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Good morning. My name is Mark Melliar-Smith and I am the Chief Executive officer of Molecular Imprints. I am pleased to be able to provide testimony today is support of the Nation's efforts in nanotechnology. My company is but one example of the successful support of new technology by the US Government, and I am happy to talk about this success.

Molecular Imprints is a start-up company, which was spun out of the University of Texas at Austin in 2001. The company was created to commercialize a newly invented technology called "Step and Flash Imprint Lithography", which has demonstrated capability to pattern features down as small as 3nm, or about the diameter of a DNA molecule.

Nano-lithography is the method of creating very small patterns on a substrate. The technology is critically important, especially to the production of electronic devices such as computer chips. Today, the technology used to do this is an optical technique, much like making photographic prints, where the patterns are projected onto a light sensitive resist on the substrate using a very sophisticated and expensive camera. However this technology has begun to be limited by the wavelength of light. It is very difficult to make a 50nm feature with a 200nm light source.

Molecular Imprints offers a superior alternative based on nano-printing. We make a very accurate master using an electron beam tool of almost unlimited resolution and then use the master to simply print, using a special ink, the features on to the substrate. As you can see the quality of the images are much better and the simplicity of the tool makes it much cheaper. The analogy to photography can be extended here. You don't make prints photographically any more – you simply print them.

The Step and Flash Imprint development will have a significant economic impact on the United States. The original optical photolithographic techniques were invented in the United States in the late fifties and early sixties and build up into a billion dollar industry. However, in the eighties and nineties the US lost this capability to superior products from Europe and Japan, and now this $10B industry is almost entirely sourced from outside the United States as shown on this chart. At Molecular Imprints we intend to turn this around and bring the business back to the US trough the use of a new and superior nano printing technology.

However, the economic impact extends well beyond the $10B of litho tools themselves. This technology enables multiple industries. The largest is the $250B computer chip industry with companies such as Intel and Texas Instruments – which itself enables the $1.5T electronics industry and much of our advanced weapons systems. This industry has been built over the past fifty years on our ability to make smaller transistors every year. The disk drive industry, with companies such as Seagate and Western Digital, is also moving into nano technology. To increase the density of their drives, they will soon have to pattern the spinning magnetic disks – an example of which is shown here. These are 20nm magnetic pillars and a large disk drive in the future would have 10 trillion – yes trillion with a T, on each drive. We are working with the LED industry, to place nano features on high brightness LEDs to increase their efficiency and brightness. The objective to is make LEDs a replacement for all architectural lighting which if completed would save a significant fraction of all the electricity used in the United States and remove 50M tons of carbon from the air each year. Finally, looking further out, there is a growing interest in the use of nano medicines. By making the drugs into very small particles – less than 50nm, and of a particular shape, there is evidence that they can be made much more effective and much more specific.

So our technology has multiple applications from semiconductors to drugs to energy saving device for clean technology.

To create this opportunity – we have received a large amount of help from many different government agencies – and that is the purpose of my testimony today. Chronologically we have been supported by

- The University of Texas where the basic invention was created in the mid nineties and I would be remiss if I did not put in a word for the large research Universities in the country – they have become a great resource especially as the large corporate labs like Bell Laboratories are less available, and a resource that is hard to duplicate/outsource
- Some of the early funding to the University of Texas in the late nineties came through the joint activities of my colleague from SRC and Defense Advanced Research Projects Agency DARPA.
- Our first funding for Molecular Imprints in 2001 came from the DARPA to the tune of $3.5M
- We also won a major Advanced Technology Program grant of $9M in 2004 from the Department of Commerce
- And finally a $2.6M contract from the Office of Naval Research to help make the process more production worthy

In all cases the program and project management from these funding agencies has been impeccable, maintaining fiscal responsibility without overly micromanaging the technical efforts.

We have also received extensive help from government funded facilities. Especially useful has been our access to state of the art electron beam tools at the Molecular

Foundry at Lawrence Berkeley National Laboratory in California to make the very fine imprint masks required for our technology.

The government funding has been supplemented by over $60M worth of ventures capital and industry investment – and I have found no dichotomy between the two sources of funding. They are synergistic and collaborative.

We are grateful for all of this support. Our company has already grown to 90 people, and I might add with an average salary in excess of $95K per year, so these are really good jobs, and we expect $25M in revenue this year, twice that of 2007, and essentially we see an almost unlimited future for ourselves and our customers. None of this would have been possible without the various forms of support I have described.

Now I think we all know that one swallow does not make a summer, but if you will grant me an example of one – I would say the programs can be very successful.