SAWE Southeast Region Presents!

SPECIAL EVENT IN SAVANNAH - DINNER WITH THE PRESIDENT

MR. WILLIAM BOZE – INTERNATIONAL SAWE PRESIDENT & EXECUTIVE DIRECTOR ELECT

William Boze
International SAWE President
Huntington Ingalls Industries

SOCIETY OF ALLIED WEIGHT ENGINEERS

Aerospace • Marine • Offshore • Land Vehicle • Allied Industries

Vic's ON THE RIVER Restaurant & Bar

Society of Allied Weight Engineers — N, W, E, S — Southeast Region

"Everything You Wanted to Know About Mass Properties Engineering but Were Afraid to Ask"

Gulfstream
A GENERAL DYNAMICS COMPANY

Society of Allied Weight Engineers, Inc.

Aerospace • Marine • Offshore • Land • Allied Industries

A Proud Chapter of the Society of Allied Weight Engineers, Inc.

4th Quarter Dinner Meeting

December 13, 2018

Agenda

- Welcome
- 2018 Chapter Accomplishments/Status
- International Topics
- Dinner
- International President’s Presentation
- Next Meeting Discussion
- Close

Our Chapter History

1982

Our Beginnings

In 1982 the Atlanta Chapter of the Society of Allied Weight Engineers was created to serve those Mass Properties Engineers primarily affiliated with Lockheed Martin and Delta Airlines in the Atlanta area. The chapter included members with backgrounds in military transport and fighter aircraft, as well as airline operations.

2011

Expansion

As the membership shifted away from Atlanta, a new focal point was created in Savannah, Georgia to serve those primarily at Gulfstream Aerospace, as well as others in the commercial aircraft and space community. The Chapter was renamed and expanded to include all of Georgia, South Carolina, and North Carolina.

PRESENT

Welcoming New Members

Our Chapter welcomes all those interested in estimating, calculating, managing and measuring the mass properties of all types of products from the aerospace, land, offshore, marine and other allied industries. We are especially excited that members from Boeing in South Carolina are now part of our chapter. Our goal is to provide our members a place to meet others in the Mass Properties field, and share ideas, innovations and opportunities.

Our Chapter Leadership Team

OFFICERS

Our Current Leadership Team

Damian Yanez
International Director

Farid Farizy
President

Tom Tanner
Vice President

Luis Alberto Lopez
Secretary

Dell Ruff
Treasurer

Who is SAWE?

- **We are a Non-Profit International Organization of Mass Properties Engineers founded in 1939**
- **Our Purpose:**
  - To promote the Mass Properties discipline
  - To provide a medium for exchanging recommended practices based on experience and innovation
  - To foster technical excellence and superior quality in mass properties prediction, control and validation
- **22 Chapters in the US, Canada, South America, UK and Europe**
- **15 Corporate Members and Partners**

Industries Served by SAWE

- **Initially - Society of Aeronautical Weight Engineers**
- **1973 - Renamed Society of Allied Weight Engineers to include:**
  - Aerospace – aircraft, missiles, space, electronics, …
  - Marine – surface, cargo, submarines, …
  - Offshore Platforms – oil and gas, launch/landing, …
  - Land Vehicles – automotive, armored, construction, …
  - Allied Industries – scales, equipment, software, …






Why is Mass Properties Control important?

- **Weight, Center of Gravity, Moments and Products of Inertia are *critical* for vehicle safety and performance**

Why is SAWE important?

- **Mass Properties discipline often overlooked**
  - Not specifically in college curriculum even though it is integral to every product and system
  - Companies mistakenly think CAD can do it all
  - Inadequate staffing/skills increases program risk
  - Aging workforce in this crucial discipline
    - 62% retiring over next 10 years*
- **SAWE provides:**
  - Proven processes and experience for mass properties control
  - Educational resources for ensuring a skilled workforce
  - International collaboration between industry and governments
  - Venue for sharing and discovering new methods and lessons learned

