High Reliability Organization Council
(Ukraine office)

Changing the way people think®

Public Safety

Scientific Study

Mission to Ukraine for

Irpin, Pittsburgh, and

Other Global Cities

(Winter 2022)

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"The will to win is not nearly as important as the will to PREPARE to win."

- Bobby Knight

For Ukraine Mission launch diagrams, please see 1/5/23 entry in "Most Recent Progress to Date" section:

https://www.thinkhro.org/ukraine.html#:~:text=MOST%20RECENT%20PROGRESS%20TO%20DATE

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Overview

Based on our experience in Ukraine, ***self-reliance*** in survival and safety is better, faster, and less costly than finding, funding, manufacturing, and delivering equipment and devices to everyone affected in a public health and **public safety crisis**.

It's better to leverage just a few tools that help many people in an area, guiding those people with those key tools, and focusing training on how they can solve "***DIY"*** the problems found.

DIY (short for "do-it-yourself") checklists and videos are plentiful. However, did you ever try to solve a major life problem, or build something with a lot of parts and instructions, when **feeling** drowsy or ill, and even worse, when ***also*** worried someone in your family is seriously ill? This is how life is for Ukrainians – and other people all over the world facing crisis, including in the U.S. (as an analogy, but also in some instances literally where those ill are themselves caring for others who are ill). This impairs ***human performance*** crucial to prevent or to solve problems.

One key problem that is leading to these human performance challenges in Ukraine is what we term ***suboptimal air composition*** of air people are breathing in Ukraine. If improved, it could:

1. Improve immune response and viral infection and spread by at least 50%.
2. Increase physical strength or endurance by up to 50%.
3. Most importantly, when it comes to preparing for the worst that could befall us, it lets us think ahead far longer and far better via its 50% or more improvement in cognitive capacity.

This is on top of **prolonged stress** lessening resilience, as it harms immunity, endurance, and cognition.

There's also growing **risk of** carbon monoxide **poisoning** our research indicates – mainly due to portable generators, which our team observed are already everywhere and poisonings occurring, and a request by the Ukrainian government for many more from around the world. With less power available and more need with colder weather more in an area will occur as more households need basic electricity to survive, this means carbon monoxide concentrations in the Ukrainian cities will likely increase, bringing with it many problems ranging from cardiac to cognitive. **Improving reliability protects** from all this.

As Pres. Biden noted in Pres. Zelenskyy's recent visit to the U.S., "[Putin] is trying to use winter as a weapon. But the Ukrainian people continue to inspire the world...Not just inspire us, but inspire the world with their courage and how they have **chosen resilience and resolve** for their future." And as Pres. Zelenskyy noted in his address to the U.S. Congress, "**Your money is not charity…It is an investment in the global security and democracy** that we handle in the most responsible way…The battle is not only for life, … this struggle will define in what world our children and grandchildren will live, and then their children and grandchildren. It will define where it will be a democracy," Zelenskyy said.

With risks like a new build-up of Russian forces in Belarus, part of a plan by Moscow for a renewed invasion of northern Ukraine possibly aimed at Kyiv, as well as collapse of the energy grid, the problem is what lies ahead is probable evacuation and **mass displacement** this winter, likely leading to much suffering, and based on our predictive models used in Defense projects, many **preventable deaths**.

Surviving in Ukraine - or any crisis - requires seeing, and preparing for, what's beyond the horizon.

When we consider **empowering** people in a job, it does not just mean providing them responsibility with the burdens and worries of accountability. It also requires ensuring people can "get the job done" (along with all its specific tasks). Similarly, empowering people to better survive and then thrive means not just telling people what they need to do, and then telling them they must get it done. In war and disaster, there's a lot of things that not only should be done, but also can be done (even those items that offer little value or may not even work), and never enough time to do them all. Our research addressed the question of, "What happens when you just give people more and more checklists – and tell them to 'overachieve' to get them done?" Answer: It cannot be done over a long period of time, especially in worsening conditions. **Overachieving, by definition, is unsustainable.**

This is what **Ukraine faces**. But this also **applies to any** place in the world during a major **disaster**, or to any vulnerable population in under-resourced, higher-stressed areas (e.g., low-income communities).

Human performance is critical to empowerment. We and others have shown human performance is based significantly on our ability to think, remember, and to focus and drive ourselves, which is basically our **cognitive bandwidth**, something that is critical to not only fighter pilots in jets, but also to people fighting for their lives or populations fighting poverty, as it allows humans to reason, focus and resist impulses – yet we have only a limited amount of it, which means we can only pay attention to, think about or remember a certain number of things at one time. And where we live – and breathe – matters. In one sense, it is true that "air is free", but *poor air* (not just dangerous or deadly air such as from high levels of carbon monoxide that lead to poisoning), comes with a significant cost in many crucial areas during a disaster, especially in terms of human performance and resilience.

What we term **suboptimal air composition** is something that goes beyond poisonous or polluted air and includes the opportunity cost if air composition is not optimized beyond normal air when necessary and possible (e.g., taking O2 to 40%, reducing CO to <10ppm, and CO2 to <900ppm). Our findings, based on our analysis of other studies and extrapolating from our own studies, is that **human performance** – and thus **self-reliance** – can increase if one can change the air composition and/or our cognitive load, to better navigate the **critical resource of available thinking capacity** – that is, our cognitive bandwidth. This lets us start – and finish – those journeys of a hundred miles that "start with the first step." Today, survival in Ukraine (or any disaster for that matter) is a journey. One that quite plausibly is to the Polish border (310 miles, or 500 km, to be precise) from Kyiv and Irpin in the event of a mass displacement.

[Website Progress Updates for Launch of Public Safety Scientific Study Ukraine Mission]

Progress update new entry on 1/20/23 (which extends the mission explanation entry on 1/5/23):

1/20/23: "Preparing for the worst: Enabling a "rapid response" evacuation – one with all the key essentials for survival and contingency plans for other major problems – may be necessary in order to avoid repeating the horrors seen during the siege of Mariupol (which our team has memorialized with an "In Memoriam" video). We now have a case study of an actual example showing how to ensure quicker yet more prepared evacuations for Ukrainians, and how to help those seeking to survive each day by enabling more reliable electricity. The diagrams shown below quickly help explain how."

The bullets:

WHERE: THE SITUATION CURRENTLY IN ALL OF UKRAINE – AND ITS ALLIES

The recent news of NATO nations agreeing to consider sending tanks to Ukraine, when they have refused for so long, could have been viewed as a game-changing, welcome development for helping the nation defend itself.

However, the timing of the announcement also alerted people to a more disturbing assessment – a likely dangerous escalation is on the near-term horizon (possibly February or March, but sometime this spring is the consensus). It would probably in the form of a re-invasion of the northern parts of Ukraine, this time from Belarus (around 60 miles from our Kyiv office), in an effort to take Kyiv and install a new pro-Russia national government in Ukraine.

Ukraine has survived intact as a nation and with much less carnage than expected when the war first started, thanks to an initial failed invasion on Kyiv, an unexpectedly mild winter helping it and the West during an energy war, reduced economic headwinds from gradually-taming inflation, not facing a recession as yet (at least in the U.S.), and also smaller than expected gains by Ukraine's opponents in the 2022 U.S. election for the House of Representatives.

However, the current forecast is now fraught with additional perils, as inflation is expected to increase again with China's reopening coupled with its expected Covid surge, a recession is looking more likely as job losses mount (and some insist it is coming). And that is before we consider the implications of a potential U.S. government default on its debt -- when even when the last one was averted, U.S. Treasury debt was downgraded, implying higher borrowing costs for the Federal Government and less money for defense, healthcare, Social Security, and other programs. This is as Russia does covert and open mobilization, again massing troops along the border, with most Ukrainians already feeling exhausted (in Bakhmut, "hellishly tired" they say) – and anxious, as a U.S. poll shows 52% of Republicans oppose further Ukraine funding.

And though fewer in number than expected, the House appears to be led by some of the most vocal anti-Ukraine Congressional members. Even the CIA director recently briefed Pres. Zelenskyy on how long Ukraine could expect U.S. and Western assistance to continue following Republicans' takeover of the House and a drop-off in support of Ukraine aid among parts of the U.S. electorate. All of this adds fuel to the question of if the West is ready for a long war.

Thus, cuts may be coming to how much assistance Ukraine can hope to get in the future.

But we believe cuts will be less likely in defense and instead more likely on the lifesaving humanitarian side. The reasoning is that Republicans have a considerable number of defense hawks that are loathe to cut defense spending, especially that can actively weaken our military opponents (e.g., that of the growing alliance between Russia and China), so military aid can be seen as following the "fight them over there so we don't have to fight them here" maxim.

So, these CUTS will LIKELY be in HUMANITARIAN items that help in survival, like essentials of communication, warmth, and health, where a narrow vision of "America First" politicians will want money spent only in the U.S., regardless of the fact that fighting Russia means less risk and cost later to our own soil, as we found in World War 2 as the Nazis advanced and took over armies and resources along the way that only strengthened their menace.

Thus, public safety and health "survival essentials" of electricity, heat, and air composition are all going to be rising in need from the humanitarian partners of Ukraine, coupled with Ukraine's own growing SELF-RELIANCE in those areas if we can implement our approach throughout the nation (i.e., our Checklist & Procedures for Survival Essentials, in our prior progress update).

And the threats to survival have increased to levels not seen since the beginning of the war. For example, the Dnipro residential building destruction shows that there are no limits on Russian civilian attacks, and that there are in reality no safe havens in Ukraine. One news agency noted that what makes the Dnipro attack particularly repulsive is that it struck in the heart of a city that had been regarded as a safe haven for internally displaced people (IDPs) since hostilities by Russia started in 2014. With a warhead of nearly one metric ton, it created a scene of destruction described by some in Dnipro as "hell." The shock could very well create a second generation of IDPs, placing additional strain on already congested safe havens such as Lviv in western Ukraine (and, in HROC's opinion, thus more inviting clusters for Russia to attack).

Moreover, Bakhmut shows that encirclement and sieges are still a tactic today by Russia, not just at the beginning of the war in Mariupol. Civilians become pawns in the battle and become leverage by Russia to force Ukraine to navigate either defending the nation or saving their own people trapped mercilessly in cities. At some point, it also becomes so horrific as to demoralize people, perhaps not in Ukraine, but certainly on even well-meaning people witnessing the atrocities or suffering (e.g., according to the U.N., children continue to be killed, wounded and deeply traumatized by the violence all around them, and families have been separated and lives torn apart in Ukraine) from afar and wanting it to stop, no matter what the price. This leads to indecision on the part of allies, as fractures emerge in NATO itself on how best to help Ukraine.

Bottom line is that we must avoid people becoming clustered, encircled, trapped, and made easy targets for relentless bombings with no escape. This requires THINKING AHEAD.

There was also the blow to civil defense this past week as the Ukrainian Interior Ministry leaders died in a helicopter crash near Kyiv. The Minister rose to the challenge of rallying international support for Kyiv's fightback when Russia launched its invasion in 2022, giving interviews to the world's press warning of a "humanitarian catastrophe" and highlighting the challenges faced by Ukraine's emergency services (which comes under the interior ministry's control). The Ministry oversees the National Police of Ukraine, National Guard of Ukraine, other functions, but most pertinently, State Emergency Service of Ukraine (civil defense). Thus, with the loss of national, experienced leaders in the helicopter crash, civil defense will need more local leadership.

Ukraine undoubtedly has courage, but in 2023 will most likely find itself needing to rely more and more on resourcefulness and resilience -- that is, using what it has available at the local levels, and being able to as self-reliant as possible within its network of remarkable people defending one another in the face of dangers beyond comprehension even to those helping who fought in wars like Iraq and Afghanistan (e.g., where they could at least rely on air support).

These are individuals who may not be losing their bravery to defend and survive against all odds, but they are eroding physically (as many as 60% of Ukrainians could enter poverty this year according to the World Bank as Ukraine's economy contracted by 35% in 2022; also heavy fighting produced disastrous levels of air, soil, and water pollution), mentally (25% of the population will develop mental-health conditions), and invariably with that erosion will come the emotional toll which hammers at the critical will to fight in a war to defend one's nation.

This is all in spite of Ukrainians, and most of the leaders of the free world, recognizing that Ukrainians fight for survival is also the fight for freedom for both Ukraine and for democracies defending against tyrannies all over world.

WHO: HROC-UKRAINE AND HROC-USA

Given the stakes, our teams at the High Reliability Organization Council (HROC), one team in Ukraine, and the other team in the U.S., have one single primary mission: preparation.

Based on seeing what is happening on the ground in Ukraine, and what people are facing (as well as what is seen in their faces), that can help Ukrainians survive and defend their nation – it is by being ready for foreseeable and likely disasters-in-waiting (preventing catastrophic loss is key to any High Reliability Organization, especially from not only doing the wrong thing, but also from not doing the right thing in time).

Our approach follows the proverb of, "Give a man a fish, he eats for a day. Teach a man to fish, he eats for a lifetime." And it is through our training seminars (used by the U.S. Department of Defense), training and promotional videos, and documentaries that we educate – while using unique methods to make sure people become reliable at what they learn, and thus self-reliant in what they need to do in order to make changes quickly.

Even if the will to fight -- and the will to win -- are there, a quote by a famous basketball coach summarized it best: "The will to win is not nearly as important as the will to PREPARE to win."

From the start of our mission to Ukraine, we have been concerned with finding ways for people to survive locally wherever they are – both at home and when they are on the move.

We believe our Ukraine office can't rely on getting enough resources from outside the nation to enough people inside Ukraine in time, so a "go-locally-sourced DIY" approach is the only option now, especially for maintaining the vital communication link of smartphones at this moment.

This then also enables people to harness smartphones to evacuate in the quickest and safest way, before people can become trapped in a nightmare beyond belief, which is a siege where people are then choked off from the basics for survival (e.g., the siege of Mariupol).

This month, as the war grinds on during the historically colder parts of winter, we expect more energy and critical infrastructure to be destroyed by Russia faster than it can be fixed or parts replenished, meaning:

1. More electricity coming from carbon monoxide-spewing portable generators will be in use, polluting the air – and where even low-levels of the carbon monoxide (CO) impairs people's minds and bodies, reducing ability to think and prepare. It also means a greater need for alternative sources of electricity, since portable generators are scarce and very expensive.

2. More heating coming from sources of wood that are more difficult (e.g., farther), more dangerous (e.g., in unknown areas that could be mined, or using wetter wood that burns worse and with more carbon monoxide), and leading to more coal burning, also releasing more CO.

Pres. Zelenskyy recently requested that businesses in Ukraine help set up Points of Invincibility (POI) in greater numbers around Ukraine. HROC can obviously help POIs seeking to address areas such as suboptimal air composition, which we view as a significant barrier to safety. But we do not plan to do full POIs ourselves, since we are not optimal (i.e., builders) for that.

However, we can instead create various models of "partial-POI" shelters, and the standards for what is needed inside them and to what degree, with our checklists. We are then giving that to the mayor of Irpin to help health and safety of POIs in that city, while also helping in the DIY of partial-POIs elsewhere in the city. We're donating HROC expertise and scientific effort to Irpin, while we also try and do more fundraising and economic development on its behalf. Thus, HROC is a charitable NGO trying to help set up these partial-POIs anywhere, and also set up what we call In-House Safety Areas (IHSAs) to serve as reasonably reliable shelters-on-the-go (given there are less subway-like shelters as you go further away from Kyiv), and finally the evacuation packs ("EvacPacs") that enable the stationary partial-POIs and the mobile IHSAs.

WHY EVACUATION PREP IS SO URGENT AND CRITICAL

The moment we are in is being considered the pivotal moment in the war by many. And we believe this moment is indeed that, and for many reasons. However, we have discovered some reasons that are hidden from plain view, as they are found inside the human mind.

As background, the threat of deadly escalation reminiscent to the war's early days was also reinforced by the news the past week that Ukraine is prepares for a new invasion by Russia and Belarus as they begin joint drills. To quote, "amid reports of Russian troops and armor pouring into Belarus...Belarus and Russia began joint military exercises, adding to fears that Moscow will use its ally to launch a new ground offensive, as it did the invasion in 2022. Air force drills will be held until Feb. 1 using all of Belarus' military air fields and joint army exercises involving a 'mechanized brigade subdivision,' the Belarusian defense ministry said."

This puts our HROC-Ukraine team, who is in the Kyiv area, at risk, since Kyiv will be the city that is the top target of Russia – as well as Irpin, which is even closer to Belarus (only 87 miles, or 140 km) where the mayor has asked for our help, and is our first major aid project.

Others are believing also that not only could see Russia launch a ferocious new offensive, but also – given a Russian cruise missile attack on a nine-story apartment block in Dnipro, in central Ukraine, that killed 45 people including six children – that any hopes for a negotiated end to the

war are more distant than ever. “We are facing the collapse of the world as we know it, the way we are accustomed to it or to what we aspire,” said Ukrainian first lady Olena Zelenska at the World Economic Forum. This war will, in the best case, likely last a long time.

Retired Gen. Wesley Clark, the former NATO Supreme Allied Commander Europe, told CNN that the West had to do much more, especially in the aftermath of the Dnipro attack. Russia is not relenting on what it’s doing, Putin is mobilizing more forces. Putin is planning for another offensive,” he said. Biden’s legacy in Ukraine – considered one of the most significant and so far successful US foreign policy ventures in decades – depends on continuing to bankroll and arm Zelensky’s forces for as long as a conflict with no end in sight lasts, likely to create continuing problems and friction with Russia and the new people in U.S. Congress against Ukraine aid.

This brings us to the first reason for an “evacuation rapid response” – a new ground invasion.

The paradox for Ukraine is that Russia can, and likely will, continue to swing from desperate, to overconfident, to calculatingly deliberate. Our HROC-USA team has modeled Russian behavior not only on the field but also in the information warfare space, and forewarned our team what to expect, and has been correct at least 75% of the time in terms of significant risks and trajectories. For example, we stated during the summer that the winter would be when Putin would try and win the war – and use brutality to do it. This proved correct, not matter how easy it was for some (but surprisingly few, as noted by our team) in Ukraine to foresee.

Moreover, we also noted that given how angry Putin seemed to be about the victory of the Ukrainians on the battlefield against the bunkers of troops, possibly removing 700 or more troops from the battlefield, he would respond likely with a new wave of severe attacks on civilians. He not only responded by moving hypersonic missiles closer to Ukraine (which have little to no time for air raid sirens to give advance warning nor for anti-missile defenses to block the attacks), but also committed the atrocity of the largest attack away from the frontlines since the opening days of the war (Dnipro), happening within 2 weeks of the Russian barracks bombing.

In fact, hypersonic missiles are another reason why evacuation away from at least Kyiv and Irpin may become the safest option. Most early warning systems (EWS) and missile defenses won’t work effectively against hypersonic missiles. At less than 90 miles from Belarus to Irpin and Kyiv outskirts (as little as 60 miles “as the crow flies”), and at a missile speed of 6,000 kilometers per hour (around Mach 5; others say it flies at Mach 9 or even Mach 10), this means less than 2 minutes (actually 1.4 minutes, or 0.7 minutes if Mach 10 – that is, only 42 seconds) of advance warning from missile detection.

This can then create even more of a “too much to do in too little time” (given the shorter lead time). Our research shows this is a recipe for task saturation and panic, leading to fatal errors. Unless people want to live full-time in the shelters, it is extremely unsafe and thus difficult to avoid panic, since there is no time to get from one's residence down into a shelter – and any attempts would likely lead to even more of a stampede and falls or trampling injuries or deaths.

NATO could try and respond to a threat such as hypersonic missiles, or other Russian military technology escalation, with even greater military transfers to Ukraine to help defend the millions of Ukrainian citizens at risk. But with Britain complaining about fellow NATO member Germany’s delays on tanks, and even the U.S. concerned about “solvency” risk (i.e., indefinite U.S. military support for Ukraine will meaningfully limit the Pentagon’s own supply of armaments, and as a

former commander responded with concern: “I wouldn’t say we’re quite there yet, but if the conflict does go on for another six months, for another year, it certainly continues to stress the supply chain).

This makes an additional argument for why evacuation may be the best course of action in the event of extreme, violent escalation by Russia – being able to get Ukrainians to NATO nations quickly and under their “nuclear umbrella” would greatly reduce the preventable deaths, and it would require less weapons to defend civilians in Ukraine if they are in a NATO nation.

Otherwise, the U.S. losing its weapon solvency is where U.S. politicians that are defense hawks would switch to actually not wanting to provide Ukraine more aid. And if Russia waits till the weather warms to invade, it may actually make it easier to have Poland and other nations help Ukrainians in refugee camps (e.g., not having to worry about heating and too much strain on their own nations’ critical infrastructure, especially if refugees bring their own electricity) – that is, timing may actually work for us if it is actually spring before Russia launches its re-invasion.

Paradoxically, increasing NATO weaponry may also lead to another reason evacuation may become more urgent. The reason is because Putin has been a reactive, if not rash, leader, with decisions depending on battlefield reversals. For example, after Ukrainian forces retook Kharkiv in a bold September counteroffensive, Putin hastily “annexed” four regions where Russia’s hold was precarious. After Ukrainian special operations forces bombed the Kerch Strait bridge to Crimea in October, a desperate Putin launched a missile assault on Ukraine’s civilian infrastructure that continues to this day. Another example of why cities Russia wants, but can't get, could likely face civilian atrocities and deadly ruin is Kherson city, which Ukraine liberated and now Russia is destroying, including striking the city’s children’s hospital.

General Valery Gerasimov, the chief of staff of the Russian military, this month was given the thankless task of directing Russian forces in Ukraine. Since Gerasimov helped plan the botched invasion last February, this might seem like doubling down on failure. But U.S. analysts believe that Gerasimov has promised his boss, President Vladimir Putin, that he will employ more aggressive tactics to regain the initiative.

BOTTOM LINE is Putin will get even more aggressive and brutal with this new director of forces.

This means time is not on Ukraine's side, unless there is a game changer. That game changer, we believe, can be based on innovative defenses that build resilience and reliability, and enable all current and potential allies to withstand acts of aggression that lead to calamitous disaster zones, especially by opponents that do not hesitate to commit war crimes.

Former Defense Secretary Robert Gates and former National Security Advisor Condoleezza Rice are both convinced that Putin believes time is on his side – that he can wear down the Ukrainians and that U.S. and European unity and support for Ukraine will eventually erode and fracture (and though the Russians will suffer as the war continues, they have endured far worse). If he can’t win this year, he will feel he must retain control of positions in eastern and southern Ukraine that provide future jumping-off points for renewed offensives to take the rest of Ukraine’s Black Sea coast, control the entire Donbas region and then move west. Much of its mineral wealth, industrial capacity and considerable agricultural land are under Russian control. Ukraine’s military capability and economy are now dependent almost entirely on lifelines from the West (primarily the United States). But the economies of the world (including the U.S.) have seen inflation and a drag on growth caused by Putin’s aggression and, unaccustomed to it, will

have political pressure, as well as economic. Under current circumstances, any negotiated cease-fire would leave Russian forces in a strong position to resume their invasion whenever they are ready.

Their recommendation is that NATO members also should provide the Ukrainians with longer-range missiles, advanced drones, significant ammunition stocks (including artillery shells), more reconnaissance and surveillance capability, and other equipment – with these capabilities being delivered in weeks, saying it is better to stop him now, before more is demanded of the United States and NATO as a whole. They note NATO has a determined partner (Ukraine) that is willing to bear the consequences of war so that NATO does not have to do so itself in the future.

All of the above brings us to second reason for evacuation rapid response – Ukraine's battlefield successes, or Ukraine's increasing battlefield strength of (i.e., from NATO).

The third reason is that in recent months, the Ukrainian government has also discussed evacuating the city if there is a collapse of the electrical grid.

And a collapsing energy grid seems to be the trajectory, considering it has been considered on the brink already recently, and moreover the trendline is worsening each month with continued Russian bombardment of critical infrastructure, as replacement parts become more difficult to get and put in place to fix the grid each time.

Energy infrastructure losses have grown from 30% in October within just a couple weeks of week of attacks, to 40% damage in November, to about 50% energy infrastructure lost or damaged at the beginning of 2023.

Moreover, the Ukrainian electricity company CEO admits that the Iranian Shahed-136 drone just as deadly as Russian cruise missiles against the nation's electrical grid. This means Russia can continue the attacks on Ukrainian energy infrastructure, even if Russian inventory of missiles and drones would run low and production capacity in Russia couldn't keep up.

In fact, the collapse of Ukraine's energy infrastructure could happen at any second, says the mayor of Kyiv, which would then imply (based on the government plans) that the evacuation of Kyiv (and likely its surrounding suburbs, like Irpin) could happen very quickly.

Given all this, beyond a government-mandated evacuation from energy grid collapse such as in Kyiv, if there is indeed a re-invasion, it likely means that some people will want to evacuate.

Above are the three reasons to evacuate. Now for the two nightmare scenarios that would result if evacuation becomes necessary and people are not prepared, and they fail to get to safety.

First, in a panicked evacuation that can't be coordinated (e.g., if smartphones are rendered inoperable to guide and warn people), people could end up moving toward greater Russian danger, or not be aware of/prepared for what they will face during a journey to greater safety.

Second, we believe – given Russia's tactic of sieges (used against Mariupol and Bakhmut) – that all civilians should be ready, willing, and able to evacuate areas being reinvaded in the north (such as our initial focal-point city of Irpin, given the city's needs outlined to us by its mayor for our winter mission) by a joint a Russia-Belarus military force. The reason is that the alternative to evacuation is to face a siege and thus likely be deprived of basic necessities such as food, water, power, and medicines, to the point of desperation given the lack of conscience shown by Russia thus far in the war, as well as its eagerness to end the war before sanctions

begin to really take hold this spring once the winter heating crisis subsides for the West and as they reduce further their reliance on Russian energy. But if people fail to evacuate, they will be trapped in a possible siege scenario. And likely at least some portion will fail to leave in time, and have to rely even more on smartphone communications in order to arrange an escape.

Therefore, we are focusing on civilians' self-reliance, to both quickly and safely evacuate – and reduce risks to survival to those trapped during a siege. This can also reduce the preventable harm, suffering, and deaths that would occur in hundreds of thousands of people that would become internally displaced or fleeing out of the nation. If the latter occurs, it would create the need to help refugees further that seek safety outside the nation, where they may have to travel for long distances, perhaps even by foot for significant portions of their journey.

And most of these evacuees will be women and girls (65% according to a key estimate, and even unaccompanied children according to news we have heard).

There are those who will, of course, bravely defy the Russians, reducing our ability to achieve our outcome, which is a safe evacuation. But isn't it often considered courageous if a person stays in place to defy the Russians? Yes, and that may work for some, but not for all. More importantly, once the window to evacuate passes, it may never return, as many people in Mariupol discovered in the harshest possible way. It can also consume inordinate resources (or concessions or trades with Russia) later to defend near-term or evacuate later when the situation becomes untenable, which also happened in Mariupol. In addition, even if an individual wants to stay, that can still result in worry by other people, including beyond loved ones (often daughters of elderly parents). This then wears down or demoralizes (when morale is crucial in a war of attrition) them when Russian brutality claims more victims.

Being prepared for speedy and safe evacuation is the ultimate defense, not just to save lives of a nation (the key role of any defense) but to also prevent Russia from taking more hostages as leverage in negotiations or to break people's will. The fewer loved ones or people in immediate danger, the more courageous focused defenders of the nation can actually be in the face of a brutal and remorseless enemy. One need only look at what Stalin did in his police state: he'd threaten brave people's loved ones in order to get submission, even as he killed as many as 20 million or more Soviets – millions of them at that time being Ukrainians who lost their lives.

WHAT IS MOST IMPORTANT GENERALLY IN EVAC PREP

We believe the most important capabilities will be in "physical energy" (i.e., electricity, especially for smartphones above all else) – but first "mental energy" in the form of cognitive bandwidth to learn, prepare for, and implement at the moment of crisis the steps needed to survive.

All the potential causes of, and effects from, the need to evacuate noted in the section above mean that Ukrainians must have the essentials to survive an evacuation (or evac for short), but the prerequisites for capabilities of these survival essentials are they must be: 1. Feasible (i.e., it needs to be cost-effectively and time-effectively completed), 2. Portable (i.e., can't be heavy or bulky when people are having to be mobile), and 3. Reliable (i.e., people must be able to count on it in an emergency).

This is the nature of our "HROC Ukraine Winter Mission" – having Ukrainians create their own capabilities to survive even during a rapid evacuation, with what we call “lifesaving self-reliance” based on do-it-yourself (DIY) High Reliability.

These capabilities to survive are also needed even before an evacuation, given that about 16 million Ukrainians have had to leave their homes so far (internally displaced inside Ukraine, or refugees outside the nation, and possibly in camps or makeshift communities. And up to 18 million people, or 40% of Ukraine’s population, will need humanitarian aid in some form in the coming months.

WHAT IS MOST VITAL SPECIFICALLY IN EVAC PREP

Based on the experience of our team living inside Ukraine, there is nothing that is more valuable to survival than operable smartphones (including first and foremost having power, since Starlink or WiFi can help even if the cellular network goes down), and there are many reasons for their importance. For example, without a smartphone, people lose the following advantages to help them in survive in a disaster zone:

1. Receiving warnings and alerts (e.g., attack or disaster happening) for immediate problems.

2. Communication with loved ones to get them help they may need (or you may need from them), or at least not worry about them as much (since anxiety reduces wastes cognitive bandwidth and lowers human performance).

3. Information on how to solve problems (which can be stored on the phone), or at least get guidance of what to immediately do and not do. Or actually solving problems, like a working flashlight, clock/timer/alarm, camera, etc. All of these capabilities are available to some degree, whether a cellular network is available or not).

4. Awareness of risks that may be coming in the future to help plan whether and how to prepare (e.g., like Russian troops seen in the area and the need to hide).

5. A computer-like device to get on Internet for some, which may be the only means to buy and pay for things (e.g., via PayPal, Venmo, etc.).

6. Law enforcement quick access, which typically increases criminal activity, since victims can't call police, and neither can those around those victims, without functioning smartphones.

