VLA Experimental Resource for Testing Innovative Configurations and Lightings (VERTICAL)

2005 IEEE Aerospace Conference

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- **Objectives**
- Approach
- Design / Solution Overview
- MS flight Simulator: Benefits, Enhancements & Limitations
- Current Prototype
- Status & Deliverables

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Objectives (from Topic)

- Develop an analytic test tool that can be used to support (VTOL)/rotorcraft ship VLA analysis and testing
    - Fly specific aircraft shipboard approaches on a personal computer with a realistic view from the cockpit
    - Adjust ship VLA components and environment lighting
    - Useable at test team member's work area

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Approach Overview

- Simply build a system that approaches the fidelity of high-end simulator

- Constraints

  – cost 2 orders of magnitude less money to develop

  – Require 2 orders of magnitude less cost in hardware to operate.

- I.e., 1/100th the cost

Know the Competition

- Aechelon considered by many to be top-of-the-line for high-end simulation

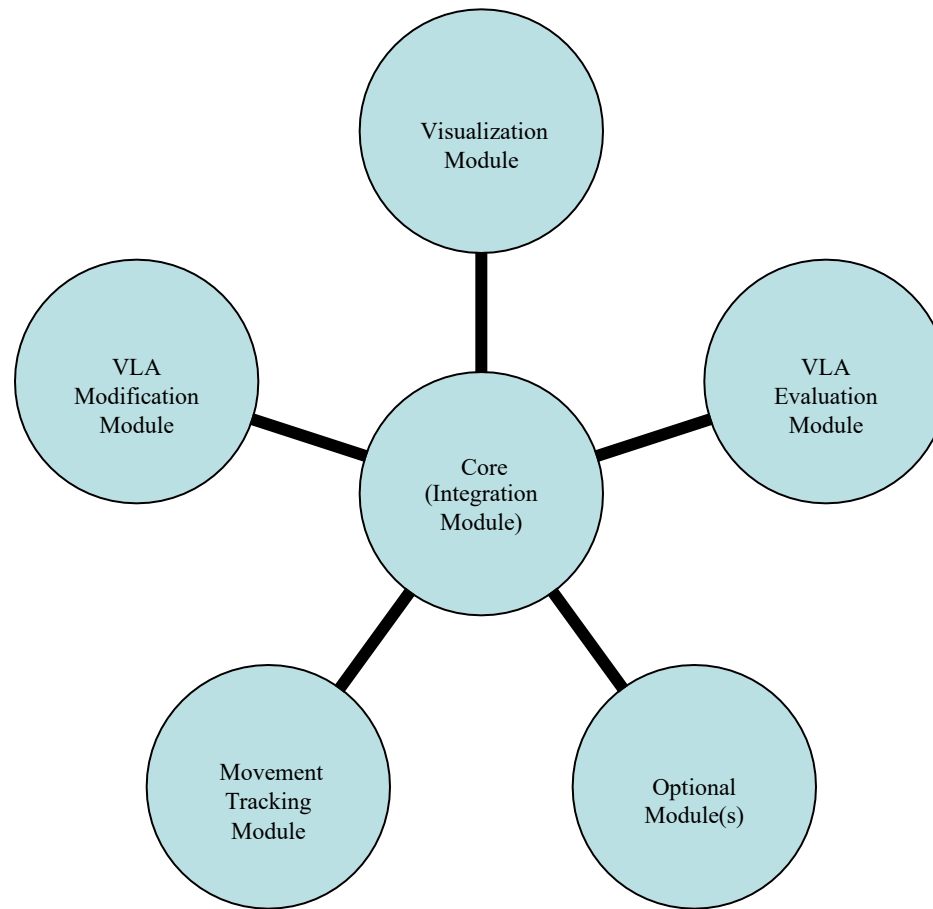 - Video of Aechelon's best presented at I/ITSEC 2004

Iterative Development

- Design, implement, evaluate, repeat

- Keeps client in the loop

- Allows for more feedback and guidance

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VERTICAL Architecture

Visualization Module

VLA Modification Module

VLA Evaluation Module

Core (Integration Module)

