Notes:
1. Below are informal notes taken by a JHU/APL staff member at the Seminar.
2. Video and audio versions of the Seminar and Captain Rubel’s viewgraphs are available in the Video Archives.

Introduction
CAPT Rubel noted that he was not an expert on innovation but had been a member of the Naval War College faculty since 1998 and had watched or participated in several innovation efforts in the Navy. He had also been asked to write a chapter in a history of Naval Aviation on the Navy’s transition to jet aircraft. During that effort he became interested in the horrific costs of that transition—the loss of 13,000 aircraft and 9,000 people between 1947 and 1988. By that time the Navy was able to reduce its accident rate level to that of the Air Force where it has stayed.

Innovation versus Reorganization
The Roman Petronius noted that despite training hard, a team would just begin to make progress when they would be reorganized again:
- People often handle any new situation by reorganizing
- Reorganization creates the illusion of progress
- Reorganization also causes “confusion, inefficiency, and demoralization”
This concept can be seen throughout all of the reorganizations of the Navy’s Sea Trial program.

Naval Aviation would not be the first place to think of as putting up barriers to innovation because it has done so much innovating over the years:
- When looking deeply into its innovation efforts the problems become evident
- Problems for innovation can occur anywhere:
  - Some places will be hotbeds of innovation but in the same community there may be great resistance to new concepts
  - Can’t just say “I want my organization to have innovation”

Phases of Innovation:
1. Conceptualization: people need the freedom to think
2. Development: people need to take an idea and make it useful to the fleet/organization
3. Absorption/incorporation: organizations need to integrate the innovation into operations

Problem: Can consider all of these as ointments where flies could be introduced.
Recommended Reading

- Warfighting and Disruptive Technologies: Disguising Innovation, Terry Pierce
  - How Gen LeJeune, others disguised radical advances as only incremental changes
- Innovation in Carrier Aviation: Naval War College Newport Papers #37 by Thomas C. Hone, Norman Friedman, Mark D. Mandeles
  - Why the USN did not invent the angled deck, steam catapult, and Fresnel lens but the Royal Navy did
- Understanding Media by Marshall McLuhan
  - Should be read like Clausewitz to understand how new technologies effect humans

General Themes

- We can try to engineer innovation, but the real world has other ideas
- It is hard to get an organization that is composed of smart, dedicated and patriotic people to not act stupid in the aggregate – learned from experience in running organizations
- How innovation effects humans is not impersonal but all about winners and losers in a power game

Note: it may be possible to extrapolate concepts of innovation into other organizations experiences but must remember that Naval Aviation has its own unique nature

- Naval Aviation has a separate identity from that of the Surface or Submarine communities
- Different tribal or corporate cultures – plus the need to struggle against the Air Corps/USAF

Themes in the Discussion

- Distraction – Why the Navy did not invent the angled deck and steam catapult
- Resistance – Why it took so long for Naval Aviation to get down to USAF accident rates
- Preoccupation – Why the fleet battle experiment program ended

Naval Aviation 1.0 (1911-1942)

Characteristics

- Open-minded and experimental with no established “baronies” to protect
  - Surface commanders like King and Halsey were able to observe and then support Naval Aviation efforts
  - Fleet was not deployed so it was available for experimentation
- Founding theories came from the peacetime NWC and the General Board provided focus
- Washington Naval Treaty had a huge impact on the design of ships and aircraft

Innovation Triangle (NWC, the Fleet, and OPNAV)

- RADM William Syms came back from WWI to take over the NWC as an aviation enthusiast
  - Knew aviation would be important to the Navy, just not exactly how it would be used
  - Had war games run to determine how aviation would play in naval strategy
- The Fleet was at home and readily available for experimentation, establishing a feedback loop between the NWC wargamers and the fleet operations experimenters
- OPNAV-NWC-Fleet synergistic triangle
  - NWC: Wargames showed that a pulse of power off carriers would be the decisive factor
    - Had to get a lot of sorties off in a short period
  - OPNAV: ADM Bill Moffitt, director of the Bureau of Aircraft, read the wargame reports
Fleet: USS Langley was running experiments in San Diego in the early 1920s
- Could only launch about 12 aircraft in order to keep the deck clear for returning aircraft that missed the arresting wires
- Landing aircraft needed to be lowered below on the elevator and the elevator raised before the next landing could take place

Connection: Moffitt had Captain Joseph Reeves, head of the NWC tactics (wargaming) department, transferred to be CO of USS Langley to find a solution

