Status Update

October 1, 2024

CONTENTS

CCAM STATUS UPDATE

This update is being submitted as required by HB6001, Chapter 2, Item 115 K.5:

> K.5. "CCAM shall submit a report on October 1 of each year to the Secretary of Finance, Chairs of the House Appropriations and Senate Finance and Appropriations Committees, and VIPA containing a status update of all new incentive programs, including but not limited to the following: (i) MOUs it has entered into with each university partner; (ii) funds disbursed to both university and private sector partners of CCAM, as well as any other recipients; (iii) any other agreements CCAM has entered into with representatives of the public and private sectors that may impact current and future incentive fund disbursements; (iv) all efforts and costs associated with obtaining federal research grants; and (v) any additional information requested by the Secretary of Finance, or the Chairs of the House Appropriations and Senate Finance and Appropriations Committees."

Elements requested in K.5. are outlined on page 24. In addition to those items requested, a brief overview is provided below to communicate CCAM's progress over the past year.

Executive Summary

Financial Update

- CCAM financial health continues to trend in a positive direction. While managed risks are still ahead, Commonwealth support has helped enable increased revenue in both federal awards and new programs with existing industry members. A key focus for FY25 will be to maintain our federal award trajectory while driving a new membership model that will grow the industry base.
- CCAM is in the process of completing its annual audit for Fiscal Year 2024. Final audit results are expected later this calendar year with an expected designation of an unqualified opinion. Audited financial statements for FY 2024 can be provided once received by CCAM.
- As of September 30, 2024, CCAM's unrestricted cash position is approximately [redacted] improvement from this time last year.
- CCAM revenue increased YOY by 21% to $10.4M in FY 2024.
- [redacted] all trade debt is current as of September 30, 2024.
- The Department of General Service's (DGS) acquisition of the CCAM building has not yet been finalized, [redacted]
- As previously reported in 2023, Chmura Economics & Analytics concluded that each dollar of state funding to CCAM generated $17.3 in economic activity within the Commonwealth. Assuming linear

projections with CCAM growth since 2022, **an additional economic impact of $42.3M and support for 199 high-paying jobs would be realized.**

Business Development

- CCAM completed its benchmarking work of other research institutions, collecting significant data that has informed the establishment of a new industry membership model aimed at increased member recruitment. The long-standing membership model hindered member recruitment, with elements such as a 5-year commitment and a large fee structure that are difficult to get approval at the highest corporate levels. This new model is in line with other communities like CCAM, e.g. AMRC and OMIC, which incorporate much more reasonable fee and term structures. This should improve CCAM's ability to recruit new industry members.
- Documentation reflecting the structure of the new membership model was finalized in Q2 and Q3. Test reviews of the new structure were extremely favorable.
- In early September, the new CCAM Member Agreement was formally sent for approval to all Industry, University, and Government Members. The target date for full ratification and implementation of the new structure is 01 January 2025.

Federal Funding: Momentum continues with significant future impact

- Commonwealth support continues to provide traction for CCAM as it pursues federally funded programs.
- FY24 Federal Award levels rose to $3.2M, a YOY increase of 146% and an 8.4x increase over FY20.
- Revenue from (i.e., CCAM expenditures against) these federal grants has increased YOY by 163% in FY24 to $2.9M.
- The pipeline of CCAM campaigns and proposals remains strong with near-term (12-24 months) projected value of awards at approximately $5.3M (probability weighted).
- CCAM secured a $962K NIST Community Add Award that will provide additional additive manufacturing capability to CCAM that may be used to attract industrial and federal R&D funding to the Commonwealth.
- CCAM, on behalf of the Alliance for Building Better Medicine (ABBM), was the lead organization for the Advanced Pharmaceutical Manufacturing (APM) Tech Hub, which was awarded to be one of 31 nationally Designated Tech Hubs by the EDA and was well-recognized by our two US Senators and others (https://www.warner.senate.gov/public/index.cfm/2023/10/warner-and-kaine-announce-major-regional-tech-hub-wins-for-virginia). CCAM also led the submission of eight proposals for Tech Hubs funding, valued at $70M. Proposals centered on growth of the APM hub in the Richmond and Petersburg Region. While the Hub proposals were not selected for funding at this time, $500K was granted to our hub in September to continue momentum for development and future resubmission of proposals.

Workforce Development: Establish a Talent Pipeline

- The Central Virginia Chapter of the **Federation of Advanced Manufacturing Education (FAME)** has expanded to serve **a total of seventeen manufacturing companies** in the region as Core Members. The second cohort of students who entered the program in 2022 have now graduated, and **all were offered full-time employment** by their sponsoring companies. Despite these successes and progressively increasing cohort sizes, FAME is facing a significant challenge with the withdrawal of

Richard Bland College as the Chapter's educational partner. CCAM is working with Brightpoint Community College in the hope that they will assume a leadership role in FAME to continue this good work.

- **CCAM's role as the In-Region Coordinating Entity for GO TEC®** (short for Great Opportunities in Technology and Engineering Careers) kicked into high-gear this year. With GO Virginia grant funding and private-sector support from The Cameron Foundation and The John Randolph Foundation, our Region has established GO TEC Career Connections labs in the middle schools of Colonial Heights, Dinwiddie, Hopewell, Petersburg, and Surry. Students in all these schools are already getting instruction that will help spark their interest to pursue STEM careers. In September, GO Virginia approved a no-cost expansion of our grant to include Sussex Central Middle School. This new lab will open in January 2025.
- CCAM was recognized for the third straight year by Virginia's Talent + Opportunity Partnership as a **2024 "Top Employer for Interns"**.
- Last year, CCAM began developing and deploying a structured **Talent Development model** to accelerate development of highly skilled students so they're ready to impact manufacturing immediately upon entering the workforce. CCAM's successful collaboration with Virginia State University faculty delivered a new course this year which addressed a key technical skill gap in students' working familiarity with Industrial Internet of Things (IIOT) technology.
- CCAM has brought on a **Talent Development Program Manager** to support the talent development ecosystem. This role will work directly with industry, university and government stakeholders to ensure programs meet workforce needs.

Operational Risks

- **Economy** – The threat of an economic slowdown and/or potential recession remains and could impact corporate spending on research and development in FY25. As CCAM rolls out its new membership model in early 2025, we may experience pressure on existing membership status. Some prospective members have already delayed engagement until 2025. CCAM will continue to look at Federal programs to diversify revenue sources.
- **Membership Model Transition** – CCAM has assessed its tiered membership levels among other best-in-class research organizations to align with the needs of a changing market. As a result of this effort, a new membership model has been designed, reviewed, and submitted to members for signature. The new model is designed to address industry feedback and improve member recruitment and retention, which has been well received so far. One feature of this new model is the elimination of an "escrow" account that members pay up front as part of their dues. Instead, members will pay dues without additional escrow funds and pay for research on an as-needed basis. Given that several members still have a balance in their escrow account, we expect reduced member income in FY25 as existing balances are depleted by the members on projects. We will aim to offset this revenue risk through targeted use of Commonwealth incentives to attract new members and additional revenue.
- **Federal Program Growth** – As previously noted, a single federal proposal is a probability weighted activity which could result in zero dollars awarded. CCAM continues to grow the federal pipeline of business and proposal development activities, including working with our US House and Senate representatives in the pursuit of Congressional funding. Our approach is to remain conservative on our probability projections, however, the large potential awards in our pipeline remain binary in

terms of win/loss. This could result in a large fluctuation in expected awarded contracts and could be exacerbated by the following risk.