7. Low-power consumption (only 5 to 10 watts) device for computing, forcing people to use more power-intensive laptop computers (about 30 watts or more often needed), assuming they have one. And if no laptop, besides increased power consumption, there is also reduced mobility if have to rely on desktop computers at home, libraries, Internet cafes, etc. – making smartphones especially critical during an evacuation. And of course, the worst case is no computing device at all.

Important note: Our team in Ukraine believes they are all still using regular cell towers, not Starlink (which is mostly being used by troops). However, even if cell towers are destroyed, locations may set up Starlink to then have people with phones communicate by accessing WiFi networks. Hence the reason always-charged smartphones are always valuable.

HOW: THE MENTAL PROCESS AND PHYSICAL IMPLEMENTATION FOR PREP

For electricity, as we had noted in our 1/5/23 progress update (which is the next website entry below), the Ukrainian government has requested the world to send it as many portable generators as possible. However, these machines have many problems in a disaster, such as not being truly portable when evacuating on a scooter, bike, or on foot, or even in smaller or already-filled cars. Portable generators also require costly diesel or gasoline as fuel which may be costly or scarce. They are too expensive for many to buy – or even keep. A problem with portable generators around the world during disasters, precisely because they have to be far away from the residence, is theft, with some even saying "out of all of the items in your house, you probably won't find anything as expensive that's as easy to steal!"). They are not safely operable in wet conditions (as they must be operated outdoors). And, above all, they emit dangerous quantities of deadly carbon monoxide – on average 1.5 kilograms per hour as they run (more than a 400-car traffic jam).

HROC's Ukraine Winter Mission is less about winter cold now than enabling an effective and safe evacuation – one that reduces preventable deaths and suffering – whether evacuation is due to a critical infrastructure collapse or to Russian re-invasion from Belarus. We believe that electricity for smaller electronic devices is the quickest major battle that civilians can win. But preparation must be soon – and if people don't mentally prepare, they won't physically prepare.

A key concern is that this re-invasion could occur as early as February, creating widespread panic if the ferocity of Russia's offensive is as terrible as we predict (and as this war's history suggests), if people are not prepared survive when internally displaced and forced to become mobile. Survival when migrating to safer areas for those not actively involved in the fighting will be critical, including to the morale for those who are defending the nation on any of the frontlines, since rescue of civilians also can put troops in more difficult situations.

Thus, HROC's efforts this winter for a critical checklist started with the concept of a safer, more truly portable generator that we have tested as "reliable power" for the most essential electrical device in Ukraine – the smartphone.

Even if there is not a sudden need for an evacuation, whether from invasion, collapse of the power grid, or a sadistic retaliatory rain of bombs from a Putin angered by battlefield losses, there is still a "slow bleed" of the energy infrastructure (which at this rate will still eventually lead to a total loss of power) due to very visible targets that are relatively few in number. What can work for more resilient and reliable power, rather than the cycle repeating of destroying and fixing the grid, as replacement parts run out and the pace of destruction seems to increase?

Our researchers' DARPA work, where much of our current innovations in reliability originated, is instructive. That work was to make a more resilient and reliable network of computers. The goal was to protect against Kremlin-launched attacks directed toward "information retrieval" server infrastructure back then, to prevent complete failure and ensure access to critical data at all times. This is called fault tolerance, which enables a system to continue operating properly in the event of the failure of one or more faults within some of its components. In our present-day work, this fault tolerance includes not only computing devices (i.e., smartphones), but also even something more fundamental for human survival today – electricity-generating infrastructure.

In all our projects, we have employed some form of “load balancing” in order to reduce clusters of nodes that become failure points. To make a resilient network, one must use distributed systems that can make things or people more self-correcting and thus self-reliant (as an aside, this is actually the same principle as a plane’s autopilot, which uses 3 parallel computers and takes instruction from any 2 that agree at any given time). We intend to help make resilient networks – one for smartphones serving up information/communications, and another for drones serving up supplies. To accomplish this, we will help implement distributed power systems, supplementing the centralized power system that is a much easier target for Russian bombings. We will strive to help all cities in Ukraine, but especially those at risk of needing a rapid response evacuation to save lives (e.g., Irpin and Kyiv) and use our DIY crank generators to accomplish this fault tolerance in electricity generation.

In short, the project is for the lifeline and (electric) power to evacuate safely. Moreover, they say "knowledge is power" – and without cognition there is no knowledge. With the above, we have described the physical energy vital component. Now for the mental energy, explained below.

As our 1/5/23 progress update also explained, there is significant preparation that must be done in order to reduce the risk of these preventable deaths. However, we also noted that preparation itself is not a “hand wave” of magic – it is most often a challenging process. And for many reasons, but fundamentally cognitive and psychological, the starting of – and completing – of these processes is the first and foremost objective.

This is where “preparation runs into procrastination.” This includes even for the essentials to survival preparation we are teaching, which uses locally-available, or even household, items and resources and can be done in a DIY manner – all to help families survive. This preparation needed to start yesterday, so to speak, but we’ll all settle for as soon as possible.

Our research on the notion of procrastinating is that it is both a willpower (and thus dopamine) issue and then also a “horizon vision” issue of both seeing problems and their dangers at a distance, as well as solutions and their value from a distance. Both of these issues need bandwidth to see a decision tree (i.e., the “if this, then this…” and “connect the dots” done when reasoning and problem-solving) and the action plan needed as a result of these decisions. It also requires having the motivation to power through the decision tree, and the impulse control to not become distracted from making it through to the end of the process.

As one researcher (and clinical psychologist) states, despite the common misperception, laziness usually isn’t the reason behind procrastination. “Laziness is like, ‘I have absolutely no desire to even think about this.’ Procrastination is, ‘It troubles me to think about this. And therefore, it’s hard for me to get the job done.’ That’s a big difference.” Visualization works,” the expert said. “If you can visualize yourself completing (a task), then it becomes more achievable simply because you have an idea that it can be done.” At the end of the day, how you approach life is “all about your belief system,” the expert said. “If you believe you can, you can. If you believe you cannot, you can’t. So whatever you believe, you’re right.”

But HROC’s own research suggests that you cannot visualize the synthesizing of a project, nor can you visualize doing all its tasks to completion and a desirable outcome, without cognitive bandwidth. In short, before you can do the physical preparation, you must do the mental preparation. Hence, this is the reason that we are focusing on cognitive bandwidth first.

For our team in Ukraine, this involved having them study our past research on how to attain High Reliability, similar to what HROC researchers and trainers had taught Military personnel. It then included actually identification of problems related to tipping points, such as blood air gases and conditions (e.g., hypoxemia), which then led us to air composition (e.g., toxic dust, pathogens, carbon monoxide, carbon dioxide, etc.), and then doing changes to their surroundings or routines that could mitigate the adverse impact and resulting cognitive impairment. This helped get them mentally prepared (and in fact was what our team informed the mayor of Irpin in the interview where he requested help from our team and acknowledged the risks of poor or dangerous air composition, and the need to address that first and foremost). With the mental strength that arises from better air, this can then lead to addressing the physical capabilities he is seeking for his populace, starting with electricity that can power smartphones.

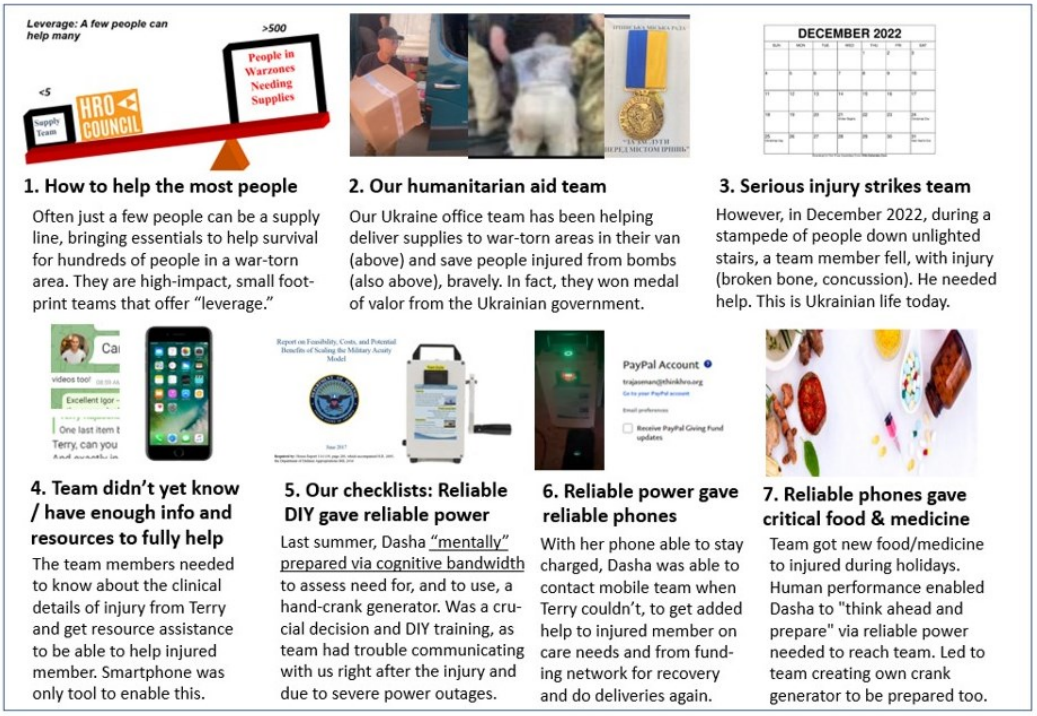
HOW: CASE STUDIES ON RELIABLE POWER FOR SMARTPHONES AND A DIY TOOL

The case study overview of HROC's "reliable power initiative" (RPI) – based on the general public in Ukraine harnessing crank generators that they can, in fact, create themselves in a DIY fashion (shown two figures down from here) – is explained in this figure below:

HROC Case Study (i.e., a live "story", redacted for team safety):

How our human performance checklists helped our team leader's recovery, so that he can continue doing team's lifesaving deliveries and rescues that have helped hundreds of people.

"Food & Medicine" image credit: https://chosenfoods.com/blogs/central/let-food-be-thy-medicine



This case study figure above may seem relatively straightforward: sending something to people in a disaster zone something that you believe they need, but that they did not specifically ask for (and did not think they needed – or didn't even know what it was). It didn't use the 7-step DIY generator process (which is two figures below). This was an already-built crank generator sent to Ukraine that, over time, became used daily. But though it was not yet a Ukraine-DIY on the technology, it was a DIY on the technique of "mentally preparing in order to physically prepare."

Here is an analogy: Imagine you are a dad trying to get your middle school-aged son a sold-out Christmas present. There is a lot of work that needs to be done with that alone, correct? But add to that that it is for the clothes he needs, not the toy he wants. That reduces the son's "process participation", as he will need to give you his size that he would feel comfortable in, and to wear it once in hand. You believe (since he wants to run track and cross-country) it's needed because it's a new T-shirt with material that keeps warmer in winter, cooler in summer, and drier in any weather when playing sports outside (to prevent falling ill from grueling practices, while keeping kids more comfortable so they can play at a higher level during "the big game"). In other words, even though it may not be understood fully or used before, it still could be highly valuable later.

Eventually, you convince your son to give you his shirt size, then you search all the stores that may still have it in inventory, calling them to confirm the item is in stock (since online information could be wrong). Then you move money into your department store credit card, then drive to that store to pick it up, confirm it is actually what you want (you want to make sure he has it for Christmas, after all, not have it be a mistake and require a return or it be a bad color or design). Then you must explain details like why and how to use the shirt, how to take care of it lasts, etc. And once again – for something your son did not request. But in the end, he loves what it does!

With the above, we can soon see this is not a hand wave of "wish it to be and it is." There is a process. And given it took two paragraphs to explain, it is a multi-step, "challenging" process.

As mentioned, at first the mental and physical (tasks) preparation may seem simple to an outsider – but it actually took a lot of work in this wartime situation. This process required the two steps noted in the prior section: 1. Mental preparation, and 2. Physical preparation. It took getting the crank generator to be accepted as something for Dasha on our team to spend time helping HROC's chief scientist (Terry) to get to her and the team, and learn to use it routinely to be ready for when Terry believed it would not only be helpful, but actually critical to potentially rescuing and helping people – like their leader, who in turn can rescue and help other people.

This smartphone-charging case study – one that led to a crucial, valuable outcome of helping many civilians – also had a several more details relevant to achieving the ultimate outcome of getting help to an HROC injured team member. Let us look at some of the challenges faced during this challenging process that required increased cognitive bandwidth to perform.

The first problem is the "shock" from a disaster (in this case, the war). Shock is the worst case scenario for cognitive bandwidth in the near-term (brain damage being worst case in the long-term). Shock leads to basically no mental ability to process information and instruction. It is like throwing a ball to someone, but they not only don't catch it, it actually hits them in the face. It is easy to understand why even a psychologist like Dasha would have shock in May of 2022 when the Russian atrocities were becoming widely circulated and spreading intense disbelief and fear.

However, she still had to "participate" in the challenging process to get her and future members of the team help we believed they would eventually need, but of which they had never heard (i.e., the crank generators). The main participation was laying the groundwork for the delivery of the generator through her "trusted intermediaries" given there was at least a 5% risk of loss we were told, and an even higher chance of significant delays that could last weeks or even months (given delays in customs processing, and risks of shipping anything with lithium batteries).

In short, there were several tasks in this process – well over the 3 simple tasks that are typically considered the universal limit to avoid task saturation under duress. Even though for this case,

there's generally only 4 stages (agree to learn about the need for the charger, then learn how to get it, then start the process of getting it, and then follow through till it's delivered), in reality there are several specific tasks in this process, including some complex (e.g., explaining to the trusted intermediary you need their help, why, and how, then providing their address information to HROC-USA to know where to ship it, given Dasha was not in Lviv where the shipment would go; also another complex task was how to initially charge and then maintain the charge of the crank generator), to this overall process. But it is a challenging process with major implications for life – first and foremost the ability to maintain smartphone capabilities.

People's participation in processes also means getting past: depression and a "fatalistic apathy" it often produces, the paralysis from having too much to consider and worry about, the breaking of old habits (e.g., using smartphones at all times for any reason), stubbornly held beliefs (like the false sense of security Ukrainians had by summer, assuming power would always be in their electrical outlets), and denial of new realities (e.g., Putin and his war leaders are so brutal, with so little conscience, they'd thus deliberately target energy and critical infrastructure in winter). Overcoming emotional numbness, accepting why something is valuable, what needs done to get it, then managing one's expectations of what can and can't be done with it, are also all part of this process – and all of it required cognitive bandwidth in order to start and then complete it.

There are additional relevant details. Terry told the HROC-Ukraine team, through Dasha (who speaks English quite well), that they should worry less about disease as he explained it was toxic dust and pathogens that could be solved (e.g., wearing a mask or raising humidity levels). This meant less anxiety, and more focus on what would be a problem, working together on a viable solution to implement (i.e., the crank generator), as they could then be more easily "connect the dots" of why they should not be complacent even though they had reliable power at the time (i.e., the early summer of 2022, then power infrastructure attacks started October).

Initially, early in the war for use in shelters, the HROC-Ukraine team was also asking for more solar from generators from HROC-USA (as we had delivered them early in the war, since they were relatively easy to get and take in our team's first trip to Ukraine). However, the HROC-Ukraine team had to understand why that was not the optimal source of power (e.g., they could not work at night, nor work well when used in the weaker winter sun, reducing their output).

With our approach, better training was absorbed, and decisions made, by the HROC-Ukraine team, by first focusing on increasing the new Ukraine team's cognitive bandwidth. The increase in bandwidth was achieved by explaining how to reduce cognitive load, but then also how to improve air composition (e.g., helping them understand how to keep from getting major respiratory infections using humidity, one of the components of "invisible masks"), and also explaining and teaching toxic air risks (radioactive dust risks, but also immediate and pervasive CO, CO2, and toxic dust from concrete / particulates in addition to pathogens). This was done at the start.

More recently, we have been helping avoid suboptimal air composition (mentioned on our previous webpage progress update from 1/5/23) from portable generators, instead harnessing all the food that our Ukraine team leader Douglas said is still widely available (if not plentiful, hopefully all throughout this war) and its calories, and then converting calories into watts of electricity. And the human body, though it will produce carbon dioxide, produces virtually no carbon monoxide, making the use of crank generators safer for not only a family, but also the entire population living around them (which ties to HROC's preventive health background). That is, this electrical power does not cost people their health, endurance, nor their cognitive abilities.

But the full process also led to more reliable power, which can then also help a person's health status by enabling communications for healthcare. For example, when power is intermittent or scarce and there is an injury like a TBI, then hours can matter. So having phone contact immediately matters (via having a charged phone at all times). This also applies for a heart attack, a stroke, even anaphylactic shock from a peanut allergy, or any other emergent issue.

In summary, we now can help many people make small crank generators, that can be put into a backpack, rollaway luggage, or even a toy wagon pulled by kids, in the event people have to evacuate quickly – ensuring smartphones can always be kept charged. But to make this crank generator, "people need to start preparing it now" is our message. So, it is by using human performance enhancement techniques that we can make it easier for them to accomplish the "challenging process" required to be ready to evacuate and survive being internally displaced in Ukraine, or being a refugee outside Ukraine and in a refugee camp.

The example above also highlighted three important benefits, discussed in the figure below:

HRO COUNCIL

Successes: What did this case study enable?

There were three main benefits shown from this actual example:

1. **Lifesaving deliveries to hundreds of people** in Ukraine are again possible by our "small footprint" high-leverage team, achieved by first using our approach of "thinking better" (just like we succeeded in "*changing the way people think*" for the U.S. Defense Department, and again showing that "one must first ***mentally*** **prepare** in order **to *physically* prepare for survival**").

2. People **seeing** that **150 watts of electricity** production – *enough for 15 smartphones* – is possible, and **harnessing** the fact that **food** is relatively abundant (**while carbon-based fuel** is scarce – and has hidden **danger**s).

3. Above all, **no carbon monoxide** (CO), **unlike** dangerous **portable generators** (which make more CO than 400-car traffic jam per hour, *and* which are also **not** really **portable** nor practical **in** an **evacuation**) threat, as they **cause health issues** – and even **death** – in Ukraine. The CO and other emissions are a hidden danger, **reducing human performance**, ability to think, **and** thus the **chances of survival** now, and mental and physical recovery in the future".

Sources / image credits: https://www.cpsc.gov/s3fs-public/PresentationSAE_SETC.pdf ; https://www.amazon.in/Apple-iPhone-Plus-Black-128GB/dp/B01LTIBO2Y; https://www.epa.gov/pesticide-labels/label-review-training-module-2-parts-label-page-2

Once again, these benefits were obtained due to specific training in human performance and human survival checklists. We wish we could say they were easy to accomplish, but as they say, "if it were easy, it would have already been done." These are not easy, but they are doable.

To recap, these processes we develop ourselves or modify from others are, as we explained in the prior posting on progress (1/5/23), what we term as challenging processes. They therefore require instructions on how to accomplish them fully and reliably. However, starting and then reliably completing everything necessary requires human performance as we also noted.

For instance, the Molotov cocktail homemade weapon is considered by some as one example of civil defense and was actually a preparation made at the beginning of the war in 2022, people

may recall (as many reporters mentioned it). Some people have noted that this process was not humanitarian in nature (i.e., not saving people's lives when they are under merciless attack).

However, it was also actually not helpful as civil defense to even protect the nation. As the New York Times noted, in the first week after the invasion, civilians prepared themselves to directly face assailants, and there was a frenzy of Molotov cocktail production among Ukrainians of all walks of life. However, those improvised incendiary weapons did not serve much use, though, in a war in which the Russian aggressors are rarely close enough to hit with a Molotov cocktail.

The effectiveness of Molotov cocktails basically matched the number of steps – our summary, based on others' descriptions of those Molotov cocktails used in combat, is a simple 3-step process: 1. Get old bottle, gasoline supply, and rag to serve as fuse. 2. Put gasoline into bottle, then the fuse into the bottle. 3. Light fuse when near target and then quickly throw at target.

That is, it was too simple and ineffective – one civil defense tactic that reinforces our argument that if it was simple, it would have already been done by now. Oversimplifying is not what we are trying to do for the civil defense that we are trying to prepare for potential evacuations.

Unfortunately, we then face the difference between 3 simple steps vs. double (or more) of that number – and thus reaching overload tipping points far too quickly, especially under duress.

This is because, in order to be successful in actually delivering the capabilities to Ukrainians for heat, electricity, and the "invisible mask" (i.e., that they will need from air composition that ranges from stifling to harmful to deadly), there are many factors – each that typically translate into some sort of task – that go into achieving success in the effort, which we will discuss below. In our procedures / safety checklists, in each there are often 10 "bite-sized" steps or more, with some much longer, or having complex tasks, or no instructions at all and thus require problem-solving creativity when problems arise while creating the tool or performing the process. Preparing mentally when creating something, like DIY items, is crucial. This is the key first step.

After this step, the DIY preparation becomes more realistic, easier to start and more able to be problem-solved. An actual example is the crank generator made by simply a high school plus college student tag team in under an hour using a battery-powered toy "ground-based" drone that that was broken (in figure below). Based on the feedback from our team, there are many damaged drones in Ukraine that cannot be fixed but that do have motors similar to this example which can be used to make portable electrical hand or pedal cranked generators to at least charge smartphones, but perhaps even larger items like laptops, water purifiers, and other battery-operated items. This example enables trickle charging for phones or can help in lighting.

It is what we call "damaged drones to charge smartphones." In the movie Apollo 13, a key quote was "power is everything." The importance of electrical power, the math needed when it is scarce (and needs conserved), and above all, having contingency plans to obtain electrical power when it's needed to survive, all comprise the ideal preparation process that Ukrainians can immediately do (given the paramount importance of smartphones). And students are a valuable resource and have a need, since, in Kyiv, school is in session whether there is power or not, and for students' computers at school or home, typically a laptop of notebook will use about 30 watts – which they can create for themselves as they also prepare for emergencies.

The figure below explains the steps for a "DIY crank generator" tool that can be made simply by student researchers to help themselves, their families, and people in their communities.

HROC Case Study of Actual Example *(done by HROC student research advisors)*:

Using a damaged "drone" to charge a smartphone

"Broken drone" image credit: https://www.popularmechanics.com/flight/drones/how-to/a23807/crashed-your-drone/

1. Start: Broken drone, or similar

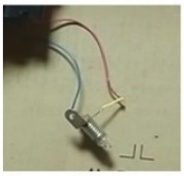
Find anything from damaged drone, toy, or tool that uses battery and moves. Tool examples: spins (portable drill), blows (port. fan), sucks (port. vacuum).

2. Making generator: What's needed

In this case, students found "ground-based" drone toy, broken. It was battery-operated motor, ensuring it created DC current and had also a permanent magnet inside the motor.

3. Get to motor and what it turns

Disassembled toy until only left with wheels, gearbox, and 2 motors inside (careful not to damage motor / wires). Strip off wires' insulation at ends.



4. Prepped the wires to connect and bulb to test

Prepped for test by using small lightbulb or LED (after, if possible, testing first on a battery to make sure bulb/LED works), twisting wires together from the motor to the bulb.

5. Tested by "cranking" the wheel to see if lights

Spun wheel and see if the small lightbulb lights. In this case, it did, indicating electric current being generated. Used online sources to determine volts, amps, and watts the motor requires, to estimate its electrical output.

6. Create a "crank" to more easily turn shaft

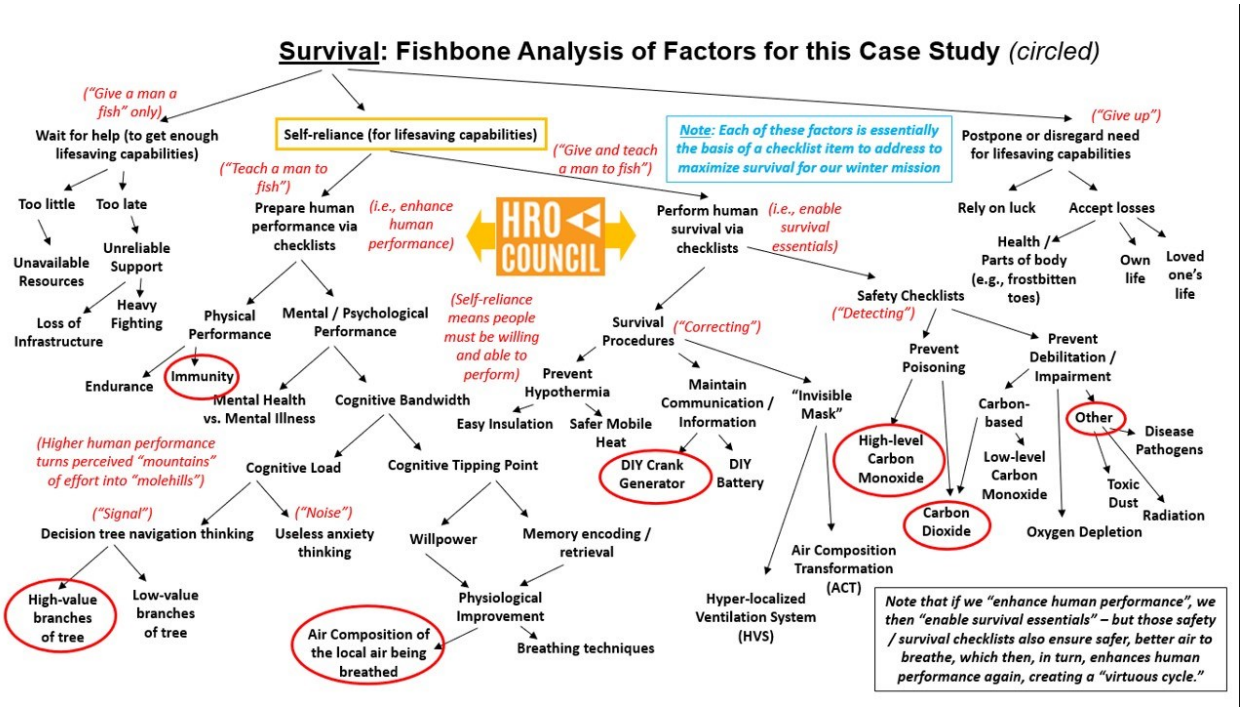
Can create a crank using hollowed out plastic pen (i.e., no ink tube in it) as a sleeve, inserted into the wheel or the drone blade. Then Insert narrow Philips head screwdriver into sleeve as crank handle.

7. A car charger can then connect phone to charge

To charge phone, tape the wires to circled area of car charger adapter (normally uses 12V battery DC current), to then have USB cable plug into it and into smartphone. Voltage must be at least 5 volts to charge a phone.

But in Apollo 13, they also note the consequences of harmful air, which can "block" preparing.

Below are the factors that went into getting the benefits from our "reliable power" for smart-phones, showing the science behind the entire successful process. Please see figure below.



As can be seen in the figure above, suboptimal air composition (SAC) solutions (e.g., by simple ventilation or other tactics) for human performance are needed before completing important

physical processes. Example: have you ever felt drowsy when trying to finish some project? Being sleepy blocks us from completing it. This is a similar effect to not being mentally prepared due to SAC, since sleepiness is brought on by carbon dioxide. Poor metabolism is a key culprit (whether poor blood sugar, or in this case, interference from carbon-compound gases), as tiredness relates to metabolism, and carbon gases adversely impact it. Finally, headaches or simply "not feeling well" are all possible from carbon gases, which further reduces mental energy.

For alerting to, and addressing, suboptimal air composition, we have a proactive "chemistry and physics" approach on how to reduce or prevent toxic gases like CO from forming (e.g., crank generators), or corrective measures to prevent reaching mental and physical impairment (or worse, toxic) levels, using something we call air composition transformation (ACT).

We also add to that a more "reactive" approach for when proactive is not possible or can be overwhelmed (e.g., if heavy use of portable generators), so as to alert via health symptoms detection such as from our checklists noted in the progress update below from 1/5/23 (with other more proactive DIY detectors in development) and how to address (e.g., immediate ventilation outdoors, our DIY hyper-localized ventilation system, and other new systems).

By using this case study as the first example of our methods affecting lives in Ukraine, we can improve their preparedness for evacuation. However, our team also feels the need to help other people beyond Ukraine, telling (via video) audiences around the world what they've learned by applying our key technique to create DIY "technologies" to aid everyone survival, which is that "human performance is what can turn what seemed like mountains into molehills."

What we have shown with our past research is that the right training can make people more self-reliant (including on health, preventing problems that they wouldn't be able to take care of themselves once problems snowball and become too large). The next section explains how.

HOW: THE RELEVANCE TO HUMAN PERFORMANCE AND COGNITIVE SCIENCE

Have you ever felt more refreshed -- and then able to take on bigger challenges -- after a good mid-day nap? That's because the nap gave a surge of cognitive bandwidth, which then gave human performance gains. There are really only two ways to get more bandwidth: lowering cognitive load or raising cognitive tipping points. And our techniques, which can be trained, and use methods that can be implemented into DIY tools, are the best way to attain this bandwidth.

The ability to think above and beyond other life on earth is what made us the dominant species, and in control of our destiny against all the dangers of the world. Without this ability, we are in no better a situation than most animals and would then be at the mercy of the world.