Result: within six months, the mid-ships barricade was invented and Langley could then operate up to 48 aircraft

Note: While this was done during a period of budget austerity, the Fleet was at home and costs were relatively low

Naval Aviation 2.0 (World War II)
- Carriers and key aircraft types were designed before the war but were built during the war
- Naval Aviation came out of the war ascendant, while ending the one-Navy outlook
  - Success in battle empowered the ethics and values of the squadron heroes – set the Naval Aviation agenda
  - Encouraged a no-tomorrow ethos
    - During WWII in the Pacific the Navy and Marines lost 3,800 aircraft in combat
    - During the same period 13,000 aircraft were lost to accidents
    - This rate was only half of the fatality rate of the early 1920s
• 1920s naval aviators expected to die

**Naval Aviation 3.0 (1945-1991)**
- Covers a great deal including a lot of struggles
  - Will focus on just one aspect
- Starting with the “Revolt of the Admirals” – Congressional testimony of Admirals Denfield and Forrest Sherman contradicting the orders of SECDEF Johnson (an Air Force proponent)
  - They were concerned that the Navy would lose its carriers to strategic bombers
  - Naval leadership was very risk tolerant – use to losing lots of aircraft
- Distractions came from:
  - Fear of a nuclear Armageddon – so could justify every effort and risk to prevent it
  - Fear of a bureaucratic Armageddon – pressure to unify the services with the Navy losing carriers so that only strategic bombers would remain

**Naval Aviation’s Post-War Threats and Distractions**
- Nuclear bombs were very large at first
  - Needed an aircraft that could carry them and fly off a carrier
- Soviets had long-range land-based aircraft that could reach carriers with nuclear weapons
  - Navy’s problem: needed to intercept Soviet bombers far from the Fleet
  - To do so needed fast interceptors so required swept-wing jets
    - Not well suited to landing on carriers
    - Accident rates showed that trying to land on a straight deck carrier was lethal
- Navy also had to fight the US Air Force
  - GEN Carl Spaatz claimed that the Navy had no one to fight – neither the Soviets nor the Japanese had threatening navies and nuclear weapons were too heavy for carrier air
- An early “solution”
  - 1951-52 Concept: Load nukes on large Neptune aircraft that in a crisis would be loaded on a carrier for one-way trips since carriers could not recover such huge aircraft

**USS United States** was supposed to be first of class but it was cancelled

This model from 1948 shows:
- Straight deck
- Advanced twin-engine jets fighters (F-7) only a year after first operational jets
- Large nuclear-capable one-way bombers

(Taken from CAPT Rubel's presentation – available on the Video Archives page)

- Problem: airframe technology was advancing much faster than engine technology
  - Airframes were not the problem
  - Not long after WWII basic concepts behind being able to fly at Mach 1 or 2 were already understood
    - Aircraft already capable of great speeds
    - Aircraft were not capable of slowing down enough to land on carriers
US Navy focused on
- Fast bombers to survive Soviets air defenses
- Fast interceptors to get to Soviet bombers long before they got near the fleet since close is good enough with nuclear weapons
- Did not focus on the ship
- Saw the Navy as the deliverer of a pulse of power as in WWII

British experience was very different – saw carriers as convoy escorts
- Focused more on the ship than the aircraft
- Not focused on nuclear weapons

US Navy was distracted by nuclear weapons
- Bombs were getting smaller so could put them on smaller planes
  - Early carrier-based planes still built as one-way, throw-away aircraft
- Brits did have problems and blind allies
  - Tried “Flex Deck” concept but too many pilots killed in experiments

Big Naval Aviation breakthrough by a British naval officer: canting the landing zone
- Don’t need a barrier – if miss the landing keep going and swing around
- \textit{HMS Argus} did not even change the shape of the deck, just the landing zone
- Allowed carriers to launch aircraft even while recovering them

(Taken from CAPT Rubel’s presentation – available on the Video Archives page)

US Navy was so distracted by need to get nukes off the front end of the carrier that this concept never occurred to anyone

Similar situations occurred with the development of steam versus hydraulic catapults
- USN heavily invested in hydraulic and exploring explosive catapults
- USN did have liaison officers with the Royal Navy who arranged a demonstration that changed opinions in the US
- Fresnel lens for use in a landing signal system was another example
  - Jets, especially swept-wing jets, needed to prepare to land too far away to see hand signals of landing signal officers
  - Needed something that could be seen from $\frac{3}{4}$mi. out to get an accurate glide slope

