



**Western Bridge Engineers' Seminar  
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**Underwater Bridge Inspection  
in the Golden State**

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# Underwater Inspection Program, Office of Specialty Investigations



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# Background

- Underwater investigation is required by federal law (23 CFR 650)
- Inspection frequency is not to exceed 5 years for bridges in excellent condition
- Can be done by wading and probing
  - By above water inspectors or divers
  - Must be able to determine condition with certainty

# U/W Inspection Inventory

- Currently 800 bridges by diving procedures
  - Water over 3 feet deep or
  - Current over 1.5 ft/sec or
  - Other hazards such as contaminated water or deep soft mud
- Bridges vary in size and complexity
  - Time required varies from 1 hour to several months
  - Average 160 U/W inspections per year



# Richmond-San Rafael Bridge



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# Antioch Bridge



# Bay Bridge



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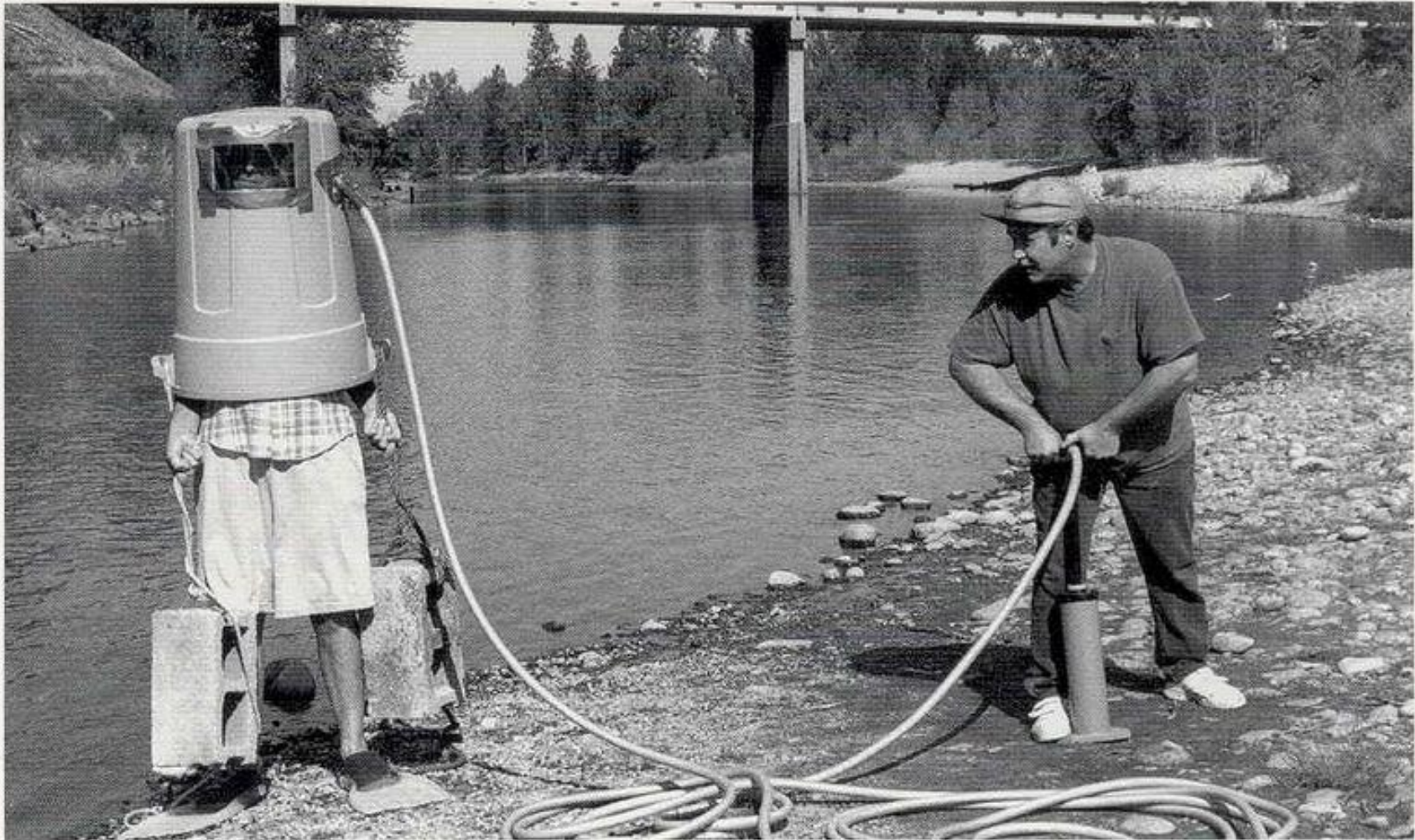


