

Program Approval

I. General Information

A. Institution

Kansas State University

B. Program Identification

Degree Level:	Bachelor's
Program Title:	Cyber Systems Design and Dynamics
Degree to be Offered:	Bachelor of Science in Cyber Systems Design and Dynamics
Responsible Department or Unit:	College of Technology & Aviation / Department of Integrated Studies
CIP Code:	11.0804
Modality:	Hy-Flex
Proposed Implementation Date:	August 2024

Total Number of Semester Credit Hours for the Degree: 120

II. Clinical Sites: Does this program require the use of Clinical Sites? NO

III. Justification

Cyber Systems Design and Dynamics (CSDD) is an innovative degree program merging the realms of digital design, human-computer interaction, virtual and augmented reality, data science, and intelligent computing systems architecture. This program equips students with unique and in-demand skills to create engaging virtual environments, immersive applications, predictive data systems, cyber physical systems, and interactive media. After extensive research stemming from Kansas State University's Academic Program Review & Revitalization Process, industry partner meetings, and discussions among the faculty within the Department of Integrated Studies on the K-State Salina Campus, it was determined that the CSDD degree is an excellent option to replace the outdated Computer Systems Technology and Digital Media Technology degrees. This new degree option was developed to support advanced industry demands within the areas of Immersive Systems Design and Machine Learning. Moreover, this new degree will be a major component of the \$41 Million Kansas Center for Advanced Immersive Research for Emerging Systems (K-AIRES) currently being built on the K-State Salina Campus and will offer students industry connections with Pure Imagination Studios (see Appendix A). The new degree is unique within the region as well as the nation. Industrial demand for the skillsets developed in this new bachelor's degree has grown rapidly over the last 3 years in the region and the nation. Additionally, the employment outlook for bachelor's degree holders in relevant fields is very positive at all geographic levels.

IV. Program Demand: Market Analysis

Student demand for degrees in cyber systems and machine learning related fields has grown in the region and the nation. Between 2014 and 2020, the number of regional bachelor's conferrals in machine learning-related fields grew annually at a rate of 48.7 percent, much faster than the average growth rate for all bachelor's conferrals. While the volume of conferrals has been below-average, the substantial completion growth rate indicates a trending emerging field. A review of the regional and national landscape suggests room for an additional bachelor's degree in the state of Kansas. No regional universities currently offer a bachelor's degree in Cyber Systems Design & Dynamics.

Nationwide, few degree programs are directly relevant (in contrast to specializations or concentrations) which suggests viable conditions for a degree option in Cyber Systems Design and Dynamics. Moreover, as of 2022, no Kansas-based institution has reported any bachelor's offerings in relevant fields. The employment outlook for cyber systems and machine learning-related occupations is positive. Federal data projects a faster-than-average employment growth for software developers and other related occupations over a ten-year period in Kansas, the region, and the nation. Recently posted job listings underscore the trend in substantial labor

demand, especially for professionals who are versed in the latest programming frameworks related to Immersive Systems Design and Machine Learning and Autonomous Systems.

V. Projected Enrollment for the Initial Three Years of the Program

Year	Headcount Per Year		Sem Credit Hrs Per Year	
	Full- Time	Part- Time	Full- Time	Part- Time
Implementation	8	7	192	105
Year 2	24	12	576	180
Year 3	36	18	864	270

VI. Employment

The employment outlook for cyber systems-related occupations is positive. Federal data projects a faster-than-average employment growth for system developers, engineers, and other related occupations over a ten-year period in Kansas, the region, and the nation (Department of Labor Statistics). However, recently posted job listings underscore the trend in substantial labor demand, especially for professionals who are versed in integrated systems design and architecture (EMSI, 2020). An understanding of cyber systems and the ability to think and work systematically when approaching industry problems, is becoming increasingly vital for employees hired in a variety of technical, engineering, science, and business positions (Werner & Pritchard, 2021). Additionally, comprehension of cyber system dynamics is frequently sought after for research and education in many different fields, as well as for analysis by large companies, governments, international agencies, and consulting companies.