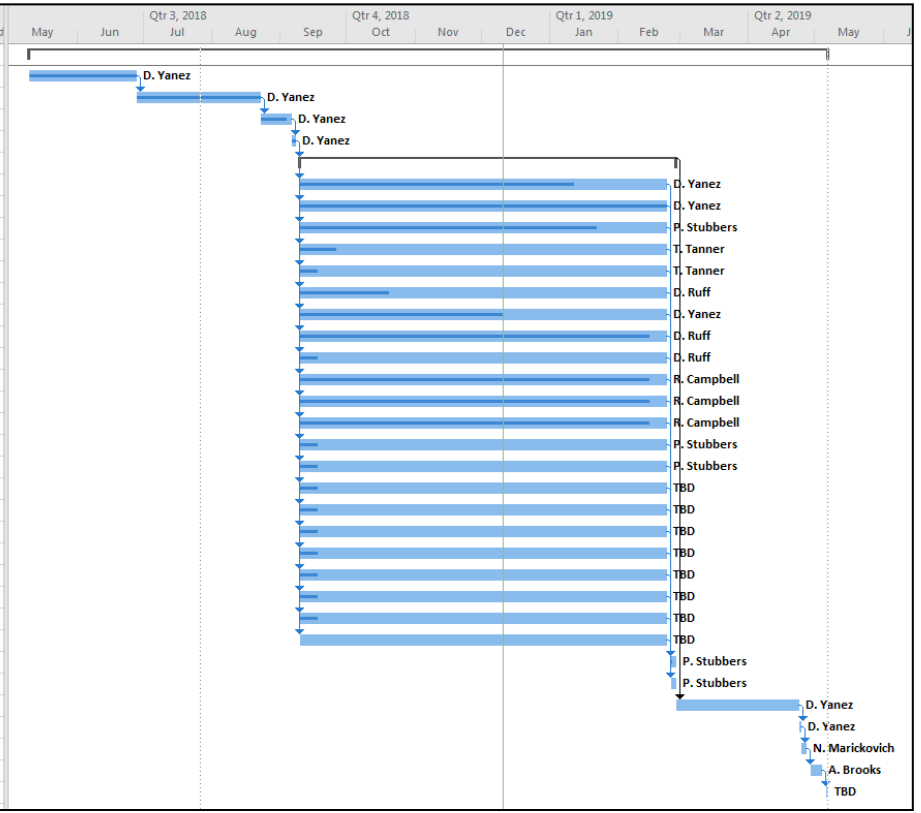
The Health of Mass Properties Engineering - 2018 Industry Survey

2018 Chapter Status/Accomplishments

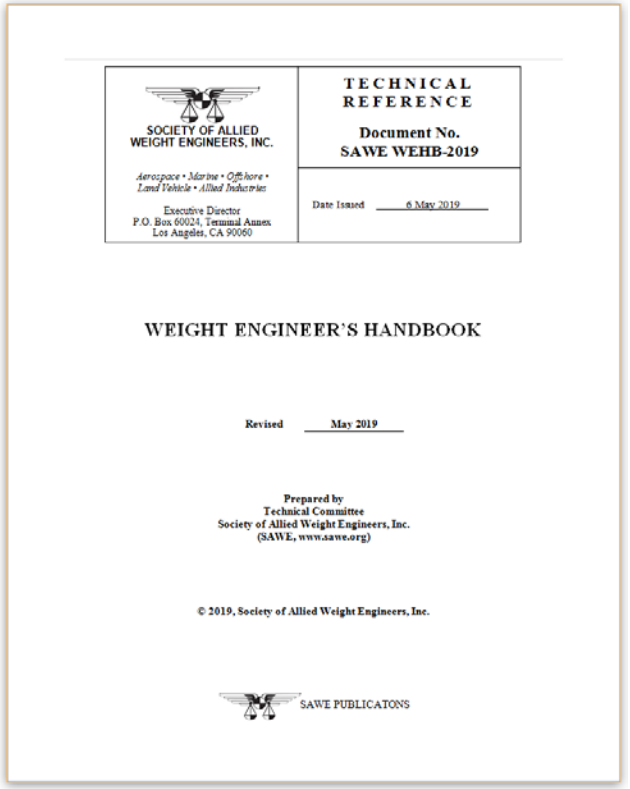
- **Membership**
  - 16 Members on Roster and 2 from Other Chapters
  - 5 New Members this year
    - Gulfstream: Peter Stubbers, Ross Campbell, Isabelle Chavarie, Khanh Tien Hoang
    - Boeing SC: Lynn Seegers
- **New Website Operational** SERSAWE.ORG
- **Held 4 Chapter Meetings and 10 Officer's Meetings**
- **Chapter Project – Handbook Update**
  - Goal – Complete by May International Conference
  - 5 member team making good progress, but falling behind a bit

