific incidence pattern story: which cancers stand out, how stable they are between the 2023 and 2024 studies, and how fixed-wing flyers differ from aircraft maintenance personnel. The 12 Cancer Incidence Heat Map, the 12 Cancer Direction of Travel chart, and the 12 Cancers Exceedance Burden chart do this work. The second is the career-lifetime burden story: HSE exit and cancer latency window entry, the significance of the pre-1992 surveillance boundary, the likelihood that the confirmed study floor undercounts/understates the full burden, and the finding that cumulative cancer deaths likely exceed LoD aviation deaths in this population over the same period. The Full Period Cancer Deaths chart and the Cancers vs. SEER Trajectory depict this burden. These two analytic levels are not parallel. They are sequential. Pattern explains burden. Burden justifies caring about pattern.

Three findings emerge from the six-chart series that no one chart could establish individually. First: the cancer signal in this population is selective, not uniform. Not all cancers are elevated. The consistent suppression of lung and bronchus, colon and rectum, and other behaviorally driven cancer(s) prevents the argument from appearing indiscriminate. It supports the view that the cancers exceeding the civilian baseline warrant occupational inquiry rather than being explained solely by the characteristics of the people who do the job. Second, a signal that persists across methodologically different DHA studies that used different ascertainment methods and captured different population slices is no longer a single-study artifact. It is a replicated finding. The core flyer pattern of melanoma dominant, thyroid secondary, prostate and female breast persistent survives that methodological transition. MACH's issue perspective is not '*a study found this'* instead it is '*two DHA studies, using different methods, found materially similar patterns*.' Third, the six-chart series constitute an interlocking evidentiary system, not a collection of single chart exhibits. Remove any of these charts and the argument loses weight and diminishes in impact. Present the charts in sequence and the convergence of six distinct visual presentations arriving at a common conclusion is stronger than any single finding because the main thrust of elevated cancer incidence is difficult to dismiss by questioning any one chart in isolation.

The case is no longer merely that there may be a cancer problem. The stronger claim, the one the charts collectively warrant, is that there is a patterned, cohort-specific cancer signal in fixed-wing military/Veteran flyers replicated across different DHA study methodologies. Importantly, the lifetime burden implied by that data signal is materially larger than what any single study window can fully capture. Under the document's modeling assumptions, the trajectory of the six charts points toward a potentially substantial 2040 burden visible in DHA data.

Conclusion: The Improved Outcome Strategy (IOS)

The six graphics assembled in this document, and the conclusions they collectively establish mark progress toward something MACH calls the Improved Outcome Strategy (IOS). To review, Phase 1 of the advocacy strategy had a bounded objective: demonstrate using DHA's data that a significant cancer burden exists among active military/Veteran fixed-wing flyers. The burden is patterned, cohort-specific, replicated across different DHA study cycles, and materially larger than the official surveillance record, taken narrowly, reveals. When the exit criteria of Phase 1 were met, that signaled a pivot to Phase 2 of the advocacy strategy. Before we leave discussion of Phase 1, the six charts of this paper do not support the conclusion that the flyer cancer problem among active/Veteran flyers is small, incidental, or adequately addressed by any program currently in existence. With the evidentiary floor established, Phase 2 is the present-day location and state of the advocacy strategy.

Briefly, Phase 2 is oriented on cancer causation analysis and where feasible, determination. This is our vision for NASEM's ACES study committee. What the ACES Act legislation does assert and what this committee might seek to understand clearly is why causation matters and precisely where it fits. The ACES Act legislation did not situate the causation question within a broader strategic framework. That is the gap this document addresses. Causation is not the destination. It is the bridge. It points when established toward two consequential outcomes: mitigation and outcomes improvement. What mitigation ultimately looks like is science-grounded and policy-driven. It cannot be predetermined and MACH does not claim otherwise. What MACH does and will continue to do is locate the science, monitor its development, and deploy it effectively in the policy environment where it ought to produce effect. Even before causation is formally established, the pattern of findings already points toward practical lines of inquiry. The elevated cancer types identified in both DHA studies, their distinct profiles across the flyer and maintenance populations, and the trajectory data all converge on two practical imperatives that, in MACH's view, define Phase 3 and the Improved Outcome Strategy: tailored cancer screening calibrated to the documented risk profile, and sustained institutional leadership in cancer detection technology within DoD and VA.

