Workforce Development and Education

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Presentation Outcomes

- Market Demand and Occupational Trends
- The State of Higher Education
- Workforce Development
- What can YOU do for the Future of Surveying?
- Survey Education – Utah Valley University (UVU)

Market Demand for Surveying and Mapping Services

Data taken from the United States Bureau of Labor Statistics (BLS) January 2023

SOC Codes

U.S. BUREAU OF LABOR STATISTICS

Standard Occupational Classifications (SOC) Codes

- 17-1021 Cartographers and Photogrammetrists
- 17-1022 Surveyors
- 17-3031 Surveying and Mapping Technicians
- 17-3022 Civil Engineering Technologists and Technicians
- 15-1299.02 Geographic Information Systems Technologists and Technicians

(BLS *Bright Outlook* rating)

Utah SAM Employment Trends (BLS)

Utah Surveying and Mapping Employment Trends

SOC Code and Title	Employment 2020		Projected Employment 2030		Projected Growth 2020-2030		Projected Annual Job Openings 2020-2030	
	Utah	USA	Utah	USA	Utah	USA	Utah	USA
17-1021 Cartographers and Photogrammetrists	120	13400	150	13700	25%	3%	20	1000
17-1022 Surveyors	1030	50000	1400	50400	36%	1%	140	3800
17-3031 Surveying and Mapping Technicians	640	59800	820	62000	28%	4%	110	7800
17-3022 Civil Engineering Technologists and Technicians	790	66300	1050	66100	33%	0%	110	6500
15-1299.02 Geographic Information Systems Technologists and Technicians	81800	408200	10640	449200	30%	10%	930	34700

Utah source: Projections Central 2020-2030 long-term projections external site. United States source: Bureau of Labor Statistics 2021-2031 employment projections external site. "Projected growth" represents the estimated change in total employment over the projections period. "Projected annual job openings" represent openings due to growth and replacement.

- 30% Average annual growth in Utah compared to 4% USA
- 96.5% increase in age > 75 professionals retiring by 2030
- Declining numbers entering the profession age 16-24

SAM Job Openings (BLS)

As of February 9, 2024 there 60 job openings in Utah alone

10 job openings for every AAS *and* BS student graduating this year

(but they already have jobs before the graduate)

Posted	Job Title	Company	Location
1/18/2024	Surveyor	Layton Construction Company, LLC	Sandy
1/31/2024	Surveyor II	Mortenson Construction	Eagle Mountain
1/29/2024	Surveyor Field Tech (internal	Staker & Parson Companies	St. George
12/27/2023	Underground Surveyor	Michels Corp	SLC
2/8/2024	Survey Manager	System	SLC
1/19/2024	Survey Project Manager	David Evans and Assosicates, Inc	SLC
1/18/2024	Survey Right-of-Way Group Leader	David Evans and Assosicates, Inc	SLC
1/18/2024	Senior Survey Technicain	David Evans and Assosicates, Inc	SLC
1/26/2024	PLS Supervisor	Am	SLC
1/10/2024	GIS Technician	Jacobs	Dugway
12/21/2023	Cartographic Technician	Innovatel, Inc.	SLC
12/21/2023	Senior Cartographer	Innovatel, Inc.	SLC
12/21/2023	Cartographer	Innovatel, Inc.	SLC
12/21/2023	GIS Technician	Innovatel, Inc.	SLC
2/8/2024	GIS Analyst I, SITLA	State of Utah- Jobs	SLC
1/26/2024	Right of Way Senior GIS Analyst	State of Utah- Jobs	SLC
12/21/2023	Senior GIS Analyst	Innovatel, Inc.	SLC
2/9/2024	Engineering Technician- Entry Level	Intertek	SLC
2/8/2024	Civil Engineering Intern	APTIM	Remote, U
2/8/2024	Facilities Technicial (FT)	City of Saratoga Springs	Saratoga S
2/8/2024	Construction Intern	Hay Baker Inc	SLC
2/6/2024	Electrical Engineering Intern	WSP	SLC
2/6/2024	Estimating Intern	Staker & Parson Compani	Draper
2/6/2024	Geological Engineering Intern- Summe	WSP	South Jord
2/6/2024	Mechanical Engineering Int n-Summer	WSP US	South Jord
2/6/2024	Construction Materials Tech ian	WSP USA	South Jord
2/6/2024	Electrical Engineerging In mmer	WSP USA	South Jord
2/4/2024	Senior Civil Constructio Inspec	HDR Engineering I	SLC
2/3/2024	Industrial Engineering hnician	Air Force Materiel nd	Hill AFB
2/1/2024	Technician I	Architechtual Inc.	SLC
1/31/2024	Telecommunication Technician	Michael Baker tional	Midvale
1/30/2024	Technician I	Intertek	SLC
1/29/2024	Civil Enginee	AECOM	Murray
1/29/2024	Sr. Technician	HNTB	Midvale
1/23/2024	ICBM Infas cture E gineering In	BAE stems	Hill AFB
1/19/2024	Senior Civil CAD Design Techn	Jacob	SLC
1/19/2024	Civil CAD Technician	Jacobs	SLC
1/18/2024	Engineer Tec ician III	Terracon	Midvale
1/18/2024	Engineeri chnician IV	Terracon	Midvale
1/18/2024	Civil/T ation Intern	vans and Assosicates, Inc	SLC
1/18/2024	Tran orta n CAD Technician	avid vans and Assosicates, Inc	SLC
1/18/2024	Cons ucti Intern (Transportation-H/B)		Murray
1/18/2024	ine g Technician I	Terracon	Midvale
1/10/20	Exp nced Civil EIT-Structural	mley-Horn	SLC
1/9/2	Civil gineering Analyst	mley-Horn	SLC
1/8/2024	ape Technician (stormwater)	Apex Companies	SLC
1/6/2024	Civil Engineering Intern	Kimley-Horn	SLC
1/5/2024	Engineering Technician I	Terracon	Ogden
1/5/2024	Engineering Technician III	Terracon	Ogden
1/3/2024	Engineering Technician I	Terracon	Midvale
1/3/2024	Engineering Intern	Bernhard, LLC	SLC
12/26/2023	Engineering Intern	Nicholson Construction Company	North SLC
12/22/2023	CADD/BIM Specialst-Design Bu	HNTB	Midvale
12/21/2023	Structural Engineering Intern (bridges)	Jacobs	Holladay
12/21/2024	Civil Engineering Intern (drainage)	Jacobs	Holladay
12/21/2123	Civil Engineering Intern (traffic)	Jacobs	Holladay
12/21/2023	Civil Engineering Intern (roadways)	Jacobs	Holladay
12/17/2023	Event Facilities Technician	The Leonardo	SLC
1/4/2024	GIS Specialist II	AECOM	Murray
12/20/2023	GIS Administrator	Springville City Corp	Springville