VII. Admission and Curriculum

A. Admission Criteria

Freshmen Students:

- Admission to the university is test-optional and requires achieving EITHER:
 - A cumulative high school GPA (weighted or unweighted) of 3.25 or higher OR
 - ACT composite score of 21, or an SAT ERW+M score of 1060 or higher
- AND, if applicable, achieve a 2.0 GPA on all college credit taken in high school.

Transfer Students:

- Students must have a minimum GPA of 2.0 on all transfer course work by the time they start at K-State.

International Students:

- High school curriculum from an accredited secondary school.
- Minimum 2.5 GPA (Grade Point Average) on a 4.0 scale in high school coursework.

International Transfer Students:

- Completed high school degree
- 24 credit hours completed at a collegiate level
- 2.0 GPA on a 4.0 scale on college or university transcripts

B. Curriculum

The Cyber Systems Design & Dynamics degree has two program options: Immersive Systems Design and Machine Learning & Autonomous Systems (MLAS). The course sequence below is for the Immersive Systems Design option. The MLAS option is included in Attachment 1.

Immersive Systems Design Option

Year 1: Fall

SCH = Semester Credit Hours

Course #	Course Name	SCH
MATH 100	College Algebra (Gen Ed Core 030)	3
ENGL 100	Expository Writing (Gen Ed Core 010)	3
CYBR 103	Computing Principles	3
MLAS 100	Survey of Machine Learning & Autonomous Systems	3
CYBR 137	Principles of Interactive Digital Storytelling	3

Year 1: Spring

Course #	Course Name	SCH
MATH 150	Plane Trigonometry	3
COMM 106	Public Speaking I (Gen Ed Core 020)	3
CYBR 163	Fundamentals of Design Thinking	3
CYBR 180	Introduction to Database Systems	3
CYBR 247	Programming I	3

Year 2: Fall

Course #	Course Name	SCH
MATH 220	Analytic Geometry & Calculus I	4
PHYS 113	General Physics I (Gen Ed Core 040)	4
CYBR 210	Interactive Media Development	3
CYBR 335	Programming II	3

Year 2: Spring

Course #	Course Name	SCH
ENGL 200	Expository Writing II (Gen Ed Core 010)	3
	General Education Elective (Social & Behavioral Science) (050)	3
	General Education Elective (Arts & Humanities) (060)	3
CYBR 250	Hardware and Network Fundamentals	3
CYBR 280	Applied Mathematics for Cyber Systems	3

Year 3: Summer

Course #	Course Name	SCH
CYBR 301	Immersive Coop Studio I	3

Year 3: Fall

Course #	Course Name	SCH
ENGL 302	Technical Writing	3
STAT 325	Introduction to Statistics	3
	General Education Elective (Social & Behavioral Science) (050)	3
CYBR 360	Foundations of Game Engine Design & Development	3
	Immersive Systems Design Elective	3

Year 3: Spring

Course #	Course Name	SCH
COT 480	Professional Conduct, Ethics, and Analysis	3
	Business Elective (300 or 400 level preferred)	3
	General Education Elective (Institutional Designated) (070)	3
	Immersive Systems Design Elective	3
	Immersive Systems Design Elective	3

Year 4: Summer

Course #	Course Name	SCH
CYBR 401	Immersive Coop Studio II	3

Year 4: Fall

Course #	Course Name	SCH
CYBR 495	Immersive Cyber Systems Capstone I	3
	Science Elective	4
	Immersive Systems Design Elective	3
	Immersive Systems Design Elective	3

Year 4: Summer

Course #	Course Name	SCH
CYBR 497	Immersive Cyber Systems Capstone II	3
	General Education Elective (Arts & Humanities (060)	3
	General Education Elective (Institutional Designated) (070)	3
	Immersive Systems Design Elective	3

Total Number of Semester Credit Hours 120

VIII. Core Faculty

Note: * Next to Faculty Name Denotes Director of the Program, if applicable
 FTE: 1.0 FTE = Full-Time Equivalency Devoted to Program

