

NASA Electronic Parts and Packaging (NEPP) Program

3rd Electronics Technology Workshop (ETW)

NEPAG Update

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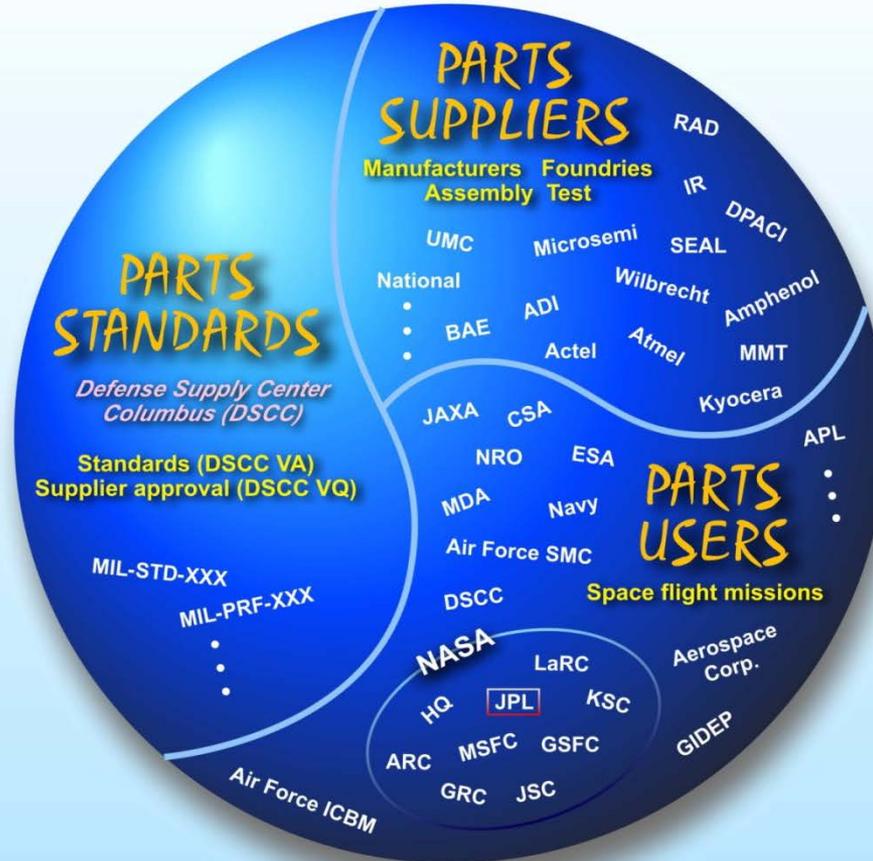
Launched: Nov. 26, 2011

