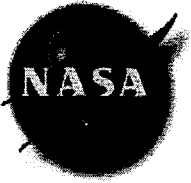
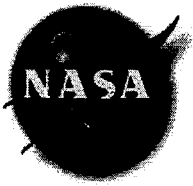


## **Three Dimensional Imaging Utilizing Structured Light**

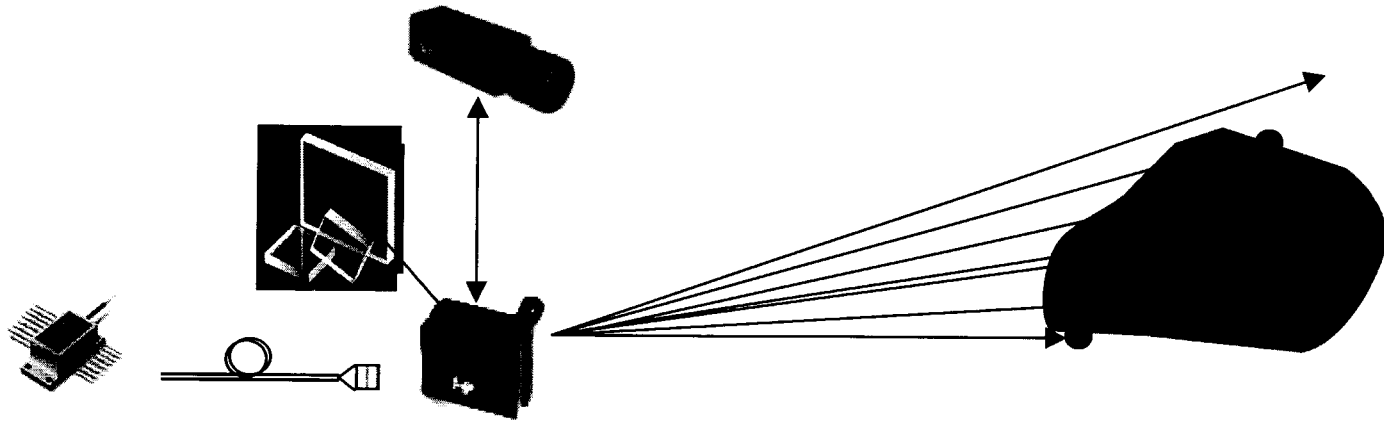
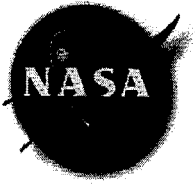
Carl Christian Liebe, Curtis Padgett, Johnny Chang  
Jet Propulsion Laboratory, California Institute of Technology  
[carl.c.liebe@jpl.nasa.gov](mailto:carl.c.liebe@jpl.nasa.gov)

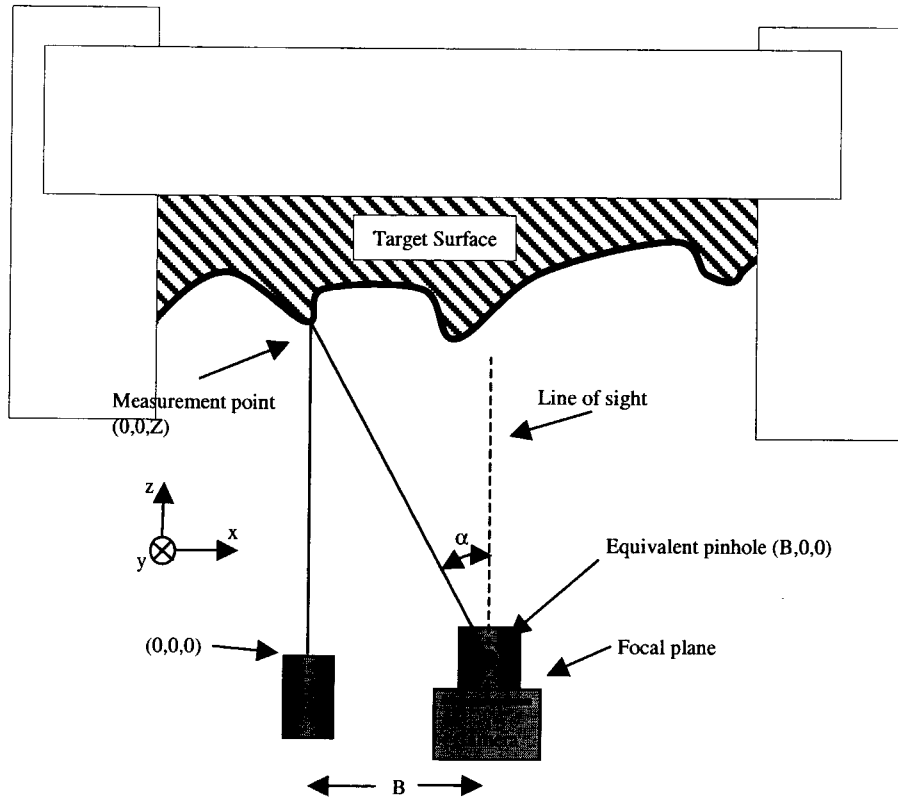
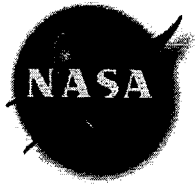