- **Federal Government Shutdown** – With an upcoming election and new leadership in the White House, and possibly Congress, an extended government shutdown or budget curtailment could result. In FY24, CCAM's federal funding was 25% of total revenue. A significant reduction in these funds could require proactive management actions. Leadership is currently outlining management strategies to offset this risk. Initial indications are that our largest federal program has FY24 funding allocated already, so we may already have some tailwind on this risk.

Overview

CCAM continues to progress the mission of driving economic activity in the Commonwealth. The results reported last year of an independent economic assessment by Chmura concluded that **each dollar of state funding to CCAM generated $17.3 in economic activity within the Commonwealth.**[1] From its inception in 2011 through 2022, the CCAM's total cumulative impact (direct, indirect, and induced) was determined to be worth $229.1 million and supported 1,259 jobs in the state. On an average annual basis, this equates to $31.3 million and 148 jobs.[2] Since 2022, CCAM revenues have increased a cumulative 35%, from $7.7M in FY22 to $10.4M in FY24 (Figure 1). Linear projections over FY22 imply a FY24 economic impact of $42.3M and support for 199 high-paying jobs.

FY24 key strategic areas for CCAM included expanded efforts in developing talent for Virginia's manufacturers, increasing industry and federal research, and an increased leadership role in pursuing strategic initiatives for the Commonwealth. CCAM has increased R&D revenues by 21%, including growing its federally funded R&D from $1.1M to $2.9M, expanded efforts in STEM education programs including expanding GO TEC® into 5 regional high schools, navigating the FAME manufacturing technician program, adapting our 3-time VA TOP award-winning internship program, and actively collaborating to drive regional economic development in the Pharmaceutical Advanced Manufacturing space, where CCAM led the EDA Tech Hub application on behalf of the Alliance for Building Better Medicine, which received one of only 31 national "Designated Tech Hub" awards.

Operational performance has improved, though significant market challenges remain. State funds provided to CCAM to develop a program for pursuing Federal funds is beginning to drive meaningful results as CCAM's annual awards since 2021 has grown from $505K to $3.2M. Commonwealth support continues to enable CCAM to strengthen relationships with Commonwealth agencies, the higher educational system and industry to drive economic development in the region.

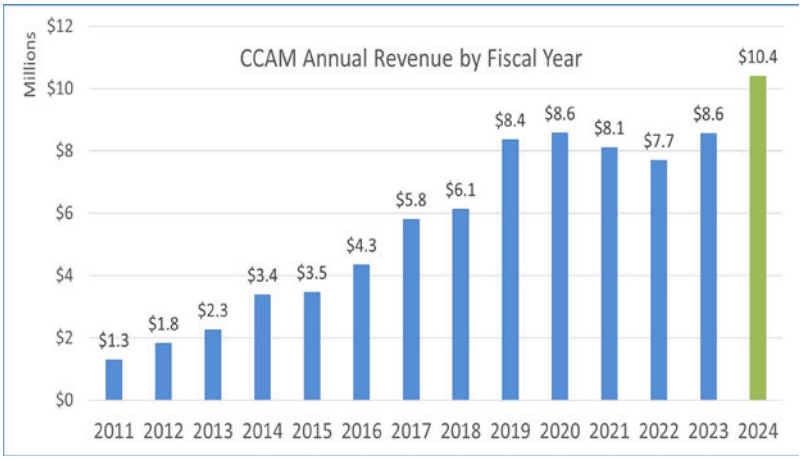

Figure 1: CCAM Annual Revenue Since Inception.

[1] This estimate excludes impact from Rolls-Royce.

[2] If the impact from Rolls-Royce is included, from 2011 to 2022, the total cumulative impact (direct, indirect, and induced) of CCAM has reached $3.1 billion. On an annual average basis, it is estimated that CCAM has generated $260.9 million in impact (direct, indirect, and induced) in Virginia, supporting 1,017 jobs in the state per year from 2011 to 2022.

Strategy and Execution

Strategic Goals

CCAM strategic focus in the three areas of Business Development, Enhanced Collaboration, and Workforce Development contribute to an overall vision of increased economic impact for the Commonwealth. Key goals in each area are outlined below and described in more detail in subsequent sections of this report.

Business Development

CCAM's expertise in applied digital thread technologies enables the pursuit of a diverse industry base while maintaining focus on core capabilities. While we roll out a new membership model that will address related recruiting impediments, we continue to pursue federal programs that enhance capabilities development and enable future industrial growth.

Collaboration

The CCAM team has increased collaboration between industry, academia and government (state and federal) significantly in seeking to drive greater economic impact in the region. Large collaboration programs include the AMPro/Subs Additive Manufacturing Center of Excellence and the Richmond/Petersburg Advanced Pharmaceutical manufacturing cluster.

Workforce Development

CCAM has received input from our industry and government partners highlighting an amplified need for an increased focus on workforce. CCAM is taking a larger, collaborative approach at driving enhanced workforce development efforts in the Commonwealth, relying on – and complimenting – the strengths of the region's educational and talent development organizations. We are also actively pursuing government funding to support the region's workforce development goals.

Business Development

Overview

CCAM activities are well aligned with the Commonwealth economic priorities, including the growth of high-paying manufacturing jobs. In FY24, CCAM expanded collaboration with the state and regional economic development organizations and has taken a leadership role in pursuing collaborative programs that will benefit the region's advanced manufacturing ecosystem. As the nexus of a strongly cooperative, multi-organizational consortium, CCAM provides significant breadth and depth across industries and throughout supply chains with

a unique capacity to impact manufacturing. CCAM continues to expand its strong multidisciplinary capability set, which ranges from materials science and engineering for manufacturing products, to manufacturing processes and modalities, to advanced automation and production methodologies, to advanced digital technologies that can be applied to manufacturing. This multi-disciplinary and multi-organizational convergence of skills, tools, experience, and assets, both in our own staff and facility as well as across our partnerships, provides a unique capability to collaboratively accelerate the maturation and de-risking of technologies for manufacturing. Through this capability, CCAM is gaining broad and growing opportunities to deliver an impact across industries, throughout supply chains, and in government agencies.

Updating the CCAM Membership Model

The legacy member agreement includes several elements that have hampered our ability to sign up new members and retain current members. In particular, elements such as a 5-year commitment and a large fee structure are difficult to get approval at the highest corporate levels. Other communities like CCAM, e.g. AMRC and OMIC, incorporate much more reasonable fee and term structures. Improving CCAM's ability to recruit new industry members requires addressing these items and developing an updated, fit-for-purpose membership model. To this end, CCAM contracted with GENEDGE to conduct best-in-class benchmarking. Based on this work, which also included Voice of the Customer" benchmarking, we have recently overhauled the CCAM Member Agreement to better support engaging with companies large and small – and to create more opportunities for manufacturers in the Commonwealth of Virginia to partner with us. As we roll out this new membership model, which includes a pay-as-you-go research structure, we expect there may be some delays in industry revenue generation as these projects are scoped. To manage this risk, we planned some reserve carry-over Industry Incentives funding that will be deployed in CY 2025 to accelerate proposal development activities and the new membership model deployment.