Landing: Aug. 5, 2012

June 11-13, 2012

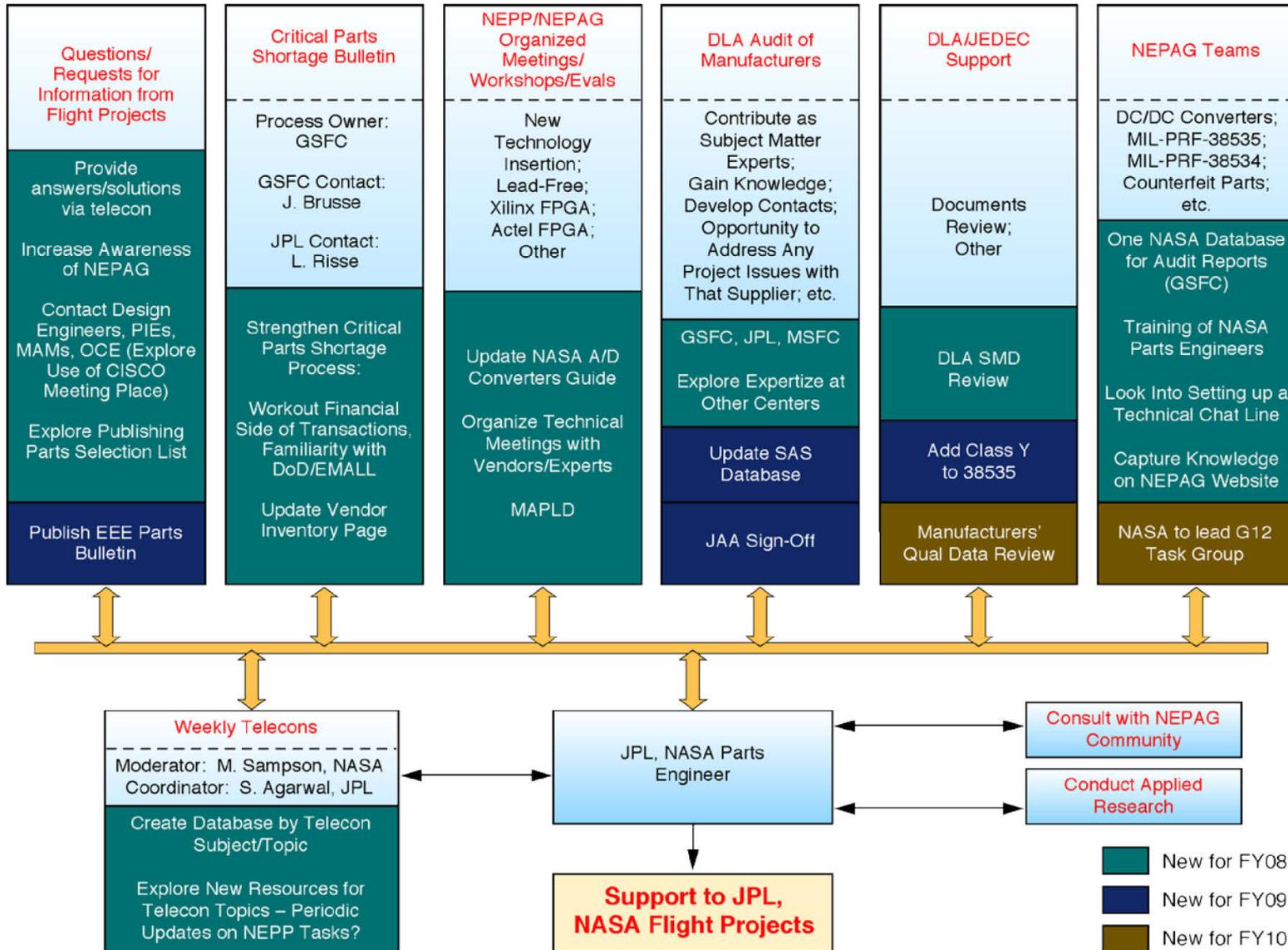
Space Parts World

A Vanishingly Small Part of the Commercial Parts World



NEPAG is actively involved with the procurement process - parts users and standards organizations join hands to ensure timely delivery of reliable parts from suppliers.

JPL NEPAG ACTIVITIES





- **Microcircuits**

- Recent Findings from Audits, New Technology Data Reviews

- **Disabled Chip Burn-ins** A recent audit for a QML device discovered that the chip was disabled during the static burn-in, thus it was not drawing any current.
Recommendation: For new SMDs add a statement within the burn-in paragraphs stating that the parts shall be kept in their enabled state during the burn-in.
- **Class Q 160-hr/125°C Burn-in** This is being interpreted as a static burn-in (even for CMOS technology).
Recommendation: Provide clarification in MIL-STD-883, Test Method 5004.
- **At Frequency (Dynamic) Burn-ins** Test equipment limitation is being cited for not doing burn-ins at the application frequency.
Recommendation: The burn-in task group to discuss and provide guidance. When the SMD says that the part can be used at 200 MHz, then doing burn-in at 6 MHz (cited as burn-in equipment limitation frequency) is not going to be meaningful!
- **Two Static Burn-ins** Some manufacturers are doing electrical testing between the two static burn-ins, whereas others do electricals after completing both static burn-ins.
Recommendation: Provide clarification in MIL-STD-883, Test Method 5004.
- **Thermal Imaging** For a device with hot spots, the thermal resistance, junction-to-case, would be much higher than the guidelines given in MIL-STD-1835. One of the suppliers used thermal imaging to find hot spots on the die.
Recommendation: Assign a task group to evaluate the effectiveness of thermal imaging at the product development stage.