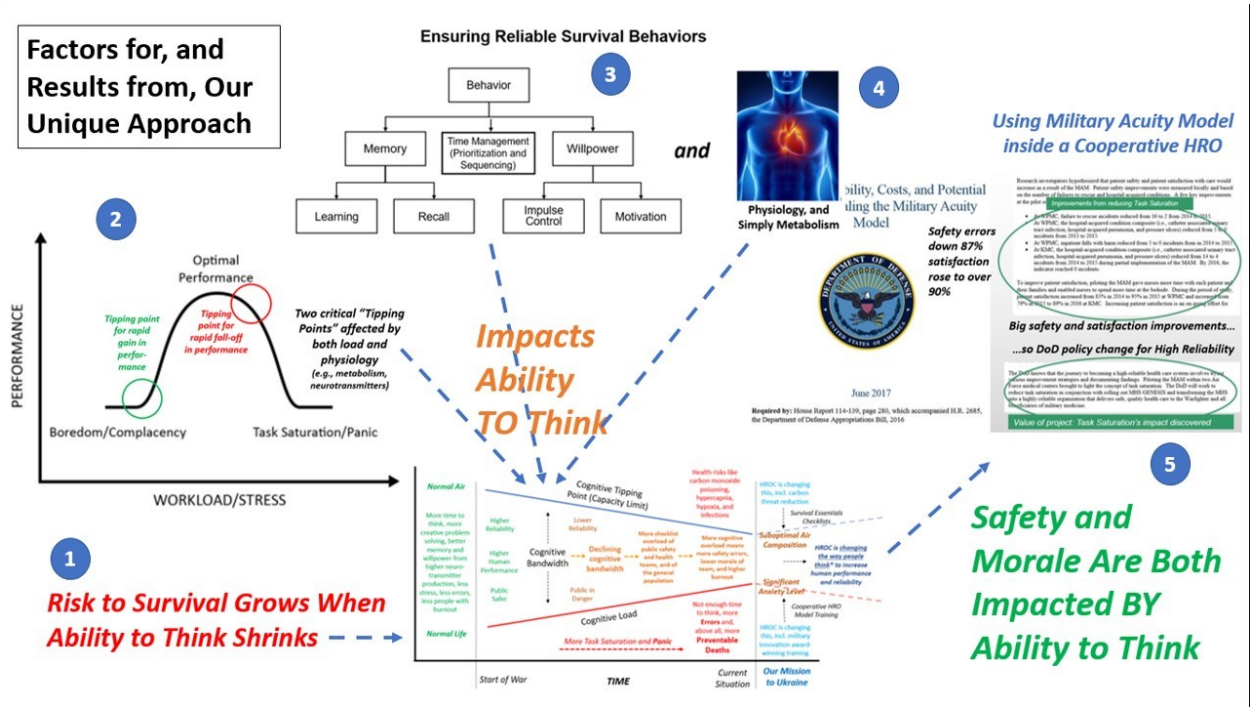
Our point of view is that to have the ability to think, we must take care of the brain's neurons' health, including metabolism and immunity, which then help cognitive function, so as to be able to prevent or solve problems. In short, we improve mental health by improving the brain's health. This means producing power without carbon monoxide, given harm from even low levels of it.

Carbon emissions, coupled with anxiety, create what we call the mental "fogginess" of war or from any other extended disaster, like recovering from a deadly flood or drought – both of which in some nations can also cause famine (note: malnutrition increases fog). This fog is not just the daze some feel from the initial shock or repeated shocks that strike fear, but an added load,

weighing, we've been told, like an albatross around one's neck. This can be attributed, based on our past and current research, to increased cognitive load from worry and anxiety as well as checklist overload from all the new steps that must be taken for safety or to navigate new resource constraints such as poverty. But it is also the lowering of cognitive capacity (i.e., tipping points) from mental degradation from mental burnout and suboptimal air composition (SAC) that interferes with cellular metabolism and proper utilization of oxygen.

For this fogginess, we believe if you change the air you breathe, you change the way you think.

Changing the way people think was in fact the tagline one of our project managers from the U.S. Military gave our projects, both in a strategic sense (making them look at problems differently) and also a tactical sense (making people think better). Improving the ability to think is what we proved in with the U.S. Department of Defense (DoD), and they noted as such in a DoD Report to Congress. The figure below (see also 1/5/23 update to see larger version of the graph for #1) explains the approach taken and its results.



Going back to the core of the case study (i.e., crank generators to obtain essential electricity to keep smartphones charged) and the many situations and ways it can help, there is also a synergistic set of benefits in using "cranking" as our approach harnesses. Though physical activity like cranking (especially pedaling) can tire people in the short-term, it helps improve physical endurance in the long-term. And it also helps reduce stress, anxiety, and depression.

When attached to pedals (which is what we will be showing in our next iteration of crank generator DIY, given the number of damaged bicycles in Ukraine), people can get the advantages of cycling, which (just like running and even walking) releases endorphins (the "feel-good" hormones). Endorphins help relax the mind and makes people feel happier and reduces feelings of anxiety. Research shows that those who regularly cycle have a significantly lower risk of feeling stressed.

Studies have also found that exercise, especially outdoors, is a valuable for emotional and mental health, and considered a key therapeutic component of any strategy to combat depression, anxiety, and stress. Cycling is particularly useful for positive mental health – it's easily accessible to most anyone (even kids), aerobic, low impact, and has known brain boosting benefits, such as improving memory, creative thinking, mood, and willpower, by rapidly spreading endorphins, and neurotransmitters like dopamine, norepinephrine and serotonin.

As discussed in the prior (1/5/23) progress update, extended low-level carbon monoxide exposure can cause long-term damage, resulting basically in neurological and cardiac chronic conditions. "Spoon theory" argues that chronic condition patients only have a limited amount of energy (analogy: only finite number of spoons to give), and they must be careful to not use up their energy on lower priority items. This is our argument too – cognitive bandwidth is finite each day, and must be recharged. Another consideration is when trying to accomplish a process – there may simply not be enough "staying power" to get it done. War can damage both body and mental health as we know, and our research indicates that SAC adds physical and cognitive chronic illness too. But our past research shows that EVERYONE has finite cognitive capacity, even if they are healthy. All resources, including our mind and body, have limits. And everyone, regardless of their health status, will suffer consequences of carbon emissions in their body.

Part of the way to overcome the problems of constricted cognitive bandwidth is to be trained (using our webinars for cognitive load balancing) to ensure that cognitive load is spread across other people or over time. All our key webinar videos will be converted by our Ukraine team into the Ukrainian language, and presented by Ukrainians who defended the nation during the war.

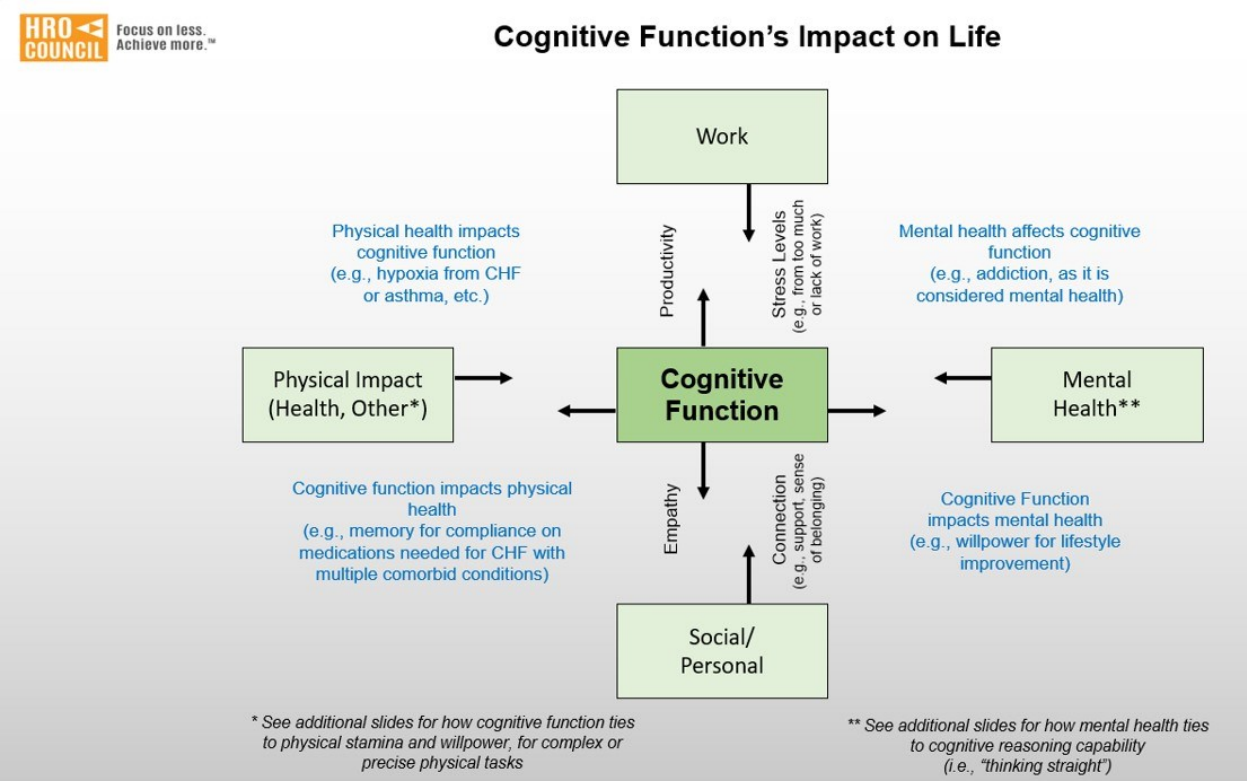
Another path that can be taken is similar to the approach for long covid fatigue, a strategy called "pacing" helps, meaning people basically don't try and do too much in too little time and burn out quickly for the time period in question. But clearly that would also reduce their "throughput." We believe people need to start viewing carbon monoxide at even low levels as a toxin, just like we could view alcohol. Alcohol leads to "cognitive impairment", but also other mental health issues, such as depression and anxiety. So instead of just living with the problem, we seek to prevent it.

To see what gains are possible if we can maximize cognitive bandwidth, look no further than the nap we brought up in the beginning – it literally helps clear the mind and raises people's tipping points. But it is also easily visible in our figure above – the Air Force Human Performance Curve (or AF HPC, which was used to describe how to maximize fighter pilots' capabilities) that shows performance vs. workload. If someone is below the first tipping point, or beyond the second, tipping point, then their human performance is much lower than if they can have a balanced workload, one that is engaging while not being overwhelming. This is similar to the "shower effect" – which helps explain why we get our best ideas in the shower. It is because there is a "sweet spot" to how engaging the activity is and its impact on creative thought: too little, and it is boring; too much, and it leaves little attention for ideating. Similar to the AF HPC we noted.

This brings us full circle to the practical issue at hand – how to solve general problems related overall to survival, or specific problems related to creating survival essentials like one's own crank generator. Even with our instructions or videos, most people will likely never get the perfect fit for their solution, but they do have a better chance of making it fit if they have ample cognitive bandwidth, which is attainable by following the methods we've outlined above.

WHY AND HOW THE WORLD BENEFITS

[More details will be coming in a further update within a week, but for now, a key figure to explain the value of improving suboptimal air composition for improved cognitive function, and thus greater cognitive bandwidth, is below…]



HOW TO ACCOMPLISH: WHAT ARE THE RESOURCES NEEDED IN HROC-UKRAINE "MOBILE LAB UNIT MISSION CONTROL" (TO ADD TO HROC-USA'S VOLUNTEER EFFORT)

Our team in the U.S. is volunteering their time toward this 3-months' worth of effort on HROC's Ukraine Winter Mission (including our chief scientist, Terry, who is spending more than a fulltime effort on the project). However, HROC's Ukraine office needs resources to validate and localize our solutions, film them as videos, and then socialize the training videos across multiple channels. The videos will be led by those who put their lives on the line to defend Ukraine, including HROC-Ukraine's team leader Douglas and his colleague Igor.

Terry also is trying to work logistics with Douglas to meet him in Warsaw for the trip to the Kyiv area / Irpin to deliver key equipment and do critical training and scientific assessments of conditions in key areas, as well as complete testing on DIY solutions that should work in Ukraine but must be tested and perhaps troubleshooted and modified if necessary.

The team in Ukraine will support Terry's volunteer effort for this mission, but are facing dire economic conditions to just survive, let alone have resources to get the necessary equipment. And even if that would happen, shipping, we have proven, will take at least a month for items

like generators. This is the reason for Terry's need to deliver the tools needed in person, in order to expedite, given the only 8 remaining weeks until spring officially arrives (and Russia may not even wait that long for a re-invasion that would necessitate an evacuation).

Having this initial proven case study in hand, and details of the Ukraine winter mission prepared, we are now finally sharing the Ukraine office GoFundMe page so that our team in Ukraine can get the resources to help Ukrainians maximize the heat, electricity, and understand / implement the "invisible mask" concept for air composition transformation. The link for it is below:

https://www.gofundme.com/f/hro-council-ukraine-help-save-lives-brave-souls

The Ukraine Winter Mission, both the local project by the team there, and the volunteer project by Terry and team in the U.S. (including Terry's planned trip to Ukraine) will be about preparing the Ukrainian people. It will be done via our Ukrainian team in Kyiv and starting in the city of Irpin, for the survival essentials like heat, electricity, and the "invisible mask" that will be needed to survive an evacuation made under duress and dire conditions so as to reduce preventable deaths and suffering. It is to help people see – and prepare for – what is on the horizon.

To give background on what the funds raised will be used for, first and foremost is to create the videos hosted by defenders of Ukraine to show people can do their part in a civil defense project that helps people in turn help family, friends, and the vulnerable in their communities in making electricity that is truly portable. We believe this is the fastest way to reach people most quickly, focusing not just on social media, but also as videos that we will request to be played in every shelter in Irpin, ranging from Points of Invincibility (POI), to partial-POIs and In-House Safety Areas that we help guide with standards, procedures, and checklists. Finally, the videos will focus on the "EvacPac" to enable speedy and safe evacuation by the populace, as well as safer journeys to safer areas. In short, our primary goal is public safety education, using videos.

Another capability we are implementing is taking the van (used by Douglas and Igor to deliver supplies to warzones) to install the equipment, sensors, and other items to convert the van into a "mobile-lab unit mission control" (MUMC) complete with a geolocation tool that models risks and opportunities / resources and constraints. It has recording/filming equipment to create videos on location, and through smartphones, offers "train the trainer" (T3) calls as second-tier support for our checklists and procedures. This would be within a Cooperative High Reliability Organization (CHRO) scalable model, containing community and neighborhood liaisons we call ambassadors that are focused on civil defense and who aid clusters of people.

This is similar to what was used by healthcare rapid response teams in our Defense projects (but this is done for neighborhoods rather than patients). Our unit would be starting in Irpin (given it is even closer to the Belarus border, has fewer shelters, and thus will need evacuated even before Kyiv. Then this mobile unit will go all throughout Kyiv. Also, given 2 new people from Odesa have been helping us, and who we in turn want to help, we will try and help the city of Odesa, which doesn't even have a subway (though they do have catacombs), and other cities where critical infrastructure has been decimated and distributed infrastructure is needed.

In terms of the major line items in the GoFundMe budget, they are:

$2k equipment delivery, on-site evals/training of office, key shelters, and example sites for partial-POI and IHSAs.

$10k for Ukraine office to support team through the min. 2-month project (6 people) for survival and supplies/expenses.

$5k for equipment, sensors, licenses, tech. support on the licenses.

$2k specialized consultants that may be needed.

$1k overhead./ misc.

$1.1k for the fundraiser (PayPal Giving Fund expense)

During the delivery and training trip by Terry to Ukraine (likely Kyiv and Irpin, unless invasion looks imminent, in which case it will likely switch to Odesa or Lviv), the itinerary will also include:

Meeting one or more government officials in Irpin, especially regarding POI, partial-POI, IHSAs, and EvacPacs, as well as the Invisible Mask Initiative (IMI) to battle against SAC, throughout the city's buildings and shelters. A key goal for Irpin is quickly implementing DIY High Reliability for survival essentials and EvacPacs. But will also discuss our scientific studies (e.g., more DIY crank chargers and other sources of electricity, as well as safer rocket stoves to help burn more items more safely, testing and treatment of SAC, and finally coordinating a drone airlift network).

Sensor readings (e.g., of CO) in Irpin and Kyiv, and while there, meeting someone from Kyiv school of economics (as there was interest stated by their leader to discuss collaboration).

Possibly a trip to Odesa to meet team there on crank generators, if time.

If power instability or rapid invasion is a concern, then we will make videos in the Lviv area, or someplace with more stable power to do the DIY item testing.

Summary: The trip itinerary is first and foremost for our onsite and virtual (via video) training to achieve a public safety success for Irpin's mayor, while we also do our scientific study on the sensor readings and the estimated risks and consequences from those readings. What is critical is Terry's delivery to the MUMC of sensors and equipment to turn the van into a mobile lab of various sensors and equipment to help guide the DIY that people in Irpin (in shelters, Points of Invincibility, partial-POIs, and IHSAs) need to do, especially to make their own EvacPacs to use anywhere. This delivery and training of all the tools enables our office in Ukraine and its mobile lab to take readings, compare to our recommended standards, evaluate levels of preparation, assess risks, recommend solutions, and train people on how to prepare on the DIY needed.

There are no simple hand waves or magic words to get to survival at this point of the war. Survival now is dependent on people being "willing and able" to do challenging processes to help themselves, their family and friends, and their fellow Ukrainians. The tanks delivery by the West could perhaps mean good things to come, but more likely it suggests escalation, and if significant enough, then there will be a need for smooth evacuations, and for that, people need to be prepared. If the evacuation fails because people aren't prepared, then that may mean incomprehensible suffering and losses from sieges similar to what happened in Mariupol.

If you have been wanting to make the greatest difference in Ukraine (i.e., help 4 million people at evacuation risk, and save our estimate of at least 1%, so 40,000 civilians given the current

mortality rates of the war), then please consider helping our Ukraine team show Ukrainians to be more self-reliant in being able to save their lives during the current disaster. But in a way it to also help defend their nation. To paraphrase General Patton: "Nobody ever won a war by just dying for his country." To win this war, Ukrainians must survive.

Along with this, our Ukraine team wants to show how the resilience and resourcefulness of Ukraine can most help all its current – and potential – allies. Part of this is how anyone can get a second wind for completing challenging processes, including from a “new air composition.” Survival procedures and safety checklists are not easy – but they are not impossible either. The proven approach we have outlined in this posting can make it easier to start and finish any challenging process. It improves human performance in order to turn mountains into molehills. And it is applying psychology (Dasha’s expertise) and cognitive science (Terry’s expertise) in order to help people not just feel better, but to also be better and do better. As we mentioned, the key will be improvising with common items but innovative applications, and: 1. Preparing human performance via checklists, and then 2. Then perform human survival via checklists.

Our last point on this project: nothing is easy, which Ukrainians are living and showing us daily – but Ukrainians aren’t giving up either. Instead, they (including our team in Ukraine) are “paving the way” for other people around the world to find it easier to survive during those times when they may also confront disasters at some point in the future. This can be done by teaching us all lifesaving self-reliance to see – and prepare for – all the challenges beyond the horizon.

Progress update new entry on 1/5/23 (which updates the incomplete entry on 12/30/22):

1/5/23: "Survival under any adversity is a challenging process. Survival in a disaster like Ukraine faces is too often beyond comprehension, not just for those viewing it, but also those living it. This affects the ability to adequately prepare for all the problems each person will face in a time of intense crisis, to in turn then have lifesaving self-reliance whenever getting outside help is unreliable at best, unavailable at worst. This is the basis of our Public Safety Scientific Study Mission to Ukraine this winter. We have now created new diagrams to help further understand the purpose of this mission."

The bullets:

As some have termed it, Ukrainians throughout the holidays during the last two weeks of December, 2022, had awoken to some of the worst bombing in the entire war including on Christmas Eve, Christmas, New Year's Eve, and New Year's Day – as press accounts aptly equated it as bombs for children on Christmas morning.

The brutality in the killings of civilians were also in Irpin, where Russia's "reign of terror" – which saw a disproportionate amount of the civilians brutalized and killed being women and included rape as a means of terrorizing the population – happened in first months of the invasion.

And it is not likely to change anytime soon, as Putin's New Year's address was unusually aggressive and combative.

This reminds us of why it's so important to consider the words of Pres. Zelenskyy as he noted in his address to the U.S. Congress, "Your money is not charity…It is an investment in the global security and democracy that we handle in the most responsible way…The battle is not only for life, … this struggle will define in what world our children and grandchildren will live, and then their children and grandchildren. It will define where it will be a democracy."

This is why it's so critical that the free world win, through its "first line of defense" – Ukraine.

Being able to overcome increasing evidence of war crimes by Russia, and their military acts of barbarism against civilians, will require having the necessary mental and physical human performance capacity.

However, this capability for those caught in war erodes over time, which is no doubt a Russian military objective geared toward forcing surrender or simply driving people away from land the Russian leadership wants to seize by force.

Studies on war's physical and mental health consequences show just how severe this erosion can be. War has a catastrophic effect on the health and wellbeing of nations, with conflict situations causing more mortality and disability than any major disease, as it also destroys communities and families. It often also disrupts the development of the social and economic fabric of nations. The effects of war include long-term physical and psychological harm to children and adults, as well as reduction in material and human capital. Deaths from war tend to be simply the "tip of the iceberg" given other consequences, besides death, are not well documented, but include endemic poverty, malnutrition, disability, economic/ social decline and psychosocial illness, to mention only a few.

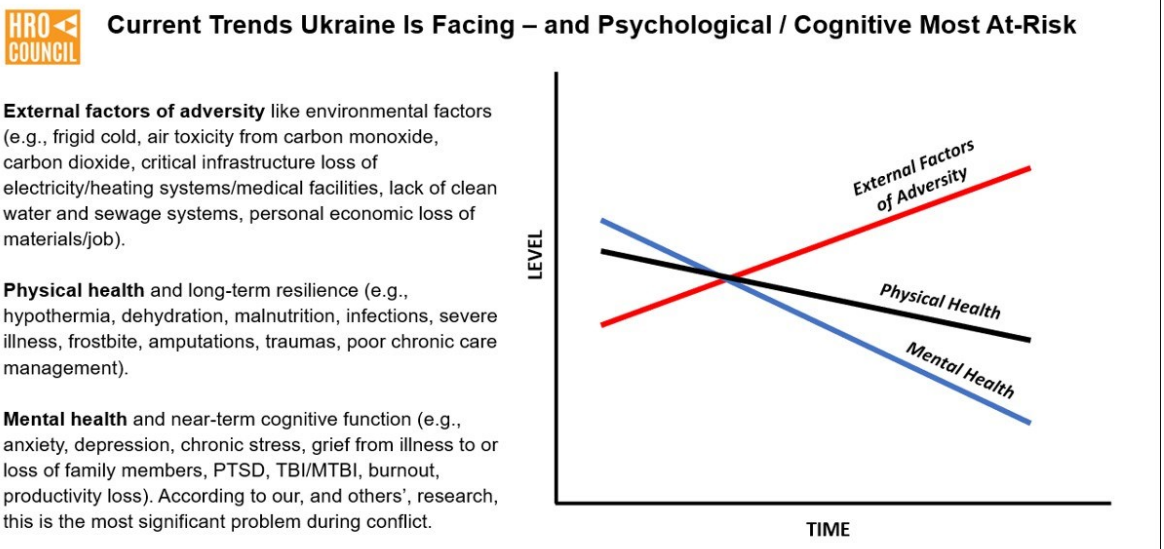
Among the consequences of war, the impact on the mental health of the civilian population is one of the most significant. Studies of the general population show a definite increase in the incidence and prevalence of mental disorders, with women more affected than men. Other vulnerable groups are children, the elderly and the disabled. Various quotes from recent wars that show the range of problems include: "We are living in a state of constant fear" (in Iraq); "War takes a toll on Iraqi mental health"; "War trauma leaves physical mark"; "War is hell... it has an impact on the people who take part that never heals"; "War is terrible and beyond the understanding and experience of most people."

But it was also the psychological impact of the world wars in the form of shell shock that supported the effectiveness of psychological interventions during the first half of the 20th

century. It was the recognition of a proportion of the population not suitable for army recruitment during the Second World War that spurred the setting up of the National Institute of Mental Health in the U.S. The differences in the presentation of the psychological symptoms among the officers and the soldiers opened up new ways of understanding the psychiatric reactions to stress.

As the war from the Russian invasion grinds on, the need to increase cognitive bandwidth, given countervailing trends like increasing burnout, will become even more critical to maintaining thinking capacity for survival as well as productivity for the current economy and future recovery.

The figure below illustrates the trendlines we seek to reverse, which we believe can be aided by increasing cognitive bandwidth.



Defeating the core belief by tyrants in the world that they can just take what they want will require Ukraine, and the West, to win the war (or at least not lose it). To achieve this, we must maintain people's willingness to endure extreme challenges of war, and not only avoid surrendering on the battlefield, but just as importantly avoid the civilian population surrendering physically and mentally. However, as a famous basketball coach noted, "The will to win is not nearly as important as the will to *PREPARE* to win."

We believe reducing the "body count" from the war crimes (which Russia is likely going to continue committing) not only saves people's lives, but also ensures there is not the surrender noted above.

So, the question is how can people prepare to survive the horrible acts inflicted by Russia designed to maximize suffering and casualties of the war?

Without the essential capabilities to survive, history has shown that morale, bodies, and spirit begin to break in any struggle for freedom (or survival, in the case of genocide, which some have argued is what Russia is committing again in Ukraine, after having killed millions of

Ukrainians 90 years ago as well). The "will to fight" is considered by some as the single most important factor in war. Even the best technology in the world is useless without the force of will to harness it and to keep using it even as casualties mount and unexpected calamities arise. Almost all wars and almost all battles are decided by matters of human will.

To see examples of how "fear and panic are more infectious than Covid" for an army, says one expert, just look at the Iraq war. When Saddam Hussein invaded Kuwait, many Iraqi soldiers simply didn't think Kuwait or Iraq's brutal leader were worth dying for. "There was one instance where Iraqi soldiers surrendered to a drone that was circling over them" the expert noted.

A more recent example of an army losing the will to fight came in Afghanistan. Amid the US military's withdrawal from the country in 2021, the Afghan National Army collapsed. They allowed the Taliban to quickly take control, even though the US had invested years and billions of dollars in training.

This is why maximizing human performance to last through this "weaponized winter" is so crucial.

Proper preparation offers the ability to withstand, if not prevent, the pain, suffering, and preventable deaths experienced in war – if people can follow through with the preparation.

This is the key reason for our focus on *cognitive bandwidth* to maintain human performance and to achieve self-reliance.

The figure below offers both a comparison and a contrast to what we believe is need to enhance what is happening on the ground to help civilians in Ukraine, but also what is needed to extend the reach of humanitarian aid, by leveraging knowledge for self-reliance – which is much quicker to implement broadly – approach that we have implemented in the past (in the area of self-care) and are showing examples of in Ukraine that we want to leverage throughout the nation, and also into Poland (where any future refugees would most likely go), the U.S. / NATO allies, and the rest of the free world.

Even with our boots on the ground in Ukraine, we realized that rapid response and scalability were in the greatest need for the winter disaster the nation is facing. Accordingly, we believed these goals of speed and scale could best be met by the benefits of using a Cooperative High Reliability Organization (CHRO) along with our Invisible Mask Initiative (IMI) to improve cognitive bandwidth for the maximum amount of people.

Assisting Various Humanitarian Crises within a Broader Disaster

(and why a traditional approach alone is insufficient in a "too urgent, too late" situation)

Traditional approach and its issues:	***Challenges with improving traditional:***	***Our solution to improve:***
1. Focus on humanitarian **shipments** (e.g., raise money, get necessities, deliver them to people)	1. Too slow a response and too few helped. **Rapid response** and **scalable** to large populations needed for the winter disaster	**1. Self-reliance** (i.e., DIY High Reliability)
2. Rely on sustained **overachieving** by all involved (e.g., aid workers, all the people in need). Unrealistic as war wears people down	2. Too little completion of the do-it-yourself **(DIY) processes** – which though not simple are still manageable – for necessities. **Need done to survive**	**2. Human performance** (to enable and ensure High Reliability)
3. React to various crises inside a disaster (meaning too often being too urgent, too late to save many)	3. Proactive is much better, but requires **predicting** and **preparing** for what lies ahead to minimize demoralizing surprises	**3. Cognitive bandwidth** (crucial to increasing human performance)

Our background in our peer reviewed studies targeted reducing preventable deaths for the U.S. Department of Defense (including at human performance-specialized Wright-Patterson Air Force Base). We also showed improvement in safety and morale is possible, simply by "changing the way people think" to increase capacity – and thus each person's capabilities.

The value of prevention for safety and scarce resource conservation can be seen through two studies we did. One example was published as a cover story of a peer reviewed journal for a civilian hospital, showing our Cooperative High Reliability Organization (CHRO) innovation reducing preventable harm by 73%.

In the other example, another of our studies for the Defense Department published in a peer reviewed journal, showed hypoxic or anxious patients (or often those with both conditions) appeared to overload more easily, as indicated by eye contact and body language among other issues, a discovery during our observation of patients needing trained in self-care. This impacted their learning, and thus they were coming back too frequently to the hospital – and in a worse condition, which then required more time and resources from the hospital for them to recover. We proved we could cut the times patients would visit the hospital by half when we improved their ability to think and follow the checklists safely for self-care. This was the genesis of how the Military Acuity Model (the foundation of the CHRO) could improve lifesaving self-reliance.

How did HROC's team get to what they have calculated as feasible solutions for survival and safety in Ukraine? By learning what can work and what won't, given the limitations and threats people confront in the nation. Our office in Kyiv opened in May 2022 upon our team's first visit, and then was registered in October 2022 (registration # in Ukraine: 44840272). Our own preparation for our mission to improve the preparation process for all Ukrainians is based on guidance from our own efforts inside Ukraine.

For example, HROC had done shipments to Ukraine of multiple items, including protective wear delivery (for logistics, and also to help for blast protection), delivery of crank generator and smartphones for tests, and their challenges (e.g., lithium batteries are very difficult to ship and creating more delays).

Ukraine has lost nearly half of its energy grid thus far. Our prediction was that electricity generation would become critical, so we delivered and tested solar generators and a hand-crank generator for charging of smartphones -- the only reliable source of power for two of our team members, they noted. Making portable, mobile heating safer was also part of our work, showing different ways to make rocket stoves to increase fuel source options (i.e., wood burning stoves, for that subset of homes in Ukraine that have them, are not safe to burn coal or wood not dried fully for 6 months for it to become actual firewood) -- while also reducing carbon monoxide risk, given the air coming from under the combustion area.