Movement Tracking Module

Optional Module(s)

Visualization & VLA Mod Modules

- Try MS Flight Simulator as Visualization Module

- Custom built VLA Modification Module

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MS FS: Benefits

- Low cost: ~$50 per seat
- Relatively open platform
  - API & FSUIPC
- Real world & user settable weather
- PC-based & supported by other products
  - E.g., Graphics cards, Motion trackers
- Many low-cost add-ons available
- 2 year upgrade cycle
 - This project migrated from 2002 to 2004

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MS FS: Limitations

- NVG capability

- Chromaticity and Photometric

  - Need to investigate quality versus other COTS tools

MS FS: Needed Enhancements

- High-definition Ship models
  - With lighting
- VLA Modification Module (Light Controls)
  - Color
  - Intensity
- Ship Motion
  - Speed, bearing
  - Pitch & roll

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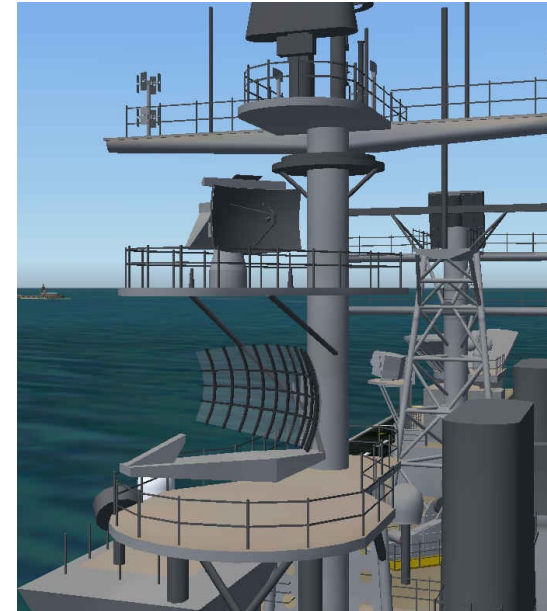
Can MS FS Support Detailed Models?

- Recall the Aechelon standard
  - [Video of Aechelon's best presented at I/ITSEC 2004](#)
- Example of MS FS
  - [LHD 5 with Helo flight](#)

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Current Prototype

- *VLA Modification Module*
- Combine with MS Flight Simulator *Visualization Module*
- *Movement Tracking Module*
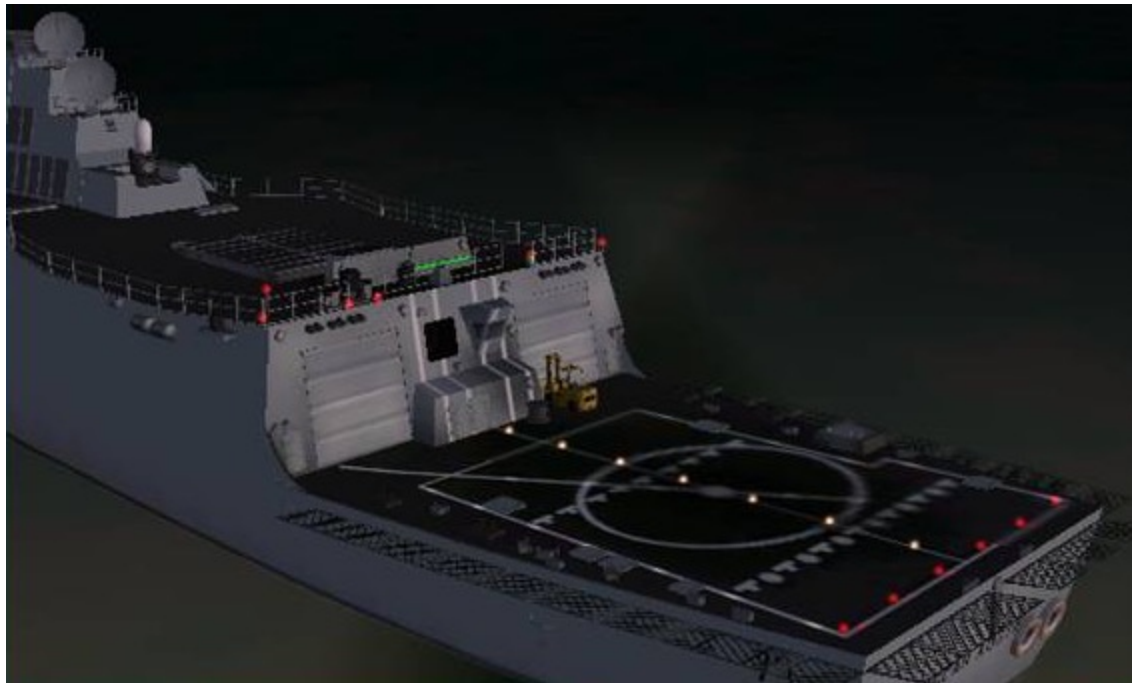 - *HMD*
  - *InterSense motion tracker*
  - *TrackIR^2*

