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**The Point of Beginning Initiative: Strengthening the Geomatics Workforce through Career and Technical Education**

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28 **Abstract**

29           The Point of Beginning (PoB) Initiative meets the growing workforce demands in the  
30 geospatial engineering and land surveying fields by expanding the Geospatial Engineering and  
31 Land Surveying Career and Technical Education (GELS CTE) pathway in Texas high schools.  
32 Led by the Conrad Blucher Institute for Surveying and Science (CBI) at Texas A&M University-  
33 Corpus Christi, the PoB initiative focuses on developing online curriculum, engaging middle,  
34 and high school students, fostering industry collaboration, establishing the GELS CTE pathway  
35 in additional school districts, and gaining approval by the Texas Education Agency (TEA) to  
36 offer this pathway in Texas high schools. The PoB Initiative provides educational experiences  
37 and partnerships with K-12 schools and outreach programs that introduce students to careers in  
38 the geomatics spectrum and encourage their pursuit of them. Additionally, the PoB Initiative  
39 strengthens workforce resilience by uniting a coalition of multisector partners, including industry  
40 leaders, government agencies, and educational institutions, to align resources and expertise at  
41 local, regional, and statewide levels. By enhancing workforce preparation and increasing  
42 capacity, the PoB Initiative creates a pathway for future geomatics professionals by expanding  
43 opportunities for high school students transitioning from CTE programs to higher education and  
44 geomatics careers.

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51 **Introduction**

52           The United States is facing a critical shortage of geomatics professionals. Over the past  
53 three decades, this crisis has unfolded and threatens national security, infrastructure integrity,  
54 and economic competitiveness (Bevis et al., 2022). The crisis began in the early 1990s, when  
55 sustained federal disinvestment, particularly by the Department of Defense, in geodesy education  
56 and research eroded the nation's capacity to train geodetic and geomatics professionals.  
57 Disinvestment has led to downsized programs, unfilled faculty positions, and ripple effects  
58 across academia, government, and industry (Bevis et al., 2022). Today, the number of geodesists  
59 employed by the Department of Defense, National Geodetic Survey (NGS), and National  
60 Geospatial-Intelligence Agency (NGA) has dropped to dangerously low levels. This erosion of  
61 geodetic expertise presents a scientific and educational challenge and a national security risk,  
62 given the central role of positioning and geospatial intelligence in defense systems, autonomous  
63 technologies, and space-based platforms.

64           At the same time, the National Society of Professional Surveyors (NSPS) has raised  
65 concerns about the demographic imbalance in the surveying profession. According to NSPS  
66 workforce data, the median age of licensed land surveyors in the United States exceeds 57 years,  
67 with a disproportionate share of practitioners nearing retirement and very few early-career  
68 professionals entering the field (NSPS, 2021). These national trends are mirrored in Texas,  
69 where data from the Texas Workforce Commission (TWC) and the Texas Society of  
70 Professional Surveyors (TSPS) point to an urgent need for workforce renewal. Internal TSPS  
71 reports and workforce projections show that nearly one-third of the current surveying workforce  
72 in Texas is expected to retire within the next five to seven years. Yet the number of new  
73 registrants each year remains insufficient to fill the gap. Licensure data from the Texas Board of

74 Professional Engineers and Land Surveyors indicate a sharp decline in candidates pursuing the  
75 Registered Professional Land Surveyor (RPLS) credential through traditional educational  
76 pathways. Many applicants are disqualified due to credit deficiencies or degree misalignment,  
77 issues especially common among career changers and graduates of non-accredited programs  
78 (Texas Board of Professional Engineers and Land Surveyors, 2025).

79 Despite being a high-skill, high-demand profession, land surveying remains largely  
80 invisible to the public, with limited access to clear, accessible information about career pathways  
81 for students, educators, and prospective workforce entrants (Advance CTE 2021; American  
82 Association of Geographers 2019). In a 2021 NSPS membership survey, more than 60% of  
83 respondents indicated that the average student or parent had no understanding of what surveyors  
84 do or how to become one (NSPS, 2021). As demand for spatial data and geospatial infrastructure  
85 increases, the profession remains underrepresented in K–12 curricula and rarely appears in  
86 Career and Technical Education (CTE) programming. Consequently, fewer students are pursuing  
87 degrees in geomatic disciplines, and the workforce continues to age without a sufficient influx of  
88 new talent (NSPS, 2021; Nara et al., 2025). Taken together, these patterns constitute a  
89 multifaceted crisis in the U.S. geomatics capacity rooted in policy gaps, educational neglect, and  
90 systemic underinvestment (Bevis et al., 2022).