NEPAG Update (Contd.)



– Class M

- **Removal of Class M** We have been told that class M parts with Q marking are equivalent to class Q parts. However, most SMDs from QML suppliers have both classes M and Q shown in table II of the SMDs. Is one part, one part number still a requirement?
Recommendation: keep class Q and remove class M from the new SMDs.

– Class Y Status

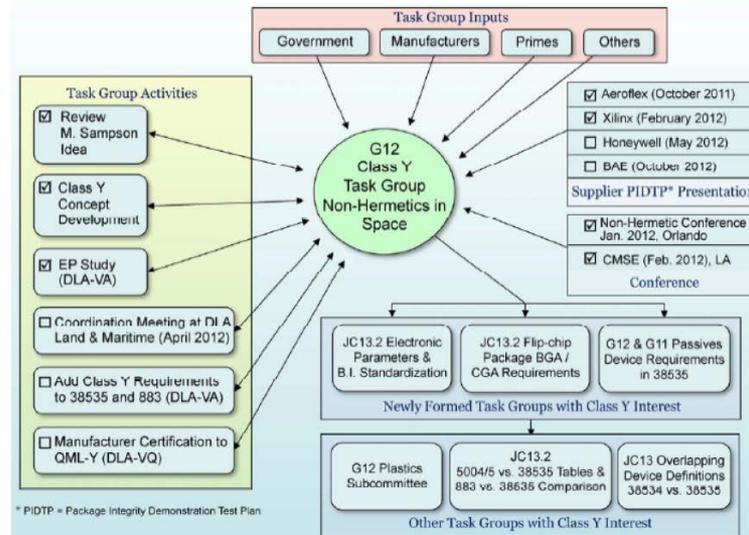
- DLA-VA hosted meeting in Columbus was very well attended (April 2012).
- Had the 7th meeting of the task group last month.
- The latest *EEE Parts Bulletin* (March/April 2012) was dedicated to Class Y.



