National Snow and Ice Data Center

Supporting Cryospheric Research Since 1976

The Human Side of Agile in Earth Sciences Application Development

Including, but not limited to:

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National Snow and Ice Data Center
Cooperative Institute for Research in Environmental Sciences, University of Colorado

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About the National Snow and Ice Data Center

- NSIDC manages and distributes scientific data, creates tools for data access, supports data users, and educates the public about the cryosphere.
- Research faculty at NSIDC address all aspects of the cryosphere: snow, ice, glaciers, frozen ground, and related climate interactions.

If it involves frozen water, we're interested!

About Us

Developers of:

- Data management tools (often involving browser-based GUIs).
- Web portals for data access.
- Scientific data products.

About Us

Technologies:

- Database:
  - PostGRES/PostGIS (moving off of Sybase)
  - Solr
- Java, Hibernate, Struts
- Ruby on Rails
- JavaScript
- Perl
- Python
- IDL

History: Project Management

- Projects conceived and implemented independently from each other.
- Developer(s) assigned to a particular scientist or product team.

History: Project Management

Impacts:

- Difficult to achieve cohesiveness in software development practices.
- Did not foster code re-use.
- Dependencies due to limited number of people with knowledge of a project.

Ultimately:

Frustrated software developers and a few frustrated project managers.

History: We want to be "agile"

- Fresh ideas brought in with new employee(s).
- Inspired by Alaska Satellite Facility (ASF) successes.
- Had a new project coming online that we decided to use as a pilot study for the process.

The result...

- Were we really "agile"? Were we doing "scrum"?
- A few people (both managers and developers) studied some more, decided we weren't, and drove the next steps.

Donna + Brendan + book = Inspiration

Next step: Consult with someone that knows what they're doing.

(We used up the training budget for group training with external Scrum Coach.)

Transition

- Identified projects willing to participate in the process.
- Project products ranged from new browser-based applications to scientific data products.
- Decided to start with two teams and split the projects between the two.
- Identified team members.

Continuing Education

- Second training session for those unavailable during the first series.
- Separate training session for Product Owners.
- Subsequent new hires learning as they go.

Definitions: Scrum

Scrum (n): A framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value.

The Scrum Guide, Jeff Sutherland and Ken Schwaber, 2011.
http://www.scrum.org/storage/scrumguides/Scrum_Guide.pdf

Definitions: Scrum Roles

- Product Owner (PO): The person responsible for the project's business value.
- Scrum Master: Maximizes the value of interactions between all parties.

Definitions

- Sprint (Iteration): a constant length time interval for work, typically 1-4 weeks. (2 weeks @ NSIDC)
- Story: a valuable slice of new functionality.
- Story point: unit in the scale of effort required to complete a story.
- Velocity: average rate of progress through work (story points per sprint).
- Backlog: a prioritized list of stories that represent the work to be completed.

Practices

Scrum teams

Starting point: "Book scrum"

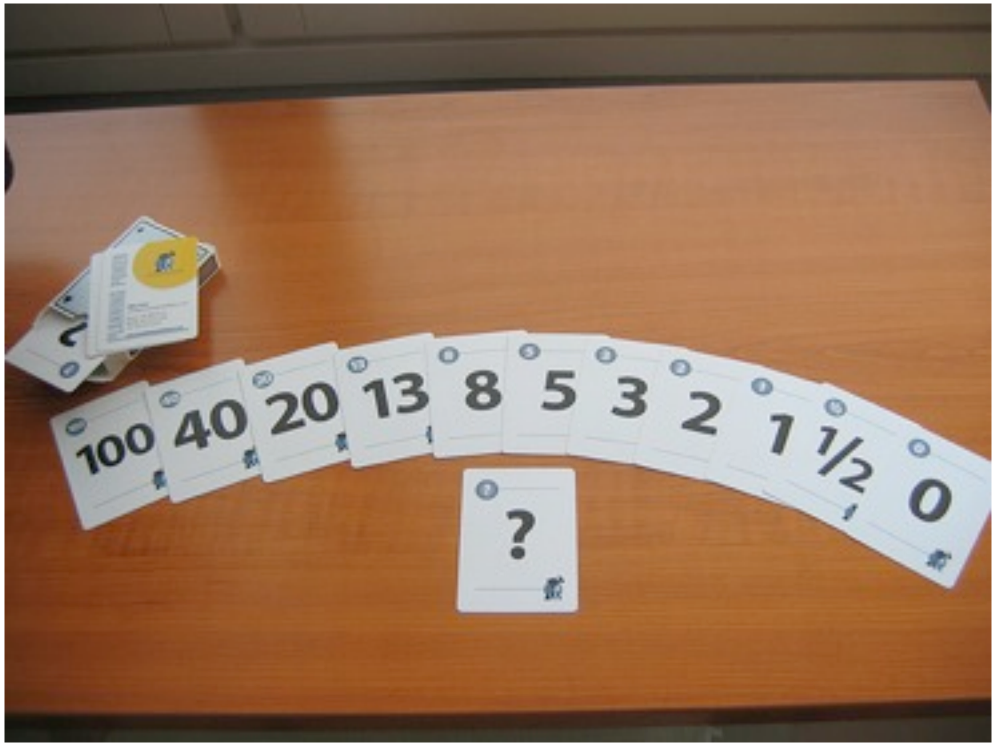
➡ except multiple POs and multiple projects