# Carquinez Bridge





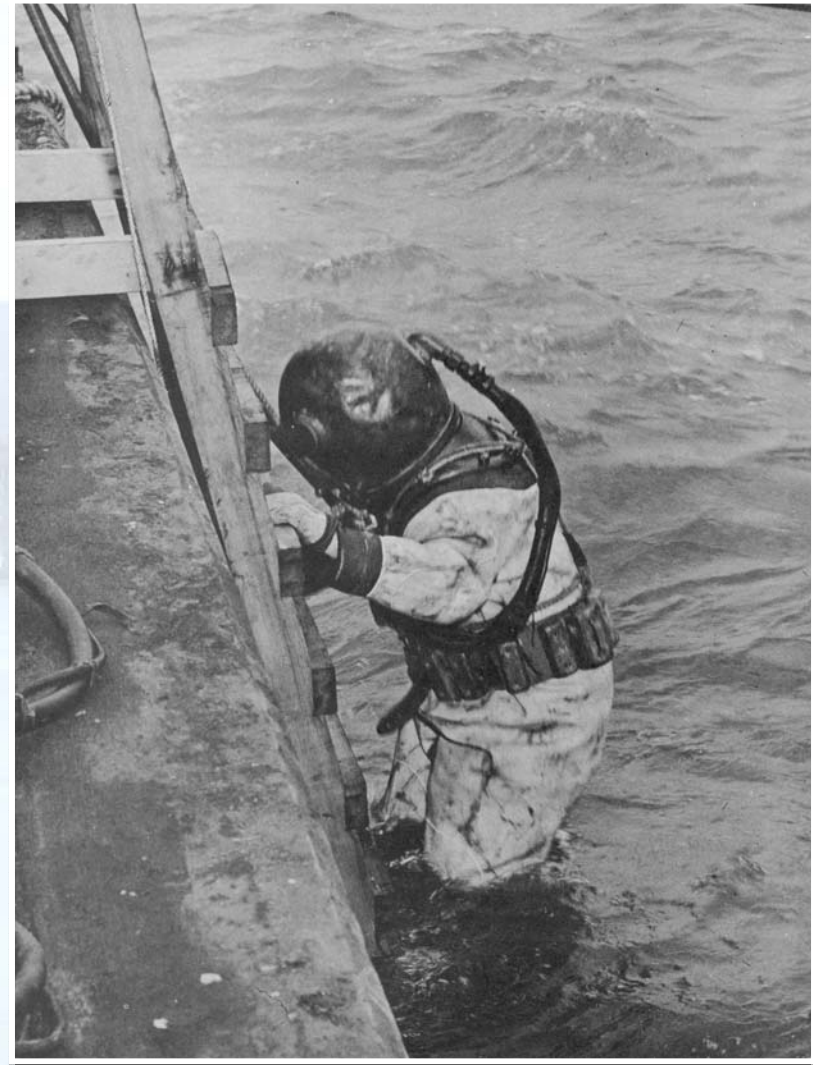
# CalTrans, In the Beginning...