Bottom line: Organizational distraction did not allow the US Navy to come up with any of these developments

\textbf{Resistance}

Naval Aviation had developed a corporate culture of no-tomorrow
- Example: Since the A-7 was a single seat aircraft, even first flights had to be done solo with an instructor in a chase plane
  - As Rubel awaited his first take off, a classmate’s aircraft crashed and burned
  - Despite this, Rubel was ready to take off for his flight since he had already inculcated
the value system of the tribe of Naval Aviation light attack pilots

- Tribal joke: an optimist can be defined as a naval aviator with a savings account
- While the number of planes and pilots were very small in the 1920s, the number of accidents and fatalities per 100,000 flight hours were enormous
  - Naval aviators of the 1920s expected to die

Rugged individualism: part of the Navy’s corporate culture also has an impact in aviation

- All naval officers taught to think for themselves – they expect to be at sea with no one turn to
- Example: Rubel had a problem landing one of his squadron’s Hornet pilots on a carrier
  - He and the air ops boss made all the decisions
  - They did not think to ask the admiral or the air wing boss who were nearby for recommendations – nor would they offer any
  - Such a situation would probably have been handled differently in the Army or Air Force

Tribalism – comes in many forms

- Rubel belongs to the tribe of East Coast light attack aviators
  - Hated their West Coast equivalents to the point of fighting over small differences
- Would also stand up against fighter pilots or A-6 aviators – all in the name of tribalism
- But every one of them would be against the “true enemy” – the US Air Force
- The problem: Tribalism can create resistance to suggestions coming from other tribes
What happened when the Air Force approach was correct

- Both Air Force and Navy had significant safety problems and set up safety centers
- The Air Force instituted standardization and their accident rates plummeted
- The Navy resisted standardization until 1961
  - Could see discussions even the early 1960s disparaging the concept
  - Aviators at the time had learned from the surviving WWII pilot heroes
    - Their view was: Yes, there are rules but let me tell you the real way to do it
- Part of the problem was that early aircraft weren’t all that reliable
  - Always had to decide whether to fly with an aircraft known not to be 100%
  - If pilots chose not to fly too often, would be considered coward or anger the skipper who wanted to meet the sortie rate
  - Pressure was on the pilot to go for it – everyone understood this
  - Pilot was conditioned by a culture of “no tomorrow” – everyone was expendable
- Navy resisted changing even though could see that the Air Force procedures worked
  - A comparison on the accident rates over 100,000 flight hours shows the differences
  - Took until 1990 and adoption of operational risk management to match Air Force rates

Impact of Technological Changes can be seen in Accident Rates

- Although the technology was getting better throughout this time, the rate change can be attributed to an attitude change, not a technology change
- Bottom line: New technology can make differences but the culture may not be willing to accept the innovation for various reasons

### Accident Rates per 100,000 Flight Hours

<table>
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<th>Year</th>
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<th>USAF</th>
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<td>1950</td>
<td>53</td>
<td>37</td>
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<tr>
<td>1960</td>
<td>19</td>
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<td>2</td>
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<td>1990</td>
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- Without the switch to the angled deck, Naval Aviation would have probably ceased to exist since losses were so great
- Aircraft technology was also advancing with engines that could provide enough thrust to take advantage of advances in air frame development
- Examples
  - F-8 Crusader: 1261 built but 88% were lost in accidents
  - A-3: had about 38% lost in accidents and only 3 lost in combat
  - Composite squadron for delivering nuclear weapons had a horrible rate of return from their training missions, but the Navy kept sending them out
 Naval Aviation 4.0 (1991-????)
Era of depressurization and ascendancy of jointness
- Carriers had become a well-accepted part of military
- Using a mature approach to risk including operational risk management
  - New basic concept: Don’t fly if there is anything wrong with your $22 million aircraft
  - A different culture took over – almost felt like a feminization of the culture
  - Bottom line: It was the correct way after years of being wrong about risk

Naval Aviation remained insular
- Example: development of maritime strategy project in 2006
  - All the Navy communities and other services jumped in except USAF and Naval Aviation
  - Naval Aviation felt that they were doing well by keeping their heads down
- Innovation occurred but with a different mindset than that of Submarine community and maybe the Surface community given the issues with the Littoral Combat Ship (LCS)