Occupational Trends

From 2020 to 2030/2040

2024 UCLS Conference, Danial L. Perry, MBA, PLS, Professor

2-21-2024

Occupational Trends

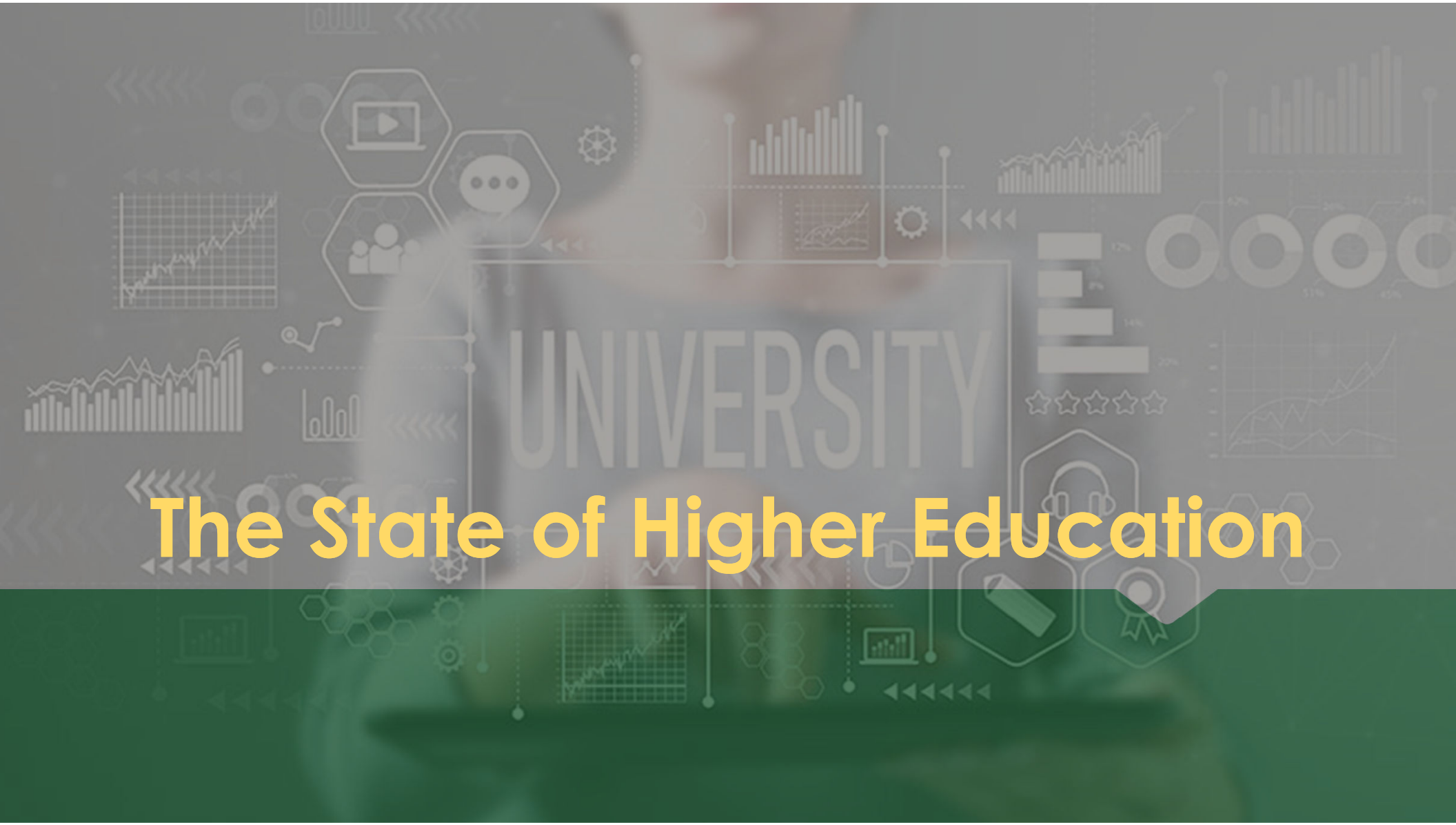
“America's shortage of skilled tradespeople, … —whose incomes are in six digits—continues in early 2021 despite the COVID-19 pandemic and despite rising salaries and potential employers offering to pay their recruits during training.”

Source: Solman, Paul (January 28, 2021). "Despite rising salaries, the skilled-labor shortage is getting worse". PBS Newshour. Retrieved February 22, 2021.

Occupational Trends

"Due to declining interest in higher education and a tight labor market, in the early 2020s, young Americans could expect to be hired right after graduating high school."

Source: Moody, Josh (May 26, 2022). "A 5th Straight Semester of Enrollment Declines". Inside Higher Education. Archived from the original on August 17, 2022. Retrieved August 21, 2022.



The State of Higher Education

Americans Have Less Confidence in Higher Ed: Why?

Cost, access and political differences have contributed to the decline, higher ed experts say.

By Sarah Wood | Aug. 7, 2023, at 5:28 p.m.

Save

America's Educational Superpower Is Fading

If US universities and colleges are to revive and thrive, they need to rethink four fundamental principles.

April 17, 2023 at 11:00 PM MDT

Amidst Questions About College Value, Leaders Must Focus On Economic Mobility

Higher Ed's Work-Force-Retention Problems Aren't Going Away

By Megan Zahneis | SEPTEMBER 14, 2023

Americans Are Losing Faith in the Value of College. Whose Fault Is That?