Key features of the new Member Model include:

1. **Structural Simplification:** CCAM wants to be clear and straightforward to work with, and this starts with how we engage with our industry members. Our previous structure had three tiers of membership – each with a complicated set of benefits and requirements associated with it. By taking this step, we are focusing on the priorities of our members and will provide an easy to understand / easy to implement approach for them. As part of this process, we've eliminated one of the three 3 research tiers and now have two classes with well-differentiated benefits.

2. **Lower Membership Cost Thresholds:** From our benchmarking work, CCAM recognized that our previous membership tier costs of $100,000, $250,000, and $400,000 were out of reach and unrealistic for most

companies; especially small and medium-sized manufacturers. In the New Membership Model, the annual cost of membership has been reduced to $100,000 for the Strategic Class and $40,000 for the Standard Class. This will put the membership and collaborative benefits of joining the CCAM community much more in-reach for a broad array of manufacturing companies.

3. **Elimination of Escrow Model:** CCAM recognizes that when joining our community, a company may not have a fully detailed plan of the manufacturing R&D work that they'll need to complete. It is therefore unrealistic for them to commit significant sums of funding to undefined needs. By eliminating the "escrow model" of putting funds "on account" at CCAM, we are enabling companies to match their financial commitments with their technical needs. This aspect is important to companies both from a timing standpoint and from the perspective of organizational responsibility. In companies with many operating units, there was often a mismatch between the unit that needed the work and the unit that was paying for it. The New Membership Model focuses on a "pay as you go" approach that eliminates both issues.

4. **Reduced Membership Commitment Timeframe:** While all manufacturers strive to have long-term strategic operating plans, the reality is that they need to be agile enough to respond to opportunities and threats as they present themselves. CCAM's previous model required companies to sign up for a 5-year commitment, and in many cases the companies had to list their membership cost as a long-term financial liability. In other cases, the long membership term was a deterrent for a company to join CCAM. The New Member Model reduces the membership commitment to 1 year, greatly reducing risk for companies joining CCAM, and enabling them to more quickly take advantage of technology advancement opportunities.

5. **Expansion of Industry Member participation on Board of Directors:** At its heart, CCAM *is* its members, and a thriving community led by those members is of paramount importance. As CCAM has significantly diversified the industries it serves, it is therefore important that the voices of those members are fully represented in our operational priorities and direction. The inclusion of Strategic Class Industry Members on our Board of Directors will absolutely enable this to happen. Combined with the lower threshold for membership, CCAM expects that a significant number of companies will now help guide our future direction.

6. **Expanded access to CCAM's Talent Development Programs:** While strictly speaking, CCAM's Talent Development Programs are not new, the expanded nature of what we offer and how it connects to all aspects of a manufacturer's talent needs is significantly enhanced in the New Member Model. CCAM

now is able to provide or broker fully integrated talent development beginning with STEM Career Awareness at the middle school level through GO TEC®, and continuing all the way through post-secondary education, graduate work, and incumbent worker upskilling. These are now prominently featured and offered in CCAM's New Member Model.

7. **Shorter Termination Notice Period:** While of course CCAM never wants to have a member leave our research community, we recognize that business conditions sometimes make this a necessity. The previous member model required between twenty-four- and thirty-six-months' notice for a member to terminate their relationship with CCAM, and the language underpinning this was somewhat ambiguous. The New Member Model reduces this commitment to 12 months after their initial one-year membership term. This reduction eliminates another barrier for companies to engage with CCAM.

The CCAM New Member Model is embodied in two main documents, a Member Agreement and Bylaws. While these have been periodically updated since CCAM's inception in 2011, those changes were incremental in nature rather than foundational. To accomplish the level of change as described above, a more fundamental overhaul of the documents was required. With simplicity, clarity, and member value as the "non-negotiables" of the process, CCAM completed this process in Q2 and Q3 of 2024. In re-writing the documents, entire sections that were redundant, confusing, or no longer necessary were eliminated or restructured. In some instances, language that was necessary for continuity was retained, but the overall result should be a much higher level of accessibility for companies large and small.

In early September, the new documents were sent to all current CCAM members (Industry, University, and Government) for review and ratification. The New Member Model is expected to officially "Go Live" on 01 January 2025.

Alignment on Member Recruitment and Retention

CCAM is already leveraging plans for this new membership model through engagements with current and prospective members. The structural changes within this new model provide significant opportunity for growth through expansion of our current member collaborations as well as recruitment of new members which align with strategic growth areas. To better serve our current members, CCAM is developing individualized collaboration plans tailored to the advanced manufacturing needs of each member within their specific markets. These plans will enable CCAM to gain a comprehensive understanding of advanced manufacturing requirements across various industries and regions represented by our members. These insights are essential for our future recruitment efforts as we strive to cultivate a collaborative ecosystem focused on the development, maturation, and deployment of advanced manufacturing technologies. The new membership model also allows CCAM to

extend our collaborations to small- and medium-sized manufacturers, facilitating the broader adoption of advanced manufacturing solutions within regional and national supply chains. To support this transition, CCAM has introduced the role of Partner Success Manager, who will serve as the primary point of contact for developing and executing these collaborative strategies.

Pursuit of Federal Funding

Federal funding is a key element in CCAM's strategy for economic impact for the Commonwealth, CCAM members, and CCAM's long-term sustainability. The funds provided by the Commonwealth for CCAM's pursuit of federal funding have been put to work and are beginning to bear fruit for CCAM and the region. In addition to our efforts in support of Austal's AMPro/Sub Center of Excellence at the IALR in Danville, we continue to work Department of Commerce (NSF and EDA) programs geared towards building up the advanced manufacturing capability in the region, including the pharmaceutical hub in the Richmond and Petersburg areas. During FY24, CCAM has worked several federally funded programs including collaborating with university researchers as they pursue NSF Career Awards, creating a US Roadmap for NIST on the development of digital tools to address the nation's supply chain resilience, and leading the application on behalf of the pharma coalition that was awarded the prestigious EDA Tech Hubs Designation. Additionally, in partnership with ABBM and VIPC, we followed that up by bringing together 44 partners from the region and beyond to pursue a large TechHub grant (see the *Pharmaceutical Cluster Economic Development* section of this report). All these programs resulted from efforts with significant collaboration between multiple entities within the Commonwealth and focus on innovation, manufacturing technology maturation, entrepreneurial ecosystems, and workforce development and education.