Faculty Name	Rank	Highest Degree	Tenure Track Y/N	Academic Area of Specialization	FTE to Proposed Program
Michael Oetken*	Asst. Prof.	Ph.D.	Y	Immersive Systems Design	1.0
William Genereux	Prof.	Ph.D.	Tenured	Immersive Systems Design	1.0
Tim Bower	Prof.	M.S.	Tenured	Intelligent Systems Design	1.0
Annie Hoekman	Asst. Prof.	Ph.D.	N	Cyber Security	1.0
Balaji Balasubramaniam	Asst. Prof.	Ph.D.	Y	Intelligent Systems Design	1.0
Sri Pudepedi	Asst. Prof.	Ph.D.	Y	Machine Learning	1.0
New Hire	Asst. Prof	M.S.	N	Cyber Operations	1.0

Number of graduate assistants assigned to this program **10**

IX. Expenditure and Funding Sources

A. EXPENDITURES	First FY	Second FY	Third FY
Personnel – Reassigned or Existing Positions			
Faculty	500,000	500,000	500,000
Administrators (<i>other than instruction time</i>)	0	0	0
Graduate Assistants	0	0	0
Support Staff for Administration (<i>e.g., secretarial</i>)	3,150	6,300	6,300
Fringe Benefits (<i>total for all groups</i>)	125,787	126,574	126,574

Other Personnel Costs	0	0	0
Total Existing Personnel Costs – Reassigned or Existing	628,937	632,874	632,874
Personnel – New Positions			
Faculty	0	0	60,000
Administrators (<i>other than instruction time</i>)	0	0	0
Graduate Assistants	0	0	0
Support Staff for Administration (<i>e.g., secretarial</i>)	0	0	0
Fringe Benefits (<i>total for all groups</i>)	0	0	18,000
Other Personnel Costs	0	0	0
Total Existing Personnel Costs – New Positions	0	0	78,000
Start-up Costs - One-Time Expenses			
Library/learning resources	0	0	0
Equipment/Technology	150,000	2,500	2,500
Physical Facilities: Construction or Renovation	0	0	0
Other (Marketing)	50,000	50,000	50,000
Total Start-up Costs	200,000	52,500	52,500
Operating Costs – Recurring Expenses			
Supplies/Expenses	125	250	250
Library/learning resources	0	0	0
Equipment/Technology	2,000	2,000	2,000
Travel	0	0	0
Other	0	0	0
Total Operating Costs	2,125	2,250	2,250
GRAND TOTAL COSTS	831,062	687,624	765,624

B. FUNDING SOURCES (<i>projected as appropriate</i>)	Current	First FY (New)	Second FY (New)	Third FY (New)
Tuition / State Funds		203,697	518,503	777,754
Student Fees		12,500	31,820	47,730
Other Sources (Univ/Industry/Corporate)		50,000	25,000	25,000
GRAND TOTAL FUNDING		266,197	575,323	850,484
C. Projected Surplus/Deficit (+/-) (Grand Total Funding <i>minus</i> Grand Total Costs)		-564,865	-112,301	+84,860

X. Expenditures and Funding Sources Explanations

A. Expenditures

Personnel – Reassigned or Existing Positions: A combined 6.0 FTE will come from faculty members as depicted in section VIII of this document.

Personnel – New Positions: A single faculty position at 1.0 FTE is anticipated by year 3 of the program. A varying number of adjunct instructors will be critical to the success of this program from the standpoint of content currency and relevancy and will share the teaching load and we currently estimate this need at 0.25 of an FTE per semester.

Operating Costs – Recurring Expenses: Limited to office costs

B. Revenue: Funding Sources

A combination of Tuition/State Funding + \$50,000 in annual program startup funding from central administration in Manhattan. Additionally, we expect Industry & Corporate funding streams to chip in annually to the program as well. As of 2023, we have tentative commitments from various corporate donors. Of course, our primary funding stream will be generated from student tuition.

Part time students are calculated at 15 hours annually (6 hour per semester twice per year, plus a single 3 hour course over the summer); whereas full time are estimated at 24 hours (12 hours per semester twice per year). And using a blended tuition rate of \$685.85 (Simple Average: \$421 (in-state rate) + \$949 (out-of-state rate)), we then take the total estimated credit hours for full time and part time students. We assume that more full time students, than part time students, will be enrolled in this program; additionally, we also assume more in-state students will be enrolling in this program due to the audience we will be marketing towards. As enrollment increases, while taking into account CSDD program expenditures, we estimate that we will break even in the second year.