- **INTRODUCTION**
- **DESCRIPTION AND THEORY**
- **EXPERIMENTS**
- **CASE STUDY: STRUCTURED LIGHT  
UTILIZED FOR MARS LANDING SYSTEM**
- **SUMMARY**



	<b>Structur ed light system</b>	<b>Stereo Vision</b>	<b>Laser Radar</b>	<b>Microwave radar</b>
<b>Mass</b>	<b>&lt;1 kg</b>	<b>&lt;1 kg</b>	<b>6 kg</b>	<b>~30 kg</b>
<b>Power</b>	<b>A few watts</b>	<b>A few watts</b>	<b>&lt;40 W</b>	<b>~200W</b>
<b>Max operating distance</b>	<b>Tens of meters</b>	<b>Tens of meters</b>	<b>2.5 km</b>	<b>Kilometer range</b>
<b>Night time operation</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>
<b>Computational Demand</b>	<b>&lt; 10 MIPS</b>	<b>&gt; 100 MIPS</b>	<b>&lt; 1 MIPS</b>	<b>&gt;&gt; 100 MIPS</b>



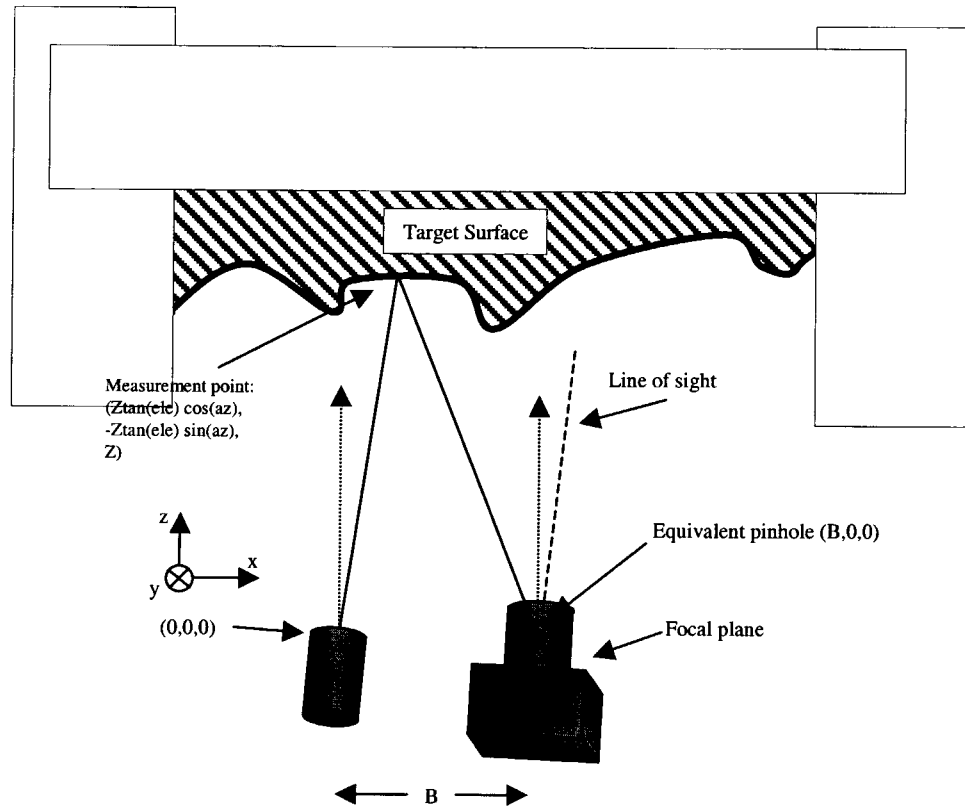
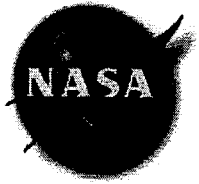