Revenue from Federal Grants

CCAM's federal funding revenue goals were designed to follow the growth in awards and culminate at a steady state of $4M in annual revenue. Funding from the Commonwealth for pursuing federal programs has enabled CCAM to hire a critical researcher, fund federal funding consultants, and expend the necessary focused effort to begin to grow this critical revenue source. Results that began to surface in FY23 have accelerated in FY24, as CCAM invoiced $2.9M in federally-funded research – a YOY increase of ~ 163% (see Figure 2). At the time of this report, revenue from federal grants in

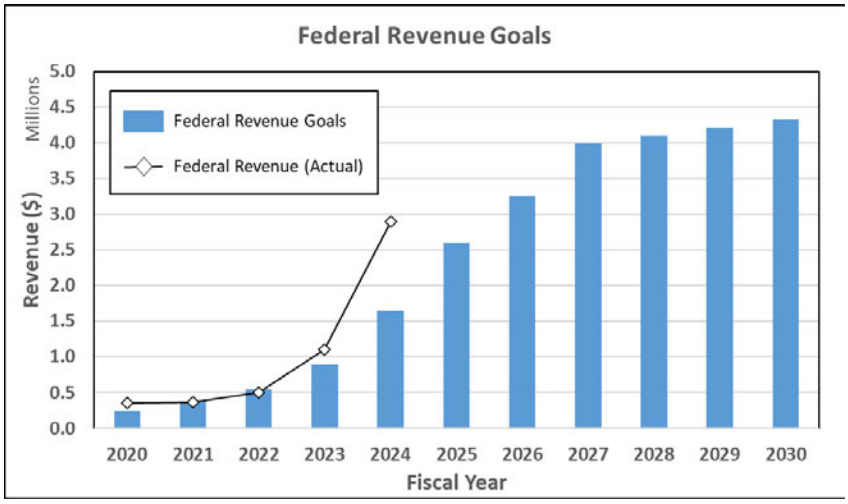

Figure 2: Federal revenue goals and actuals

the first two months of FY25 are in line with the plan for the current fiscal year. As we continue to focus on larger programs, we expect the ROI on the Commonwealth's investments to increase as incoming federal funds are spread across the larger advanced manufacturing community in the region and the larger Commonwealth. These funds are critical to keep up the momentum in this area.

New Awards of Federal Grants

Generating federal revenue necessarily requires the winning of federal awards. Thus, awards are a leading indicator of future revenues. New awards to CCAM and its partners continue to grow. In FY24 federal awards leapt up to $3.2M, a YOY increase of 146% and an 8.4X increase over FY20 (see Figure 3). Our award plan for FY25 meets our steady state revenue goal of $4M. To meet this revenue goal, the $4M awards level per year must be met for multiple years, as most federal programs are approximately 3-years in length, so any award is typically spread out over the 3-year performance period. For FY24, we were able to exceed our revenue goals despite the perceived underperformance in awards because the majority of our federal funding is being awarded in a series of contracts that are less than 12 months. Thus, future funding that is in the pipeline has not officially been awarded. Similarly, as we land longer term contracts (5 years), this would result in an awards spike in a given year that would spread over a longer time horizon in terms of revenue. A reasonable picture of performance to goal is an average over multiple years. Overall, we are approaching our targets in both awards and revenue with some variability to be expected.

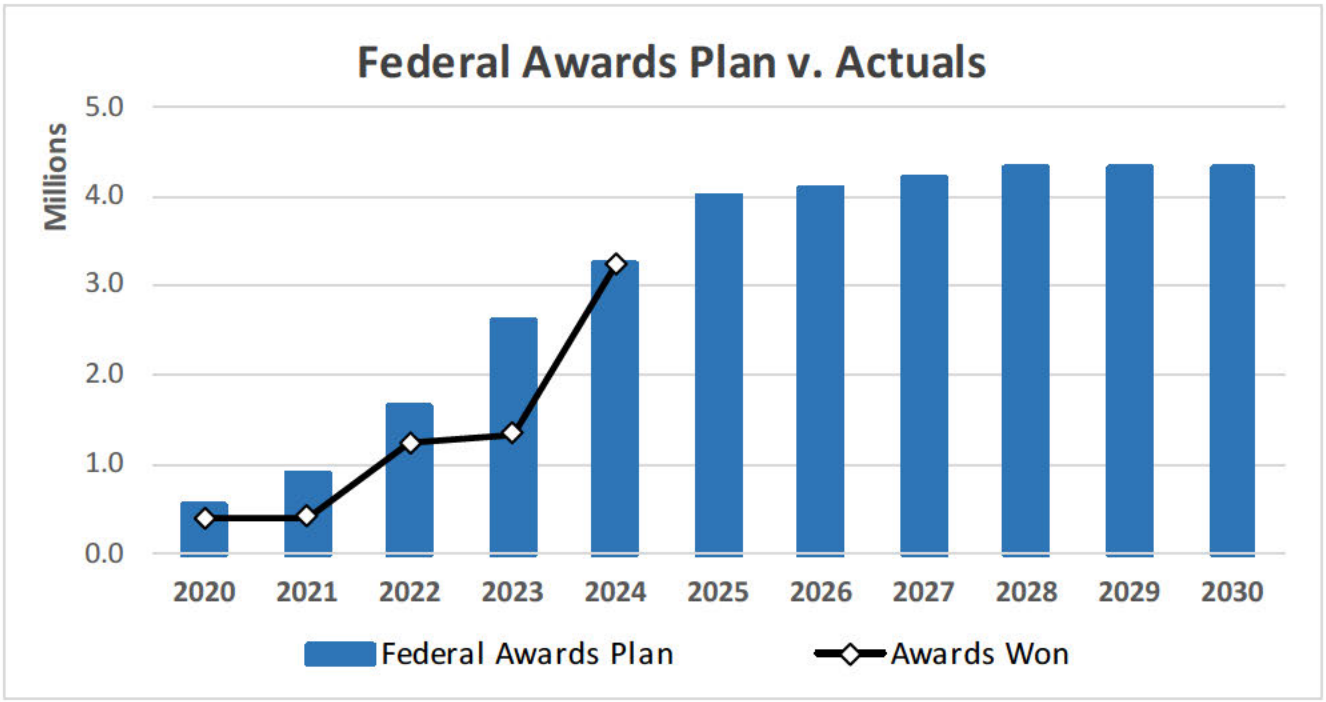

Figure 3: CCAM's federal awards plan v. actuals by fiscal year.

During this fiscal year, CCAM has secured additional funding from the AMPro/Sub program. Led by Austal USA and in partnership with others (including Virginia entities IALR, UVA, the Spectrum Group, Phillips, etc.), this program is focused on the US Navy significant supply chain challenges for both the Virginia class submarines as well as the new Columbia class strategic submarines. The development of the Navy's Additive Manufacturing Center of Excellence (COE) in Danville, VA, promotes the growth and resilience of the Marine Industrial Base (MIB) through establishment and expansion of dedicated additive manufacturing and non-destructive testing (NDT) capabilities and other supporting technologies. CCAM has a critical role for the AM Pro/Sub program by 1) defining the digital strategy for implementation and 2) shepherding the development and validation of new technologies for the COE and MIB. In FY24, CCAM focused on the assessment, development, validation and implementation of industry ready process intelligence tools (i.e. hardware/software devices and systems which provide information of value about a process) needed at the COE to accelerate the qualification of additively manufacturing parts that will supplement the MIB supply chain. This work is also providing data collection and analysis to support the Navy's future goal of using in-situ monitoring techniques to assess the quality of AM parts.

