Human population concentrated in coastal regions

SOF missions necessitate submersible deployment

Current deployment method requires ad-hoc land transport

Seek Advanced Deployable Compact Rotorcraft
Mission Profiles

ARV
- Transport SOF crew
- Payload: 800 lbs
- 4-min HOGE drop-off

UEV
- Unmanned “eye in the sky”
- Payload: 600 lbs
- 3-hour loiter
ARV:
• Operational by non-pilots

UEV:
• Operational by pre-programmed and in-flight instructions

Maximum SSCN size:
14' x 70' x 44'
Transportable by C130J: 40' x 10' x 9'

Launch capable:
Surfacing to take-off: 10-min
Landing to submersion: 10-min

TCDL
Video, data, comm
VHF and UHF radio

Maximize SOF crew transport from SSCN to objective in 6-hours

RFP Requirements

Productivity Metric
Data Package

Time Constraints
Size Constraints

Operation & Control
Design Methodology

• Design performed in conjunction with ENAE 634 Helicopter Design
• Students developed own analysis tools and software to support component selection and sizing
• All graphics developed using CATIA V5 CAD software and Deep Exploration V5
Launch & Recovery Strategy

Submersible Launch and Recovery Pod (SLRP)

- TRITON ARV/UEV helicopters transported via submersible pod
- ARV crew transported in SLRP with ARV
- Life support provided via umbilical between SSCN and SLRP
- Interior of pod maintained at 1 atm to mitigate decompression sickness
- Submersible pod transforms to floating helicopter pad at surface
- Cable tether provides controlled ascent and descent of SLRP
Selection Criteria:

- Compact
- Cruise-speed
- Low noise
- Safety
- Reliable

Selected single main-rotor with fan-in-fin as optimal trade between cruise speed, noise and compact design
Modular ARV/UEV Design

TRITON ARV

Remove seats, TCS interface, hoist

Add seats, TCS interface, hoist

Remove modular payload

Add UEV modular payload

TRITON UEV

Modular ARV/UEV design

Design ensures CG position within rotor limits for all configurations and fuel levels
TRITON Design Features

- Advanced lower fuselage geometry
  *Minimize Earth plowing*

- CRYSTALOY armored composite skin

- Watertight, corrosion resistant fuselage

- Rear clam-shell doors
  *Fast access to mission equipment*

- Integrated hard points and door step for HOGE crew deployment
TRITON Design Features

- Self sealing, crashworthy fuel tanks
  Additional 10% tank volume to provide shock absorbing air pocket

- Sine-wave keel beams
  High energy buckling mode absorbs impact load

- Retractable landing gear

- All electric controls

- Armored crashworthy seats
TRITON Design Features

- Swashplateless, bearingless, composite-coupled rotor
  *Reduced weight, drag and maintenance*
- Quad trailing edge flaps
  *Provide primary control and vibration reduction*
- Ultrasonic DC motors: flap actuation
- Advanced swept/anhedral tip
- Opposing flexbeams constructed as single body
  *Reduces weight, drag, manufacturing cost and structural complexity*
TRITON Design Features

Automatic blade folding with off-blade primary actuation

Robotic arm driving mechanism
TRITON Design Features

Folded Dimensions:
- Length = 19.0 ft
- Height = 7.5 ft
- Width = 8.5 ft

Automatic folding tail

Transport 2 TRITONS in a single C130J transport
- NO DISSASSEMBLY REQUIRED -
TRITON Design Features

Composite housing
Low weight and impervious to sea water

Face-gear input train

Reduced acquisition and maintenance cost through use of common and off-shelf components

5000-hour MTBF for low maintenance
TRITON System Networking

- ARV/UEV operated via Tactical Control System (TCS) software
- TCS provides seamless command and control transfer between operating stations in SSCN, ARV and ground soldier
- Primary data link through TCDL, secondary via UHF/VHF data link
- Portable TCS interface for remote ARV control
SLRP Design Features

- UAV Common Automatic Recovery System
- Harpoon capturing system
- Emergency escape hatch
- Turntable
  Vehicle yaw correction
- Hot refueling via umbilical to SSCN
Hangar Configuration

- Simultaneous deployment and recovery of 2 TRITON helicopters
- Central elevator system for optimal use of vertical space
- Stow up to 9 TRITON helicopters
Performance Summary

Best range velocity = 140 kt
Hover ceiling (6k/95) > 6000ft
Productivity Metric

Available in SSCN

2 TRITON UEV 2 SLRP 7 TRITON ARV

Total SOF deployed in 6 hours = 28
Conclusions

TRITON
The new advanced deployable compact rotorcraft

- Watertight, armored composite fuselage
- Mission adaptable ARV/UEV design
- Crashworthy airframe and fuel system
- All electric design
- Innovative transmission with composite housing
- Revolutionary automatic blade folding
- Swashplateless multifunctional control system
- Affordable state-of-art technologies