

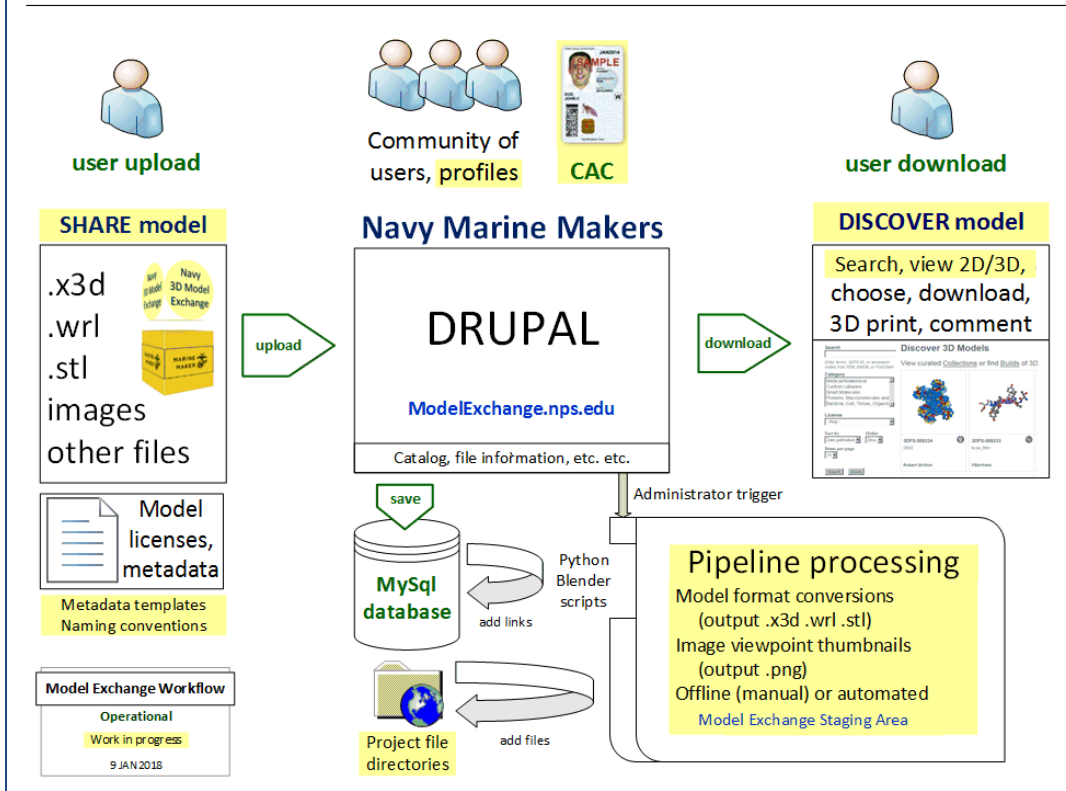
## Naval Additive Manufacturing (AM) Initiative: NPS X3D Model Exchange