March/April 2012 • Volume 4 • Issue 1

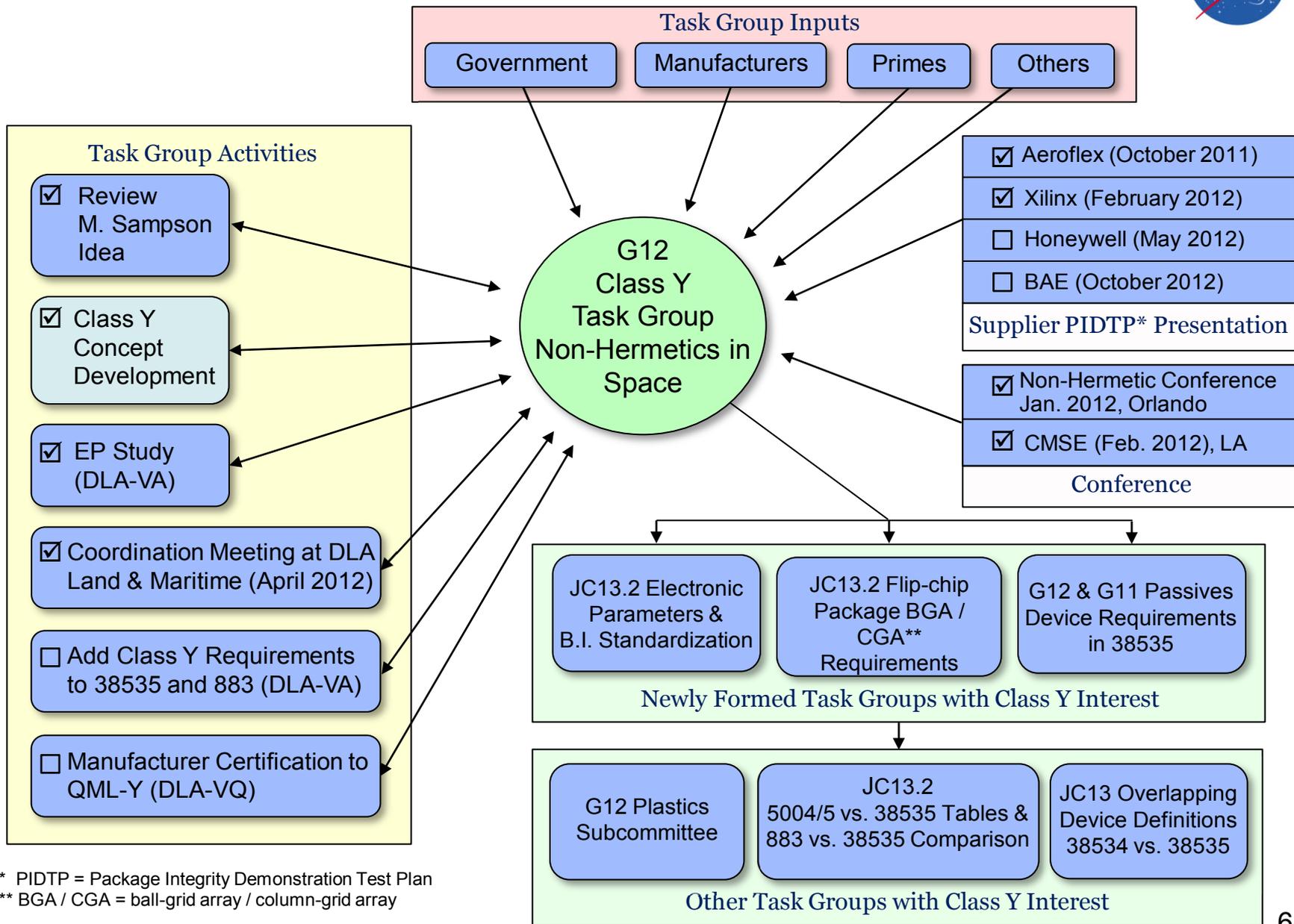
Class Y Special Issue

This issue of the *EEE Parts Bulletin* introduces Class Y, a new category of microcircuits. Class Y brings the Xilinx Virtex-4 field-programmable gate array (FPGA), the Virtex-5 FPGA, and similar devices into the Qualified Manufacturer List (QML) as standard space products. The Class Y development is an effort to infuse new packaging technology into the QML with the benefits of schedule and cost savings to flight projects. The space community has been working to develop the necessary screening and qualification requirements for Class Y. The snapshot below summarizes these activities, and the diagram on the next page provides major milestones for this development.



Infusion of New Technology into the QML System

G12 Class Y Effort at a Glance



* PIDTP = Package Integrity Demonstration Test Plan

** BGA / CGA = ball-grid array / column-grid array

D. Sunderland Notes from Columbus Meeting



1. The extra time allotted for discussion in this forum was useful – 1 hour at JEDEC/TechAmerica meetings is too limited for this topic.
2. We walked through the entire EP Study report, achieving consensus on most comments that should allow an update soon after April 24 (when all comments are due).
3. Post-column electrical test remains a stumbling block. Proposed that either 1-temp post-column test or 3-temp LGA test following thermal simulation of column attach process be accepted. Also discussed sample post-column testing instead of 100% screen.
4. Various mechanical and radiation tests should have the option of being performed without balls or columns, as long as a failure mode due to balls or columns is not what is being tested.
5. All tables (screening, TCI and qualification) should have side-by-side columns for Class V and Y, differing in text and format only where hermeticity issues require it. Flip-chip and solder termination issues should apply to both columns.
6. Moisture resistance test: Consensus was that Class Y should see HAST instead of TM 1004 for V, but conditions (biased or unbiased) remain open.

