Predicting a Better Future for Baltimore and the Nation

The Baltimore Tech Hub Consortium ('Consortium') is pleased to apply for EDA Regional Technology Innovation Hub Designation. The **geographic location of the Tech Hub is the Baltimore-Columbia-Towson Metropolitan Statistical Area (MSA)**, home to 3.1M residents, comprised of seven counties: Anne Arundel, Baltimore City, Baltimore, Carroll, Harford, Howard, and Queen Anne's. Cecil County is an adjacent suburb outside the MSA but an active member of the Consortium. Consortium members are committed to working collaboratively to **transform Baltimore into a global "Equitech" leader**. Therefore, no geographic constraints are anticipated. **The Baltimore Tech Hub Consortium consists of 38 members** comprising of 8 educational institutions, 10 private sector firms, 8 not-for-profits, and 12 public sector entities, which includes government agencies *(see Consortium map and letters of commitment cover letter for details on Consortium members).*

The Baltimore Tech Hub will center on **the intersection of two key technology focus areas** (KTFAs): artificial intelligence / machine learning ("AI / ML") and biotechnology**. Our core tech focuses on predictive healthcare technologies that harness the power of AI/ML to support clinical decision making, bioethics, personalized medicine, new biologics, therapeutics, and health insurance**. Furthermore, our technology has significant potential for downstream applications such as enhancing advanced biomanufacturing capabilities (e.g., across chemicals, materials, med-tech etc.), ensuring supply surety and advancing supply chains to enable on-shoring of production and scaling (e.g., drugs, devices, industrial products, and materials, etc.). To meet our technology's promise, we intend to use the Tech Hub designation to catalyze commercialization of predictive healthcare technologies which **will improve wellbeing and equitable care delivery for individuals, communities, and the nation.**

Technology-Based Potential for Global Competitiveness:

Economic opportunity: The global economic opportunity for predictive healthcare technologies is projected to reach ~$700B by 2030. By 2030, the projected US market size of the core tech is estimated to be $12.7B (growing 20% annually), with an additional ~$197B of economic value being created via the downstream use cases. In addition to a growing market size, the core technology is expected to add a total of ~5.6M jobs nationally by 2030. **By 2030, the region is projected to have a market size of $4.2B (~$640M for core tech area and $3.6B in value created via the applications of predictive healthcare technologies), along with 52K jobs created.** We are confident that, with the help of the designation, the Baltimore MSA has the potential to emerge as a global competitor in predictive healthcare technologies.

Assets in the region to support commercialization: Baltimore is home to major corporations, world-class universities, unrivaled federal spending on R&D, and a high concentration of diverse talent. These assets provide a strong foundation to advance the commercialization of predictive healthcare technologies. The region's universities boast one of the highest academic R&D spend in the country with **a combined $3.2B in academic R&D spend in FY 2021**, **~$2B of which was dedicated to information technology (IT) and life sciences.** In 2022, Baltimore was home to over 400 tech/scale startups, including 350 funded startups - 64% of which were in healthcare and information technology. Around 60 private sector entities are driving innovation in predictive healthcare technologies and 14 accelerators are supporting companies that advance technologies in healthcare analytics and services (e.g., Delfi Diagnostics, Protenus).

The MSA has a history of successful commercialization in the core tech domain, supported by significant VC investments in relevant fields; in 2022, $500M+ was invested in life sciences, digital health, AI, and advanced manufacturing. In addition to R&D and VC spend the region

currently has over 60 assets in the region at or above approximate technology readiness level (TRL) of 6. These TRL 6+ technologies fall into four broad categories: (i) medical diagnostics/interventions (e.g., Previse's licensed biomarker technology and Astek Diagnostics' benchtop UTI diagnostic), (ii) health analytics (e.g., Haystack Oncology's precision medicine platform), (iii) medical devices (e.g., EpiWatch, an app that detects seizures before they occur and Feelix, a Smart Stethoscope), and (iv) gene / drug therapeutics (e.g., PGDx / LabCorp's tumor profiling platform). All these technologies are spin outs from the Consortium's members including Johns Hopkins University (JHU) and University of Maryland Medical System (UMMS). Baltimore MSA is also blessed with density and proximity of potential end customers for predictive healthcare technologies in the region – including health systems, payors, pharmaceutical companies, and biotech companies. The Consortium accelerates commercialization of new technologies across our region (e.g. UMMS [annual revenue: $4.9B], The Johns Hopkins Hospital [annual revenue: $2.5B], and federal player CMS [FY2022 outlays: ~$1.4T]).