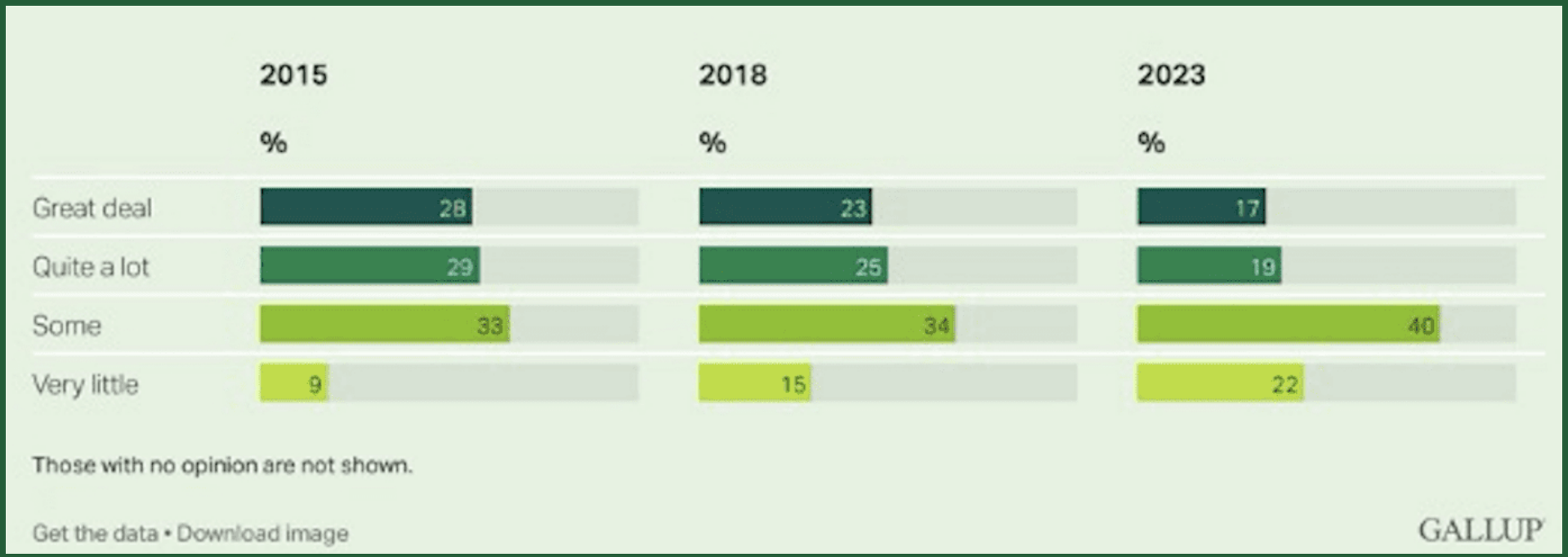
For most people, the new economics of higher ed make going to college a risky bet.

Prospective College Students Increasingly Say They Feel Unprepared for Higher Education

By Emma Hall | JUNE 12, 2023

AI Has Arrived in Higher Education. Now What?

How much confidence do you have in Higher Education?

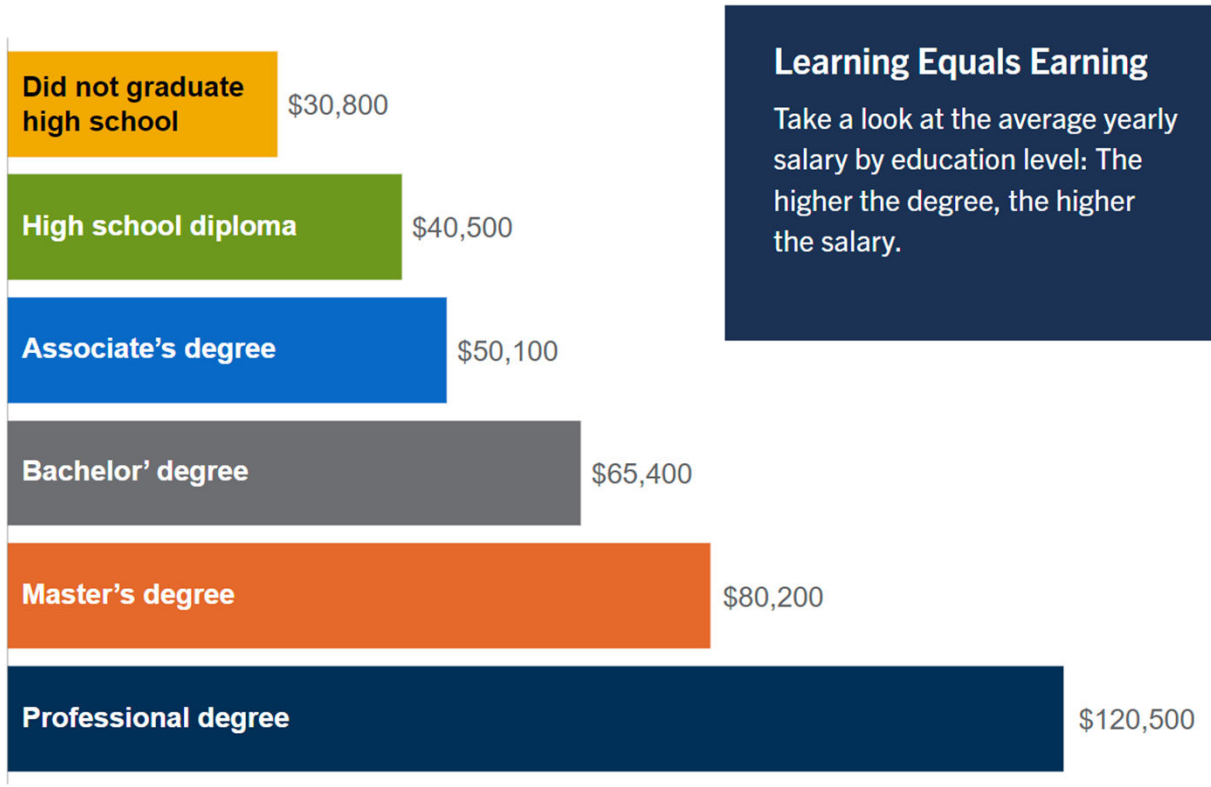


What is the value of formal education?

"Upon no foundation but that of popular education can man erect the structure of an enduring civilization. This is the basis of all stability, and underlies all progress."

Andrew Carnegie, Triumphant Democracy, 1886

True for the future?