Handbook Status

	% Complete	Task Name	Duration	Start	Finish	Resource Names
1	**37%**	**Update SAWE Handbook**	**258 days**	**Thu 5/10/18**	**Mon 5/6/19**	
2	100%	Collect files and post on Group Office	35 days	Thu 5/10/18	Wed 6/27/18	D. Yanez
3	100%	Decide on new format	2 mons	Thu 6/28/18	Wed 8/22/18	D. Yanez
4	75%	Solicit Volunteers for each Section	2 wks	Thu 8/23/18	Wed 9/5/18	D. Yanez
5	100%	Conduct a Kickoff Meeting to ensure consistency	2 days	Thu 9/6/18	Fri 9/7/18	D. Yanez
6	**35%**	**Perform updates and verify**	**122 days**	**Mon 9/10/18**	**Tue 2/26/19**	
7	75%	Cover Page & Acknowledgements	6 mons	Mon 9/10/18	Fri 2/22/19	D. Yanez
8	100%	Section 1 - Units	6 mons	Mon 9/10/18	Fri 2/22/19	D. Yanez
9	80%	Section 2 - Section Properties	6 mons	Mon 9/10/18	Fri 2/22/19	P. Stubbers
10	10%	Section 3 - Material Properties	6 mons	Mon 9/10/18	Fri 2/22/19	T. Tanner
11	5%	Section 4 - Component Properties	6 mons	Mon 9/10/18	Fri 2/22/19	T. Tanner
12	25%	Section 5 - Mass Properties Calculation	6 mons	Mon 9/10/18	Fri 2/22/19	D. Ruff
13	55%	Section 6 - Mass Properties Measurement	6 mons	Mon 9/10/18	Fri 2/22/19	D. Yanez
14	95%	Section 7 - Loads	6 mons	Mon 9/10/18	Fri 2/22/19	D. Ruff
15	5%	Section 8 - Strength	6 mons	Mon 9/10/18	Fri 2/22/19	D. Ruff
16	95%	Section 9 - Structural Dynamics	6 mons	Mon 9/10/18	Fri 2/22/19	R. Campbell
17	95%	Section 10 - Aerodynamics	6 mons	Mon 9/10/18	Fri 2/22/19	R. Campbell
18	95%	Section 11 - Propulsion	6 mons	Mon 9/10/18	Fri 2/22/19	R. Campbell
19	5%	Section 12 - Thermodynamics	6 mons	Mon 9/10/18	Fri 2/22/19	P. Stubbers
20	5%	Section 13 - Space Flight Mechanics	6 mons	Mon 9/10/18	Fri 2/22/19	P. Stubbers
21	5%	Section 14 - Crew Systems	6 mons	Mon 9/10/18	Fri 2/22/19	TBD
22	5%	Section 15 - Power Systems	6 mons	Mon 9/10/18	Fri 2/22/19	TBD
23	5%	Section 16 - Mathematics	6 mons	Mon 9/10/18	Fri 2/22/19	TBD
24	5%	Section 17 - Marine Vehicles	6 mons	Mon 9/10/18	Fri 2/22/19	TBD
25	5%	Section 18 - Land Vehicles	6 mons	Mon 9/10/18	Fri 2/22/19	TBD
26	5%	Section 19 - Miscellaneous	6 mons	Mon 9/10/18	Fri 2/22/19	TBD
27	5%	Section 20 - Communications	6 mons	Mon 9/10/18	Fri 2/22/19	TBD
28	0%	Additional Sections	6 mons	Mon 9/10/18	Fri 2/22/19	TBD
29	10%	Table of Contents	2 days	Mon 2/25/19	Tue 2/26/19	P. Stubbers
30	0%	Index	2 days	Mon 2/25/19	Tue 2/26/19	P. Stubbers
31	0%	Conduct a thorough review of content and format	2 mons	Wed 2/27/19	Tue 4/23/19	D. Yanez
32	0%	Post final document to Group Office	1 day	Wed 4/24/19	Wed 4/24/19	D. Yanez
33	0%	Deliver document file to publisher	2 days	Thu 4/25/19	Fri 4/26/19	N. Marickovich
34	0%	Update SAWE Website links as required	1 wk	Mon 4/29/19	Fri 5/3/19	A. Brooks
35	0%	Notify Membership that Update is available	1 day	Mon 5/6/19	Mon 5/6/19	TBD



Handbook Sample



SOCIETY OF ALLIED WEIGHT ENGINEERS, INC.