In other efforts, CCAM also continues to support partners as they work to secure federal funding. Often CCAM provides support without direct funding to promote or improve submissions of our partners. Examples include faculty at member universities, including NSF Career awards, Engineering Research Center proposals, and other regional partners, such as the DOE MESC Virginia Smart Manufacturing Accelerator project led by Genedge.

The NSF Career Award project won by Dr. Radhika Barua at VCU is one example where CCAM expertise in additive manufacturing is being leveraged to good result. This project will enable the additive manufacture of exchange-biased rare-earth-free bulk permanent magnet composites. The goal of this work is to combine computational materials analysis with experimental validation at CCAM to produce additively manufactured, nanocomposite, hard magnetic alloys that are envisioned to replace rare earth material containing permanent magnets that are limited in supply due to global market realities.

The Virginia SMART Manufacturing Accelerator (VSMA) program, led by GENEDGE Alliance and supported by CCAM, Virginia Tech, Virginia Commonwealth University, Virginia State University, and Old Dominion University, will accelerate the deployment of smart manufacturing systems with Small and Mid-Sized Manufacturers (SMMs) in Virginia. CCAM is supporting this effort by developing technical webinars related to Industry 4.0 technologies, conducting hands-on workshops providing practical training for integrating smart manufacturing solutions into operations, assisting with workforce development curriculum that provides training and education in the skills needed for the modern digital manufacturing environment and collaborating with GENEDGE and

others to provide tailored support for SMMs to help them implement these advanced technologies, driving improvements in efficiency, sustainability, and profitability.

Table 1: Federal Awards to CCAM, FY24 & FY25 to date.

Agency	Project	Prime	Est Total Award	CCAM Award
US Navy	AM Pro Sub	Austal USA	[redacted]	2,554,932
DOE MESC	Virginia Smart Manufacturing Accelerator	GENEDGE		105,000
NSF	NSF Engine - ABBM	Activation Capital		86,000
NSF	NSF Career Award	VCU		50,000
NIST	NIST Community Add	CCAM		963,000
EDA	APM Tech Hub Continuation	CCAM		500,000
		Total		**4,258,932**

Pipeline of Federal Opportunities

The federal award pipeline continues to grow, with several target opportunities that are well aligned with the needs of our partners and the region. Near-term (12-24 months) projected value of awards are approximately $5.3M (probability weighted, see Figure 4). This is in line with our strategic plan to generate $4M in new awards annually. It is important to note that there have been substantial shifts over the past 1-2 years in federal funding programs. Programs generally target advanced manufacturing technology maturation and workforce development in DOD (Navy), pharma, and aerospace verticals. The larger programs are collaborative initiatives that bring together public and private organizations within Virginia and beyond. Support from the Commonwealth has been critical in CCAM's engagement with the federal community and our ability to pursue these larger programs.

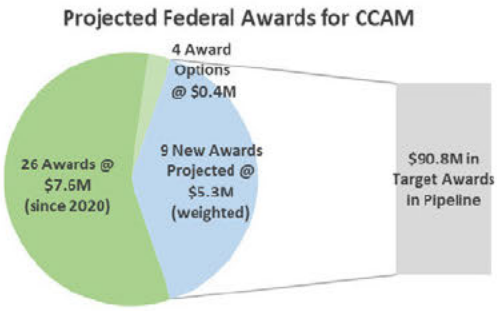

Figure 4: Projected Federal Awards for CCAM.

Congressional Adds

CCAM received notice of a FY24 $962,000 Community Add award in April 2024. In FY23, CCAM submitted two requests for congressional funding in the FY24 federal budget focused on bringing new digital technologies and process intelligence into manufacturing. One of these programs, the awarded Community Add, is a $962,000 NIST program that will be used to purchase, install, set up, and integrate an additional additive manufacturing capability at CCAM. This additional capability will help CCAM attract additional industrial and federal R&D funds to the region.

CCAM has also submitted two defense program requests to congress in FY24 for the FY25 budget. One of the two requests was authorized for funding but was not included in the budget appropriation draft by the house. We continue to work with our legislators to have this line item included in conference during a difficult budget cycle. If unsuccessful, we will continue to work to get it included in the FY26 budget cycle. As with many federal funding campaign efforts, patience and consistency are key.

Pharmaceutical Cluster Economic Development

CCAM continues to take a leadership role on behalf of the Alliance for Building Better Medicine (ABBM) in the growth of the advanced pharmaceutical manufacturing (APM) hub in the Richmond and Petersburg Region. CCAM was the lead organization for an EDA Tech Hub submission that was named one of only 31 national Designated Tech Hubs by the EDA, as recognized by our two US Senators. (See warner-and-kaine-announce-major-regional-tech-hub-wins-for-virginia and EDA-funding-programs-regional-technology-and-innovation-hubs-2023-Advanced-Pharmaceutical-Manufacturing-Tech-Hub). This prestigious **Designee** title put us in a position to compete with the other 30 Tech Hubs for significant government funding awards associated with the program. On behalf of ABBM, CCAM, with key support from the Virginia Innovation Partnership Corporation (VIPC), led a multi-month, 44 organization proposal team (see Figure 6) that submitted a set of eight proposals in February of 2024 valued at $70M for the APM community in Virginia. While our Hub was not selected for funding at this time, the EDA has made it clear that all proposals were fundable and that they see themselves as a partner as much as a funding agency. They also informed us that they understand the need to keep the momentum going while unfunded Tech Hubs prepare for resubmission under the next round of funding. To this end, the EDA has informed us that **they will provide $500k of funding to support our Regional Innovation Officer engaged and continue to develop the strategy for our cluster**.

Figure 5: Our Advanced Pharmaceutical Manufacturing community was named a Designated Tech Hub by the EDA.

This effort is also opening additional funding opportunities for the region. Reynolds Community College is leveraging the Tech Hubs workforce development proposal efforts to apply to the EDA Good Jobs Challenge. Under this program, Designated Tech Hubs get additional points in the evaluation criteria, which will improve other odds of success for this submission. America Achieves, a philanthropic organization dedicated to national economic development priorities has selected our region as one of 12 in the nation where they will provide strategic assistance. In addition to their in-kind efforts, they have notified us that they will also provide $200k in funds to help our consortium develop workforce and governance strategy. Finally, the EDA has informed us

that other initiatives that they are engaged on with other Federal agencies will produce additional programs that recognize Designated Tech Hubs with a favored status in evaluating proposals.

Figure 6: The APM Designated Tech Hub consortium consists of 44 members in the region and beyond.

Enhancing Collaboration

CCAM has found that there is an increasing recognition of the need for communal approaches to solving systemic challenges, which require the engaged collaboration of complementary partners across industries, supply chains, and organizational types. With collaboration one of CCAM's key values, we continue to find opportunities and a growing pull from partners to assist with larger collaborations to address some of these systemic challenges that individual organizations are unable to adequately solve alone. Examples include the regional APM consortium (with CCAM serving varying roles across funded programs from Build Back Better, NSF Engines, and EDA Tech Hubs), programs led by the US Navy (such as AM Pro/Subs), new programs focused on expanding efforts to support the Defense Industrial Base (DIB), and more. CCAM's contributions to these collaborations range from strong out-in-front leadership, such as with the APM Tech Hub initiative detailed earlier, to ownership of specific technology deliverables, such as in AM Pro/Subs, and most often encompass strategic input and guidance to enable collaborative success.