And there is the risk of possible re-invasion early this year, nuclear fallout risk, and an unparalleled evacuation of Kyiv and its surrounding areas, including Irpin (a city where we have teamed with its mayor, Oleksandr Markushyn, at his request for help, given the challenges he faces with the shelters in his city that we had filmed), which had already sustained brutality and torture early in the campaign).

In fact, we have a Checklist and Procedures for Survival Essentials (Draft -- to be verified upon HROC's Chief Scientist's arrival in Ukraine for DIY feasibility there) for people to download to their smartphones there in Ukraine. This would be the next step in our initiative of the winter mission, once we can actually help increase cognitive bandwidth to make the procedures and checklists needed not seem like such a "heavy lift" to people who have too much on their mind and who are mentally exhausted.

Our team has determined that making survival essentials mobile (to enable internally displaced persons inside Ukraine, or refugees going out to easily carry them, especially women with children), portable (to be more easily delivered via tactics such as "drone airlifts" we are advocating once they can be powered by our DIY method for crank generators, to people such as the elderly who are more resistant to leaving), and resilient (given the battering the DIY items made may sustain in war conditions and travel) are all critical.

The reason is that some people "are considering fleeing Ukraine either again or for the first time," according to a Polish nonprofit that supports refugees arriving in Warsaw. They note that in winter, "it's simply difficult to survive if you don't have a supply of energy or heating." In fact, about a third of Ukrainians have been forced from their homes since Russia invaded in February, according to the U.N., and nearly 8 million refugees have been recorded in Europe, the fastest-growing displacement crisis since World War 2. On the flip side, a recent U.N. survey found only 7% of respondents still in Ukraine indicated they were actively considering leaving their location, and humanitarian agencies are trying to send as much aid into Ukraine as possible since it can be difficult for the elderly to leave.

Our Ukraine team's belief is that the more locally-resourced DIY High Reliability in Ukraine, the less of a mass migration and of a refugee crisis there will then be. There will also be less risk of hostility increasing toward the refugees, such as recently happened in Germany, or the loss of popular and political support inside host nations or those providing major assistance. Having relatively safe and locally feasible electricity and heat sources, being able to prevent health crises, and even to endure nuclear fallout at greater than 80% protection levels (as we've

identified and developed in one of our procedures) all would reduce the number of Ukrainians having to leave for other nations and relying on aid shipments for energy equipment like fuel-powered portable generators, or even scarce resources like medicine (e.g., if serious infections can be prevented "upstream").

However, there were other findings that became even a higher urgency once we looked at the degree of preparation needing done, the scale of the checklists people needed to learn, and just the sheer number of people. Given respiratory and neurological issues of our Ukraine team in shelters, as a few members of our team revealed to us, there was our discovery on the combination of disease and panic also being symptomatic of what Mayor of Irpin also asked for our help – “suboptimal air composition” and then ways to solve it (or “clear the air” as the mayor termed it).

How did the suboptimal air composition issue become our focus? What initially had gotten us thinking about this “hidden problem” was that our team has said that even with just the regular pollution monitoring mechanisms (not the detailed sensors, such as low-level carbon monoxide detectors and carbon dioxide level sensors), their newsfeeds in Kyiv constantly indicate days of poor air quality. And on these poor days, the levels of depression, anxiety, and tenacity they observed were indeed impacted for the worse. Clearly, there could be other confounding variables (e.g., missile strikes that create fires and their carbon-based emissions while also depressing people), but research on suboptimal air found drops in cognitive function even in controlled environments (and where there was no war).

Thus, it may be a key cause of at least some of the “paralysis” that performing sufficient preparation confronts that our team has witnessed, including at times, with themselves – and by changing it, we could perhaps give people greater resilience and reliability. We believe it at least warrants a scientific study and tests HROC’s Chief Scientist will be performing on himself to assess the level of impact (e.g., reaction times, mental calculation capabilities, and memory recall) from moving to optimal from suboptimal air compositions.

Based on persuasion from our initial evidence that we had provided the mayor of Irpin, and what he knew about his own shelters’ age and limitations, he greenlighted our project to attempt to solve this problem, given the emerging crisis in Ukraine from the change in risk when heating air to poor air compositions, such as relative humidity dropping and indoor fuel emissions rising.

They are all part of the observations used to draw our conclusions regarding cognitive bandwidth and human performance challenges in Ukraine, with respiratory conditions and neurological challenges becoming more evident.

The end result? Compliance and follow through is insufficient in the Kyiv area to do necessary lifesaving checklists quickly and effectively (i.e., with less errors of omission and commission), that would help people accomplish processes that get them survival essentials. For example, our team members in Ukraine pointed out that people there will panic at times (the term "panic" here is not frantic or emotional, rather a task saturation panic, so more like a vapor lock / brain freeze), which affects their performance on civil defense, such as highly-educated people saying that absolutely nothing could be done on things like radiation-protective shelters being constructed quickly at home, especially those homes with no basements.

Beyond just our own observational evidence compiled by our team, another sign of the cognitive bandwidth problem is the horribly adverse impact the war is having on people, while ironically

the complexity of preventions and solutions is not overly complex, according to another NGO. There is corroborating evidence from that NGO is that Impact scores of problems and solutions are extreme, but Complexity score is only middling, indicating self-reliance should actually be effective, while Ukraine's current situation indicates it may be the only realistic option – one where moderate effort yields much higher benefits – to help people in time (given delay risks and constraints we've seen on the ground).

To be more precise, according to ACAPS, a nonprofit NGO, Ukraine currently faces a Crisis Severity score of 4.1. But the outsized opportunity for reducing preventable deaths from "changing the way people think" is apparent when comparing the Impact score, which is at the most severe 5.0, yet the Complexity score is 2.8 -- a much more navigable challenge.

This is a form of paralysis at first. But we have shown it can be overcome for maintaining health and for even generating electricity. We call this initial paralysis a “barrier to initiative” and then subsequent fall-off in effort (usually from being overwhelmed) a "challenge to cross the finish line" for survival. In our view, this indicates, as we have seen with our own team's research and observations that the complexity of mitigating, perhaps even solving, the crisis situation is not insurmountable, and can actually be improved dramatically if there is greater "self-reliance" to do procedures / checklists.

In other words, the impact if we can get people to do better self-reliance via "do-it-yourself" (DIY) survival procedures and safety checklists is disproportionate, if not a significant force multiplication on the ground, in terms of humanitarian relief and public safety gains. But our team said that “people don’t have the will nor time to think” of these survival essentials. An idea of the degree of impact is simply survival from having enough food, even when food is available nearby. For instance, in war-torn areas of Ukraine, HelpAge indicated that 91% of the older people they surveyed needed help obtaining food because they had mobility issues. With load balancing of tasks across people, and over time, as well as raising "cognitive tipping points" (all of which is our team's expertise), processes to solve this problem can be done more locally with the right level of individual initiative, adherence to instructions, and reasonable creativity in problem solving.

Without cognitive bandwidth, problem-solving creativity becomes much more difficult, and perhaps not possible when a person faces the panic situation. So even if preparation is started, it does not get completed adequately and thus has more errors. In any of these cases, the result is the same – a preventable problem, perhaps even a preventable catastrophe.

Our goal and mission for Ukraine this winter are to have:

1. More people doing the essentials for their survival in a do-it-yourself (DIY) manner, using locally-available resources (especially household items) since deliveries take so long and may not arrive in time.

2. All people training on these DIY procedures doing so much more safely and successfully, since the number of steps in the processes are often many, and challenging to some extent.

The figure below, done with our Ukrainian team, explains what our goal is in our Public Safety Scientific Study Mission to Ukraine – above all, to find ways to **increase cognitive bandwidth**, which is narrowing in Ukraine due to stress, cold, and other factors.

In Ukraine, things *FEEL* worse because they *ARE* worse – and people can't *THINK* well enough to fix enough things

Accomplishing this preparation requires initiative, perseverance, and follow-through to both start and then finish "challenging processes" that help survival and safety.

And all of this is made possible by cognitive bandwidth viewed at its most comprehensive level – including the thinking capacity *and* willpower to properly prepare for the crisis and all its contingencies. Cognitive bandwidth is critical to enabling human performance that in turn gets things done. Based on our team's research for, cognitive bandwidth also offers additional benefits such as higher levels of safety and a greater ability to conserve scarce resources (as we proved in our study that became the cover story article for a peer reviewed journal on our team's Cooperative HRO innovation). Safety and conservation of scarce resources are also both needed in Ukraine this winter.

This figure below shows why increased cognitive bandwidth will improve survival, by **increasing successful completion of the preparation** needed to maximize survival.

When starting a challenging process, people are actually most motivated (i.e., releasing the highest level of dopamine, which is also known as the "motivation molecule") when people perceive something to be both a desirable and attainable challenge:

1. If it appears too easy, we demotivate ourselves because it feels boring and mundane, so we ignore and procrastinate.

2. More importantly, if it seems too difficult, we demotivate ourselves and give up while -- or without even -- trying.

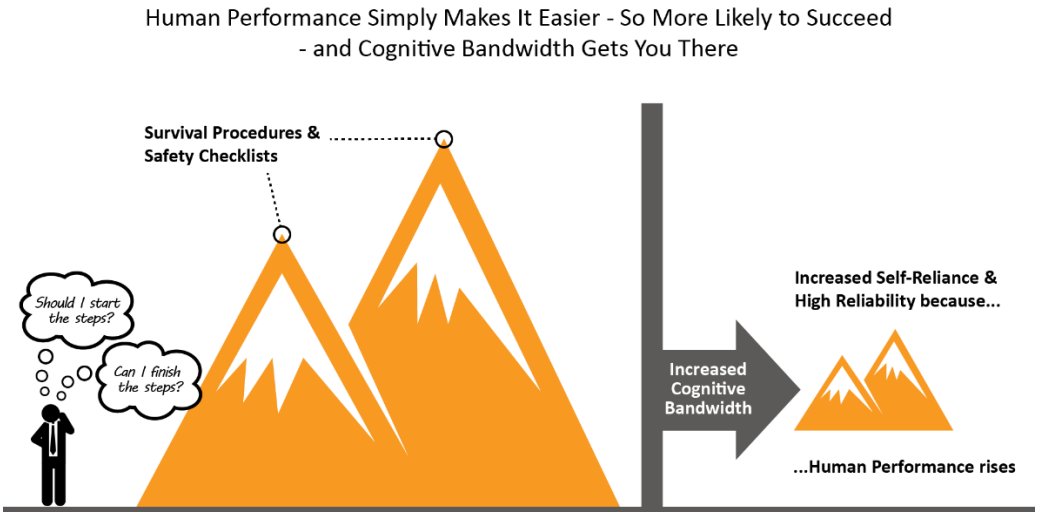
Our research shows that increasing cognitive bandwidth makes both of these problems less likely, as:

1. People realize the importance to survival and that the process is effective (i.e., they realize they want it), and thus the “rewards” possible. The rewards are not only of the end result, but also the neurochemical rewards occurring during the process (especially dopamine) to get past the boredom and distraction that that slows down or halts the process.

2. People realize the process – and its requirements – are feasible, and that they are not overwhelmed at the start or task saturated while trying to complete all the challenging set of steps in the process. If the mountain looks **“too” steep**, people don’t bother trying to climb it.

As an interesting side note on point #1 above that discusses dopamine, the reason for dopamine release when we can apply our human performance to solve problems is because it is how we survived. Evolving via natural selection over tens of thousands of generations, people's minds want to solve problems and "puzzles", since the daily data a person accrues from their senses is often a puzzle itself in order to harness all of it effectively for one’s life.

In short, our cognitive bandwidth-expanding approach helps make “mountains of mental effort” seem easier to traverse, becoming more hill-like (figure below) – i.e., mountains *into* molehills.



This approach overcomes the usual "mental blocks" to completing challenging processes, enabling people to see the "big picture" by being able to think and “connect the dots” that:

1. "Nothing good is free, especially freedom" (as Ukrainians prove each day with their sacrifices)

2. "If it were easy, it would have already been done"

3. "The journey of a thousand miles begins with the first step"

And all these words that teach us can be better learned and done if given the essential resource of cognitive bandwidth.

Coming full circle, this brings us back to the Ukrainian team at our Kyiv office, who are pioneering an effort to not only help all Ukrainians, but also the rest of the world whenever anyone confronts significant adversity. Adversity, it seems, is unfortunately growing in many ways around the world, but especially from climate disasters and armed conflict, where our team’s efforts can have near-term benefits.

For example, as already noted, HROC-Ukraine has already started with raising awareness and developing solutions for "suboptimal air composition" (SAC), which our research has shown impacts cognitive bandwidth. The team is doing this by educating leaders (e.g., the mayor of the city of Irpin), showing how to detect the adverse effects, and creating early warning systems as well as early intervention systems also.

Air composition includes properties in two categories:

1. Chemical properties, such as ratios and percentages of oxygen, carbon dioxide, carbon monoxide, toxic dust, radioactive isotopes, etc.

2. Physical properties, such as amount of water content, particulate matter, volume of air and turnover of air, temperature, etc.

When SAC is improved via optimization, it can:

1. Improve immune response and viral infection and spread by at least 50%.

2. Increase physical strength or endurance by up to 50%.

3. Most importantly, when it comes to preparing for the worst that could befall us, it lets us think ahead far longer and far better via its 50% or more improvement in cognitive capacity.

Improving SAC is the quickest win when seeking to increase cognitive bandwidth, and thus the first step in our goal. Without the ability to think clearly, the ability to survive drops dramatically.

There are other SAC dangers lurking that are more urgent of course in terms of preventable deaths, such as the carbon monoxide poisonings. Our research indicates this is mainly due to portable generators, which our team observed are already everywhere and poisonings occurring, and a request by the Ukrainian government for many more from around the world. With less power available, needs growing with colder weather, and more generators in an area occurring as more households need basic electricity to survive, this means carbon monoxide concentrations in the Ukrainian cities will likely increase, bringing with it many problems ranging from cardiac to cognitive disorders and deficits.

But there are other, longer-term adverse effects as well. Think of the CO monoxide danger as a more hidden debilitation (unlike frostbite's gangrene and amputation) -- it can have lasting effects on the cardiac, neurologic, and other systems, since it basically poisons the blood and suffocates cells from receiving vital oxygen.

Our Ukraine-office team has designed two detection solutions with the help of our chief scientist, one more "reactive" that uses a health-based symptom checklist, and the other more "proactive" that uses a "chromophore" tool based on household items that may be possible for people in Ukraine to make. The proactive solution offers the ability warn earlier at the source of the risk, or near the people who may be asleep (carbon monoxide is called a "silent killer" where people basically fall asleep before dying -- but it is especially a risk when people are sleeping, since they don't realize the symptoms when asleep). These solutions allow more people to have the capabilities of a carbon monoxide detector (a device they may not currently have, nor be able to realistically find and afford). Then there needed to be an approach (which they also designed for DIY) to reduce carbon monoxide levels without the need for the metal platinum, which is scarce in Ukraine, and costly anywhere (and hence why catalytic converter thefts are increasing).

But this also applies to the rest of the world too, where CO poisonings happen – and at a 9 times greater rate during disasters when many people are using portable generators, burning wet wood, or trying to conserve heat and fuel by burning indoors.

In fact, during its power outage, Texas had the worst carbon monoxide poisoning catastrophe in recent U.S. history (likely because many people in the nation aren't familiar with all the safety risks). In fact, this Texas example is why a "mission control" is necessary in Ukraine (or for any disaster) that can monitor for risks if equipped with tools, or at least be a resource to "multicast" alerts tailored to different risk groups (e.g., those without electricity, versus those without water, etc.). The reason it's necessary to prevent deaths is that when cognitive function deteriorates from cold, carbon emissions, etc., and cognitive bandwidth narrows, more mistakes will be made, including catastrophic errors, which is the key reason we created a Cooperative HRO.

There were several examples of risks and errors after a winter storm brought down the Texas power grid. When the power went off in millions of homes across Texas during the state's historic freeze in mid-February 2021, families faced an impossible choice: risk hypothermia or improvise to keep warm. One error was people were using their cars to stay warm. Another error was that many brought charcoal grills inside or ran cars in enclosed spaces, either

unaware of the dangers or too cold to think rationally. The third error was the state doesn't require carbon monoxide alarms in homes, so many people didn't get what they needed to prepare for a power outage in advance (which includes a CO detector) to warn of dangerous levels, or even understand why it is necessary for safety, especially under certain scenarios.

SAC is not the only factor that literally "chokes" cognitive bandwidth, but our research indicates it certainly is a major factor, based on our analysis of the research (and findings that are not counterintuitive, given the rhetorical question of "how well can anyone think when they are struggling for breath?").

The immediate benefits of early detection of SAC are to then be able to:

1. Move to better air elsewhere (i.e., moving from the current location)

2. Obtain better air from elsewhere (i.e., general ventilation, or our hyper-localized ventilation system)

3. Change and optimize the air composition in one's current location (i.e., by transforming air via chemistry or physics)

And optimizing air composition can be a rapid way to increase bandwidth and human performance to prepare what is necessary to survive this winter in Ukraine, or any crisis around the world.

We believe that the efforts of our Ukraine team help realize what President Zelenskyy said, which is that helping Ukraine efforts is investing in the free world, one committed to human rights and the rule of law.

It can also help in gaining further ground with potential new allies, since natural disasters and armed conflicts are reaching some of the largest population and GDP nations, such as India (e.g., given the flooding in South Asia, as well as border skirmishes with both Pakistan and China).

In fact, the actions of Russia have led other nations to have to consider consequences of being tied to the emerging Russian and Chinese partnership even among historic allies such as India, which is playing a role in mediating the conflict in diplomacy, and trying to moderate the worst impulses of Russian leaders, such as nuclear saber rattling, which can potentially show the world a new calculus for democracies to have at least enlightened self-interest. For example, on a recent visit to India, Treasury Secretary Janet Yellen said the U.S. wanted to "diversify away from countries that present geopolitical and security risks to our supply chain," singling out India as among "trusted trading partners."

Beyond economics, there is a military calculus as well to India, since with border skirmishes with China more a risk these days, it appears unlikely that India can count on Russia given Moscow's growing economic and military dependence on China, making India's strategic relationship with the West critical. Ukraine's experience in civil defense to bolster the resilience of India's citizens and to make them more prepared for more contingencies makes it beneficial to other nations at risk of nuclear-armed or terrorist-tactic nations, to reduce potential fear and panic in its populace – and to make nations think twice before attacking (a key goal of defense).

Supporting the HROC-Ukraine mission also enables finding answers to complex questions, such as "how to problem-solve problem-solving," by using human performance improvement

techniques, when the consequences of failing at problem solving take the form of preventable deaths.

Tying to a critical metric, the team's work answers, "how to increase survival rates in any disaster (both natural and man-made)."

How does cognitive bandwidth impact other problems found in the U.S., even the world? There are many benefits.

Civil defense is perhaps the most immediate, both for natural and man-made disasters. In the case of Ukraine, even more specifically it is the improving of defenses against Russian war crimes of targeting civilians.

One example is that Russia is preparing a prolonged air campaign using Iranian-made drones in an effort to exhaust the Ukrainian people, Pres. Volodymyr Zelensky said right after the New Year. “We will do everything” for this campaign to fail, he said. Ensuring the Russian objective of demoralizing via drone strikes does indeed fail will require creative problem solving, like learning how to defend against drones requires (e.g., Ukrainian forces are growing more adept at defending against Russian drones, as they say they shot down all the drones Russia launched over the new year). This capability is enhanced or – when people are nearing mental exhaustion – enabled by cognitive bandwidth. However, even further creative problem solving is needed, and will be continually needed, because though Ukraine keeps downing Russian drones, the price is high.

Therefore, given the end game is ensuring people do not become exhausted, that is another objective that greater human performance helps attain.

An additional civil defense example is that our team and also news reports are noting, fortunately, the winter thus far has been relatively mild (e.g. The relatively warm and sunny winter weather in Ukraine has led to reduced daytime demand on the country’s beleaguered electricity grid, the national energy company said), but we must prepare people for if and when it turns considerably colder, since that could lead to a mass casualty event, which takes an extreme toll on family members, and could be significantly demoralizing to an exhausted populace.

Our Ukraine office’s mission strives toward greater lifesaving self-reliance of the general population (i.e., to better protect themselves and survive independently of the overstretched military and first responders), via expanding cognitive bandwidth.

Healthcare is another sector that can benefit from expansion of cognitive bandwidth. Proper use of checklists and protocols, proper administration of medications, proper operation of equipment and interpretation of results all improve with a greater ability to remember what’s been learned, as well as navigating decision trees (i.e., “if this, then this…”). It applies to everything from: 1. Preventive measures, 2. Self-care for patients, 3. Mental and physical health of clinicians who care for patients, who are simply overloaded or burning out.

Foremost for this winter around the world is the now-endemic Covid-19 and its many variants. Respiratory illnesses were the 3rd leading cause of death in Ukraine even before the war (i.e., in 2020), but it is also normally the 5th leading cause of death in the U.S. Increased cognitive bandwidth, we have proven in multiple studies, improves adherence to checklists and protocols, and can aid in preventive measures like masking, social distancing, and vaccinations, but when

that is not adopted by the local population, that is where a checklist like the Invisible Mask Initiative (IMI) can be even more valuable, as it reduces spread and viral load (thus reducing severity of illness).

Why should this be such a high priority? There is a new Covid variant XBB.1.5, which is spreading very quickly. In terms of immune evasion, the variant has shifted as far away from the antibodies made to use against them. The levels of immune evasion are “alarming” and they could further compromise the efficacy of the Covid-19 vaccines. Moreover, the risk of millions of new cases that can spawn a vaccine-evading variant is growing. A top Chinese public-health official warned of widespread Covid-19 outbreaks across the country’s more vulnerable rural areas as millions of citizens prepare to travel home for the coming Lunar New Year holiday.

And ironically, it may be that we may now be in a no-win situation, as vaccines may be fueling new Covid variants. Public-health experts are sounding the alarm about a new Omicron variant dubbed XBB that is rapidly spreading across the Northeast U.S. Some studies suggest it is as different from the original Covid strain from Wuhan as the 2003 SARS virus. Though it isn’t clear that XBB is any more lethal than other variants, its mutations enable it to evade antibodies from prior infection and vaccines as well as existing monoclonal antibody treatments. Growing evidence also suggests that repeated vaccinations may make people more susceptible to XBB and could be fueling the virus’s rapid evolution.

And in a further blow to preventing long-term loss of cognitive bandwidth, the new subvariant may now attack the brain even more.

As we have now seen from the past 3 years facing the pandemic, what happens when you have to trust people to be smarter (e.g., when you can't realistically go back to mandatory social distancing and shutdowns)? We need to consider making them smarter, by giving them more thinking capacity.

As noted above, the checklist we are employing as part of our mission is the Invisible Mask Initiative (IMI) – which our research theorizes helps slow spread and lower infection risk. The original initiative was a simple 3-point checklist focused on: 1. Detection of respiratory infection risk from low humidity (indicated by static electricity, which dries out the mucous membranes, the first line of defense in the body’s immune system), 2. Corrective actions of using a humidifier, even a no-cost evaporative humidifier, and 3. The confirmation of reaching a safe level by looking for condensation at lower temperatures but not so high that the condensation occurs at higher temperatures.

Given the primary focus on breathable air for the Checklists and Procedures for Survival Essentials (CPSE), we have expanded from the original initiative to now include reducing risk of not only disease but also death (which would occur with air toxicity increases from carbon monoxide, carbon dioxide, oxygen depletion, toxic dust from shelling, etc.), once again, in both detection and correction. The reason it is called an “invisible mask” is that this does not require actual masks, and instead relies on physics, chemistry, and understanding of human physiology and limits.

We have already explained how self-care for patients coming back to the hospital in one of our Defense projects was tripled in memory permanence (i.e., keeping people from being admitted again to the hospital to every 49 days rather than 16 days between those hospital admissions).

There is also the risk of carbon-emissions harming people long-term via climate change, which will impact health in non-obvious ways as well. Noting that “climate change produces both hotter summers and colder winters,” the researchers urged patients, doctors and public health officials to become more aware of the potential health risks of temperature extremes. For example, heart failure deaths increase 12% on very hot days, and even greater 37% on very cold days, as blood vessels constrict, causing more resistance to the heart's pumping, when the body is cold and heat needs retained. And of course, given the cold of Ukraine, and the elderly who have remained in the nation, there will be a much higher risk of heart failure deaths as soon as the first extended frigid cold wave descends on areas of Ukraine, and not just from the more obvious hypothermia and respiratory infections.

There is also a psychological and social toll of the war, as even intimacy and bonding become uphill battles from the psychological weight. A member of the Ukrainian military said, "When you’re there, you’re constantly being shelled — there’s constant adrenaline and stress and wounded friends and concussions. You see death, every kind of death, and you can only handle it for so long."

At the outset of the war there was a kind of thrill to the daring Ukrainian resistance, said a therapist in Kyiv. But that quickly dissipated. What took its place, the expert said, was the psychological weight of the war’s innumerable traumas — as many as 100,000 soldiers killed or wounded; more than 5 million Ukrainian civilians forced out of their homes and turned into refugees; more than 10 million now throughout the country facing humanitarian disaster. “It’s a real trauma, and trauma and romance don’t go together,” said one expert. War zone trauma can also cause a sort of “survival mode thinking” -- you have this heightened sense of mistrust of others...When a service member returns home, it’s hard to turn off that survival mode the expert noted.

In HROC's view, trust is a form of reliance. And people relying on you means you need to be reliable to others in order to build trust. That reliability suffers when cognitive bandwidth erodes.

Now perhaps the greatest lingering crisis to healthcare since the pandemic is burnout, as it affects so much more care than just those infected by Covid. As one author explained, when Covid-19 hit, workers in teaching, nursing, hospitality and retail (occupations where women predominate) bore a fair part of the burden associated with the disease. Women especially struggle to balance self-care against filling the needs of their families, ending up exhausted and emotionally drained. It is also unhealthy, leading to lost friends and mentors to hypertension-induced strokes, heart attacks, diabetes complications and simply exhaustion from adequate self-care.

Many don’t have the necessary tools to cope with their feelings in a healthy way and, as a result, may engage in unhealthy coping strategies such as eating unhealthy foods, drinking alcohol, using illicit drugs, being sedentary or a workaholic. Thus, focusing on self-care, the author noted, is a matter of survival. Cognitive bandwidth is the ultimate coping mechanism, enabling people to feel better as they are more able to think their ways out problems.

We can also relate what the population of Ukraine is facing, including to its health workers, to the burnout and exodus of healthcare workers in the U.S., and what can be learned from problems and proposed solutions for overloaded first responders and health-related staff in Ukraine that can have benefits to the U.S. system.

In addition, health resources that overload cause preventable errors. If we can optimize air composition in these areas affected by war, and use additional techniques like “protected flanks” from the Cooperative HRO to reduce checklist overload impact during a crisis, we can correct issues proactively for higher reliability and fewer preventable deaths.

In the U.S., what we have learned during the Ukraine disaster can be applied to prepare for the next pandemic. The findings can also inform (via publications and / or press releases for news stories) the U.S. government on the risks, and the need create more surge capacity in the U.S. for natural and man-made disasters.

Our research shows that the more episodes of cognitive overload you have, the faster a person will burn out. With burnout, not only does morale suffer but so does performance and reliability of the frontline teams and their support teams.

The issues being seen in Ukraine reduce productivity not only of doctors, but also importantly (to offload work from doctors), their support team. And the issues leading to overload in Ukraine are relevant to a significant degree at least during any natural or man-made disaster, but also if current trends hold. In both overwhelmed areas of Ukraine, but even areas that have more resources, the factors we've uncovered we believe are significant contributors adversely affecting reliability of all who are involved in healthcare, including the patients themselves.

One study provides findings on the burnout and exodus from the healthcare industry: More than half a million people in the healthcare and social services sectors quit their positions in September [2022] — evidence, in part, of burnout associated with the coronavirus pandemic — and the American Medical Association says 1 in 5 doctors plan on leaving the field within two years.

The shortages have hit the health-care system like a tsunami [the chief medical officer at Yale said...] "Physicians, nurses and support staff have experienced a shift in how the public treats them compared with 2020. When covid first hit, there would be all of these parades past our hospital where people would call health-care workers heroes...now, we’re seeing nurses who show up in scrubs try to sign up for apartments being turned down because [management companies] don’t want people living there who work in health care."

In November [2022], the American College of Emergency Physicians and 35 other health-care associations sent a letter to President Biden urging the administration to address ER staffing shortages and burnout...[Many problems] can all affect the mental health and well-being of the physicians and nurses,” they wrote.

"...The assumption was when the coronavirus surges subsided, things would return to normal," [said a leader from Mass General Brigham] “[but] there is no more normal. Everything has changed, and now all those issues at the forefront are only getting more exacerbated over time.”

Raising the stakes further, burnout is an actual medical diagnosis according to the ICD-10 classification codes (Z73.0 Burn-out), so it is also a clinical concern, not just a workplace concern.

Burnout itself has been shown to reduce safe throughput (which we improved with the reduction of task saturation at the Hopkins at the Pancreatic Multi-Disciplinary Clinics) by up to 50%, which would explain the deteriorating condition of the healthcare industry. Burnout has been frequently associated with various forms of negative reactions and job withdrawal, including job

dissatisfaction, low organizational commitment, absenteeism, intention to leave the job, and turnover. For people who stay on the job, burnout leads to lower productivity and impaired quality of work.

Another study found that 89% of psychiatrists had either thought about or experienced a clear threat of severe burnout. Another study found that 90% of the respondents with severe burnout (i.e., daily occurrence of burnout symptoms) reported a physical or mental disease, with musculoskeletal pain and depression as the most common problems. And finally, a longitudinal study found that increases in burnout predicted increases in subsequent prescriptions of antidepressant medication.

