INTRODUCTION TO OPTICAL ALIGNMENT TECHNIQUES

SPEAKER: Dr. Kenneth R. Castle, President of Ruda-Cardinal, Inc. of Tucson, AZ.

COURSE DESCRIPTION: This course will concentrate exclusively on the equipment and skills necessary to align optical devices. Industry often uses optical systems such as transits, theodolites and alignment telescopes to align mechanical systems such as bridges, conveyor assemblies, etc. This course will not discuss these applications.

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BENEFITS: This course will teach you how to

- determine if errors in the optical system are due to misalignment errors or other factors such as fabrication, design, or mounting problems;
- recognize and understand the fundamental imaging errors associated with optical systems;
- diagnose (quantitatively and qualitatively) what's wrong with an optical system by simply observing these fundamental imaging errors;
- use the variety of tools available for aligning optical systems, and more importantly, how to logically "tweak" the adjustments on these devices so that the alignment proceeds quickly and efficiently;
- align more complex optical systems such as those containing off-axis aspheric surfaces.

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INTENDED AUDIENCE: This course is directed toward engineers and technicians needing basic, practical information and techniques to achieve alignment of simple optical systems, as well as seemingly more complicated off-axis aspheric mirrors. To benefit most from this course you will need a basic knowledge of the elementary properties of lenses and optical systems (i.e. focal lengths, f/numbers, magnification, and other imaging properties) and a working knowledge of a simple interferometer. Some familiarity with the basic aberrations such as spherical aberration, coma, and astigmatism will be helpful.