Focused Collaborative Teaming

Figure 7: Andy Greaves (Kyocera SGS), Karen Taminger (NASA Langley Research Center) and Andwele Grant (CCAM) collaborate on the tooling and machining process for the xEMU backplate

CCAM continues to develop and support technology and collaborations constructed of multi-organizational teams to address industry or government challenges. The members of these teams are selected and gathered based on the unique requirements of each situation and continue to demonstrate success. These teams integrate advanced technology, manufacturing materials and process intelligence, and talent development to mature and de-risk manufacturing technology to holistically address customer needs. CCAM currently has several of these focused programs in development now, where funds from the Commonwealth are being carefully leveraged to grow capability and seed efforts that are planned to secure significant additional external investments. One example of challenge-specific collaboration is the NASA Exploration Extravehicular Mobility Unit (xEMU) team that was supported through critical manufacturing technology development work at CCAM, together with Industry Member Kyocera-SGS. In August, the team was recognized at the NASA Honor Awards in the category of Exceptional Group Achievement for outstanding contribution developing, manufacturing, weld and inspection procedures for internal cooling channels in the xEMU spacecraft portable life support system backplates. This group included CCAM researchers and was led by Karen Taminger, Materials Researcher and Project Lead at NASA Langley, and worked directly on a backplate for the Portable Life Support System (PLSS) for the xEMU spacesuit, led by NASA's Johnson Space Center.

Another collaborative example is in Integrated Process & Materials Modeling for Additive Manufacturing of Refractory Metals for Critical Applications. This project brought together CCAM with partners Siemens, Oak Ridge National Laboratory, and the University of Virginia to leverage US Department of Energy and Commonwealth of Virginia funding to advance this innovative technology for power generation. Refractory metals have a lot of potential in high-temperature applications, such as turbine combustion engines and hypersonics, but are notoriously hard to process – especially additively. Developing stable process parameter windows is the challenge goal of this program, which has been highlighted as a success story on the Lawrence Livermore National Labs (LLNL) website.[3]

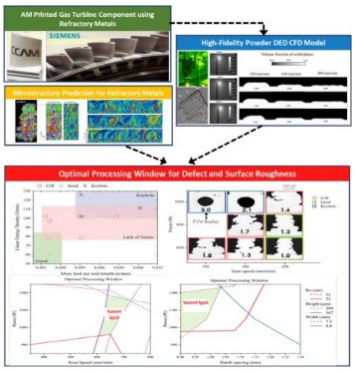

Figure 8: Additive Manufacturing of Refractory Metals collaboration between CCAM, UVA, ORNL, and Siemens.

CCAM Research Days – May 21st & 22nd 2024

CCAM continued its Research Days in May of this year. This annual event allows us to highlight a CCAM member – typically a partner University – as host of the event where they can showcase their research work as it applies to industry. The other CCAM Organizing University Members and CCAM's own team attend and present key research efforts before touring the member facilities. This year Virginia Tech hosted the 1-1/2 day event, which was attended by approximately 50 industry, university and government guests. From this event emerged several new collaboration opportunities, inspired by the excellent laboratory demonstrations and research discussions.

CCAM Industry Days – November 12th & 13th 2024

The Research Days event has been rebranded to Industry Days and planning is underway for the November 2024 event. The Industry Days event will focus on the opportunities and challenges of maturing manufacturing technologies in regulated industries. Last year's event focused on supply chain resilience and featured keynote speaker, Matt Sermon, who leads the Strategic Subs Program for the Navy. His focus was on meeting the needs of a changing workforce and removing obstacles to innovation to meet

Figure 9: CCAM 2024 Industry Day is focused on technology maturation in regulated industries.

[3] https://hpc4energyinnovation.llnl.gov/success-stories/refractory_materials_for_critical_applications.

our nation's critical security goals of delivering Virginia and Columbia class submarines on time. This year, speakers representing pharma, aerospace, and the navy will provide insights on how their organizations are accelerating manufacturing technology maturation in a conservative, heavily regulated industry.

University Collaborations

The collaboration with member universities is growing and expanding, with a primary focus on securing federally funded programs beneficial to all partners. This includes direct collaborations with individual faculty and research labs, such as the continued partnerships with Dr. Radhika Barua at VCU and Dr. Tao Sun of VT (co-located @ CCAM), which have resulted in some success. One important element of many of these collaborations is the incorporation of talent development efforts and the connection to the overarching programmatic goals and other collaboration opportunities.

An example of this is the Virginia Smart Manufacturing Accelerator (VSMA) project, awarded in FY24 by the US Department of Energy's Manufacturing & Energy Supply Chains (DOE MESC) program and led by GENEDGE. The program is charged with understanding, developing, and piloting deployment of educational content to help Small and Medium-sized Manufacturers (SMMs) onboard the skills necessary to support adoption of new technologies in their manufacturing processes. The initial year of this program is anticipated to grow into a multi-year, multi-faceted collaboration.

Talent Development

Since CCAM's inception, Talent Development has been recognized as a key element of the value proposition that we bring to the Commonwealth. Historically, this aspect has been approached as isolated elements, with undergraduate internships and graduate research assistantships playing the primary role. Over the past 18 months, CCAM has completely revised this view to be much more holistic in nature, with partnerships, programs, and capabilities designed to more systematically connect all aspects of an advanced manufacturing ecosystem across Virginia.

In recognition that Talent Development with a broad array of partners cannot be "an afterthought" CCAM has recently hired a dedicated Talent Development Manager with strong roots in our communities. This person's role will include strengthening the connections among our programs and constituencies and making sure that we are always providing value for our members and for the Commonwealth. Whether CCAM is actually the content provider, or acting more as a convener, we recognize that for Virginia to thrive in Advanced Manufacturing, CCAM must fully lean-in to support a talent ecosystem.

Central Virginia FAME

Demand for skilled technicians to support manufacturing operations continues to be strong in our Central Virginia, and CCAM supports that pull through our regional chapter of the Federation for Advanced Manufacturing Education (FAME). This summer, WestRock became the seventeenth Core Member company in the chapter.

Figure 10: The FAME central VA chapter consists of 17 industry members.

The second cohort of FAME students completed their two-year program in May of 2024 and graduated from CCAM partner Richard Bland College with Associate of Science degrees. As in 2023, ALL of the students who completed the program were offered full-time employment by their sponsoring Core Member companies, again confirming that FAME's combination of mentor-based career experience plus technical laboratory and classroom learning at CCAM delivers successful results.