Visualization Module

VLA Evaluation Module

VLA Modification Module

Core (Integration Module)

Movement Tracking Module

Optional Module(s)
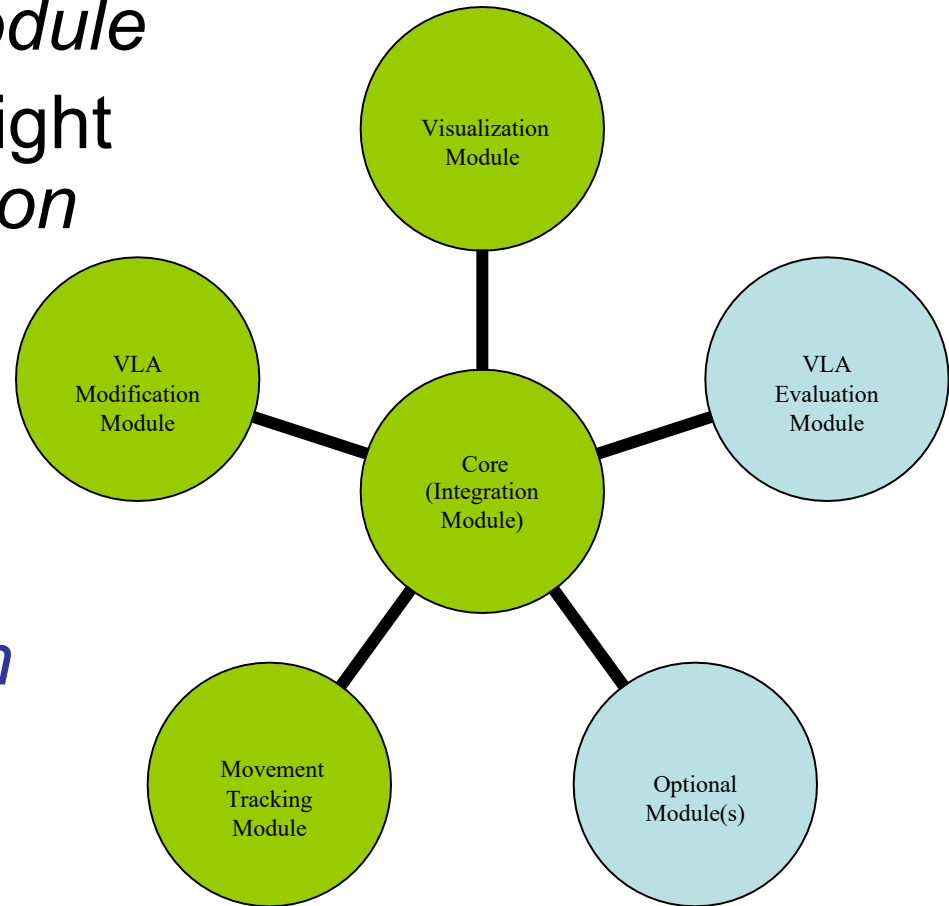
Modeling Visual Landing Aids