D. Sunderland Notes (Contd)



7. We need a definition of PIDTP, clear indication of when one is needed, and list of what one should include. Consensus was that this should go into MIL-PRF-38535 Appendix H (Qualification), and a PIDTP would be required if any of the following technologies was used: a) non-hermetic package, b) flip-chip, or c) solder terminations. PIDTP requirements would be different for each case.
8. Use of ancillary passives not compliant with MIL-PRF-123 remains a stumbling block. Most believe that specific applications (such as power supply decoupling for low-voltage FPGAs) could be approved on the basis of: a) low stress, and b) low parametric sensitivity, and that language saying so might be useful. More generally, a lot-specific qualification program seems required, and Aerospace plans to convene a group to define what that will be. Suppliers seem resistant to creating a new military specification for BME capacitors. Limitation to only capacitors could be “at this time” to facilitate including other types in product roadmaps.
9. The exercise revealed a number of issues with MIL-PRF-38535 that have nothing to do with Class Y, flip-chip, or solder terminations. Recommendations to study the relevant passages should be made to relevant subcommittees or task groups.

38535 QML Space – Current Status



		Class V (Existing)	Class Y (In Development)	Comment
QML	Need class specific PIDTP	No	Yes	
CGA**	Offered as QML	Yes	No	
CGA*	Need CGA specific PIDTP	Yes	Yes	same for both classes
Flip-chip*	Need Flip-chip specific PIDTP	Yes	Yes	same for both classes
Passives*	38535 Para 3.15	applies	applies	same for both classes
Passives*	Any updates for BME	would apply	would apply	same for both classes

- **Observations**

- * represents an issue which is common to both classes
- ** highlights the fact that CGA devices are currently offered as QMLV.
- Despite limited resources in working this task, a meaningful QML Y product must be delivered to the flight projects in a timely manner. While the common issues are being worked, we should be able to update MIL-PRF-38535 to include Class Y requirements. This would enable the manufacturers and DLA-VQ to gear up for Class Y audits, an activity that can start now and continue in parallel with resolution of common issues, thus saving time.

- **Recommendations**

- Upon completion of the Class Y specific actions from the coordination meeting in Columbus (PIDTP, tables and any others), DLA-VA to update 38535 with Class Y requirements and release it (keeping the requirements for common issues the same as they exist today for QMLV).
- Keep working the common issues as quickly as possible. Continue to update the MIL documents as conclusions are reached on these issues.

PIDTP = Package Integrity Demonstration Test Plan
 CGA = column-grid array BME = base metal electrode

Infusion of New Technology into the QML system

Roadmap to QML-Y Flight Parts Procurement



- Major Milestones:
 - ☑ G12 approval of TG charter
 - ☑ G-12 Class Y Task Group to develop requirements
 - ☑ G12 approval for DLA-VA to commence EP study
 - ☑ DLA-VA to conduct EP study
 - ☑ DLA-VA to release “final” report
 - ☑ Coordination meeting at DLA Land and Maritime (April 2012)
 - ☐ DLA-VA to update 38535 and 883 with Class Y requirements
 - ☐ DLA-VQ to begin audit of suppliers to Class Y requirements
- After milestones completed,
Users to procure QML-Y flight parts from certified/qualified suppliers

CLASS Y - Package Integrity Demonstration Test Plan (Class Y - PIDTP)



Data Sharing with the Space Community

- Presentations by Major Suppliers:
 - Aeroflex (Presented at the Class Y TG meeting in October 2011)
 - Xilinx (Presented at the TG meeting in February 2012) 2011)
 - Honeywell (Presented at the TG meeting in May 2012)
 - BAE (Scheduled for October 2012 TG meeting)
 - Other (TBD)

The Team



The **Team members** are:

- Muhammad Akbar, DLA-VA
- Larry Harzstark, Aerospace
- David Sunderland, Boeing
- Shri Agarwal, NASA/JPL
- Roger Carlson, NASA/JPL

