Data Acquisition, Data Management and Remote Participation for ITER

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What Do We Propose?

- The U.S. take the primary responsibility for definition, design and implementation of software for data acquisition, data management and remote participation for ITER.

- Note: We **would not** include data acquisition hardware, IT infrastructure, plant control or plasma control but we would clearly be closely coordinating and integrating with these activities (see proposal from SAIC)

Why Is This Task Important For The ITER Mission?

- ITER would be the largest, most expensive **scientific instrument** ever built for fusion research
- Scientific productivity is inextricably linked to the quality and usability of the data and computing systems
- ITER will not be built in the US:
  - It will be desirable and practical to carry out a significant amount of scientific work remotely.
  - Off-site environment should be as productive and engaging as on-site

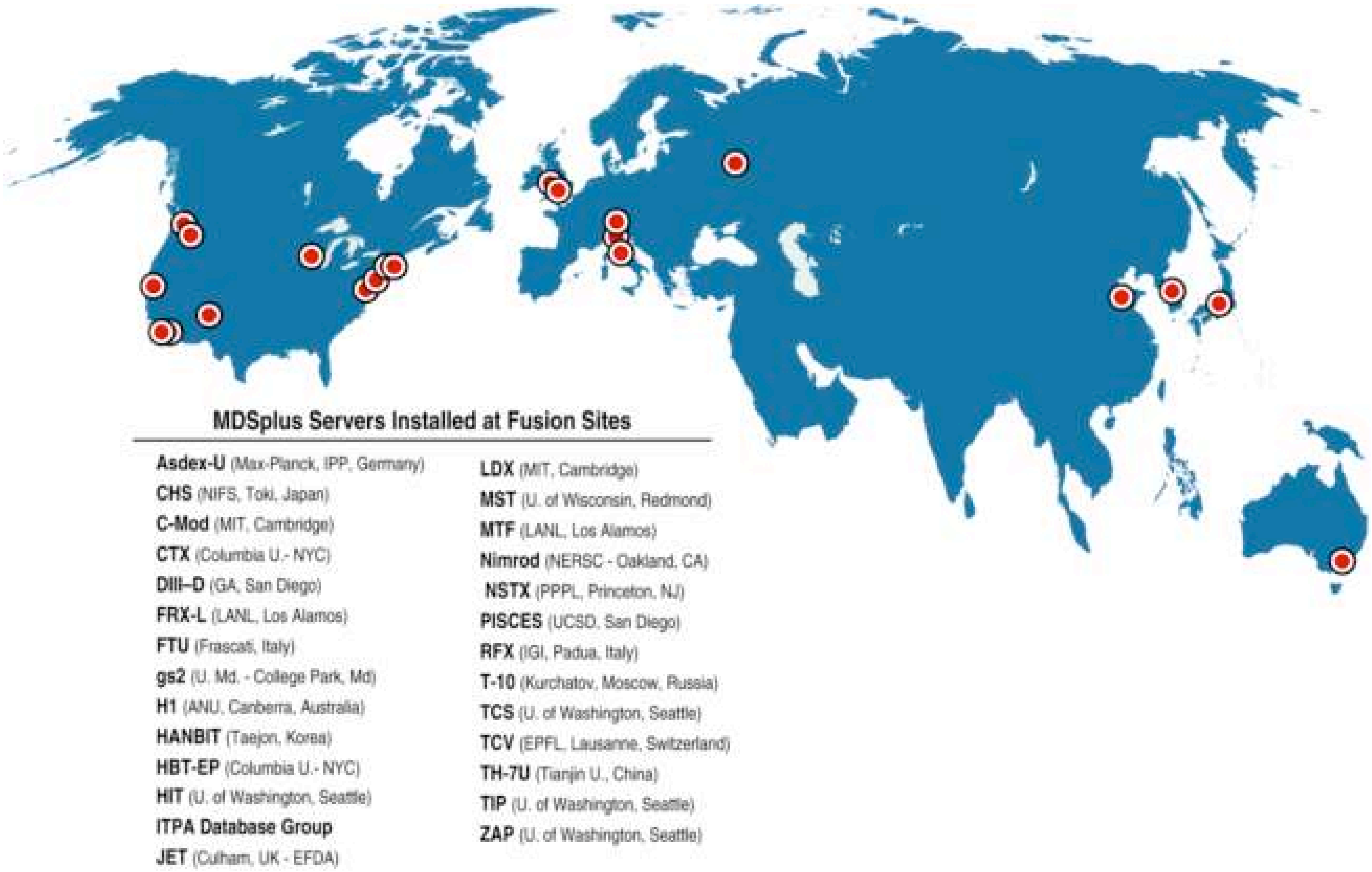
Why Should The U.S. Take This Role?