While Baltimore MSA has the strengths above, we also understand that there are areas we could invest in to become a true global leader in predictive technologies. For example, despite outspending peers in academic R&D ($1,160 per capita vs. $310 among peers), Baltimore has faced challenges in commercializing innovations ($553 venture per 1M people vs. $1,523 among peers) because of a mind-to-market gap (conversion of R&D to patents/venture capital), a resource-to-innovation gap (accelerating venture capital funding to new startups), and an innovation-to-growth gap (supporting new-startup maturity and job creation). **We believe, the EDA designation will address these commercialization barriers by unlocking a robust resource pool of funds for start-ups as well as developing the surrounding ecosystem necessary for scale (e.g., manufacturing capabilities and skilled workforce).** The Consortium plans to implement this via 5 regional concepts: **(i) Accelerator & Funding Program:** Investing in AI-based therapeutic ventures and digital health commercialization with a focus on minority entrepreneurs **(ii) Anchor Innovation Hub(s):** Physical building(s) to serve as anchor for regional innovation ecosystem and scaling **(iii) Bio-Manufacturing Facilities:** Physical infrastructure to support the development and scale of products/technologies in core tech area and allied fields, especially among women and minority entrepreneurs **(iv) Lab Infrastructure:** Wet lab space to support development/testing of technologies in the core tech area and allied fields, especially among women and minority entrepreneurs and **(v) Workforce Development & Upskilling/Training:** Preparing Baltimore region's labor force for jobs of the future in predictive healthcare, with a focus on equity and empowering globally minded leaders.

Programs and investments: The EDA designation will work in conjunction with other ongoing federal funding efforts to amplify impact through strengthening the surrounding commercialization infrastructure**:** (i) $24M in omnibus federal funding for infrastructure, healthcare, education, and workforce projects (ii) $84M from CDC for healthcare infrastructure, (iii) a DOD initiative in Harford County for biomanufacturing (iv) $25M NIH grant to invest in neurotech startups, (v) The Office of Naval Research awarded Morgan State University (MSU) a $9M grant to build a diverse knowledge base for AI/ML and cybersecurity (vi) a federal designation as one of five workforce hubs, enabling it to receive additional resources and deploy best practices in training a highly skilled workforce. In addition to federal funding, there are several existing state-level development programs and funding efforts that promote innovation within our core tech area, including the **Maryland Department of Commerce Biotechnology Incentive Tax Credit, the One Maryland Tax Credit along with $12.6M from the state of Maryland for healthcare access and equity in the region**. The region's EDA Tech Hub bid is also supported

by public sector leaders such as Senator William Ferguson, Senator Antonio Hayes, MD Commerce Secretary Kevin Anderson, and Baltimore Mayor Brandon Scott. In addition to state and city level support, local investments include an upcoming multidisciplinary center including JHU focused on applications of AI/data science/ML in various fields including neuroscience and precision medicine. While these resources support the region's capacity for innovation, the EDA designation will help unlock resources that will ensure development of a robust commercialization ecosystem that will cement Baltimore's status as a thriving innovation hub for predictive healthcare technologies.

Role of the Private Sector:

Baltimore has robust private sector participation in predictive healthcare technologies with **~60 firms driving innovation and commercialization**. The private sector's commitment is reflected in the Consortium's membership (10 private sector firms and 5 private not-for-profit entities) and strong partnerships (50+ regional private sector players agreed to partner with the Consortium). Participation from the private sector in the region's effort represents players from every part of the value chain for successful enterprises – innovation enablement (Wexford Science & Technologies), commercialization assistance (Blackbird Labs, Early Charm), scaling and manufacturing support (LaunchPort), workforce skilling and sourcing (Catalyte, NPower), and end customer access (CareFirst BlueCross BlueShield, Haystack Oncology). We have had significant successes recently in private sector led innovation and commercialization like AI-X Foundry-JHU, InHealth-JHU, Stocastic (a digital health startup founded in JHU and incubated in Towson University), Delfi Diagnostics (raised $225M), Thrive Earlier Detection-JHU (acquired by Exact Sciences for $2B). **Diversity is a key focus for our Consortium - with 21% and 29% of the Consortium being women-led and BIPOC-led, respectively.** Examples of startups in our region that are female founded include b.well Connected Health (personalized healthcare) and Black female-founded Sonavi Labs (medical devices and software rooted in AI). The designation will support expansion of programs, like Conscious Venture Partners' learning laboratory and 1501 Health (an incubator led by LifeBridge Health and Healthworx, the innovation & investment arm of CareFirst BlueCross BlueShield) which focus on connecting minority entrepreneurs to payer-provider innovation resources and supporting founders focusing on healthcare access solutions.