Scrum Ceremonies: Standup

- Key daily coordination activity for the team.
- Reflects what has been accomplished, what is planned for the day, and identifies impediments.

Scrum Ceremonies: Story Estimation Meetings

- Developers and POs.
- Planning poker helps guide conversation.
- Level of detail increases as work gets closer.



Scrum Ceremonies: Sprint Planning

- Team commits to a set of stories from top of prioritized backlog.
- Consider past performance - "yesterday's weather."

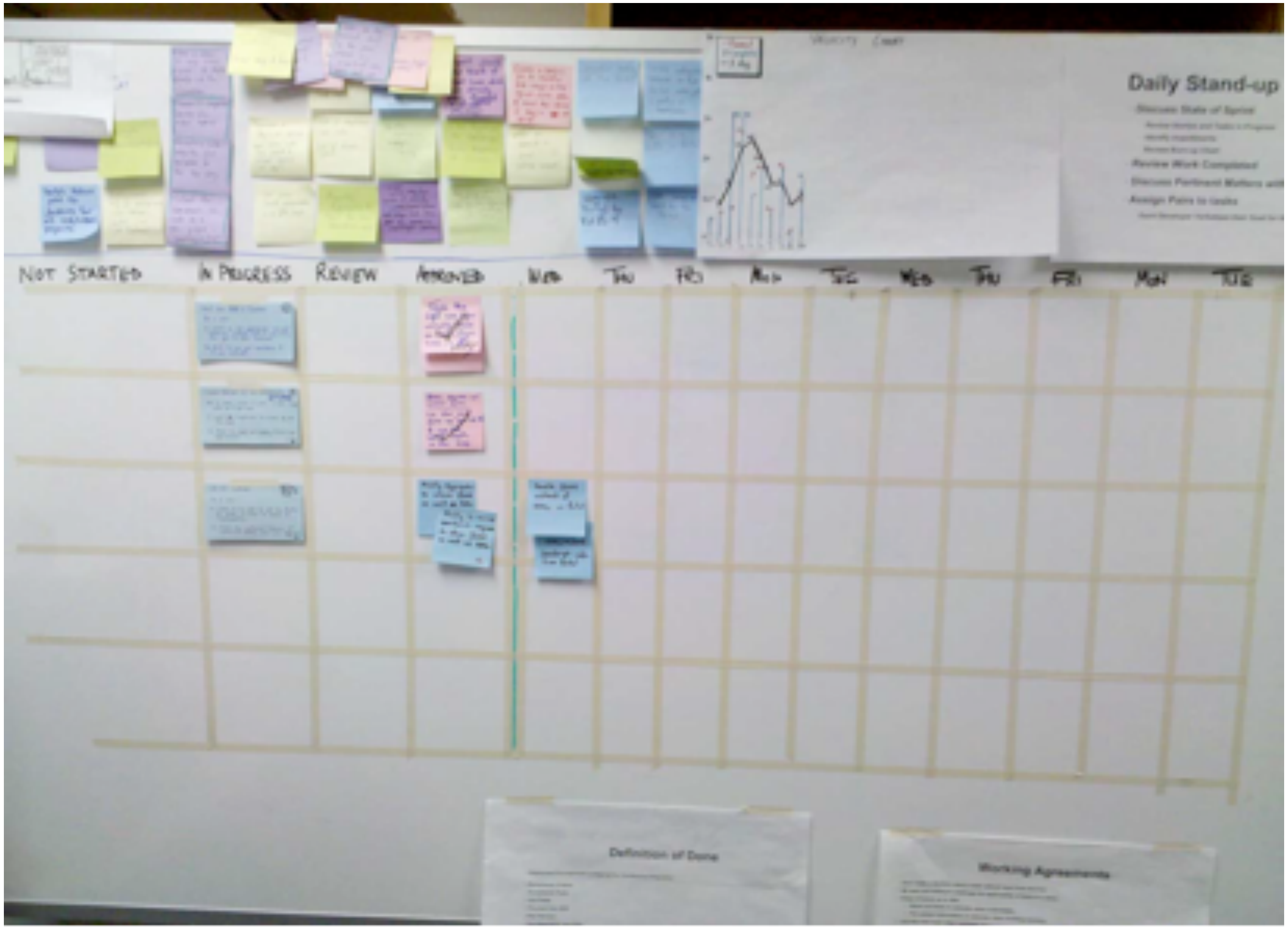
Scrum Ceremonies: Sprint Review

Show it off!

Scrum Ceremonies: Retrospectives

- Inspect and adapt - closes the loop.
- Acknowledge successes.

Scrum Artifacts: Physical Information Radiator



Continuous Integration

- Small increments in functionality, automatically tested.
- Applied to new code, but legacy code yet to be incorporated into CI environment.
- Coordination between teams, especially with regard to database changes.

(Acceptance) Test-Driven Development

Writing tests (executable specifications) for the software *before* the software is written.

(Acceptance) Test-Driven Development

Results in:

- Efficient, complete solutions.
- Solid, readable code.

(Acceptance) Test-Driven Development

...but we learned that it's hard to:

- write good tests,
- learn,
- keep doing TDD.

Pair Programming

- Adjustments for different personalities and programming styles.
- Code benefits.

Mixed pairing/independent code development

- If it's not pair-programmed, it requires code review.