- *LHD 6 at Dusk showing lighting*

Field of View:
From cockpit: Unoccluded

Field of View:
From Any Spot Outside of Aircraft

Field of View: Harrier
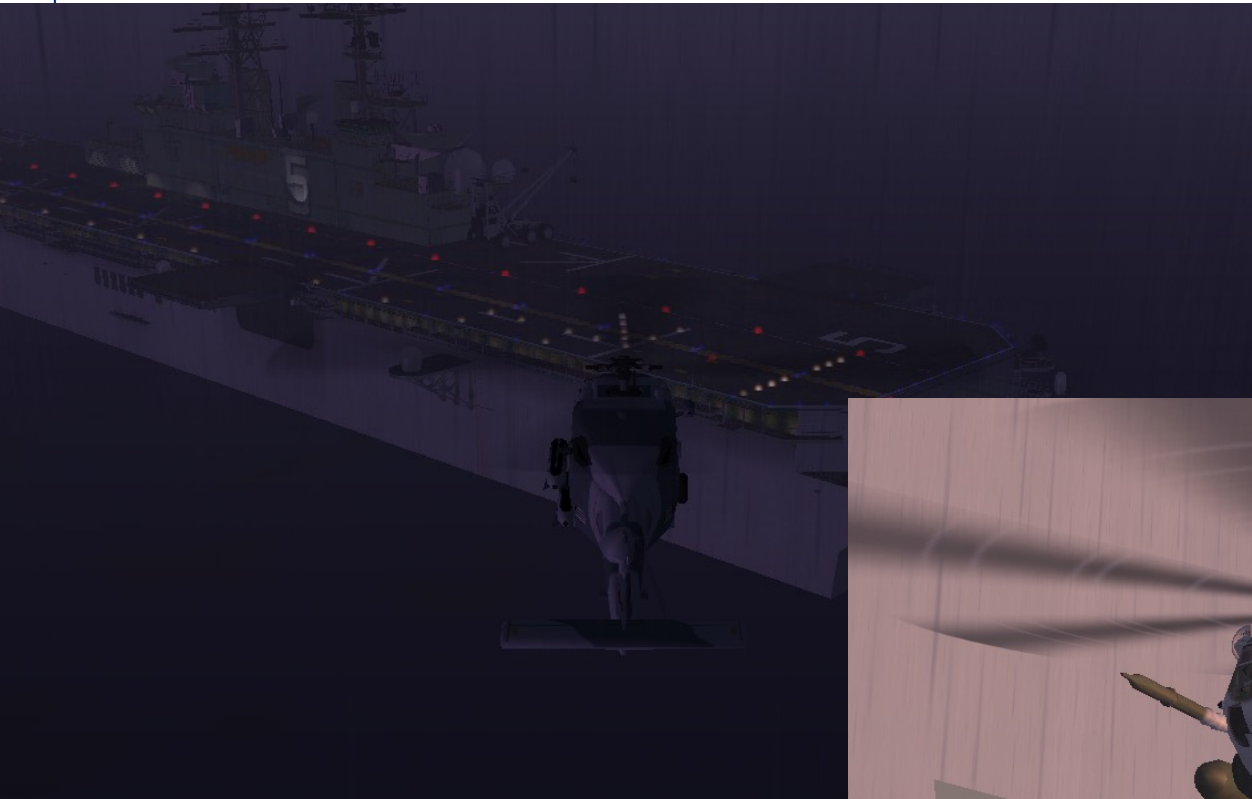## From cockpit: Showing Cockpit

Aircraft

- Most Navy / Marine aircraft available
- More being built / updated

Example: Landings

Images

VLA Modification Module

VLA Modification Module Capabilities

- Set lights
  - Color, intensity
- Load desired ship(s)
  - LHDs & DDG
- Set ship speed and bearing
- Aircraft Placement & Status
- Save / load different configurations

Example with DDG
Example with LHD

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Pitch & Roll

- Currently reacts to weather (wind)
- Will be setable via VLA Modification Module