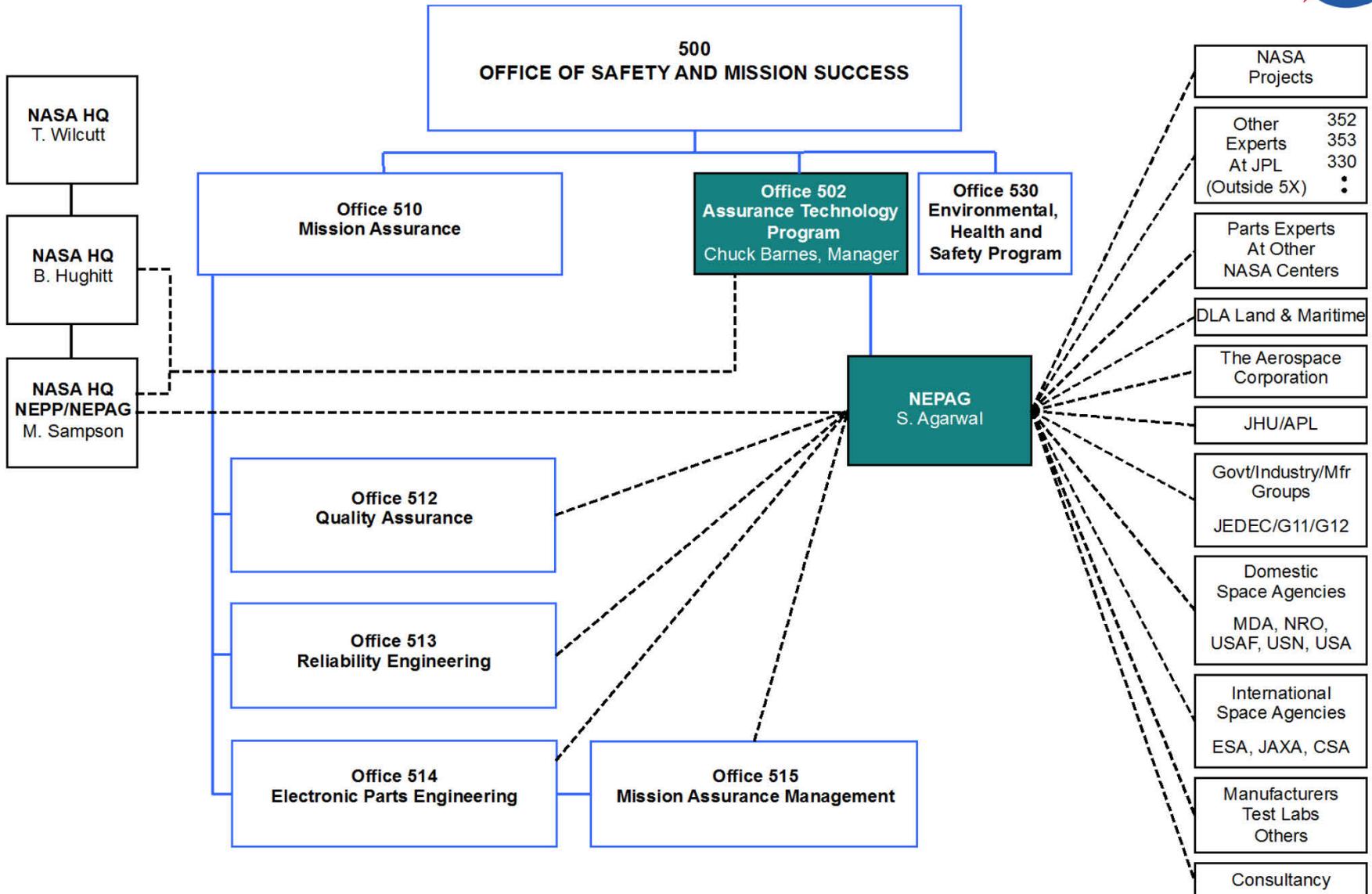
Team resources include:

- Mike Sampson, NASA/GSFC
- Mark Porter, G12
- Brent Rhoton, JC13
- Anduin Touw, G12
- Mike Adams, DLA-VQ
- Rob Heber, DLA-VA
- Tom Hess, DLA-VA
- Charles Saffle, DLA-VA



Backup Information

JPL NEPAG COMMUNICATION



2Q FY12 – Accomplishments (Contd.)