91 Addressing this crisis requires more than increased funding or student enrollment; it calls  
92 for a fundamental rethinking of how geomatics is taught, who has access to it, and how education  
93 connects to licensure and industry. Scholars have long emphasized the need for interdisciplinary,  
94 learner-centered, and industry-aligned curricula that reflect the convergence of spatial  
95 technologies and the evolving role of the modern surveyor (Young, Smith, & Murphy, 2012;  
96 Konecny, 2006; Frank, 1995). Reports from the American Association of Geographers (2019)

97 and Advance CTE (2021) note that the future geospatial workforce will require hybrid skills  
98 spanning data science, land management, and geospatial reasoning capabilities, which are often  
99 missing from traditional surveying programs. Berkley (2025) and El-Mowafy et al. (2013)  
100 highlight the role of authentic learning experiences, flexible delivery methods, and intentional  
101 industry partnerships in making CTE effective for emerging fields like geomatics. Carto (2023)  
102 and DiBiase et al. (2006) further underscore the importance of aligning instruction with  
103 employer expectations in rapidly evolving technical domains.

104         The Point of Beginning (PoB) Initiative<sup>1</sup> was created in response to these longstanding  
105 structural challenges and national critiques surrounding geomatics education and workforce  
106 development. Led by the Conrad Blucher Institute for Surveying and Science (CBI) at Texas  
107 A&M University-Corpus Christi (TAMU-CC), the initiative expands the Geospatial Engineering  
108 and Land Surveying (GELS) Career and Technical Education (CTE) pathway across Texas high  
109 schools to support comprehensive workforce renewal. It incorporates early student outreach,  
110 educator professional development, strong industry partnerships, and curricular alignment into a  
111 vertically integrated, competency-based framework. By embedding industry-recognized  
112 credentials and dual credit opportunities, the PoB Initiative repositions geospatial education as a  
113 cornerstone of 21st-century workforce strategy, shifting the model from isolated technical  
114 training, or singular degree attainment, to a comprehensive, applied, and accessible approach to  
115 geomatics education.

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<sup>1</sup> <https://www.conradblucherinstitute.org/pob>

119 **Background**

120 CBI has played a central role in advancing surveying education and research in Texas for  
121 nearly four decades. Established through a bequest from Conrad Meuly Blucher, a Registered  
122 Professional Land Surveyor and the third generation of the Blucher family to serve as Nueces  
123 County Surveyor, CBI was founded to preserve the legacy of professional surveying in South  
124 Texas and to ensure that future generations would have access to a rigorous education in  
125 geomatics. Since its dedication in 1987, the Institute has served as a hub for measurement  
126 science while supporting academic programs in geospatial science and surveying.

127 In recent years, CBI has expanded its focus to include workforce development and K–12  
128 outreach as critical components of its mission. The GELS CTE pathway emerged from this  
129 strategic expansion. Initially launched at Klein Collins High School in 2018 through a  
130 partnership between local educators and industry professionals, the GELS pathway was designed  
131 to provide high school students with core competencies in geomatics. Students in the program  
132 earn industry-recognized credentials such as the NSPS Certified Survey Technician (CST) Level  
133 I, FAA Remote Drone Pilot license, and AutoCAD certification while completing dual-credit  
134 coursework with Lone Star College and TAMU-CC. The program's success in student  
135 engagement, academic achievement, and postsecondary transition provided compelling proof of  
136 concept for scaling the initiative statewide.

137 Multiple frameworks and bodies of knowledge inform the statewide expansion of the  
138 GELS CTE pathway. Chief among these is the Geospatial Technology Competency Model  
139 (GTCM) developed by the U.S. Department of Labor in collaboration with geospatial industry  
140 stakeholders. The GTCM outlines a tiered system of foundational, technical, and industry-  
141 specific skills that define success in geospatial careers (U.S. Department of Labor, 2014). It has

142 become a cornerstone for curriculum alignment, credentialing frameworks, and workforce  
143 readiness initiatives. In Texas, the GELS CTE pathway is also governed by the Texas Essential  
144 Knowledge and Skills (TEKS) standards, which define the expected learning outcomes for  
145 secondary courses, including those in CTE pathways. Aligning instructional content with TEKS  
146 and GTCM ensures that students meet state graduation requirements and are prepared to  
147 transition into a competitive workforce or post-secondary education.