Aerospace • Marine • Offshore • Land Vehicle • Allied Industries

Executive Director
P.O. Box 60024, Terminal Annex
Los Angeles, CA 90060

TECHNICAL REFERENCE

Document No. SAWE WEHB-2019

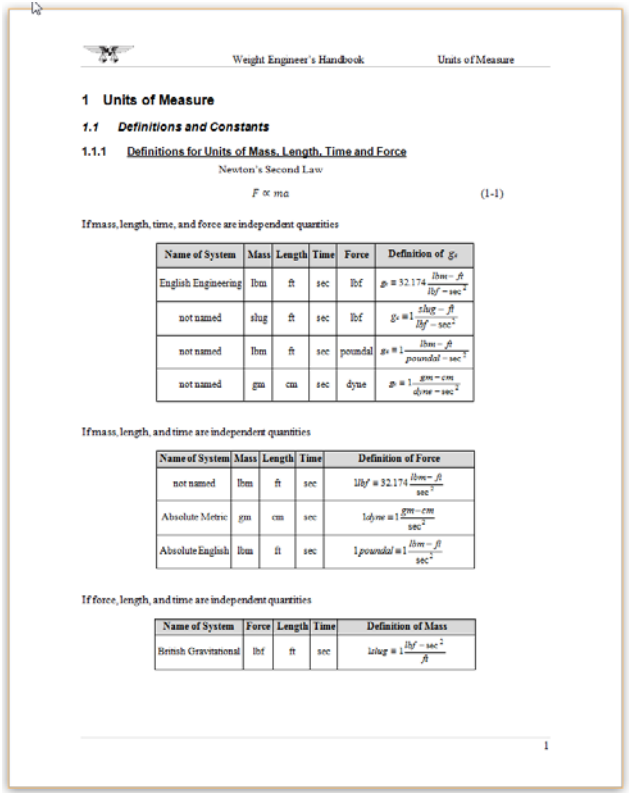
Date Issued 6 May 2019

WEIGHT ENGINEER'S HANDBOOK

Revised May 2019

Prepared by
Technical Committee
Society of Allied Weight Engineers, Inc.
(SAWE, www.sawe.org)

SAWE PUBLICATONS



1 Units of Measure

1.1 Definitions and Constants

1.1.1 Definitions for Units of Mass, Length, Time and Force

Newton's Second Law

$$F \propto ma \qquad (1\text{-}1)$$

If mass, length, time, and force are independent quantities

Name of System	Mass	Length	Time	Force	Definition of g_c
English Engineering	lbm	ft	sec	lbf	$g_c = 32.174 \frac{lbm - ft}{lbf - sec^2}$
not named	slug	ft	sec	lbf	$g_c = 1 \frac{slug - ft}{lbf - sec^2}$
not named	lbm	ft	sec	poundal	$g_c = 1 \frac{lbm - ft}{poundal - sec^2}$
not named	gm	cm	sec	dyne	$g_c = 1 \frac{gm - cm}{dyne - sec^2}$

If mass, length, and time are independent quantities

Name of System	Mass	Length	Time	Definition of Force
not named	lbm	ft	sec	$1lbf = 32.174 \frac{lbm - ft}{sec^2}$
Absolute Metric	gm	cm	sec	$1dyne = 1 \frac{gm - cm}{sec^2}$
Absolute English	lbm	ft	sec	$1 poundal = 1 \frac{lbm - ft}{sec^2}$

If force, length, and time are independent quantities

Name of System	Force	Length	Time	Definition of Mass
British Gravitational	lbf	ft	sec	$1slug = 1 \frac{lbf - sec^2}{ft}$

Treasurer’s Report

- **Current Balance = $2,225.90**
  - Includes domain renewal
  - Includes ticket proceeds for this meeting
  - Does not include costs for this meeting

International Topics

- **Damian supporting individual and corporate recruitment efforts**
  - Presented *Welcome to SAWE*
    - Corporate Steering Committee Web Meeting, Sep 27, 2018
    - Hampton Roads Regional Conference, Nov 30,2018 Norfolk, VA
    - International Conference, May 18-23, 2019 Norfolk, VA
- **Call for Papers - Abstracts due ASAP**
- **Award Nominations due ASAP**
- **MPE Certification being researched**

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4th Quarter Dinner Meeting

December 13, 2018

Presentation

Everything You Wanted to Know About Mass Properties Engineering but Were Afraid to Ask

William Boze

International SAWE President

Huntington Ingalls Industries

Introduction – William “Bill” Boze

- **Current SAWE International President, and Executive Director Elect (May 2019)**
- **As a naval architect, he has more than 35 years of ship design and construction experience with Huntington Ingalls Industries Newport News Shipbuilding division encompassing research and development, design, construction, overhaul, fleet support, and disposal of ship platforms, principally submarines and aircraft carriers.**
- **Honorary Member of the Society of Allied Weight Engineers, and a former Society of Naval Architects and Marine Engineers Ship Design Committee Panel Chair for Mass Properties.**

What is the profile of a Mass Properties Engineer (MPE)?

By use of tact and diplomacy, he is able to contribute many useful ideas to the program and infuse his fellow engineers with his enthusiasm for mass properties control.

Why must everyone be enthusiastic about mass properties control?

"If a serious error were made in the estimate of either the value of the weight or the position of the center of gravity during the Preliminary Design Stage, ***serious delay or abandonment of the whole design may be involved****."*

Thomas. C. Gillmer

Naval Architect and Author

(Annapolis, 1 May 1959)

How can mass properties impact a program?

- **Aircraft Flight Qualities are affected by the mass properties of the vehicle design**
  - Range, mission radius, time on station, maneuverability, speed, take-off performance, landing performance, etc.