*Do-It-Yourself Diving Gear*

# CalTrans Diving History

- Assistant Bridge Engineer in 1950s and '60s
  - Standard Navy dress
- 1978 to 1987 California Department of Water Resources
  - Damage inspections
  - SCUBA Gear





# CalTrans Diving History

- In 1988, the National Bridge Inspection Standards were amended to require underwater investigations of bridges
- Caltrans responded to the 1988 NBIS amendment by creating a formal underwater inspection program



# CalTrans Diving History



- Caltrans dive team was formed in 1988
  - Standard SCUBA gear
  - Trained at SCRIPPS as research divers (100 hrs)
- In 1992 bought two Superlite 17s, dive control system and umbilicals
  - Trained by Santa Barbara City College, off-site
- Program has since evolved
  - Fully equipped SS Diving spread
  - Formal dive training program
- Engineering inspections only, no construction or maintenance work



# CalTrans Underwater Program Today...



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## CalTrans Underwater Inspection Team Make-up

- (1) Program Manager (PE), Dive Supervisor
- (2) Engineer (PE), Dive Supervisors, Bridge Divers
- (1) Engineer, Bridge Diver
- (3) Engineering Technician, Bridge Divers
- (3) 25% Engineer (PE), Bridge Divers from other programs within Caltrans
  
- Within this program there are six (6) California PEs, three (3) qualified Diving Supervisors, six (6) Bridge Inspection Divers and one (1) Entry Level Diver/Tender.

# CalTrans Typical Crew Size

- Minimum crew size is four divers.
- This number is increased for conditions such as contaminated water, penetration dives, larger bridges, repetitive deeper dives, or other hazardous conditions.
- On any given dive, the minimum crew is:
  - (1) Dive Supervisor (similar to ADCI Air Diving Supervisor)
  - (1) Bridge Inspection Diver (similar to ADCI SS Air Diver)
  - (1) Rescue Diver (similar to ADCI SS Air Diver)
  - (1) Dive Tender (similar to ADCI Entry Level Diver/Tender)
- The Dive Supervisor also acts as the NBIS Team Leader meeting the requirements of the NBIS.



# Typical CalTrans Dive Spread

- Superlite 17 or 37 for the inspection diver
- KMB 18 Band Mask for the rescue diver
- DCS II Manifold
- Amron Radio
- 165m Umbilical
- 140m Umbilical
- Miller Harnesses and 15L Bail out cylinders
- DUI Dry suits
- Bank of 50L breathing gas cylinders







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# Typical CalTrans Bridge Inspections

- Visibility—zero to 30 feet
- Currents—zero up to 3 ft/sec
- Water Temp—40 to 90 degrees F
- Altitudes from sea level to 7,000 feet
- Average depths are about 25 feet
  - Dives limited to 100 feet per CT Policy
- All water types (salt, brackish, fresh, contaminated, and grossly contaminated)
- Dives planned within no-decompression diving limits









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# Inspection Qualifications of Diving Personnel

- FHWA Bridge Inspection Diver
  - An underwater bridge inspection diver must complete an FHWA-approved comprehensive bridge inspection training course (80 hrs) or other FHWA-approved underwater diver bridge inspection training course (24hrs)
- FHWA Team Leader
  - This requirement is met by
    - being a registered professional engineer or,
    - having at least 5 years bridge inspection experience or,
    - certified NICET Level III or IV Bridge Safety Inspector or,
    - BS Engineering and 2 yrs bridge inspection experience + pass a national engineering fundamentals exam or
    - AS Engineering and 4 yrs bridge inspection experience
    - and in all cases, taking and passing the National Highway Institute 80 hour training course for bridge inspectors (NHI Course No. 130055)
- All CalTrans Dive Team members meet both the bridge inspection diver requirements as well as bridge inspection team “Team Leader” requirements of the NBIS regulations.



# Bridge Inspection Experience?

- The current NBIS (§ 650.305, Definitions.) defines **bridge inspection experience** as:

“Active participation in bridge inspections in accordance with the NBIS, in either a field inspection, supervisory, or management role. A combination of bridge design, bridge maintenance, bridge construction, and bridge inspection experience, with the predominant amount in bridge inspection, is acceptable.”

