

## BAA07-36 Thermal Ground Plane (TGP) Questions and Answers

**Updated 5/29/2007**

Q : When are the abstract proposals due?

A : No later than 5:00 PM, Eastern Daylight Time, Friday, June 1, 2007

**Updated 5/7/2007**

Q : One concept for the TGP, as shown in your slides from the MTO Symposium (<http://www.mtosymposium.org/>) shows die mounted face-up on the TGP, with wirebonds to traces on the surface of the TGP (see Fig 1).

Is this the only scenario DARPA expects for TGP use in applications?

A : No, we're hoping that TGP substrates are used for many applications that differ from what is shown in Figure 1. For example, figure 2 shows use of TGP layers between the die in a 3-D stack. Figure 3 shows an architecture where die are mounted face-down on both sides of a standard MCM substrate, with TGPs attached to the backsides to carry heat from the die to the chassis. We understand that some specific requirements for the TGP materials would be different in these different cases, and we look for proposers to define their intended applications, and discuss their materials selection and design choices in the context of those applications. Obviously, approaches that serve multiple applications are preferred, but there are some issues that may require specialization.

**Figure 1**

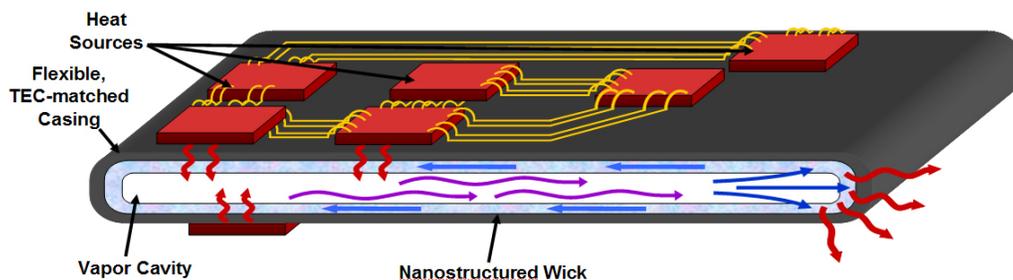


Figure 2

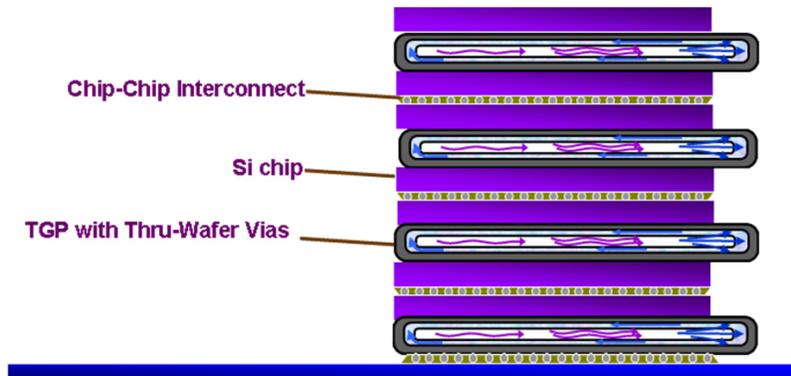
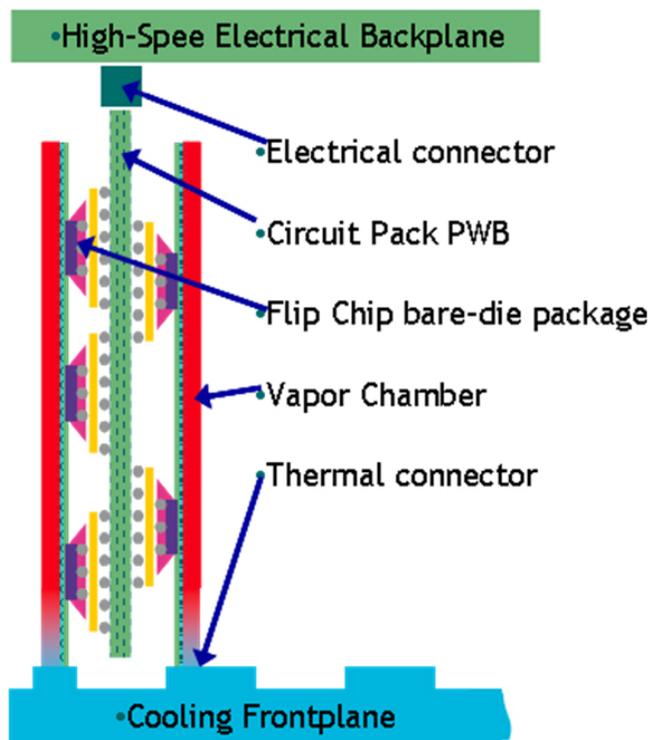


Figure 3



## **Updated 5/2/2007**

Q : What is the overall Budget for TGP, and what is the target budget for single proposals?