Source: The College Board, *Education Pays 2019.*

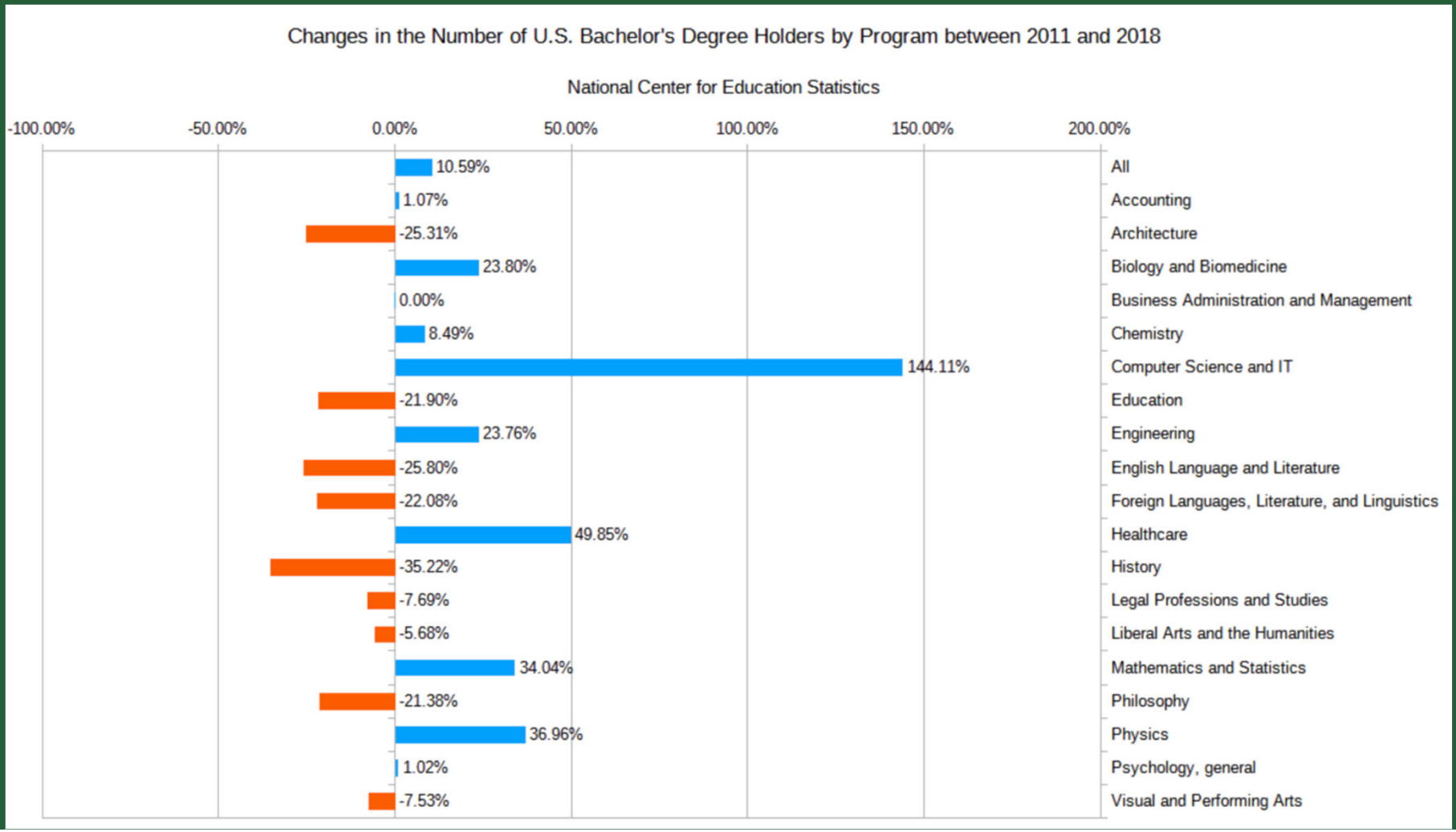
Trends in Higher Education

“Twenty-first-century manufacturing is increasingly sophisticated, using advanced robotics, 3D printing, cloud computing, among other modern technologies, and technologically savvy employees are precisely what employers need.

Four-year university degrees are unnecessary; technical or vocational training, or perhaps apprenticeships would do.”

Source: Mindlin, Alan (October 30, 2019). "Gen Z Is the Answer to the Skills Gap— They Just Don't Know It Yet". Talent. Industry Week. Retrieved November 3, 2019.

Changes in BS degrees 2011-2018



Source: Dutt-Ballerstadt, Reshmi (March 1, 2019). "Academic Prioritization or Killing the Liberal Arts?". Inside Higher Ed. Retrieved March 1, 2021.

UVU™

Class of 2021

87%
Employed

83%
Employed in Utah

79%
Employment related to their degree

UVU Grads Stay!

77% Of UVU Students Live In Utah 10 Years After Graduation.

83% Of UVU Students Live In Utah A Year After Graduation.

SLCC & UVU Surveying Program Enrolments

Survey	2018	2019	2020	2021	2022	2023
Enroll			35	30		42
Gradua						5
Enrollment (AAS)						21

ENROLLMENTS CONTINUE DECLINE

UVU

Past 5 years average 5 graduates

SLCC Catalog 2023-24 states: "The Su… …te of Applied Science degree was discontinued effective …

Geomatics & Surveying Tech.	2007-2010	2011-2015	2016-2018	
Enrollment (approx.)	120	85	60	< 30