# CalTrans Dive Training Requirements

- Our In-House Dive Training Standard closely follows the ANSI/ADCE-01-1998 National Training Standard for Commercial Diver Training.
- Our Standard includes formal classroom training, confined water training (pool), open water training, and on the job training totaling over 512 hours of formal training.
- Due to the nature of our work, our Training Standard does not include training such as welding, equipment maintenance, hot water systems, marine engines and compressors, or mixed gas diving.
- We do, however, include Bridge Inspector's training, Emergency Diving Accident Management, Surface Supplied Diving Rescue Training, Nitrox Training, California Safe Boating Course, and Bridge Diving and Inspection Techniques as part of our training program.

# Diving Safety

- All of our diving operations meet or exceed the minimum requirements of Fed-OSHA 29 CFR Part 1910, Subpart T – Commercial Diving Operations.
- Continuing Safety Training
  - Cylinder and Dive Equipment Maintenance
  - Boating and Vehicle operations
  - Courses of opportunity
    - Swift water rescue
    - Bomb recognition
  - Annual Basic Diver Safety Training
    - CPR, First Aid, O2 Admin, AED, In Water Diver Rescue, Hyperbaric Medicine, Diving Physics and Physiology, Diving Accident Management Procedures, Dive Planning, Proficiency Exams.



## 2006—Private Sector Engineer/Diver Services Sought

- CalTrans' first underwater contract with outside commercial diving firm.
  - Supplement CalTrans dive team
  - Assist with FHWA inventory inspection requirements
  - Provide specialized dive condition services
    - Grossly contaminated water (Class 4)
    - Water depths over 100 fsw (Deco Chamber)
  - Afford information/experience sharing
- Two-year, task order type agreement.
- Same dive team/equipment specifics as CalTrans.

# CalTrans Underwater Inspection Services Contract Requirements

- All underwater inspectors shall have bridge inspection experience certifications meeting 23 CFR 650, National Bridge Inspection Standards.
- All underwater operations and equipment shall be in accordance with the minimum requirements of OSHA 29 CFR Part 1910, Subpart T for Commercial Diving Operations.
- On-site California PE required during all dive inspection operations.
- Prepare detailed engineering reports, in Caltrans format, detailing inspection findings.

# CalTrans Underwater Inspection Services Contract Requirements

- All dive team members shall be currently certified commercial divers per ADCI Consensus Standards.
- All divers shall have current CRP, First Aid, O2 Admin and AED training.
- Sufficient prior dive logs showing participation/ competency in dive operations similar to the required contract dives.





# CalTrans Underwater Inspection Services Contract Requirements



- Minimum 4 person dive team required (Diving Supervisor, Diver, Rescue Diver, Tender).
- Commercial Surface Supplied Hard Hat with hard-wire communications and digital video camera.
- Surface Supplied back-up with hard wire communications for the rescue/back-up diver.

# Collins Engineers' Divers Selected

- 30 years of U/W inspection experience
- Over 9,000 U/W bridge inspections completed
- Wrote the book for U/W bridge inspection
  - FHWA-DP-80-1  
“Underwater Inspection of Bridges”
- Developed and currently teach the NBIS-required inspection diver course
  - NHI Course No. 130091  
“Underwater Bridge Inspection”
- In-house ADCI Commercial Dive Training Program

