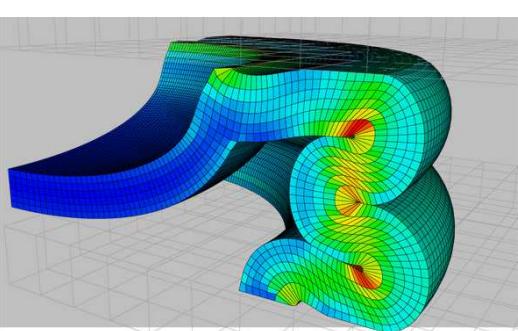


Collaborative Science – An ASC Code Team Perspective (Sierra)



Micheal W. Glass
Sandia National Laboratories

DOE Workshop on Integrated Simulations
for Magnetic Fusion Energy Sciences
Washington D.C., June 2-4, 2015



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Outline

- Overview of ASCI/ASC
- Overview of ASCI/ASC at Sandia
- Overview of Sierra
- Challenges and Sucesses

ASC Overview

- 1995: Accelerated Strategic Computing Initiative to promote Science Based Stockpile Stewardship in response to the Comprehensive Test Ban Treaty.
- 2000: Evolved to the Advanced Simulation and Computing program
- 2005: Mission evolved to deliver predictive capability
- Today, ASC has six “Program Elements”
 - Integrated Codes (IC)
 - Physics and Engineering Models (P&EM)
 - Verification and Validation (V&V)
 - Computational Systems and Software Environment (CSSE)
 - Facility Operations and User Support (FOUS)
 - Advanced Technology Development and Mitigation (ATDM)

ASC Collaborations

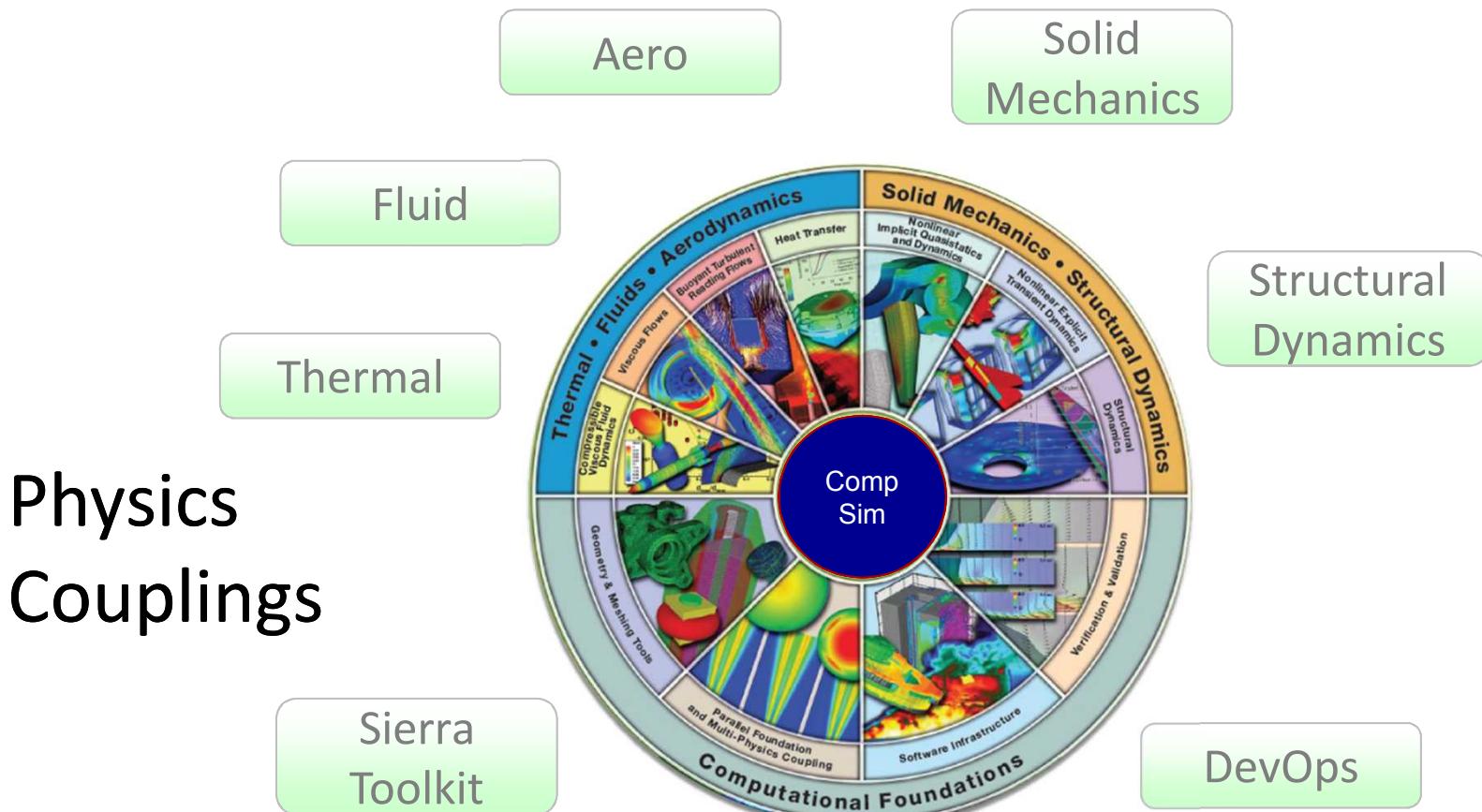
- Within each lab
- Between NNSA Labs
- Industry
 - Delivery of massively parallel platforms
 - FastForward, DesignForward, and PathForward
 - Centers of Excellence
- Academia
 - Academic Alliances
 - Predictive Science Academic Alliance Program (PSAAP)