A significant challenge emerged in March of 2024, with CCAM's educational partner Richard Bland College (RBC) making the difficult decision to end their participation in FAME for financial reasons. Since the formal educational component of FAME is a foundational element of the program, CCAM has been working to identify a new educational partner to support the program going forward. Since RBC announced their intentions, CCAM has been working directly with Brightpoint Community College to become the FAME educational partner. Brightpoint's outstanding labs and faculty are a great fit for FAME, and CCAM believes that this program complements their existing degree and certificate programs. Brightpoint is currently going through a formal

assessment of FAME and will decide by Fall 2024 whether or how they are able to support the Chapter. Many of the Core Member companies have written letters of support asking Brightpoint to continue the work that has been started. With each annual cohort growing in number and increased participation from employers, CCAM also hopes that Brightpoint will reach that decision.

In the meantime, students in the third FAME cohort are halfway through their program. Brightpoint has agreed to provide technical and classroom instruction for these students, so that they can complete their degrees. The former Central Virginia FAME Program Director is now an Associate Professor of Mechanical Engineering Technology at Brightpoint, helping to ensure continuity for both the students and the employers.

GO TEC®

The past twelve months have seen a huge expansion of the program Great Opportunities in Technology and Engineering Careers (GO TEC®) across the Commonwealth, and CCAM is proud to be at the heart of that effort in Central Virginia. Founded in 2017 by the Institute for Advanced Learning and Research (IALR) in Danville, GO TEC is committed to building a STEM-energized workforce pipeline in Central Virginia by engaging with students in 6th, 7th, and 8th grades. CCAM functions as the In-Region Coordinating Entity (IRCE) for GO TEC in Central Virginia and is supported by the VSU College of Engineering & Technology and Brightpoint Community College. This year, CCAM opened a GO TEC Teacher Training lab to support all participating schools in our region. Staffed by a Training Coordinator and a Program Coordinator from the IALR, the lab at CCAM is now supporting new GO TEC labs in the middle schools of the cities of Colonial Heights, Hopewell and Petersburg, as well as the counties of Dinwiddie, Greensville, and Surry.

GO Virginia Per-Capita funding for these labs was secured by CCAM in 2023. Also recognizing the importance of STEM career opportunities in our region are The Cameron Foundation and the John Randolph Foundation. Both of these entities have generously contributed financial support to ensure that students in the communities they serve have access to opportunities for exciting and rewarding careers.

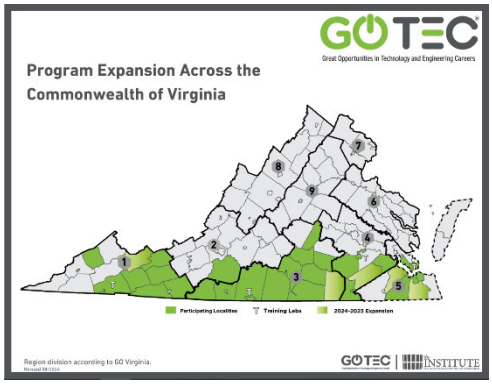

Figure 11: GO TEC® deployments across Virginia, including the teacher training lab at CCAM.

The schools in GO Virginia Region 4 are joining more than 50 other GO TEC schools across the Commonwealth, with the state recognizing that GO TEC is much more than just a local program. At the September GO Virginia State Board meeting, approval was granted for Region 4 to add a lab in

Sussex County, bringing STEM career awareness opportunities to students in this rural county. Funding for this lab has come from cost savings by bundling purchases for the previous schools' implementations.

> *"We want to thank (CCAM) for working with Sussex and including us in (GO TEC®). We are truly grateful and excited about the experiences our students will gain from your hard work. Your dedication is deeply appreciated."*
>
> *Alvina Matthews, Director of Curriculum and Instruction*
> *Sussex County Public Schools*

The CCAM / IALR team is now actively meeting with schools in Richmond City, Powhatan, and Prince George to explore possibilities for expanding GO TEC to their schools. CCAM and partners VSU and Brightpoint are also now working to establish a clearinghouse and process for schools and employers to create Youth Registered Apprenticeships in STEM fields across the region. This work will help to transform the excitement that younger students build from their GO TEC experiences into meaningful and rewarding career pathways. We have identified benchmarks in other areas of the state and are partnering with those organizations to ensure that this effort is launched successfully.

CCAM Internship Program

CCAM's Internship Program has accommodated over 250 Interns and Graduate Research Assistants (GRA) since its inception in 2012. At CCAM, students:

- Build skills by directly interacting with manufacturing materials, tools, and processes and solve real-world challenges.
- Engage in an immersive environment where mentors guide them toward effective solutions.
- Gain insights into manufacturing and learn how to leverage technology to improve quality, productivity, and outcomes.

Figure 12: CCAM named a TOP Employer for Interns for a 3rd straight year.

CCAM was recognized for the third straight year by the Virginia Talent + Opportunity Partnership as a 2024 "Top Employer for Interns" (Figure 12). This award acknowledges the value that our Internship Program delivers to employers, students, and Virginia's economy.

Talent Incubator Model

As mentioned last year, CCAM's unique position as a collaborative organization with members from diverse industries, universities and federal organizations provides valuable insight with respect to challenges in technology worker readiness as they enter industry. CCAM continues to see itself pulled by partners to help address these challenges and is bringing together community partners and leaders to create a holistic plan that builds new approaches upon active, successful programs to deliver transformational change in talent development. CCAM believes that convergent collaboration presents an opportunity for guided, accelerated development of highly skilled talent that is ready to impact manufacturing immediately upon entering the workforce. One example program we referenced in last year's report has been demonstrated with great success: CCAM's collaboration with Virginia State University faculty to develop new courses that address a key technical skill gap in students' working familiarity with Industrial Internet of Things (IIOT) technology.

Andwele Grant, Senior Researcher at CCAM and VSU Adjunct Professor

In response to feedback from our industry members on this technical skill gap, CCAM staff (who are also VSU alumni and Adjunct Faculty) developed a project-based learning course that was deployed in the Spring 2024 semester. This course is tailored to meet current and emerging industry needs through immersive experiences and hands-on operation of equipment. The course includes a focus on data collection, storage, and management and standards such as MTConnect, MQTT, OPC UA, Grafana, InfluxDB, and Node-RED. The course and labs are taught by CCAM Researchers and VSU Adjunct Professors, Andwele Grant and Benjamin Standfield. It was well-received by the students and earned praise from the College of Engineering and Technology Dean, Dr. Dawit Haile.

"The VSU College of Engineering and Technology was pleased to partner with CCAM to develop and deliver a customized course introducing our upperclassmen to key principles and applications of the Industrial Internet of Things (IIOT). CCAM's talented researchers, who are also VSU alumni and adjunct faculty, were uniquely positioned to translate industry challenges into concepts our students could grasp, better preparing them for successful engineering careers. We look forward to offering this course again and exploring new partnership opportunities with CCAM."

- Dawit Haile, Ph.D., Dean, College of Engineering and Technology, Virginia State University

Commonwealth Funding

Commonwealth support has positioned CCAM to deliver increased economic impact for the region. CCAM remains on track to grow federal funding for both the organization and its collaborative partners in the region. This progress would not be possible without the support from the Commonwealth. While we reaffirm the need for level funding support in FY25/26, we also note that it is successfully attracting additional funding from other sources (see Figure 13), which in turn are generating greater economic impact in the region and across the Commonwealth. In FY26, we expect the funding from the Commonwealth to be less than 1/3 of CCAM resources, reduced from a peak of 53% in FY21.