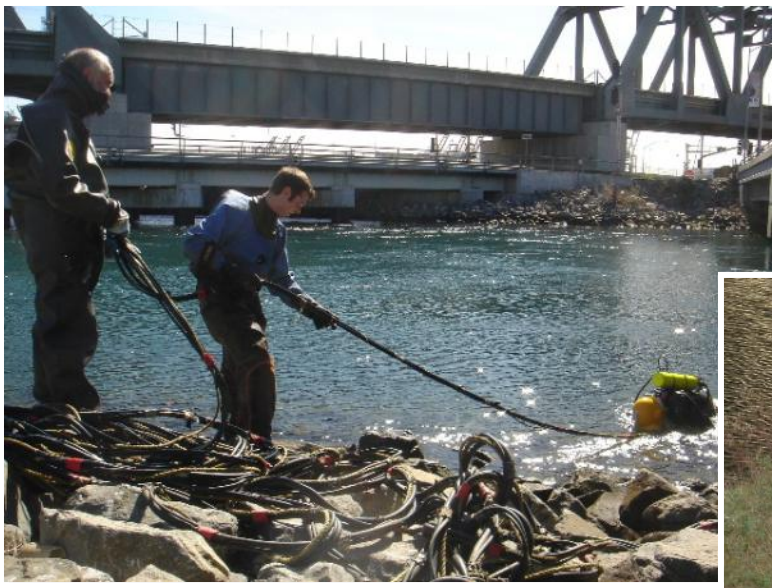
9,200 Underwater Bridge Inspections Performed





# Task Order No. 2

- Southern California
- Dominguez Channel
- California Aqueduct





# Task Order No. 3

- All American Canal
- New River
- Class 4 contamination and “Then Some”



# Task Order No. 4

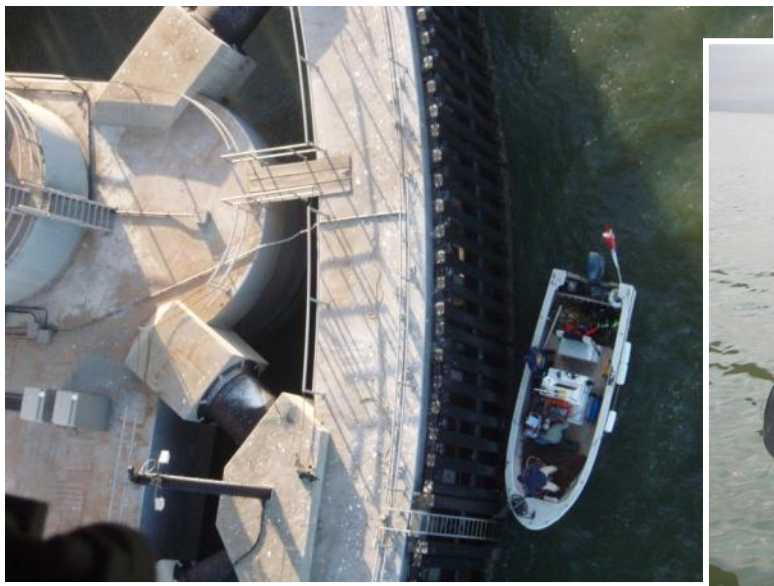
- Richmond-San Rafael Bridge
- Joint partnering effort





# Task Order No. 5

- San Mateo-Hayward Bridge
  - 7 miles long, 857 spans
  - Strong tidal currents
  - 3 to 60 foot water depths





# Task Order No. 8

- Antioch San Joaquin River Bridge
  - Swift currents, vessel traffic



# Task Order No. 8

- Richmond-San Rafael Bridge
  - Fuel barge vessel impact
  - Emergency inspection





# Task Order No. 8

- Canals, aqueducts, syphons
- Minimum freeboard, penetrations
- Bridge closure





# CalTrans/Collins Partnering Effort

- CalTrans (A) & Collins (B) teams
- Common dive supervisor
- Four self-sufficient set-ups





# CalTrans/Collins Partnering Effort

- Optimize inspection “window”
- Maximize efficiency and safety



# CalTrans/Collins Partnering Effort

- Co-equal training/  
experience background
- Independent, yet common
- Seamless operation





# Closing Thoughts

- The combination of diving safety and bridge inspection quality has been a hallmark of the CalTrans Underwater Inspection Program.
- CalTrans' in-house dive crews, as well as the consultant's dive crew, must be fully qualified with commercial diving training and procedures, strictly adhere to all appropriate safety regulations, and meet or exceed the minimum inspection requirements of the National Bridge Inspection Standards.



# Questions?



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