NEPAG PROGRAM SUPPORT



- **Telecons**

- Held weekly
- Participation
 - Domestic telecons: ~45
 - International telecons (held once a month): ~35
- The telecons drive other NEPAG activities
- Runs like a weekly production
- Point of contact: Roger Carlson

2Q FY12 – Accomplishments (Contd.)

NEPAG PROGRAM SUPPORT



- **Critical Parts Shortages**

- Support flight projects with their critical parts needs
- Point of contact: Lori Risse (514)
- Additional support
 - JPL 514 Parts Support group
- Four Prong Approach
 - Space community wide announcement through J. Brusse (GSFC)
 - Contact manufacturers
 - Contact franchized distributors
 - Contact defense contractors through JAPC (T. Gutierrez)
- Chance of Success
 - The above approach pretty much guarantees finding parts if they are out there and available
 - Best case example: Took only two days to find FPGAs for MIRI
- Accomplishment this quarter: Worked with manufacturers to find parts for MARS-TGO, NASA/MSFC, NASA/GSFC.

2Q FY12 – Accomplishments (Contd.)

NEPAG PROGRAM SUPPORT



- **EEE Parts Bulletins**

- A periodic newsletter – joint effort of ATPO/NEPAG/514
- Distribution
 - JPL/NASA centers/NEPAG: ~2000
 - QLF through Diana Shellman: ~3000
- Approvals
 - Template has NASA approval – obtained yearly
 - Bulletin is cleared for unlimited distribution by JPL URS – each issue
- Support
 - Assigned support: Lori Risse (514), Roger Carlson (274), Jim Okuno (FA photo)
 - Other support: Articles from NASA and JPL experts
 - Final version is approved by S. Agarwal, R. Menke, C. Barnes, M. Sampson
- New for FY11
 - Add MDA advisories – B. Hughitt's suggestion
 - Solicit more articles from specialists across the Agency – M. Sampson's suggestion
- Accomplishment this quarter:
 - Released March/April 2012 edition.
 - Response from specialists has been slow.

2Q FY12 – Accomplishments (Contd.)

NEPAG PROGRAM SUPPORT



- **NASA Review of Pre-released SMDs for Space Products**
 - Understanding between NASA and DLA Land and Maritime: NASA to provide comments within 10 days. JPL has responsibility for microcircuits and hybrid commodities.
 - Increased co-operation from DLA Land and Maritime and the manufacturers. NASA comments are viewed by DLA Land and Maritime as essential comments.
 - The in-house experts (Parts specialists, radiation specialists, packaging specialists, reliability engineering, and others) are called upon to support this effort.
 - No. of SMDs reviewed in FY12: 10 (20 including new technology SMDs)
 - Total No. of SMDs reviewed in FY11: 33 (40 w/new tech SMDs).
 - Total No. of SMDs reviewed in FY10: 80; Reviewed 41 in FY09.

NEPAG DLA Audits



- **DLA Audits Support**

- DLA Land and Maritime (formerly DSCC) is the designated DoD entity that has **authority to approve or disapprove suppliers**. They have a big team of auditors covering all parts commodities. They use certain established methods to conduct these audits. They audit close to 200 domestic and international QML/QPL suppliers every year..
- What the Agencies like NASA, Air Force, NRO bring to the audits is their **technical expertise**. An MOU was signed off few years back. It provides the guidelines for how the audits are to be supported.
- **The MOU between DLA and space users is very clear on certain things**, e.g. the auditors must be the recognized subject matter experts, they must actively participate in the audit, and stay with the team until the audit has been concluded, etc.
- Audits to be supported by the space community are **decided on the NEPAG telecons**. Our participation in the audits is therefore customer driven.
- There are two parts to an audit: certification (capability demonstration) and qualification (successfully building product). In most cases we don't visit the supplier facility for qualification approval.