148 Career and Technical Education research further supports integrating competency-based  
149 learning and industry engagement. Dougherty (2018) and Hughes and Karp (2006) note that  
150 high-quality CTE programs are most effective when they offer clear pathways to employment  
151 and postsecondary education, include work-based learning opportunities, and are responsive to  
152 labor market trends. Berkley (2025) emphasizes the role of educational leadership in sustaining  
153 CTE programs, particularly in rapidly evolving technical fields. Additionally, Kreamer and  
154 Bodilly (2018) highlight the importance of employer engagement in the curriculum design  
155 process, when donating or providing equipment, and by offering internships. The PoB Initiative  
156 draws from these insights, and has also incorporated advisory councils, developed cross-sector  
157 partnerships, and included industry in hands-on field experiences into this statewide  
158 implementation model.

159 The Texas Education Agency (TEA) approves and regulates CTE programs and  
160 recognizes the need for expanded access to geospatial education. However, the process of  
161 establishing new programs remains complex and regionally governed. The PoB Initiative works  
162 within this framework by helping school districts submit TEA proposals, develop instructional  
163 sequences, and secure letters of industry support. As of 2024, the GELS CTE pathway has been



176 **Methods**

177           The Point of Beginning Initiative is a multi-pronged strategy to address workforce  
 178 shortages in geospatial engineering and land surveying by expanding the GELS CTE pathway  
 179 across Texas high schools. There are five prongs to the strategy: 1) Dual-Credit Curriculum; 2)  
 180 Summer Institute for High School Educators; 3) Summer Camps for Junior High Students; 4)  
 181 Industry Partnerships; 5) TEA Program Approval; 6) Articulation Agreements.

182           At the core of the PoB Initiative is the development of an online, asynchronous, and dual-  
 183 credit curriculum aligned with TEKS and the GTCM. Course offerings are scaffolded to allow  
 184 students to build foundational knowledge and progress into technical electives that prepare them  
 185 for college and industry certification exams. Curriculum development is supported by faculty at  
 186 TAMU-CC and reviewed by advisory councils to ensure alignment with emerging technologies  
 187 and licensure requirements. Schools adopting the GELS CTE pathway receive a curriculum  
 188 playbook, instructional guides, and access to free or low-cost dual credit through TAMU-CC's  
 189 Islander Academy.

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<b>Geospatial Engineering and Land Surveying CTE Pathway</b>	
<b>Grade 10</b>	
GISC 1470 Geospatial Systems I (4 Credit Hours)	GISC 2301 Geospatial Systems II (Four Credit Hours)
<b>Grade 11</b>	
GISC 1336 - Digital Drafting and Design (3 Credit Hours)	GISC 3421 Visualization for GIS (4 Credit Hours)
<b>Grade 12</b>	
GISC 2470 Geospatial Plane Measurement I (4 Credit Hours)	GISC 3412 Geospatial Plane Measurement II (4 Credit Hours)

191

192 ***Figure 2: GEL Pathway Courses Offered via the Islander Academy***

193           The success of the PoB Initiative would not be possible without the support of high  
194 school educators, who play a central role in the success of CTE pathways and awareness of  
195 geomatics fields. The PoB Initiative hosts an annual Summer Institute for High School Educators  
196 to prepare teachers to deliver geomatics content. This one-week professional development  
197 program provides Continuing Education Units (CEUs), stipends, and hands-on training with  
198 hardware and software. Participants also receive instructional materials, ongoing mentoring, and  
199 access to a community of practice. These supports help ensure high-quality instruction while  
200 expanding local capacity for surveying and geospatial education.

201           Recognizing that awareness is a key barrier to entry into the geomatics professions, the  
202 PoB Initiative prioritizes outreach to middle and high school students through geospatial summer  
203 camps, career fairs, survey days, guest speaker events, and field-based demonstrations. These  
204 experiences are designed to introduce geomatics concepts, spatial reasoning, and STEM-based  
205 problem-solving in authentic contexts. By embedding surveying and GIS into exploratory STEM  
206 activities, the PoB Initiative sparks student interest and brings awareness to the field of  
207 geomatics.

208           Industry engagement and professional partnerships are foundational to the success of the  
209 PoB Initiative. The initiative builds on the successful model piloted at Klein Collins High  
210 School, where industry leaders at Gratia Geomatics contribute weekly to classroom and field  
211 instruction, offer job-shadowing opportunities, and mentor students through hands-on projects,  
212 preparing them for SkillsUSA and the NSPS Annual Student Competition. These collaborations  
213 also provide students with early exposure to the hardware, software, technologies, and  
214 expectations of the geospatial workforce. Additionally, professional organizations such as the  
215 Texas Society of Professional Surveyors (TSPS), BeASurveyor, and the NSPS have played a

216 pivotal role in expanding these opportunities statewide. These organizations assist CBI by  
217 providing guidance on aligning the GELS CTE pathway with industry standards and licensure  
218 requirements. Additionally, these organizations foster professional identity and community  
219 among GELS CTE students. By connecting education with professional practice, these  
220 partnerships ensure career readiness and offer students direct paths into geomatics professions.