SLCC

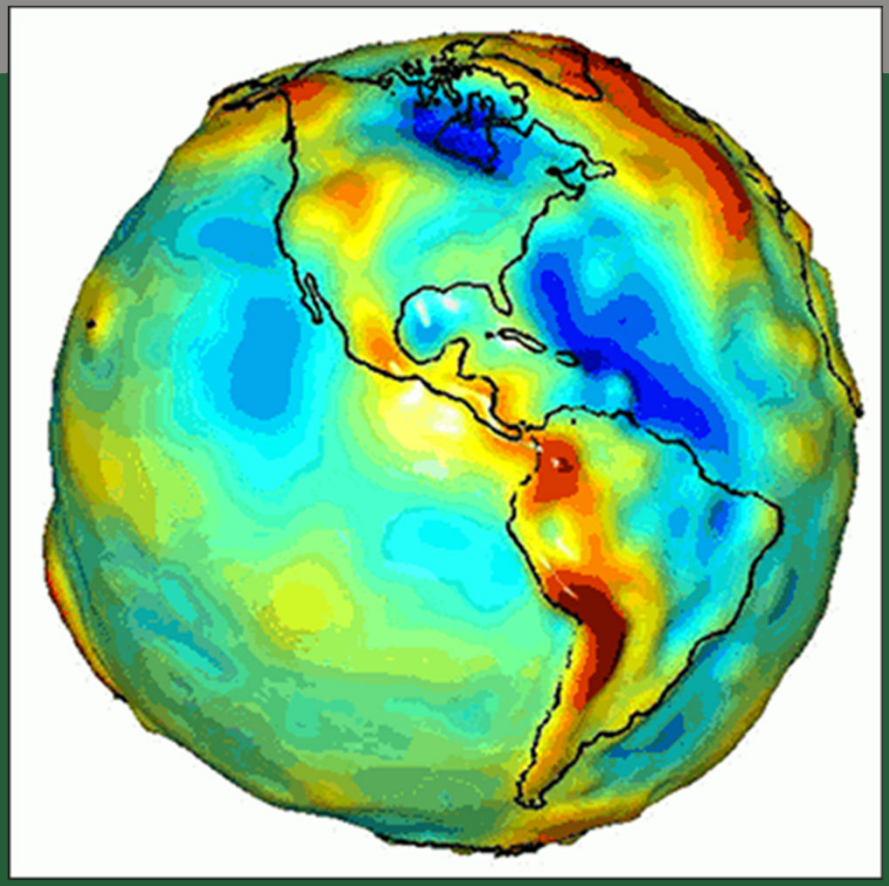
NSPS

Geodesy Crisis

NSPS White Paper to Congress and others

Geodesy Crisis – What is a Geodesist?

- Geodesists are scientists that study the Earth's shape, orientation, and position.
- They determine where things are and where they are going with extreme accuracy.
- They are responsible for the US Global Positioning System (GPS).

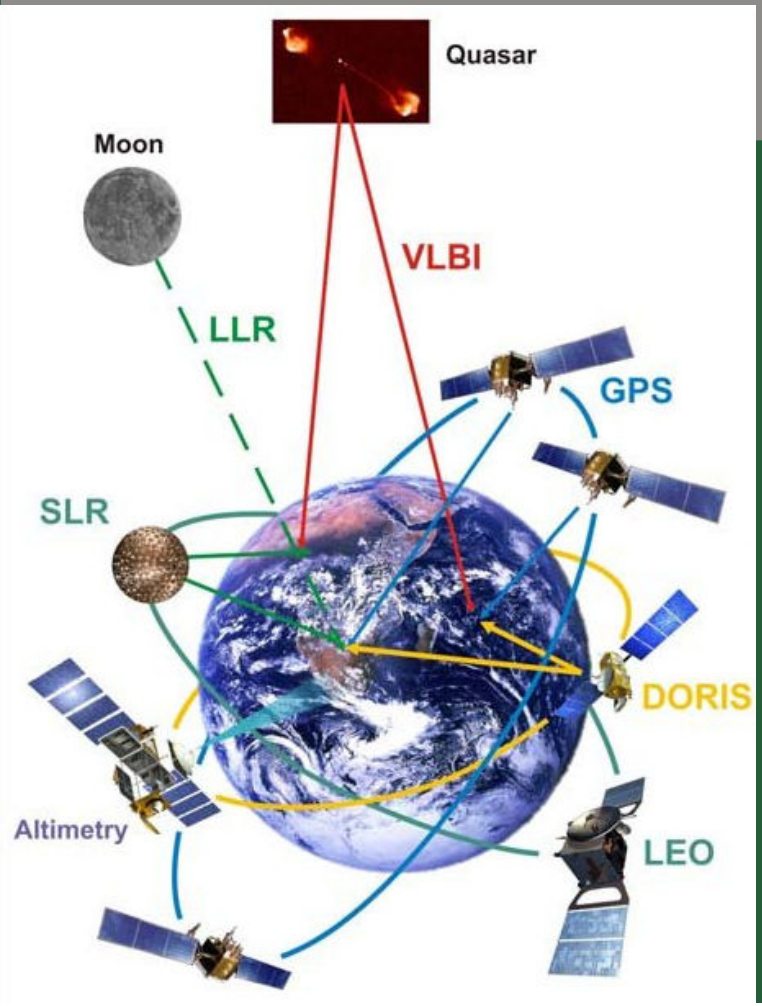


Geodesy Crisis- Current Uses for GPS

GPS provides precise positioning, navigation, and timing for many things we depend on daily such as:

- food production [precision agriculture] - $5,830 (million)*
- professional surveying [productivity gains, cost reductions, and increased accuracy - $48,124 (million)*
- national defense and security
- disaster response
- infrastructure development and maintenance
- telecommunications [improved reliability and bandwidth] - $685,990 (million)*
- electricity [system reliability and efficiency] - $15,730 (million)*
- financial services [transaction timing]
- maritime industries [navigation, port operations, fishing, recreational boating]
- mining [efficiency gains, cost reductions, and increased accuracy] - $12,350 (million)*
- oil and gas [positioning for offshore drilling and exploration] - $45,922 (million)*
- consumer applications [services, and experiences; e.g. Uber] - $215,702 (million)*