A different study looked at the occupational burnout and productivity loss among academic university staff. Using a Maslach Burnout Inventory-Human Services Survey (MBI-HSS) to assess occupational burnout dimensions (i.e., emotional exhaustion “EE,” depersonalization “DP,” and personal accomplishment “PA”), while work productivity was assessed with the Health and Work Performance Questionnaire (HPQ), it was found that in total, 28% of respondents scored high in EE [95% confidence interval (CI): 22.5–33.8%]. The absenteeism rates among respondents with moderate and high EE were 2.1 and 3.3 times the rates among those with low EE, respectively. Likewise, the presenteeism rates among respondents with moderate and high EE were 2.4 and 4.7 times the rates among those with low EE, respectively.

However, it can apply even in specialty care. For instance, in cancer patients, the worries about cancer’s consequences increases their cognitive load. At the same time, the effect of the treatment (i.e., “chemo brain”) reduces their cognitive tipping points. This reduction in cognitive bandwidth and thus human performance ultimately reduces self-reliance when complying to instructions from the patients’ physicians, making it difficult to maintain through treatment and to recover once done. It also adversely impacts lifestyle choices that can impact the disease, whether before or after cancer diagnosis and treatment.

Outside of this research’s relevance to healthcare, it can directly affect people’s finances and the overall broader economy. For instance, even business productivity is suffering from something related to burnout – according to one survey, burnout is the leading cause of at least 50% of “quiet quitting.”

When we consider empowering people in a job, it does not just mean providing them responsibility with the burdens and worries of accountability. It also requires ensuring people can "get the job done” (along with all its specific tasks). Similarly, empowering people to better survive and then thrive means not just telling people what they need to do, and then telling them they must get it done. In war and disaster, there's a lot of things that not only should be done, but also can be done (even those items that offer little value or may not even work), and never enough time to do them all. Our research addressed the question of, “What happens when you just give people more and more checklists – and tell them to ‘overachieve’ to get them done?” Answer: It cannot be done over a long period of time, especially in worsening conditions. Overachieving, by definition, is unsustainable.

This is what Ukraine faces. But this also applies to any place in the world during a major disaster, or to any vulnerable population in under-resourced, higher-stressed areas (e.g., low-income communities).

Human performance is critical to empowerment. We and others have shown human performance is based significantly on our ability to think, remember, and to focus and drive ourselves, which is basically our cognitive bandwidth, something that is critical to not only fighter pilots in jets, but also to people fighting for their lives or populations fighting poverty, as it allows humans to reason, focus and resist impulses – yet we have only a limited amount of it, which means we can only pay attention to, think about or remember a certain number of things at one time. And where we live – and breathe – matters. In one sense, it is true that "air is free", but *poor air* (not just dangerous or deadly air such as from high levels of carbon monoxide that lead to poisoning), comes with a significant cost in many crucial areas during a disaster, especially in terms of human performance and resilience.

Education is another area. According to experts, one of the most important factors in education is "a simple willingness to learn." Students who are open to new knowledge will learn. Students who aren't, won't. The entire point of cognitive bandwidth is to improve not only memory encoding and recall, but also to speed up navigation of decision trees in the process of synthesizing data and activating creativity. But above all, our evidence indicates that it can improve the willpower necessary to seek data and then process it.

Crime prevention is actually similar to education and productivity -- memory recall, navigating decision trees, and willpower. Most critical is that people need to think through the consequences of their actions. This was the basis of the Lead-Crime Hypothesis, which we think parallels the cognitive impairment of suboptimal air composition. Lead is widely understood to be highly toxic to multiple organs of the body, particularly the brain. Individuals exposed to lead are more vulnerable to learning disabilities, lower I.Q., ADHD, and problems with impulse control, all of which negatively impact decision making and could lead to the commission of crimes, especially violent crimes. Any means of improving cognitive bandwidth, we believe, will aid in reducing crime.

Social cohesion overall, especially in global democracies, will be another benefit of increasing cognitive bandwidth, as it can change society. It does this by enabling people to think better, making them more resilient to protect themselves and others, and ensuring they are less susceptible to misinformation and irrationality (both of which are all parts of Russia's broader war that includes "information warfare") so as not to be misled by Russian disinformation campaigns that are meant to stoke hate and division, and which intend to undermine the free world.

Regarding just Ukraine, if disinformation looks as if it will work to the Russians, they will use it. This then puts Ukraine at greater risk. For example, one expert noted that Russia's dirty bomb claims that would happen in Ukraine were planned in great detail as a disinformation campaign, intended for world consumption, to be able to more easily deny their own culpability in a nuclear fallout attack. However, if rationality prevails in the target audience of the world, it makes the risk of consequences too great for Russia's allies, especially India, which has spoken out against the use of nuclear tactics, likely even deterring their use thus far according to the CIA.

In short, carbon capture, and other techniques and technologies being pioneered in Ukraine will help that nation and can help the rest of the world at the same time in an area that could present the greatest immediate risk – a world where words have no reliability and people can't separate the truth from lies.

Coming back to defense, it is the developing of allies that see value in working with democracies which, though not perfect by any means, tend to respect rules and human rights more than the alternative forms of government. One of the advantages of the Cooperative HROC is that for specific outcomes – focusing on the ones that most nations value for their stability and citizens – it is precisely cooperation in this “enlightened self-interest” manner that can advance the interests of more nations working together. As we have seen over the past 2 decades, in terms of global change, there is now a reality check -- where the U.S. has less power to compel outcomes, it needs better strategy to achieve its ends.

For example, recently, the Biden Administration's national security adviser noted that old Cold War construct of blocs is not a realistic alignment anymore, as countries don’t want to choose, and we don’t want them to. Rather than trying to divide the world, the U.S. needs to seek an affirmative agenda — like infrastructure, climate, and food security. The term “net assessment” during the Cold War was about weighing the Soviet-American strategic balance, “net” of each other’s offsetting strengths and weaknesses, using this formula to calculate deterrence — and estimate what the balance might be after a nuclear exchange.

Today, it is more about spotting trends and future prospects, and making a realistic assessment of the relative positions of the U.S. and its adversaries in what has become a truly multipolar world. For instance, there has been success in dramatically in bolstering American partnerships abroad: NATO is stronger than it has been for a generation and is about to add Finland and Sweden; Japan is becoming a serious defense partner; South Korea’s cooperation with the United States and Japan is better than it has been in years; and India is moving toward a strategic partnership through the Quad (the United States, Japan and Australia). This is considered a pragmatic foreign policy for today's world as it is, rather than as we would like it to be – and have no longer have the ability to change in the old traditional ways. We need new ways to get people to see the enlightened self-interest of appreciating science and math, while also seeing the benefits of adhering to rules and simply being "reliable" partners.

One more lesson that can be garnered from what Ukraine and the West can do? How to win a war against a brutal nuclear power. We need to be preparing for nuclear war if there is a humiliating set of defeats for Russia, given the brutal, unpredictable, and even self-destructive nature of their leadership. Experts have assessed scenarios: Under what conditions would Putin be more likely than not to order a nuclear strike? Likely answer: If conditions on the battlefield force him to choose between a humiliating defeat, on one hand, and a nuclear attack that offers even a slim chance of an acceptable outcome to his war, on the other.

If Pres. Zelensky succeeds in his current objective to liberate every square inch of Ukraine seized by Russia, including Crimea, this decisive defeat of Putin’s armies would not pose an existential threat to Russia. It would, however, pose an existential threat to Putin’s rule. If he is forced to choose between a humiliating loss and conducting a nuclear strike, the expert cited believes he will choose the latter. The reason? President John F. Kennedy came away from that the 1962 Cuban Missile Crisis with a major lesson that he passed to his successors. He said in his most important foreign policy speech, just before he was assassinated: “Above all, while defending our own vital interests, nuclear powers must avert those confrontations that bring that force an adversary to choose either a humiliating retreat or a nuclear war.”

In other words, any quick and glorious victory for Ukraine would likely be a Pyrrhic victory -- one that would eventually lead to dramatic escalation that could consume all of Ukraine, but most of

the world as well. If trying to avoid this nuclear confrontation, it is probably best to prepare for a long slog that wears the Russians down, then out -- similar to their exit from Afghanistan back in the 1980s. Rather than abrupt actions, it becomes more of a slow realization that it just isn't worth the loss of blood and treasure in the Russian leadership's eyes.

This means Ukrainians need to outlast the Russians. This won't be possible if they collapse physically, mentally, and emotionally, so every effort to reinforce their resilience should be made so they can endure the war's many hardships.

Finally, the benefit that may offer the greatest long-term impact on the planet from our HROC-Ukraine work is how our approach can "change the way people think" about climate change -- that greenhouse gases simply reduce your human performance, and quite significantly at that.

One series of question could allow people to view the problem differently than most people do today (i.e., something too large and abstract, not personalized, and too far in the future to affect them DIRECTLY): "What if the car you're in gets you to where you want to go, but during that trip, has toxic levels of carbon emission buildup inside it? By the time you arrive, you don't know where you are, or even why you came there? Is that worth it? When survival is at stake, is having power to address one need (e.g., transportation) worth sacrificing problem-solving capabilities for addressing many needs?"

The value of improving air composition, in spite of all its health benefits, is it requires interest BEYOND HEALTH (a key argument by our team member Dasha, who is a psychologist in Ukraine) OR CLIMATE CHANGE for most people to take the initial steps necessary to change the way they think.

Our new report includes more on these findings, and the details of our project in Irpin, where we have teamed with the city's mayor, who sees the risks and opportunities found in the air each person breathes to be able to survive now and into the future.

One of the key findings is the impact of our finding of suboptimal air composition and its impact on human performance, as it constricts the cognitive bandwidth of the human mind (and thus its thinking capacity).

This led to the discovery that there was a different way to frame the crisis the world is seeing in climate change, such as more extreme weather and the number one cause of preventable deaths from natural disasters, which is floods.

And that discovery is that reducing greenhouse gases can be personalized to individuals and not just the "too abstract" (and let's face it, too distant to impact everyone in a tangible way every day) concept of the planet and its future.

How? By reorienting what Benjamin Franklin said makes a person "healthy, wealthy, and wise" to not just be our sleep schedule but rather to be our entire human performance, which itself is heavily dependent on cognitive bandwidth.

And higher greenhouse gases and overall suboptimal air composition in the air we breathe, our research has shown, reduces cognitive bandwidth and human performance, such as in immunity, physical performance, and cognitive function -- and by up to 50% or more.

What are some of the benefits tied to encouraging people to reduce production of, or (by using our methods we've identified in Ukraine) capture the carbon gases given this new tie-in to human performance?

The project to overcome suboptimal air composition in Irpin (and then expanding to the rest of Ukraine) that our team in Ukraine helped discover appears that it can also benefit Pittsburgh neighborhoods like Oakland, the Hill, East Liberty, Homewood, etc., in terms of health, education, public safety, business opportunity, and other priorities of the city. This is something we would like to also create a dialogue between the mayor in Irpin and the city leaders in Pittsburgh, perhaps even a partnership to create economic opportunity for both cities based on the scientific discoveries.

Pittsburgh is in a valley, which will build up "CO2 domes" (as carbon dioxide is heavier than air, thus sinks and tends to stay in place), trapping CO2 in the city. The CO2 dome risk can be further assessed based on per capita carbon footprint -- which is worse than that of N.Y.C., L.A., Chicago, and D.C., and twice as bad as Miami.

As the figure below shows, the top cities for per capita footprint appear to be industrial in nature.

Table of U.S. Cities with Largest Carbon Emissions At Risk for Significant Cognitive Impact

Source Data from: https://www.citycarbonfootprints.info/

Heavy Industry?	Urban Cluster	Country	Population	Footprint	Footprint per Capita	Global ranking	-	Nation	anking	Ppm/cap	bt Indr. PPM level	Ratio	Risk of Tip
Energy	New Orleans	USA	598,000	15.6 ±7.8	26.1 ±13.0	12		1		26.1	1221	1.526	87%
Manufacturing	Detroit	USA	2,770,000	70.8 ± 15.4	25.5 ±5.6	13		2		25.5	1193	1.491	85%
Manufacturing	Cleveland	USA	973,000	24.0 ±8.8	24.7 ±9.0	17		3		24.7	1156	1.444	83%
Manufacturing	St. Louis	USA	1,177,000	28.3 ±9.8	24.1 ±8.2	19		4		24.1	1127	1.409	81%
Manufacturing	Pittsburgh	USA	602,000	14.5 ±8.3	24.0 ±10.4	21		5		24	1123	1.404	80%
Manufacturing	Toledo	USA	257,000	5.9 ±3.5	22.8 ±13.5	22		6		22.8	1067	1.333	76%
Manufacturing	Kansas City	USA	1,004,000	22.7 ±7.4	22.6 ±7.4	23		7		22.6	1057	1.322	76%
Manufacturing	Grand Rapids	USA	315,000	7.1 ±3.7	22.6 ±11.7	25		8		22.6	1057	1.322	76%
Manufacturing	Cincinnati	USA	521,000	11.8 ±4.8	22.6 ±8.9	26		9		22.6	1057	1.322	76%
Energy	Tulsa	USA	398,000	8.7 ±4.0	22.6 ±10.3	27		10		22.6	1057	1.322	76%
Manufacturing	Akron	USA	209,000	4.7 ±2.6	22.6 ±12.6	28		11		22.6	1057	1.322	76%
Manufacturing	Dayton	USA	278,000	6.1 ±3.4	21.8 ±12.1	31		12		21.8	1020	1.275	73%
Manufacturing	Minneapolis	USA	1,516,000	33.0 ±9.8	21.8 ±6.4	32		13		21.8	1020	1.275	73%
Manufacturing	Fort Wayne	USA	153,000	3.3 ±2.1	21.5 ±13.7	33		14		21.5	1006	1.257	72%
Manufacturing	Louisville	USA	575,000	12.3 ±4.9	21.5 ±8.6	34		15		21.5	1006	1.257	72%

In fact, Pittsburgh is at #6 in the U.S. per capita, and #21 in world, with 14.5 Mt CO2 total for its urban cluster of 600,000 people, based on a compiled study explained by a scientific journal, with maps by NASA, and other information. There have also been articles written on how low-income residents of the city are finding clean air is an elusive goal, as the region's air remains among the most polluted in the country.

One study suggested by our team for Pittsburgh is on a combination of mental health crises events, crimes, and physical health events during the days most applicable to the Invisible Mask Initiative risk assessment and predictive model of where the solution likely would have made a difference, looking at the environmental factors and the relevant population, coupled with other impacts on:

1. Immunity resilience as measured by sick days in school or work, or admission counts to hospitals

2. Chronic care management checklists relying on cognitive bandwidth, and overall health (e.g., ambulance calls) or safety crises (e.g., 911 calls)

3. Laws and other rules adherence (e.g., criminal behavior noted by police calls) or mental health crises (e.g., suicide hotline calls)

4. Education can be evaluated by looking at student scores on standardized tests during affected days

5. Economic productivity could be measured by employer statistics on absenteeism and presenteeism, which we believe would increase on those days of or right after suboptimal air composition

Note that according to Inflation Reduction Act (IRA), CO2 has become identified by the US Government as a pollutant. That is, the new law amends the Clean Air Act, the country's original air-quality legislation, to define the carbon dioxide produced by the burning of fossil fuels as an "air pollutant."

Thus, there are development dollars for cities, and subsidies for those wanting to improve their health and human performance through air composition, within the U.S. Cities such as Pittsburgh that can be used to implement the techniques we have learned in Ukraine relating to how to move away from dangerous fossil fuels into new or revamped technologies like heat pumps – manufacturing it in Pittsburgh and Irpin for personal use or for resale by people who become skilled, including those not having a college degree.

What do we mean by "for personal use or for resale"? We want to first and foremost have a DIY approach to create the tools for improving human performance. We have found in work done with Veterans Administration that health is less of a priority than something that can help people excel in their jobs, and thus bring in more income – hence the focus on human performance.

The DIY approach is for those at the lowest incomes that don't have money, but do have time to learn and create their own version of the tools -- and a dire need for survival essentials -- do not need to buy from *any* manufacturer, but can instead make their own, if they have sufficient cognitive bandwidth, which we have found is always the first step, based on our Defense projects – "if people can't think enough, it's very difficult to do enough." More insights gained from our Defense work is the value of DIY, we determined, as the best way for the Defense Department to benefit from techniques we had pioneered in order to show rapid results the military facilities, since then they could implement the tools they needed much faster and at a lower cost.

For those that can afford to have our team of people in Ukraine and Pittsburgh do this for them (e.g., if they can get grants, or even through the subsidies of the green energy components of the Inflation Reduction Act), this technology is something HROC would like to manufacture in a nonprofit manner that can bring these benefits to the masses (to help both individuals and the planet), as well as the jobs to lower-income community workers in both Pittsburgh and Irpin, given the DIY nature of the devices that can be made from these techniques, as well as the fact that we can make the job seem easier to the workers by increasing their own cognitive bandwidth.

The new Climate Change provisions in the newly-signed IRA makes inventions possible from our Ukraine projects even more valuable to jobs and future economic growth and trade between the U.S. and Ukraine, since it can remove "pollution" from air in multiple ways, including now CO2, not just toxic dust, smoke, and pathogens.

Given that heat pumps will be a key option, from our Ukraine techniques, we have a new design based on Stirling Engines which we have advanced from the older versions of the technology. It

can tie heat pumps to carbon capture mechanisms we have also shown. Finally, Stirling Engines can also be used to create even more efficient solar generators.

Currently, heat pumps are technology where demand is already rising. Demand is already skyrocketing in Europe, where surging gas prices due to the war in Ukraine have forced consumers to scramble for alternative home-heating strategies. In Germany, heat pump sales jumped 25% from 2021 to 2022. In Finland, they rose 80%. Heat pumps, which can serve as both heating and cooling systems, were once considered useful only in warmer climates. But in the past few years, they've become far more sophisticated, and are now considered by some as the best chance there is to phase out fossil fuels as a means of heating and could help move toward a climate revolution.

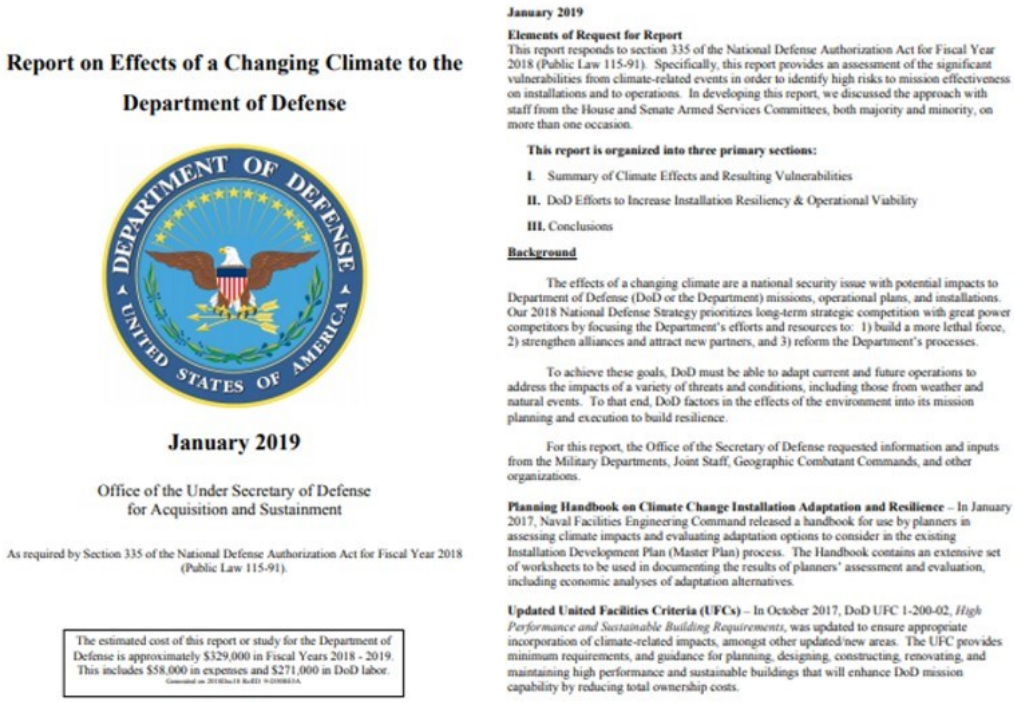
In our view, perhaps more important could be a sea change event if people adopt the "peak human performance" angle we have discovered. This can create demand for tools to reduce fossil fuel use and mitigate the consequences of its past and continuing use (so as to be realistic and practical -- carbon-based fuels are still over 80% of U.S. sources of power) for the time-being, carbon capture may be a new growth area for improving not only the planet and society, but also business productivity and individual well-being and happiness. It can become similar to what computers became to leverage and increase productivity of the human mind, while also addressing the challenges facing the human body and future threats.

Beyond the health, economic, and quality of life issues, climate change is also considered a human rights issue as many have noted (e.g., poor countries' populations are hit hardest by it, though those nations emit much less carbon emissions). However, climate change appears to be raising levels of domestic violence against women and children, irritating people not just from heat, but frustrating them when there is drought or famine as a result, and they lash out at those at home.

Coming full circle back to defense, the adverse outcomes of climate change can impact an entire population (through violent government suppression), neighboring nations (through refugees), and -- if Russia shows it can take what it wants without consequences -- perhaps even have nations losing portions of their land as it is seized by force if a nation faces a climate change-induced extreme weather event like drought or flood that could lead to civil uprising.

One key example is that the U.S. Department of Defense noted about the Syrian climate crisis from 2011 throughout the bulk of the rest of that decade was as a result of climate change. One reason was that climate change in the Fertile Crescent had implications of the Syrian drought that led to civil unrest. Before the Syrian uprising that began in 2011, the greater Fertile Crescent experienced the most severe drought in the instrumental record. For Syria, a country marked by poor governance and unsustainable agricultural and environmental policies, the drought had a catalytic effect, contributing to political unrest. Moreover, the Syrian refugee crisis also resulted from this. The U.S. Defense Department even did a report on this emerging global threat to world stability and national security, with the cover shown in the figure below.

Climate Change & National Security



Report on Effects of a Changing Climate to the Department of Defense

January 2019

Office of the Under Secretary of Defense for Acquisition and Sustainment

As required by Section 335 of the National Defense Authorization Act for Fiscal Year 2018 (Public Law 115-91).

The estimated cost of this report or study for the Department of Defense is approximately $329,000 in Fiscal Years 2018 - 2019. This includes $58,000 in expenses and $271,000 in DoD labor.

January 2019

Elements of Request for Report
This report responds to section 335 of the National Defense Authorization Act for Fiscal Year 2018 (Public Law 115-91). Specifically, this report provides an assessment of the significant vulnerabilities from climate-related events in order to identify high risks to mission effectiveness on installations and to operations. In developing this report, we discussed the approach with staff from the House and Senate Armed Services Committees, both majority and minority, on more than one occasion.

This report is organized into three primary sections:

I. Summary of Climate Effects and Resulting Vulnerabilities

II. DoD Efforts to Increase Installation Resiliency & Operational Viability

III. Conclusions

Background

The effects of a changing climate are a national security issue with potential impacts to Department of Defense (DoD or the Department) missions, operational plans, and installations. Our 2018 National Defense Strategy prioritizes long-term strategic competition with great power competitors by focusing the Department's efforts and resources to: 1) build a more lethal force, 2) strengthen alliances and attract new partners, and 3) reform the Department's processes.

To achieve these goals, DoD must be able to adapt current and future operations to address the impacts of a variety of threats and conditions, including those from weather and natural events. To that end, DoD factors in the effects of the environment into its mission planning and execution to build resilience.

For this report, the Office of the Secretary of Defense requested information and inputs from the Military Departments, Joint Staff, Geographic Combatant Commands, and other organizations.

Planning Handbook on Climate Change Installation Adaptation and Resilience – In January 2017, Naval Facilities Engineering Command released a handbook for use by planners in assessing climate impacts and evaluating adaptation options to consider in the existing Installation Development Plan (Master Plan) process. The Handbook contains an extensive set of worksheets to be used in documenting the results of planners' assessment and evaluation, including economic analyses of adaptation alternatives.

Updated United Facilities Criteria (UFCs) – In October 2017, DoD UFC 1-200-02, *High Performance and Sustainable Building Requirements*, was updated to ensure appropriate incorporation of climate-related impacts, amongst other updated/new areas. The UFC provides minimum requirements, and guidance for planning, designing, constructing, renovating, and maintaining high performance and sustainable buildings that will enhance DoD mission capability by reducing total ownership costs.

Thus, there was the creation of conflicts (civil war from famine, mass migrations creating instability in neighboring nations, and rise of unhappy populations joining terrorist groups), all shown during Syrian conflict.

Bottom Line: It is likely that a terrorism increase (ISIS) and humanitarian disaster (Syrian Refugees) all originated from a climate change event (a drought in Syrian farmland).

In terms of defense against conflict like Ukraine is seeing, or the U.S. and the E.U. has seen, in terms of attacks on their own soil, the world has now seen over 20 years of petrostate-funded terrorism and war.

A new approach to move from fossil fuels to alternative, non-carbon emitting sources of energy is one technique in our approach. The other is to capture carbon, which is part of our techniques as well.

Our overall argument is simple: To improve your own human performance, reduce greenhouse gases where you live and breathe.

In conclusion, for the planet, society, and the free world, teaching self-reliance via human performance is what can make people better and safer, not just happier. “Changing the way people think” to not only address greenhouse gases and climate change, but to also add social cohesion by broadening of minds (i.e., giving people more mental space to think and solve problems and understand other people better) is simply one more unexpected benefit learned from working with Ukrainians focused on their survival. As the Greek philosopher Aristotle pointed out, you do indeed “derive wisdom through suffering.”

Acknowledgments: In this progress update, we would like to thank all those who donated for our New Year's Eve online fundraiser by physicians seeking to aid Ukraine. The team in Ukraine doing this innovative work is truly appreciative of the $900 that was raised toward their efforts on New Year's Eve.

Summary:

1. A Reliable Power Initiative (RPI) < https://www.thinkhro.org/images/CaseStudyStory.jpg>, based on do-it-yourself (DIY) <https://www.thinkhro.org/images/DamagedDroneForChargingPhone.jpg) crank generators to charge smartphones (a lifeline in any disaster), instead of using gasoline-/diesel-powered portable generators in a disaster, especially to make the evacuations that Ukraine is facing more coordinated and safer. Relying on portable generators is unsafe, as they are too often scarce/expensive/targeted, impractical to carry and fuel them during evacuations (as evacuees will consist more of women and children), can't run safely in conditions like rain or snow, and dangerous given the carbon monoxide (harming near-term / long-term physical and mental health, and simply the ability to think). RPI is tied to our first major project – for the city of Irpin by request of the mayor < https://thinkhro.org/vids/IrpinMayorInterviewWithTranslation-RequestingHROChelp.mp4> to help with safer air, given how air composition can turn debilitating or even deadly. One case study is on "RPI as a critical link" enabling aid deliveries to continue to hundreds of recipients. Another case study is on educating most people, but especially students, on our "damaged drones to charge smartphones" initiative – showing how to create crank generators from not only broken drones but also many electric devices that most anyone can find in their homes or even in trash or scrapyards. Irpin's Mayor asked for our help on survival essentials like electricity that can avoid poor air (what we call "suboptimal air composition") that could harm his residents, especially in shelters < https://thinkhro.org/vids/ShelterVideo1-110322v2.mp4>, and we don't want to see Ukraine "mortgage its future" in terms of health and thinking capacity by significantly increasing carbon monoxide levels, since it is avoidable. Besides, getting people food (to give people energy to crank) is more beneficial and practical than getting carbon-based fuel in a disaster – especially since fuel is dangerous, while food is a helpful, if not necessary, item in many care packages. Coordinated successful evacuations will be critical, as everyone wants to reduce the possible targets and victims of sieges, brutality, and torture – as well as, of course, civilian deaths. STATUS: On the ground testing in Ukraine, with a mission to complete in Irpin and Kyiv before a likely re-invasion by Russia and thus likely exodus from cities surrounding Kyiv in the most safe, coordinated evacuation possible. This would not be possible without charged smartphones.
2. Self-reliance through our human performance initiative to increase cognitive bandwidth and support DIY training – focusing on innovations to address "suboptimal air composition" which is both dangerous for near-term and long-term survival of people in Ukraine and any disaster worldwide. STATUS: On the ground testing in Ukraine, with a mission for scientific study planned by HROC's Chief Scientist.
3. Cooperative HRO civil defense support DIY training – Our "Remote Force Multiplication" team maximizes the positive impact support teams on the ground can make, while minimizing errors, of overwhelmed, overworked, and limited staff and resources -- like we did in U.S. Defense

Health care teams. The training videos from the webinars include subtitles, since people can't play them at volume when hiding in shelter. STATUS: On the ground testing in Ukraine.

4. Respiratory infection and inflammation DIY kit assembly – Our "Remote Prevention" team has expertise in preventing serious infections (like we did in U.S. Defense Health) that would otherwise consume scarce and costly x-ray or radiology equipment, as well as require ventilators/ICUs. Also critical is its ability to reduce the use of medications when not beneficial, as well reduce the time of clinical teams who are overloaded and burning out already. The same approach can be used in preventing inflammation from toxins, which can also lead to cancers and other long-term afflictions like those experienced by 9/11 first responders in the U.S., by monitoring for toxic dust on black surfaces. STATUS: On the ground testing in Ukraine.
5. Improvised power using do-it-yourself (DIY) – HROC's Remote Rapid Response team is similar to a simulation team. It is used to problem solve based on conditions on the ground. In this case, it determined how to use disabled engines and motorized appliances in disaster zones to be sources of power to help civil defense (e.g., using an alternator-to-generator conversion process) which can be attached to bicycle frames, or even wind or water turbines, to generate power anywhere. STATUS: On the ground testing of design in Ukraine.
6. Crank generator and smartphones for shelters' civil defense – HROC developed a "new innovation" for reliable power in underground shelters (using creative problem solving from situational analysis, given importance of smartphones in shelters to learn survival tactics and safety measures). These crank generators can also offer a more practical way to charge at night, and also at higher wattages. Is necessary to charge drones that enable early warnings and also offer ability to deliver small supplies like medicines in dangerous areas. STATUS: Our delivery of our initial hand-crank generator < https://www.youtube.com/shorts/3lJIkSam1r8 > for charging of smartphones is in the field in Ukraine.
7. Protective wear with add-ons – HROC Team members and their contacts created a supply line and distribution network, and with an HROC "new innovation" of protective metal placement as an add-on to ensure higher reliability given Russian weaponry being used in the field. This was done by using creative problem solving from our situational analysis, and is being applied initially to help improve the safety of Ukrainian logistics support teams. STATUS: Our delivery of protective wear < https://www.youtube.com/watch?v=n2MJQvi5NeU > and protective DIY techniques are in the field in Ukraine.
8. Solar chargers – HROC Advisory Board members created a supply line and distribution network for this critical item to charge smartphones, laptops, and mobile water purification systems. Power is needed for various tools for public safety and public health, so solar power were welcome innovations to bring to those on the move in Ukraine where the electric grid is unavailable. This delivery of solar chargers also led to our new HROC office in Kyiv, a supply line from Medyka Poland to Kyiv, and a supply line from Kyiv to Eastern and Southern Ukraine. STATUS: Our delivery of solar generators https://thinkhro.org/vids/v3-Cropped-OurCivilDefenseInHelpingDefense-SolarPanelsUsedBySoldiers-IMG_0344.mp4>, especially to charge critical smartphones, is in the field in Ukraine.