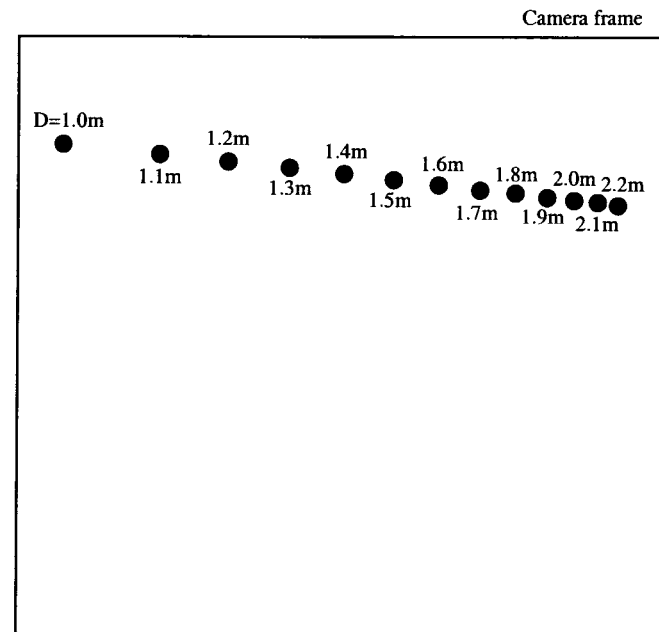
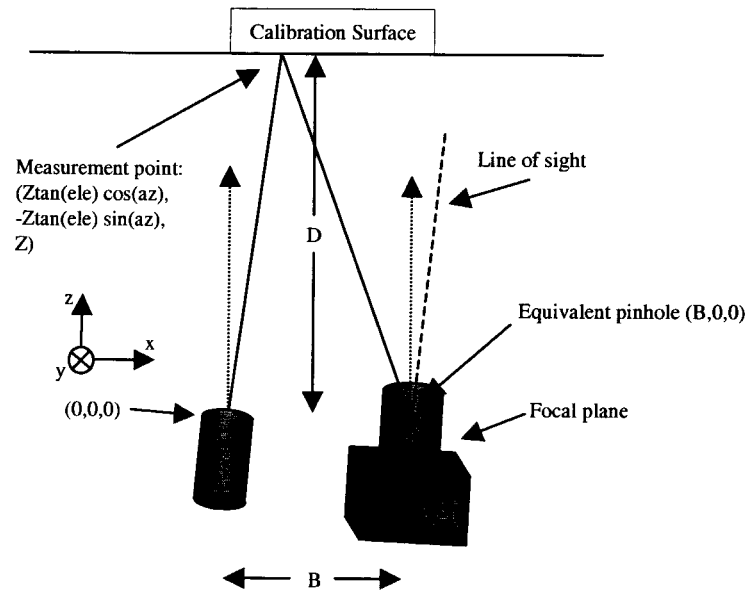
$$\frac{B}{Z} = \tan \alpha \Leftrightarrow Z = B \cot(\alpha)$$



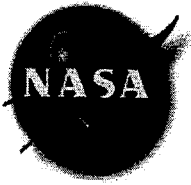
- Field of view of the camera (FOV),
- Number of pixels
- The accuracy of centroiding the spot.