To unpack the Improved Outcome Strategy (IOS), its two halves are first, tailored cancer screening; second, long term institutional science and technical leadership in cancer detection. The first of these imperatives is a practical matter of calibration. If active military/Veteran fixed-wing flyer cancer rates exceed peer SEER data, why does military aerospace medicine resort to peer developed screening criteria meant for civilians who have little to none of a military flyer's occupational or lifestyle exposures? Moreover, screening criteria that do not reflect what DHA's studies document are not merely inadequate; they are structurally incapable of finding the cancers they are not designed to detect. DoD and VA must construct surveillance and detection protocols for this population around the specific cancer profile the DHA studies document, applying them

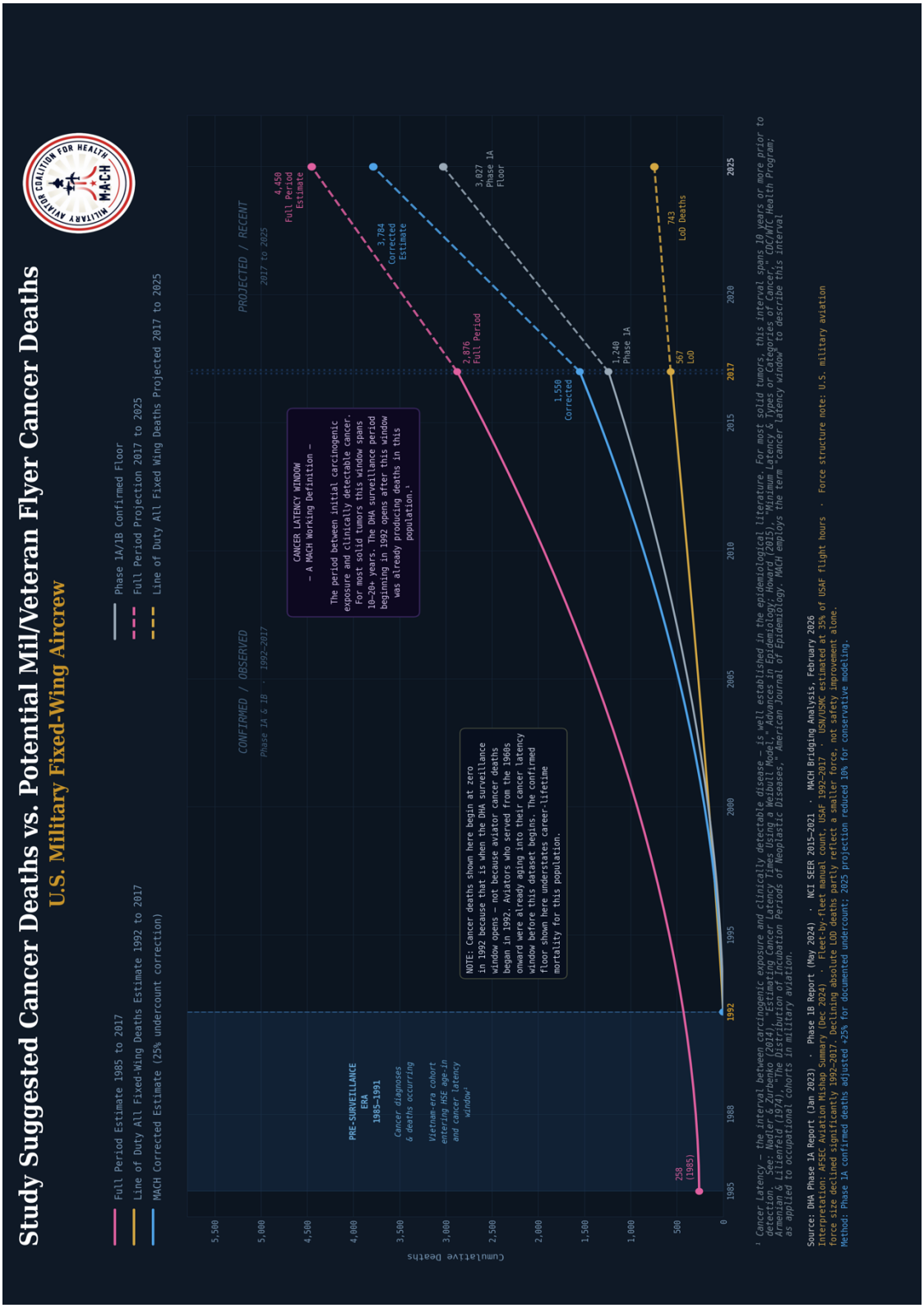
during active service and sustaining them systematically into the post-separation and Veteran years. The need is lifelong, through the transition out of the healthy soldier effect (HSE) window and into the cancer latency years when clinical disease frequently emerges. The second element, recognized and resourced DoD and VA technology and medicine cancer detection leadership, is a matter of institutional ambition. Without it, DoD and VA cannot deliver cancer care cognizant of the health consequences of flying warfighter exposures on a timeline and scale that effectively bends downward the incidence/mortality curve(s).