Introduction to Plan

What can save the most people in Ukraine this winter, given the urgency, shortage of resources, and difficulty shipping more there? Enabling the most self-reliance using what's available there right now.

However, our HROC team in Ukraine has observed that there's a form of "paralysis" occurring physically of the civilian population in hard-hit areas like Kyiv, because there's a paralysis occurring mentally (or, more specifically, cognitively). We believe that breaking that "mental logjam" will enable people to start preparing for survival under even more extreme conditions, or to evacuate to safety more successfully. With the help of our team in the U.S. and Ukraine, we will document why this paralysis is happening, how we have proven we can fix it, save more lives in Ukraine, and finally show why it can improve lives for Americans and people worldwide in terms of safety, quality of life, and economic gains – going well beyond the "defense of freedom against dangerous tyrants" stake the free world has in Ukraine.

Ukraine has lost nearly half of its energy grid thus far. And there is the risk of an unparalleled evacuation of Kyiv and its surrounding areas, including Irpin (a city where we have teamed with its mayor on help given the problems he faces with his shelters), which had already sustained brutality and torture early in the campaign). Based on our Ukraine team's on-the-ground assessment, there will be a panic situation with an extensive loss of life if there is a January re-invasion of Kyiv by Russia launched from Belarus, which is an increasing possibility. And, despite the resilience and courage shown thus far by the Ukrainians against painful deprivation and literal freezing, there will likely be an extreme refugee crisis if people are plunged into a Russia's goal of a total energy grid collapse, unless there is a viable means of survival (e.g., heat, electricity, basic preventive health, and even keeping smartphones operating to ensure access to information), as well as less obvious situations of avoiding of dangerous situations, like gaseous poisonings (e.g., carbon monoxide) and respiratory infection health disasters. As a famous basketball coach once said, "The will to win is not nearly as important as the will to *PREPARE* to win."

All of this means that the ability to power "human action" by Ukrainians is even more important than electricity to saving lives this winter, since actions preparing solutions in advance can not only generate electricity, they can also yield heat, protection from blasts and radiation, means to get drinkable water, breathable air, food, etc. -- all through greater initiative and self-reliance on the steps Ukrainian civilians can take. However, as the saying goes, "if it were simple, it would have already been done." Indeed, the simple stuff has mostly been done -- now we are left with the more "challenging" processes. Basically, these are the not-so-simple yet not-at-all-impossible procedures and checklists for survival and safety that most Ukrainians need to prepare for that they will quite plausibly face this winter.

This is the reason for our Ukraine Winter Initiative -- our past U.S., and current Ukrainian, initiatives show that these can be overcome, and using our process, minimize preventable harm and even preventable deaths -- just by increasing "cognitive bandwidth" of people in ways we have discovered when people face "checklist overload." For example, our research demonstrates that morale contributes to dopamine and thus initiative (to reach first tipping point to get started), and that safety is increased by avoiding task saturation and panic. Sufficient cognitive bandwidth (by avoiding a phenomenon called "task saturation") helps improve dramatically both morale and safety, the U.S. Department of Defense has reported to the U.S. Congress about our team's work. In our research document, along with our detailed proposal, we illustrate how to improve the situation in Ukraine -- and in our own major U.S. cities as they confront a similar human performance problem – unexpectedly and significantly as well.

Executive Summary of Our Ukraine Winter Initiative by HROC Also Helping the U.S.

Discovery by our HROC-Ukraine office team from scientific study in Ukraine

Overview of our work and discoveries in Ukraine:

1. Problem: Our observational studies in shelters of overall health decline, but also unexpected mental health and reliability / performance declines. (Cross-checked against another NGO's assessment of high impact solutions having a lower-level complexity – so missed opportunities.)
2. Key Reason: *Suboptimal air composition*, even if not harmful (yet) physically, creates a "downward spiral" of errors due to a loss of thinking capacity. Some of these errors may unfortunately prove lethal in the near future.
3. Old solution: Masks were thought to be best defense by many (note: they are still a net gain).
4. Better solution (we're doing in Ukraine): "Invisible masks" – based on changing "air composition" that people breathe – offer bigger gain in adoption / effect of lifesaving measures.
5. Limitations: Starting and finishing any checklist or procedure, even if it can save your life, is too difficult for too many Ukrainians right now, and many are "mentally surrendering" – even though emotionally and physically they are not. But a relevant quote is "the will to win is not nearly as important as the will to *prepare* to win."
6. Best "human-driven" solution: Human performance solution with a prioritized sequence (*similar to systems "power-up" in Apollo 13 with the astronaut in the simulator*) on tasks that conserve and most efficiently harness available human cognitive bandwidth.
7. Unexpected benefits: Resilience, reliability, and significantly better human performance.
8. Broad impact: Touches – if not drives – many priorities in the U.S., most any nation, and the globe.
9. Ultimate solution in the future: A machine that gets all the benefits of these techniques in an automated fashion (made in Pittsburgh and Ukraine).

The 4 reasons Terry Rajasenan needs to go to Ukraine, based on these findings in this document that can help Ukraine, and then U.S. (starting in Pittsburgh) and its allies:

1. Verify for himself the sampling studies indicating these problems, following the scientific method.

2. Confirm the solution implementations to can be done by him and then the team there.

3. Validate the changes / improvements (i.e., from the threat situations to the improved situations) to prove solutions do work.

4. Look comprehensively that HROC solutions not only meet its target metrics, but also see if there are any other results, whether good or bad (e.g., any opportunity missed, any unintended consequences?).

Detailed Explanation of Our Ukraine Winter Initiative by HROC Also Helping the U.S.

Discovery by our HROC-Ukraine office team from scientific study in Ukraine

1. Problem: Our observational studies in shelters of overall health decline, but also unexpected mental health and reliability / performance declines. (Cross-checked against another NGO's assessment of high impact solutions having a lower-level complexity – so missed opportunities.)

- In shelters in and around Kyiv, symptoms of more respiratory infections and symptoms like headaches – i.e., an expected health crisis. But there was also found to be behavior challenges, like confusion and panic, and insufficient ability to follow lifesaving safety checklists (at least by too many people too many times). There was a discovery of ***inordinate increases*** in both disease and panic-related ***task failures***.

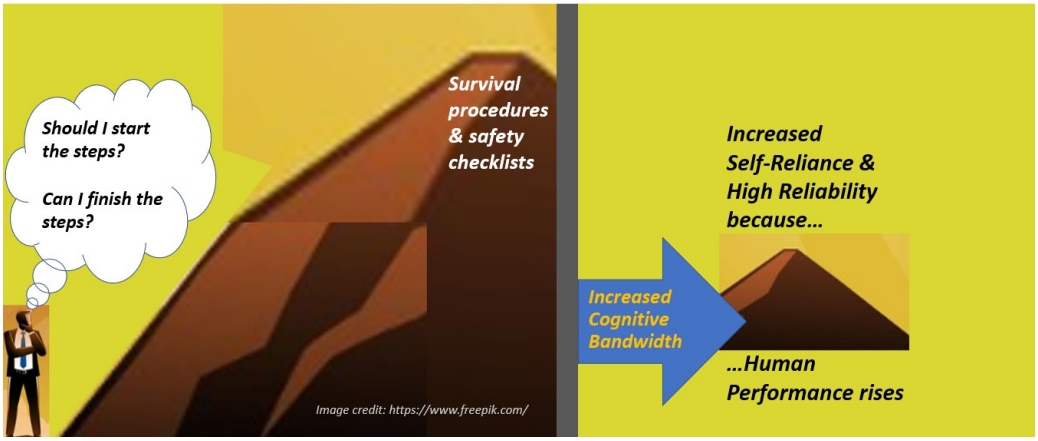
- Compliance and ***follow through*** is ***insufficient*** in Kyiv to do necessary lifesaving checklists quickly and effectively (i.e., with less errors of omission and commission), that achieve survival essentials. Beyond just our own observational evidence compiled by our team, one sign is the impact the war is having, while the complexity of preventions and solutions is not overly complex. For example, according to (the nonprofit NGO) ACAPS, Ukraine currently faces a Crisis Severity score of 4.1. The opportunity for reducing preventable deaths from "changing the way people think" is apparent when comparing the Impact score, which is at the most severe 5.0, yet the Complexity score is 2.8 -- a much more navigable challenge [https://www.acaps.org/country/ukraine/crisis/conflict]. In our view, this indicates, as we have seen with our own team's research and observations that the complexity of mitigating and solving the situation is not insurmountable, and can actually be improved dramatically if there is greater "***self-reliance***" to do procedures/checklists, whether from our own research or that of others. That is, these checklists can be ours, but they can also be helping people (especially older people, who -- based on our extensive research but also by most people's own observations -- cognitively overload and get overwhelmed far faster than younger populations, and have less resilience due to the frailty that accompanies age [https://dovidka.info/en/what-is-shelter/]. *Reducing time it takes to think is critical.*

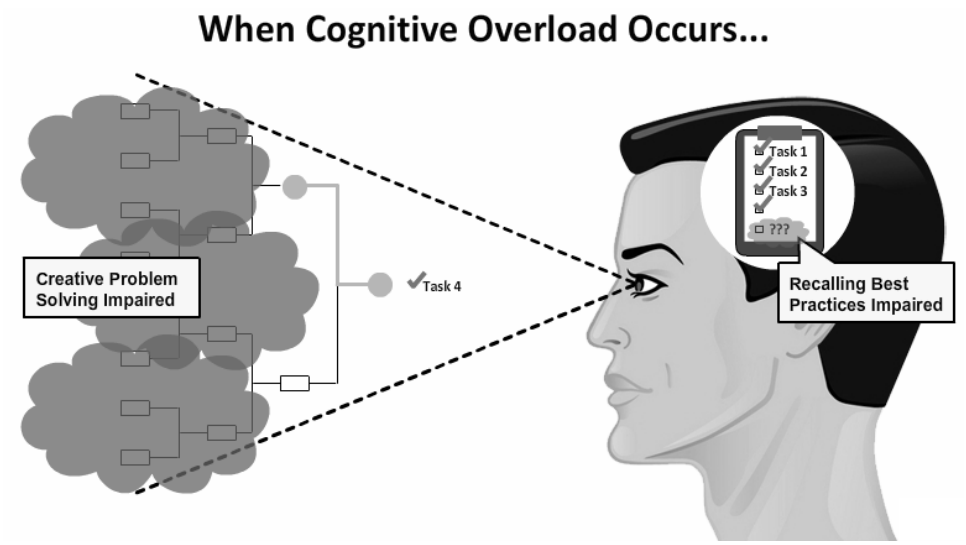
- In other words, the impact if we can get people to do better self-reliance via "do-it-yourself" (DIY) survival procedures and safety checklists is ***disproportionate***, if not a significant ***force multiplication*** on the ground, in terms of humanitarian relief and public safety gains. But our team said that "people don't have the will nor time to think." An idea of the degree of impact is simply survival from having enough food, even when food is available nearby. For instance, in war-torn areas of Ukraine, HelpAge indicated that 91% of the older people they surveyed needed help obtaining food because they had mobility issues [https://www.hi.org/sn_uploads/document/Factsheet-Ukraine-Advocacy-EN-final-14102022.pdf]. With load balancing of tasks across people, and over time, as well as raising "***cognitive tipping points***" (all of which is our team's expertise), processes can be done more locally with the right level of individual initiative, adherence to instructions, and reasonable creative problem solving.

The figures on the next two pages help explain the problem, solution, and opportunity. *(Note: In the Human Performance Curve graph, the lefthand side is viewed differently in Ukraine – it is not "boredom" but rather a hopelessness/apathy, based on demoralization/demotivation. The righthand side term of panic not frantic or emotional, but more of a vapor lock/brain freeze.)*

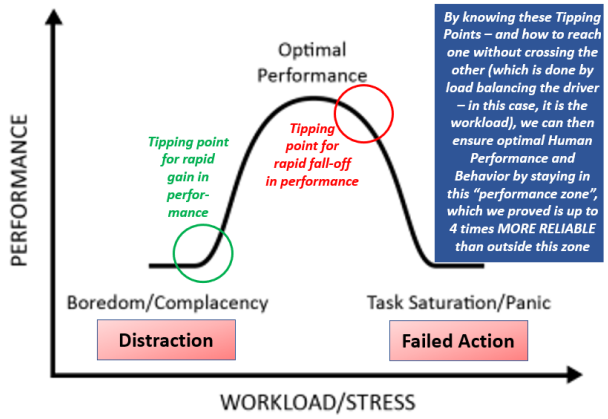
Figures 1 through 4. Understanding why we focus on <u>cognitive bandwidth for self-reliance.</u>

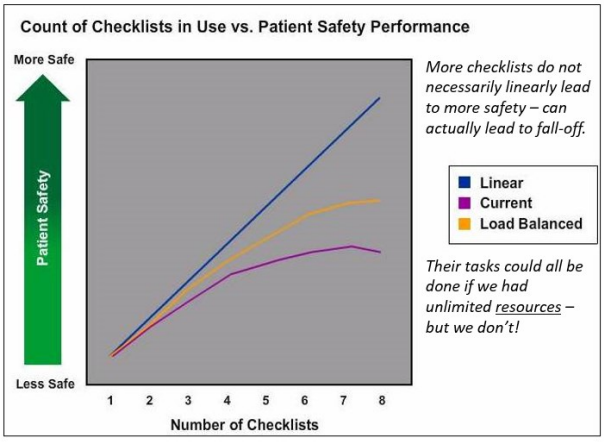
Human Performance Simply Makes It Easier – So More Likely to Succeed – and Cognitive Bandwidth Gets You There





U.S. Air Force Human Performance Curve:
Hidden Variables of Just Two Tipping Points





More checklists do not necessarily linearly lead to more safety – can actually lead to fall-off.

Their tasks could all be done if we had unlimited <u>resources</u> – but we don't!

In Ukraine, things *FEEL* worse because they *ARE* worse – and people can't *THINK* well enough to fix enough things

As the above figure shows, more checklists get done more often giving more safety, if there's greater cognitive bandwidth. Safety is less when bandwidth is lower.

Another way of looking at the problem is looking at the war from its opening days to now. For example, for Ukrainians, making Molotov cocktails early in the war were getting done by seemingly everyone. But now, just getting these essentials for survival are not getting done at the pace needed, and our past research combined with observational evidence from our team in Ukraine suggests strongly that cognitive bandwidth narrowing, resulting in task saturation and panic or mental capitulation or numbing is the culprit, weakening resolve and ability.

2. Key Reason: *Suboptimal air composition*, even if not harmful (yet) physically, creates a "downward spiral" of errors due to a loss of thinking capacity. Some of these errors may unfortunately prove lethal in the near future.

- "Suboptimal air composition" given first of all high carbon-based gases, but also dirtier air from particulates, and potentially oxygen depletion, etc. All these affect cognitive function, and thus the ability to think and perform at peak human performance levels. This is dangerous for the individual, and also groups that rely on the person for assistance – or at least to not be a burden during a crisis.

3. Old solution: Masks were thought to be best defense by many (note: they are still a net gain).

- Masks of course is initial solution, but unfortunately is a "passive solution" requiring people to actively remember to get, use, wear correctly, etc., the masks. And they have a hidden cost as well that reduces human performance, harming safety and productivity, and can increase risk of infections (CO_2 level rise). And there is the problem shown in the pandemic that about 30% of people will not wear them.

4. Better solution (we're doing in Ukraine): “Invisible masks” – based on changing “air composition” that people breathe – offer bigger gain in adoption / effect of lifesaving measures.

- Even better would be an invisible mask for both health and thinking, one that "actively" changes air composition for people, including (greenhouse gases) carbon capture and oxygen replenishment (just like a plant, which makes it fit under climate change goals). That can be done if people are willing and able to take the necessary steps.

5. Limitations: Starting and finishing any checklist or procedure, even if it can save your life, is too difficult for too many Ukrainians right now, and many are “mentally surrendering” – even though emotionally and physically they are not. But a relevant quote is “the will to win is not nearly as important as the will to *prepare* to win.”

- The key challenges:

    a. The problem here is that it is difficult to get people past the first tipping point to start a process and then not exceed the second tipping point where they would get overwhelmed.

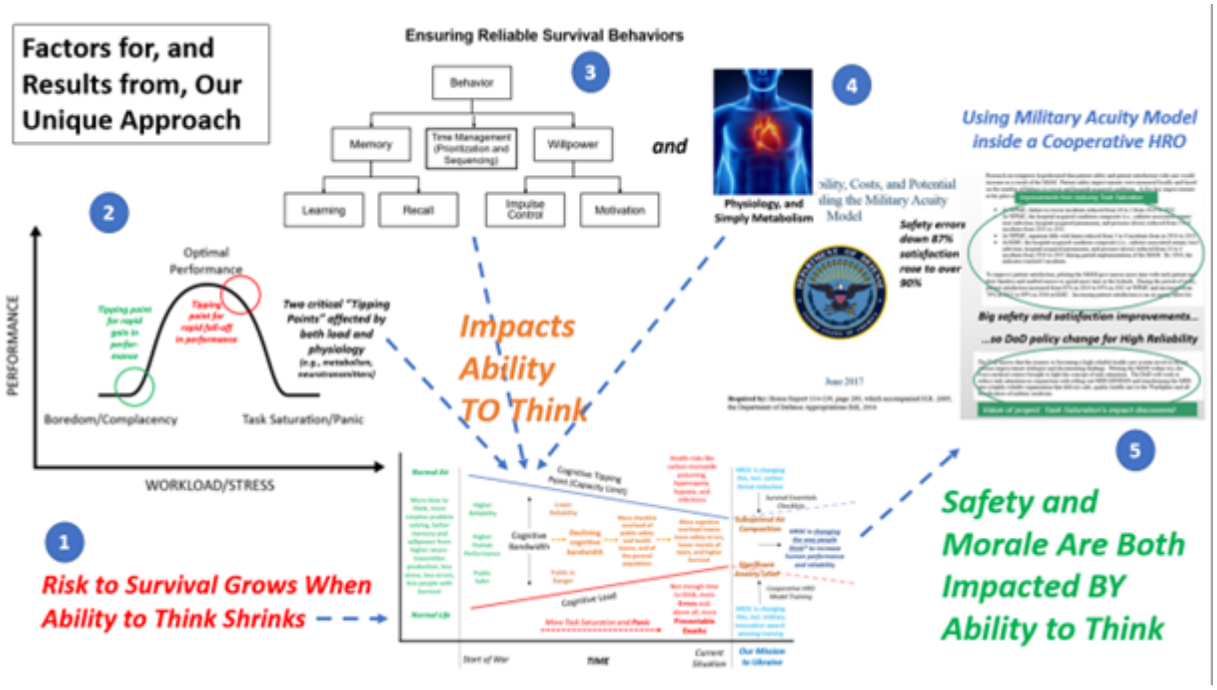
    b. To get better thinking (and health, etc.) and to stay within these 2 tipping points, the paradox is you need better thinking to get better thinking (so you need an “upward spiral”).

    c. And the problem is people are usually not self-aware of their impaired thinking, and the need to improve these two tipping points (i.e., lower the tipping point to start and raise the tipping point to not get overwhelmed) -- and that a checklist already exists to accomplish this.

    d. The value of improving air composition, in spite of all its health benefits, is it requires interest BEYOND HEALTH (a key argument by our team member Dasha, who is a psychologist in Ukraine) OR CLIMATE CHANGE for most people to take the initial steps necessary to "change the way they think."

6. Best "human-driven" solution: Human performance solution with a prioritized sequence (*similar to systems "power-up" in Apollo 13 with the astronaut in the simulator*) on tasks that conserve and most efficiently harness available human cognitive bandwidth.

- Not a "health solution", but rather a "human performance solution" (for winning the war, safety of your family and self, etc.) personalizes the benefits of climate change and health benefits -- you much more quickly (for those who want less delayed gratification) see benefits in not only how you feel, but also how you think and perform to be able to win (at physical and mental performance, whether work, school, or play). And it needs touted by people who have defeated enemies in war by "thinking ahead" and preparing (similar to the Bobby Knight quote).



7. Unexpected benefits: Resilience, reliability, and significantly better human performance.

- We educated the mayor of a city of 100,000 people (Irpin) of the unexpected dangers of "suboptimal air composition" during a time of crisis, clearly for survival and health, in Ukraine.

- But our team together discovered the unexpected benefit is not direct survival and health risks, but the indirect: Poor reliability, a rise in errors, and a drop in human performance.

- ***This is not only relevant to any city where air is going to be less optimal (e.g., due to "CO2 domes") -- like Pittsburgh -- but also anywhere in the U.S. that is under-resourced or under-performing when wanting to increase human performance.***

8. Broad impact: Touches – if not drives – many priorities in the U.S., most any nation, and the globe.

- Broad, significant impact on Ukraine and U.S./its allies: Cognitive function and cognitive bandwidth impact almost everything humans do -- including need to do, and need to not do. For example, given the odds of a recession in 2023 are increasing, we enable preparing for recession for poor communities with new type of IRA-funded device that offers benefits in:

- Green energy (which we personalize with a twist based on our Ukraine work, which was going opposite direction is our team's discovery which we are trying to reverse, but in cities same thing happening, and we can go opposite direction and go even higher than standard performance)
- Healthcare
- Education
- Public safety and crime (e.g., the Lead-Crime Hypothesis)
- Mental health

- Civil defense (for both man-made and natural disasters)
- Offering entry-level work for people for new jobs
- Significant increase in productivity for all jobs, both blue collar and white collar work
- Above all, human performance overall, but especially in "cognitive function" (as the saying goes, a mind is a terrible thing to waste -- and narrowing bandwidth leads to irrationality in social and human behavior, and declines in mental health due to further anxiety and depression)
- Note: Certain benefits are for individuals themselves, but some include benefits to all in their household, then for every business in the city, every household, thus improving the city overall that is in the CO2 dome, Finally the nation and the planet. And its own cost for the training services or machine products are offset by reductions in other costs.

9. Ultimate solution in the future: A machine that gets all the benefits of these techniques in an automated fashion (made in Pittsburgh and Ukraine).

- Automated solution that is machine-driven. We call the machine a QCHEIM Micro-Energy Plant™ (MEP), which not only behave like supercharged plants to improve air composition, they also have multiple ways of generating actual power, including DIY, making them electricity generators to serve as backup or supplemental energy also. But it also generates more human energy and thus productivity and positive behavior. *Thus, these MEP machines that can be manufactured can then in turn manufacture "invisible masks."*

- e.g., MEPs using DIY scraps like old vacuum cleaners and appliances can let users get hand- or pedal-cranked energy, for their phones/devices, or even to sell back to the grid, while also getting solar, geothermal, and heat pump tax credits.

- But this also gets neurochemical rewards like dopamine from problem solving and competition with oneself and others such as family, and endorphins from exercise, etc.
- In the end, it turns more users greener, safer, and more self-reliant and resilient -- for not only climate change but also civil defense goals, since we will be able to create emergency power, heat, and ability to follow rules, helpful instruction, and do creative problem solving (which also enables innovation for productivity or new inventions, such as most recently the fusion breakthrough).
- It is much more tangible and valuable than cryptocurrency could have ever been -- because it is for "Survival Essentials."
- Pittsburgh has poor air, just like Kyiv and Irpin that now face with war have learned and are doing something about.
- And there are disproportionate effects from solving this using IRA dollars.

- From the 2 cities that discovered a solution and that can benefit themselves -- and the world (as it personalizes why reduce greenhouse gases, why reduce viral spread, why learn and appreciate science and not conspiracy theories given low bandwidth leads to more cultish and addictive behaviors, etc.)

The Science: Why our Green Energy / Health / Education / Civil Defense product to manufacture both against stopping a silent danger and for enabling a hidden opportunity for Irpin and Pittsburgh?

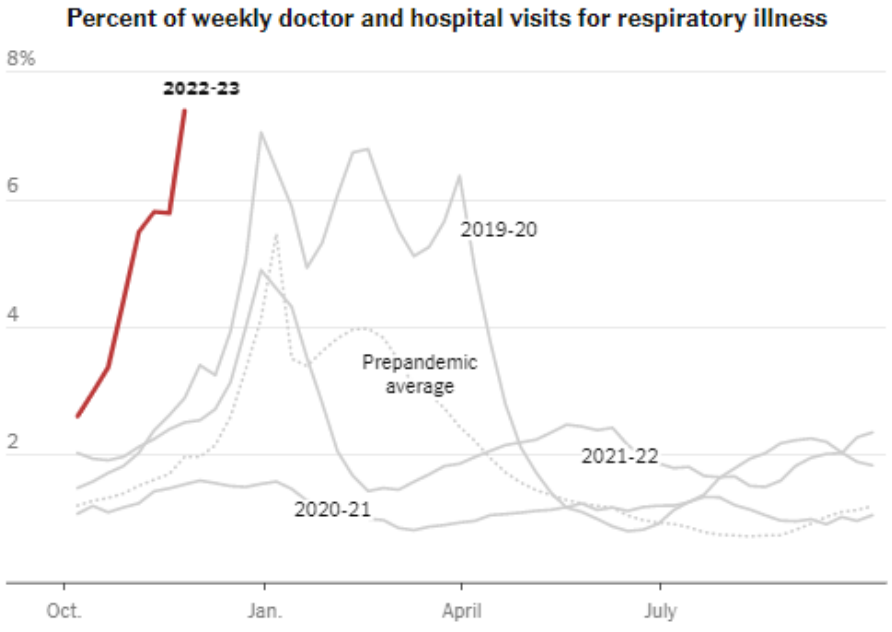
The air is becoming more and more dangerous in Ukraine – but it is also more dangerous in Pittsburgh than people realize, as it undermines various goals for improving safety, health, and quality of life.

Situation:

How many people died winter 2021 through 2022 from Covid in Pittsburgh? (i.e., after we got the gracious letter from Rep. Wheatley, but health department contact didn't want to change approach.)

- Averaged about 10 deaths per day after the holidays for Covid in Allegheny County -- but also 2 months after the eviction moratorium expired, like we noted would happen [https://www.nytimes.com/interactive/2021/us/pennsylvania-covid-cases.html] [https://www.pghcitypaper.com/pittsburgh/allegheny-countys-eviction-moratorium-extension-rejected-by-court/Content?oid=20497480]

'Tripledemic' Data Shows Cold and Flu Season Is Already Among the Worst on Record - The New York Times [https://www.nytimes.com/interactive/2022/12/16/us/covid-flu-rsv-tripledemic-data.html]



- The graph in it, showing largest spike ever in respiratory infections, shows why our Invisible Mask Initiative checklist in the proposal can be so critical this winter throughout NATO nations and the West. If there is a new pandemic variant from China, this could be repeated

How bad are Pittsburgh hospitals faring in the tripledemic?

- In addition to COVID-19, there's influenza activity and respiratory syncytial virus. The "tripledemic" has led to backed up emergency rooms in Pennsylvania and around the nation. [https://patch.com/pennsylvania/across-pa/tripledemic-hammers-pa-emergency-rooms-covid-death-rate-spikes] [https://www.acep.org/globalassets/new-pdfs/advocacy/emergency-department-boarding-crisis-sign-on-letter-11.07.22.pdf]
- Ongoing staffing shortages and also stressed the urgent care centers and emergency rooms are very busy. They urged people to be prepared for long waits. [https://www.pennlive.com/coronavirus/2022/12/as-pa-faces-its-worst-flu-season-in-years-and-covid-19-ticks-up-how-are-hospitals-faring.html] (May be peaking for now, but it is before the travel and gatherings of the holidays.)

Why it could get much worse next year, so we need to be prepared?