221 To link these resources with school districts, CBI staff work closely with districts to  
222 guide them through the TEA program approval process, including curriculum planning, staffing  
223 requirements, and industry support documentation. The PoB Initiative team also advocates for  
224 adopting a statewide CTE program of study in geospatial engineering and surveying, with the  
225 long-term goal of simplifying implementation for school districts and standardizing quality  
226 across the state.

227 To ensure that high school CTE coursework connects directly to higher education and  
228 licensure, the PoB Initiative facilitates the development of articulation agreements between high  
229 schools, two-year surveying programs, and four-year geospatial science/geomatics degrees.  
230 These agreements guarantee credit transfer and reduce barriers for students transitioning into  
231 associate or bachelor's programs. The initiative also supports curriculum alignment with Texas's  
232 Registered Professional Land Surveyor (RPLS) licensure framework. It includes advisory input  
233 from the Texas Board of Professional Engineers and Land Surveyors (TBPELS).

234 Through this multi-pronged approach, the PoB Initiative provides a replicable model for  
235 modernizing surveying education, increasing student access to geospatial careers, and  
236 strengthening workforce resilience. Each strategy component is designed to be scalable,  
237 sustainable, and responsive to evolving industry demands.

238

239 **Initial Results**

240           Since its inception in 2023, the PoB Initiative has made measurable progress in  
241 expanding access to geospatial engineering and land surveying education across Texas. At Klein  
242 Collins High School, where the pathway was first piloted, student enrollment has grown from an  
243 initial cohort of five to nearly forty students annually. In 2024, ten students earned their NSPS  
244 Certified Survey Technician (CST) Level I credential, and one of the first students in the GEL  
245 CTE Pathway graduated from Texas A&M University-Corpus Christi as president of the  
246 university's GIS student organization. These early indicators suggest that the pathway is not only  
247 effective at recruiting students into geospatial education but also supports long-term persistence  
248 through post-secondary programs.

249           The initiative has also demonstrated success in professional development and educator  
250 training. The Summer Institute for High School Educators, launched in 2022, has now trained 20  
251 STEM teachers from across the state. Participants receive CEUs, stipends, classroom resources,  
252 and direct instruction in geospatial technologies such as GNSS, UAVs, and LiDAR. Educator  
253 feedback has provided the opportunity for curriculum adjustments and indicated that there is a  
254 strong demand for continuing education, including field-based training, particularly among those  
255 without a background in surveying or GIS. CBI's summer geospatial camps for middle school  
256 students have also shown promise. Over the last two years, more than 80 students participated in  
257 week-long immersive programs that introduced them to land surveying, geocaching, drone  
258 mapping, and GIS analysis. These programs were designed to broaden participation in geomatics  
259 by providing hands-on experience and instruction and are supported by local industry and  
260 university faculty.

261 In addition to outreach and instruction, the PoB Initiative strived to make progress on  
262 academic alignment. The PoB, through CBI and TAMU-CC, has facilitated articulation  
263 agreements between high schools, two-year institutions (such as Lone Star College and Del Mar  
264 College), and the four-year program at TAMU-CC, reducing credit loss and smoothing the  
265 transition into professional pathways. The initiative also supports dual credit enrollment through  
266 TAMU-CC's Islander Academy, with eighteen GELS students enrolled in online geospatial  
267 courses during the 2024–2025 school year. Importantly, the cost of these courses is subsidized or  
268 waived for students who qualify for free or reduced lunch in Texas.

269 Perhaps most significantly, the PoB Initiative has helped reshape the CTE and workforce  
270 development landscape for surveying in Texas. It has closed gaps that previously fragmented the  
271 educational pipeline by aligning the GELS pathway with licensure expectations, industry-  
272 recognized certifications (such as CST and Part 107), and post-secondary curricula. In the  
273 upcoming school year, students in the GELS CTE pathway will also sit for the pre-GISP Exam  
274 through the GIS Certification Institute (GISCI).

275 These outcomes align with literature emphasizing the importance of integrated,  
276 competency-based, and industry-supported CTE programs (Dougherty, 2018; Hughes & Karp,  
277 2006; Kreamer & Bodilly, 2018). They also reinforce the argument that early exposure,  
278 meaningful career awareness, and structured transitions into higher education are critical for  
279 recruiting and retaining students in high-skill fields like geomatics (Advance CTE, 2021; Nara et  
280 al., 2025).