- Area of strength for U.S. Fusion Program – excellent track record
  - Data systems - MDSplus
  - Remote participation experience
  - Collaboration with computer science community - FusionGrid
- General U.S. leadership in Information Technologies
- **Our contribution in this area will make ITER a better experiment**

MDSplus – an Example of US Leadership

- By far, the most widely used and successful data acquisition and management system in the international fusion program
- Used at more than 30 sites spread over 4 continents
- Has become a *de facto* standard for data access
- Uses client server model – seamless remote access built-in
- Built as collaboration between MIT, LANL, IGI-Padua. (Majority of internals designed and implemented in the U.S.)

MDSWorld


MDSplus Servers Installed at Fusion Sites
Asdex-U (Max-Planck, IPP, Germany)
CHS (NIFS, Toki, Japan)
C-Mod (MIT, Cambridge)
CTX (Columbia U.- NYC)
DIII–D (GA, San Diego)
FRX-L (LANL, Los Alamos)
FTU (Frascati, Italy)
gs2 (U. Md. - College Park, Md)
H1 (ANU, Canberra, Australia)
HANBIT (Taejon, Korea)
HBT-EP (Columbia U.- NYC)
HIT (U. of Washington, Seattle)
ITPA Database Group
JET (Culham, UK - EFDA)
LDX (MIT, Cambridge)
MST (U. of Wisconsin, Redmond)
MTF (LANL, Los Alamos)
Nimrod (NERSC - Oakland, CA)
NSTX (PPPL, Princeton, NJ)
PISCES (UCSD, San Diego)
RFX (IGI, Padua, Italy)
T-10 (Kurchatov, Moscow, Russia)
TCS (U. of Washington, Seattle)
TCV (EPFL, Lausanne, Switzerland)
TH-7U (Tianjin U., China)
TIP (U. of Washington, Seattle)
ZAP (U. of Washington, Seattle)

Remote Participation

- U.S. program has been a leader in fusion **and** in the broader scientific community.
  - *"They laughed when we said we needed to run our experiments remotely"*
- Remote operation of diagnostics as early as 1992 (TFTR)
- Full remote operation of tokamak in 1996 (C-Mod) and 1997 (DIII-D)
- Remote control of diagnostics SOP for all major facilities

Collaboratory Work

- As part of SciDAC program, we are exploring advanced technologies and applications in partnership with computer science researchers.

- Providing data, codes and tools as network accessible **services**

- Investigating shared applications and advanced visualization.

- Making important contacts with CS community

How Would We Proceed?

- Clearly too early to choose particular technologies
- Two phase approach – about 5 years each
- Phase I
  - Develop requirements
  - Build a series of prototypes
- Phase II
  - Implementation and Deployment
  - Coordination with infrastructure, plant control & diagnostics

Phase I - Requirements & Prototyping

- Requirements gathered from potential users based on plans and experience.
- Define critical extrapolations (e.g. long pulse).
- Survey other scientific programs with similar needs.
- Build prototypes to test concepts for internals and user interactions.
- Apply to actual and simulated experiments.
- Iterate.

What are the Overall Resource Requirements?

- Only very rough guess at this point, but **manpower** estimates may be ……
- ~ 4 FTEs for Phase I
- ~ 10 FTEs for Phase II

How Could We "Task Share" With Other Parties?