Agenda*

1.0 Introduction and General Comments

2.0 Recognizing Elementary Aberrations and Their Role in Optical Alignment

3.0 Alignment Equipment and Diagnostic Tools

4.0 Classic Alignment Examples

5.0 The Alignment of Off-axis Aspherics

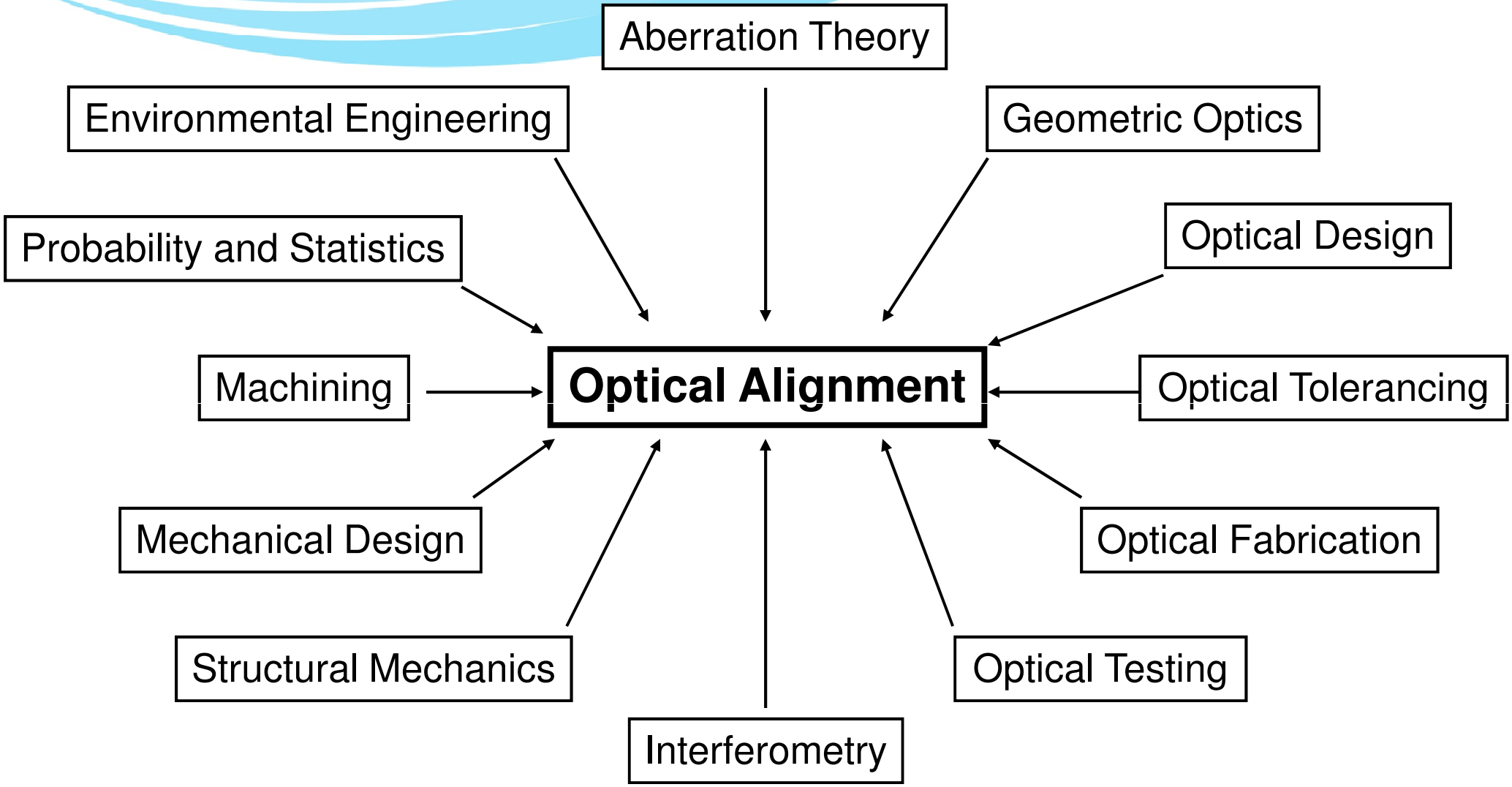
6.0 References

* Not all of the material in the notes will be presented

1.0 Introduction and General Comments

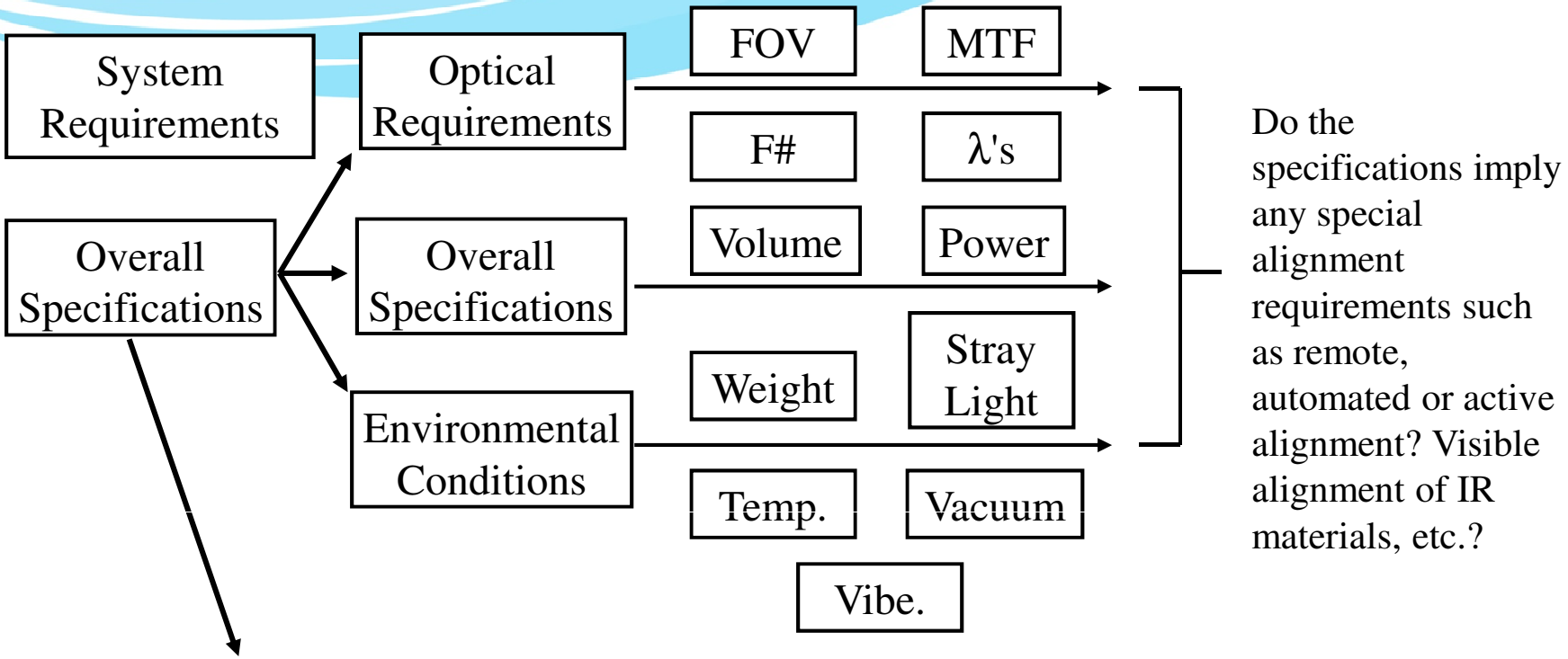
- Fields drawn upon for optical alignment
- Alignment and scheduling
- Basic optical terms and definitions
  - Cardinal points
  - Auto-reflection
  - Retro-reflection
  - Cassegrain telescope

Fields drawn upon for optical alignment



Also: Radiometry, Detectors and Detector Electronics, Signal Processing

Alignment and Scheduling



Some Comments

- Alignment Plan:

  The basic philosophy of how to perform the alignment. A very important step!

- Alignment Procedure:

  The nuts and bolts, step by step document covering the "how to" to a specific accuracy.

- Iterative Alignment:

  Always adopt a philosophy where the entire system is brought into alignment gradually, rather than sequentially. Do not align each component to high accuracy before proceeding to the next. Align to a foot, an inch, a mm, a mil then a micron!

  Can also mean the relative cross-talk (orthogonality of alignment controls).