- China is now facing what is likely the world's largest COVID surge of the pandemic," NPR reports. "China's public health officials say that possibly 800 million people could be infected with the coronavirus over the next few months. And several models predict that a half million people could die, possibly more." [https://www.npr.org/sections/goatsandsoda/2022/12/15/1143002538/china-appears-to-be-facing-what-could-be-the-world-s-largest-coronavirus-outbrea]
- China's new covid nightmare may become a global catastrophe: "One danger is that China's outbreak will generate new variants that threaten the rest of the world. It is impossible to predict, but previous variants with a transmission edge have spread rather quickly. Millions of infections in China increase the chances of a new variant rising." [https://www.washingtonpost.com/opinions/2022/12/20/china-covid-policy-endanger-world/].
- And there is business between Pittsburgh and China, which could bring that variant here. [https://www.wtae.com/article/man-who-returns-from-wuhan-china-fears-people-in-pittsburgh-area-not-serious-enough-about-pandemic/31789845]
- So the risk of vaccine and treatment resistant mutations will be growing by the day, and coming to Pittsburgh, so buffers we argue should be put into place; in fact, is already a worry:
    - The U.S. is concerned China's runaway Covid-19 outbreak might spawn new mutations of the virus, as the world's most populous country continues to grapple with the impact of loosening "Covid Zero" protocols that had kept the pandemic at bay, Bloomberg reports. [https://www.bloomberg.com/news/articles/2022-12-19/us-worries-china-s-covid-outbreak-could-lead-to-virus-mutations?utm_source=substack&utm_medium=email&leadSource=uverify%20wall]

Ukraine has to deal with that Covid risk too -- and prepare to possibly relive the literally torturous hell of another invasion:

- Putin Visits Belarus, Stirring New Concern on Future of Ukraine War [https://www.nytimes.com/2022/12/19/world/europe/belarus-putin-kyiv.html]
- (And he may be thinking about the March offensive problems of vehicles stuck in the mud, and that it's better when ground is frozen to attack in January)

Problem / Opportunity of "<u>Suboptimal Air Composition</u>" (SAC), in terms of the chemistry and physics:

- What the Ukraine team (i.e., Douglas and his colleague Igor in Kyiv, as well as Dasha and her colleague Dima near Kyiv), have brainstormed with me based on their observational evidence, including of themselves in addition to other people they observe in the shelters and around the community, then finally based on social media like Telegram. Include cognitive function drop statistic given panic (& illogical actions and irrational thinking, like conspiracy theories and devolving into hate, like racially motivated crimes) increasing due to cognitive bandwidth drop.
- ***Given respiratory and neurological issues of our Ukraine team in shelters, like Dasha and Dima told us, there is a <u>new finding on disease and panic</u> also being symptomatic of what Mayor of Irpin also asked for our help, based on evidence we were providing (that not even the world class universities and hospitals in Pittsburgh know since they are not on the ground in Ukraine with our Defense work), given the emerging crisis in Ukraine from the change in risk when heating air to poor air compositions, such as relative humidity dropping and indoor fuel emissions, in the change from 20-degree air to a livable 55 degrees F, or 13C.***
- We educated the mayor of a city of 100,000 people (Irpin) of the unexpected dangers of "suboptimal air composition" during a time of crisis, clearly for survival and health, in Ukraine.
- But our team together discovered the unexpected benefit is not direct survival and health risks, but the indirect: Poor reliability, a rise in errors, and a drop in human performance.
- This is not only relevant to any city where air is going to be less optimal (e.g., due to "CO2 domes") -- like Pittsburgh -- but also anywhere in the U.S. that is under-resourced or under-performing when wanting to increase human performance.

How much does CO2 reduce immune system? (i.e., in order to assess the net gains from the humidity, air composition, and temperature improvements of a face mask versus CO2 retention)

- Recent studies have shown that hypercapnia adversely affects innate immunity, host defense, lung edema clearance and cell proliferation. [https://pubmed.ncbi.nlm.nih.gov/30202079/#:~:text=Hypercapnia%2C%20the%20elevation%20of%20CO,edema%20clearance%20and%20cell%20proliferation.]
- Hypercapnia significantly [from 25% to 60%, so absolute increase of 35% and relative of 140%, within just 3 days of the infection in tests] increases mortality at CO2 levels **as low as 7%** after inoculation with the **human pathogen S. aureus** (D):
    - Staph Aureus is the leading cause of skin and soft tissue infections such as abscesses (boils) and cellulitis.
    - S. aureus can cause serious infections such as bloodstream infections (sepsis), pneumonia, or bone infections.
    - https://www.health.state.mn.us/diseases/staph/basics.html#:~:text=It%20is%20the%20leading%20cause,or%20bone%20and%20joint%20infections.
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2773965/

Side note: There should also not be a fear of what a virus gains in terms of extra oxygen vs. what we do, since increasing our immunity is at least a wash, if not net gain over anything a virus gains from extra oxygen:

- *In general, viruses that naturally infect and replicate in tissues with high oxygen content are impaired by hypoxic environments. BUT conversely, hypoxia has been shown to increase the infection of viruses that naturally infect organs with lower oxygen tensions. [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7385969/#:~:text=In%20general%2C%20viruses%20that%20naturally,organs%20with%20lower%20oxygen%20tensions.]*

How much does a surgical mask increase CO2 retention?

- 3% for an N95-type mask = 30,000 PPM [https://pubmed.ncbi.nlm.nih.gov/33858372/]
    - In terms of %-conversion-to-PPM, this is:
    - (e.g., To convert an 8% concentration of substance X to parts per million of X (in whatever, air, water, gas) = 8.0 % (concentration) x 10,000 = 80,000 ppm)
    - https://inspectapedia.com/hazmat/Gas_Concentration_Conversions.php

For the Black communities in Pittsburgh and Allegheny County:

- We know that diabetes predisposes to common infections, such as cellulitis and pneumonia. And diabetes common in the Black community. [https://diabetesjournals.org/care/article/44/2/367/35485/Glycemic-Control-and-Risk-of-Cellulitis#:~:text=We%20know%20that%20diabetes%20predisposes,rate%20of%20infection%20is%20unknown.]
- Blacks are disproportionately affected; they're almost twice as likely as whites to develop type 2 diabetes by middle age. And those who get it are significantly more likely to suffer complications such as blindness, kidney disease and amputations than their white counterparts. [https://www.aarp.org/health/healthy-living/info-2018/role-of-race-in-diabetes.html#:~:text=Blacks%20are%20disproportionately%20affected%3B%20they,amputations%20than%20their%20white%20counterparts.]

So given the 7% increasing infection mortality for things like Cellulitis / Pneumonia / Sepsis, the 3% CO2 levels that good masks against spread can also unfortunately retain CO2 ***would cause 60% increase in infection mortality rates.***

- But masks also help retain moisture, which can reduce infectiousness by 50% in many respiratory viruses [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3583861/]
- Masks also warm the air breathed, which also reduces infection by nearly half [https://www.healthline.com/health-news/scientists-finally-figure-out-why-youre-more-likely-to-get-sick-in-cold-weather#:~:text=New%20research%20has%20found%20that,colds%20and%20flu%20during%20winter.]

Optimal Solution:

So an "invisible mask" for changing a room's air composition, or instead a Hyper-localized Ventilation System mask, would change this:

- i.e., the ideal is a humidified to 45%, CO2-scrubbed, air warmed to 20C air (with <10ppm CO from catalyst, and 21% up to 42% O2 levels w/household items of peroxide and bleach, in 1:7 [if 35% perox] ratio or 12:7 [if 3% perox] for 21%, or double that if need "super-human performance") -- which our techniques do, and international patent-pending machine designed to do
    - via air-warming conduction tube, or heating filament of steel wire, then the chemical reactions of catalysts, slaked lime, and bleach-peroxide components
- Part of solving this also requires addressing cognitive overload, whether from task saturation (too much to do in too little time and tasks are dropped as a result) or from increased cognitive load from anxiety and worry. Examples can be found in our DoD projects, this is similar to our clinical "core measures" (i.e., crucial checklists to improve outcomes, based on evidence) work for hospitals. These measures went from a checklist adherence rate of 85% to 99% in cases of heart failure. In sepsis compliance, it went from 35% to 71%, along with a 62% reduction in time to intervention, and an overall reduction in preventable complications (i.e., preventable harm) of 73%. But these were for people who had more training (i.e., specialized staff, like clinicians). In the cases of those people in the general population actually having little to no training, and also some degree of hypoxia / hypercapnia, and yet needing to become more self-reliant for their care to then be able to avoid urgent problems (i.e., ones that required trips to the emergency room and admission to the hospital), the study had a different component for the hospital admissions. It required a longitudinal study for the portion of the population that was considered the "responsive cohort" to the instructions provided. That is, those people near their cognitive tipping points, which was about 40% for this population. This specific cohort affected showed in the peer reviewed study a tripling of their self-reliance capacity (i.e., to do self-care), going from an average of 16 days to when they needed help from trained clinicians, to an average of 49 days for this cohort.

Benefits:

***Optimal air composition improves dramatically as well safety checklist adoption and adherence (which is our project in Ukraine, with a graphical explanation). Without it, there is* cognitive function decline:**

- To illustrate, in one study from 2016, researchers at Harvard and Syracuse University found that human cognitive function declined by about 15% when indoor CO2 reached 945 parts per million (or ppm for short). This point of concern is even under the 1,000 ppm which used to be considered a safe standard. More disturbingly, it crashed by 50% when indoor CO2 reached just 1,400 ppm, which many indoor meeting locations can reach.
- Why is this part of the solution though? It is because if the levels are above 1,400, then finding ways to reduce it to below 900 ppm, then there is the potential to improve thinking and cognitive capacity by 2x (i.e., double) – extremely valuable when one is trying to save their own or others' lives.

- So, CO2 is a reliability and productivity impediment as we can see in this study. But there is additional research by us and others. HROC's research calculations indicate that many workplaces (or shelters, where Ukrainians often have to try and work) have locations like meeting rooms that reach 1,000 ppm at least on occasion. The reason behind the impairments of the cognitive ability, according to medical research, is that increased level of CO2 in the blood decreases the cerebral metabolism of oxygen. In short, the brain becomes oxygen deprived and has an impact on our thinking abilities.
- Our view is that excessive carbon dioxide levels affect safety overall, given its impact on body and brain tissues (i.e., gradually suffocating them). Safety risks are also because a reduction in cognitive function leads to poorer reliability, interfering with the ability to follow safety checklists and procedures.
- For economics, dampening cognitive function harms workplace safety but also productivity of workforces, as noted in another study done in a workplace, where the results were similarly dramatic. Participants who worked in the elevated CO2 levels were found to have significant difficulty with their decision-making abilities and thinking capabilities. The cognitive scores of participants in the experimental building with improved air were 61% higher than the participants in the conventional buildings, and the participants in the further optimized air had cognitive skills as high as 101% higher (i.e., double again). Given that Ukraine's economy still needs to function, and all leaders and knowledge workers in cities, including those in government, business, or healthcare need to maintain optimal critical thinking skills, this can be a significant boost to both economic activity and public policy.
- Solving this cognitive human performance problem in Ukraine also has a global benefit: This project can help all nations in their *climate change, preventive healthcare, and economic productivity* goals, since carbon capture for one's personal health and work productivity is more tangible and personalizes the more "abstract" need to reduce greenhouse gases. We call this technique, and tool, we want HROC Ukraine to make toward these goals part of its "Peak Human Performance" (PHP) products and services. Our research shows that these tools would help reduce errors, including catastrophic, by raising tipping points and reducing cognitive load. PHP's ability to generate concentrated oxygen and capture carbon offers a better physical functions and brain metabolism, immune system, and in multiple ways offers better thinking and reasoning, thus reducing vulnerability to not only errors but also to lapses in judgement

Example of difficult but lifesaving checklist that requires cognitive bandwidth:

- Starlink been lifesaving for Ukrainians, which is relevant to our analogy:
- Starlink internet becomes a lifeline for Ukrainians. Parts of war-torn Ukraine that have little or no internet service have found an alternative: emergency Starlink receivers.
- BUT: "This is not an ideal internet," said Dmytro Zinchuk, the head of network operations for the internet provider Freenet, which mostly serves the area around Kyiv and western and northern Ukraine. "But still when there is no connection at all, Starlink is just a salvation for people who have been without connection for many weeks."
- That can mean wiring hundreds of people to a terminal meant for a single household.
- [https://www.nbcnews.com/tech/security/elon-musks-starlink-internet-becomes-lifeline-ukrainians-rcna25360]

Types of example checklists we are enabling or assisting:

- Enabling in our Survival Essentials, but not only for smartphones, but also heat and electricity -- and overall public health and public safety
    - ***Example: The Invisible Mask Initiative, extended from its initial mission to reduce viral spread to now include addressing suboptimal air composition.***

Other key findings from Ukraine tied to our U.S. research:

- This data on impediments to cognitive function shows the will to win not nearly as important as the will to prepare to win. It would be like charging into a battle drunk -- you may be less afraid, yet ironically more vulnerable.
- With these findings in mind, HROC has constructed a plan showing how it can help Kyiv and Irpin survive even as there are simply not enough adequate shelters, as detailed by our team, and also how to survive only with 2/3rds power, and finally how to survive if cities have to evacuate in the event of power grid collapse or another ground invasion by Russia through Belarus. The key impediments include:
    - Factor 1. Based on our Defense research, multitasking itself has been shown to reduce cognitive abilities by an average of 25% as well, which can happen when there's a crisis requiring many steps, or even a simple task but with a lot of "cross-thinking" anxiety that interferes with the task. Overall, this increases errors and reduces the speed of thinking through problems to reach solutions.
    - Factor 2 that we will need to overcome in terms of checklist adherence is the negative impact that simply being too cold will have on cognitive function. What does hypothermia do to cognitive function? Relative to baseline performance, working memory, choice reaction time, and executive function declined during exposure to 10°C (50F), and these impairments persisted 60 minutes into the recovery period. For example, Choice Reaction Time ($z = 3.34$, $p = .001$), taking up to 15% longer. The results indicate that cognitive function is reduced during acute cold exposure and acute recovery [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3375336/]
    - Factor 3 that we will need to overcome in terms of checklist adherence is the negative impact that simply getting colds, due to lower immunity, will have on cognitive function. Stress can undermine the immune system's effectiveness in fighting off viruses. The participants with colds reported less alertness, more negative moods and sluggish thinking. A second round of tests showed they also had slower reaction times and were slower at learning new information and completing tasks involving verbal reasoning and semantic processing [https://www.apa.org/monitor/2013/02/colds-cognition].
- The reason these impediments to cognitive function are important to understand is that it shows how difficult training (on survival and safety) will be. Optimal air composition helps it.

What Joan Dickerson, a colleague of HROC researchers, and Terry Rajasenan (Chief Scientist of HROC) are proposing as the story that Pittsburgh can offer its residents, the U.S., and the world:

"There is a project our team is doing in Ukraine, based on key discoveries our team has made there, that we are trying to expand -- but it appears is should also benefit Pittsburgh neighborhoods like Oakland, the Hill, East Liberty, Homewood, etc., in terms of health, education, public safety, business opportunity, and other priorities of the city and city government."

Carbon emissions problem for Pittsburgh – and 14 other cities (many others available in our Excel file):

	Table of U.S. Cities with Largest Carbon Emissions At Risk for Significant Cognitive Impact										NYC Baseline PPM: (indoor)		Sensitive p
											800	Source for	30%
		Source Data from:	https://www.citycarbonfootprints.info/										
Heavy Industry?	Urban Cluster	Country	Population	Footprint	Footprint per Capita	Global ranking	-	National ranking		Ftprn/cap	Est.indr. PPM level	Ratio	Risk of Tip
Energy	New Orleans	USA	596,000	15.6 ±7.8	26.1 ±13.0	12		1		26.1	1221	1.526	87%
Manufacturing	Detroit	USA	2,770,000	70.6 ±15.4	25.5 ±5.6	13		2		25.5	1193	1.491	85%
Manufacturing	Cleveland	USA	973,000	24.0 ±8.8	24.7 ±9.0	17		3		24.7	1156	1.444	83%
Manufacturing	St. Louis	USA	1,177,000	28.3 ±9.6	24.1 ±8.2	19		4		24.1	1127	1.409	81%
Manufacturing	Pittsburgh	USA	602,000	14.5 ±6.3	24.0 ±10.4	21		5		24	1123	1.404	80%
Manufacturing	Toledo	USA	257,000	5.9 ±3.5	22.8 ±13.5	22		6		22.8	1067	1.333	76%
Manufacturing	Kansas City	USA	1,004,000	22.7 ±7.4	22.6 ±7.4	23		7		22.6	1057	1.322	76%
Manufacturing	Grand Rapids	USA	315,000	7.1 ±3.7	22.6 ±11.7	25		8		22.6	1057	1.322	76%
Manufacturing	Cincinnati	USA	521,000	11.8 ±4.6	22.6 ±8.9	26		9		22.6	1057	1.322	76%
Energy	Tulsa	USA	386,000	8.7 ±4.0	22.6 ±10.3	27		10		22.6	1057	1.322	76%
Manufacturing	Akron	USA	209,000	4.7 ±2.6	22.6 ±12.6	28		11		22.6	1057	1.322	76%
Manufacturing	Dayton	USA	278,000	6.1 ±3.4	21.8 ±12.1	31		12		21.8	1020	1.275	73%
Manufacturing	Minneapolis	USA	1,518,000	33.0 ±9.8	21.8 ±6.4	32		13		21.8	1020	1.275	73%
Manufacturing	Fort Wayne	USA	153,000	3.3 ±2.1	21.5 ±13.7	33		14		21.5	1006	1.257	72%
Manufacturing	Louisville	USA	575,000	12.3 ±4.9	21.5 ±8.6	34		15		21.5	1006	1.257	72%

Footnotes:

1. *For the PPM conversion from tons per capita carbon dioxide, we did an extrapolation formula. The formula that converts carbon footprint to PPM was based on using a city with measured indoor levels of CO2 in PPM, then using a ratio of each city relative to that. New York City had studies done on that, and was a middle of the pack city, not one of the worst.*
2. *Unfortunately Kyiv was not available in study of carbon footprint, even pre-war, but we have observational evidence, and the city is in a river valley, which led to our initial calculations, based on cognitive and physical health impact of carbon monoxide, on a par of Pittsburgh or worse for adverse air composition, not to mention the increased cognitive load and lack of health and other resources caused by the war's threats to life, bodily injury, and human suffering from destruction of critical infrastructure*
3. *The cognitive function tipping point for CO2 is 1000 PPM based on the latest research noted in our proposal's links on supporting evidence.*
4. *The cognitive function tipping point for CO2 risk jumps to the general population at the 950 level cited in our proposal's research supporting evidence, but below that level becomes targeted to only the elderly and those with key chronic conditions, especially cardiac and neurological -- so roughly 30% of the population rather than 100%.*

Key findings from this table and our U.S. research:

- For American priorities, these findings also show that manufacturing is a double edge sword, looking at cities with highest per capita CO2 (e.g., Detroit, New Orleans, etc., with all their smokestacks).
- Industrial activity accounts for 24% of all greenhouse gas emissions[https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions].
- Additive manufacturing reduces energy use by 25% and can cut waste and materials costs by up to 90%, compared to traditional manufacturing methods [https://www.energy.gov/eere/articles/what-additive-

manufacturing#:~:text=Additive%20manufacturing%20reduces%20energy%20use,compared%20to%20traditional%20manufacturing%20methods.]

- Another way 3D Printing helps reduce CO2 is indirect: Weight reduction is the holy grail of aerospace engineering: every kilogram saved prevents 25 tons of CO2 emissions during the lifespan of an aircraft. Parts produced by AM weigh up to 55 percent less, while reducing raw material used by up to 90 percent. De-carbonization is the reason why the aerospace industry and Airbus led the charge in 3D printing [https://www.3dprintingmedia.network/am-for-sustainability-3d-printing-a-better-tomorrow/]
- [China's Covid policies] might deal a roundhouse blow to the U.S. economy. It is causing widespread disruption to production and supply chains. Should China's manufacturing slow, the world will feel the pain in the form of shortages and inflation [https://www.washingtonpost.com/opinions/2022/12/20/china-covid-policy-endanger-world/]. With additive manufacturing, Pittsburgh could pick up slack on certain supply chains quickly, but paradoxically it is by manufacturing, at least traditional, that other suboptimal air composition risk grows, we have identified, in both physical and mental health. But this is why we need help from the Inflation Reduction Act (IRA) for this first manufacturing item of the MEP.
- Manufacturing is an opportunity given not only supply chains wanting to unwind from China, but also possibilities coming next year with a Republican-controlled House: Biden can certainly invoke the Defense Production Act and order General Motors to produce an extra 100,000 electric cars, because depending on Russia or the unstable Middle East for oil is a threat to national security [https://www.electoral-vote.com/evp2022/Items/Dec21-4.html].
- This can also help explain the notion of why industrial cities may not be able to keep up with cities like Boston, San Francisco, etc., or get considered as "sleepier" tech cities.
- The irony is that manufacturing and industry needs for power produce much more carbon emissions than humans, as NYC with its high population density but relatively low per capita carbon footprint (17.1, and an indoor CO2 PPM of approximately 800 based on one study).
- That is, it would then affect only certain segments of the population (like those with chronic conditions, instead of affecting people in the entire general population), versus a relatively flat, lower-density city like Detroit, which is one of the highest.
- That's because a human produces about a kilogram of carbon dioxide each day, while burning fossil fuels generates about 3 kg each hour (assuming 1 kg of fuel is burned in that hour).
- And if there is not a lot of wind, the CO2 dome forms (because CO2 is heavier than air) -- and basically begins to slowly suffocate people.
- Since additive manufacturing reduces material waste but also energy waste (and thus usage) significantly, this needs to be the trend of Pittsburgh, Detroit, and other rust belt cities for all facets of a better life.
- This is especially true for low-income populations in higher-density areas, especially at lower relative altitudes to their surroundings.
- One key suggested study to do in Pittsburgh is on mental health crises events, crimes, and physical health events during the days most applicable to the IMI risk assessment and predictive model of where the solution likely would have made a difference, looking at the environmental factors and the relevant population, coupled with other impacts on:
    - Immunity resilience as measured by sick days in school or work, or admission counts to hospitals

- Chronic care management checklists relying on cognitive bandwidth and overall health
- Laws and other rules adherence
- Education can be evaluated by looking at student scores on standardized tests during affected days
- Economic productivity could be measured by employer statistics on absenteeism and presenteeism, which we believe would increase on those days of or right after suboptimal air composition

Opportunity for city:

- Article: “For Low-Income Pittsburgh, Clean Air Remains an Elusive Goal” (The region's air remains among the most polluted in the country.) [https://e360.yale.edu/features/for-low-income-pittsburgh-clean-air-remains-an-elusive-goal]
- Also, Pittsburgh is in a valley, which will build up “CO2 domes” (as CO2 is heavier than air). In terms of CO2 dome risk: For total carbon footprint (a good gauge; note this is different than carbon footprint per capita, which is in the table further up), Pittsburgh is #32 in U.S., #165 in the world, and is at 24 tons CO2 per capita (worse than NY, LA, Chicago, and DC, and twice as bad as Miami -- #6 in the U.S. per capita, and #21 in world!), and 14.5 Mt CO2 total for its urban cluster of ~600k people. [https://www.citycarbonfootprints.info/] [https://earthobservatory.nasa.gov/images/144807/sizing-up-the-carbon-footprint-of-cities] [https://iopscience.iop.org/article/10.1088/1748-9326/aac72a/pdf]
- A New Manufacturing Boom Could Come To Pittsburgh, But It’s Not Steel. Will cells and robots be Pittsburgh's new steel and coke? [https://timesofe.com/a-new-manufacturing-boom-could-come-to-pittsburgh-but-its-not-steel/]
- (Civil defense should thus be a huge growth area as well...) Military Spending Surges, Creating New Boom for Arms Makers [https://www.nytimes.com/2022/12/18/us/politics/defense-contractors-ukraine-russia.html]
- The new government budget that looks ready for passage includes: Another large round of aid to Ukraine, a nearly 10% boost in defense spending and roughly $40 billon to assist communities across the country recovering from drought, hurricanes and other natural disasters,” the AP reports. “The bill includes about $772.5 billion for non-defense discretionary programs and $858 billion in defense funding.” [https://apnews.com/article/ap-top-news-3e0fef206f524f6b1b67f7c36178a688?utm_source=homepage&utm_medium=TopNews&utm_campaign=position_05]
- Inflation Reduction Act funds include around $300 billion for support and tax credits, but also $300 billion in loan guarantees, to help climate change related projects including carbon capture.
- HROC qualifies on multiple portions of it, and can bring many jobs including to the Hill for home-based work that is typically difficult for single mothers with children.
- Relevance to Pittsburgh and Irpin: Potential ability for mayors to work together, and our team near there to help (including a psychologist and the other a documentary filmmaker who is from L.A. volunteering there for us that we met through human rights advocate Jack Healey)

[https://en.wikipedia.org/wiki/Jack_Healey], who used to be head of Amnesty International and from Pittsburgh.

- We know our techniques can help "clean the air" (i.e., change air composition), and with a QCHEIM MEP we want to make in Pittsburgh, we can do so much more -- and change the game in climate change, making it a win-win for most everyone, regardless of ideology, by giving the ultimate in immediate enlightened self-interest, with neurochemical reward production.
- ***It enables not only happier people, but also better people.***

Summary:

We are planning to leverage just a few tools that help many people in areas of Ukraine, then guide those people with the small set of tools, focusing training on how they can solve “DIY” the problems found.

We are starting in Ukraine, but some of these techniques and tools will also apply to the Pittsburgh area (where HROC's first office is).

One key problem where our technology and methods can assist that is leading to these human performance challenges in Ukraine is what we term suboptimal air composition of air people are breathing in Ukraine.

What's noteworthy is that Pittsburgh ranks 6th worst in one of the key suboptimal air composition metrics, which is carbon emissions per capita.

The approach we are taking is as follows:

1. Given time urgency and delivery delays based on our experience delivering protective wear, and various electric generators to Ukraine (including one set by an HROC Advisory Board member who has already gone to Kyiv), we have found that survival and safety in Ukraine are only feasible through self-reliance of Ukrainians to make do-it-yourself (DIY) solutions. However, our research shows self-reliance is dependent on human performance.

2. Cognitive bandwidth is critical to human performance, otherwise people can't motivate themselves, learn, remember, and do problem-solving. As our proposal and mission document illustrate, we are seeing signs cognitive bandwidth is narrowing, and for multiple reasons (mainly increased anxiety, chronic stress, and environmental factors).

3. Cognitive capacity limits (i.e., "tipping points") appear to be lowering, as people are becoming less reliable for doing lifesaving processes, based on our team's observations, and not only due to stress and anxiety. Our key finding is the problem of "suboptimal air composition", addressing the risk of carbon monoxide poisoning first and foremost, but then other improvements (via chemistry and physics)

fundamental to cellular metabolism. We have two solutions for this dangerous indoor threat (given portable generators are operating too close to dwellings, and there is burning of wet wood and even coal happening indoors). These solutions are to be tested further when I get to Ukraine to ensure they can be done DIY to improve public safety for that problem – and others "downstream" from having normal or enhanced cognitive function.

4. Cognitive load is the other component in bandwidth, and here we have many proven techniques (e.g., based on our research we all did together when we cognitively load balanced teams at Hopkins and the Military, based on Terry Rajasenan's past research for DARPA). We will apply these, and a practicing psychologist, Dasha **<redacted>,** who is on our team in Ukraine, believes they should help considerably the failure to adequately prepare not just for survival in people's homes given most will not be able to get into shelters, but also to prepare for evacuation in cities like Kyiv, which is becoming more and more likely it seems. Our abilities to combat task saturation and cognitive overload helped our main proving ground (Wright-Patterson Air Force Base) to reduce preventable deaths by 87% if you recall in our joint work there, and it changed DoD policy on High Reliability, as noted in a Report to Congress by the Defense Dept. in 2017.

5. There are also all the subprojects and checklists we have already proven to some degree inside Ukraine, but that I intend to test as DIY with local resources and improve processes further in Ukraine when I get there, including for health/safety detection and intervention tests, electricity generation especially for smartphones, heat generation, and preparing shelters inside homes with no basements, especially for nuclear fallout. There are at least 8 subprojects I will be testing and iterating as solutions with the team once before, during (I plan to be there for 1 week), and after my visit, but suboptimal air composition of the most important. But these are all "DIY solutions" for Ukrainians, so they must have the cognitive bandwidth to execute them, which is again why we are focusing on that problem first.

6. One example of the need to address the suboptimal air composition problem is in Irpin, a city of 100,000 people (metro, and fastest growing city in Ukraine since 2000) which sustained brutality and torture early in the war. We have teamed with its mayor, Oleksandr Markushyn (who garners significant attention around Kyiv as he is a war hero, as is also our Ukraine office team leader, Douglas Busby, who was awarded a medal of valor in helping defend Irpin in March) to help his city. This is due to the problems he faces with his shelters, including simply not having enough adequate, reachable ones for up to 80% of his residents (given the city's growth occurred after the Cold War, when bomb shelters were considered no longer necessary). We educated the mayor on the unexpected dangers of air in his shelters and at homes during a time of crisis, and our team also discovered the unexpected benefit beyond direct survival and health, is the indirect we can solve as well: Poor reliability, a rise in errors, and a drop in human performance. Irpin is where our project will initially focus to then attempt to scale up by spiraling out to Kyiv and the rest of the nation, via our public service announcement / training videos for the techniques to improve human performance and also our safety checklists.

[Website Update of 12/17/22 on Self-Reliance through Human Performance Initiative]

Pinned-to-top item addition (i.e., new item on list, which is #7) on 12/17/22:

Self-reliance through our human performance initiative to increase cognitive bandwidth and support DIY training – focusing on innovations to address "suboptimal air composition" which is both dangerous for near-term and long-term survival of people in Ukraine and any disaster worldwide. STATUS: On the ground testing in Ukraine, with a mission for scientific study planned by Chief Scientist.

Introduction for new entry on 12/17/22:

12/17/22: "This Holiday Season, when we take time to reflect and count our blessings, understanding of the hardships and risks that Ukrainians face this winter can lead not only inspiration, but also to teams in Ukraine and their partners around the world innovating in ways that aid not only their survival, but also of the rest of the world's. One example: Our Ukraine team is showing -- and teaching -- that when surviving crisis, self-reliance through lifesaving human performance is the greatest gift of all."

Bullets:

HROC is pleased to announce the evolution of our Invisible Mask Initiative, and our Energy Victory Gardens initiative, into becoming our new Ukraine Winter Initiative.

It focuses on safer energy for a world at risk from energy cost rises and even fuel shortages, which is leading to the use of fuels that release more pollution -- which has an unintended consequence on people's reliability and their human performance.

Details can be found in this new, soon-to-be-released Ukraine Public Safety Scientific Study (link: https://thinkhro.org/pdfs/PublicSafetyScientificStudy-Winter2022UAMission.pdf) for our "Winter 2022 Mission" to Ukraine, which explains the physiological and cognitive risks associated with carbon emissions such as what were formerly considered "safe" levels of carbon dioxide and carbon monoxide.

But recent research by us and others show that there are adverse consequences even at relatively low levels of these gases.