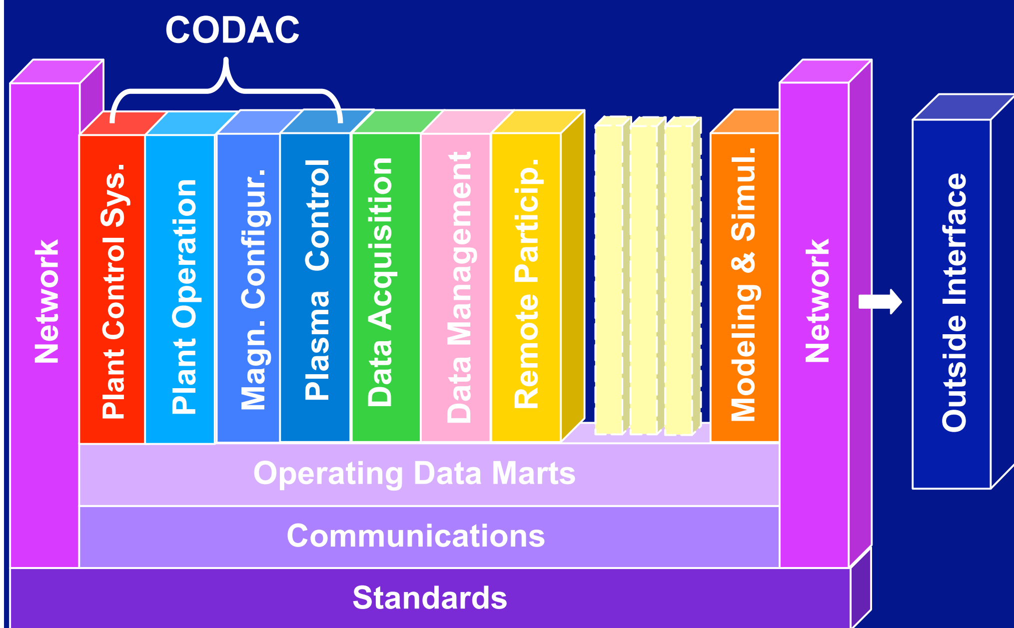
- Strong international collaborations are already in place.
- We have experience with "distributed" software development.
- We would fit into overall IT plan for ITER – regardless of which party led.
- We would want to maintain overall leadership in data system software.
- We would expect each party to collaborate substantially in plans for their own remote participation.

Summary

- A well-functioning data system is essential to the success of the ITER project
- We assert that the U.S. has proven record of accomplishment in this area.
- **We propose that the U.S. lead the effort to design and build software for data acquisition, management and remote participation for ITER**

ITER Information Plant (ITER IP)

N. Putvinskaya (SAIC), D. Schissel (GA), M. Sabado (SAIC)



- SAIC and GA propose to build an ITER Information Plant (ITER IP) as a centralized multi-component Information System for ITER
- The development of the ITER IP will require participation of teams with expertise in both fusion and large-scale IT systems.

- The ITER IP will allow the U.S. to become the most informed ITER participant by providing detailed knowledge of all project components at all stages of ITER development.

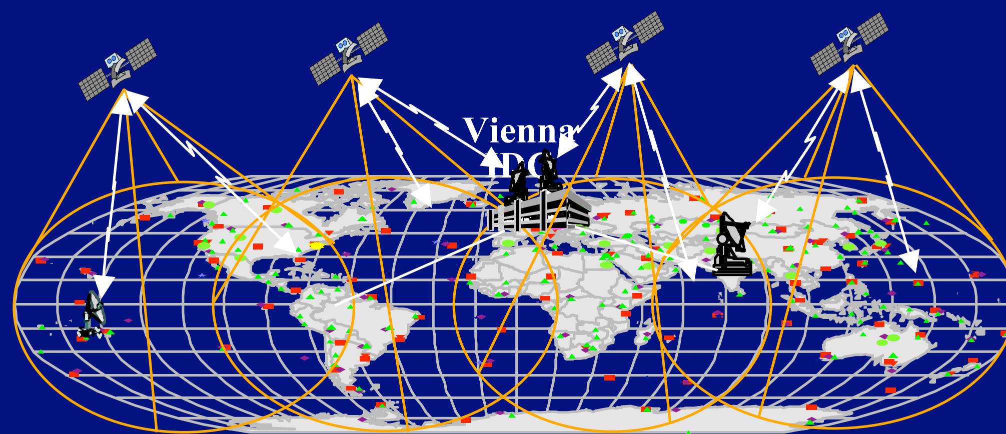
- The ITER IP will bring the highest return on investment (ROI) for the U.S.

SAIC – A Large-Scale Systems Integrator

N. Putvinskaya (SAIC), D. Schissel (GA), M. Sabado (SAIC)

1. Monitoring System Operations (MSO)

Nuclear Monitoring
Customer: United Nations
Real time system
400 stations worldwide
Operating since 1995



2. Design of a Control System
Plutonium reprocessing plant

Customer: IAEA
Rokkasho (Japan)

Data Processing has Universal Applicability

3. Hosting ITER

Customer: DOE
Technical support
1993 - 1999