Example: $\text{Range} = (L/D)(V/sfc)\ln(W_i/W_f)$

- (L/D): **A measure of Aerodynamic Efficiency**
- (V/sfc): **A measure of Propulsion Efficiency**
- $\ln(W_i/W_f)$: **A measure of Airframe Weight Efficiency**

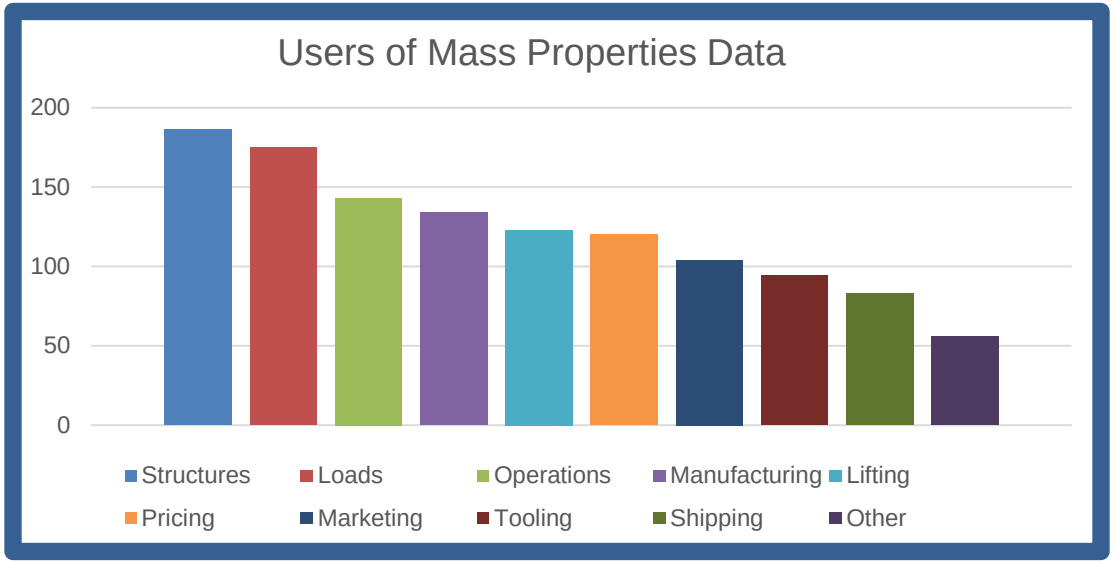
Safety of Flight is impacted by the center of gravity and weight of the vehicle

What is the value of a Mass Properties Engineer (besides the obvious)?

- **Mass Properties Engineers:**
  - Understand that any program has to have a balanced design (not just the lowest weight)
  - Have knowledge of the total design and operation of the system
  - Are in the best position to offer solutions to cross discipline problems
  - Perform system integration and configuration management as part of their process
  - Always view the vehicle with and eye on product delivery
  - Identify technical or program risks

Who are the users of MPE data?

- **Mass Properties Engineers are not there just to get their own tasks done:**
  - They assist many others that are dependent on their data
  - Provide direct design input
  - Ensure everyone is working from the same data



SAWE 2018 Survey Results

Customers of MPE are many; Structures and Loads are greatest but many others strongly rely on MP products

Are there potential risks to overlooking a mass properties detail?

Mistakes could potentially lead to public humiliation, or worse, the death of many innocent people

https://www.bing.com/videos/search?q=Massive+Ship+Launch+Fail&&view=detail&mid=396D7D37C8E409265DE6396D7D37C8E409265DE6&&FORM=VRDGAR

Are Mass Properties Engineers Still Needed?

Year	Problem	Consequence
2015	Package needs to shed weight	3 Contracts Issued for Weight Reduction Study
2014	Vehicle overweight and late in delivery	Buyer Cancels Entire Order
2013	Vessel overweight	Millions of dollars spent to assess issue; Correction could cost a billion euros
2013	Vehicle overweight because components exceeded weight threshold	Program Cancelled
2009	Increasing weight and cost	Program Cancelled
2008	Vessel weight increases at dramatic rate	Hull modified after delivery to meet stability criteria
2007	17 vehicle mishaps	Study reveals mass properties issues were a factor
2006	Contractor unable to properly forecast weight issues	Platform insufficient due to weight constraints

Worldwide News Reports say Yes!

What concerns are there for MPE's today?

- Many people believe myth that MPE is a "push button" product of CAD/product modeling systems.
- MPEs often seen as "bean counters" or accountants rather than "real engineers."
- Program Management often does not understand MP resulting in discipline being shunted from one org to another.
- Widespread cost-cutting often hits MPE harder than other disciplines.
- Lack of recognition means mass properties often experiences lack of sufficient budget to perform the job.

Shouldn't management already know the value of MPE's?