And the key research observations and findings that led to the conclusions for this document can be credited primarily to our team of researchers and problem-solvers there in the nation of Ukraine. They include those at our now registered office (Ukraine registration #: 44840272) in Kyiv and their colleagues and fellow citizens in their communities in the war-ravaged nation.

In spite of this devastating war, advancements relevant to world problems are still possible, since, as Plato once said, "necessity is the mother of invention."

That necessity? A new way was needed to ensure, and improve, human performance, to help endure an extremely difficult winter. This included finding safer ways to generate heat when fuel

is short, make electricity when the power goes down, and ensure that health risks do not become "too urgent, too late."

Our new report includes more on these findings, and the details of our project in Irpin, where we have teamed with the city's mayor, who sees the risks and opportunities found in the air each person breathes to be able to survive now and into the future.

One of the key findings is the impact of our finding of "suboptimal air composition" and its impact on human performance, as it constricts the cognitive bandwidth of the human mind (and thus its thinking capacity).

This led to the discovery that there was a different way to frame the crisis the world is seeing in climate change, such as more extreme weather and the number one cause of preventable deaths from natural disasters, which is floods.

And that discovery is that reducing greenhouse gases can be personalized to individuals and not just the "too abstract" (and let's face it, too distant to impact everyone in a tangible way every day) concept of the planet and its future.

How? By reorienting what Benjamin Franklin said makes a person "healthy, wealthy, and wise" to not just be our sleep schedule but rather to be our entire human performance, which itself is heavily dependent on cognitive bandwidth.

And higher greenhouse gases and overall suboptimal air composition in the air we breathe, our research has shown, reduces cognitive bandwidth and human performance, such as in immunity, physical performance, and cognitive function -- and by up to 50% or more.

In short, to improve your own human performance, reduce greenhouse gases where you live and breathe.

The new initiative is the result of nearly 6 months of iterating our team’s past scientific and educational initiatives.

In September, our Independence Day-released "P.U.U.R.E. Energy CHRO" initiative was manifested into the form of "Energy Victory Gardens."

These new Energy Victory Gardens could serve the dual role of both generating energy from non-fossil fuel and renewable sources, while also improving the air we breathe as well as that regulates our climate, just like an organic plant-based garden would.

This then led us to analyze how we could apply the methods researched in Ukraine could help Ukrainians in their plight for the coming winter, as well as serve the rest of humanity with these new innovations.

This is just as President Zelenskyy told to the U.S. Congress on December 21st, 2022, saying that, “Your money is not charity…It is an investment in the global security and democracy.”

[GoFundMe Page for Ukraine – Bolded Version (designed for skimming)]

Ukrainians teach lifesaving self-reliance to all

[Picture of Pittsburgh]

Surviving in Ukraine -- or any crisis -- requires seeing, ***and preparing for***, what's beyond the horizon.

That is, to endure and then thrive, people need to see beyond the horizon for problems coming their way, and what solutions are available – or that have yet to be created that require innovation. And as a famous basketball coach noted, “The will to win is not nearly as important as the will to *prepare* to win.” And winning against Russia and its use of “winter as a weapon” in Ukraine will require **self-reliance** on Ukrainians doing lifesaving measures **before crises become too urgent and too late.**

But in order to prepare, people have to **perform** during, but preferably **before an emergency** – that is, they must be able to start, persevere, and finish these lifesaving measures, procedures, and safety checklists to get themselves the essentials of heat, electricity, and the maintaining of health and communications this winter. In addition, there are those less visible, even invisible, issues that haven't yet been solved for those in Ukraine and those in need around the world. This has led to crucial **discoveries** from our Ukraine team as well in safety for individuals and also for the globe, as both climate disasters seem to be worsening and is the threat of major war (including with nuclear fallout or attacks on energy grids). We will be explaining the innovations related to these discoveries further below.

This performing of these checklists needs to be done by people, so simply put, it requires **human performance**, which enables people to understand the problem, find effective solutions, and then make sure that those solutions can be put in place and with high reliability.

Another complicating factor is that, given the time urgency and delivery delays, based on our experience delivering protective wear, smartphones, and various electric generators to Ukraine (including by an HROC member who went to Kyiv), we have found that survival and safety in Ukraine are only feasible through **self-reliance** of Ukrainians to make **do-it-yourself (DIY) solutions**. However, our research shows *self-reliance is dependent on human performance*.

HROC Objectives for Mission

HROC is **helping** people in this preparation, both by improving Ukrainians' health and safety in **shelters** by explaining to key leaders the upcoming problems and creating checklists we are converting to videos to help people be more self-reliant, not just with DIY solutions, but even more importantly, how to improve human performance.

Beyond shelters, it is helping when people can't reach an adequate shelter in time (which is over 80% of the time, based on the circumstances of one city which grew dramatically after the Cold War ended, so after shelters were thought to be obsolete) and need to create their own "**in-house safety area**" (IHSA), as well as create their own **evacuation kit** (our *HROC EvacPac* checklists and procedures) during their journeys to their destinations when displaced – an ever-increasing likelihood for cities like Kyiv and the areas around it that are planning evacuations if the power grid, which is running out of replacement parts, eventually collapses, or if there is another invasion of Kyiv and its northern suburbs attempted this winter, given the troop buildups in Belarus.

Our first major project to showcase to Ukraine and the world is in **Irpin**, a city of 100,000 people in its metro are (and the fastest growing city in Ukraine since 2000) which sustained brutality and torture early in the war. We have teamed with the city's mayor, Oleksandr Markushyn (who garners significant attention around Kyiv as he is a war hero, as is also our Ukraine office's team leader, Douglas Busby, who was awarded a medal of valor in helping defend Irpin in March) to help his city, and then apply to what we develop into helping the vulnerable areas of Pittsburgh, Pennsylvania.

The project focuses on the pending problems the mayor faces with his shelters, including simply not having enough adequate, reachable ones for up to 80% of his residents (given the city's growth occurred after the Cold War, when bomb shelters were considered no longer necessary). We informed and persuaded the mayor on the unexpected dangers of what we term "**suboptimal air composition**" (SAC) in his shelters and at homes during a time of crisis that will *adversely affect both health and human performance* through the winter and in the event of Russian escalation, including nuclear, which he himself, in the interview he gave us, voiced as a significant concern.

Our team also **discovered the unexpected benefit** beyond direct survival and health from addressing SAC, which is the **hidden problem** that we **can solve** as well: *Poor reliability* in civil defense measures, *inability to achieve self-reliance*, a rise in harmful or *catastrophic errors*, and a *drop in overall human performance* – and that will likely cause **preventable deaths**.

Your contributions to this *Public Safety Scientific Study Mission to Ukraine* will not only help a Ukrainian **team that faces life-threatening hardships** and inability to do their regular jobs (given Ukraine's economy is down by 30%, worse than any recession or depression the U.S. has faced) to get income. But in spite of these hardships, this team with their colleagues in the U.S. is **still making discoveries**, even in the shelters where they try and withstand constant attacks. And these discoveries can **help all not only Ukrainians, but also people all over the world**, especially in the areas of human performance improvement for resilience and survival in any disaster or crisis that people may face in their lives. And they will make videos to show how.

HROC Researchers' Experience, including in Ukraine

Reducing preventable deaths is an area of intense study for HROC, and where we have proven expertise. Our team of scientists and former military **changed U.S. Defense Department policy** in High Reliability relating to task saturation and cognitive overload, proving a reduction of 87% in preventable deaths at the Air Force Base specialized in human performance for the U.S. Military (which is Wright-Patterson AFB), becoming the cover story of a peer reviewed journal based on these results, and also winning a U.S. **Military innovation award for safety**. The key to the solution was increasing **cognitive bandwidth** (i.e., the thinking capacity available, above current load and below the capacity limit). This acquired expertise, some of it from research our team pioneered, is also what we have been contributing to Ukraine through our office there to help get attention of key figures such as the mayor of Irpin.

How did HROC's team get to what they have calculated as **feasible solutions** for survival and safety in Ukraine? By **learning what can work** and what won't, given the limitations and threats people confront in the nation. Our office in Kyiv opened in May 2022 upon our team's first visit, and then was registered in October 2022 (*registration # in Ukraine: 44840272*). Our own preparation for our mission to improve the preparation process for all Ukrainians is based on guidance from our Ukraine team's efforts – as shown below in the links to video and pictures. They include:

1. Shipments of multiple items, including protective wear delivery (for logistics, and also to help for blast protection), delivery of crank generator and smartphones for tests, and their challenges (e.g., lithium batteries are very difficult to ship and creating more delays):

https://www.youtube.com/watch?v=n2MJQvi5NeU

2. Understanding the challenge of Irpin's shelters:

https://thinkhro.org/vids/ShelterVideo1-110322v2.mp4

3. The request from Irpin's mayor:

https://thinkhro.org/vids/IrpinMayorInterviewWithTranslation-RequestingHROChelp.mp4

4. Our prediction that electricity generation would become critical, so we delivered and tested solar generators and hand-crank generator charging of smartphones -- only reliable source of power 2 of our team members have, they noted:

https://thinkhro.org/vids/v3-Cropped-OurCivilDefenseInHelpingDefense-SolarPanelsUsedBySoldiers-IMG_0344.mp4

https://www.youtube.com/shorts/3lJIkSam1r8

5. Making portable heating safer: Rocket stove to increase fuel options (i.e., wood burning stoves, for that subset of homes in Ukraine that have them, are not safe to burn) -- and reduces carbon monoxide risk given the air coming from under the combustion area:

https://www.youtube.com/shorts/B7t2Qqxmj3g

6. Checklist and Procedures for Survival Essentials (Draft -- to be verified upon HROC's Chief Scientist's arrival in Ukraine for DIY feasibility there) for people to download to their smartphones:

https://thinkhro.org/pdfs/+DRAFT-ChecklistAndProceduresForSurvivalEssentials101422v7_mobile.pdf

7. The biggest problem we uncovered, and greatest contribution we can make can be found in this document (with the 2 most important figures from the document being placed directly below):

https://thinkhro.org/pdfs/PublicSafetyScientificStudy-Winter2022UAMission.pdf

(Please see key figures from document above as to why cognitive bandwidth is critical to giving people the means to start, persevere, and finish survival procedures and safety checklists, as well as do problem-solving. And also what our goal is in our Public Safety Scientific Study Mission to Ukraine – find ways to increase cognitive bandwidth, narrowing in Ukraine due to stress, cold, and other factors.)

Figure 1. **Cognitive bandwidth is critical** to giving people the means to start, persevere, and finish survival procedures and safety checklists, as well as do problem-solving.

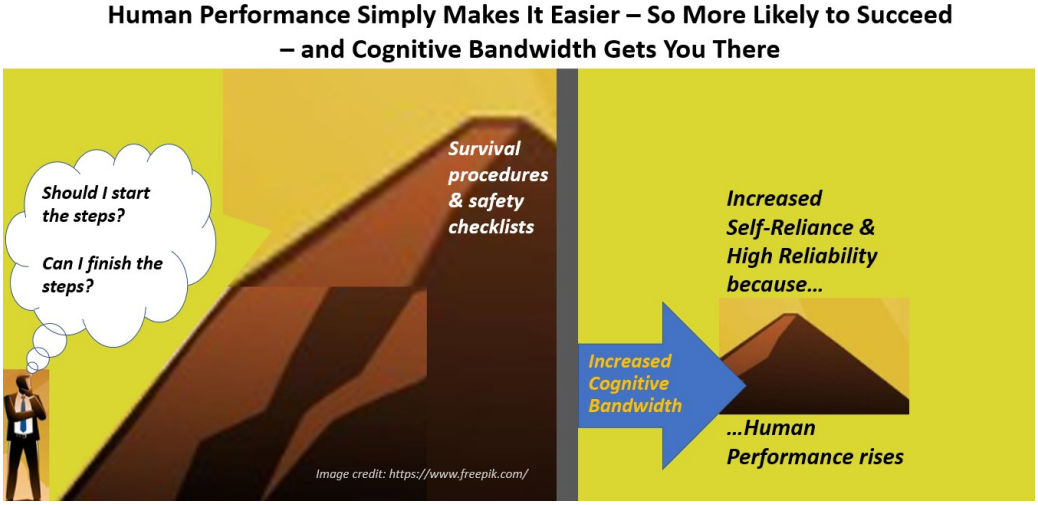
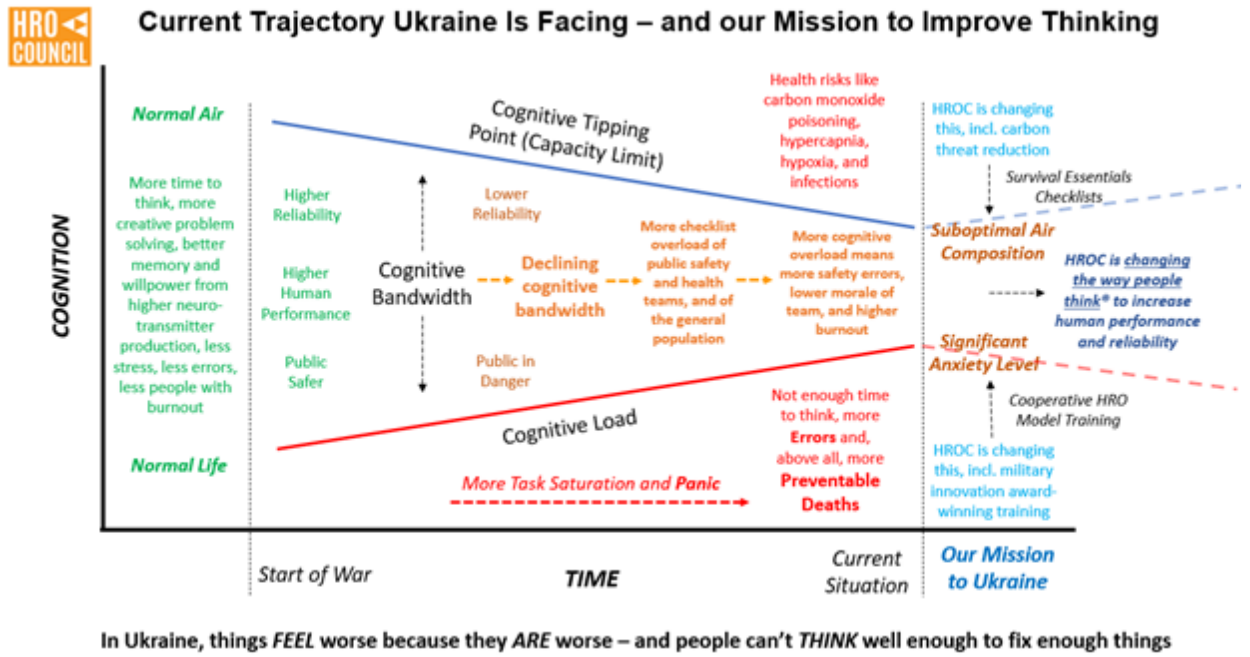


Figure 2. What our goal is in our Public Safety Scientific Study Mission to Ukraine – find ways to **increase cognitive bandwidth**, narrowing in Ukraine due to stress, cold, and other factors.



As Plato so aptly put it, "**Necessity is the mother of invention**." Inventions and innovations are at least one silver lining in the dark clouds of war hovering over Ukraine, because there is a lot of necessity. We believe **Ukrainians and their allies could also get more inventions** by adding cognitive bandwidth after necessity.

Our team is identifying and helping **teach how to** not only better survive their catastrophe, but also for the rest of the world to **survive disasters** (whether man-made or natural), and to **reduce crises** already existing, such as disease, poverty, fraying social cohesion, and the rise of greenhouse gases. We believe (as one might assume from the name of our nonprofit NGO) that what is most important is that which **enables self-reliance** and **ensures high reliability** in achieving these goals.

The famous Pennsylvanian and a Founding Father of America, Benjamin Franklin, stated that "Early to bed and early to rise makes a person **healthy, wealthy, and wise.**" What other factor (besides sleep schedules) does this? Based on our research, including in Ukraine, it turns out everything related to **human performance** – and human performance relies on **cognitive bandwidth**. Thus, the only real solutions, based on our Defense research, are: 1. Raise capacity limits (i.e., the mind's tipping point), 2. Lower cognitive load (e.g., from anxiety and checklist overload), or 3. Do both #1 and #2, which is our highest priority in our Ukraine mission.

Our first key discovery from Ukraine was that **self-reliance requires human performance** to help see ahead, prepare better, and be ready for problems or for opportunities that lie ahead.

However, the second key discovery (and perhaps most immediate value for a quick win, and most important long-term for the planet's climate change crisis) is how **suboptimal air composition is a rising threat** in Ukraine, and also for the world, not just due **to health and climate** effects, but also for **resilience, thinking capacity, and human performance** effects.

One example that had gotten us thinking was that our team has said that even with just the regular pollution monitoring mechanisms (not the detailed sensors, such as low-level carbon monoxide detectors and carbon dioxide levels), their newsfeeds in **Kyiv constantly indicate days of poor air quality**. **And on these poor days, the levels of depression, anxiety, and tenacity**, they have observed, are indeed **impacted**. Clearly, there could be other confounding variables (e.g., missile strikes that create fires and their carbon-based emission while also depressing people), but research on suboptimal air found drops in cognitive function even in controlled environments (and where there was no war). Thus, it may be a key cause of at least some of the "paralysis" that sufficient preparation confronts that they have witnessed, including at times, with themselves – and by changing it, we could perhaps give greater resilience and reliability. We believe it at least warrants a scientific study and tests HROC's Chief Scientist will

be performing on himself to assess the level of impact (e.g., reaction times, calculation capabilities, and memory recall) from moving to optimal from suboptimal air compositions.

What are the consequences or "**downstream effects**" **of this drop in cognitive bandwidth**? Lack of bandwidth also puts people at **much greater risk later**. How? As Figure 1 shows, it can make even starting a survival procedure seem too daunting, thus demotivating people. Then even if one starts the procedure, it can lead to misremembering a key item if you don't have the procedure on your phone or a piece of paper and have to rely on memory (i.e., it makes recall harder), or it leads to misinterpretation of an instruction. This **leads to errors**, some of which can be catastrophic Finally, consider our DIY survival procedure (or any government procedures, etc.). They assume a certain set of resources. However, what if not all of them are available, and a substitute must be used, or a workaround needs to be created? Then that procedure will require some level of "resourcefulness" (i.e., using what you have available to you at the moment) by the person, and thus some ability to put pieces together / connect the dots in one's head (i.e., problem-solving creativity and synthesizing). Without cognitive bandwidth, this becomes much more difficult, and perhaps not possible when a person faces a "panic" situation (not necessarily an "emotional" or "frantic" panic, but rather a task saturation panic, so more like a "brain freeze"). So even if preparation is started, it does not get completed adequately and thus more errors. In any of these cases, the result is the same – **a preventable problem, perhaps even a preventable catastrophe**.

How about an example of the **downstream benefits** to thinking ahead and preparing? One is from our team members in Ukraine, Dasha and her husband (who is also a volunteer for HROC). Because of HROC's **prediction from thinking ahead** of energy grid strains, and thus the future need for electricity generation, HROC-USA sent her a **crank generator** (*seen in one of the video links above charging a phone*) in preparation for the winter. In November, they commented it was the only **reliable power** they have for their smartphones, given the unpredictable and extended electrical blackouts they face. It also led to our **creative problem-solving "DIY survival essential procedure"** for creating electricity at a rapid and large scale for the entire nation this winter, which is our method that can use wrecked cars' alternators, or instead damaged appliances (e.g., refrigerators, washing machines, even vacuum cleaners and blenders, using the electric motors inside, many of which enable getting electricity for not only phones but even drones at sufficient wattage, to create a crank-based generator). This is to make the same types of generators that we have already proved are highly effective in Ukraine.

Solution for "Changing the Way People Think" on Carbon Emissions and Human Performance

HROC-Ukraine's public safety R&D team is testing what we call a **"hyper-localized carbon capture"** (HCC) method to capture carbon near or at its source or where it may pose its greatest risk. The process is based on one of the most abundant and lowest cost materials in

the Earth's crust. That substance is limestone (which is comprised mostly of calcium carbonate) and its derivatives.

HCC can be used also as a "technique" to enable storing energy (though not nearly as powerful as lithium batteries, but not nearly as scarce nor costly either), then generate heat, and finally capture carbon in the form of carbon dioxide. This last point means that other harmful carbon-based compounds, like carbon monoxide or methane, must first be oxidized into carbon dioxide. However, our team focused on this mission has factored that into the solution as well.

Or it can be automated into a "technology" that is encapsulated by a machine we term a *QCHEIM Micro-Energy Plants*™, or MEPs. HROC Ukraine plans to manufacture in our Ukraine office these MEPs in order to help **rebuild Ukraine**'s economy, as an example of discoveries and innovations that Ukraine was able to help create with its partners in the U.S. as a result of the war.

Inventions like these techniques and technologies are **similar to how during World War 2**, the inventions like *radar*, *penicillin*, *computers*, and *atomic energy* were all pioneered – as a result of necessity.

Ultimately, this helps not only Ukraine -- and the world -- better **survive the war effort** and the **energy and carbon emission havoc** the war has unleased, but also **help create jobs** in Ukraine and in the U.S. from the devices, and create additional tax base, such as from the 10% in *royalties* from the invented machine's patent pending licensed design that the Ukraine office will generate from sales of the machines.

Manufacture of these machines will be done **through our nonprofit NGO** (in Irpin, Pittsburgh, and Kviv, which are the regions where HROC's current offices are located), in order to create jobs in local communities, where DIY versions can even be done at people's homes for themselves, or to sell as units to others. **Given its DIY**-capable nature, it is also the **fastest way to** make it more ubiquitous, and thus fastest way to **help society and the planet**.

But it also can help the local communities where they are created (including DIY) in other ways, such as to **improve physical and mental health**, and, with the greater cognitive function, **education** as well, as well as business **productivity**, and societal issues like adherence to laws (i.e., reduce **crime**, similar to the Lead-Crime Hypothesis of why crime started to fall once the toxin lead was removed from the atmosphere with the use of unleaded gas), and other benefits that help any indoor locations in cities suffering from a "*CO2 dome*" (which form because carbon dioxide is heavier than air, and tends to hover in place, especially in valleys or where there is insufficient wind).

Toward the war effort -- or, more aptly, given the history of terrorism and war fueled by petrostate dollars, the "maintaining peace" effort -- the Micro-Energy Plants could then become part of a global "Energy Victory Gardens" effort to have alternatives to fossil fuels, thus **reducing dependence on unpredictable and dangerous petrostates**, but also **helping neutralize carbon emissions** when fossil fuels are the only realistic (and sometimes humane, when energy is desperately needed and there are shortages or extreme price inflation) option and must have carbon emissions converted at the point of combustion (given that, in the U.S., over 80% of its energy needs require something to be burned).

India's former leader and legendary peace activist, Mahatma Gandhi, was quoted as saying, "*Be the change you wish to see in the world.*" Our discovery in Ukraine of **personalizing the value of reducing carbon-based gases**, as part of the way to increase cognitive bandwidth, can allow everyone to be part of the change many people want to see and that the planet needs in terms of reduced carbon emissions – but for **many different reasons and benefits now**, not just one (i.e., the planet and its climate). It can also be for the individual humans that impact the planet in so many different ways, in terms of their **health and productivity**, which have personal economic benefits as well.

It can even be the change in society as it leads to people that think better, **improving education, reducing crime**, and making them more resilient to protect themselves and others, as it is a society **less susceptible to** misinformation and irrationality – both of which are all parts of Russia's broader war that includes "information warfare" – so as not to be misled by Russian disinformation campaigns that are meant to stoke **hate and division meant to undermine the free world**. In short, carbon capture, and other techniques and technologies being pioneered in Ukraine will help that nation and can help the rest of the world at the same time. In addition, for society, teaching self-reliance via human performance is what can **make people better and safer, not just happier.** Changing the way people think to not only address greenhouse gases and climate change, but to also add social cohesion by broadening of minds (i.e., giving people more mental space to think and solve problems and understand other people better) is simply one more unexpected benefit learned from working with Ukrainians focused on their survival. As another Greek philosopher, Aristotle, pointed out, often you do indeed “derive wisdom through suffering.”

The most immediate benefit offered by this set of **inventions from HROC-Ukraine's work** is that it could increase the carbon capture capability all over the world – as it expands and **personalizes the reasons to do carbon capture** and optimize air composition **beyond climate change** to improve lives more quickly and tangibly by reducing carbon-based gases in the air we breathe down to an individual's level, impacting **immunity, physiology, and cognitive function** (impacting each of those items by **50% or more**), enabling Ukrainians and the rest of the free world to prepare better for the long arduous winter ahead (e.g., more energy independence), but also enabling people all over the world to become more "healthy, wealthy, and wise" – giving them a reason to think of Ukraine long into the future for the contributions

they are making. The cognitive bandwidth benefits including greater initiative, better remembering, and more problem-solving creativity, help **enable and ensure greater self-reliance** for everyone, and not just during disasters, but also for when people need to overcome any crisis they may face now – or most importantly, as they now have the thinking capacity to think ahead, that they want to **prevent problems that are beyond the horizon**.

Project Plan

Irpin is where our project will initially focus to then attempt to scale up by spiraling out to Kyiv and the rest of the nation, via our public service announcement / training videos for the techniques to improve human performance and also our safety checklists.

The nature of HROC Chief Scientist Terry Rajasenan's mission to Ukraine in January has several dimensions. The first is to deliver the sensors, test them, get readings at different locations and circumstances, then use the electronic sensor products as baselines for the self-reliant DIY solutions that people can create.

For example, his own experimental testing and research on standard carbon monoxide (CO) detectors showed that it takes at least 4 minutes for the detectors to trigger -- even when deadly levels of CO. This means that many people (especially those with cardiac conditions, the elderly, etc.) may pass out, collapse, and get fatal levels of the deadly gas before they can even be warned.

Our Ukraine-office team has designed two solutions with the help of our chief scientist, one more "reactive" that uses a health-based symptom checklist, and the other more "proactive" that uses "chromophore" tool based on household items that may be possible for people in Ukraine to make. The proactive solution offers the ability warn earlier at the source of the risk, or near the people who may be asleep (carbon monoxide is called a "silent killer" where people basically fall asleep before dying -- but it is especially a risk when people are sleeping, since they don't realize the symptoms when asleep). These solutions allow more people to have the capabilities of a carbon monoxide detector (a device they may not currently have, or be able to realistically find and afford). Then there needed to be an approach to reduce carbon monoxide levels without the need for the metal platinum, which is scarce in Ukraine, and costly anywhere (and hence why catalytic converter thefts are increasing).

But this also applies to the rest of the world too, where CO poisonings happen -- and at a 9 times greater rate during disasters when many people are using portable generators, burning wet wood, or trying to conserve heat and fuel by burning indoors.

The second part of the mission is to train the public, including how to better learn and follow through on the "survival essentials" training we are trying to instill in the at-risk Ukrainian population. How will we best serve the estimated 10 million or more Ukrainians that will likely be under attack or displaced this winter? The well-known proverb of "give a man a fish he eats for a day, teach a man to fish and he eats for a lifetime." In other words, our goal is to educate through the power of video, and also the power of personalities, in this case, heroic defenders of Ukraine who not only want to save the people of Ukraine, but also who want to the people of Ukraine to help save each other, relying on one another and performing at a higher level to save their families and fellow citizens.

Budget for Personnel

To accomplish these objectives of showcasing and raising awareness of these human performance methods in this Ukraine Winter Initiative of HROC, there is a budget of $21,100 is for the 5-person team (2 of whom are volunteering) for the 2-month winter initiative, with the following itemization:

$2,000 for the delivery of the equipment, sensors, and other tools needed for the mission done to cover the expenses of Terry Rajasenan, who is volunteering as HROC’s Chief Scientist pro bono to spend the time also training the team on all of the deliveries once he arrives and doing the testing and verification of the innovations.

$10,000 budget for the paid team (3 people for $1,250 per month each for 2 months, for a subtotal of $7,000, with the remaining 3,000 for purchases of supplies, fuel for travel, and misc. expenses, or to be shifted to the additional work in the event more can be done and the team needs the extra pay). This will be for producing as many videos as can be made in that time, but at least 20 Ukrainian and English videos by the end of the 2-month project, with the highest impact ones frontloaded in order to maximize the lives saved or significantly improved during the depths of the winter. The team will also be assisting and supporting the Chief Scientist on his evaluation and refinement on the minimum of 8 DIY innovation subprojects they are testing, refining, and verifying inside Ukraine, that they have designed and researched and tested outside Ukraine, and where they intend to have at least one if not more breakthroughs by the end of his travel to Ukraine. Note that this $10,000 is also humanitarian in nature, since it is very difficult for them to get new work at this time, and this would provide the team enough money to survive the winter, and in a more “relevant” yet still valuable job of showing how our lifesaving techniques and DIY methods can help save their lives, so others can learn from them using these Ukraine-produced videos by an experienced video production team and the award-winning documentary filmmaker leading our Ukraine office.

$5,000 budget for equipment and sensors (estimated $2,000), and other tools / license purchases and technical support (estimated $3,000) to be able to have set up the office as a full

HROC lab, our team's van as a mobile lab, and both office and van as a mission control for the shelters and eventually the IHSAs. This includes the high reliability technologies and geolocation maps used in Defense projects (i.e., the one that changed U.S. Defense Department policy in High Reliability due to a reduction of preventable deaths by 87% in its flagship study) from the partner organizations, which are contributing at severely discounted rates on most items, and no-cost on other items. Examples of the equipment include a low-level carbon monoxide detector, hygrometer, pulse oximeter / other vital sign and diagnostic devices

$2,000 is for any specialized consultants that may be needed in the project, such as accounting and legal expenses

$1,000 is for overhead and miscellaneous items including supplies and services

$1,100 is for fees needed by PayPal Giving Fund to process donations, and 2.5% for interest expenses to advance funds on the delays associated with receiving the donated funds and other fees associated with the transfer and distribution of the money inside Ukraine

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$21,100 Total to optimally implement the 2-month project

Thank you for any support you can give to our HROC-Ukraine team's mission.