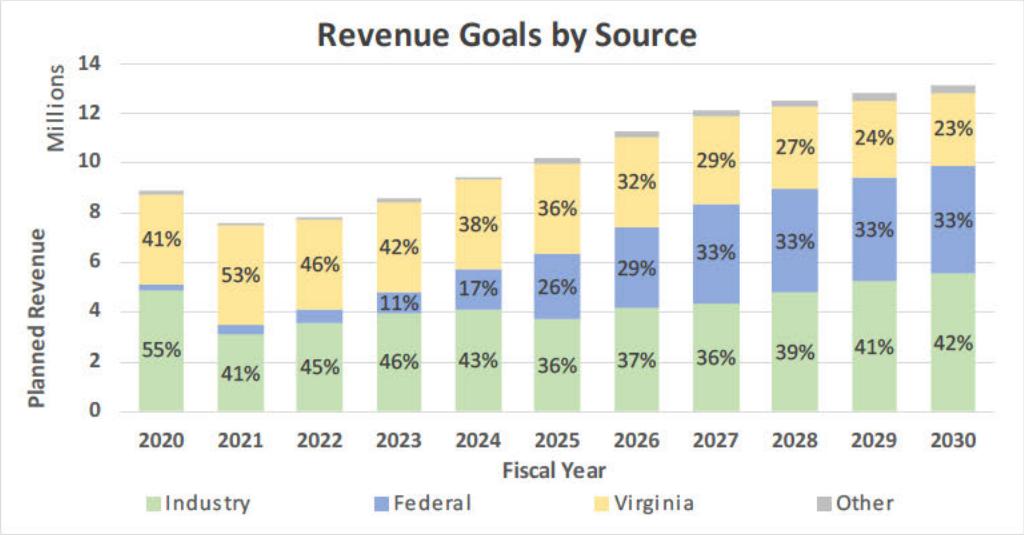

Figure 13: CCAM revenue plan targeting industrial and federal funding growth.

CCAM strategy execution requires flat funding (no change) for FY25/26, which includes:

- Continue CCAM's current operational budget allocation from the Commonwealth for $925k. These funds are critical in providing Finance, IT and operational improvements needed to meet federal requirements associated with increased federal funding.
- Continuation of the $1.1M industry grant. These funds have proven to be a very vital component in driving additional revenue through existing members while attracting new ones.
- Continuation of the $600K university grant for joint projects and follow-on efforts, including road mapping activities, marketing and proposal development, to continue momentum and leverage previous project activities for the pursuit of CCAM/University jointly funded federal programs.
- Continuation of the $1M appropriation to support federal award program development. CCAM continues to gain traction in the federal space. This funding is key to furthering that growth which results in significant economic impact for the Commonwealth.
- Provide building rent and operations support. Original legislation language outlined the building purchase by DGS and subsequent M&O support beginning **July 1 of FY22**. As the **transaction is still an open item**, this remains a critical need for CCAM's success.

HB6001, Chapter 2, Item 115 K.5 Requirements

(i) MOUs with university partners

There have been no additional MOUs developed with university partners this past year. One MOU signed January 2019 between CCAM and its Organizing University Members was included in CCAM's Operating Plan submitted to VEDP in July 2019. This referenced university placement of Research Professors and Graduate Research Assistants at CCAM, and university commitments for innovation funding. At that time, UVA, VCU, VSU and VT each committed to their placement of a Research Professor at CCAM. An MOU was established between CCAM and ODU in December 2019 to recuse their "placement" of a Research Professor. Fulfillment of university commitments is being met over an extended time.

(ii) Funds disbursed to university and private sector partners of CCAM

Private Sector Incentive Grants

With the use of this grant funding, CCAM has been successful in growing organic industry investment, above annual member dues, to levels that are approaching that of the pre-COVID era. With the upcoming release of the aforementioned new membership model, this funding will be heavily relied upon when marketing to prospective members. The funds shown in the table below have been deployed as private sector incentives in FY 2024 and have been designated for research match funding.

Industry Member	Detail	Grant Funding
[redacted]	Project D-513	$ 19,332
[redacted]	Project D-520	$ 174,448
	Project D-500	$ 41,876
		$ 235,656

The funds in the table below have been invested in seed projects that are intended to support skill, technology, and capability development targeted towards growth in industry investment at CCAM. Each of these programs are targeted towards a specific manufacturing process, technology, partner, or industry, and are being marketed to existing and prospective members.

Area of Study	Grant Funding
3D scanning method development for locating for robotic applications	$ 66,615
Materials characterization method development	$ 43,409
Cooperative human/machine processing	$ 162,078
Digital systems for manufacturing	$ 29,758
Tooling optimization test method development	$ 11,019
	$ 312,879

University Research Grants

CCAM has continued its focus on multi-organizational engagement when deploying these funds. Technological building blocks are being developed which are of increasing interest to federal agencies. The funds deployed at CCAM in FY 2024 are outlined in the table below. These Innovation Projects were executed in partnership with CCAM Organizing University Members.

University Member	Detail	Grant Funding
UVA, VSU, VT	**Project E-111** Cooperative Processing - Core Activities	$ 128,000
VCU	**Project E-117** Additive Manufacturing of Anisotropic Alnico Permanent Magnets: Phase II	$ 125,480
UVA, VSU, VT	**Project E-118** Standardization of Cooperative Processing (CooP)	$ 61,410
UVA, VSU, VT	**Project E-119** CooP Use Case Intuitive Robotic Programming	$ 30,128
UVA, VSU, VT	**Project E-120** CooP Use Case AI-Assisted Work Instruction Platform	$ 143,751
VT	**Project E-127** In-situ Part Quality Assurance in LPBF using Heterogenous Sensor Data	$ 89,817
UVA, VSU, VT	**Project E-134** 2024 Summer Intern Capstone Project: Demonstration of Human-Robot Interaction	$ 97,520
		$ 676,106

(iii) Other agreements entered into with public and private sectors

CCAM has not entered into any agreements with representatives of the public or private sectors that would impact current and future incentive fund disbursements.

(iv) Federal Award Program Development

Obtaining federal award or grant funding requires significant business development efforts to establish relationships with various agencies and to understand their research interests. This insight can lead to more effective proposal development, with a higher probability of winning an award. Past and continued business development efforts led to an increased level of proposal development activity this year. The FY 2024 use of funding in the Federal Grant development category is summarized in the table below.

Category	Detail	Grant Funding
Business Development	Engagement with federal agencies, exploration of award solicitation, campaign material development, travel for award related business development, process infrastructure consulting and development (award admin, export control, CMMC compliance).	$ 490,855
Proposal Development	Concept paper & proposal ideation, development and submission.	$ 784,142
Non-reimbursable Federal Award Costs	Federal research program costs not reimbursable on federal research awards.	$ 25,007
		$ 1,300,004

(v) Additional Information Requested

No additional information has been requested at this time.

APPENDIX

Financial Schedules