- **"While it may be painfully obvious to a Mass Properties Engineer that Mass Properties Engineering is a critical process for the success of a program, it is not enough to think that it should be as apparent to anyone else."***
  - Mass Properties Engineers must explain:
    - The what, the why, and the how of our discipline, as well as for whom
    - Why a Mass Properties Engineer is best suited to the task
  - Mass Properties Engineers must show:
    - What value is brought to the program
    - How in following our proven processes, program goals and objectives will more easily be met

Above all, giving solutions will go much farther in management's eyes than harping on problems

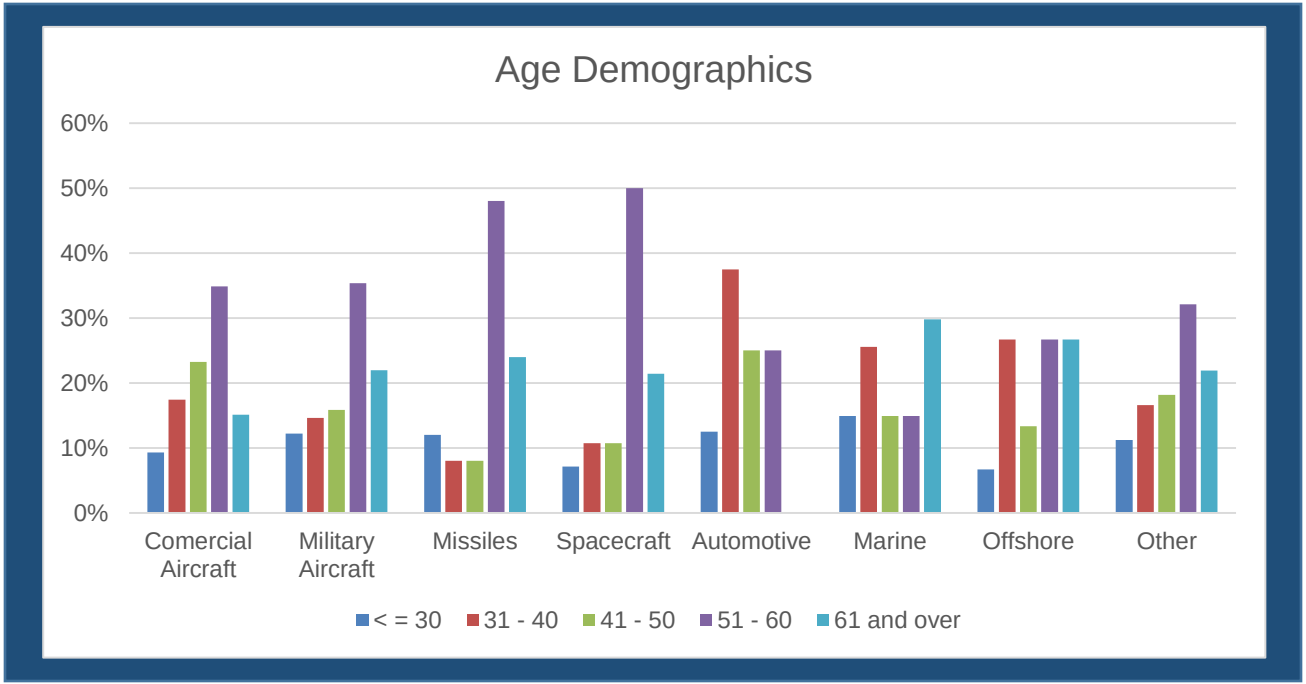
*Source – Belt, SAWE Paper 3300 – The Value of Mass Properties Engineering,, 2003

What aside from MPE concerns should management be uncomfortable with?

- **Nearly 2 out of 3 MPEs plan to retire within the next 10 years**
- **By 2028, it is forecast that 50% of MPEs will have 0 to 5 years experience**
- **This will create a workforce impact that will result in:**
  - A serious degradation in mass properties capability and knowledge
  - Higher program risk
  - Lessons will have to be relearned the hard way