ASC at Sandia National Labs



- Sandia's nuclear weapons mission can be summed up in two simple words: **always** and **never**.
 - Provide nuclear weapons that **always** function properly to provide the desired military yield when demanded by the President.
 - but **never** produce a dangerous yield when not desired.
- Provide validated computational simulation [CompSim] tools to support stockpile needs such as refurbishments, SFIs [Significant Findings Investigations], LEPs [Life Extension Programs], annual assessments, and evolving future requirements.
 - CompSim models the environments and device response
 - **Sierra** for Thermal, fluid, and mechanical effects
 - **RAMSES** for radiation, electrical, and electromagnetic effects

Sierra Overview



Physics Couplings

**Design for inter-operability and coupling
Between Sierra modules
and with other internal and external codes
– CTH, Alegra, Sigma, ITS, Nemo, Gemini, Kestrel, etc.⁶**

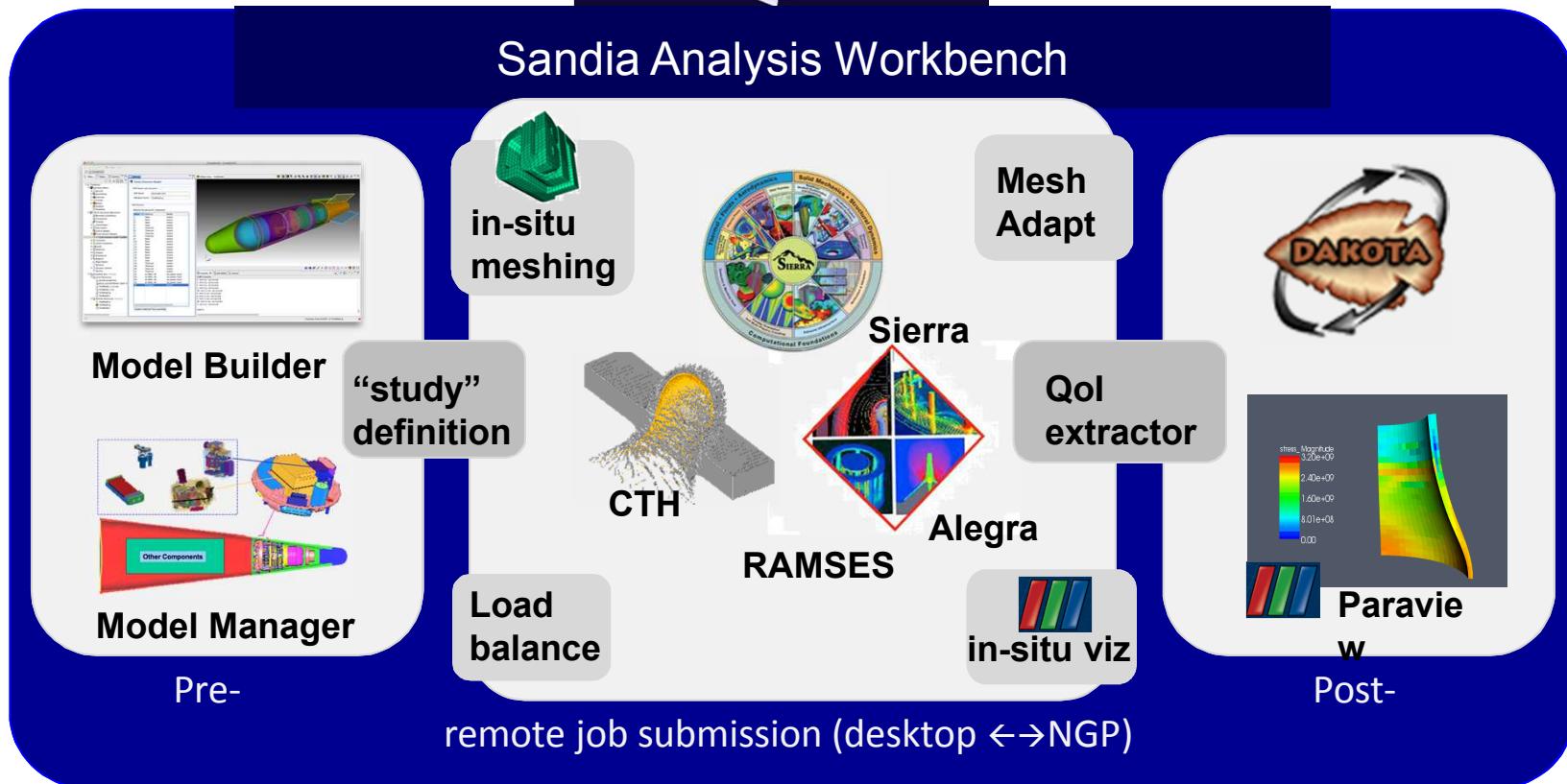
Workflow Integration

- 5 yrs in the making
- Integration of components
- move to in-situ

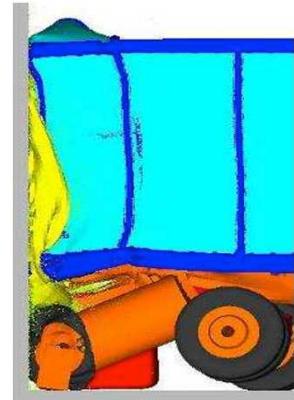
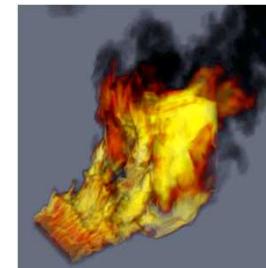
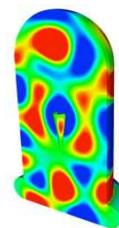
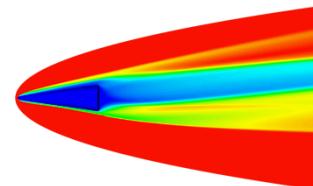


- Defined workflows
 - model calibration
 - Verification
 - Validation
 - UQ

(defined by V&V methodologies)



A Few Examples



Images from "The Need for Advanced Computing", SAND2014-0477C

Images from "Structural-Acoustic Analysis and Test Design", SAND2013-7916C



<http://nnsa.energy.gov/mediaroom/pressreleases/nnsa-achieves-significant-milestone-b61-bomb>