Age of maturity has problem of Preoccupation
- Going beyond Naval Aviation to Fleet Battle Experiment (FBE) program
  - Final view: rather than trying to do too many things at once, just concentrate on a few
  - The problem: all these new things were being pressed on a very busy Fleet
  - NWDC (Navy Warfare Development Command) did not manage to maintain leadership
    - Lost an opportunity
    - Drifted away from NWC
- Navy has revolutionized its command and control (C2) in the last decade but other innovations not so much
  - New Maritime Operations Centers totally changed C2
  - Attempts at other reorganizations/new methodologies failed because all the numbered fleet reps said they did not have time or money to do more than their current tasks
- Result: FBE turned into science experiments
  - Outsiders brought exotic black boxes out to the fleet to test concepts through operating systems, talking to each other, etc.
  - Afterwards black boxes were left aboard but with no logistics/maintenance support so soon broke down
  - Failure caused by
    - CNO trying to contract out innovations to the Fleet without giving them any extra manpower, money
    - No experimental squadron, so no opportunity to develop innovations
    - The Navy was preoccupied – as is still the case
- Bottom line today: Navy is already stretched thin and the situation will get worse
  - Won’t get innovation without dedicated time, people, and resources
  - Leaving no room for experimentation

Network Centric Warfare & the LCS
- Concepts put off a lot of people
- However, today the Fleet is wired up but through grassroot, practical, local efforts
  - Not run by an all-encompassing theory of naval warfare
- Problems have reverberated for the LCS – designed as a 500 ton street fighter but has morphed into a 3,500 ton vessel
NWC is about to publish a paper by Under SECNAV Bob Work on the history of the LCS – how it came to be / how policy decisions are made in the acquisition process

Paper also discusses using the LCS in “associated support”
- Concept might provide an opportunity for naval operational art for the first time since cruisers provided such support to the battleline
- Navy is good at tactics and strategy – not at the in-between level of operational art (an Army concept) despite NWC efforts
- LCS could revolutionize naval thinking – whether or not the platform works well

Despite all the problems, there is a great deal of innovation
- All of the spaces on the new USS Gerald Ford are new – propulsion, arresting gear, radars, etc.
- Despite the improvements remain much the same concept as 1948 proposed USS United States
  - Built to put a pulse of power across the bow – hasn’t changed since 1944
- Unmanned vehicles could bring big changes in the future

Why Innovation is Hard
- Navy did not know it was distracted in 1951
  - If instituted safety measures then, they would have interfered with their value system since it would cause cut backs on essential mission issues such as the flight schedule
  - People were trying to do the right thing but status quo is a powerful thing
- Navy in the inter-war period had luxury of being a thinking organization – did not have to produce anything then
  - Today the Navy must produce presence
  - Must choose to be a thinking or a production organization
- It is possible to have sub-groups in a production organization to do some thinking
  - Example: Deep Blue established to provide thinking for CNO
  - When the thinking unit does start producing good concepts it is asked to do more and more – all needed tomorrow
    - Then the thinking organization becomes a production organization
    - No one believes that they are doing wrong
- Another problem: Navy is good at paying lip-service to innovation
  - Example: SECDEF Rumsfeld called for transformation and then everything was identified as transformational
  - Basically, people find revolutionary ways to keep doing the same thing – that’s not innovation
- Cults get in the way as well as tribes
  - USAF has a cult of air power – independent air campaign for strategic purposes
  - Baronies – personal equities in a programs
  - Lots of sub-cultures from cults and baronies – informal, may not be visible
    - Tribes defend identity
    - Cults defend a theory or dogma
    - Baronies defend personal equities
  - Bottom line – they don’t like change and find ways to avoid it while giving lip service
    - But not bad people – patriots trying to do the right thing

How to improve the situation for innovation
- CNO must make the decision that to accept less presence, less ability to respond to COCOM
(Combatant Commanders) demands in order to free up resources for experimentation

- There is an effort at this including the Naval Board of Navy and Marine 3-star flag officers
  - Talking about the single naval battle – not clear what that means
- More collaboration needs to happen but get something like the concept of the Expeditionary Sensor Grid
  - Would involve sensors under the sea and on satellites and much more
  - Said to be everything but that really means nothing – can’t nail down exactly
  - If draw lines too clearly would have to defend it
    - Would be hard to meet production schedule
  - Result: treat concepts like programs that needed defending
- Compare this approach to what the Royal Navy did between the wars
  - Some ideas were bad and could be recognized as such and eliminated
- Problem comes when a thinking organization has to produce ideas on a schedule
- One effort to overcome this problem: Halsey Alpha at Naval Wargaming Center
  - Two faculty members / 15 students dedicated to studying concepts such as anti-access
    - No other tasks for faculty
    - Doesn’t matter whether program lasts beyond a single academic year
  - Halsey Alpha war game process starts a tactical problem given to Blue and Red Cells
    - Cells develop a concept and give it to the White Cell that takes as long as needed to adjudicate the move
    - Decisions sent back to Red and Blue cells to do more – taking as long as is needed to get through the process
    - Iterations go back and forth as long as needed and can’t do more
  - Have done this for 10 years and think they now know what a high tech war in a specific area would look like
- Bottom line: Need to have a place to let logic take you where it will, but need resources to do that
  - Halsey Alpha looking into other areas such as missile defense, undersea warfare, nuclear deterrence and escalation – getting some results