This is where the Improved Outcome Strategy (IOS) can help. IOS calls for sustained commitment within DoD and VA to lead, not follow civilian pacing in the development of cancer early detection technology and medicine. The military aviation community that endured these exposures, and Veterans living with these consequences, deserve institutions willing to build and mobilize the future care concept and model of detection capability around military flying specific exposures and documented individual cancer profiles. A serious enduring commitment resourced appropriately could generate knowledge and technology outputs that might in time propagate well beyond active military/Veteran flyer populations. The United States military and VA enterprise have the analytic capacity and institutional heft to visibly lead from the front of earlier, more accurate cancer detection everywhere it matters to best serve flying warfighters.

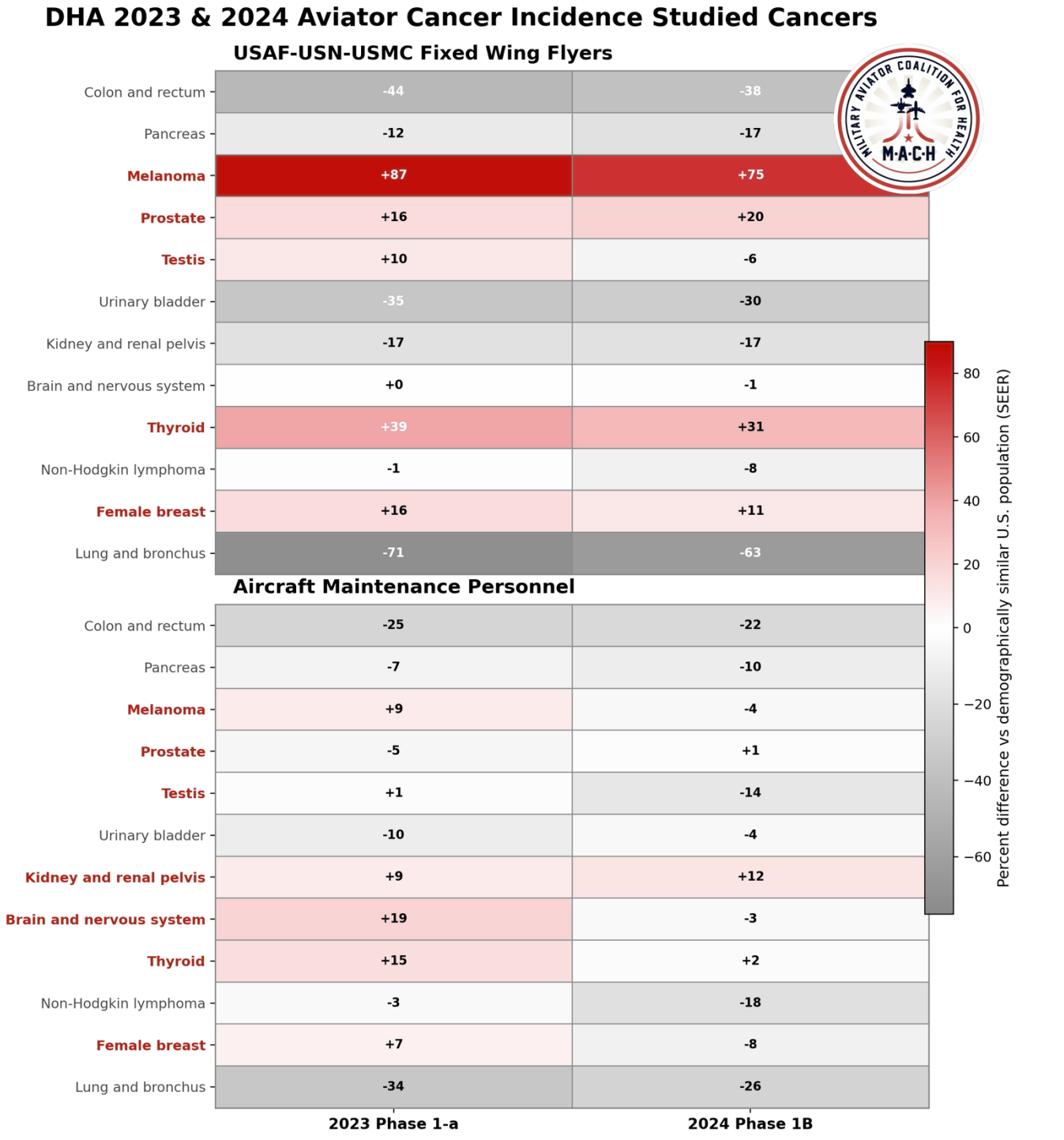
Stepping back, the six charts in this document establish the burden. The causation work underway in this study group is intended to evaluate possible causation mechanisms. We respectfully ask this esteemed committee to situate its findings within the full strategic logic that the ACES Act and the studies' findings suggest. A causation determination that stands alone, disconnected from the screening and institutional leadership outcomes it could inform, may not be sufficient to the scale of the problem the DHA studies both document. In a larger sense, the Improved Outcome Strategy (IOS) exists to provide that connection across the phases, anchor the identified endstate, and ensure that each successive body of work advances the welfare of the population it was designed to serve rather than adding to accumulated science literature without meaningful, tangible, and visible consequence in people's lives. The trajectory visible in the six charts of this document is unlikely to reverse long established health trends without coordinated and deliberate campaign-like intervention. The window in which that intervention can materially change outcomes is not permanent. What is decided in the next years concerning causation, screening, and institutional buy-in and enduring commitment will help determine what follows.