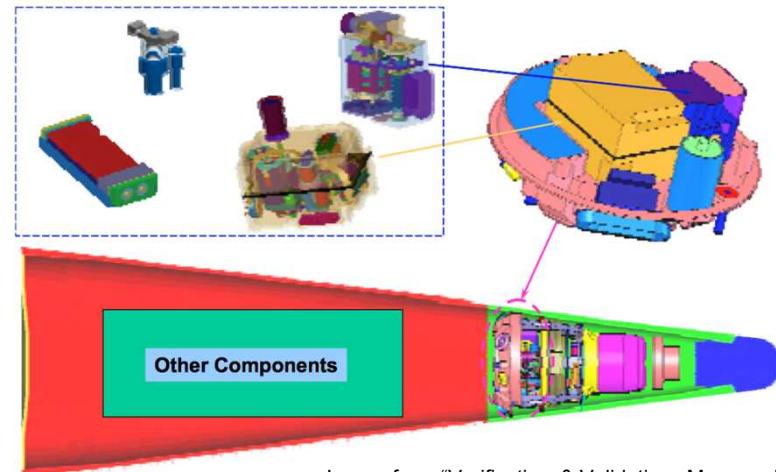
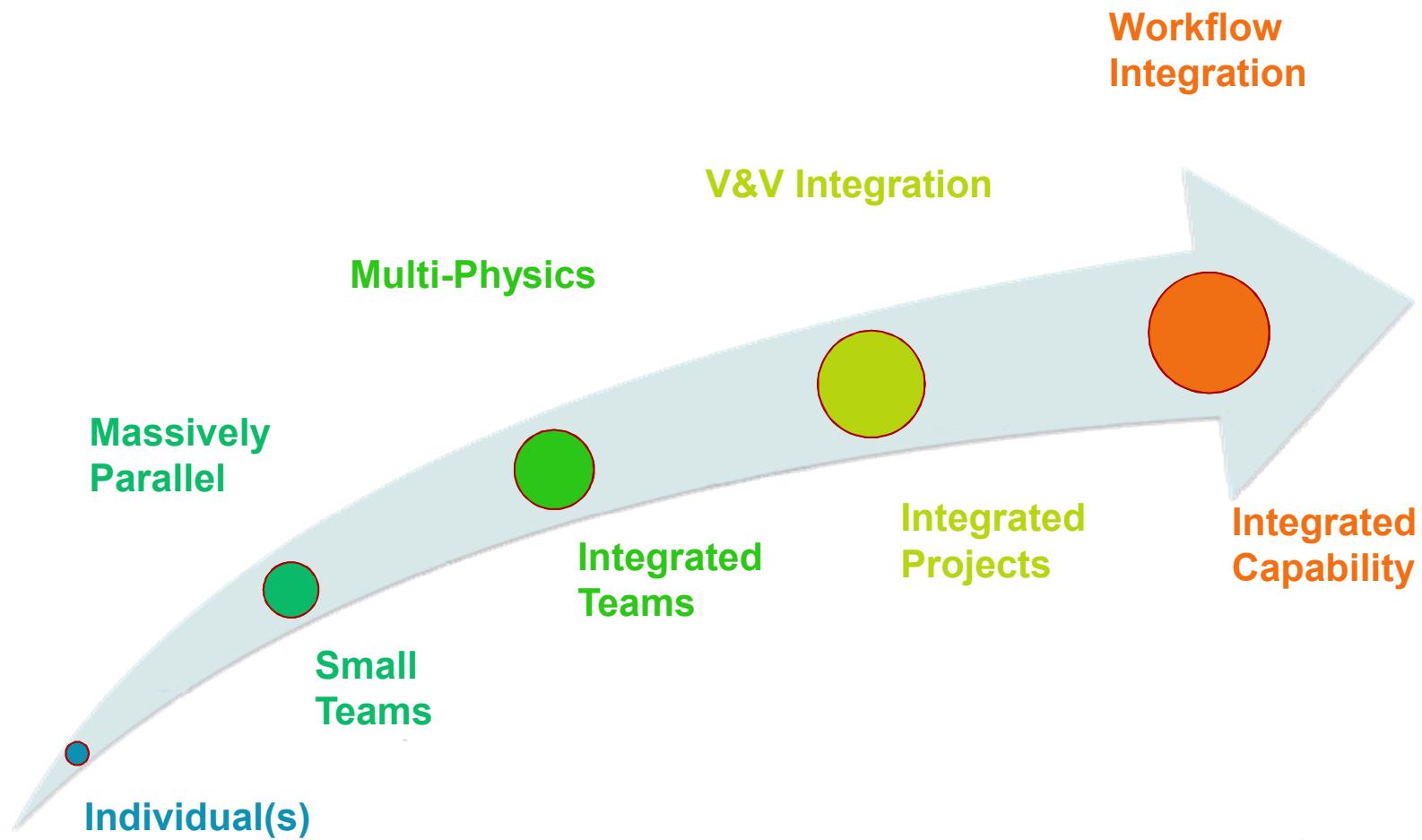


Image from "Verification & Validation: Measured Credibility, on Demand, for Stockpile Applications" SAND2007-2483C

Sierra Collaborations

- Intra-Team
- Inter-Team
 - P&EM
 - Algorithms
 - V&V
 - CSSE
 - ATDM
 - Workflow
- Stakeholders
- Other labs
- Other government entities
- Industry
- Academia

Sierra Has Evolved Over the Years



PARTNERSHIPS VS. COLLABORATIONS

What Were the Challenges and Successes



- Social/Cultural Aspects
- Technical Aspects
- Management Aspects

Social (Engineering) Aspects

“Organization doesn't really accomplish anything. Plans don't accomplish anything, either. Theories of management don't much matter. Endeavors succeed or fail because of the people involved. Only by attracting the best people will you accomplish great deeds.”