$$\epsilon_{\alpha} = \frac{FOV \cdot \epsilon_{subpixel}}{N_{Pixels}}$$

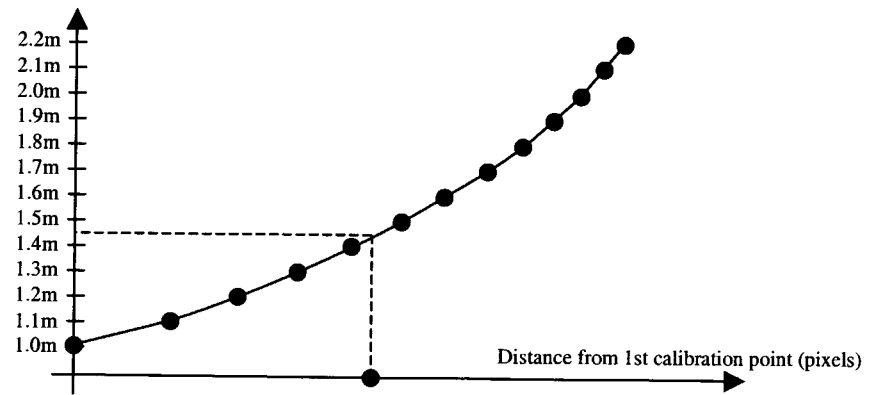
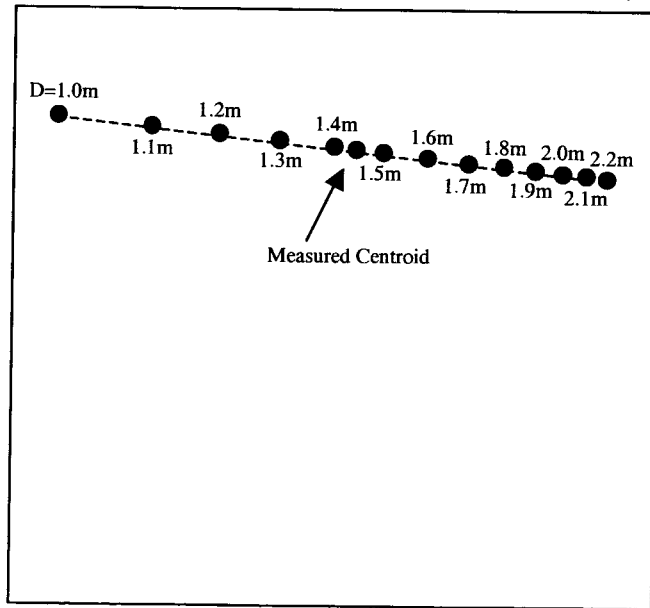


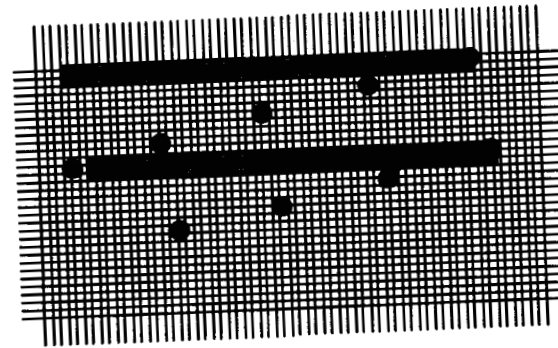
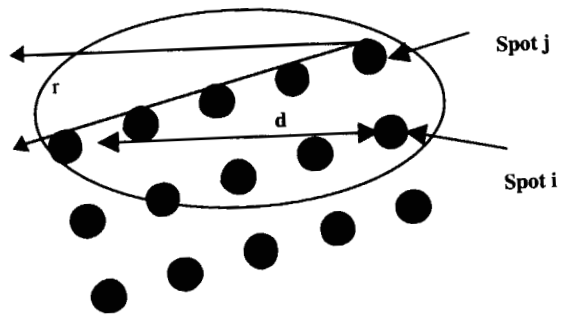