APPENDIX

Full Period Cancer Deaths

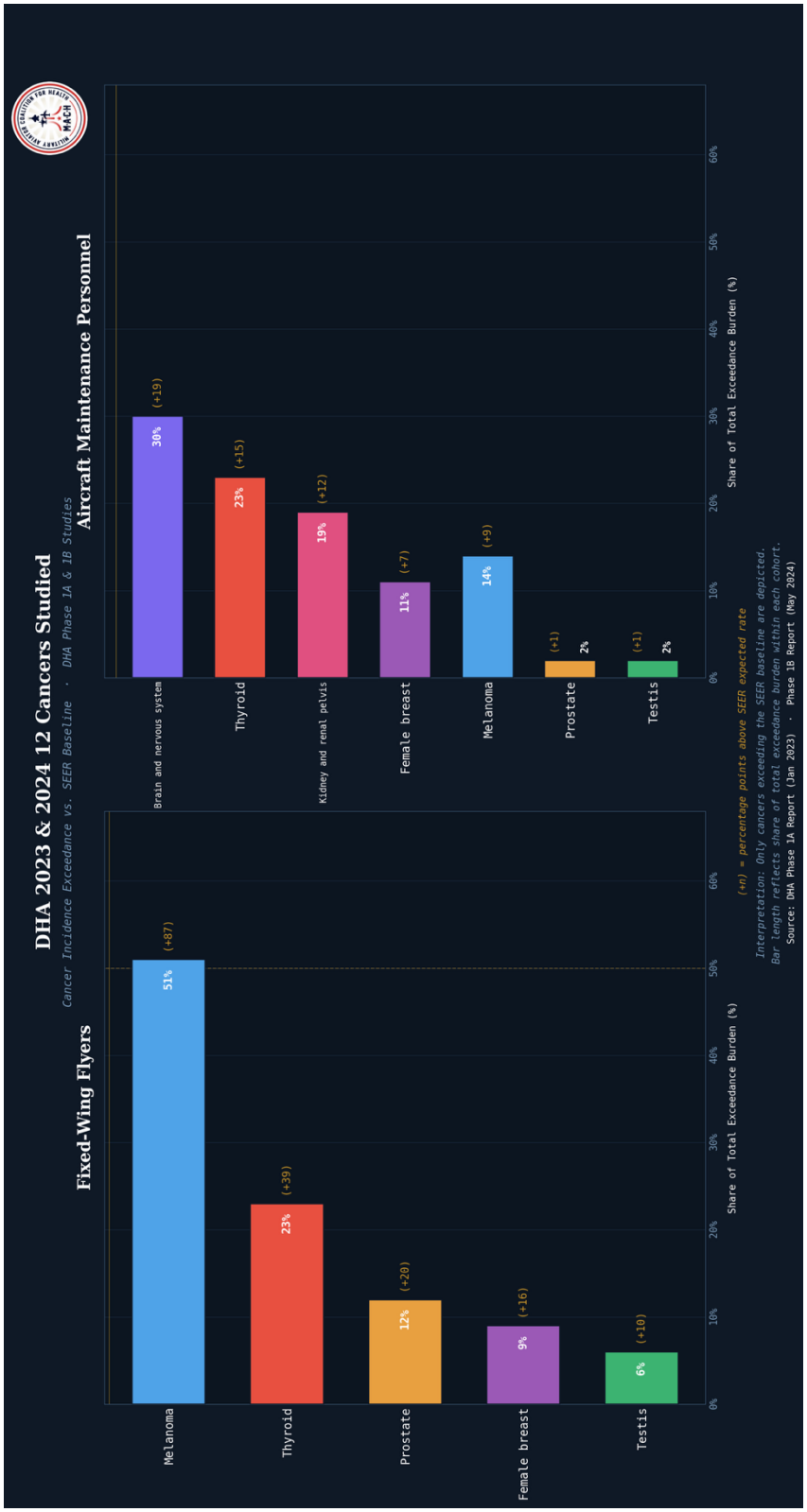


12 Cancer Incidence Heat Map

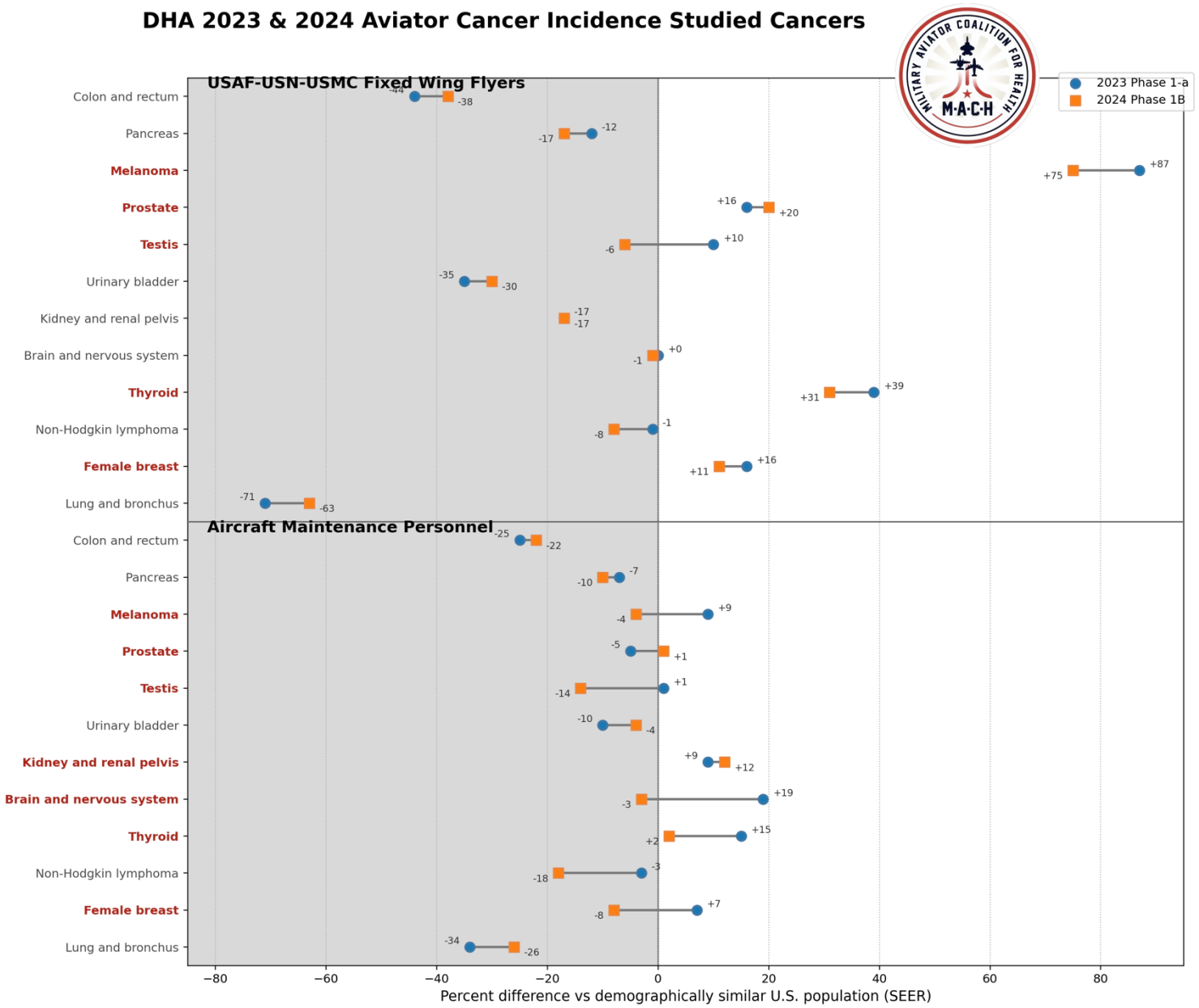


Note: this is a directional comparison across studies, not a strict apples-to-apples cohort match. Phase 1-a used Active Component incidence analysis; Phase 1B expanded incidence ascertainment to all Components and veterans/state registry linkage.