C. Projected Surplus/Deficit

The campus intends to develop a digital marketing campaign for this program. We expect program enrollments to increase after the second year of the program. These early cash marketing expenditures will help us to realize the estimated ROI. Additionally, we recognize that the blended tuition rate might not be the only approximation method for forecasting ROI.

In-and-Out-of-State Enrollment Model: Blended Tuition Rate = \$685.85 Per Credit Hour

This model assumes an even breakdown between in-state and out-of-state tuition:

- Year 1 Estimated ROI: -\$564,864.55
- Year 2 Estimated ROI: -\$112,301.36
- Year 3 Estimated ROI: +\$84,859.96

✓ *This model is fairly realistic given our target learner audience.*

It is estimated that the program will continue to grow enrollment up to year 6, at which time enrollment is estimated to plateau around 75 full-time students and 25 part-time students. At the current tuition rate, the Year 6 ROI would be estimated at \$726,099.75

XI. References

Economic Modeling Specialists International (EMSI). (2020). *Third Quarter 2020 Report for Aerospace Engineers*. (Provided by Kansas Department of Commerce.)

U.S. Department of Labor. (2023, September 22). See yourself in cybersecurity. U.S. Department of Labor Blog. <https://blog.dol.gov/2023/09/22/see-yourself-in-cybersecurity>

Werner, S., & Pritchard, M.J. (2021). *Aviation versus Aerospace: A Differential Analysis of Workforce Jobs via Text Mining*. International Journal of Transport and Vehicle Engineering. Vol:15, No:10.

Machine Learning & Autonomous Systems Option**Course Sequence Roadmap****Freshman Fall Semester: 15 Credit Hours**

MATH 100 – College Algebra	3	(Gen Ed Core 030)
ENGL 100 – Expository Writing I	3	(Gen Ed Core 010)
CYBR 103 – Computing Principles	3	
MLAS 100 – Survey of Machine Learning & Autonomous Systems	3	
CYBR 137 – Principles of Interactive Digital Storytelling	3	

Freshman Spring Semester: 15 Credit Hours

MATH 150 – Plane Trigonometry	3	
COMM 106 – Public Speaking I	3	(Gen Ed Core 020)
CYBR 163 – Fundamentals of Design Thinking	3	
CYBR 180 – Introduction to Database Systems	3	
CYBR 247 – Programming I	3	

Sophomore Fall Semester: 14 Credit Hours

MATH 220 – Analytic Geometry & Calculus I	4	
PHYS 113 – General Physics I	4	(Gen Ed Core 040)
MLAS 200 – Introduction to Automata & Cybernetic Systems Theory	3	
CYBR 335 – Programming II	3	

Sophomore Spring Semester: 15 Credit Hours

ENGL 200 – Expository Writing II	3	(Gen Ed Core 010)
General Education Elective (Social & Behavioral Sciences)	3	(Gen Ed Core 050)
General Education Elective (Arts & Humanities)	3	(Gen Ed Core 060)
CYBR 250 – Hardware and Network Fundamentals	3	
CYBR 280 – Applied Mathematics for Cyber Systems	3	

Sophomore/Junior Summer Semester: 3 Credit Hours

MLAS 350 – Machine Learning Data Structures	3	
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Junior Fall Semester: 15 Credit Hours

ENGL 302 – Technical Writing	3	
STAT 325 – Introduction to Statistics	3	
General Education Elective (Social & Behavioral Sciences)	3	(Gen Ed Core 050)
ETB 310 – Applied Data Analysis & Tools	3	
MLAS 390 – Unsupervised Learning in Autonomous Systems	3	

Junior Spring Semester: 15 Credit Hours

COT 480 – Professional Conduct, Ethics, and Analysis	3	
Business Elective (300 or 400 level preferred):	3	
General Education Elective (Institutional Designated)	3	(Gen Ed Core 070)
MLAS 400 – Supervised Learning in Autonomous Systems	3	
MLAS 410 – Natural Language Processing	3	