– General Colin Powell

“Culture eats strategy for lunch.”
– Tim Trucano, Sandia Senior Scientist

Build High Performance Teams and High Performance Culture



(Aug. 24, 2012 - Source: Simon Watts/Getty Images AsiaPac)

Software Engineering



R → D → A

Management



Cat Herders/Youtube

Provide the Leadership

Leadership is not so much about managing people, it is about inspiring individuals for a common cause and vision.



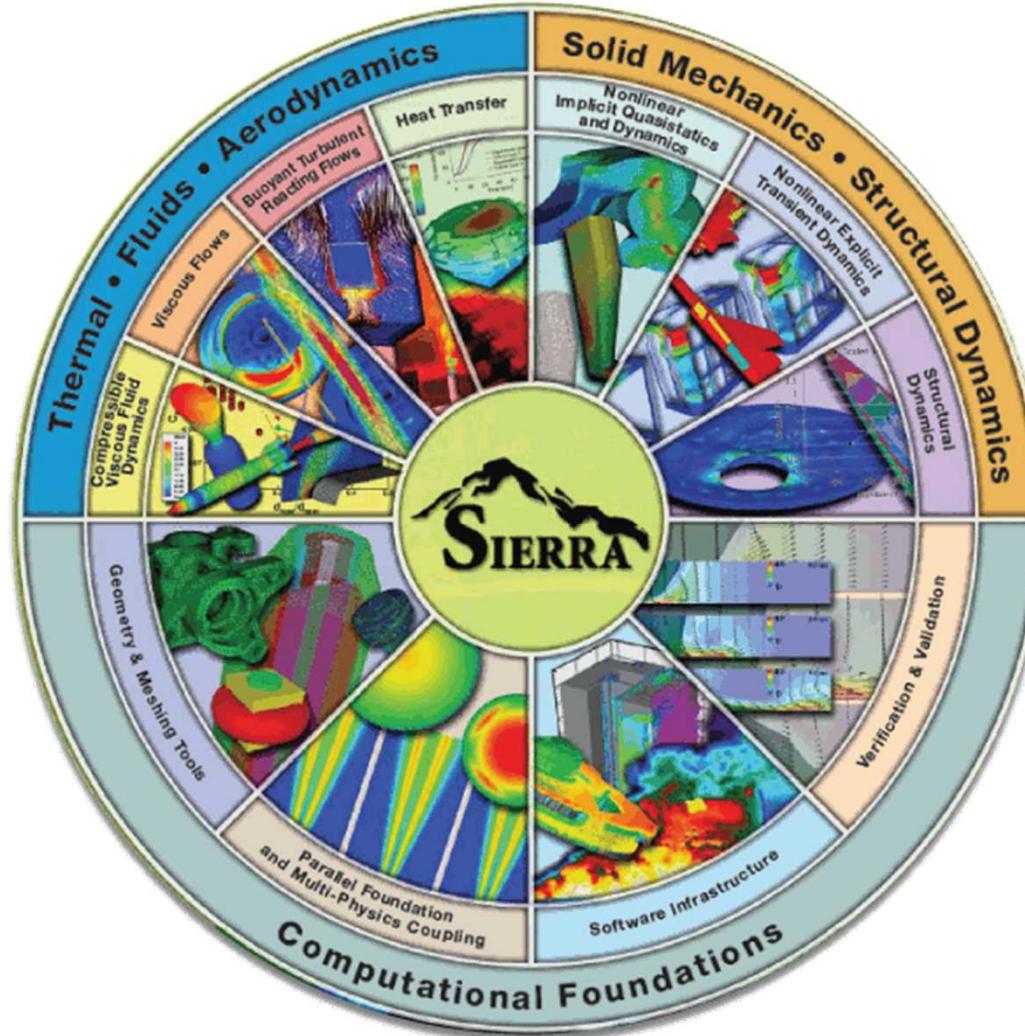
Thomas Juli, Empowerment Partners
<http://motivate2b.com/a-project-success-formula/>