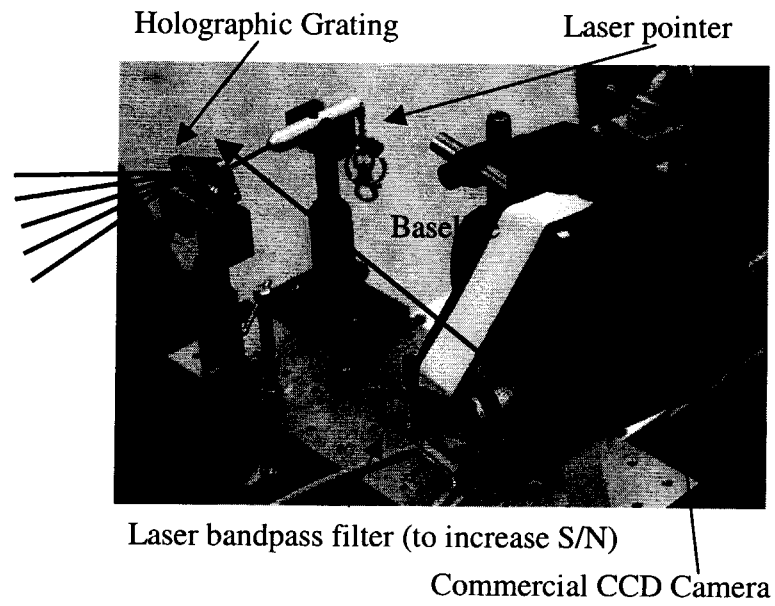
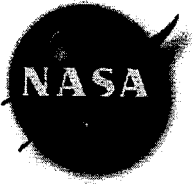


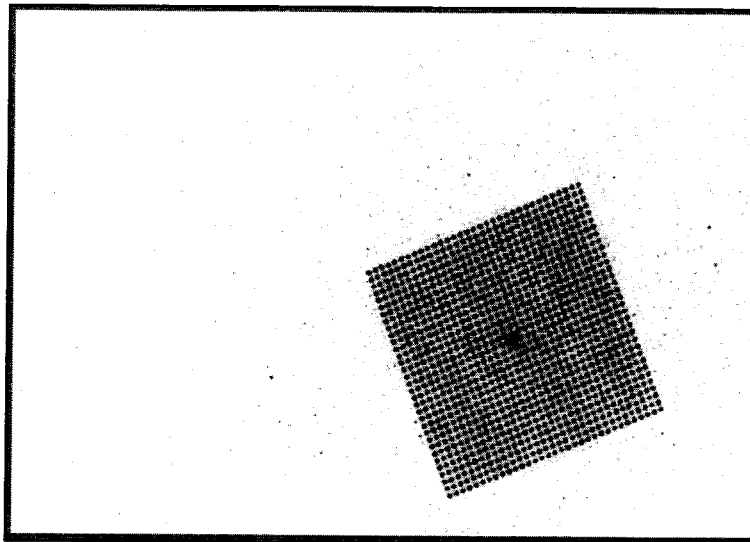
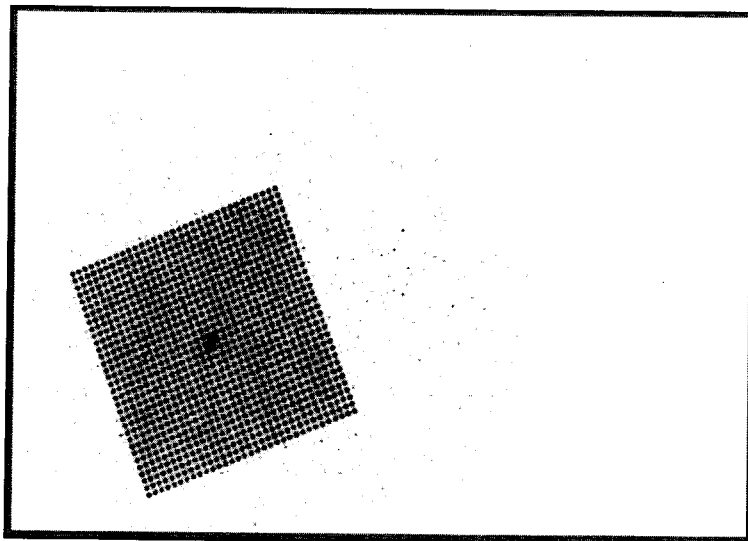
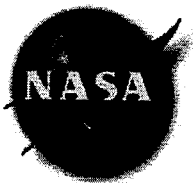