Impact of Shortage of Geodesists



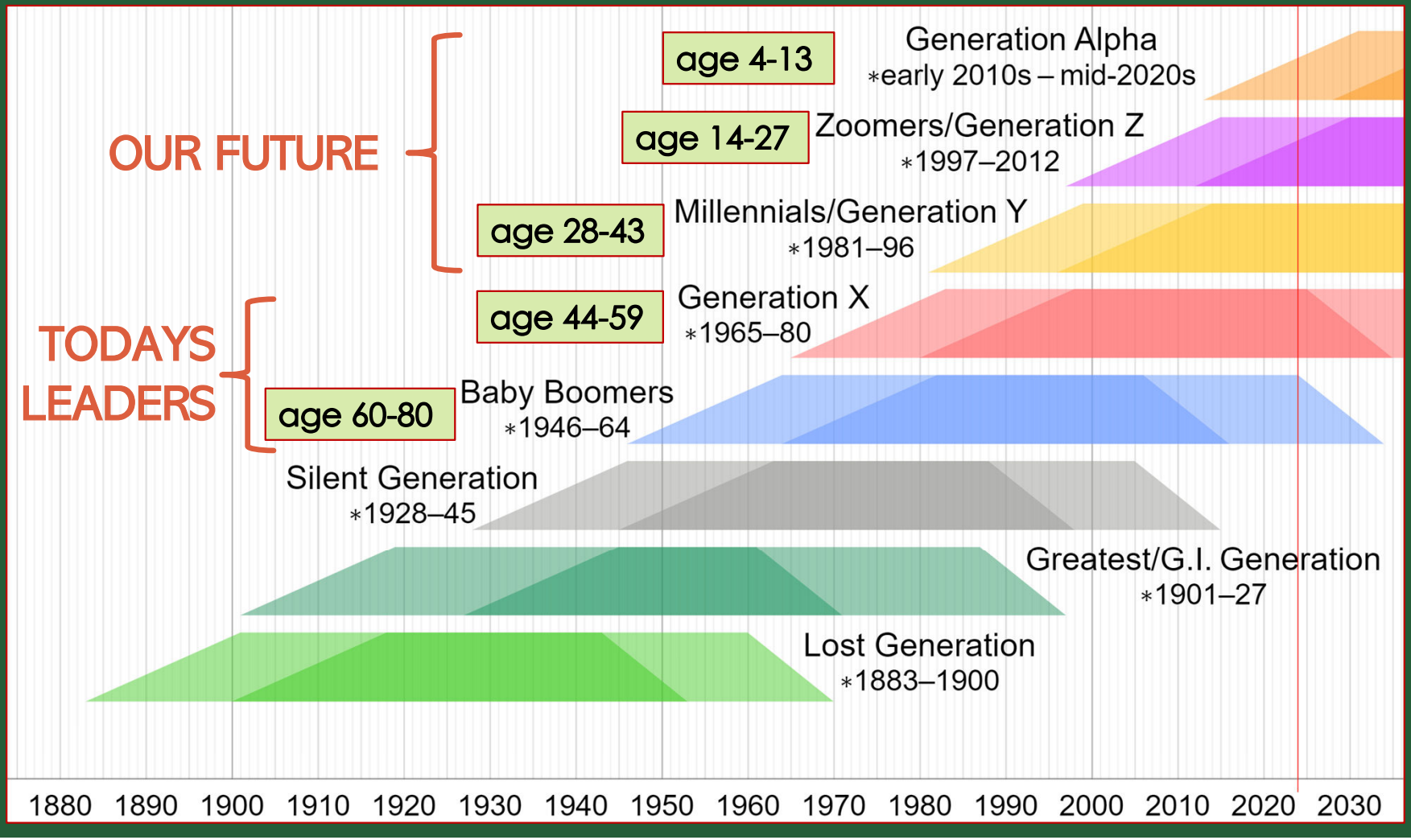
- U.S. will no longer be able to maintain GPS system
- Become dependent on CCP and others for expertise
- U.S. Constitution Article 1, Sec 8, 5 stipulates the Federal Gov. to “fix the Standard of Weights and Measures”
- GPS has generated nearly $1.4 trillion in economic benefits
- Estimated loss of GPS service would be $1 billion per day

Geodesy Crisis- What to do now?

Federal Government could provide funding to …

- Graduate Geodesy programs in the U.S.
- Individuals to study in Geodesy (future Faculty too)
- State funds for Workforce Development Services who can recruit, train, and fund individuals to pursue related undergraduate degrees in preparation for Graduate Programs such as:
  - Geospatial Science
  - Physics
  - Astronomy
  - Mathematics
  - Surveying and Mapping
  - Other Related Disciplines

The Social Generations



What about the Zoomers or GenZer's?

For Gen Zers "the most important qualities in a job are income, fulfillment, work-life balance, and job security. Most prefer to work for a medium or large company rather than a startup or a government agency."

They are our future?

Source: Pandey, Erica (January 21, 2023). "What Gen Z wants to be when they grow up". Axios. Retrieved January 23, 2023, and others.

What about those Boomers?

- 58 is the average age of licensed surveyors in Utah and U.S.
- 60% are over 40 years old.
- Only 10% will remain in the Surveying workforce after 2030.
- Most of the historical survey knowledge will leave with them.
- 75% are the current business/professional decision-makers.

In summary…. So far!

- We have high demand for Surveying and Mapping Services.
- We are living in a major surveying labor shortage which is only going to get MUCH worse.
- Surveying Education is not keeping up with demand
- Attitude toward Higher Education is changing rapidly

Where do we go from here?

A few thoughts and ideas

Workforce Development

Body of Knowledge, Licensure Requirements, and Continuing Education

"Current trends suggest that developments in artificial intelligence and robotics will not result in mass unemployment but can actually create high-skilled jobs. However, in order to take advantage of this situation, one needs a culture and an education system that promote **lifelong learning**. Honing skills that machines have not yet mastered, such as teamwork, [communication, and reliability] will be crucial."

Source: Kasriel, Stephane (January 10, 2019). "What the next 20 years will mean for jobs – and how to prepare". World Economic Forum. Retrieved October 25, 2019.

My Journey through Higher Education

Other Life-Long Learners

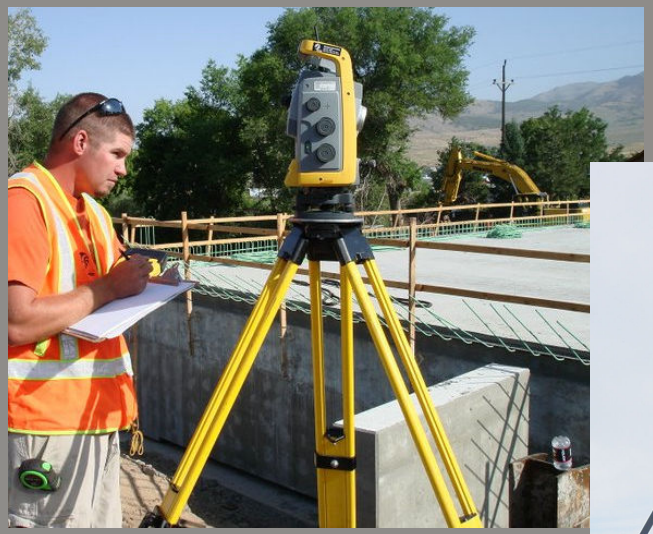
John Stahl

Mike Nadeau

Jeremiah Cunningham

Jeff Stromberg

Tim Johanson



Body of Knowledge (BOK)

Skills, Experience, Education, NCEES Requirements

SKILLS

- Computer and instruments
- Software (CAD, Maps)
- Construction Staking
- Measuring

What is the value of having skills?