Working Together for the Common Good

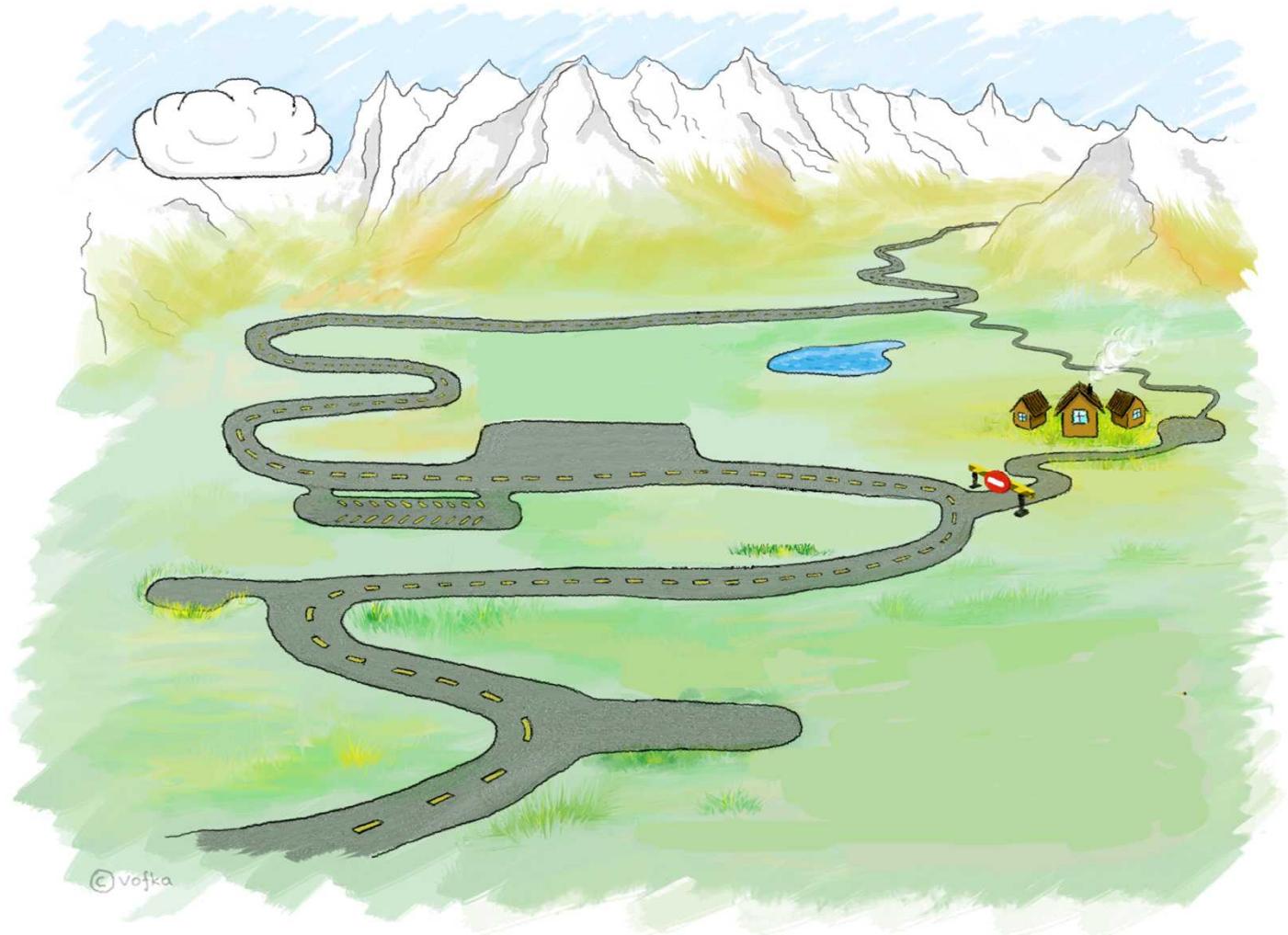


<http://partner.allblacks.com/tips/the-scrum/>

Have We Been Successful?



Success is a Journey...



PROGRESS, NOT PERFECTION

THANK YOU...