### Design Criteria, Progress Plan and FY2018 Milestones

- a. **Emerging Capability.** Web-accessible IT infrastructure and test environment for 3D Model Exchange (3DMX) support has been established at ModelExchange.nps.edu website. NPS has successfully adapted the 3D Print Exchange code provided by National Institutes of Health (NIH) so that functionality, features and user interface can continue to co-evolve in a compatible way.
- b. **Open.** NPS 3DMX design remains royalty free, repeatable, standards based, and closely similar to ongoing NIH 3D MX exchange efforts. Both open and vendor-proprietary model formats are accepted, and then converted to Extensible 3D Graphics (X3D) International Standard for further adaptation, sharing and quality assurance (QA). Standards collaboration for emerging CAD, metadata, 3D printing and 3D scanning capabilities is ongoing through Web3D Consortium Working Group efforts.
- c. **Team Efforts.** The Naval Research Program (NRP) and Marine Maker initiatives have each enabled establishment of important initial capabilities. Partnership is now established among NPS, OPNAV N415, MCSC, NAVFAC and SPAWAR stakeholders with shared needs and goals. Each of the partners have different areas of interest that can now be pursued in combination together. Regular dialog is ongoing and quarterly partner collaboration meetings have commenced. Observation and comment by other services is welcome.
- d. **Naval Focus.** Multiple domains of interest include Navy Makers, Marine Makers, expeditionary applications, NIH medical users, and Additive Manufacturing (AM) experimenters. Near-term potential partners include Navy History & Heritage Command (NHHC) with USCG also indicating interest. Compatibility is directly feasible with Web-based 3D visualization capabilities such as NAVFAC SPIDERS3D.
- e. **Milestone 1: Developers Beta.** Starts 1 February 2018. Objective: accept, test, print, publish and share 100 contributed 3D models. NPS approach provides partners with controlled access and full visibility to Model Exchange software, architectural development, and the project-based 3D Model Staging Area. Partner contributions are welcome. This open spiral-development approach allows NPS to work on quality control of 3D model publication, partner-specific community theming, end-user support, and coordination of all related partner efforts.
- f. **Rules of Engagement.** Only royalty-free, unrestricted, open-source models and software are accepted. License declarations are required, with guidance provided on best practices. Developer access is granted to government personnel and their supporting contractors. All contributions require user identification via CAC card. The nps.edu web presence is fully certified and authorized for access by other navy.mil and usmc.mil systems. Once models have passed acceptance tests, model downloads and 3D printing is public and unrestricted. This approach avoids hacking vulnerabilities and enables Sailor + Marine users to freely collaborate using trusted 3D assets.

- g. **Milestone 2: Soft Launch.** Starts Summer 2018. Objective: support 100 end users who can share, discover and 3D print diverse models. Once FY18 funding arrives, three months of Milestone 1 developer work on first 100 models will ensure smooth operation, useful help documentation, and community collaboration in Milestone 2. Customized theming will be available for each service. Interested parties are welcome to contribute. Navy/USMC Fab Labs are the primary customers because they provide Sailors and Marines with deployed capabilities and informed guidance.
- h. **Metrics.** “You get what you measure.” Usage metrics and 3D model statistics are being engineered and integrated at every stage of design so that data-driven decision making becomes possible. A continual spiral development methodology enables informed improvement on how to best engage and empower end users of the Model Exchange. Effective near-term refinement and long-term integration with larger enterprise processes becomes practical. Partnered scrutiny and improvement enables steady improvement and avoids lockin. Informed metrics enable broader innovation that amplifies user successes and propagates “lessons learned.”
- i. **Enabling Future Evolution.** All of these partnered stakeholder efforts are expected to improve best practices for Naval model sharing and end-user effectiveness. Each service will be able to plan logistics adaptations, transitions to cloud services and scalable production in FY19. The NPS Model Exchange will remain available as an open, standards-based partnership development asset. Ongoing work is welcome to support applied research on emerging capabilities such as innovative Maker community outreach, cyber defense of 3D data, blockchain ledger accounting, support for advanced materials, growing metadata vocabularies for effective search, enterprise-wide business analytics, contracting requirements guidance for 3D models, Digital Thread (DT) initiatives, etc. etc.
- j. **Links for Developers and Users**
- Model Exchange website: <https://ModelExchange.nps.edu>
  - Model Exchange developers mailing list:
    - [ModelExchange@MovesInstitute.org](mailto:ModelExchange@MovesInstitute.org) with subscription at
    - <https://www.movesinstitute.org/mailman/listinfo/ModelExchange>
  - Version Control for 3D content staging area and software source code:
    - <https://gitlab.nps.edu/ModelExchangeGroup> requires account for access
    - <https://gitlab.nps.edu/ModelExchangeGroup/ModelExchangeServer>
    - <https://gitlab.nps.edu/ModelExchangeGroup/ModelExchangeStagingArea>
  - Twitter announcements:
    - @NavyMakers <https://twitter.com/NavyMakers>
    - @MarineMakers <https://twitter.com/MarineMakers>
  - Contact and feedback: [makers@nps.edu](mailto:makers@nps.edu) (Don Brutzman and Becca Law)
- k. **Architecture Design.** The following diagrams show
- Original design basis used from NIH 3D Print Exchange, <http://3dprint.nih.gov>
  - Decoupled design used for shared developer access to NPS Model Exchange Staging Area, which also allows “pipeline processing” tools to work independently under team observation.

## Original Model Exchange Workflow: Collected Within Drupal Database



## Staging Area Shared Dataflow: Sharable Assets, Gitlab Version Control

