

COMMENCEMENT ADDRESS
DEPARTMENT OF AEROSPACE AND MECHANICAL ENGINEERING
UNIVERSITY OF NOTRE DAME
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Professors Tryggvason, Goodwine, and Seelinger,—faculty, parents, and friends,— and especially the 2012 graduating class of Aerospace and Mechanical Engineering seniors, it is an honor to address you today. In fact, knowing that several here on stage have excelled in delivering this address with wit and wisdom in years past makes this a little daunting.—That’s code for “My jokes just aren’t that good!”—If you don’t become resigned to *that* by the time this address is over, talk to any of the seniors here, who will draw upon experience in dozens of my lectures to verify.

Most of those seniors likely remember a cold day in January 2010 at 8:30 AM when we first met. They were then sophomores enrolled in AME 20231, Thermodynamics. While I have taught at Notre Dame for twenty-three years, I had never taught a class required of all the sophomores, and never had a class with over one hundred students. It was not clear what to expect and was in fact more daunting than today. The seniors will remember I set my expectations high and put them through the proverbial ringer throughout the term. Having seen their performance in that class, and better still, in interacting with many in later classes, advising, and informal conversations throughout 2010, 2011, and 2012, I am happy to say that a large number met the goal we discussed on a snowy day in a crowded Nieuwland Hall classroom:— to be competitive with the best engineers in the world.—I have watched what you’ve built, heard about your jobs, had positive reports from your other teachers, seen you excel in my classes, and heard from your past, present, and future employers. You have done well and have it in you to succeed at a high level.

Now, my main message to you today will require a return to AME 20231— one last thermo lecture, if you will. Having read your comments on the CIFs, I know *exactly* how much you enjoyed Friday morning character-building quizzes; you will be happy to learn there will be no quiz today! To arrive at my message requires an appeal to the second law of thermodynamics. This

law speaks to how disorder, also known as *entropy*, evolves in our universe. Loosely put,—in the absence of external intervention—

Things fall apart,

to borrow from the poet William Butler Yeats. The Catholic corollary to this is heard on Ash Wednesday,

Remember man that thou art dust and unto dust thou shalt return.

One of your main challenges as engineers will be to intervene to delay things from falling apart, to slow the return to dust, and better still—to build new things, be it an engine, airplane, bridge, software tool, theory, business enterprise, or family. This is not always easy! And to do this, you will likely have to invoke what *is* in fact my main message:

Commit unnatural acts.

There’s a lot of directions this speech could go from here!... Those words are not mine, but were spoken by CBS News president Richard Salant at my graduation in 1989. He explained himself, and so will I. You will no doubt realize that the “natural” thing to do is to give in to the second law and let “things fall apart;” no effort is required to do so. It often takes hard work, confidence, and courage to do what is unnatural—to build order from chaos.

And I hope you will not shirk some of the grander non-technological challenges we face at present. It is much easier to tear things down than build them up—while destruction requires a choice, it is a choice which lets you coast downhill, rather than trudge uphill—it is more aligned with what is *natural*. And there is no shortage of people with a variety of naturally destructive impulses. Digging deeper into Yeats’ 1919 poem *The Second Coming*, we find words that ring too true today:

Things fall apart; the centre cannot hold;

Mere anarchy is loosed upon the world,

The best lack all conviction, while the worst

Are full of passionate intensity.

Those words came to me last week while proctoring a final examination where three of today's seniors were busy expounding on the subtleties of candle flames and aero-thermo-chemistry. It was a combustion exam, and I must admit, the subject of the course was not just letting things fall apart, it was more towards "Burn, baby, burn!" In any case, after distributing the exam, I opened a web browser, which by default pointed to Notre Dame's home page. There, I was directed to the recent words of our president, Fr. John Jenkins. I was delighted to find an eloquent prescription to Yeats' pessimism; I quote here from that May 2012 address at Washington's National Cathedral:

Conviction. It is indispensable to every good deed. It defies the forces of inertia – the prevailing winds and currents that fight to keep everything the way it is, or worse. Without conviction, there would be no hope.

Conviction, however, is not all good. It can easily be corrupted by pride and greed and lead to hatred and division.

Now, when the country is increasingly diverse, when the number of disputed moral questions is rising, when citizens have deep and opposing passions that neither side will give up for the sake of civility – Can citizens of the United States learn to express their convictions in more skillful, more respectful ways?

... we have to call on our conscience to explore our convictions and how we express them. Even in the case of my most noble belief, I must ask myself: am I trying to advance this belief through persuasion or coercion, with respect or contempt, by accepting sacrifice or imposing sacrifice?

Those were Fr. Jenkins' words. I ask you to take them to heart and do the hard work of engaging with respectful art those many among us who are naturally drawn to destructive debate comprised of arguments better exiled to bumper stickers. I hope the graduates share my belief that things *need not* fall apart so rapidly, the dust can be delayed, that we can harness the vast *energy* of the universe and put it to work in service of mankind so as

to reduce our *entropy* locally, that we can use rhetoric in pursuit of truth, persuasion, and understanding, that if we bring engineering skill and human wisdom to our endeavors, we can build a better world. That the world values your years of study and sacrifice is clear; that in these most challenging of economic times the world needs your technological and leadership skills is clear too. And many of you are meeting these challenges by taking to heart Albert Einstein's maxim:

Only a life lived in service to others is worth living.

Let me close with an anecdote. I did not know what to expect when I arrived here in 1989 as a 28-year old assistant professor, with my dad along to help me move. While sitting with my usually mirthful father, eating a huddle-burger in LaFortune Hall, I learned—unusually—of his high hopes and expectations. He told me of the joy my grandfather would have had had he been with us; actually, his *own* joy shone through clearly that day. Growing up in a small Illinois farming community where some of the best students of our local Irish tribe had been sojourning to South Bend since the 1870s, Dad had a *full appreciation* for the education and values instilled by this university. Twenty-three years later, I do know what to expect here: fine and talented students and human beings, many with those same values respected by my father and mother. Graduates of 2012, your families have every right to be proud of your achievements at Notre Dame and your promise for better things to come.—Do build things.—Do work against entropy.—And, in so doing, do commit unnatural acts.