- Focus on streamlining code review process:
  - Smaller checkins.
  - Scrum board signals status.
  - Announcement on IM chat room.

Challenges

Unstable Velocity

Challenges Encountered

- Inconsistent estimation.
- Impacts of holidays, meetings, illness.

Impact

- Lowers PO's confidence.

Unstable Velocity

Resolutions

- Re-evaluating story estimates.
- Comparing new story estimates to established baseline.
- "Bucket" stories at the end of planning meetings.
- Attention to definition of "done" during planning.

Multiple projects in a single team

Challenges Encountered

- How to distribute projects within or across sprints.
- Different numbers of projects assigned to each team (two vs. four).
- Difference in project loads forced different style of management by POs.

Multiple projects in a single team

Resolutions

- Focused on the fewest number of projects possible in a sprint (but this means a project might be put aside for weeks or months while other projects are being worked).
- Developers reorganized from two teams to three.

Adoption of new practices

- e.g. Scrum, Pair programming, TDD.
- Requires consensus from both developers and POs.
- Requires flexibility.

Testing (TDD), Quality and Time

Challenges

- Convincing POs whether long-term benefits are worth the short-term costs.
- Learning TDD.

Testing (TDD), Quality and Time

Resolution

- Find someone to champion the process.
- Negotiate six month trial period.
- Success!

Successes

Customer Satisfaction

(In this case, PO satisfaction.)