Ship Motion

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Status & Deliverables

- Current Prototype
  - High definition LHD & DDG Ship Models
    - Ship speed and bearing settable
    - Support pitch & roll
  - Light Control GUI
  - Aircraft Placement & Status GUI
  - Ship speed & bearing settable via GUI
  - Windows Installer
- User's Manual
- Proven with movement tracking

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DDG Flight

Presenter: Robert Richards, Ph.D.
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BRAKES

Extra Slides

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Visualization Module: Components

- Models independent from Visualization Engine

- Ship Models Generated
  - Output to MS Flight Simulator
  - Output to OpenFlight

```
                ┌─────────────────────────┐
                │  Visualization Module   │
                └─────────────────────────┘
          ┌──────────────┴──────────────┐
┌──────────────────────┐      ┌──────────────────────┐
│ Visualization Engine │      │     Ship Models      │
└──────────────────────┘      └──────────────────────┘
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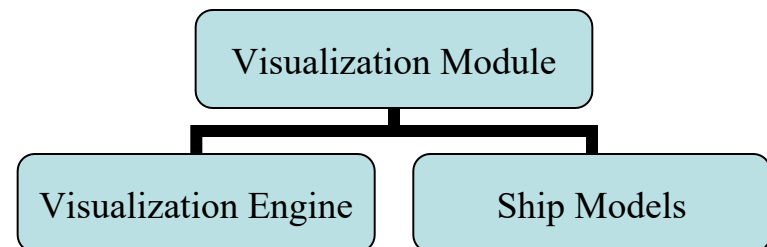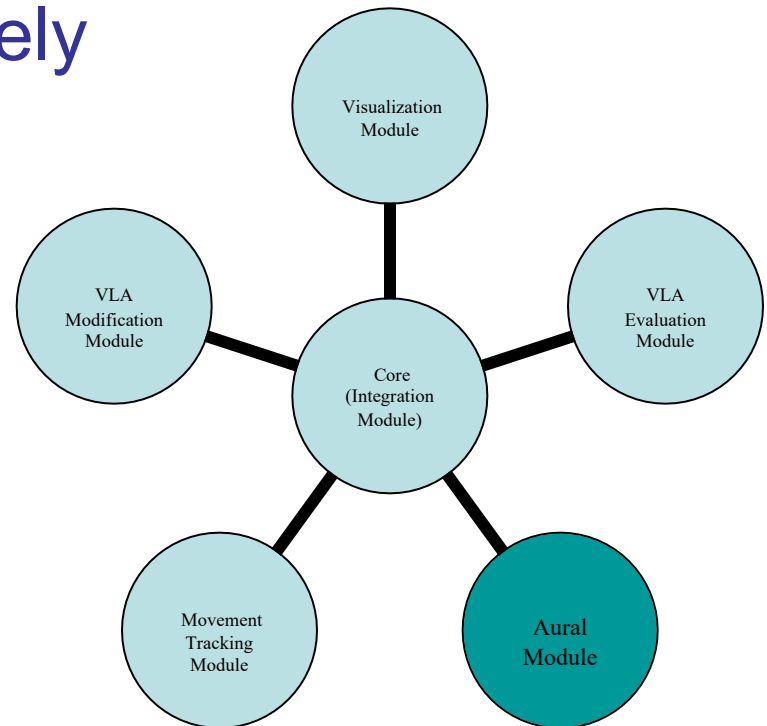
Multiple Configurations

- Low-end version on many desktops
  - E.g. utilize MS FS
- High-end version
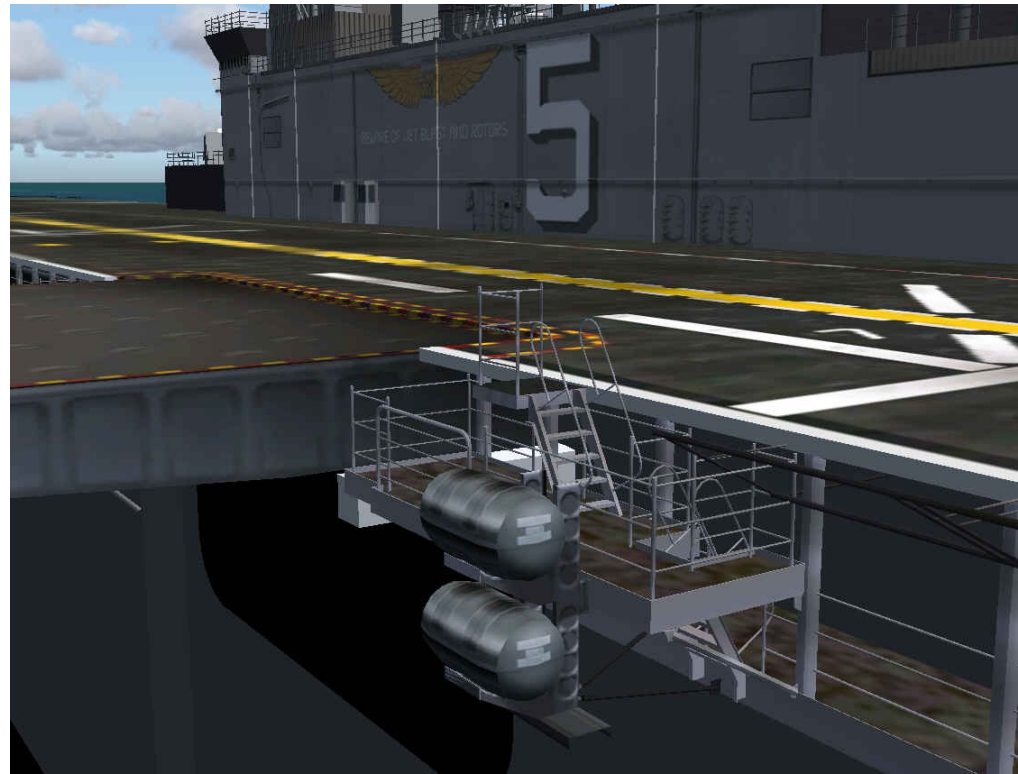 - More detailed analysis
  - NVG analysis / more detailed NVG

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Optional Modules: Easy to Add

- Aural module
  - Provide audio to simulate real-world conditions more closely

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High-definition model of LHD
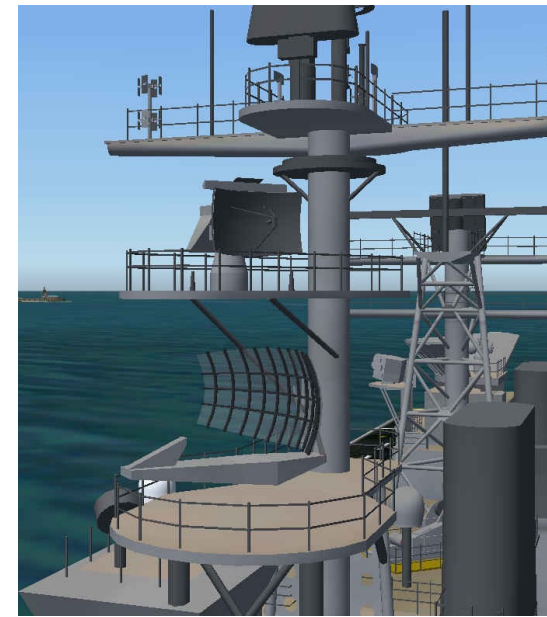
- Video – LHD Model

Weather & Time of Day: E.g. Fog

Video: Foggy Flyby

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Field of View: MH-60S/R
From cockpit: Showing Cockpit

Movement Tracking Module

- Head-Mounted Display
- Motion Tracking (E.g., by InterSense)

NVISOR SX

NVIS
New Virtual Imaging Systems

High-Resolution, Wide Field-of-View
Head-Mounted Display

1280 x 1024 Pixels / Eye
24 Bit Color
Stereoscopic
60 degree diagonal field-of-view
Motion Tracking Available

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