EXPERIENCE

- 4 years and 6 years
- Office skills
- Fieldwork skills
- Good Judgement and Common Sense

What is the value of experience?

EDUCATION (formal)

- Gain knowledge that is difficult to obtain on-the-job
- Obtain advanced knowledge and understanding of Why *and* How
- Exposure to new and different ideas/approaches
- Learn how to learn new things: Life-long learning skills
- Learn better Critical-thinking skills- Analysis

What is the value of formal education?

NCEES - Body of Knowledge

NCEES

Fundamentals of Surveying Exam Specifications (110 questions)

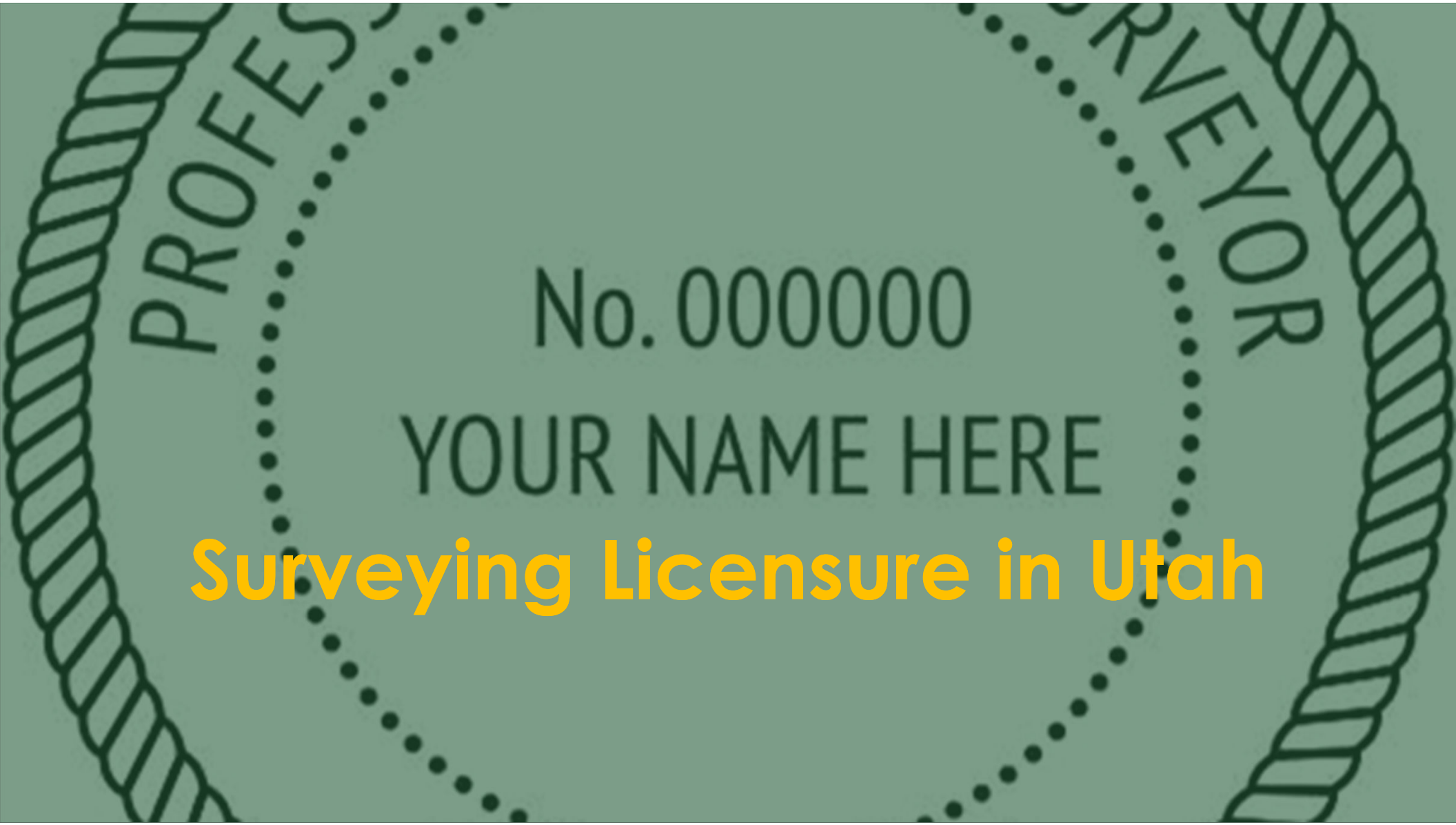
- Surveying Processes and Methods (16-24 Q's- 16%)
- Mapping Processes and Methods (14-21 Q's- 14%)
- Boundary Law and Real Property Principles (19-29 Q's- 19%)
- Surveying Principles (13-20 Q's- 14%)
- Survey Computations and Computer Applications (17-26 Q's- 17%)
- Business Concepts (11-17 Q's- 11%)
- Applied Mathematics and Statistics (10-15 Q's- 9%)

NCEES - Body of Knowledge

NCEES

Principles & Practice of Surveying Exam Specifications (100 Q's)

- Legal Principles (18-27 Q's)
- Professional Survey Practices (22-33 Q's)
- Standards and Specifications (8-12 Q's)
- Business Practices (13-19 Q's)
- Areas of Practice (24-36 Q's)



Surveying Licensure in Utah

Licensure requirements for PLS (Utah Codes)

Experience (Utah Administrative Code R156-22-302)

- 50% Field and 50% Office working under direct supervision of a PLS
- 6 yrs. w/AAS, 4 yrs. w/BS, 3 yrs. w/MS, 2 yrs. w/PhD

Exams (Utah Administrative Code R156-22-302)

- Fundamentals of Surveying (FS)
- Principles & Practice of Surveying (PS)
- Utah Professional Land Surveyor

Education (next slide)

office of
Administrative
Rules

Education Requirements for PLS in Utah

Utah Administrative Code R156-22-302c states: In accordance with State of Utah Code Title 58-22-302(3)(c), … completion of one of the following land surveying programs …:

a) an associate in applied science **(AAS)** degree in land surveying;

b) a bachelor's **(BS)**, master's (MS), or doctorate degree (PhD) in land surveying or geomatics;

c) a bachelor's **(BS)**, master's (MS), or doctorate degree (PhD) in a **field related to land surveying** which includes or is in addition to 30 semester hours of course work in land surveying.