Junior/Senior Summer Semester: 3 Credit Hours

STAT 705 – Regression & Analysis Variance 3

Senior Fall Semester: 13 Credit Hours

STAT 730 – Multivariate Statistical Methods 3

Science Elective 4

MLAS 412 – Deep Learning 3

MLAS 500 – Reinforcement Learning in Autonomous Systems 3

Senior Spring Semester: 12 Credit Hours

General Education Elective (Arts & Humanities) 3 (*Gen Ed Core 060*)

General Education Elective (Institutional Designated) 3 (*Gen Ed Core 070*)

MLAS 501 – Artificial Intelligence Studio 3

MLAS 502 – Autonomous Systems Senior Capstone 3

TOTAL CREDIT HOURS: 120



October 15, 2023

Kansas State University Salina
Degree Approval Committee
2310 Centennial Rd,
Salina, KS 67401

Dear Kansas State Degree Approval Committee:

Please accept this letter as Pure Imagination Studios' unwavering support of the K-AIRES Center and Cyber Systems Design and Dynamics Degree (CSDD) program as it represents a new era of innovation that will introduce countless new jobs and catapult the community to a cutting-edge position in the spatial computing industry.

Pure Imagination Studios is an award-winning independent studio that combines proprietary spatial computing technology with groundbreaking storytelling to bring the next generation of entertainment to audiences of all ages as our content and experiences have been utilized by hundreds of millions worldwide.

Throughout the next decade, the demand for content will not only continue to rise but the way it's developed, produced, and ultimately consumed will rely heavily on spatial computing and real-time technologies – therefore an entirely new workforce will be pivotal to support our film, television, interactive, experiential, and extended reality (XR) content. Kansas State is currently bringing large companies to the state of Kansas that need solutions to enhance their workforce. With the training models implemented by the K-AIRES and Cyber Systems Design and Dynamics Degree (CSDD) program, we will be able to initiate hands-on, remote training to students, new hires, and professionals alike to prepare them with career-ready knowledge and experiences.

The number of challenges we face as a community are rooted in the lack of skilled resources that can keep up with the ever-evolving advancements in storytelling technology. Therefore, Pure Imagination is deeply committed to supporting the K-AIRES Center and Cyber Systems Design and Dynamics Degree (CSDD) program as the studio and learning center will be a beacon for combining immersive technologies and an extraordinary, unparalleled hands-on training experience.

It's priceless to find a partner so equally committed and aligned not only with our vision, but our overall goals as a company, which are:

- Grow a transformational business around the future of entertainment.
- Educate and build an inclusive workforce.
- Foster development of underrepresented communities.
- Develop, patent, retain, and exploit technology and create intellectual property made from within the K-AIRES Center and Cyber Systems Design and Dynamics Degree (CSDD) program.
- Raise additional private investment to develop new ventures based on the technology created in state, fueling our continued expansion into the enterprise sectors.

Due to this perfect alignment of vision and values, Pure Imagination is committed to a future in Kansas and supporting Kansas State University Salina build the K-AIRES Center and Cyber Systems Design and

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Dynamics Degree (CSDD) program as well as expand and influence advancements made at the University and state level.

As part of the K-AIRES Center and Cyber Systems Design and Dynamics (CSDD) program, Pure Imagination will help develop a core curriculum ranging from software development, computer animation, volumetric capture, artificial intelligence, augmented reality, computer vision, and embrace virtual reality to heighten the importance of storytelling and the business side of “show business,” as well as so much more.

Additionally, given the deep interrelationship between technology and entertainment, Pure Imagination will also be able to leverage the K-AIRES Center and Cyber Systems Design and Dynamics Degree (CSDD) program’s approach to collaborate on projects directly with the CSDD students, thus leading to early access and exposure of relevant experiences, the latest tools, and current technologies valuable for employment post-graduation.

We look forward to supporting Kansas’ efforts in embracing technology and providing a path of inspiration and infrastructure for education and job placement, not only helping the state of Kansas and Kansas State University Salina recognize their long term visions but fueling our deepest inspirations for creating to begin with.

Sincerely,

A handwritten signature in blue ink, appearing to read "Joshua Wexler", is written over a faint, larger version of the same signature.

Joshua Wexler
Chief Executive of Fun
Pure Imagination Studios, Inc.