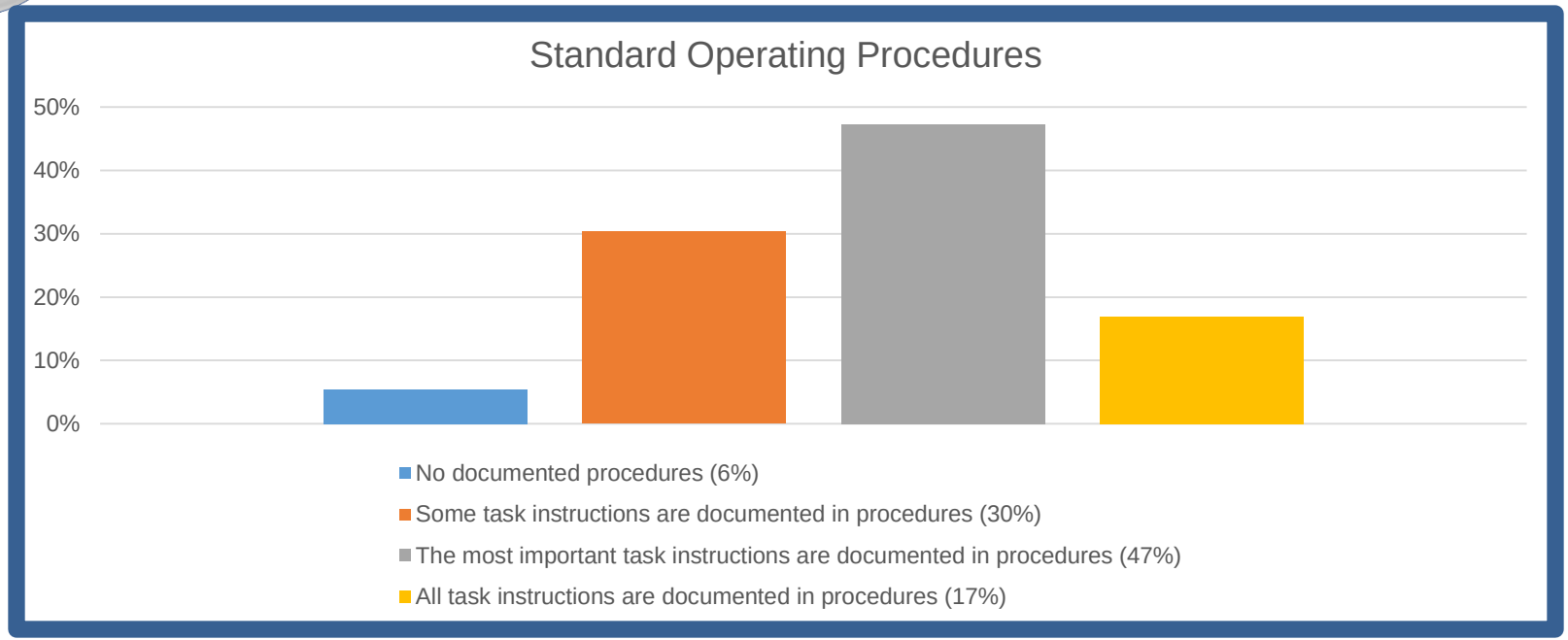
Steps must be taken soon to address this wave of retirements to eliminate negative effects

Is the future exodus in any one industry?



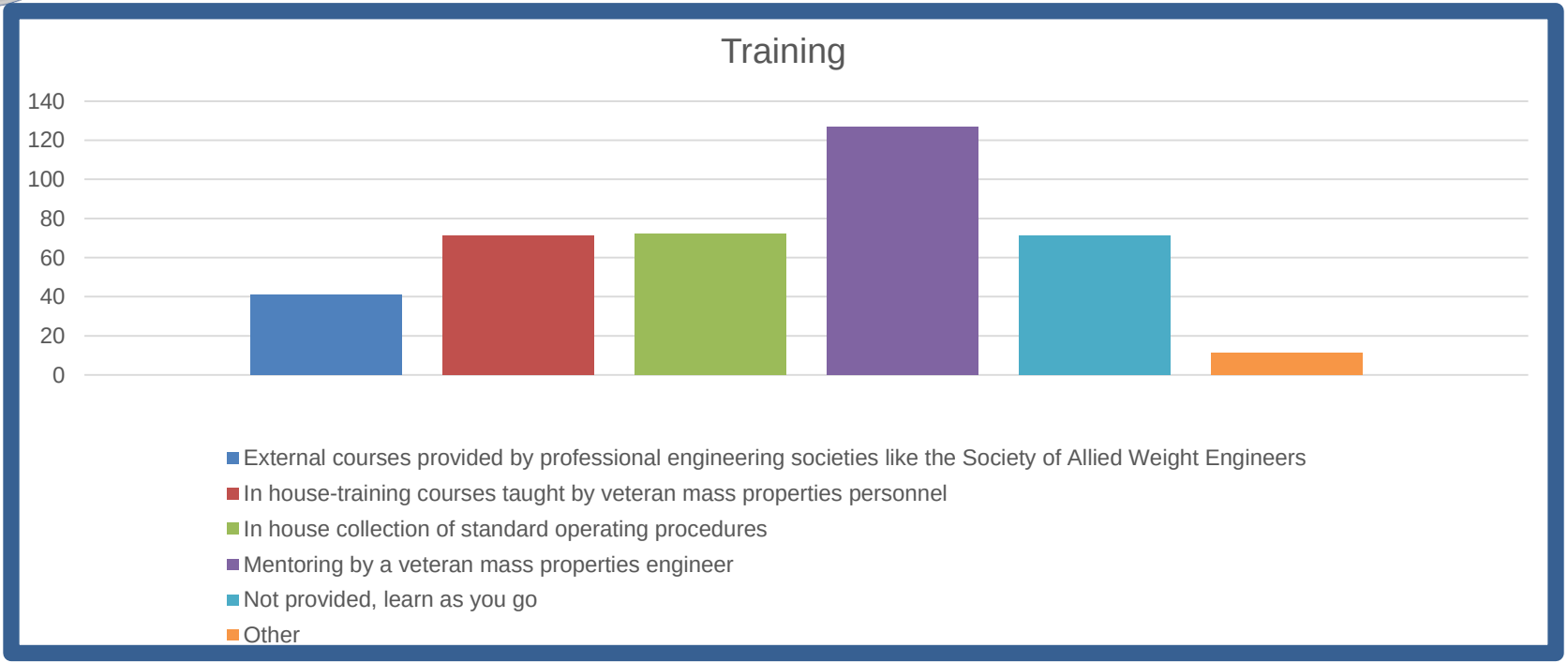
All industries are affected

Isn’t MPE knowledge available on the WWW?