Credentials

- NSPS- CST
- PLS and PE
- ROW
- CFeds
- Certified Mediator
- Certified Water Rights Examiner
- Vendor Certifications (AutoDesk, Carlson, Leica, ESRI, etc.)
- College and University Degrees (Certificate, AAS, AS, BS, MS, PhD)

More Facts about Surveyors

- 60% of Utah PLS's are Utah Residents
- 65% of PLS Utah Residents are UCLS members
- An estimated 1/3 of PLS's licensed in Utah hold an AAS degree
- An estimated 2/3 of PLS's licensed in Utah hold a BS degree or higher

- ❑ 720 PLS's licensed in Utah
- ❑ 436 PLS's licensed in Utah are Utah residents
- ❑ 285 PLS's in Utah are members of UCLS

Source: Utah Division of Professional Licensing (DOPL) and Utah Council of Land Surveyors (UCLS) and Todd Jacobsen Survey taken December 2023 Data

Survey Ed. Requirements- Other States

Western State	Minimum Education Required (Yrs)	Total Years Education & Exp. Required	3 Exams: FS, PS, State License
California	2	6	Yes
Colorado	2	6	Yes
Hawaii	2	7	Yes
Montana	2	8	Yes
Nevada	***2***	6	Yes
Utah	***2***	8	Yes
Wyoming	***2***	8	Yes
Arizona	***4***	6	Yes
Idaho	***4***	8	Yes
New Mexico	***4***	8	Yes
Alaska	4	8	Yes
Oregon	4	8	Yes
Washington	4	8	Yes

Summary- Developing our Workforce

- Develop a workforce of life-long learners
- Understand the Body of Knowledge required:
  - Skills
  - Experience
  - Education
  - Credentials

What is our future?

UCLS

UTAH COUNCIL OF LAND SURVEYORS

1960

Education Survey

2 minutes right now!

What can we do for the Future of Surveying in Utah?

- Revise licensure laws
  - Require BS degree (comparable to other Prof. Services)
  - Require Certification (CST) of ALL survey technicians (construction, etc.)
  - Increase the Rigor of our Continuing Education Requirements
- Start High School students at Applied Technology Centers
- Increase the publicity of the Surveying Profession

What can YOU Do?

ABET
Applied and Natural Science Accreditation Commission

UVU SURVEYING & MAPPING
UTAH VALLEY UNIVERSITY

Survey Education in Utah -Program Overview

www.uvu.edu/aed/surveying

Program Mission

ABET Applied and Natural Science Accreditation Commission

Provide a strong foundation of principles and practices of the surveying profession to prepare competent surveyors, mappers, and civil designers who serve the regional and global community.

What's the Difference between an AAS an AS and a BS degree?

Associate in Applied Science (AAS)

The AAS degree is about ***HOW*** (skills only)

- 63 semester credits minimum
- Overall grade point average of 3.0 (B) or above
- 20 credit Residency hours
- Completion of department General Education requirements;
- Completion of specific department major requirements.
- Considered to be a Terminal Degree (typically not stackable to BS)

Associate in Science (AS) degree

- **AS** is intended to be the first two years of a BS degree
- **AS** stacks directly into the BS degree
- **AS** completes ALL General Education requirements for the BS degree
- **AS** contains entry level courses included in a BS degree
- **AS** **Does not** complete the educational requirements for licensure

Bachelor of Science Degree (BS)

The BS degree is about ***WHY*** (principles, theories, and skills)

- 120 total semester credits minimum including the following:
- 30 credit Residency hours
- Completion of specific Surveying and Mapping requirements
- 40 credit hours is upper division courses (3000-4000 level)
- Completion of General Education requirements (36) (soon to be 30)
- Completion of Global/Intercultural Requirement course (3)
- GPA 3.0 (B) Surveying and Mapping program minimum

UVU SURVEYING & MAPPING

Comparing the BS and AAS degrees

Bachelor of Science Degree

Everything in the AAS degree PLUS more GE (12) and the following:

- LEGL 3000 Business Law
- SURV 3030 Land Dev., Planning, and Platting
- SURV 3010 Measurement Analysis & Adjustments
- SURV 3210 Advanced Photogrammetry
- SURV 3230 Construct. & Route Surveys
- SURV 3220 Control Surveys
- SURV 3250 Geodesy
- SURV 3340 Boundary Law
- SURV 3400 Emerging Surveying & Mapping Technologies
- GIS 3620 Advanced Geographic Information Systems
- GIS 3630 GIS Development Applications
- SURV 4340 Surveying Legal Principles
- SURV 4500 Professional Services Practicum
- SURV 451R Surveying & Mapping Lecture Series
- SURV 455G Global Prof. Ethics and Liabilities
- SURV 4700 Fundaments of Surveying (FS) Exam Prep
- SURV 4930 Surveying & Mapping Capstone

Associate in Applied Science

GE (18): Public Speaking, Geography, Physics, Algebra and Trigonometry, and Written Business Communications

- SURV 1020 Introduction to Surveying and Mapping
- SURV 1030 Fundamentals of Geodesy and Control Surveys
- EGDT 1040 Fundamentals of Tech Eng. Drawing (AutoCAD)
- SURV 1220 Remote Sensing & Photogrammetry
- SURV 1340 Fundamentals of Boundary Law
- EGDT 1400 Survey Field Techniques I
- SURV 2100 Mapping from Field to Finish
- SURV 2240 Fundamentals of Adjustments and Computations
- SURV 2310 Surveying US Public Lands
- SURV 2320 Public Records and Property Descriptions
- SURV 2350 Ethics and Liabilities for Surveyors
- GIS 2800 Intro. to Geographic Information Systems

UVU SURVEYING & MAPPING

Stackable Degrees and Certificates

Bachelor of Science Degree – Surveying and Mapping (ABET)

Associate of Science (AS) Degree – Surveying and Mapping

(AAS) Degree Surveying Technology

GIS Certificate

Hosted by Earth Science

Surveying Technology Certificate

Questions? and Comments?

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