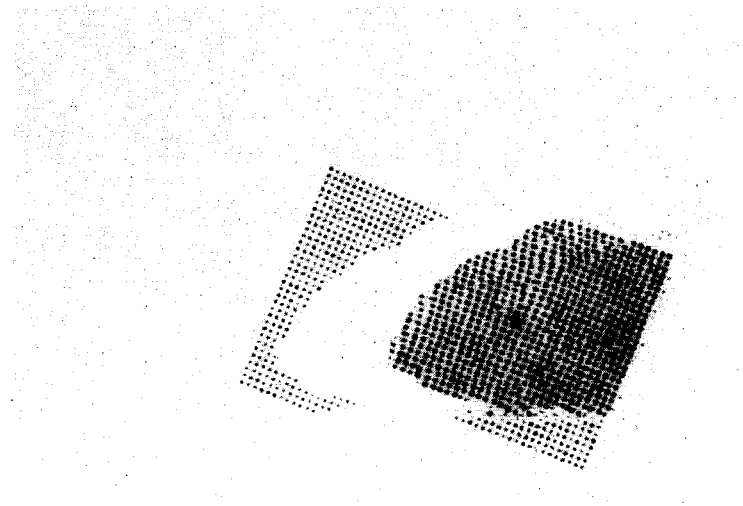
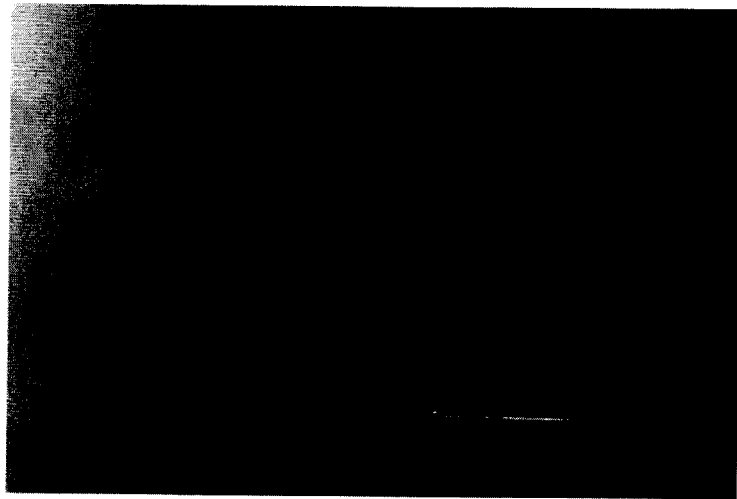
Camera frame

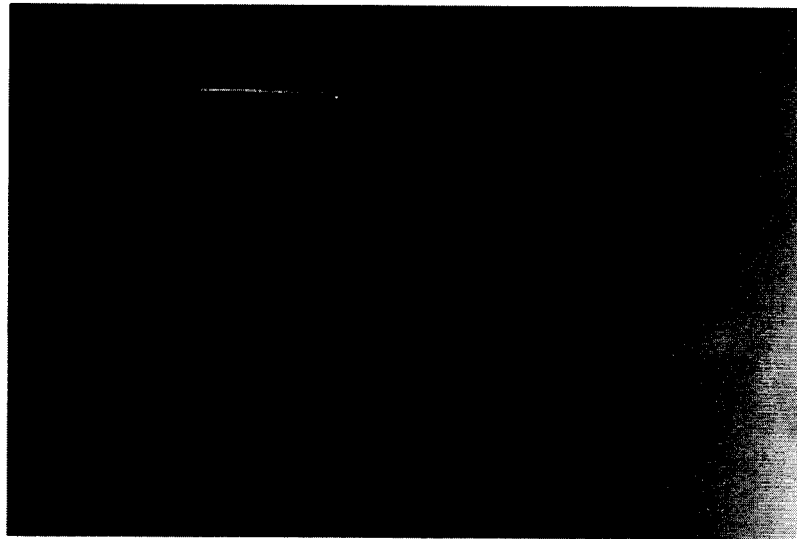
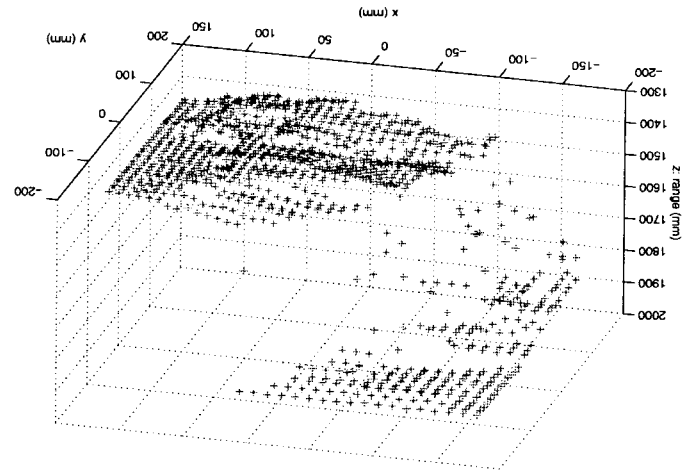
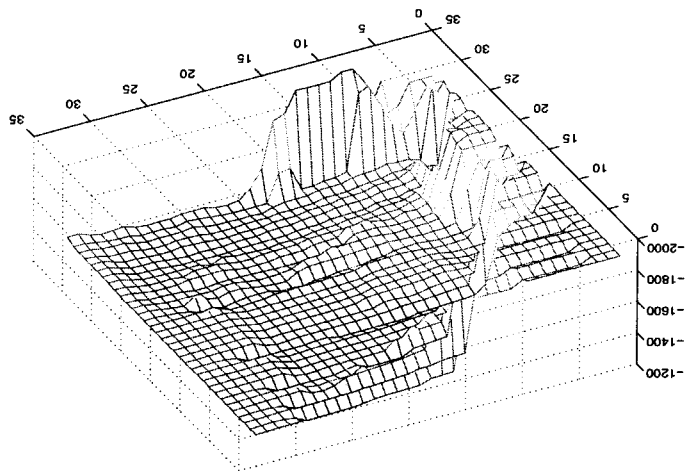