Only 17% of respondents report having complete documentation of MPE practices

What is the most common means for MPE knowledge exchange?



Mentoring is key to knowledge transfer

Why is mentoring so important?

- **Mentors:**
  - Provide information, knowledge and guidance
  - Find ways to stimulate our personal and professional growth
  - Offer encouragement and help us keep going
  - Act as sounding boards for an unfiltered opinion
  - Are trusted advisors
  - Can be connectors
  - Have a wealth of experiences to help us avoid reinventing the wheel.
  - Are free, making them priceless in more ways than one

Having a mentor is not a sign of weakness; it shows you are smart enough and driven enough to succeed

Source: John Rampton, Jan 9, 2016

Conclusions to be drawn from Industry Survey

- **We Still Need Mass Properties Engineers and Service Providers**
  - 10 vehicle mass property failures with significant consequences cited over the past 15 years, and there likely were many more.
  - We must educate management on the importance of mass properties and relate how mass properties is directly linked to vehicle performance and contractual compliance.
- **We need to encourage and accelerate the transfer of knowledge that is leaving due to retirements**
  - A large percentage of degreed and experienced mass properties engineers will be leaving or retiring within the next ten years (62% based on this survey).
  - While the critical knowledge or processes have been mostly documented, there is much that hasn't been documented. This knowledge leaves as veterans retire.

So how is SAWE responding to the survey?

- SAWE has compressed the results of the industry survey and captured the salient points and graphs in a 23-slide presentation deck (available on our SAWE blog page)
- SAWE has featured articles within it's published Journal featuring SAWE Fellows and Honorary Fellows telling their career story and how mentors and mentoring has been an important part of their career
- SAWE has created a 21-slide presentation package for introducing SAWE to students, professionals, and organizations (available on our SAWE blog page)
- SAWE proposed and presented to the SAWE Corporate Steering Council a proposal to offer American National Standards Institute (ANSI) accredited Mass Properties Engineering certifications (Preliminary construct to be presented at the International Conference in May 2019)

So why belong to a society like SAWE?

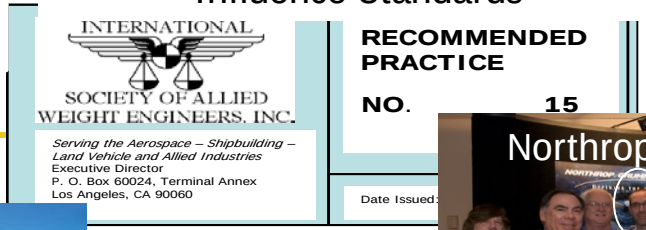
- Joining a society is an investment in yourself
- You get out of it what you put into it
- Contribute without expecting anything in return
- “Have something to bring to the table, because that will make you more welcomed” – Dr. Randy Pausch
- “Luck is what happens when preparation meets opportunity” – Seneca (Roman Philosopher, 5 BC)
- It will help you make a difference!

“The brick walls are there to stop the people who don’t want it badly enough.” – Randy Pausch

I'm in Chapter 12

Influence Standards

Have your work published



Software Development

Capture Knowledge

Vendor Product Awareness

Benchmarking

Will a MPE ever make a lot of money?

- Postulate 1: Knowledge is Power.
- Postulate 2: Time is Money.
- Every engineer knows that: Power = Work/Time
- So, since: Knowledge = Power,

  then Knowledge = Work / Time,
- And since, Time = Money

  then Knowledge = Work / Money
- Solving for Money, we get: Money = Work/Knowledge

Moral: The more you know the harder you have to work

Will a MPE ever become a celebrity?

- **Unlikely!**

Dina Lohan: “So AJ, what do you do for a living now?” (when asked at his high school reunion)

AJ: “I’m a naval architect and build ships!” (boasting proudly)

Dina Lohan: “Well I guess somebody has to do it.” (as she turns and walks away…..)

Will a MPE ever drive fashion trends?

- **Engineers have no fashion sense**

Without Supervision

With Supervision

So why be a MPE?

Answer:

So we can work on really cool stuff…

Answer Continued:

And work with great people…

And potentially appear on television

Plus share in the trust, passion, commitment, and belief that as a collaborative unit, we can achieve a solution, product, or capability greater than anyone of us can accomplish individually

Next Meeting

- **Officer's Meeting in January**
  - Plan 2019 Chapter schedule
    - 4 Quarterly Meetings, Monthly Officers' Meetings
- **1st Quarter Lunch Meeting in March**
  - Gulfstream?