281 However, challenges remain. The decentralized nature of Texas CTE approvals requires  
282 intensive regional coordination and stakeholder engagement, and there is currently no unified  
283 statewide program of study for surveying and geospatial engineering. Additionally, many

284 districts face staffing limitations, as few educators have prior training in geomatics technologies.  
285 To address these challenges, the PoB Initiative will encourage and provide expanded educator  
286 training, additional articulation agreements, and formalized regional advisory councils to ensure  
287 ongoing alignment with licensure and labor market needs.

288         The PoB Initiative provides strong evidence that offering dual enrollment opportunities  
289 via CTE at the high school level, combined with institutional support, workforce engagement,  
290 and curricular alignment, can reverse declining enrollment trends and expand participation in the  
291 geomatics professions. While the PoB Initiative is in its early stages, its success so far provides a  
292 replicable framework for other states with similar workforce challenges.

### 293 **Conclusion and Future Work**

294         The Point of Beginning Initiative provides a strategic and scalable response to the  
295 growing geospatial workforce crisis in Texas and the United States. Anchored in the academic  
296 leadership of the Conrad Blucher Institute and sustained through collaboration with educators,  
297 employers, and licensing authorities, the initiative confronts longstanding challenges in  
298 exposure, access, and curriculum alignment within surveying and geomatics education. By  
299 expanding the GELS CTE pathway, PoB establishes a vertically integrated model that links high  
300 school exploration to college credit, industry certification, and eventual professional licensure.  
301 Initial results from participating school districts demonstrate that the PoB Initiative is achieving  
302 its goals, raising awareness of the profession, promoting access to high-demand technical skills,  
303 and strengthening students' transitions into post-secondary education and geomatics fields.  
304 Through ongoing investments in curriculum development, educator training, and advisory  
305 infrastructure, the PoB Initiative is reshaping entry points into the geospatial workforce to reflect  
306 national competency frameworks and best practices in workforce development.

307           Nonetheless, barriers to this initiative remain. The absence of a unified statewide program  
308 of study, fragmented credentialing systems, and limited awareness among students and educators  
309 impede the growth and sustainability of surveying education. To address these challenges, the  
310 Texas Education Agency should adopt a single, statewide GELS program of study, reducing  
311 implementation barriers for school districts and promoting consistent instructional quality across  
312 the state.

313           Establishing regional advisory structures that include educators, licensed professionals,  
314 employers, and post-secondary representatives would help ensure continuous alignment between  
315 CTE curricula, licensure requirements, and labor market needs. Additional investments are also  
316 recommended to expand the PoB Summer Institute and to develop year-round professional  
317 learning communities for CTE instructors. Targeted recruitment of experienced industry  
318 professionals into teaching roles should be explored to bolster instructional capacity and bring  
319 real-world expertise into the classroom.

320           Furthermore, universities and community colleges should continue building partnerships  
321 with independent school districts to broaden access to online dual credit and internship  
322 opportunities.

323           Finally, national geospatial and surveying organizations, including NSPS, GISCI,  
324 American Association for Geodetic Surveying (AAGS), National Council of Examiners for  
325 Engineering and Surveying (NCEES), and the U.S. Department of Labor, are encouraged to  
326 support and replicate similar high school-to-licensure pathways in other states. Federal funding  
327 mechanisms such as Perkins V, NSF ATE, and DOL apprenticeships offer promising avenues to  
328 scale this model and extend its impact nationwide.

329 By reframing surveying and geomatics education as an interdisciplinary, high-tech, and  
330 community-embedded career pathway, the PoB Initiative represents an important shift in how  
331 the profession prepares for the future. Its early successes suggest that, with the right structures  
332 and support, CTE programs can do more than complement traditional academic models; they can  
333 provide a long-term workforce solution to address the geomatics crisis.

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342 aligning secondary education with professional standards.

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345 Surveying Career and Technical Education pathway at Klein Collins High School and to the  
346 educators, Ms. Jennifer High, and administrators who continue to lead its implementation in  
347 districts across the state.

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349 summer institutes, and outreach activities. Your enthusiasm and engagement are the driving  
350 force behind this work.

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358 **Keywords**

359 Geomatics education; Career and Technical Education (CTE); Land surveying workforce;  
360 Dual credit pathways, Geospatial curriculum development, Workforce development, High school  
361 outreach, Industry-aligned education.

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