Customer Satisfaction

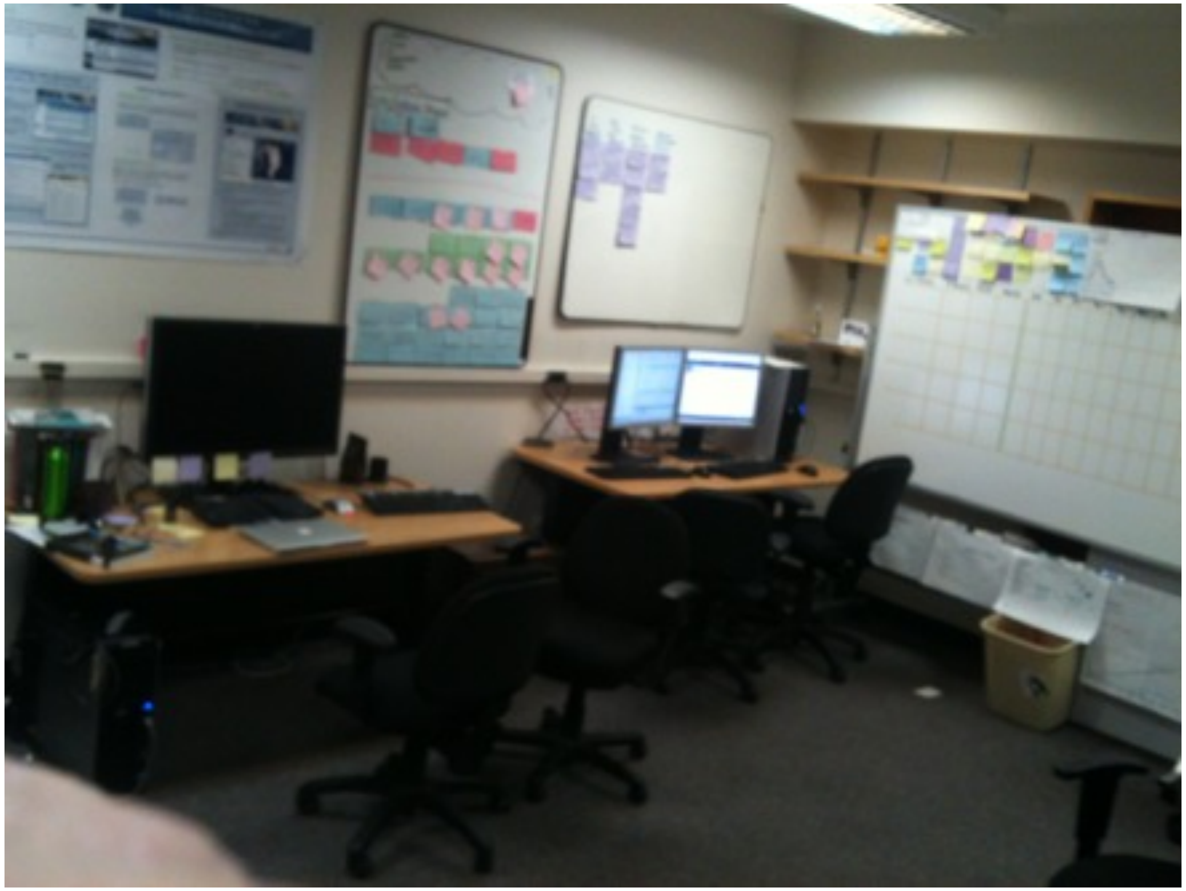
- External deadlines met.
- Successful demos (internal and external).
- Velocity used to effectively gauge future progress.

Highly effective collaboration

- Up to eight people working in same codebase.
- Very little confusion about what people were working on and how it impacted the work others were doing.
- There were times that we stepped on each other, but those issues were recognized and dealt with quickly.
- Never had significant amount of divergent or duplicated work.