**QUESTION & ANSWER SESSION**

**Re: Resurrecting the General Board**

- There is a movement afoot
- It won’t be the whole answer

**Re: Navy Warfare Development Command (NWDC)**

- The original concept was to go beyond the old Navy Doctrine Command and place it near the NWC to take advantage of the synergy – the Newport advantage
- But it fell apart – had self-actualization issues – couldn’t figure out what they should do
  - Thought the Fleet would accept its pronouncements like manna from heaven – wrong!
  - Had difficulty finding their spot in the Navy
- NWDC wanted to be an independent echelon two command with a 2- or 3-star director
- Did become the executive agent for concept development
- At worker-bee level NWDC and NWC have a good relationship
  - NWDC lacks a good wargaming capability so NWC handles that for them
  - NWDC does have a good exercise and command post exercise capability
- NWDC is well-networked out to the Fleet where they can develop their concepts further
Not well set up for generating concepts but are trying hard to do so

**Re: “Responsible Oversight” versus Innovation**
- Term **Responsible Oversight** is bureaucratic
  - Has caused the current acquisition system
- No one was trying to do anything wrong – only trying to prevent irresponsible acquisition
  - Consequence: risk averseness and red tape
  - Must be a better way to do this
- Production organizations do need to have responsible oversight
- A thinking organization needs leaders who protect it from such oversight so that it can do its magic
  - Then a sponsor needs to use deception or other form of leadership to get innovations assimilated despite opposition
- Biggest problem: not understanding the difference between a production organization and a thinking organization – forcing thinking organizations to produce stuff

**Re: Concept of the Single Naval Battle**
- Naval Board recently had some discussions about whether this was just amphibious operations or more but no one had the words to get into any depth about the concept
- Need new words:
  - *Sea control* – definitions are not wrong but not helpful
- Will soon suggest **Sea Denial**
  - To help explain the US role in East Asia
  - Let the Chinese try to do sea control – harder
  - *Sea denial* is cheaper, easier, more fun
  - Just need to keep the PLA from moving troops by sea
  - China should be limited to a continental power
- **Air Sea Battle** does not explain what needs to be done
  - Know that Navy and Air Force need to cooperate – have known that since WWII
    - Involved long range strategic air since even then
    - Navy stayed under the Air Corps umbrella until Leyte Gulf
  - Have always had AF tankers available when they were needed
  - No problem working with the Air Force throughout the world but in Washington only get lip service
- **Command of the Sea** term
  - See Rubel’s **Command of the Sea: An Old Concept Surfaces in a New Form** in fall NWC Review
  - Explains what this means in current geo-political terms and risk management for a potential fight in the South China Sea
  - Not a pulse of power anymore
  - May need to deal with a drip-drip of power over years
    - Don’t need to win in a single day
    - Don’t roll the dice if you don’t have to
- Bottom line: Can’t define the fight unless you have the words to do and they are lacking now

**Re: The Space Program and Innovation**
- The Government threw a lot of money at the program but little guidance for the engineers
• Shows the difference between having a goal and having a production schedule
• Example: NWDC was handed Sea Trial and it wanted to provide responsible oversight
  o Problem: had lots of technical programs bubbling along but none were ready for development in the Fleet
    ▪ Wanted to pick the winners and direct all the resources to them
    ▪ To get an overview had all info put into STIMS – Sea Trail Information Management System – all including budget data
    ▪ Program managers feared loss of budgets if truth readily available so hid it
    ▪ Result: STIMS failed
• Bottom line: There are lots of technical possibilities available now but can’t tell which ones by looking at them – need Fleet experiments but largely lack the resources to do so

Re: Fighting Together in an Integrated Manner
• Training opportunities like Red Flag also allow operators to get to know each other, their methods and tactics
• Need to do provide more such exchanges opportunities to allow learning from each other in tactics, etc.