Regional Coordination and Partnerships:

The Consortium includes stakeholders across the Baltimore community that are committed to driving progress, innovation, and equity in the region. All Consortium members were invited to submit project ideas for consideration and contributed to the development of the narrative over **7 sessions (including in-person) attended by 50+ attendees**. The Consortium is organized around working groups for the five regional concepts designed to build an ecosystem to advance predictive healthcare technologies by providing commercialization and scaling support as well as ensuring equitable workforce development. Our regional concepts are intentionally designed for cross-functional collaboration to ensure the sum of our consortium is greater than its individual parts and we benefit from the collective brain trust of the region. Regional concepts will build on existing collaborations in the region like: (i) Blackbird Labs' $100M fund which collaborates with JHU and University of Maryland, Baltimore (UMB) to support life science innovation companies, (ii) The 1501 Health Incubation program which is working to bolster startups focused on changing the future of healthcare and improving the health of members and patients, (iii) The multi-institutional effort to develop an Institute for Trustworthy AI in Law and Society led by UMB and including MSU supported by the NSF. **The Greater Baltimore Committee as the lead organization for**

the Consortium will appoint an RIO who will lead Tech Hub implementation efforts by ensuring strategic direction for Consortium activities, progress and impact over time.

Equity & Diversity:

The Baltimore MSA has a uniquely diverse population – a true microcosm of America – that will inform, execute on, and benefit from the convergence of these technologies launching and growing in the region. Approximately 45% of the MSA population are BIPOC and the region houses two minority serving institutions (**Coppin State and MSU - which produces the largest number of engineers of color in the nation).** Maryland is ranked 2nd nationally for minority entrepreneurs and Baltimore City entrepreneurs exhibit more diversity than the national average **(17% vs 11% share of Black executives in startups).** However, Baltimore's innovation industries still do not reflect the level of diversity within the city. The Consortium recognizes the potential to advance equity in the region given significant existing disparities (e.g., economic opportunities, health, etc.) and plans to pursue new initiatives as well as scale existing efforts to ensure designation-status resources help achieve shared and equitable prosperity. As part of the implementation of the Tech Hub vision, the Consortium commits to making Baltimore the **first "Equitech city"** focused on investing and supporting women founders and founders of color and developing the local workforce across educational backgrounds to meet the Tech Hub's promise. To that effect, several member-led initiatives are in flight that can be further catalyzed with expanded resources: (i) UpSurge's Equitech city initiative, which has already drawn the interest of companies and investors, was cited as a deciding factor in Baltimore receiving a $25M NIH grant to invest in neurotech startups, (ii) University of Maryland's Institute for Health Computing (IHC) explores AI, machine learning and network medicine in the context of health equity (by incorporating racial, gender, demographic, and social strata diversity into discovery efforts), (iii) Hutch, Conscious Venture Partners, and Loyola University Maryland work to promote and invest in businesses owned by minority founders (iv) Fearless which has won federal contracts worth $120M and has funded tech incubators, including Hutch (v) UMBC's Meyerhoff Scholars Program which is focused on increasing diversity among leaders in STEM-related fields and (vi) JHU's Vivien Thomas Scholars Initiative which ensures 100 slots for diverse students in 30+ STEM programs, (vii) NPower (75% graduates have received industry recognized credentials and experience), (viii) Last Mile Education Fund (~300 participants impacted) and Digital Harbor run programs focused on addressing the skill gaps in underrepresented communities that inhibit participation in tech. Impact on addressing inequity in the region can be furthered with investments in new initiatives, like JHU's proposed JUMPSTART Life Sciences fund to promote female and minority founders.