A : There is no overall budget or proposal target budget. Each proposal should include a budget based on the costs required for that team to achieve the technical milestones of the program. These costs will certainly vary, depending on the methods and approaches taken. Proposals will be selected on the basis of technical merit and with a goal of promoting multiple, complimentary efforts capable of serving a wide array of DoD thermal management challenges.

## **Updated 4/30/2007**

Q: When will ITAR Restrictions be applied to the TGP Program.

A: The TGP program will begin with fundamental research (basic and applied research ordinarily published and shared broadly within the scientific community), and will not have ITAR restrictions imposed at the outset. As the program moves from fundamental research towards a manufactured technology, ITAR restrictions are likely to be imposed. The timing for this is not clear at this time, and depends on many factors. Because of the possibility of ITAR restrictions being imposed on the program, it is necessary for proposers to formulate plans and mechanisms for ITAR, including some discussion of how the restricted portions of their work can be completed under ITAR.

Preliminary plans for ITAR can be outlined in the pre-proposal due on June, and the feedback from the pre-proposals will provide an opportunity for discussion of specific elements of your plans.

## **Updated 4/24/2007**

**Q :** The TGP BAA doesn't focus on any specific application. Is there a DARPA-preferred application for teams to concentrate on?

**A :** Correct, the BAA doesn't have a single application focus. Our goal is for the TGP technology developed in this program to be generically applicable. However, please note that the technical goals and go/no-go milestones do not constitute a complete set of specifications. Some items, such as the total heat flux and operating temperatures, are not included.

This is deliberate, and is an opportunity for proposal teams to select applications that are familiar to them, and where they believe TGP can make a significant impact, and to tailor the unstated parameters to that application. A strong proposal will include detailed discussion of an application, and explain how the proposed effort will address all of the needs of that application.

## **Updated 4/18/2007**

**Q:** How many contracts does the government anticipate awarding?

**A:** The number of contracts to be awarded is based upon the availability of funding and the quality and diversity of the proposed solutions.

**Q:** Any cap on phase duration?

**A:** No; however, as stipulated in the BAA, "Schedule Realism" is one of the evaluation factors to be considered by the Government (Factor 5 - Schedule Realism: The offerors' abilities to aggressively pursue performance metrics in the shortest timeframe and to accurately account for that timeframe will be evaluated.)

**Q:** Any cap on the total duration over all 3 phases?

**A:** No; however, as stipulated in the BAA, "Schedule Realism" is one of the evaluation factors to be considered by the Government (Factor 5 - Schedule Realism: The offerors' abilities to aggressively pursue performance metrics in the shortest timeframe and to accurately account for that timeframe will be evaluated.)

Q: Is there a recommended maximum phase length?

A: No; however, as stipulated in the BAA, "Schedule Realism" is one of the evaluation factors to be considered by the Government (Factor 5 - Schedule Realism: The offerors' abilities to aggressively pursue performance metrics in the shortest timeframe and to accurately account for that timeframe will be evaluated.)

Q: Any limits/restrictions on the number of teams a contractor can be on?

A: There are no restrictions on the teams, members, or leaders.

Q: Can foreign entities apply?

A: Foreign entities are allowed to apply, but some of the technology developed or involved in this program may be ITAR restricted. The proposals must describe the plans for managing information and work when these restrictions become relevant.

### **Updated 4/16/07**

Q : The performance of present heat pipes is a complicated function of many parameters. Is there a concise paper that describes the relationship between these parameters and performance?

A : Yes, there are books, such as Heat Pipe Science and Technology by Amir Faghri. A recent paper by Ravi Prasher ("A Simplified Conduction Based Modeling Scheme for Design Sensitivity Study of Thermal Solution Utilizing Heat Pipe and Vapor Chamber Technology", ASME Journal of Electronics Packaging, V.125, P.378 (2003)) is an excellent concise description of the scaling rules.

Q: The BAA does not describe a specific application. Does DARPA have a specific application in mind?

A: No. There are many potential applications for TGP, just as present Copper alloy substrates are used in a broad array of applications. It is a good idea for you to describe one or more applications in the proposal, and select the free parameters to match the needs of your applications.

Q: Can individual investigators propose work on a single component of the TGP, such as the wick?

A: We prefer to see complete TGPs built in this program, in a process that is compatible with volume manufacturing. For that reason, teams are encouraged, including representatives with expertise in basic science, fabrication, testing, and manufacturing. Teams led by industrial members capable of manufacturing TGP products are expected to be strong.

Q: Are systems which include pumps, thermoelectrics, and refrigeration encouraged?

A: The vision of this program is for simple, high-performance substrates that fit specific volume and performance constraints. There is a preference for “passive” thermal management, such as is provided by heat pipes, but “active” solutions are not explicitly excluded. Proposals that include active approaches must address how their approach will allow adoption of those technologies, given that the present versions of these technologies are not in wide use.