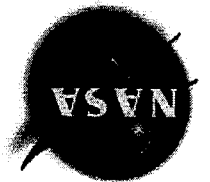


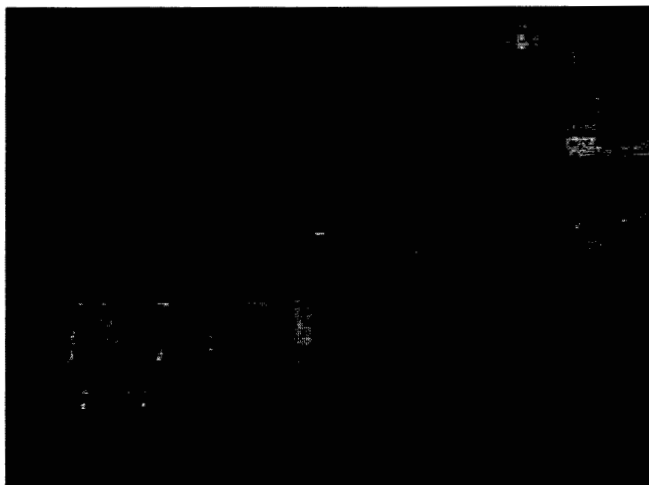




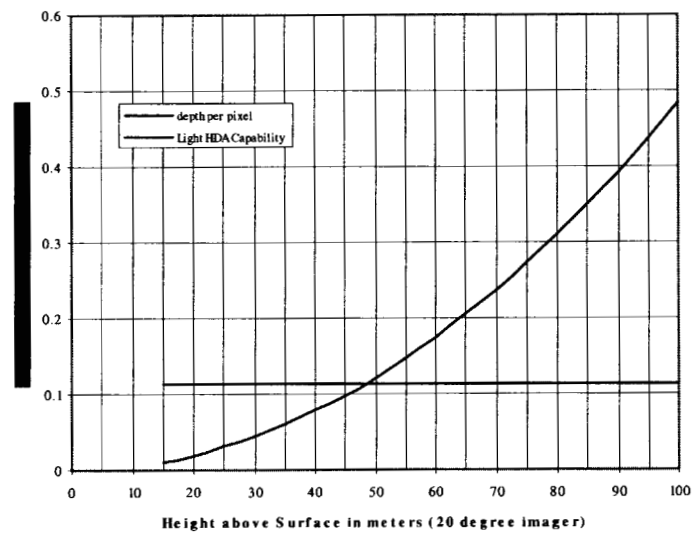


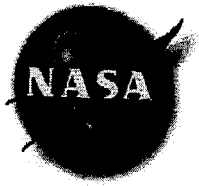
**Yer**





Range Resolution for Patterned Light





# Conclusions