12 Cancer Exceedance Burden

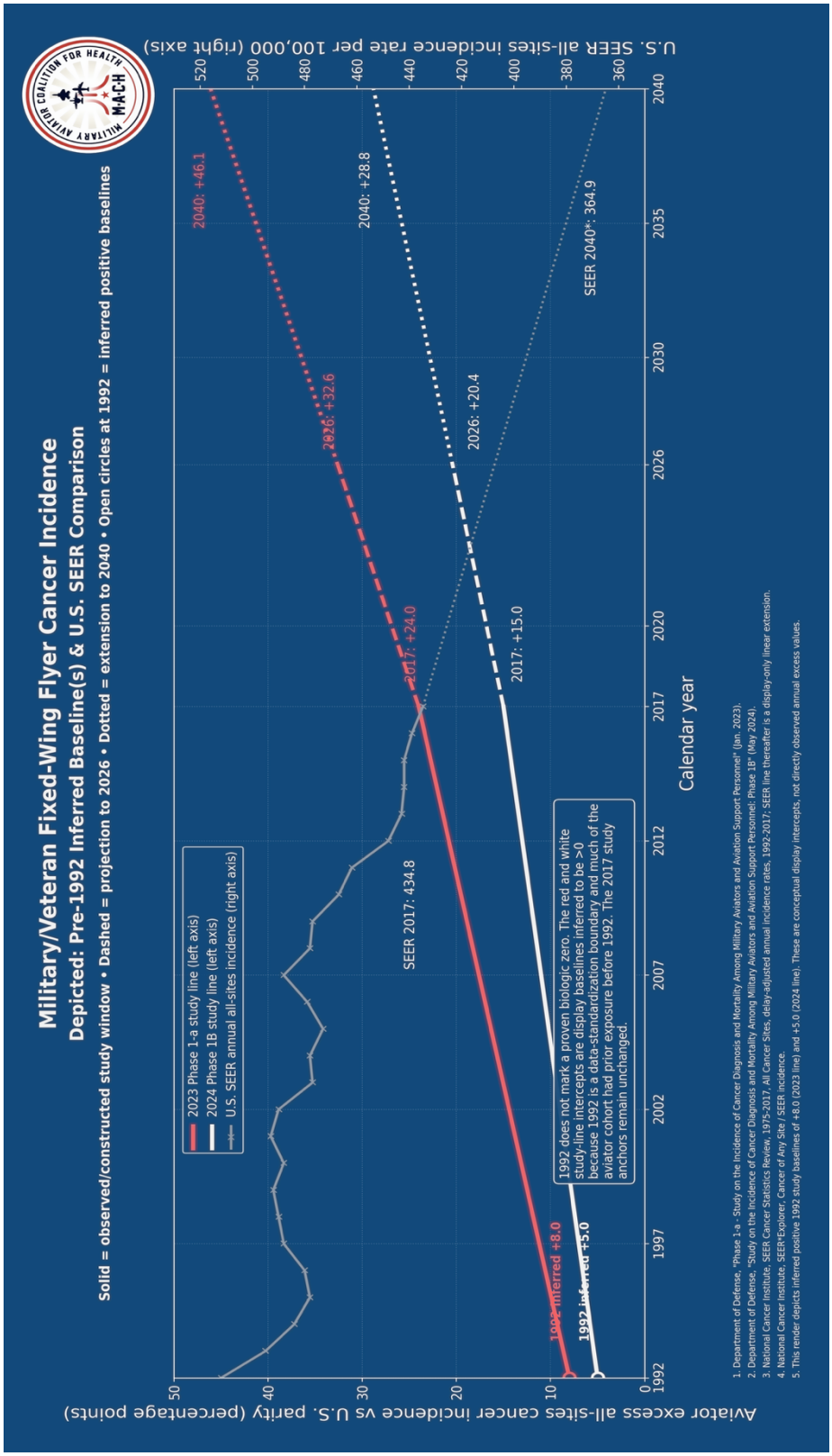


12 Cancer Direction of Travel



Note: this is a directional comparison across studies, not a strict apples-to-apples cohort match. Phase 1-a used Active Component incidence analysis; Phase 1B expanded incidence ascertainment to all Components and veterans/state registry linkage.

Av Cancers vs SEER Trajectory



12 Cancers Bubble Chart