NEPAG DLA Audits



- **DLA Audits Support (contd.)**
 - These **U. S. government audits** are based on the premise **”trust but verify”**. The certification audits can not be done via phone calls or other such means (which would cover only “trust” part of the audit).
 - Many documents are company proprietary and can only be looked at during the audit. They wouldn’ t send them outside even if there was an NDA.
 - The audit team spends a vast portion of the audit time to go on the production floor, test floor, etc. to talk to the operators, engineers, physically witness the operation or test being performed. It can not be done via webex.
 - In NASA view the audits are a multi-prong effort: we support them as subject matter experts, gain personal knowledge, make contacts, **resolve any flight project issues with that supplier** (e.g., oscillator issue for NASA Kepler project).
 - Only a small portion of the audits conducted by DLA are supported by NASA. **In FY11, NASA supported 39 of the 180 DLA domestic and overseas audits** (all commodities). This number represents a 20% cut from FY10. Further cuts are planned in FY12.
 - The findings are reported on the NEPAG telecons. A high level summary of the audits supported by NASA is entered into the NASA **SAS** (supplier assessment system) database.

Class Y



DLA-VA's Engineering Practice (EP) Study for Class Y is **complete**

DLA-VA hosted a coordination meeting regarding Class Y on April 12 & 13, 2012

Background

Back in 2009, there was a big push to bring the Xilinx Viirtex-4 (a non-hermetic part) into the QML system as Class V device. NASA and others were not in favor as it would have created massive confusion. Mike Sampson conceived the idea of a new Class Y for non-hermetic space parts to provide QML coverage for Xilinx Virtex-4 and similar devices.

A new G-12 Task Group, TG 2010-01, was formed in early 2010 to address non-hermetic devices for space. Shri Agarwal was asked to lead the effort.

This task was challenging because it:

- Was far more involved than typical G12 tasks,
- Required development of a brand new concept,
- Used system-on-a-chip (SoC) — one of the most complicated devices,
- Needed to be simple and easily understood,
- Possessed sketchy testing and board assembly boundaries, and
- Was needed to procure a standard QML product as quickly as possible.

Why “Class Y”?



- This effort is an attempt to bring advancements in packaging technology into the QML system.
- Advancements in packaging technology, increasing functional density and increasing operating frequency have resulted in single die SoCs with non-hermetic flip-chip construction, in high-pin-count ceramic column grid array packages
 - “Poster Child” example: Virtex-4 (V-4) FPGAs from Xilinx
 - Such products were evaluated for radiation and reliability and have drawn the attention of the space user community
- Question: How do we bring V-4 and similar microcircuits into the QML system as space products?
 - It can’t be Class V because those are hermetic devices
 - Our intent is to put V-4 like products for space users in a new category: “Class Y”.
 - A year ago, G-12 opened a Task Group to develop Class Y
- What if we dropped the Class Y effort?
 - It would be a major loss for the space community and the QML program at large because the industry would be limited to ordering via Source Control Drawings (SCDs), which is counterproductive to Mission Assurance, prevents standardization, and is expensive.

G12 Class Y Task Group Summary



- The Team requested G12 approval for DLA - VA to conduct an Engineering Practice (EP) study using the detailed requirement input the Task Group has developed. This request was approved by G12.
- The Team's request for clear approval of the Task Group charter was also approved by G12. The charter statement reads:

"This task group will develop requirements, including qualification and screening standards, for non-hermetic, ceramic-based microcircuits suitable for space applications. Initial effort will be focused on support for devices using flip-chip ceramic column grid array packaging, with resulting requirements to be submitted as a proposal for consideration to DLA Land and Maritime."
- So far 10 manufacturers have expressed interest in offering Class Y products (Xilinx, Actel, Intersil, Aeroflex, BAE, Honeywell, TI, e2v, 3D Plus, and Cypress).

Closure of QML-Y (and related) Activities



Time T
(Goal: October 2012)