Highly effective collaboration

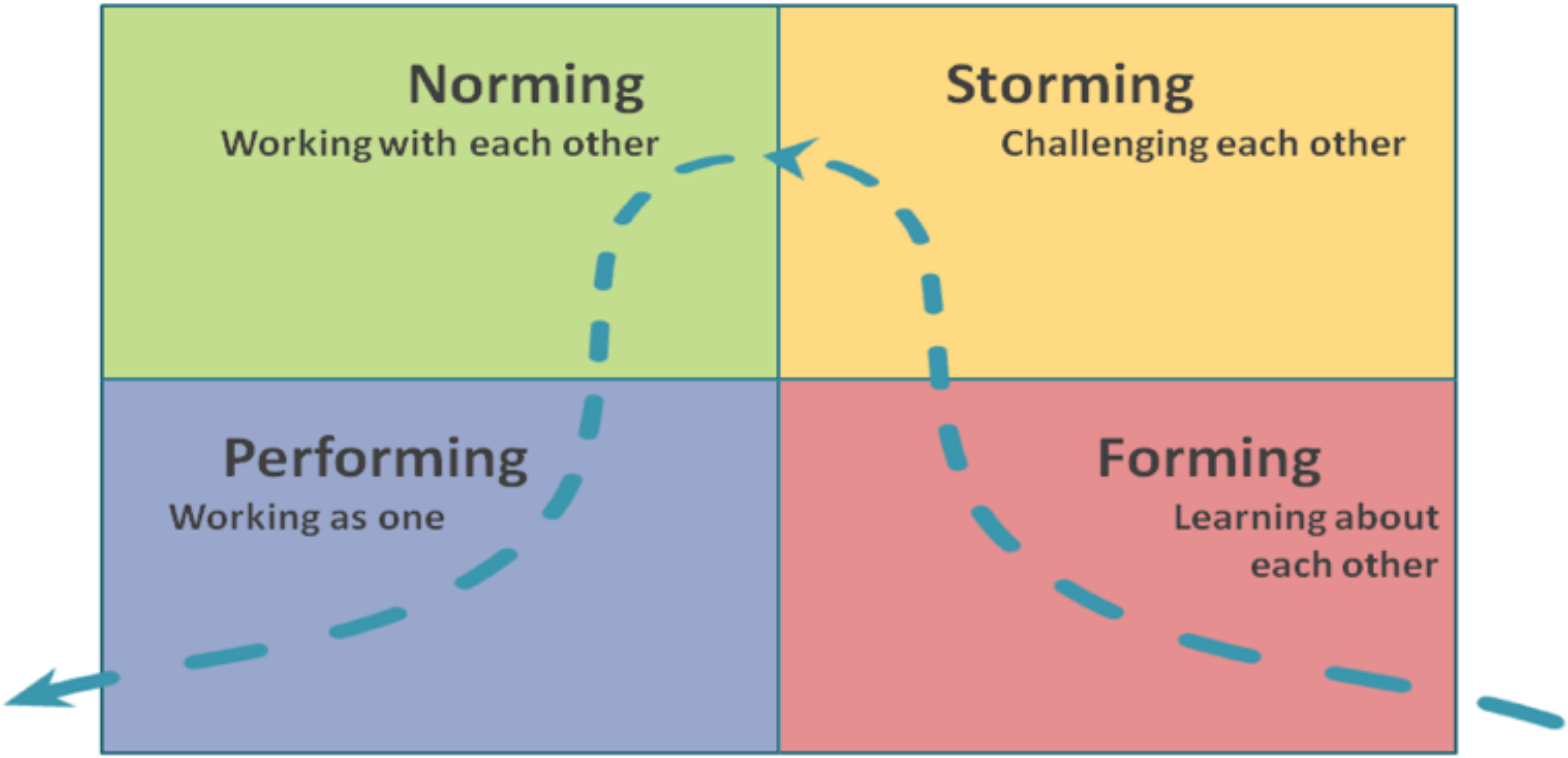
- Co-location and open team space.
- More high-bandwidth conversations, fewer emails.



What Next?

New team structure

Tuckman's model:



Continuous Delivery / Deployment

- Need to standardize lessons from Continuous Integration across teams (even if we're not Continuously Deploying).
- Dependency management for libraries, databases, web services is a hard problem.

Multiple teams, one codebase

Will multiple teams be as successful as a single cohesive team in managing this challenge?

Inter-team Learning

Implement a “Scrum of Scrums” as a mechanism for self-inspection and adaptation.

Agile Science Programming

Goals:

- Knowledge transfer.
- Automation.

Agile Science Programming

Strategy:

- Automated testing.
- Continuous integration.

Agile Science Programming

Intersection of experiences

Science programming, IDL and NumPY vs Agile, web application development and Java.

Agile Science Programming

Other challenges:

- Exploratory approach to data processing makes it difficult to write concise, estimatable stories.
- External deadlines for data products forced some Agile practices to be compromised.

Agile Science Programming

Bottom line:

We're still learning how to deliver "science code" via a Scrum framework.

Contact Info

Email us:

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[$firstName, ".", $lastName, "@nsidc.org"].concatenate()
```

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Questions ?

Slides available at http://bit.ly/y6RuoK
or
https://docs.google.com/present/edit?id=0AZQaguDOzK9rZGQ3bWZ4YjlfMjNnZm5nbjhkbQ