Composition and Capacity of the Regional Workforce:

Baltimore has a **highly skilled and diverse workforce**, with considerable specialization in healthcare services and allied industries (e.g., 43% of MSA workforce aged 25-64 possesses a bachelor's degree). Baltimore represents 62% of Maryland's innovation economy and the healthcare sector is the second largest employer in our MSA. Approximately 215,000 workers are employed in healthcare and ~5,000 workers work in AI. We estimate thousands more have capabilities prime for upskilling at the intersection of healthcare and analytics to fill the anticipated ~52,000 new jobs that will be created by 2030. By our estimation, the jobs created will have annual salaries $75,000 and upwards (above median income), which, when coupled with the continued development of the minority talent pipeline, will enable us to **increase equitable access to 'good jobs**' (as described by the Department of Commerce principles). The Consortium has also received support from the newly formed workforce and education focused MD Dept. of Service and Civic Innovation's Secretary Paul Monteiro.

The MSA is well-positioned to meet demand for jobs across predictive healthcare fields and its use cases in healthcare given its **13 institutions of higher education**. The Baltimore MSA produces about 100,000 graduates a year, of which 20% have acquired STEM degrees. The workforce is also increasingly diverse with 40% of the bachelor's degrees in 2020 being awarded to individuals from minority communities. Consortium members like Catalyte, Digital Harbor, Last Mile Education Fund, and NPower highlight the Consortium's focus on not only developing a growing tech workforce, but also ensuring **opportunities for upskilling/reskilling with a distinct focus on underrepresented communities.** These efforts ensure that a college degree is not a barrier to accessing the new opportunities unlocked in the core tech area and other allied fields in the region. To retain talent, the Consortium will focus on creating competitive employment opportunities for diverse talent, facilitating an innovator-friendly investment environment, and continuing to make Baltimore an attractive destination.

Innovative "Lab to Market" approaches:

Commercialization barriers in the MSA are well recognized by the leaders of the region and there are multiple efforts underway to address them. Some key examples include University of Maryland's BioPark and BioInnovation Center, which provide **centralized resources and workforce development programs** to accelerate life sciences businesses while leveraging the talent and tech emerging from UMB, and JHU's Tech Ventures 'FastForward' incubator program which provides healthcare, drug development, manufacturing, and IT startups with a coordinated suite of resources that can propel growth and get them to market. Our Consortium also includes local accelerators, incubators, venture studios and startups with successful alumni (e.g., Early Charm, Healthworx, LaunchPort, TEDCO, and Blackbird Labs) as well as initiatives such as Fearless and programs led by Coppin State that specifically focus on developing minority talent in the commercialization pipeline. **The Consortium plans to accelerate these efforts through 3 out of its 5 planned regional concepts** (anchor innovation hub, biomanufacturing facilities development, expanding lab infrastructure).

Impact on Economic and National Security of the entire United States:

Reducing healthcare costs, improving healthcare outcomes, and improving economic inclusion and equity are national priorities, as indicated in the goals of various federal legislations (e.g. Inflation Reduction Act – healthcare cost reduction, the American Rescue Plan – healthcare access and cost reduction, the CHIPS Act – improving economic inclusion) and the HHS's budget priorities for FY 2023 – 'invest(ing) in all Americans' health and well-being'. The Baltimore Tech Hub's focus on predictive healthcare technologies and its use cases is uniquely poised to **improve and save lives and create enormous economic value nationally**. With spending on healthcare reaching $4.3 trillion (~ 20% of GDP) as of 2021, advancement of AI applications to healthcare operations has the potential to affect affordability in healthcare (studies show that broader adoption of AI can lead to savings between 5-10% in healthcare spending, or ~$200B to $360B a year). From this national opportunity, **Baltimore can drive outsized impact** above and beyond its size given its strengths in predictive healthcare technologies. Our focus on a diverse workforce and ecosystem combined with our belief that our core tech use cases can drive **more equitable health and wellness outcomes** means that we are able to deliver on many of the nation's priorities. Beyond the impact on the citizens of the region, we believe other regional assets, like expertise in cybersecurity and the proposed Harford County biomanufacturing facility to commercialize products delivered for defense applications, will help advance AI/ML applications with national security implications.